JBM Solar Projects 8 Ltd

Padbury Brook Solar Farm

Flood Risk Assessment & Outline Drainage Strategy

680623-R1(04)-FRA
November 2022

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RSK GENERAL NOTES

Project No.: 680623-R1(04)-FRA

Site: Padbury Brook Solar Farm

Title: Flood Risk Assessment & Outline Drainage Strategy

Client: JBM Solar Projects 8 Ltd.

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APPENDICES

1 INTRODUCTION

1.1 Context

RSK Land and Development Engineering Ltd (RSK) was commissioned to carry out a Flood Risk Assessment (FRA) and outline drainage strategy for RSK ADAS Ltd on behalf of JBM Solar Projects 8 Ltd (the 'client'). The assessment is in support of the planning submission for the proposed Padbury Brook Solar Farm near Bicester (the 'site').

The assessment has been prepared in accordance with the National Planning Policy Framework (NPPF)[1] and its accompanying Planning Practice Guidance[2], the Interim Code of Practice for Sustainable Drainage[3], BS 8533-2017 Assessing and Managing Flood Risk in Development Code of Practice[4], BS 8582:2013 Code of practice for surface water management for development sites[5] and the Non-statutory technical standards for sustainable drainage systems[6], with site-specific advice from the Environment Agency (EA), the Lead Local Flood Authority (LLFA), the Local Planning Authority (LPA), the architect and the client.

The NPPF sets out the criteria for development and flood risk by stating that inappropriate development in areas at risk of flooding should be avoided by directing development away from areas at highest risk, but where development is necessary, making it safe without increasing flood risk elsewhere.

The key definitions within the PPG are:

- "Flood risk" is a combination of the probability and the potential consequences of flooding from all sources – including from rivers and the sea, 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; and,
- "Areas at risk of flooding" means areas at risk from all sources of flooding. For fluvial (river) and sea flooding, this is principally land within Flood Zones 2 and 3. It can also include an area within Flood Zone 1 which the EA has notified the local planning authority as having critical drainage problems.

For this site, the key aspects that require the assessment are:

- The EA's indicative flood zone map shows the site is located within Flood Zone 1, and,
- The total site area is 59.4Ha therefore surface water drainage must be considered, and sustainable drainage systems (SuDS) incorporated, where possible.

[1] Communities and Local Government, 'National Planning Policy Framework', July 2021.

[2] Communities and Local Government, 'Planning Practice Guidance - Flood Risk and Coastal Change, ID 7', August 2022. http://planningguidance.planningportal.gov.uk/blog/guidance/flood-risk-and-coastal-change/

[3] DEFRA, 'Interim Code of Practice for Sustainable Drainage Systems' National SUDS Working Group, July 2004.

[4] BSI, 'BS 8533-2017 Assessing and managing flood risk in development Code of practice', 2017.

[5] BSI, 'BS 8582:2013 Code of practice for surface water management for development sites', November 2013.

[6] DEFRA, 'Sustainable Drainage Systems - Non-statutory technical standards for sustainable drainage systems', March 2015.

1.2 Scope of work

A key element of project development is to prepare a FRA to establish the flood risk associated with the proposed development and to propose suitable mitigation, if required, to reduce the risk to a more acceptable level.

The scope of work relating to a FRA is based on the guidance provided in Section 14 of the NPPF and its accompanying Planning Practice Guidance.

A site-specific FRA 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 scope of this assessment therefore comprises the following elements:

- To review architect plans, planning information and other studies to determine existing site conditions;
- To obtain information on the hydrology and hydrological regime in and around the site;
- To obtain the views of the EA/LLFA including scope, location and impacts;
- To determine the extent of new flooding provision and the influence on the site;
- To assess the impact on the site from climate change effects and anticipated increases in rainfall over a 40 year period for energy production uses;
- To review site surface water drainage based on the proposed layout and, if necessary, to determine the extent of infrastructure required; and
- To prepare a report including calculations and summaries of the source information and elements reviewed.

Reliance has been placed on factual and anecdotal data obtained from the sources identified. RSK cannot be held responsible for the scope of work, or any omissions, misrepresentation, errors or inaccuracies with the supplied information. New information, revised practices or changes in legislation may necessitate the re-interpretation of the report, in whole or in part.

The comments given in this report and opinions expressed are subject to RSK Group Service Constraints provided in **Appendix A**.

2 SITE DESCRIPTION

2.1 Existing site

2.1.1 Location

Site Name and Address: Land near Stratton Audley, Cherwell District, Oxfordshire, England

Site National Grid Reference: (E) 462550; (N) 227502

The site is approximately 59.4Ha in size and is located to the north / northeast of Bicester. The site covers a number of existing fields. The site is located off Mill Lane to the west Stratton Audley Road to the south and is accessed via the existing entrance off this road.

Table 2.1: Site setting

Direction	Characteristic
North	To the north is a small wooded area and agricultural land.
East	Agricultural fields lie beyond the eastern boundary.
South	The site is bounded by Stratton Audley Road to the south, with agricultural land beyond.
West	The site is bounded by agricultural fields and Mill Lane in the southwest and by Stratton Court Barn and its associated land in the central and northern extents. Agricultural land is located further to the west.

Figure 2.1 shows a site location map.

Figure 2.1: Site location map

2.1.2 Land use and topography

The existing site currently comprises undeveloped agricultural land. The site can therefore be described as Greenfield.

The approximate land use of the site is as follows:

Table 2.2: Existing site land uses

Land use	Area (Ha)	Percentage (%)
Impermeable	0	0
Permeable	59.4	100
Total	59.4	100

A site-specific topographic survey has not been provided for the site, instead LiDAR DTM data has been utilised to understand the local elevation in the area. The survey (Figure 2.2) shows a fall from the west to the eastern and northern boundaries. The lowest on-

site point is located along the site's eastern boundary, at an approximate level of 89.5mAOD. The high point on site is located at 105.7mAOD in the south western section of the site.

Figure 2.2: Local elevation contours

2.1.3 Hydrology

There is an unnamed ordinary watercourse which crosses NW – SE through the central area of the site before running in a NE direction along the eastern boundary. The watercourse continues in a NE direction connecting into Padbury Brook.

Padbury Brook is a second ordinary watercourse, located approximately 0.28km from the site's eastern boundary. The watercourse ultimately conveys flow north-east for approximately 12km, discharging to the River Great Ouse near Buckingham.

There is a small pond located inside the western boundary of the site on the alignment of the ordinary watercourse crossing the site.

2.1.4 Geology

2.1.4.1 Desk Study

According to British Geological Surveying mapping, the underlying geology on the site can be described as the following:

- Superficial Geology:

- Central and northern sections of the site: Till, Mid Pleistocene - Diamicton. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by ice age conditions (U).
- Eastern boundary: Alluvium - Clay, Silt, Sand And Gravel. Superficial Deposits formed up to 2 million years ago in the Quaternary Period. Local environment previously dominated by rivers (U).
- Southern extent of the site: No superficial deposits recorded.

➢ Bedrock Geology:

- Peterborough Member - Mudstone. Sedimentary Bedrock formed approximately 164 to 166 million years ago in the Jurassic Period. Local environment previously dominated by shallow seas.

BGS Borehole data records were searched for nearby borehole logs that may give relevant information regarding the on-site geology. There were no borehole records within the site, with one in the near vicinity (reference SP62NW4). The borehole records for the well show layers of clays and hard rock to the termination of the core (73m below ground level). Water is noted as being struck at depth.

2.1.5 Hydrogeology

Hydrogeological information was obtained from the online Magic Maps service. The central and northern areas of the site are underlain with superficial geology designated as an 'Unproductive' aquifer. The eastern boundary (alluvium) is designated a Secondary A aquifer. The site is underlain with bedrock geology designated as an 'Unproductive' aquifer.

The site is not located within a Groundwater Source Protection Zone (SPZ).

2.2 Development proposals

The development will involve the Installation and operation of a renewable energy generating station comprising ground-mounted photovoltaic solar Arrays together with substation, switchgear container, inverter/transformer units, Site access, internal access tracks, security measures, access gates, other ancillary infrastructure and landscaping and biodiversity enhancements.

The approximate land uses of the proposed site are summarised in **Table 2.3** below,

Table 2.3: Proposed site land uses

Land use	Area (Ha)	Percentage
Impermeable	0.28	<1%
Permeable	59.12	>99%
Total	59.40	100%

The site layout is in **Appendix B**.

3 LEGISLATION, POLICY AND GUIDANCE

3.1 National policy

Table 3.1: National legislation and policy context

Legislation	Key provisions
National Planning Policy Framework (2021)	The aims of planning policy on development and flood risk are to ensure that flood risk is taken into account at all stages in the planning process to avoid inappropriate development in areas at risk of flooding, and to direct development away from areas at highest risk. Where new development is, exceptionally, necessary in such areas, policy aims to make it safe without increasing flood risk elsewhere and where possible, reducing flood risk overall.
Planning Practice Guidance (2022)	The NPPF is supported by an online Planning Practice Guidance, which provide additional guidance on flood risk.
Flood and Water Management Act 2010[7]	The Flood and Water Management Act (FWMA) aims to implement the findings of the 2007 Pitt Review and co-ordinate control of drainage and flood issues. There are a number of increased responsibilities within the Act that affect adoption of SuDS features and the role of the EA to expand on the mapping data they provide. The implementation of SuDS features has many beneficial impacts on the treatment of surface water during remediation works.
Water Resources Act 1991[8]	Section 24 – The EA is empowered under this Act to maintain and improve the quality of 'controlled' waters Section 85 – It is an offence to cause or knowingly permit pollution of controlled waters Section 88 – Discharge consents are required for discharges to controlled waters
Water Framework Directive (2000)[9]	The Water Framework Directive (WFD) requires all inland and coastal waters to reach 'good' chemical and biological status by 2015. Flood risk management is unlikely to have a significant impact on chemical water quality except where maintenance works disturb sediment (such as de-silting) or where pollutants are mobilised from contaminated land by floodwaters. The main impact of the WFD on flood risk management, both now and in the future, relates to the ecological quality of water bodies. Channel works, such as straightening and deepening, or flood risk management schemes that modify geomorphological processes can change river morphology. The WFD aims to protect conservation sites identified by the

[7] Flood and Water Management Act, 2010

[8] Water Resources Act, 1991

[9] EU Water Framework Directive, 2000

Legislation	Key provisions
	EC Habitats Directive and Birds Directive that have water-related features, by designating them as 'protected sites'.

