Mallard Pass
Solar Farm

Mallard Pass Solar Farm

Preliminary Environmental Information Report

Volume 3: Appendices

Appendix 12.3: Flood Risk Assessment

May 2022

PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

FLOOD RISK ASSESSMENT

MALLARD PASS SOLAR FARM

MALLARD PASS SOLAR FARM LIMITED

MAY 2022

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1 INTRODUCTION

1.1 Background

This Flood Risk Assessment (FRA) is submitted as part of the Preliminary Environmental Information Report prepared on behalf of Mallard Pass Solar Farm Ltd (the Applicant) for the installation of a solar photovoltaic array ("the Proposed Development") on land at Mallard Pass, Essendine, Lincolnshire (the "Site").

Arcus Consultancy Services Ltd ("Arcus") has been commissioned to undertake a FRA for the Proposed Development, which is intended to meet the requirements of the:

- Environment Agency (EA);
- Rutland County Council (RCC) Strategic Flood Risk Assessment (SFRA)[1];
- RCC Local Plan 2018 – 2036, Strategic Flood Risk Assessment Update[2];
- RCC Local Flood Risk Management Strategy[3];
- Lincolnshire County Council (LCC), Preliminary Flood Risk Assessment[4];
- South Kesteven District Council (SKDC), SFRA[5];
- Construction Industry Research and Information Association (CIRIA) The Sustainable Drainage System (SuDS) Manual (C753)[6];
- National Policy Statements (NPS) EN-1 and EN-3 and Draft NPS EN-1 and EN-3; and
- Revised National Planning Policy Framework (NPPF)[7].

The Site is located within the jurisdiction of RCC and SKDC. Section 3.6 of the SKDC SFRA indicates that LCC are the Lead Local Flood Authority (LLFA) for the district. As such the LLFA for the Site is assessed to be LCC and RCC.

The indicative layout of the Proposed Development can be found in Annex A of this FRA.

1.2 Proposed Development

The Proposed Development comprises the following;

- PV Arrays;
- Mounting structures;
- Inverters;
- Transformers;
- Switchgears;
- Primary Onsite Substation and Ancillary Buildings;
- Low Voltage Distribution Cabling;
- Grid Connection Cables;
- Fencing, security and ancillary infrastructure;
- Access Tracks;
- Green infrastructure (GI);
- Access Tracks; and

[1] Rutland Strategic Flood Risk Assessment (2009). [Online]. Available at: https://www.rutland.gov.uk/my-services/planning-and-building-control/planning/the-local-plan/local-plan-withdrawn-2021/archived-local-plan-evidence-base/water-and-flooding/
[2] Rutland County Council Local Plan 2018 – 2036, Strategic Flood Risk Assessment Update (2020). [Online]. Available at: https://www.rutland.gov.uk/my-services/planning-and-building-control/planning/the-local-plan/local-plan-withdrawn-2021/archived-local-plan-evidence-base/water-and-flooding/
[3] Rutland County Council Local Flood Risk Management Strategy (2018). Available at: https://www.rutland.gov.uk/my-community/environment/flood-and-water-management/local-flood-risk-management-strategy/
[4] Lincolnshire County Council, Preliminary Flood Risk Assessment (2011). [Online]. Available at: Preliminary flood risk assessment report (lincolnshire.gov.uk)
[5] South Keveston, Strategic Flood Risk Assessment (2017). [Online]. Available at: Layout: POTRAIT - ADD TITLE:1 (southkesteven.gov.uk)
[6] https://www.ciria.org/Resources/Free_publications/SuDS_manual_C753.aspx
[7] Ministry of Housing, Communities & Local Government (2021). "Revised National Planning Policy Framework" [Online] Available at: https://www.gov.uk/government/publications/national-planning-policy-framework--2

- Green infrastructure (GI).

During the construction phase, several temporary construction compounds will be required as well as temporary tracks to facilitate access to the Site.

1.3 Site Characteristics

1.3.1 Site location

The Site covers approximately 906 hectares (ha) and the Solar PV Site is located on approximately 460 ha of agricultural land east, west and south of Essendine, centred at National Grid Reference (NGR) TF052115as shown in Annex B.

This FRA will focus on the extent of the Solar PV Site boundary detailed in Annex B.

1.3.2 Surrounding Hydrological Network

The EA Catchment Data Explorer[8] indicates that the Site is located within the Glens operational catchment within the Welland management catchment within the Anglian River basin district.

The West Glen River bisects through the north and east of the Site and flows north-west to south-east.

The River Gwash is located approximately 50 metres (m) south of the Site at its nearest point and flows west to east and ultimately discharges into the River Welland approximately 1 kilometre (km) south of the Site.

Open land drains are located throughout the Site. Ordnance Survey (OS) mapping indicates land drains located in the north of the Site ultimately discharge into the West Glen River and land drains located in the south of the Site ultimately discharge into the Greatford Cut (Drain) located approximately 3.5 kilometres (km) east of the Site.

Rutland Water is located approximately 4.8 km south-west of the Site and Tallington Lakes Leisure Park is located approximately 3 km east of the Site.

A number of small ponds are located towards the north-east boundary of the Site. A large pond is located approximately 10 m east of the Site with an approximate surface area 13,500 m^2 with a connection to the West Glen River.

The A6121 dissects the centre of the Site and is assumed to have a drainage system based on satellite imagery and Google Street View[9] mapping.

The Site is not shown to be located within the operational boundary of an Internal Drainage Board (IDB)[10] with the operational boundary of the nearest IDB, Welland and Deepings IDB, located approximately 680 m south-west of the Site.

During consultations between Arcus and LCC[11], it was highlighted that LCC hold a memorandum of understanding with IDBs that operate within Lincolnshire, with IDBs acting as agent to the LLFA. The Site is shown to fall within the extended operational boundaries of the Black Sluice and Upper Whitham IDBs.

1.3.3 Site Elevations

The latest available LiDAR data (2020) at a 1 m resolution identifies the Site has an elevation ranging from 16 m Above Ordnance Datum (AOD) to 67 m AOD.

[8] Environment Agency, Catchment Data Explorer. [Online]. Available at: https://environment.data.gov.uk/catchment-planning/
[9] Alphabet Inc., Google Maps, Street View. [Online]. Available at: https://www.google.co.uk/maps
[10] Association of Drainage Authorities, Internal Drainage Boards Map. [Online]. Available at: https://www.ada.org.uk/idb-map/.
[11] Email communications between R. Duff (Arcus) and I. Field (LCC) dated 18th January 2022 to 24th January 2022.

1.3.4 Flood Zone Categorisation

The EA Flood Map for Planning[12] shows that the majority of the Site is located within Flood Zone ('FZ') 1.

Areas of the Site are located within FZ 2 and FZ 3, areas described as 'Medium' and 'High' probability of flooding in Table 1: Flood Zones of the 'Planning Practice Guidance to the National Planning Policy Framework'[13], principally confined along stretches of the West Glen River towards to north and east of the Site.

This zone is categorised as having a high flood risk and comprises land assessed as having a 1 in 100 or greater annual probability of river or sea flooding in any year.

1.3.5 Flood Defences

The Flood Map for Planning indicates the Site does not benefit from the protection of flood defences.

The DEFRA Spatial Flood Defences dataset[14] indicates flood defences are located along the banks of the River Gwash and the West Glen River. Defences along the River Gwash are located approximately 600 m west of the Site and comprise privately owned engineered high ground. The flood defence is shown to have crest levels in the range of approximately 19.1 m to 29.5 m AOD and a Standard of Protection (SoP) of 25 years.

Defences along the West Glen River run along the banks of the watercourse through the centre of the Site and comprise privately owned natural high ground. The flood defence is shown to have crest levels in the range of approximately 13.6 m to 21.8 m AOD and a SoP of 50 years.

Neither of the flood defences along the River Gwash and West Glen River are considered within the EA Flood Map for Planning.