Table 3.2: Local policy context

Legislation	Policy	Key provisions
Cherwell District Local Plan (2011 – 2031) [10]	Policy ESD 6: Sustainable Flood Risk Management	The Council will manage and reduce flood risk in the District through using a sequential approach to development; locating vulnerable developments in areas at lower risk of flooding. Development proposals will be assessed according to the sequential approach and where necessary the exceptions test as set out in the NPPF and NPPG. Development will only be permitted in areas of flood risk when there are no reasonable available sites in areas of lower flood risk and the benefits of the development outweigh the risks from flooding. In addition to safeguarding floodplains from development, opportunities will be sought to restore natural river flows and floodplains, increasing their amenity and biodiversity value. Building over or culverting of watercourses should be avoided and the removal of existing culverts will be encouraged. Existing flood defences will be protected from damaging development and where development is considered appropriate in areas protected by such defences it must allow for the maintenance and management of the defences and be designed to be resilient to flooding. Site specific flood risk assessments will be required to accompany development proposals in the following situations: • All development proposals located in flood zones 2 or 3 • Development proposals of 1 hectare or more located in flood zone 1 • Development sites located in an area known to have experienced flooding problems • Development sites located within 9m of any watercourses. Flood risk assessments should assess all sources of flood risk and demonstrate that: • There will be no increase in surface water discharge rates or volumes during storm events up to and including the 1 in 100 year storm event with an allowance for climate change (the design storm event) • Developments will not flood from surface water up to and including the design storm event or any surface water flooding beyond the 1 in 30 year storm event, up to and

[10] Cherwell District Council (2015), The Cherwell Local Plan 2011-2031, Part 1 Adopted 20 July 2015, (incorporating Policy Bicester 13 re-adopted on 19 December 2016)

Legislation	Policy	Key provisions
		including the design storm event will be safely contained on site. Development should be safe and remain operational (where necessary) and proposals should demonstrate that surface water will be managed effectively on site and that the development will not increase flood risk elsewhere, including sewer flooding.
Cherwell District Local Plan (2011 – 2031)	Policy ESD 7: Sustainable Drainage Systems (SuDS)	All development will be required to use sustainable drainage systems (SuDS) for the management of surface water run-off. Where site specific Flood Risk Assessments are required in association with development proposals, they should be used to determine how SuDS can be used on particular sites and to design appropriate systems. In considering SuDS solutions, the need to protect ground water quality must be taken into account, especially where infiltration techniques are proposed. Where possible, SuDS should seek to reduce flood risk, reduce pollution and provide landscape and wildlife benefits. SuDS will require the approval of Oxfordshire County Council as LLFA and SuDS Approval Body, and proposals must include an agreement on the future management, maintenance and replacement of the SuDS features.

3.2 Area guidance

Table 3.2: Area Guidance

Study	Overview of key provisions and policies
SFRA: Cherwell and West Oxfordshire - Level 1 Strategic Flood Risk Assessment[11] 2009	The principle aim of the SFRA was to map all forms of flood risk in order to provide an evidence base to locate new development. It also aims to provide appropriate policies for the management of flood risk and identify the level of detail required for site-specific FRAs. The SFRA contains information and maps detailing flood sources and risks. Information relevant to the site is detailed in Section 4 of this report. There is limited historical flood information available for the area to the north east of Bicester. There were no records of groundwater flooding in the region.
CFMP: Great Ouse Catchment Flood Management Plan[12] 2009 /	Catchment Flood Management Plans (CFMP) give an overview of the flood risk from inland sources across each river catchment and recommend ways of managing those risks now and over the next 50-100 years. The EA is responsible for producing CFMPs.

[11] Scott Wilson (2009) Cherwell and West Oxfordshire, Level 1 Strategic Flood Risk Assessment: April 2009

[12] Great Ouse Catchment Flood Management Plan: Summary Report, Environmental Agency, December 2009

Study	Overview of key provisions and policies
Thames Catchment Flood Management Plan[13] 2009	

3.3 Site-specific consultation

As part of this assessment, the following authorities have been contacted to obtain relevant data/guidance and establish key site constraints:

Table 3.4: Key site-specific consultations

Consultee	Date issued	Enquiry	Summary of Comments	Appendix
Environment Agency (EA)	June 2022	Product data Pre-application enquiry	We have no historic flood event information for this area. It is possible that other flooding may have occurred that we do not have records for, and other organisations such as local authorities or IDBs may have records.	**App C**
Oxfordshire CC (LLFA)	July 2022	Pre-application enquiry	I have checked our historic flood data base and we do not have any recorded flood events in the area provided below. I should stress that this is not to say it has not flooded but it means we do not have a record of it. Unfortunately, we do not have any maps or modelling of flooding currently.	**App D**

Key findings are referred to in the relevant part of Section 4 and full details are contained in the relevant appendices.

[13] Thames Catchment Flood Management Plan: Summary Report, Environmental Agency, December 2009

4 SOURCES OF FLOOD RISK

4.1 Criteria

In accordance with the NPPF[1] and advice from the EA, a prediction of the flood sources and levels is required along with the effects of climate change from the present for the design life of the development (in this case assumed to be 40 years).

Changes to climate change guidance in May 2022 indicate that increased allowances in peak river flow and rainfall intensity should now be incorporated within any assessment. The appropriate allowance for peak river flow is based on the site's location in the country, the lifetime of development, the relevant flood zone and the vulnerability of the proposed end use.

The flood risk elements that need to be considered for any site are defined in BS 8533 as the "Forms of Flooding" and are listed as:

- Flooding from rivers (fluvial flood risk);
- Flooding from the sea (tidal flood risk);
- Flooding from the land;
- Flooding from groundwater;
- Flooding from sewers (sewer and drain exceedance, pumping station failure etc); and
- Flooding from reservoirs, canals and other artificial structures.

The following section reviews each of these in respect of the subject site.

4.2 Definitions of Risk

Table 4.1: Flood Map for Planning Risk Zoning

Flood Zone	Description
Flood Zone 1	Land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%)
Flood Zone 2	Flood Zone 2 - land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% – 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5% – 0.1%) in any year
Flood Zone 3	Land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3b	Land having the potential to flood for storm events up to the 1 in 20 year return period (>5% annual probability of flooding occurring). It is classified as 'functional floodplain'.

Table 4.2: Flood Risk from Rivers or the Sea and Flood Risk from Surface Water

Flood Risk	Description
High	High risk means that each year this area has a chance of flooding of greater than 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Medium	Medium risk means that each year this area has a chance of flooding of between 1% and 3.3%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Low	Low risk means that each year this area has a chance of flooding of between 0.1% and 1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.
Very Low	Means that each year this area has a chance of flooding of less than 0.1%. This takes into account the effect of any flood defences in the area. These defences reduce but do not completely stop the chance of flooding as they can be overtopped, or fail.

Table 4.3: Flood Risk category matrix from Reservoirs, Groundwater, sewers and other artificial sources

Threat Probability	Low Impact	Medium Impact	High Impact
High	Medium	Medium	High
Medium	Low	Medium	Medium
Low	Low	Low	Medium
Very Low	Very Low		

4.3 Flooding from rivers (fluvial flood risk)

4.3.1 Main river

The EA Flood Zone mapping study for England and Wales is available on their website at: https://flood-map-for-planning.service.gov.uk.

The latest EA published flood zone map (**Figure 4.1**), taking into account the presence of flood defences, shows the site is within Flood Zone 1 representing a less than 0.1% change of flooding.

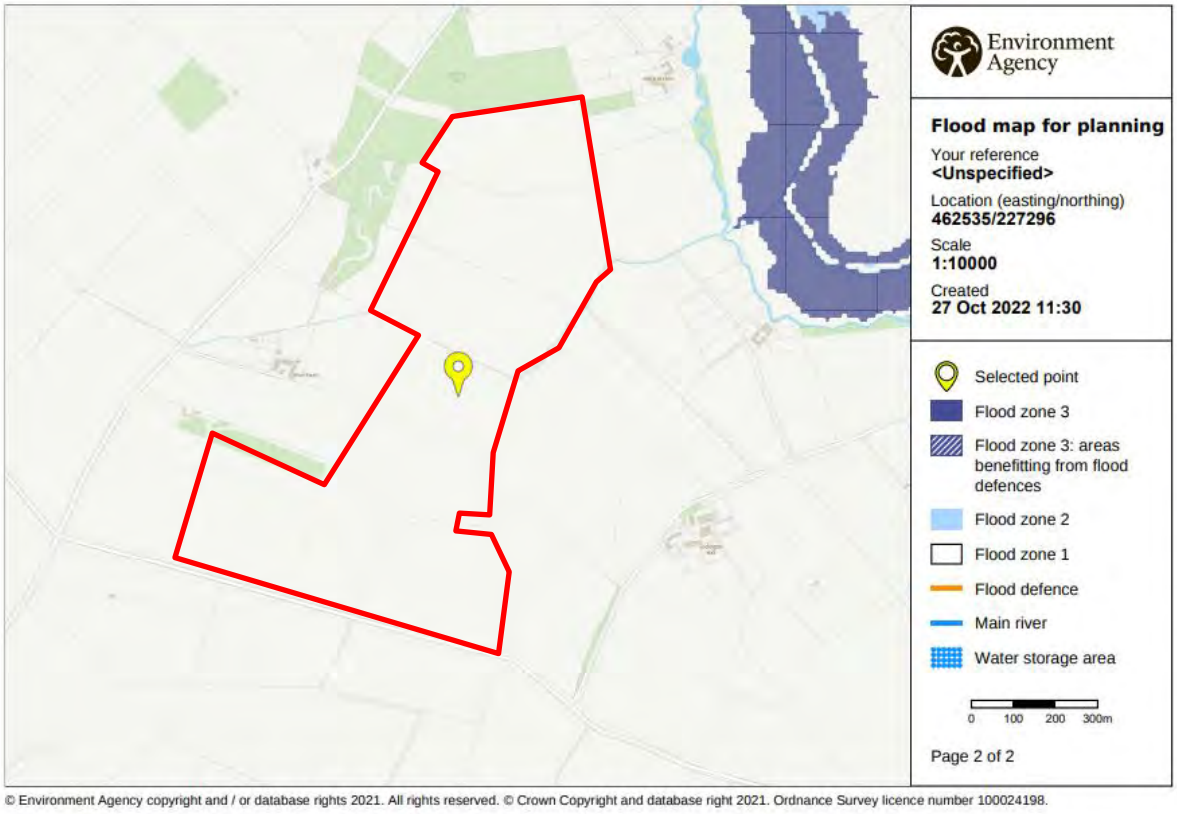


Figure 4.1: Environment Agency 'Flood map for planning' (accessed October 2022)

In December 2013, the EA released an additional form of mapping 'Risk of Flooding from Rivers and Sea', which is available at:

https://flood-warning-information.service.gov.uk/long-term-flood-risk

The latest 'Risk of Flooding from Rivers and Sea' flood map (**Figure 4.2**), which shows the EA's assessment of the likelihood of flooding from rivers and the sea at any location and is based on the presence and effect of all flood defences, predicted flood levels, and ground levels, indicates that the eastern, southern and western extents of the site are at site are considered to be at '**very low**' risk of flooding.

Figure 4.2: Environment Agency 'Flood risk from rivers or the sea' map (accessed October 2022)

The resultant fluvial flood risk to the site is considered to be **very low**.

4.3.2 Ordinary watercourse

The ordinary watercourse which crosses the site in a W- E orientation and the watercourse which runs along the eastern boundary are not mapped within the Environment Agency's fluvial flood extent mapping. This is likely due to the small upstream catchment of the watercourses. With no topographical information on the watercourses, the scale and nature of the features is unclear, however as a result of the small upstream catchment the risk to the site from the ordinary watercourses is considered to be **very low - low**.

4.3.3 Climate change

Fluvial flooding is likely to increase as a result of climate. A greater intensity and frequency of precipitation is likely to raise river levels and increase the likelihood of a river overtopping its banks. Climate change guidance for river modelling was updated by the EA in July 2021.

Due to the distance to the nearest fluvial flood zone, climate change increasing fluvial flows and levels is unlikely to have a significant impact upon the site.

4.4 Flooding from the sea (tidal flood risk)

The site is not considered to be at risk of flooding from tidal sources due to its elevation and inland location.

4.5 Flooding from the land (overland pluvial flood risk)

If intense rain is unable to soak into the ground or be carried through manmade drainage systems, for a variety of reasons, it can run off over the surface causing localised floods before reaching a river or other watercourse.

Generally, where there is impermeable surfacing or where the ground infiltration capacity is exceeded, surface water runoff can occur. Excess surface water flows from the site are believed to drain naturally to the local water features, either by overland flow or through infiltration.

The EA's surface water flood map (**Figure 4.3**) shows the site is predominantly at a very low risk of surface water flooding. There is a section of low - high surface water flood risk associated with the watercourse crossing the site and running up the eastern boundary of the site.

Figure 4.3: Environment Agency 'Flood risk from surface water' map (accessed October 2022)

EA flood depth mapping (**Figure 4.4**) of a medium risk scenario (up to 1 in 100 years) indicates flood depths of up to 300mm can be expected within the central and eastern areas of the site.

Figure 4.4: Environment Agency 'Flood risk from surface water' medium risk scenario (1 in 100 year) map (accessed October 2022)

Given the proposed development, it is not likely that the solar panels and associated infrastructure will generate significant quantities of on-site surface water runoff. The scheme will incorporate a suitable surface water drainage system for the development and will ensure that any runoff generated from the development will be controlled and managed in a suitable manner. This is discussed further in **Section 7**. It is also unlikely that the solar panels and associated infrastructure will pose any imposition to overland flow routes.

The risk of surface water flooding at the site is predominantly considered to be **very low** with the southern and northern sections of the site categorised by this risk. However, there are areas of **low – high** risk are associated with the watercourse crossing the site and running up the eastern boundary of the site.

4.5.1 Climate change

Surface water flooding is likely to increase as a result of climate change in a similar ratio to fluvial flooding. Increased intensity and frequency of precipitation is likely to lead to reduced infiltration and increased overland flow. Climate change guidance for rainfall intensity has been updated by the EA in May 2022. Revised allowances for climate change have been included in the indicative drainage strategy (refer to **Section 7**).

4.6 Flooding from groundwater

Groundwater flooding tends to occur after much longer 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. Groundwater tends to flow from areas where the ground level is high, to areas where the ground level is low. In low-lying areas, the water table is usually at shallower depths anyway, but during very wet periods, with all the additional groundwater flowing towards these areas, the water table can rise up to the surface causing groundwater flooding.

From the above and due to the sporadic nature of groundwater flooding, the design of the development and the possibility of groundwater emergence at the site, it is unlikely that groundwater flooding would affect the development.

The resultant groundwater flood risk is considered to be **very low**.

4.6.1 Climate change

Climate change could increase the risk of groundwater flooding as a result of increased precipitation filtering into the groundwater body. If winter rainfall becomes more frequent and heavier, groundwater levels may increase. Higher winter recharge may however be balanced by lower recharge during the predicted hotter and drier summers. This is less likely to cause a significant change to flood risk than from other sources, since groundwater flow is not as confined. It is probable that any locally perched aquifers may be more affected, but these are likely to be isolated. The change in flood risk is likely to be low.

4.7 Flooding from sewers

Flooding from artificial drainage systems occurs when flow entering a system, such as an urban storm water drainage system, exceeds its conveyance capacity, the system becomes blocked or it cannot discharge due to a high water level in the receiving watercourse. A sewer flood is often caused by surface water drains discharging into the combined sewer systems; sewer capacity is exceeded in large rainfall events causing the backing up of floodwaters within properties or discharging through manholes.

Most adopted surface water drainage networks are designed to the criteria set out in Sewers for Adoption[14]. One of the design parameters is that sewer systems be designed

[14] WRC, 'Sewers for Adoption' 8th Edition, August 2018

such that no flooding of any part of the site occurs in a 1 in 30 year rainfall event. By definition a 1 in 100 year event would exceed the capacity of the surrounding sewer network as well as any proposed drainage. Due to the rural nature of the site it is unlikely that there will be any sewers in the immediate vicinity which will pose a flood risk to the site.

Development has the potential to cause an increase in impermeable area, an associated increase in surface water runoff rates and volumes, and a consequent potential increase in downstream flood risk due to overloading of sewers, watercourses, culverts and other drainage infrastructure.

To ensure that sewer and surface water flooding is not exacerbated; surface water must be considered within the design of the site. This ensures that any additional surface water and overland flows are managed correctly, to minimise flood risk to the site and the surrounding area.

The resultant sewer flood risk is considered to be **very low**.

4.7.1 Climate change

The impact of climate change is likely to be negative regarding flooding from sewers. Increased rainfall and more frequent flooding put existing sewer and drainage systems under additional pressure resulting in the potential for more frequent surcharging and potential flooding. This would increase the frequency of local sewer flooding but would not impact the site.

4.8 Other sources of flooding

4.8.1 Reservoirs

Flood events can occur from a sudden release of large volumes of water from reservoirs, canals and artificial structures.

The EA reservoir flood map (reproduced as **Figure 4.5**) shows the largest area that might be flooded if a reservoir were to fail and release the water it holds. Since this is a prediction of a worst-case scenario, it is unlikely that any actual flood would be this large. According to the EA Reservoir flood maps the site is not at risk of flooding from reservoirs.

Figure 4.5: Environment Agency 'Flood risk from reservoirs' map (accessed October 2022)

Reservoir flooding is also extremely unlikely. There has been no loss of life in the UK from reservoir flooding since 1925. Since then reservoir safety legislation has been introduced to ensure reservoirs are maintained.

The resultant flood risk is considered to be **very low**.

Reservoirs can be managed over time, controlling inflow/outflow of water and therefore there is the capacity to control the effects of climate change. Increased rainfall has the potential to increase base flow, but this should be minimal. It is unlikely that there will be a substantial change to the risk of flooding for this site.

4.8.2 Canals

There are no Canal & Rivers Trust owned canals by the within the vicinity of the site. As a result, the risk to the site from this source is considered very low.

4.8.3 Blockages of artificial drainage systems

There is a possibility that flooding may result due to culverts and/or sewers being blocked by debris or structural failure. This can cause water to backup and result in localised flooding, as well as placing areas with lower ground levels at risk.

There appear to be watercourse crossings for farm vehicle access. If the culverts are blocked, then flows will potentially back up within the surrounding land, albeit with very localised effects. Hence, these structures are not considered to pose a risk, with any exceedance flow passing over the track and re-entering the watercourse. Also, if the culverts are kept clear and maintained, blockages are not thought to pose a risk.

The risk of flooding from artificial drainage systems is considered to be **very low**.

Climate change is unlikely to affect the flooding risk to the site from such blockages.

5 FLOOD MITIGATION MEASURES

5.1 Overview

The site lies within Flood Zone 1. To facilitate the development of the site a surface water drainage network has been considered.

5.2 Overland flood flow

No further overland flow control measures are proposed as all surface water runoff up to the 1 in 100 year climate change storm will be stored on-site and discharged via infiltration into the ground.

There is a section of low - high surface water flood risk crossing the central area of the site and located along the eastern boundary. Aside from the solar panels there is minimal infrastructure located within the surface water flood extent on the site. The elevated panels will not pose an imposition to the overland flow path.

The surface water flow path / extents encroach upon the proposed access track. The proposed access track will be made from permeable material, and as such will not impact the route of the flow path.

5.3 Finished floor levels

The eastern extent of the solar panels can expect flood depths of up to 300mm when considering a medium risk surface water flooding event (1 in 100 year). If practicable in terms of design, it is recommended sensitive electrical equipment on these panels is raised 300mm above this level (600mm above ground level).

5.4 Flood compensation

The site is shown to be outside of the 1 in 100 year plus climate change fluvial flood extent, so floodplain compensatory measures are not deemed necessary.

5.5 Safe access/egress

The site lies outside of the 1 in 1000 year fluvial flood extent, therefore safe access and egress will be available up to this storm event.

5.6 Environmental Permit/Ordinary watercourse easement and consents

Under the Water Resources Act 1991 and associated byelaws, works in, over, under or adjacent to main rivers require the consent of the EA and works in, over, under or adjacent to ordinary watercourses will require IDB, Local Authority or LLFA consent. This is to ensure that they neither interfere with the IDB/EA/LPA/LLFA's work nor adversely affect the environment, fisheries, wildlife and flood defence in the locality.

6 PLANNING CONTEXT

6.1 Application of planning policy

Section 14 of the NPPF includes measures specifically dealing with development planning and flood risk using a sequential characterisation of risk based on planning zones and the EA Flood Map. The main study requirement is to identify the flood zones and vulnerability classification relevant to the proposed development, based on an assessment of current and future conditions.

6.2 Land use vulnerability

Planning Practice Guidance (PPG) includes a list of appropriate land uses in each flood zone dependent on vulnerability to flooding. In applying the Sequential Test, reference is made to **Table 6.1** below, reproduced from Table 3 of PPG.

Table 6.1: Flood risk vulnerability and flood zone 'compatibility'

Flood Risk Vulnerability Classification		Essential Infrastructure	Water Compatible	Highly Vulnerable	More Vulnerable	Less Vulnerable
Flood Zone	Zone 1	**Appropriate**	Appropriate	Appropriate	Appropriate	Appropriate
	Zone 2	Appropriate	Appropriate	Exception Test Required	Appropriate	Appropriate
	Zone 3a	Exception Test Required	Appropriate	Should not be permitted	Exception Test Required	Appropriate
	Zone 3b functional floodplain	Exception Test Required	Appropriate	Should not be permitted	Should not be permitted	Should not be permitted

With reference to Table 2 of the PPG, the use as a solar farm energy production site is classed as 'Essential Infrastructure'. This classification of development is appropriate for areas within Flood Zone 1 and Flood Zone 2, with the exception test required for areas within Flood Zone 3. Given no development is proposed within Flood Zones 2 or 3, the Exception Test does not need to be applied.

6.3 Sequential Test

The flood risk aspect of the Sequential Test is required to assess flood risk and the PPG recommends that the test be applied at all stages of the planning process to direct new

development to areas with the lowest probability of flooding (Flood Zone 1). The site therefore passes the flood risk elements of the Sequential Test.

7 SURFACE WATER DRAINAGE ASSESSMENT

7.1 Scope

The site is located in Flood Zone 1 though it is greater than 1Ha in size, therefore the LLFA requires such development to focus on the management of surface water run-off. This section discusses the potential quantitative effects of the development on both the risk of surface water flooding on-site and elsewhere within the catchment, as well as the type of potential SuDS features that could be incorporated as part of the masterplan.

In accordance with the Defra Non-Statutory Technical Standards, the surface water drainage strategy should seek to implement a SuDS hierarchy that aspires to achieve reductions in surface water runoff rates to greenfield rates. Where a reduction to the greenfield rate is not practicable, the proposed surface water drainage strategy should not exceed the existing runoff rate.

In addition, Building Regulations Part H[15] requires that the first choice of surface water disposal should be to discharge to an adequate soakaway or infiltration system, where practicable. If this is not reasonably practicable then discharge should be to a watercourse, the least favourable option being to a sewer (surface water before combined). Infiltration techniques should therefore be applied wherever they are appropriate.

This assessment includes an overview and comparison of the existing greenfield scenario and proposed development scenario.

7.2 Pre-development situation

The existing site area is 59.4Ha and <1% impermeable.

The pro-rata IoH 124 method[16] has been used to estimate the Greenfield surface water runoff for the total site area of the site, shown in **Table 7.1**. Calculations are contained in **Appendix D**.

[15] HM Government (2010 with 2013 amendments), 'The Building Regulations 2010: Approved Document H - Drainage and Waste Disposal (2002 Edition incorporating 2010 amendments)'

[16] Institute of Hydrology (IoH), 'Flood Estimation for small catchments - Report 124', 1994

Table 7.1: IOH 124 surface water runoff (greenfield) for total site area (59.4Ha) – (note calculations suggest a soil type of 1 in this location leading to very low runoff rates)

Return period	Peak flow (l/s)
QBar	8.69
1 in 1 year	7.56
1 in 30 year	21.29
1 in 100 year	30.93

7.3 Off-site discharge options and limits

7.3.1 Infiltration

Infiltration should be considered as the primary option to discharge surface water from the developed site. The effectiveness of infiltration is completely dependent on the physical conditions at the site. Potential obstacles include:

- Local variations in permeability preventing infiltration – It is understood from the BGS geological mapping that the site is underlain with superficial clay, silt, sand and gravel geology, underlain with mudstone bedrock geology
- Shallow groundwater table - For infiltration drainage devices, Building Regulation approved document H states that these “should not be built in ground where the water table reaches the bottom of the device at any time of the year”; and,
- Source Protection Zones - The site is not located within a Groundwater Source Protection Zone.