Acknowledging the SoP and location of the West Glen River flood defences within the Site Boundary it is assessed that the Site benefits from protection associated with such defences.

1.4 Historical Flooding

The EA's Historic Flood Map[15] shows that the Site is not located in areas with recorded previous flooding history. Evidence from local stakeholders has been provided during the Stage 1 (informal) Consultation which indicates parts of land surrounding the Site have previously been impacted by surface water flooding.

2 Flood Risk Assessment

As the Site is over 1 ha in size and is partially located within FZ 2 and FZ 3, a FRA has been undertaken in accordance with footnote 55 of the revised NPPF, paragraph 5.7.4 of NPS EN-1 and paragraph 5.8.6 of the Draft NPS EN-1.

[12] The EA Flood Map for Planning. [Online]. https://flood-map-for-planning.service.gov.uk/
[13] Department for Communities and Local Government (DCLG) (2014). "Planning Practice Guidance". [Online]. Available at: http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/.
[14] Department for Environment, Food and Rural Affairs (DEFRA). Spatial Flood Defences. [Online]. Available at: https://environment.data.gov.uk/DefraDataDownload/?mapService=EA/SpatialFloodDefencesIncStandardisedAttributes&Mode=spatial
[15] Environment Agency, Historic Flood Map. [Online]. Available at: https://data.gov.uk/dataset/76292bec-7d8b-43e8-9c98-02734fd89c81/historic-flood-map

2.1 Methodology

Flood risk will be classed as Negligible (where little or no risk is identified), Low (where theoretical risk is identified but mitigating factors may influence flood levels) or Moderate to High (where modelled levels or historical events show risk to the Site).

Several factors will be taken into account when attributing the residual risk of flooding to the Site, including:

- Depth of flooding;
- Flooding extent / ingress into site;
- Type of infrastructure affected; and
- Intervening structures / flood protection.

A risk table is provided in the conclusion of this FRA and will provide comment and justification for the risk category using professional judgement and experience of assessing similar types of scenarios.

2.2 Fluvial Flood Risk

The EA Flood Map for Planning shows that the Site is partly located within FZ 2 and FZ 3, an area described as 'high probability' of flooding from the West Glen River, which runs through the centre of the Site.

The EA provided the West Glen Hydraulic Modelling Report (August 2016) and associated modelled flood level results.

2.2.1 Modelling Approach

The study area for the West Glen model encompasses the West Glen from Boothby Pagnell to Shillingthorpe, covering a distance of approximately 30 km. The modelling approach within the study consists of a hydrodynamic 1D MIKE 11 model covering the West Glen River, River Tham and Holywood Brook.

The model simulated flows for a range of return periods from 50 % Annual Exceedance Probability (AEP) to 0.1 % AEP plus climate change (CC). The CC allowance applied to the model was 20 % based off the DEFRA 2006 guidance. The source of this guidance could not be found through a literature review.

As the Proposed Development is classed as Essential Infrastructure, as per Table 2: Flood risk vulnerability classification of the Flood risk and coastal change guidance[16], and has an anticipated operational lifetime of 40 years (for the purpose of the Environmental Impact Assessment) although this could be extended, the higher central band for the 2050's is assessed as the appropriate climate change allowance.

The revised 'flood risk assessments: climate change allowance'[17] peak river flow allowances for the Wellland Management Catchment for the Higher 2050s is 10 %. The Proposed Development lifespan is approximately 40 years therefore the CC allowance used in this FRA is a conservative approach and deemed appropriate and this approach has been agreed with the Environment Agency.

2.2.2 Modelling results

Elevations for the Site have been incorporated into ArcGIS software along with the in channel West Glen River water levels for the 100-year plus 20 % climate change (CC)

[16] Department for Levelling Up, Housing and Communities and Ministry of Housing, Communities & Local Government (2014) Flood risk and coastal change guidance [Online]. Available at: https://www.gov.uk/guidance/flood-risk-and-coastal-change
[17] Flood Risk Assessments: climate change allowances (2021). [Online]. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

event. The Thiessen polygons tool in ArcGIS was utilised to extrapolate the areas of the Site associated to the in channel nodes.

The difference in the in channel 1:100-year plus 20 % water level and topography sourced from 1 m LiDAR data was used to derive flood depths for the Site. This approach adopts a conservative method in calculating flood depths as it assumes all land below the modelled in channel water level is flooded without accounting for the potential of flood waters to disperse across a floodplain.

The maximum 1:100-year plus 20 % flood depths for the Site are approximately 0.8m as shown in Annex C.

No elements of the Proposed Development are located within the 1:100-year plus 20 % flood extent with the exception of two small areas located to the of the East Coast Main Line Railway and south of Greatford Level Crossing.

PV Arrays will be mounted on narrow footings with the base of the PV panels approximately 0.8 m above ground level. Therefore the PV Arrays will not displace flood water or be at risk to damage during extreme flooding events (i.e., events which exceed the 1:100-year plus 20 %).

Acknowledging the location of the Proposed Development outside of the conservative 1:100-year plus 20 % CC flood extents, the fluvial risk is Negligible.

2.3 Pluvial Flood Risk

The EA Risk of Flooding from Surface Water Map[18] indicates that areas within the Site are at risk of surface water flooding during the 'medium' risk 1:100-year pluvial event; however, the electrically sensitive infrastructure (Primary Onsite Substation) is not located within the 1:100-year pluvial event, as shown in Annex D.

The 1:100-year pluvial depths data highlights pluvial flooding to the north and centre of the Site. The pluvial depths for these areas are predominately less than 0.3 m; however the maximum modelled depth at the Site is 0.6 m.

PV Arrays will be located in areas where pluvial depths are 0.3 m or less. As the base of PV panels are located at a height of 0.8 m there will be significant freeboard above the maximum pluvial depths. No elements of the Proposed Development will be located in areas with pluvial depths of 0.6 m or more during the 1:100-year event.

The Mounting Structures which the PV Modules sit upon will be installed into the ground via narrow legs, limiting any footprint of the PV Arrays. As such the PV Arrays will not displace pluvial flood waters to any significant extent.

The electrical connections on the PV Arrays will be located on the upper edge of the panels and therefore well above ground level and would still function should areas of the Site be under water following such an extreme rainfall event, as shown in Plate 1.

[18] Environment Agency, Risk of Flooding from Surface Water data. [Online]. Available at: https://data.gov.uk/dataset/b391e876-4571-44f9-85c5-3485ddf6333a/risk-of-flooding-from-surface-water-depth-0-1-percent-annual-chance

Plate 1: Typical PV Array Racking Set up off the Ground

Where required, the electrically sensitive infrastructure will be located within contained units upon ground mounted platforms within aggregate based embankments which will lift the infrastructure above ground level and provide additional protection from surface water flooding as shown in Plate 2.

Plate 2: Electrical Infrastructure Raised Above Ground[19]

The onsite pluvial flood risk will be mitigated through the implementation of a surface water drainage regime, discussed further in Section 3 of this report.

Acknowledging the location of any sensitive infrastructure outside of modelled pluvial flood risk areas and the raised nature of the PV arrays the surface water flood risk is Negligible.

2.4 Tidal Flood Risk

There are no tidally influenced watercourses within the vicinity of the Site and the Site is at an elevation range 16 m to 67 m AOD.

As such, the onsite tidal flood risk is Negligible.

2.5 Groundwater Flood Risk

British Geological Society (BGS) borehole records[20] located across the Site show clay-based strata to an approximate depth of 23 m followed by approximately 23 m of Lincolnshire limestone. Water was encountered between 12 m to 24 m below ground level. Due to the structure of the underlying strata at the Site, it is unlikely that water would rise through the ground and inundate the Site, as passage through clay strata is impeded.