Based on the underlying geology of the site, any infiltration techniques used in the surface water drainage design will be designed based off assumed infiltration rates, pending any infiltration testing.

7.3.2 Discharge to watercourse

Discharging surface water directly to a local watercourse is considered feasible for the site, as there is a watercourse crossing the central area of the site and running along the eastern site boundary.

7.3.3 Discharge to surface water sewer

There are no surface water sewers on-site or within the vicinity of the site, hence discharge to sewer is not a feasible option.

7.4 Post-development situation

According to the principles of the BRE planning guidance for the development of large-scale ground mounted solar PV systems, in general solar panels do not increase the

impermeable area of a site and it is generally considered that they do not contribute to an increase in surface water runoff from the site.

The solar panels will not increase the impermeable area across the site; therefore, no formal drainage is required. As such a pragmatic approach has been developed to promote infiltration and provide storage areas across the site. This will involve the management and maintenance of vegetated and grassed areas surround the panels (particularly at the low edge) and the design of gravel subbase for the onsite units. These features will intercept and attenuate runoff, promoting infiltration across the site.

7.4.1 Solar arrays

7.4.1.1 Design

It is anticipated that any precipitation falling on each solar panel will runoff the panels and flow towards / infiltrate in the rain shadow of the down-slope modules. The rows of panels on the site are generally aligned from parallel to a 25° angle to the contours of the site. As such rainwater falling of the trailing edge of the panels will generally flow away from the base of the panels between a 90° and 25° angle towards the rain shadow of the down-slope panels. This feature will enable the use of the rain shadow area of the panels to maintain the infiltration potential of the site.

In some instances, runoff from solar panels could result in the kinetic compaction of soils at the base of the panels and the intensification of runoff into rivulets running along the trailing edge of the rows of panels. This could conceivably lead to a slight increase in the amount of runoff when compared to the pre-development situation resulting from a decrease in infiltration potential.

The specifications of the solar array supports are to be designed to be widely spaced and are driven vertically into the ground with no additional foundations. The arrays are in rows with spaces of several metres in between the leading edge of one row and the trailing edge of the row behind.

The panels are typically mounted in double horizontal rows and are separated by a horizontal 'rainwater' gap. This gap allows rainwater to drain freely to the ground between the panels helping to replicate the Greenfield runoff conditions.

7.4.1.2 Vegetation and soil structure

Sustainable management of the post development situation in terms of vegetation planting and soil type can be used as a means of managing surface water runoff from the solar panels. As such to ensure that there is no increase in surface water runoff managed sustainable vegetation (with a good soil structure e.g. chisel ploughed soils) will be allowed to grow beneath the solar panels, which will avoid kinetic compaction and ensure that any potential instances of rivulet formation are minimised and surface water runoff flows over the ground in a natural way as noted in the paper Hydrologic Response of Solar Farms (Cook and McCuen 2013[17]). Vegetation planting and soil management should be site wide to encompass all solar panel rows.

[17] Cook, L.M and McCuen, R. H (2013), Hydrologic Response of Solar Panels, Journal of Hyrdologic Engineering, American Socey of Civil Engineers, May 2013

7.4.2 Equipment Housing

It is intended that surface water runoff from the equipment housing (specifications included in **Appendix F**) will be discharged to the ground after passing through the gravel subbase to closely mimic the existing situation. The design rainfall event for this assessment has been taken as the 6 hour, 1 in 100-year event with the intention of retaining any additional surface water runoff generated as a result of the development on the site in the gravel subbase. The possible methods of discharging surface water from the site will be via the existing drainage infrastructure on site or due to the small volumes of runoff, by using natural infiltration / evaporation.

Table 7.2 details the specifications of the indicative drainage subbase that could be used to serve the onsite equipment.

The area of the drainage subbase has been determined using the perimeters of the equipment housing / containers. It is intended that test ditches are backfilled with a granular material for health and safety reasons and to allow access.

The rainfall data used in the calculations has been gathered from the Centre of Ecology and Hydrology's Flood Estimation Handbook rainfall database. In accordance with National Planning Policy Framework, climate change has been taken into consideration for the lifetime of the development; as such an increase in rainfall of 25% has been included in the storage requirements.

Table 7.2: Approximate Gravel Subbase Sizing and Volumes

Description	1 in 100-year Rainfall (m)	Approx. Impermeable Development Area per unit (m^2)	1 in 100 yr Surface Water Volume Required (m^3)	1 in 100yr Volume Required with 25% Climate Change (m^3)	Minimum Gravel Base Sizing				Volume Created (m^3)*
					Side Slope	Min Area (m^2)	Depth (m)	Void ratio	
Battery units	0.069	0.8	0.05	0.0625	Vertical	1	0.3	0.3	0.09
Inverter building	0.069	30	2.07	2.58	Vertical	30	0.3	0.3	2.7
Customer Switchgear	0.069	30	2.07	2.58	Vertical	30	0.3	0.3	2.7

*Assuming a void ratio of 0.3

The attenuation volume (m^3) calculated per metre for the hardstanding, has been calculated using a void ratio of 0.3 of the total volume of aggregate in the base.

If natural infiltration on-site is not adequate to effectively discharge surface water runoff from the transformer stations, the gravel subbase would be utilised as on-site attenuation. These would be designed to store excess runoff before naturally discharging at greenfield rates across the site.

7.4.3 Access track surface water drainage

Where required, access tracks are kept to a minimum, and are usually a temporary measure. As such, 'floating roads' could be used on site, typically these will require a wide strip of geotextile laid on the ground covered by a nominal layer of stone to form the track. As such, the access tracks will maintain a permeable nature and not increase the surface water runoff from the development. Any flows in excess of the infiltration rates will discharge to the surrounding ground and will not impact on land outside of the site. For solar panel maintenance access could be gained by way of using 4x4 vehicle, quadbike or agricultural vehicles to minimise impacts on the ground.

Although part of the access track crosses the high risk surface water flow path, this should not disrupt the route of the existing flow path as it will be made from permeable material.

7.4.4 Maintenance

Maintenance of any drainage network is essential to ensure optimal performance of the drainage elements. As such maintenance requirements of the drainage system will include, but not be limited to the management and maintenance of the vegetation between the panels and the inspection and cleaning of gravel subbase to ensure that the capacity and infiltration rates are maintained.

The drainage systems are likely to remain in private ownership and therefore the site operator will be responsible for the maintenance of the drainage features on-site.

8 CONCLUSIONS AND RECOMMENDATIONS

This FRA complies with the NPPF and Planning Practice Guidance and demonstrates that flood risk from all sources has been considered in the proposed development. It is also consistent with the Local Planning Authority requirements with regard to flood risk.

The site lies in an area designated by the EA as Flood Zone 1, outlined to have a chance of flooding of 1 in 1000 or less (≤0.1%) in any year.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test have been met, with the site area located within Flood Zone 1 and 'Essential Infrastructure' classification of the development.

This flood risk assessment has considered multiple sources of flooding and concluded the following:

Table 8.1: Flood risk summary

Source	Level of risk	Mitigation
Fluvial	Very Low - Low	The site is located within Flood Zone 1. According to EA data, the site is not affected by fluvial flooding. However ordinary watercourses cross the central area of the site and run along the eastern boundary. The risk from these features is likely to be very low to low based on a limited upstream catchment.
Tidal	Very Low	The site is not at risk of tidal flooding due to its inland and elevated location.
Surface water	Very Low-High	There is a low – high risk flow path which crosses the site. Only solar panels are outlined for this area which will not impose any restrictions to the flow path. If practicable in design terms the electrical components of the panels should be raised a minimum of 600mm above ground level in the area affected by surface water flooding in the central eastern section of the site.
Groundwater	Very Low	Groundwater is not thought to pose a risk to the site. Groundwater levels on-site are unknown; further testing would confirm the levels.
Sewers	Very Low	The site is rural in setting and no significant sewerage infrastructure is anticipated at the site which would pose a flood risk to the development.

Source	Level of risk	Mitigation
Reservoirs	Very Low	The site in not located in an area at risk from reservoir flooding.
Artificial sources	Very Low	There site is not at risk from artificial sources.

The site is currently a greenfield site and is existing agricultural land. The proposed development will only alter the impermeable area on site by a diminutive amount, resulting in a negligible increase in surface water runoff. The solar panels will not increase the impermeable area on-site, and therefore will not increase the volume of surface water runoff.

NPPF sets out a Sequential Test, which states that preference should be given to development located within Flood Zone 1. This flood risk assessment demonstrates that the requirements of the Sequential Test and the Exception Test have been met, with the site's location within Flood Zone 1 and 'Essential Infrastructure' classification of the development.

Overall, taking into account the above points, the development of the site should not be precluded on flood risk grounds.

APPENDIX A
RSK GROUP SERVICE CONSTRAINTS

1. This report and the drainage design carried out in connection with the report (together the "Services") were compiled and carried out by RSK LDE Ltd (RSK) for RSK ADAS Ltd on behalf of JBM Solar Projects 8 Ltd (the "client") in accordance with the terms of a contract between RSK and the "client". The Services were performed by RSK with the skill and care ordinarily exercised by a reasonable civil engineer at the time the Services were performed. Further, and in particular, the Services were performed by RSK taking into account the limits of the scope of works required by the client, the time scale involved and the resources, including financial and manpower resources, agreed between RSK and the client.

2. Other than that expressly contained in paragraph 1 above, RSK provides no other representation or warranty whether express or implied, in relation to the Services.

3. Unless otherwise agreed in writing, the Services were performed by RSK exclusively for the purposes of the client. RSK is not aware of any interest of or reliance by any party other than the client in or on the Services. Unless expressly provided in writing, RSK does not authorise, consent or condone any party other than the client relying upon the Services. Should this report or any part of this report, or otherwise details of the Services or any part of the Services be made known to any such party, and such party relies thereon that party does so wholly at its own and sole risk and RSK disclaims any liability to such parties. Any such party would be well advised to seek independent advice from a competent environmental consultant and/or lawyer.

4. It is RSK's understanding that this report is to be used for the purpose described in the introduction to the report. That purpose was a significant factor in determining the scope and level of the Services. Should the purpose for which the report is used, or the proposed use of the site change, this report may no longer be valid and any further use of or reliance upon the report in those circumstances by the client without RSK's review and advice shall be at the client's sole and own risk. Should RSK be requested to review the report after the date of this report, RSK shall be entitled to additional payment at the then existing rates or such other terms as agreed between RSK and the client.

5. The passage of time may result in changes in site conditions, regulatory or other legal provisions, technology or economic conditions which could render the report inaccurate or unreliable. The information and conclusions contained in this report should not be relied upon in the future without the written advice of RSK. In the absence of such written advice of RSK, reliance on the report in the future shall be at the client's own and sole risk. Should RSK be requested to review the report in the future, RSK shall be entitled to additional payment at the then existing rate or such other terms as may be agreed between RSK and the client.

6. The observations and conclusions described in this report are based solely upon the Services, which were provided pursuant to the agreement between the client and RSK. RSK has not performed any observations, investigations, studies or testing not specifically set out or required by the contract between the client and RSK. RSK is not liable for the existence of any condition, the discovery of which would require performance of services not otherwise contained in the Services. For the avoidance of doubt, unless otherwise expressly referred to in the introduction to this report, RSK did not seek to evaluate the presence on or off the site of asbestos, electromagnetic fields, lead paint, heavy metals, radon gas or other radioactive or hazardous materials.