The Mounting Structures supporting the PV Modules are to be driven into the ground by approximately 1 m to 2.5 m and given the aforementioned groundwater depths, are unlikely

[19] South Lowfield Solar Farm (2021).
[20] British Geology Society (BGS) borehole records, BGS ID 467042. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/467042/images/10810458.html, BGS ID 467750. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/467750/images/10811373.html, BGS ID 467740. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/467740/images/10811363.html, BGS ID 467897. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/467897/images/10811548.html, BGS ID 467921. Available at: http://scans.bgs.ac.uk/sobi_scans/boreholes/467921/images/10811572.html.

to interact with, displace or develop surface pathways for groundwater beyond the baseline scenario.

The RCC SFRA update[21] highlights in the presence of limestone bedrock, groundwater flooding may be possible but the risk is considered to be low.

Acknowledging the low susceptibility and the infrastructure's unlikely interaction with ground water, flooding of the Proposed Development as a result of groundwater fluctuations is unlikely and the risk is Negligible.

2.6 Reservoir Flood Risk

The EA Flood Risk from Reservoirs Map[22] indicates the Site is modelled to flood should there be a breach or failure at the nearest reservoir; Rutland Water. The main areas identified at risk are located towards the centre of the Site.

The maximum extent of flooding from reservoirs for both scenarios, 'when river levels are normal' and 'when river there is also flooding from rivers' is shown in Annex E.

The risk of flooding from reservoir is reduced through regular maintenance by the operating authority, with reservoirs in the UK having an extremely good safety record with no incidents resulting in the loss of life since 1925.

The Reservoirs Act 1975 requires all large reservoirs to be regularly inspected and supervised by reservoir panel engineers.

As such, the residual risk of flooding associated with reservoirs is Negligible.

2.7 Flooding from Drainage

The Site is located within a rural area with the A6121 dissecting through the centre in a general north-east to south-west direction and is assumed to have a drainage system based off satellite imagery and a Site walkover conducted in March 2022.

The nearest infrastructure, PV Arrays, are located approximately 40 m north of the A6121 with a woodland located between the highway and PV arrays. Surface runoff that is not contained within the highway drainage system will be intercepted by the neighbouring woodland and will therefore not impact the PV Arrays. In addition, the base of PV Modules are located at a minimum height of 0.8 m and therefore will not impacted if surface runoff from the highway were to reach the Proposed Development infrastructure.

As such, flood risk from drainage is Negligible.

2.8 Artificial sources (canals, docks, lakes, ponds)

Tallington Lakes Leisure Park is located approximately 3 km east of the Site and is at an approximately elevation 12.5 m AOD. The nearest extent of the Site boundary has an approximate elevation 26.7 m AOD; the difference in elevation highlights the unlikely nature of the Lakes posing any flood risk to the Site.

A large pond is located approximately 10 m east of the Site, in the event of water overtopping the pond, topography shows any exceedance would fall away from the Site and towards the West Glen River.

[21] Rutland County Council, Rutland Local Plan 2018-2036, Strategic Flood Risk Assessment Update (2020). [Online]. Available at: https://www.rutland.gov.uk/my-services/planning-and-building-control/planning/the-local-plan/local-plan-withdrawn-2021/archived-local-plan-evidence-base/water-and-flooding/

[22] Environment Agency, Flooding from Reservoirs Map. [Online]. Available at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map.

The EA Surface water flooding map shows that any exceedance of the ponds located towards the north-east boundary of the Site would flow away from the Site and therefore would not impact the Proposed Development.

The Tallington Lakes and ponds are both excavated into the ground reducing the risk of breach scenario.

As such the flood risk from artificial sources is Negligible.

2.9 Sewer flooding

It is not envisaged that the construction of the Proposed Development will increase the risk existing sewers flooding risk. It is proposed the temporary construction compound areas and the Primary Onsite Substation will utilise private (closed) drainage systems, such as septic tanks, which will be periodically emptied and disposed of offsite by a licensed waste carrier.

As such sewer flood risk is Negligible.

3 SURFACE WATER MANAGEMENT

3.1 Existing Surface Water Drainage

The Site is currently greenfield and is assumed to be 100 % permeable. The majority of surface water runoff migrates to the land drains and to the West Glen River. A small southern portion of the Site drains towards the Greatford Cut land drain.

There are a number of ponds located on the Site as stated in Section 1.3.2, which may infiltrate or evaporate surface water runoff.

The bedrock geology for the Site ranges from Lincolnshire Limestone towards the north and north-west, Rutland formation towards the centre of the Site, Blisworth Limestone the north-east and a combination of Blisworth and Cornbrash Limestone to the south of the Site.

3.2 Proposed Surface Water Drainage Strategy

An Outline Surface Water Drainage Strategy will be prepared as an appendix to the Environmental Statement which will outline how surface water runoff associated the Proposed Development will be intercepted, attenuated and discharged.

The design life of the Proposed Development for the purpose of the Environmental Impact Assessment is 40 years, subject to maintenance and repairs. The peak rainfall intensity allowance[23] for the Site is 20 % based off the Upper end '2050s'; however, the catchment is greater than 5km^2. The catchment for the Site is approximately 164.3 km^2 therefore as per the guidance the peak river flows allowance would be used which is 10% for the Welland Management Catchment Higher 2050s. To take the most conservative approach to the drainage design, a 20% climate change allowance will be applied.

The dominant presence of clay-based strata located through the Site suggests infiltration may not be feasible; however, infiltration testing to Buildings Research Establishment (BRE) 365 standard will be conducted to determine the Sites capability to infiltrate surface runoff associated with hard standing areas implemented.

Infiltration will be the favored technique to manage runoff from hardstanding areas to reduce peak runoff to surrounding watercourses and, thus, reducing flood risk downstream. In the event infiltration as the means of surface water drainage is not feasible, attenuation and controlled discharge to the nearest watercourse at a greenfield rate or alternative rate

[23] Flood Risk Assessments: climate change allowances. [Online]. Available at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-rainfall-intensity-allowance

agreed with the LLFA will be utilised. The location of any attenuation or interception structures will be confirmed through on ground infiltration testing and surface water flow route modelling to enable surface water to be captured along pre-existing flow routes.

Attenuation structures within the Outline Surface Water Drainage Strategy will be designed in accordance with the SuDS Manual (C753)[24] to intercept and release surface water runoff from non-permeable hardstanding areas within the Proposed Development to the 1:100-year (+20%) return period without overtopping. Drainage attenuation and runoff calculations will be conducted using Micro Drainage software.

The Proposed Development will increase the impermeable areas as a result of the Solar Stations, Primary Onsite Substation compound and associated plant storage areas. Existing tracks will be utilised wherever possible and any new internal access tracks are assumed to comprise permeable aggregate, as shown in Plate 3. If this is not the case, access tracks will also be included in the impermeable surface calculation.

Plate 3: Typical Permeable Aggregate Solar Farm Track[25]

PV Arrays will be held above ground level on Mounting Structures. This will avoid sealing the ground with impermeable surfaces and replicating pre-development conditions on the Site, preventing a significant increase in surface water runoff relative to the baseline scenario.

The lack of impermeable surfaces and increase in surface water runoff associated with the PV Arrays Rural SuDS[26] (RSuDS) techniques will be utilised to manage surface water runoff in relation to the PV Arrays.

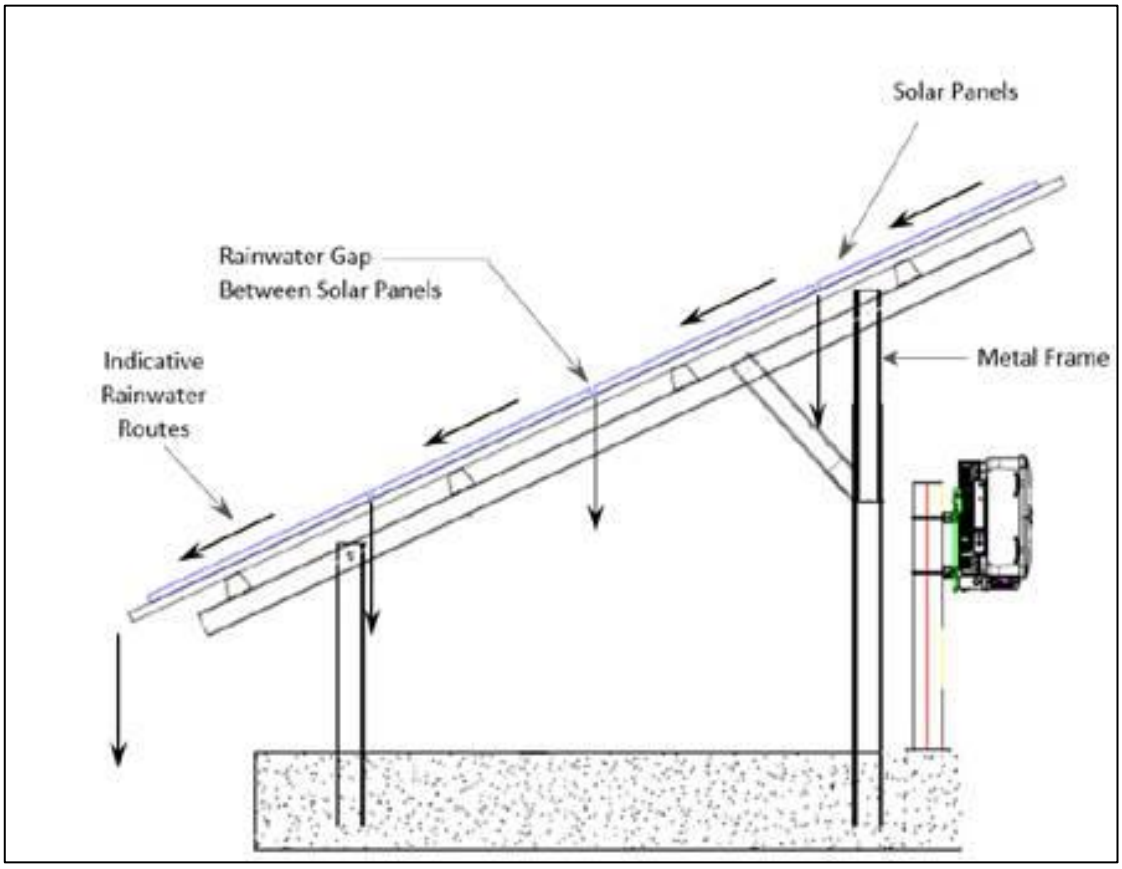
The PV Tables will have regular rainwater gaps to prevent water being concentrated along a single drip line, as shown in Plate 4. As such, rainfall landing on the PV Modules will drain

[24] CIRIA, The SuDS Manual (2015). [Online]. Available at: https://www.susdrain.org/resources/SuDS_Manual.html
[25] Arkwright Solar Farm, Chesterfield, Arcus As-built drainage review.
[26] Environment Agency, Rural Sustainable Drainage Systems (RSuDS) (2012). [Online]. Available at: https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/291508/scho0612buwh-e-e.pdf

through rainwater gaps and infiltrate into the ground beneath and between each row of panels, as shown in Plate 5.

Plate 4: Typical PV Drip Line

Plate 5: Typical PV racking system



To limit possible channelisation from surface water from PV Arrays and promote interception and infiltration potential throughout the Site, the ground surrounding and underneath the PV Arrays will be planted with grassland and wildflower mix which will act as dripline planting with an example shown in Plate 6. This will allow surface water which falls from the drip line across the face of PV Arrays to be intercepted by the vegetation and limit the potential of surface water to concentrate and run across the surface and into the surrounding hydrological network.

Plate 6: Established Wildflower Mix under PV Drip Line[27]

3.3 Proposed Foul Water Drainage Strategy

During construction of the Proposed Development foul water will be disposed of via 'Port-a-loo' type facilities and disposed of via a licenced waste carrier.

The construction of a site office or welfare facility will contain welfare facilities for the use of staff during the operation phase. It is proposed that any foul water will be collected in a septic tank(s), cesspits or similar units and not discharged to any public sewer.

The septic tank or cesspit will be managed, inspected and drained by a licensed waste carrier who will then dispose of the waste offsite. The septic tank or cesspit will either meet the general binding rules for the operation of a cesspit or the EA will be consulted to obtain an operational permit.

4 NPPF SEQUENTIAL AND EXCEPTION TEST

4.1 Sequential Test and Exception Test

Paragraph 159 in NPPF states that developments located within Flood Zone 3 should apply a risk based sequential test to steer the proposed development towards areas classed as having a lower probability of flooding. The same paragraph does, however, acknowledge that under certain circumstances it may not be possible to locate the development on land identified as having a lower risk of flooding (Flood Zone 1) but the benefits of the development should be clearly stated.

[27] Malmaynes Solar Farm – Arcus As-built drainage review

The Planning Practice Guidance to the NPPF also states that the two criteria set out in the Exception Test should be applied to developments. The two criteria are listed below:

1. It must be demonstrated that the Development provides wider sustainability benefits to the community that outweigh flood risk, informed by a Strategic Flood Risk Assessment; and

2. A site-specific flood risk assessment must demonstrate that the development will be safe for its lifetime taking account of the vulnerability of its users, without increasing flood risk elsewhere, and, where possible, will reduce flood risk overall.

The Site is located partly within FZ 2 and 3. The Proposed Development is located primarily within FZ 1, with all sensitive elements (substations, inverters etc.) of the Proposed Development outside of the 1:100-year (+20%) extents. Only PV arrays, which are raised above ground level are located in FZ 2 and 3 highlighting a sequential design process. This, therefore, satisfies the criteria of the NPPF Sequential and Exception Tests.

5 CONCLUSION

This report has been written to meet the requirements of the NPS, NPPF and the EA.

The Site is partially located within FZ 2 and FZ 3.

In channel 1:100-year plus 20 % water levels for the West Glen River have been extrapolated utilising 1 m resolution LiDAR data to confirm a conservative 1:100-year plus 20 % flood extent.

Electrically sensitive elements associated with the Proposed Development has been sequentially designed to be located outside of the 1:100-year plus 20%.

The maximum pluvial 1:100-year depths located at the Site are 0.6 m; however, no infrastructure will be located within these areas. PV panels are to be set at 0.8 m above ground level and therefore will not be impacted during a 100-year pluvial event.

The use of vegetation under the PV array drip line will reduce the potential for surface water run-off rates to increase at the Site.

An Outline Surface Water Drainage Strategy will be submitted as part of the Environmental Statement which will outline the surface water management measures to be implemented at the Proposed Development.

Table 2 shows that the residual risk of the Proposed Development flooding from all sources is Negligible.