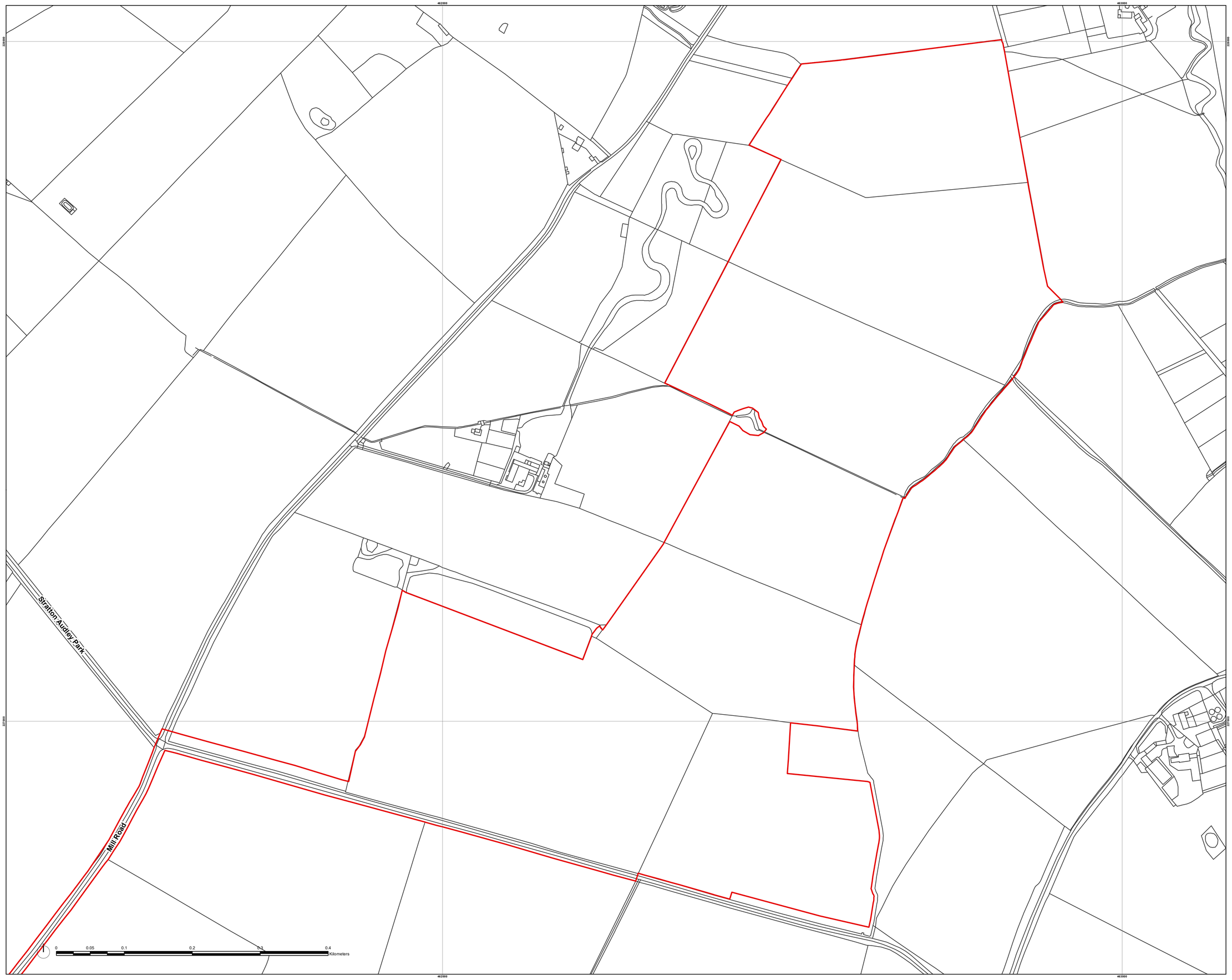
7. The Services are based upon RSK's observations of existing physical conditions at the site gained from a walk-over survey of the site together with RSK's interpretation of information including documentation, obtained from third parties and from the client on the history and usage of the site. The Services are also based on information and/or analysis provided by independent testing and information services or laboratories upon which RSK was reasonably entitled to rely. The Services clearly are limited by the accuracy of the information, including documentation, reviewed by RSK and the observations possible at the time of the walk-over survey. Further RSK was not authorised and did not attempt to independently verify the accuracy or completeness of information, documentation or materials received from the client or third parties, including laboratories and information services, during the performance of the Services. RSK is not liable for any inaccurate information or conclusions, the discovery of which inaccuracies required the doing of any act including the gathering of any information which was not reasonably available to RSK and including the doing of any independent investigation of the information provided to RSK save as otherwise provided in the terms of the contract between the client and RSK.

8. The phase II or intrusive environmental site investigation aspects of the Services is a limited sampling of the site at pre-determined borehole and soil vapour locations based on the operational configuration of the site. The conclusions given in this report are based on information gathered at the specific test locations and can only be extrapolated to an undefined limited area around those locations. The extent of the limited area depends on the soil and groundwater conditions, together with the position of any current structures and underground facilities and natural and other activities on site. In addition chemical analysis was carried out for a limited number of parameters [as stipulated in the contract between the client and RSK] [based on an understanding of the available operational and historical information,] and it should not be inferred that other chemical species are not present.

9. Any site drawing(s) provided in this report is (are) not meant to be an accurate base plan, but is (are) used to present the general relative locations of features on, and surrounding, the site. Features (boreholes, trial pits etc) annotated on site plans are

not drawn to scale but are centred over the appropriate location. Such features should not be used for setting out and should be considered indicative only.

APPENDIX B
PROPOSED BOUNDARY AND LAYOUT



LEGEND

Site

Issue.	Issue Details	Date
01	-	07/11/2022

Client:

JBM Solar

Project:

Padbury Brook Solar Farm

Drawing Title:

Site Location Plan A

Drawing No: 1120022-ADAS-XX-XX-DR-P-8001

Scale: 1:2,500 at A1

Drawn by: IH Date: 07/11/2022

Checked by: DH Date: 07/11/2022

ADAS, 11d Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS
Tel: 01235 355630

Semi-mature Trees to be planted at 10m centres, within the proposed hedgerow

Mature Tree planting spaced at 15m centres.

Where the existing hedgerow planting is sparse, gaps withing the hedgerow will be re-enforced with new hedgerow planting.

Mature Trees to be planted at 15m centres.

Semi-mature Trees to be planted at 10m centres within the proposed double staggered hedgerow

Mature Trees to be planted at 10m centres.

Mature Tree planting spaced at 10m centres.

Mature Tree planting spaced at 15m centres.

Where the existing hedgerow planting is sparse, gaps withing the hedgerow will be re-enforced with new hedgerow planting.

Semi-mature Trees to be planted at 10m centres, within the proposed double staggered hedgerow

Mature Trees to be planted at 20m centres.

Mature Trees to be planted at 20m centres.

MILL ROAD

Bloxeter Road

MILL ROAD

HV/OH-D

0 100m 1:2,500

SOFT LANDSCAPE KEY

Planning boundary

Existing trees and vegetation (Showing canopy extents)

PROPOSED TREES

Species	Common Name
Acer campestre	Field Maple
Betula pendula	Silver Birch
Malus sylvestris	Crab Apple
Malus cultivars	Apple
Ilex aquifolium	Holly
Pinus sylvestris	Scots Pine
Populus nigra 'Italica'	Lombardy Poplar
Prunus avium	Wild Cherry
Quercus robur	Oak
Sorbus aucuparia	Rowan
Tilia x europaea	Lime

Proposed Hedgerow planting

Species	Common name	Mix %
Acer campestre	Field Maple	5
Cornus sanguinea	Dogwood	5
Corylus avellana	Hazel	5
Crataegus monogyna	Hawthorn	50
Euonymus europaeus	Spindle	5
Ilex aquifolium	Holly	5
Ligustrum vulgare	Wild Privet	10
Prunus spinosa	Blackthorn	5
Rhamnus catharticus	Buckthorn	5
Viburnum opulus	Guelder Rose	5

Grazing Meadow Mix - Habitat Aid 'Grazing Meadow Seed Mix' or similar approved 4g/m2

Species Rich Grassland - Emorsgate EM2 'Generol' Purposed Meadow Xie' - Sown at 4g/m²

TRP Membrane

Overhead Line

Solar Panels
For details of solar equipment and layout, please see Engineers Specification

CCTV

Inverter

Spare Container

Substation

Inverter Containers

Maintenance Track

Deer Fence

Public Rights of Way

Existing Footpath

Permissive Footpath

NOTES:

No dimensions are to be scaled from this drawing.

Existing vegetation to be enhanced and strengthened. Exact locations/specifications of planting will be agreed via planning condition / the final conditioned LEMP.

Please Note: Some of the layers show in the key above may not appear within each layout

Rev.	Issue Details.	Date.
Eleventh Issue	Amendments to planting	23/11/22
Tenth Issue	Amendments to layout and planting	22/11/22
Ninth Issue	Amendments to planting	18/11/22
Eighth Issue	Amendments to planting	09/11/22
Seventh Issue	Amendments to planting	08/11/22
Sixth Issue	Amendments to planting	04/11/22
Fifth Issue	Alignment to new layout	25/10/22
Forth Issue	Amendments to tree density and quantity	30/09/22
Third Issue	Amendments to planting	09/09/22
Second Issue	Alignment to new layout	07/09/22
First Issue		26/07/22

Client:

JBM

Project:

Padbury

Drawing Title:

Site Layout Plan - Overall

Drawing No: 1051745-ADAS-XX-XX-DR-PL-8000

Scale: 1:2500 at A1

Drawn by: A.F. Date: 26/07/22

Checked by: D.H Date: 26/07/22

ADAS, 11d Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS

Tel: 01235 355630

Bicester

MILL ROAD

Mature Tree planting spaced at 10m

Semi-mature Trees to be planted at 10m centres, within the proposed double staggered hedgerow

SOFT LANDSCAPE KEY

Planning boundary

Existing trees and vegetation (Showing canopy extents)

PROPOSED TREES

Species	Common Name
Acer campestre	Field Maple
Betula pendula	Silver Birch
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Malus cultivars	Apple
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Tilia x europaea	Lime

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Grazing Meadow Mix - Habitat Aid 'Grazing Meadow Seed Mix' or similar approved 4g/m2

Species Rich Grassland - Emorgate EM2 'General Purposed Meadow Mix' - Sown at 4g/m²

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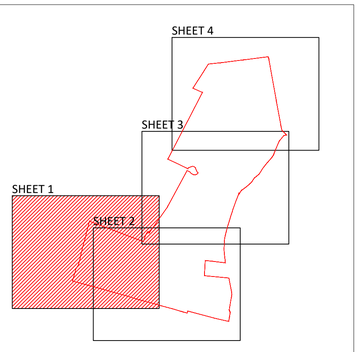
Please Note: Some of the layers show in the key above may not appear within each layout

SHEET LOCATION PLAN

Not to scale



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Rev.	Issue Details.	Date.
Tenth Issue	Amendments to planting	23/11/22
Ninth Issue	Amendments to layout and planting	22/11/22
Eighth Issue	Amendments to planting	18/11/22
Seventh Issue	Amendments to planting	09/11/22
Sixth Issue	Amendments to planting	08/11/22
Fifth Issue	Amendments to planting	04/11/22
Forth Issue	Alignment to new layout	25/10/22
Third Issue	Amendments to planting	09/09/22
Second Issue	Alignment to new layout	07/09/22
First Issue		26/07/22

Client:
JBM

Project:
Padbury

Drawing Title:
Site Layout Plan - 1 of 4

Drawing No: 1051745-ADAS-XX-XX-DR-PL-8001

Scale: 1:1000 at A1

Drawn by: A.F. Date: 26/07/22

Checked by: D.H Date: 26/07/22

ADAS, 116 Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS

Tel: 01235 355630

Mature Trees to be planted at 20m centres.