Table 2: Risk of Development Flooding

Flooding Source	Potential Risk	Comment	Residual Risk
Fluvial (River)	Negligible	The Proposed Development is defined as Essential Infrastructure and located out with of the 1:100-year (+20%) modelled extents. Only PV arrays, which are raised above ground level are located in FZ 2 and 3, highlighting a sequential design process.	Negligible
Pluvial (Surface Water)	Negligible	The maximum pluvial depths located at the Site are 0.6 m however no infrastructure will be located within these areas. Areas with a pluvial depth 0.3 m or less will only have PV-arrays located within them. The PV arrays are located at a minimum height of 0.8 m and therefore will not be impacted.	Negligible
Tidal	Negligible	There are no tidally influenced watercourses within the vicinity of the Site which is at an elevation range of 16 to 67 m AOD.	Negligible
Groundwater	Negligible	BGS borehole records show clay-based strata to an approximate depth 23 m below ground level followed by 23m of limestone. Water was encountered between 12 – 24 m across the Site. It is unlikely that water would rise through the ground and inundate the Site, as passage through clay strata is impeded. The Mounting Structure posts will be driven into the ground by circa 1 to 2.5 m and therefore is unlikely to impact, displace or develop surface pathways for groundwater.	Negligible
Reservoirs	Negligible	The EA Flood Risk from Reservoirs Map shows that the Site is located in an area modelled to be at risk of flooding from reservoirs. The risk of flooding from reservoir is reduced through regular maintenance by the operating authority, with reservoirs in the UK having an extremely good safety record with no incidents resulting in the loss of life since 1925.	Negligible
Drainage	Negligible	Surface water not contained with the A6121 drainage system will be intercepted by neighbouring woodland located between the Site and the highway. PV Arrays are located at a minimum height of 0.8 m and therefore will not be impacted if surface runoff from the highway were to reach the Proposed Development.	Negligible

Artificial	Negligible	Tallington Lakes Leisure Park is at an approximately elevation 12.5 m AOD. The nearest Site boundary has an approximate elevation 26.7 m AOD, the difference in elevation highlights the unlikely nature of the Lakes posing any flood risk to the Site. In the event of water overtopping the large pond, topography shows any exceedance would fall away from the Site and towards the West Glen River. The EA Surface water flooding map shows any exceedance of the ponds located towards the north east boundary of the Site would flow away from the Site and therefore would not impact any infrastructure associated with the Proposed Development.	Negligible
Sewer	Negligible	It is not envisaged that the construction of the Proposed Development will increase the risk existing sewers flooding risk. It is proposed that construction compound area and staff welfare facilities during the operational phase will utilise local private drainage systems such as septic tanks which will be periodically emptied offside by a licensed waste carrier.	Negligible

ANNEX A – SITE LAYOUT

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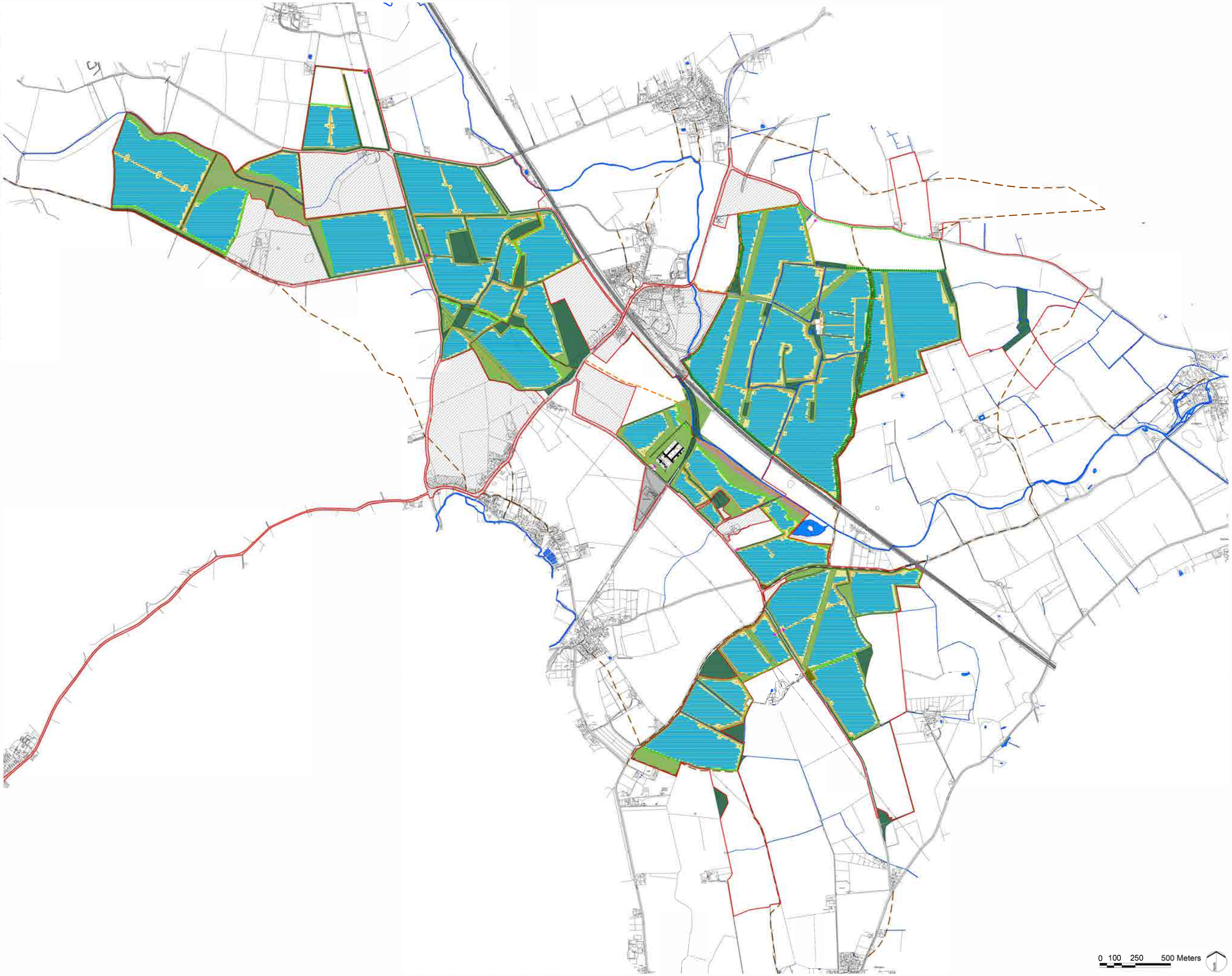


LEGEND

- Site Boundary
- Existing Woodland
- Existing Hedgerow / Verge
- Existing Water Course / Drain
- Existing Waterbody
- Public Right of Way
- Area outside of Site Boundary

Proposed Development Features

- Proposed Tussock Grassland with Wildflowers
- Proposed Wildflower Grassland with Calcareous Species
- Proposed Grazed Grassland (Within Fenced Solar Arrays)
- Proposed Screening / Structure Planting Woodland Copse
- Proposed Scattered Wet Woodland Planting
- Proposed Screening / Structure Planting Tree Belt
- Proposed Screening / Structure Planting Hedgerows
- Proposed Onsite Primary Substation
- Proposed primary and secondary access points and internal tracks
- Proposed Permissive Footpath
- Proposed PV Arrays with Central Inverter / Transformer
- Grid Connection Route

0 100 250 500 Meters

REV. DESCRIPTION APP. DATE

LDĀDESIGN

PROJECT TITLE
MALLARD PASS SOLAR FARM
PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

DRAWING TITLE
Annex A: Fixed South Facing
Illustrative Development Layout (1 of 2)

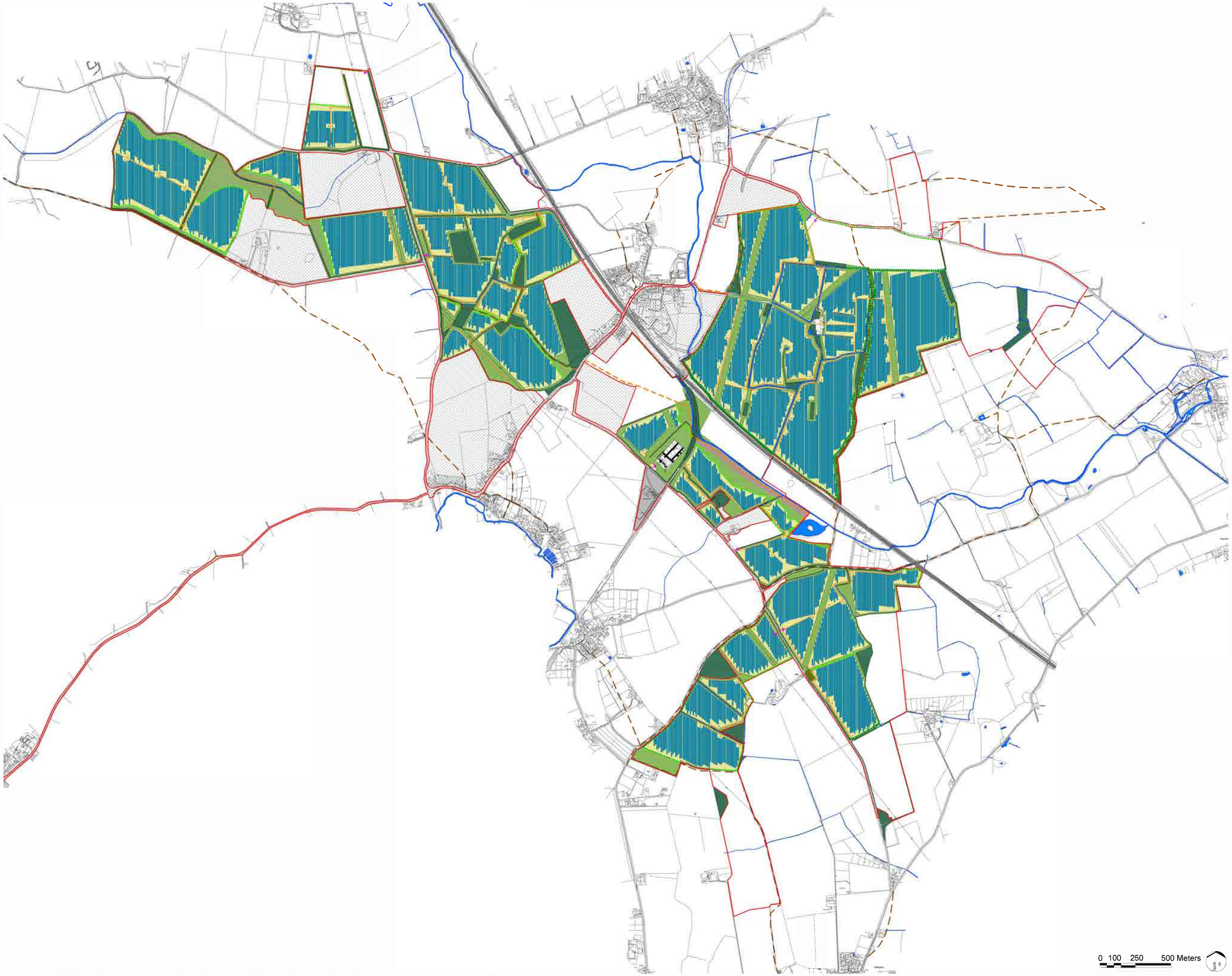
ISSUED BY	Oxford	T: 01865 887 050	
DATE	May 2022	DRAWN	TB
SCALE@A1	As Shown	CHECKED	BC
STATUS	Final	APPROVED	RP

DWG. NO 7863_SK_300

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Sources Ordnance Survey

Z:\7863_NSIP_SOLAR_FARM_CONFIDENTIAL\7CAD\DRAWINGS\7863_SK_301_STAGE2_PEIR_MASTERPLAN_TRACKING_LAYOUT_16.DWG



LEGEND

- Site Boundary
- Existing Woodland
- Existing Hedgerow / Verge
- Existing Water Course / Drain
- Existing Waterbody
- Public Right of Way
- Area outside of Site Boundary

Proposed Development Features

- Proposed Tussock Grassland with Wildflowers
- Proposed Wildflower Grassland with Calcareous Species
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- Proposed Screening / Structure Planting Hedgerows
- Proposed Onsite Primary Substation
- Proposed primary and secondary access points and internal tracks
- Proposed Permissive Footpath
- Proposed PV Arrays with Central Inverter / Transformer
- Grid Connection Route

0 100 250 500 Meters

North

REV. DESCRIPTION APP. DATE

LDĀDESIGN

PROJECT TITLE
MALLARD PASS SOLAR FARM
PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

DRAWING TITLE
Annex A: Single Axis Tracker
Illustrative Development Layout (2 of 2)

ISSUED BY	Oxford	T: 01865 887 050	
DATE	May 2022	DRAWN	TB
SCALE@A1	As Shown	CHECKED	BC
STATUS	Final	APPROVED	RP

DWG. NO 7863_SK_301

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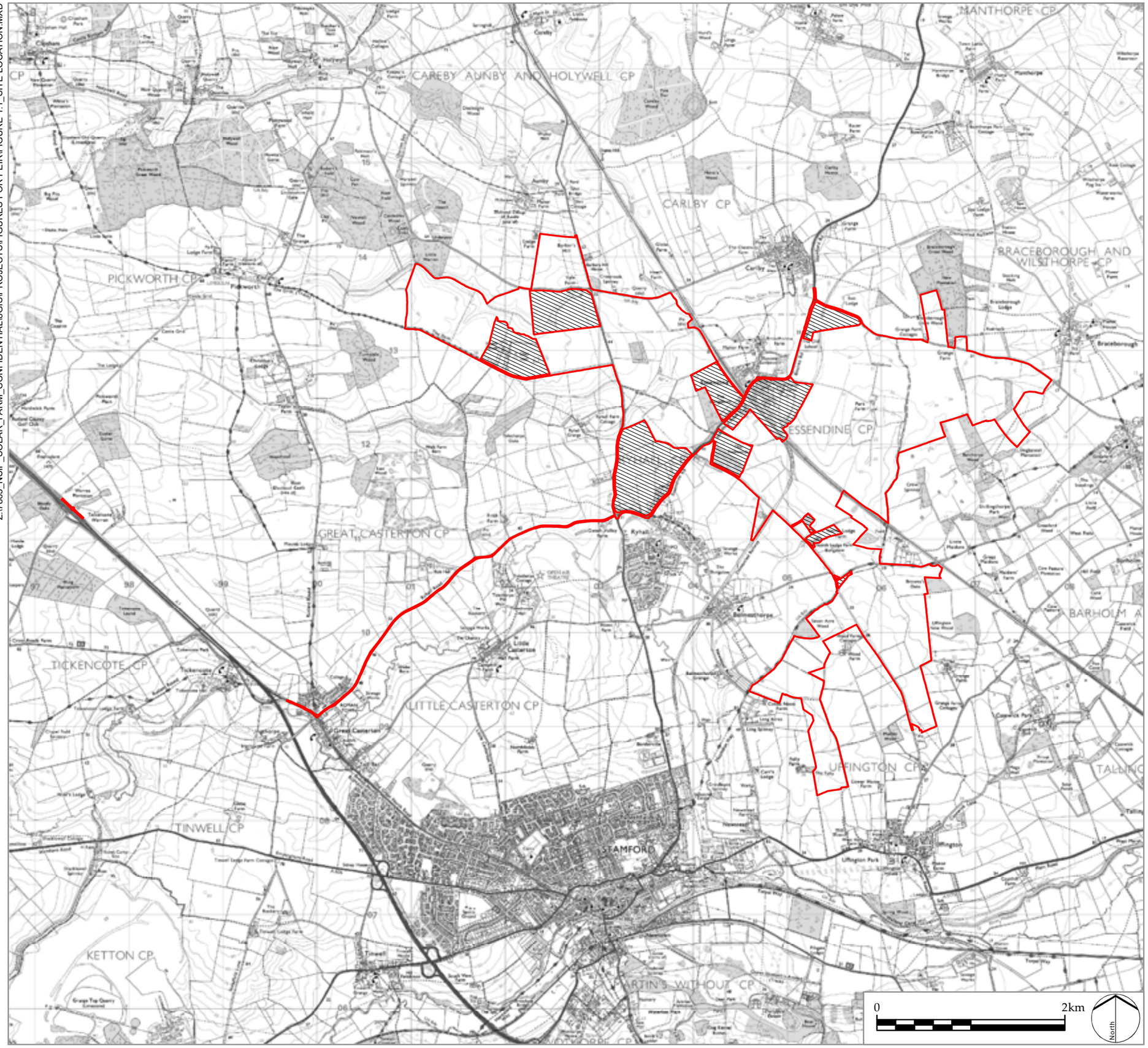
Area measurements for indicative purposes only.