Mature Trees to be planted at 20m centres.

SOFT LANDSCAPE KEY

Planning boundary

Existing trees and vegetation (Showing canopy extents)

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Overhead Line

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CCTV

Inverter

Spare Container

Substation

Inverter Containers

Maintenance Track

Deer Fence

Rights of Way
Existing Footpath

Permissive Footpath

NOTES:

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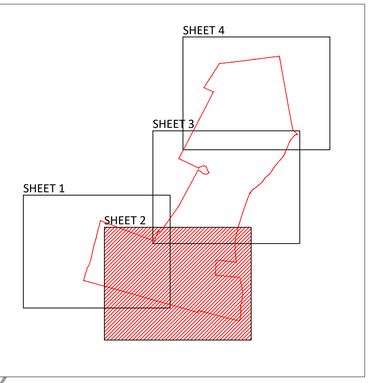
Please Note: Some of the layers show in the key above may not appear within each layout

SHEET LOCATION PLAN

Not to scale



Rev.	Issue Details.	Date.
Tenth Issue	Amendments to planting	23/11/22
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Forth Issue	Alignment to new layout	25/10/22
Third Issue	Amendments to planting	09/09/22
Second Issue	Alignment to new layout	07/09/22
First Issue		26/07/22

Client:
JBM

Project:
Padbury

Drawing Title:
Site Layout Plan - 2 of 4

Drawing No: 1051745-ADAS-XX-XX-DR-PL-8002

Scale: 1:1000 at A1

Drawn by: A.F. Date: 26/07/22

Checked by: D.H Date: 26/07/22

ADAS, 11d Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS

Tel: 01235 355630

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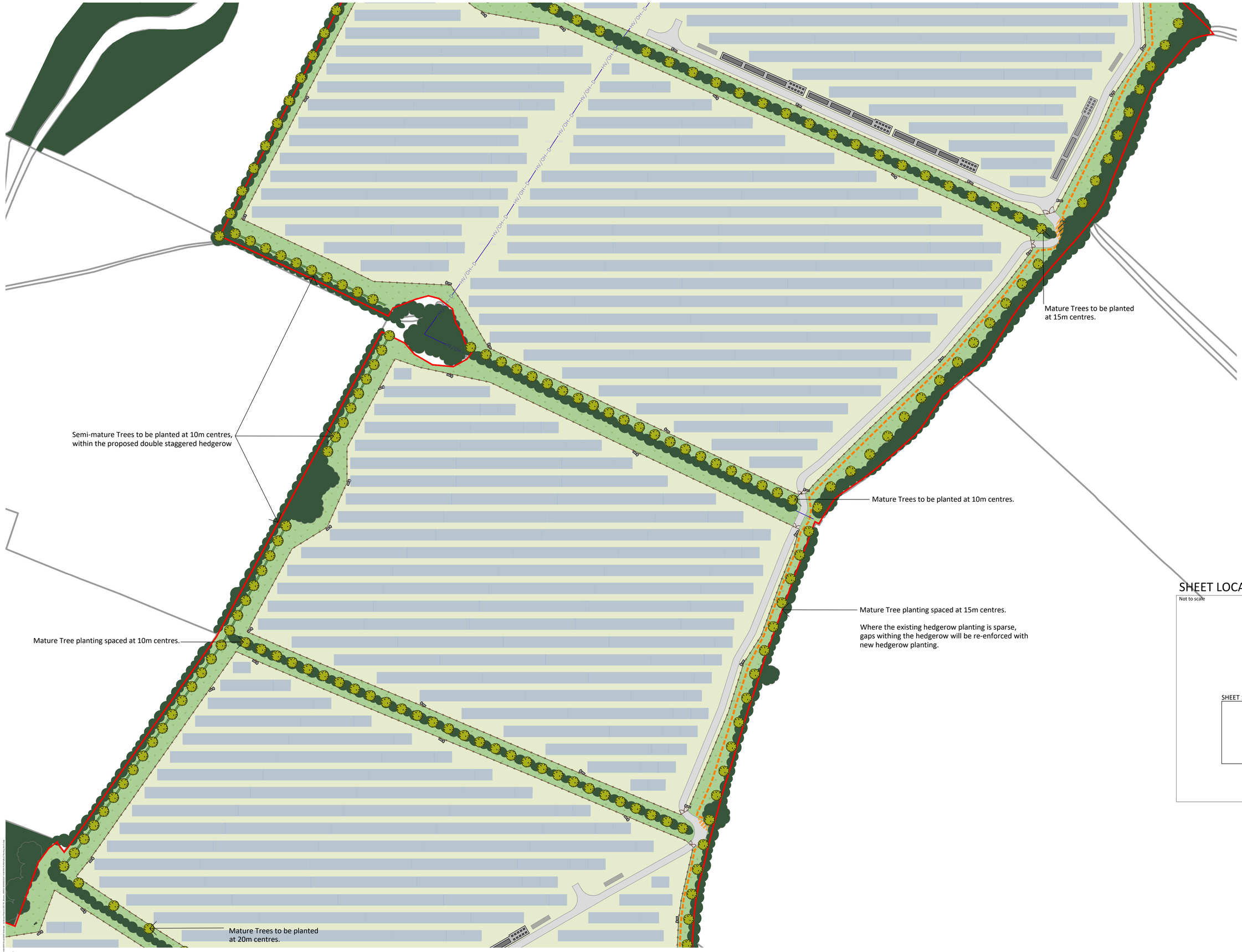


SOFT LANDSCAPE KEY

Planning boundary

Existing trees and vegetation (Showing canopy extents)

PROPOSED TREES

Species	Common Name
Acer campestre	Field Maple
Betula pendula	Silver Birch
Malus sylvestris	Crab Apple
Malus cultivars	Apple
Ilex aquifolium	Holly
Pinus sylvestris	Scots Pine
Prunus nigra 'Italica'	Lombardy Poplar
Prunus avium	Wild Cherry
Quercus robur	Oak
Sorbus aucuparia	Rowan
Tilia x europaea	Lime

Proposed Hedgerow planting

Species	Common name	Mix %
Acer campestre	Field Maple	5
Cornus sanguinea	Dogwood	5
Corylus avellana	Hazel	5
Crataegus monogyna	Hawthorn	50
Euonymus europaeus	Spindle	5
Ilex aquifolium	Holly	5
Ligustrum vulgare	Wild Privet	10
Prunus spinosa	Blackthorn	5
Rhamnus catharticus	Buckthorn	5
Viburnum opulus	Guelder Rose	5

Grazing Meadow Mix - Habitat Aid 'Grazing Meadow Seed Mix' or similar approved 4g/m2

Species Rich Grassland - Emorsgate EM2 'General Purposed Meadow Mix' - Sown at 4g/m²

TRP Membrane

Overhead Line

Solar Panels
For details of solar equipment and layout, please see Engineers Specification

CCTV

Inverter

Spare Container

Substation

Inverter Containers

Maintenance Track

Deer Fence

Public Rights of Way

Existing Footpath

Permissive Footpath

NOTES:

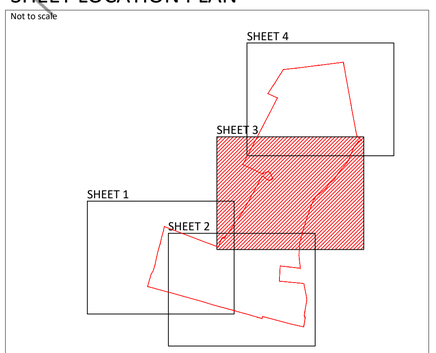
No dimensions are to be scaled from this drawing.

Existing vegetation to be enhanced and strengthened. Exact locations/specifications of planting will be agreed via planning condition / the final conditioned LEMP.

Please Note: Some of the layers show in the key above may not appear within each layout

SHEET LOCATION PLAN

Not to scale



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Second Issue	Alignment to new layout	07/09/22
First Issue		26/07/22

Client:
JBM

Project:
Padbury

Drawing Title:
Site Layout Plan - 3 of 4

Drawing No: 1051745-ADAS-XX-XX-DR-PL-8003

Scale: 1:1000 at A1

Drawn by: A.F. Date: 26/07/22

Checked by: D.H Date: 26/07/22

ADAS, 11d Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS

Tel: 01235 355630

Semi-mature Trees to be planted at 10m centres, within the proposed hedgerow

Mature Tree planting spaced at 15m centres.

Mature Tree planting spaced at 15m centres.

Where the existing hedgerow planting is sparse, gaps withing the hedgerow will be re-enforced with new hedgerow planting.

0 50m 1:1,000

SOFT LANDSCAPE KEY

- Planning boundary
- Existing trees and vegetation (Showing canopy extents)

PROPOSED TREES

Species	Common Name
Acer campestre	Field Maple
Betula pendula	Silver Birch
Malus sylvestris	Crab Apple
Malus cultivars	Apple
Ilex aquifolium	Holly
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Crataegus monogyna	Hawthorn	50
Euonymus europaeus	Spindle	5
Ilex aquifolium	Holly	5
Ligustrum vulgare	Wild Privet	10
Prunus spinosa	Blackthorn	5
Rhamnus cathericus	Buckthorn	5
Viburnum opulus	Guelder Rose	5

- Grazing Meadow Mix - Habitat Aid 'Grazing Meadow Seed Mix' or similar approved 4g/m2
- Species Rich Grassland - Emorgate EM2 'General Purposed Meadow Mix' - Sown at 4g/m²
- TRP Membrane
- Overhead Line
- Solar Panels
  For details of solar equipment and layout, please see Engineers Specification
- CCTV
- Inverter
- Spare Container
- Substation
- Inverter Containers
- Maintenance Track
- Deer Fence

Public Rights of Way
- Existing Footpath
- Permissive Footpath

NOTES:

No dimensions are to be scaled from this drawing.

Existing vegetation to be enhanced and strengthened. Exact locations/specifications of planting will be agreed via planning condition / the final conditioned LEMP.

Please Note: Some of the layers show in the key above may not appear within each layout

SHEET LOCATION PLAN

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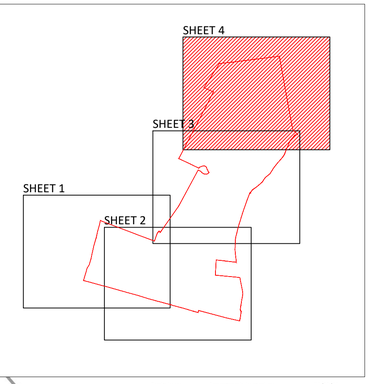

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First Issue		26/07/22

Client:
JBM

Project:
Padbury

Drawing Title:
Site Layout Plan - 4 of 4

Drawing No: 1051745-ADAS-XX-XX-DR-PL-8004

Scale: 1:1000 at A1

Drawn by: A.F. Date: 26/07/22

Checked by: D.H Date: 26/07/22

ADAS, 11d Park House, Milton Park,
Milton, Abingdon, Oxford, OX14 4RS

Tel: 01235 355630

APPENDIX C
ENVIRONMENT AGENCY RESPONSE

Kristian Jackson

From: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Sent: 22 July 2022 14:36
To: Kristian Jackson
Subject: EAN/2022/269189: Product 4 data request - Land near Stratton Audley, Cherwell District, Oxfordshire, England (OX27 9AL)
Attachments: East_Anglian_External Climate Change Allowances Guidance_March2022.pdf

Dear Kristian

Thank you for your enquiry which we received on 27 June 2022

We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

The model which has been used to produce the Flood Map for Planning (Rivers and Sea) only has 1% and 0.1% AEP undefended outlines. Therefore, this is the best available information. The flood zones are the result of 2D modelling from the Environment Agency's Upper Ouse Broadscale B1 model.