Sources Ordnance Survey

ANNEX B – SITE LOCATION

Z:\7863_NSIP_SOLAR_FARM_CONFIDENTIAL\8GIS\PROJECTS\FIGURES FOR PEIR\FIGURE 1.1_SITE LOCATION.MXD



LEGEND

Site boundary

Areas outside of Site Boundary

LDĀDESIGN

PROJECT TITLE

MALLARD PASS SOLAR FARM:
PRELIMINARY ENVIRONMENTAL INFORMATION REPORT

DRAWING TITLE

Annex B: Site Location Plan

ISSUED BY	Oxford	T: 01865 887050	
DATE	March 2022	DRAWN	AG
SCALE @A3	1:40,000	CHECKED	DB
STATUS	Final	APPROVED	RP

DWG. NO. 7863_SK_302

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Area measurements for indicative purposes only.

Sources: Ordnance Survey, Esri

ANNEX C – 100-YEAR PLUS 20 % CC FLUVIAL DEPTHS

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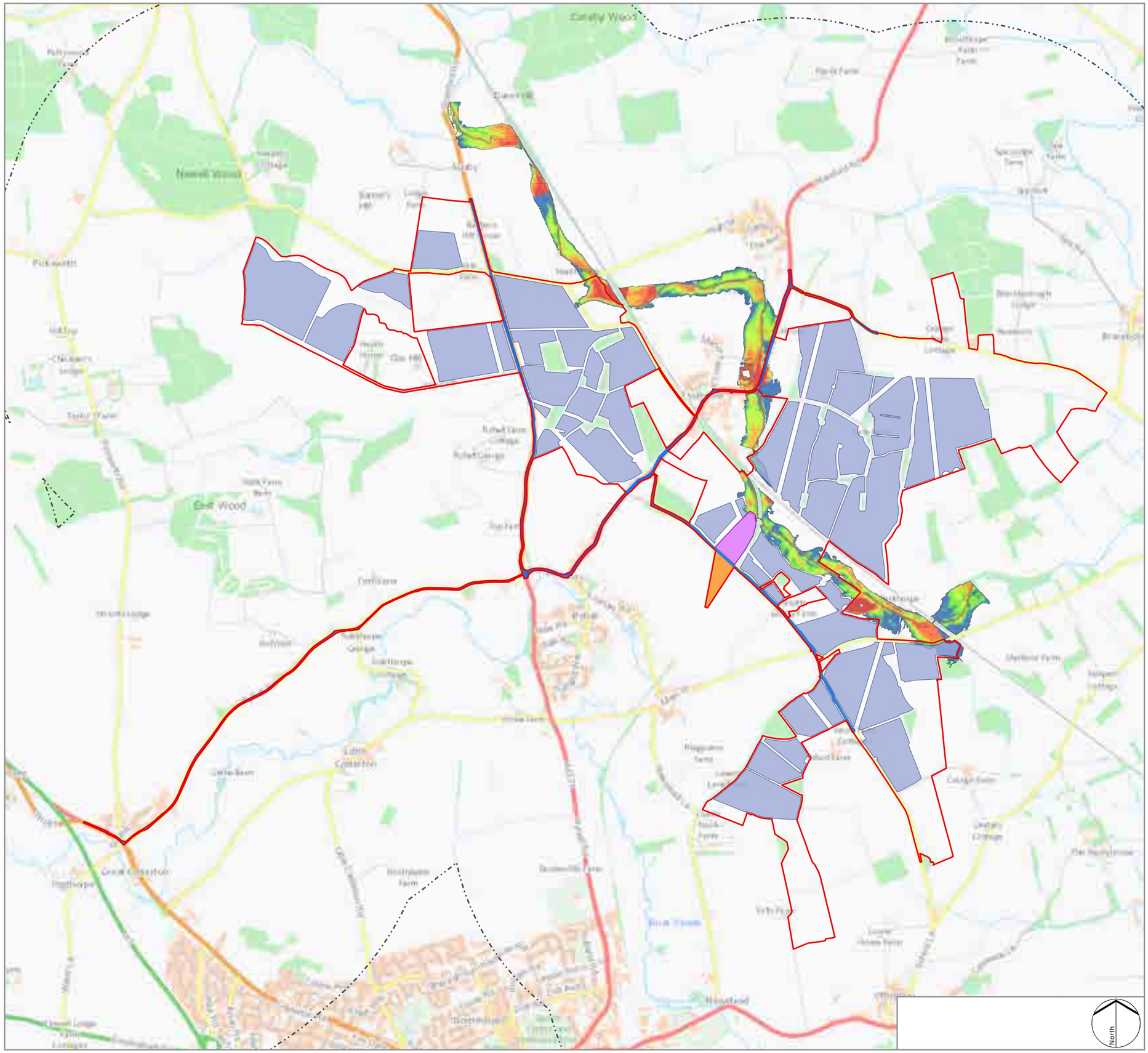

LEGEND

Study Areas
- Site Boundary
- PWS Study Area (2km)
- Wider Study Area (5km)

Site Works
- Solar Panel Area
- Potential Highway Works
- Grid Connection Route
- Primary Onsite Substation

West Glen 1:100-Year(+20%) Flood Depth (m)
- 0.2
- 0.4
- 0.6
- 0.8
- 1
- > 1

LDĀDESIGN

PROJECT TITLE

MALLARD PASS SOLAR FARM:
FLOOD RISK ASSESSMENT

DRAWING TITLE

100-Year plus 20% CC Fluvial Flood Depths

ISSUED BY		T:	
DATE	01 March 2022	DRAWN	CH
SCALE @A3	1:30,000	CHECKED	RD
STATUS	Draft	APPROVED	SC

DWG. NO. Annex C

No dimensions are to be scaled from this drawing.
All dimensions are to be checked on site.
Area measurements for indicative purposes only.