We can provide the raw modelled output data from this model if this would be of use. If so please request a product 6 from Enquiries_EastAnglia@environment-agency.gov.uk

Flood Map for Planning (Rivers and Sea)

The Flood Map for Planning (Rivers and Sea) can be viewed and downloaded as a PDF file on GOV.UK by following this link: **https://flood-map-for-planning.service.gov.uk**

Recorded Flood Events

We have no historic flood event information for this area. It is possible that other flooding may have occurred that we do not have records for, and other organisations such as local authorities or IDBs may have records.

Long Term Flood Risk Information

Long term flood risk mapping including: ***Risk of Flooding from Rivers or the Sea***, ***Flood Risk from Surface Water*** and ***Flood Risk from Reservoirs*** can be viewed on GOV.UK: **https://flood-warning-information.service.gov.uk/long-term-flood-risk/map**

Climate Change Allowances
For information on the use climate change allowances in Flood Risk Assessments, please see the attached document - **East_Anglian_External Climate Change Allowances Guidance_March2022.pdf**.

The guidance provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, which varies depending on which management catchment a site lies within. It advises on which allowances to use for assessing the impact of climate change on fluvial flood risk based on vulnerability classification, flood zone and development lifetime.

If you have any comments regarding this letter please contact our Partnership & Strategic Overview team directly by email at pso.eastanglia@environment-agency.gov.uk

There are no Environment Agency Flood Defences protecting this site.

Please refer to the Open Government Licence available here: http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3/ which explains the permitted use of this information.

Additional information

Please be aware that we now charge for planning advice provided to developers, agents and landowners. If you would like advice to inform a future planning application for this site then please complete our https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion and email it to our Sustainable Places team at:planning.brampton@environment-agency.gov.uk. They will initially provide you with a free response identifying the following:

- the environmental constraints affecting the proposal;
- the environmental issues raised by the proposal;
- the information we need for the subsequent planning application to address the issues identified and demonstrate an acceptable development;
- any required environmental permits.

If you require any further information from them (for example, a meeting or the detailed review of a technical document) they will need to set up a charging agreement. Further information can be found on our website.

If you want to discuss this please call our Sustainable Places team on 020 8474 5242.

Please get in touch if you have any further queries or contact us within two months if you would like us to review the information we have sent.

Kind regards

Tim Prior
Customers & Engagement Officer, Customers & Engagement Team, East Anglia Area
Environment Agency, Bromholme Lane, Brampton, Huntingdon, Cambs. PE28 4NE

enquiries_eastanglia@environment-agency.gov.uk
External: 0203 0255472

From: Kristian Jackson <KJackson@rsk.co.uk>
Sent: 27 June 2022 08:55
To: Enquiries_EastAnglia <Enquiries_EastAnglia@environment-agency.gov.uk>
Subject: Product 4 data request - Land near Stratton Audley, Cherwell District, Oxfordshire, England (OX27 9AL)"

Product 4 data request - **Land near Stratton Audley, Cherwell District, Oxfordshire, England (OX27 9AL)"**

Kristian Jackson BA (hons) MCD MCIWEM
Principal Hydrologist

RSK
Land & Development Engineering
14, Beecham Court, Pemberton Business Park, Wigan, UK, WN3 6PR

Mobile: 07464 595362

kjackson@rsk.co.uk

http://www.rsk.co.uk

Flood risk assessments: Climate change allowances

Application of the allowances and local considerations

East Anglia; Essex, Norfolk, Suffolk, Cambridgeshire and Bedfordshire

1) The climate change allowances

The National Planning Practice Guidance refers planners, developers and advisors to the Environment Agency guidance on considering climate change in Flood Risk Assessments (FRAs). This guidance was updated in October 2021 and is available on Gov.uk. The guidance can be used for planning applications, local plans, neighbourhood plans and other projects. It provides climate change allowances for peak river flow, peak rainfall, sea level rise, wind speed and wave height. The guidance provides a range of allowances to assess fluvial flooding, rather than a single national allowance. It advises on what allowances to use for assessment based on vulnerability classification, flood zone and development lifetime.

2) Assessment of climate change impacts on fluvial flooding

Where existing EA flood risk datasets and models do not provide the required climate change allowances, it is up to developers to undertake any work needed to appropriately assess the impacts of climate change on flood risk. They can do this by using the approaches in **Table A** below:

Table A below indicates the level of technical assessment of climate change impacts on fluvial flooding appropriate for new developments depending on their scale and location. This should be used as **a guide only**. Ultimately, the agreed approach should be based on expert local knowledge of flood risk conditions, local sensitivities and other influences. **For these reasons, we recommend that applicants and / or their consultants should contact the Environment Agency at the pre-planning application stage to confirm the assessment approach, on a case by case basis**. The email addresses for our Sustainable Places teams at our respective offices can be found in Section 8 below.

Table A defines three possible approaches to account for flood risk impacts due to climate change, in new development proposals:

- **Basic:** Developer can add an allowance to the 'design flood' (i.e. 1% annual probability) peak levels to account for potential climate change impacts. The allowance should be derived and agreed locally by Environment Agency teams.
- **Intermediate:** Developer can use existing modelled flood and flow data to construct a stage-discharge rating curve, which can be used to interpolate a flood level based on the required peak flow allowance being applied to the 'design flood' flow.
- **Detailed:** Perform detailed hydraulic modelling, either through re-running Environment Agency hydraulic models (if available) or construction of a new model by the developer.

Table A – Indicative guide to assessment approach

VULNERABILITY CLASSIFICATION	FLOOD ZONE	DEVELOPMENT TYPE		
		NON-MAJOR	SMALL-MAJOR	LARGE-MAJOR
ESSENTIAL INFRASTRUCTURE	Zone 2	Detailed		
	Zone 3a	Detailed		
	Zone 3b	Detailed		
HIGHLY VULNERABLE	Zone 2	Intermediate/ Basic	Intermediate/ Basic	Detailed
	Zone 3a	Not appropriate development		
	Zone 3b	Not appropriate development		
MORE VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Intermediate/ Basic	Detailed	Detailed
	Zone 3b	Not appropriate development		
LESS VULNERABLE	Zone 2	Basic	Basic	Intermediate/ Basic
	Zone 3a	Basic	Basic	Detailed
	Zone 3b	Not appropriate development		
WATER COMPATIBLE	Zone 2	None		
	Zone 3a	Intermediate/ Basic		
	Zone 3b	Detailed		

Note: Where the table states 'not appropriate development', this is in line with national planning policy. If in exceptional circumstances such development types are proposed in these locations, we would expect a detailed modelling approach to be used.

NOTES:

- Non-Major: 1-9 dwellings/ less than 0.5 ha | Office / light industrial under 1ha | General industrial under 1 ha | Retail under 1 ha | Gypsy/traveller site between 0 and 9 pitches
- Small-Major: 10 to 30 dwellings | Office / light industrial 1ha to 5ha | General industrial 1ha to 5ha | Retail over 1ha to 5ha | Gypsy/traveller site over 10 to 30 pitches
- Large-Major: 30+ dwellings | Office / light industrial 5ha+ | General industrial 5ha+ | Retail 5ha+ | Gypsy/traveler site over 30+ pitches | any other development that creates a non-residential building or development over 1000 sq m.

The assessment approach should be agreed with the Environment Agency as part of pre-planning application discussions to avoid abortive work.

3) Specific local considerations

Where the Environment Agency and the applicant and / or their consultant has agreed that a '**basic**´ level of assessment is appropriate, the figures in Table B below can be used as a precautionary allowance for potential climate change impacts on peak 'design' (i.e. 1% annual probability) fluvial flood level rather than undertaking detailed modelling.

Table B – Local precautionary allowances for potential climate change impacts

Essex, Norfolk and Suffolk

Hydraulic Model (Watercourse)	Precautionary allowance (basic approach)
Blackwater & Brain - Blackwater between TL7520925623 and TL7820324314 Brain between TL7373323312 and TL7683821321	500mm
Other main rivers, tributaries and ordinary watercourses	For other main rivers, tributaries and ordinary watercourses that are not stated above, basic allowances have not been calculated. In this instance you can either: • If flow data is available you can request this data from us and can conduct an intermediate assessment yourself • Or alternatively, you can choose to undertake a Detailed Assessment and "perform detailed hydraulic modelling, through either re-running our hydraulic models (if available) or constructing a new model

Cambridgeshire and Bedfordshire

Watercourse / Model	Precautionary allowance (basic approach)
Alconbury Brook	600mm
River Kym	
Lower Ouse (Model Extent)	700mm
Mid Ouse (Cold Brayfield to Bromham – between SP9156852223 and TL0132950919)	700mm
Mid Ouse (East of Bedford to Roxton – between TL0791848903 and TL1618854543)	700mm
River Hiz and River Purwell	400mm
River Ivel	500mm
Pix Brook	450mm
Potton Brook	500mm
River Cam and tributaries (excluding the Cam Lodes and the Slade System)	450mm
Great Barford (ordinary watercourses)	500mm
Bromham (ordinary watercourse)	550mm

NOTES:

Urban areas excluded from the 'basic' approach: St Ives, Holywell, Godmanchester, Swavesey, Over, Bedford, Newport Pagnell, Buckingham and Leighton Buzzard. More detailed assessment of climate change allowances will need to be undertaken in these locations.

Use of these allowances will only be accepted after discussion with the Environment Agency.

4) Fluvial flood risk mitigation

For planning consultations where we are a statutory consultee and our Flood risk standing advice **does not** apply we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications. **These are a guide only**. **We strongly recommend you contact us at the pre-planning application stage to confirm this on a case by case basis.** For planning consultations where we are not a statutory consultee or our Flood risk Standing advice applies, we recommend that local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as '**essential infrastructure**' our benchmark for flood risk mitigation is for it to be designed to the '**higher central**' climate change allowance for the epoch that most closely represents the lifetime of the development, including decommissioning. Please note that nationally significant infrastructure projects (NSIPs) may also need to assess a **credible maximum climate change scenario** by applying the '**upper end**' allowance for peak river flow as a sensitivity test. This will help to determine how sensitive the development is to changes in the climate and to ensure that it can be adapted to large-scale climate change over its lifetime.

- For **highly vulnerable**, **more vulnerable, less vulnerable and water compatible** developments in flood zones 2 and 3a, the '**central**' climate change allowance is our minimum benchmark for flood risk mitigation. For large urban settlement extensions or developments that form new communities, the credible maximum climate change scenario must be assessed; in these circumstances, you should use the '**upper end'** allowance.

- For **water compatible** development in flood zone 3b, the '**central**' climate change allowance for the epoch that most closely represents the lifetime of the development is our minimum benchmark for flood risk mitigation.

For peak river flow allowances and a visual representation of the above, please see Tables 1 and 2 below.