Sources: Ordnance Survey

ANNEX D – 100-YEAR PLUVIAL EVENT DEPTHS

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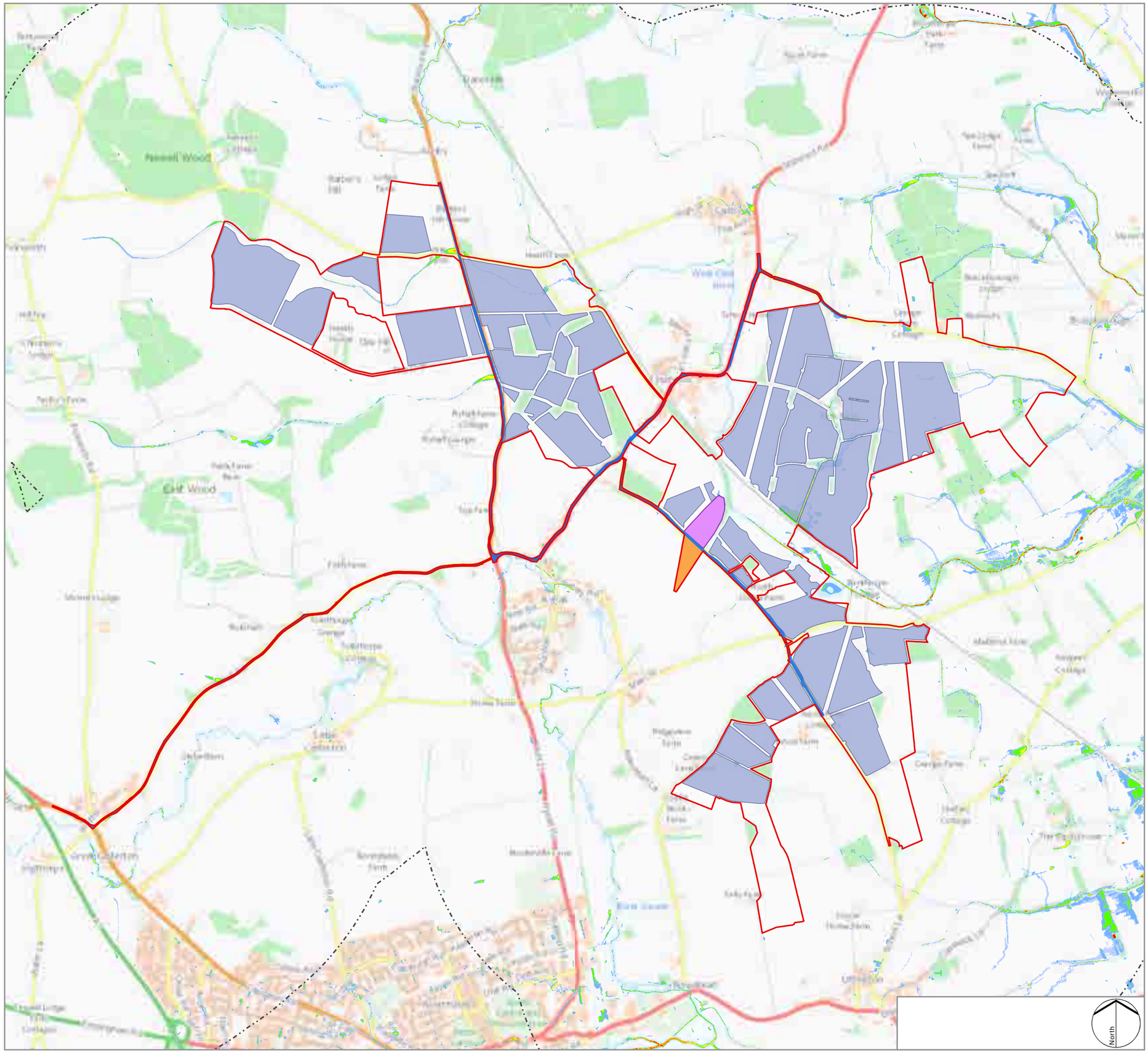

LEGEND

Study Areas

- Site Boundary
- PWS Study Area (2km)
- Wider Study Area (5km)

Site Works

- Solar Panel Area
- Potential Highway Works
- Grid Connection Route
- Primary Onsite Substation

100-Year Pluvial Flood Depths (m)

- 0.00 - 0.15
- 0.15 - 0.30
- 0.30 - 0.60
- 0.60 - 0.90
- 0.90 - 1.20
- > 1.20

LDĀDESIGN

PROJECT TITLE

MALLARD PASS SOLAR FARM:
FLOOD RISK ASSESSMENT

DRAWING TITLE

100-Year Pluvial Flood Depths

ISSUED BY		T:	
DATE	1 March 2022	DRAWN	CH
SCALE @A3	1:30,000	CHECKED	RD
STATUS	Draft	APPROVED	SC

DWG. NO. Annex D

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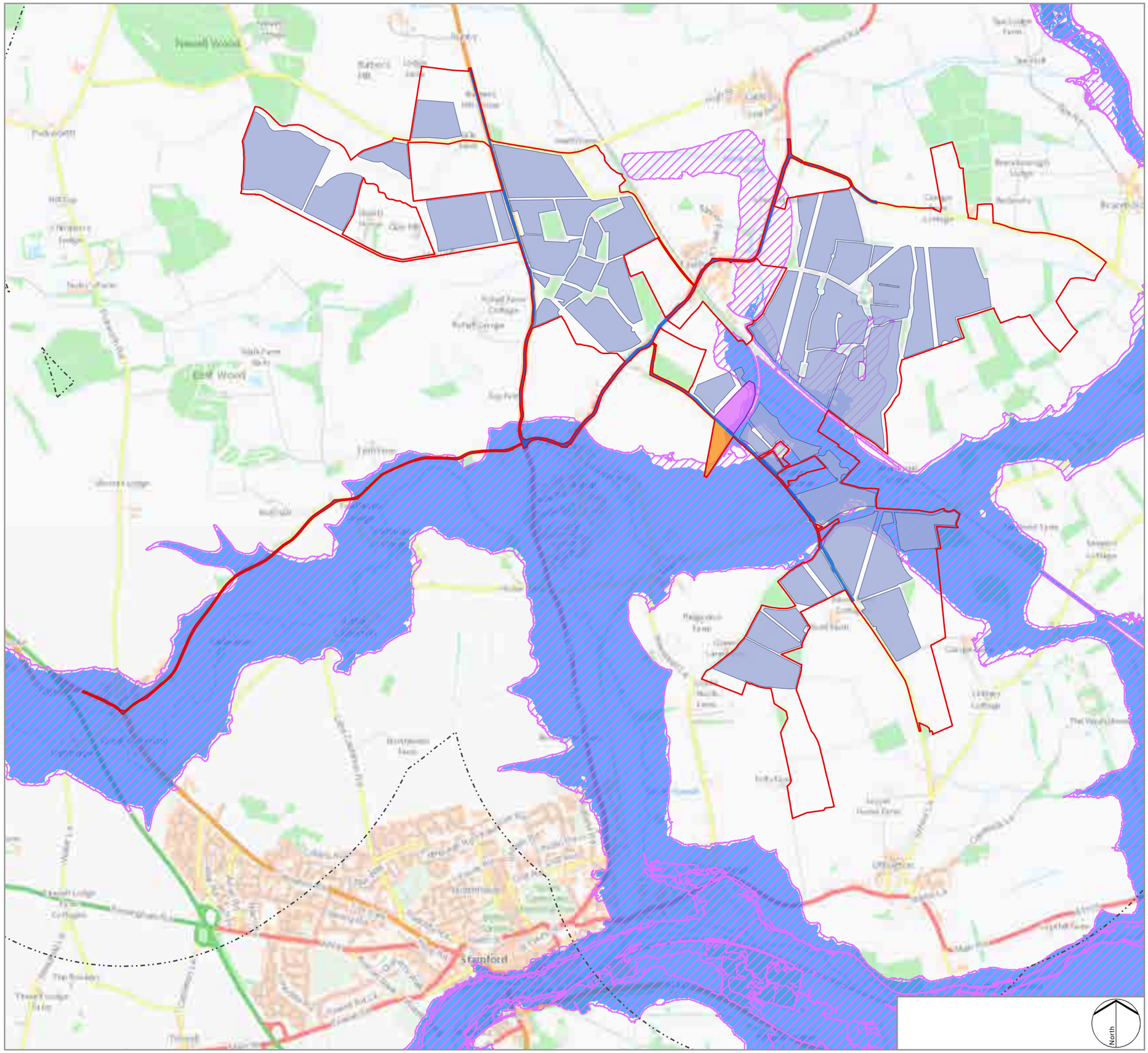
Area measurements for indicative purposes only.

Sources: Ordnance Survey

ANNEX E – RESERVOIR FLOODING EXTENT MAP

Y:\GIS\HYDROLOGY\PROJECTS\4217 ESSENDINE SOLAR FARM\4217 ESSENDINE SOLAR FARM.APRX



LEGEND

Study Areas

- Site Boundary
- PWS Study Area (2km)
- Wider Study Area (5km)

Site Works

- Solar Panel Area
- Potential Highway Works
- Grid Connection Route
- Primary Onsite Substation
- Reservoir flooding - Also flooding from rivers
- Reservoir flooding - River Levels are normal

LDĀDESIGN

PROJECT TITLE

MALLARD PASS SOLAR FARM:
FLOOD RISK ASSESSMENT

DRAWING TITLE

Reservoir Flooding Extent

ISSUED BY		T:	
DATE	1 March 2022	DRAWN	CH
SCALE @A3	1:30,000	CHECKED	RD
STATUS	Draft	APPROVED	SC

DWG. NO. Annex E

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Sources: Ordnance Survey