Table 1 peak river flow allowances by Management Catchment (use 1961 to 1990 baseline)

Management Catchment	Allowance category	Total potential change anticipated for '2020s' (2015 to 39)	Total potential change anticipated for '2050s' (2040 to 2069)	Total potential change anticipated for '2080s' (2070 to 2125)
Upper and Bedford Ouse	**Upper end**	24%	30%	58%
	Higher central	10%	11%	30%
	Central	5%	4%	19%
Cam and Ely Ouse	**Upper End**	21%	22%	45%
	Higher Central	7%	5%	19%
	Central	2%	-2%	9%
Old Bedford and Middle Level	**Upper End**	23%	22%	39%
	Higher central	9%	4%	15%
	Central	3%	-3%	6%
North West Norfolk	**Upper End**	30%	34%	57%
	Higher central	18%	18%	33%
	Central	13%	11%	23%
North Norfolk Rivers	**Upper End**	26%	27%	48%
	Higher central	13%	11%	24%
	Central	7%	4%	14%
Broadland Rivers	**Upper End**	27%	27%	44%
	Higher central	14%	10%	20%
	Central	8%	3%	11%
East Suffolk	**Upper End**	25%	29%	54%
	Higher central	13%	13%	29%
	Central	8%	7%	19%
Combined Essex	**Upper End**	27%	37%	72%
	Higher central	13%	16%	38%
	Central	7%	8%	25%

South Essex	**Upper End**	22%	27%	48%
	Higher central	11%	11%	26%
	Central	6%	5%	17%

If you are not sure which management catchment your site falls within, please use the guidance and link to the peak river flow map, which can be found at: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances#peak-river-flow-allowances

Table 2: Using peak river flow allowances for flood risk assessments

Flood Zone	Essential Infrastructure	Highly Vulnerable	More Vulnerable	Less Vulnerable	Water Compatible
2	higher central[1]	central[2]	central[2]	central	central
3a	higher central[1]	**X**	central[2]	central	central
3b	higher central[1]	**X**	**X**	**X**	central

X – Development should not be permitted
If (exceptionally) development is considered appropriate when not in accordance with flood zone vulnerability categories, then it would be appropriate to use the higher central allowance.

[1] For NSIPs, the 'upper end' allowance should be used to assess a credible maximum climate change scenario.

[2] For large urban settlement extensions or developments that form new communities, the credible maximum climate change scenario must be assessed. In these circumstances, you should use the 'upper end' allowance.

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case we may want to check this data and how you propose to use it.

Assessing off-site impacts and calculating floodplain compensation

The appropriate allowance to assess off-site impacts and calculation floodplain compensation requirements depends on the land uses in affected areas.

The '**central'** allowance should be used in most cases. However, the '**higher central'** allowance should be used when the affected area contains essential infrastructure.

5) Development in tidal flood risk areas

For flood risk assessments and strategic flood risk assessments, assess both the **higher central** and **upper end** allowances for all development vulnerability classes (see table 3 below).

For NSIPs and large urban settlement extensions or developments that form new communities, the **credible maximum climate change scenario** should be assessed (sea level rise and sensitivity test allowances for offshore wind speed and extreme wave height and storm surge uplift). To assess the flood risk from a high impact climate change scenario, you should use the H^{++} allowance of 1.9m for the total sea level rise to 2100.

Table 3: sea level allowances for each epoch in mm for each year (based on a 1981 to 2000 baseline) – the total sea level risk for each epoch is in brackets

Area of England	Allowance	2000 to 2035 (mm)	2036 to 2065 (mm)	2066 to 2095 (mm)	2096 to 2125 (mm)	Cumulative rise 2000 to 2125 (metres)
Anglian	Higher central	5.8 (203)	8.7 (261)	11.6 (348)	13 (390)	1.20
Anglian	Upper end	7 (245)	11.3 (339)	15.8 (474)	18.1 (543)	1.60
South east	Higher central	5.7 (200)	8.7 (261)	11.6 (348)	13.1 (393)	1.20
South east	Upper end	6.9 (242)	11.3 (339)	15.8 (474)	18.2 (546)	1.60

6) Tidal flood risk mitigation

For planning consultations where we are a statutory consultee and our flood risk standing advice does not apply, we use the following benchmarks to inform flood risk mitigation for different vulnerability classifications. **These are a guide only. We strongly recommend you contact us at the pre-planning application stage to confirm this on a case by case basis. Please note you may be charged for this advice.** For planning consultations where we are not a statutory consultee or our flood risk standing advice applies, we recommend that local planning authorities and developers use these benchmarks but we do not expect to be consulted.

- For development classed as essential Infrastructure, highly vulnerable development and more vulnerable development, our minimum benchmark for flood risk mitigation is the **'upper end'** climate change allowance for the development lifetime (including decommissioning where relevant).

- For water compatible or less vulnerable development (e.g. commercial), our minimum benchmark for flood risk mitigation is the **'higher central'** climate change allowance for the development lifetime. In sensitive locations it may be necessary to use the **'upper end'** allowance to inform built in resilience.

If you are using our 2018 Coastal Flood Modelling Data outputs:
The **upper end** allowance become progressively higher each year than the climate change flood level outputs used in our current 2018 coastal flood model. So as an approximation we recommend that the following uplift values are added on to the on-site climate change flood levels provided in the Product 4:

- For development lifetimes extending to 2122, add 0.34m
- For development lifetimes extending to 2123, add 0.36m
- For development lifetimes extending to 2124, add 0.38m
- For development lifetimes extending to 2125, add 0.40m

If the proposed development is greater than 30 houses and the flood zone is in an open-coast location, we recommend that a more accurate impact of the increased upper end flood levels on the overtopping on-site flood levels is modelled by rerunning our coastal overtopping model with the new flood levels; you can obtain the model from us with a Product 6 and 7 request. If the site is located within a small or constrained tidal or coastal floodplain then regardless of the size of the development, you may also need to undertake remodelling of the flood levels to obtain an accurate assessment of the impacts of climate change; please contact us for advice (contact details in Section 8 below).

If you are using our Broads 2008 Flood Modelling Data outputs:
For the **upper end** allowance, please add the following uplift values onto the climate change flood levels provided in the Product 4:

- For development lifetimes extending to 2122, add 0.34m
- For development lifetimes extending to 2123, add 0.36m
- For development lifetimes extending to 2124, add 0.38m
- For development lifetimes extending to 2125, add 0.40m

If you are using our 2008 Thames Flood Modelling Data outputs:
Please add the appropriate climate change allowances for the South East River Basin District onto the present day flood levels obtained in the Product 4, starting from a base year of 2005. The allowances should be applied to the year appropriate to the respective development lifetime for residential or commercial developments.
***** note**:*** *We anticipate that there will be updated flood modelling outputs available for the Thames Estuary in mid-2022. Developers preparing Flood Risk Assessments for developments in this area should check for availability of new data with the East Anglia (East) PSO team (contact details in Section 8 below).*

There may be circumstances where local evidence supports the use of other data or allowances. Where you think this is the case, we may want to check this data and how you propose to use it.

7) Assessment of climate change impacts for Surface Water Management

Please see the latest advice on the use of Peak Rainfall Intensity climate change allowances, which can be found here: https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

The Environment Agency is not a statutory consultee to the land use planning system for the consideration of surface water flood risk and management. We therefore recommend that you contact the relevant Lead Local Flood Authority (contact details listed below) to discuss Flood Risk Assessment requirements to support your development's surface water management proposals.

Cambridgeshire County Council - fr.planning@cambridgeshire.gov.uk
Central Bedfordshire Council – floodrisk@centralbedfordshire.gov.uk
Bedford Borough Council – floodrisk@bedford.gov.uk
Milton Keynes Council – llfa@milton-keynes.gov.uk
Buckinghamshire County Council - floodmanagement@buckscc.gov.uk
Herts County Council - floodandwatermanagement@hertscc.gov.uk
Northamptonshire County Council - floodandwater@northamptonshire.gov.uk
Norfolk County Council – llfa@norfolk.gov.uk
Suffolk County Council – floods@suffolk.gov.uk
Essex County Council – suds@essex.gov.uk
Thurrock Council – TransportDevelopment@thurrock.gov.uk
Southend-on-Sea Council – llfa@southend.gov.uk

8) Our Service

Non-chargeable service

We will give a free opinion on:

- What climate change allowance to apply to a particular development type
- Which technical approach is suitable in the FRA

Chargeable service:

- Review of climate change impacts using intermediate and detailed technical approaches (i.e. modelling review)
- Assessment and review of proposals for managed adaptation.

Contact Details

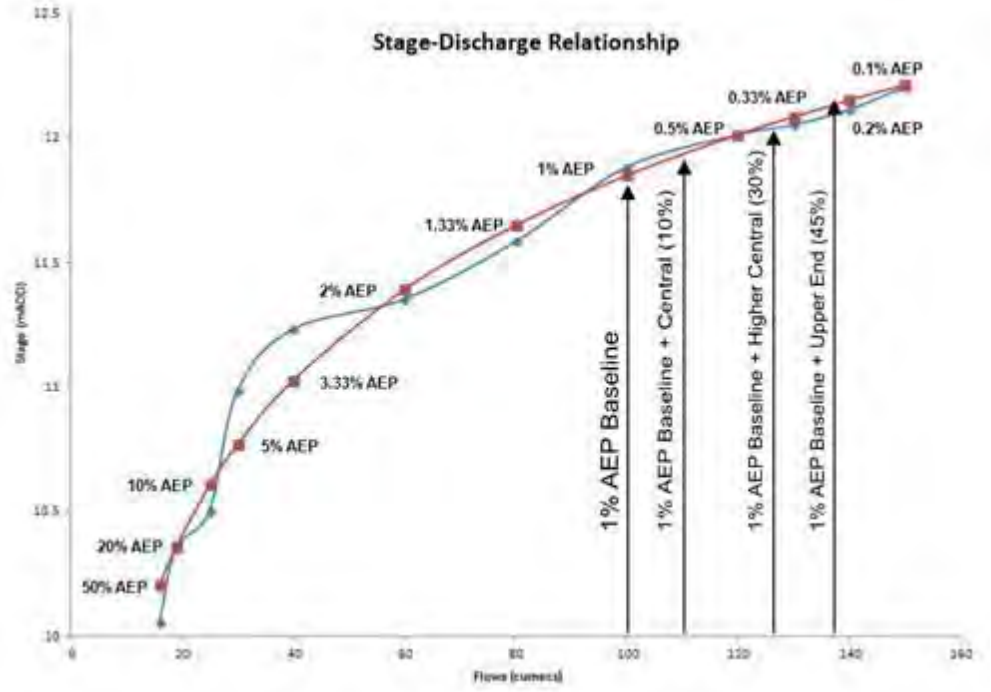
For East Anglia (Great Ouse Catchment): planning.brampton@environment-agency.gov.uk

For East Anglia (East): planning.ipswich@environment-agency.gov.uk

Appendix 1 – Further information on the Intermediate approach.

1) The methodology the chart is based on does not produce an accurate stage-discharge rating and is a simplified methodology for producing flood levels that can be applied in low risk small-scale development situations.
2) The method should not be applied where there is existing detailed modelled climate change outputs that use the new allowances. In such circumstances, the 'with climate change' modelled scenarios should be applied.

An example stage-discharge relationship is shown below.



APPENDIX D
OXFORDSHIRE CC RESPONSE

Kristian Jackson

From: Littler, Adam - Oxfordshire County Council <Adam.Littler@Oxfordshire.gov.uk>
Sent: 08 July 2022 11:02
To: Bawar, Nagina - Oxfordshire County Council; Kristian Jackson
Subject: RE: Flood information request - land near Stratton Audley, Cherwell District (OX27 9AL)

Dear Kristian,

Thank you for your email enquiry.

I have checked our historic flood data base and we do not have any recorded flood events in the area provided below. I should stress that this is not to say it has not flooded but it means we do not have a record of it. Unfortunately we do not have any maps or modelling of flooding currently.

With regards to your other elements of enquiry, please could I direct you to the LLFA Pre-Application service, a link to which can be found in the below signature.

Kind regards,

Adam.

Flood Risk Engineer (South and Vale)
Environment and Place | Growth and Place
Oxfordshire County Council
County Hall
New Road
Oxford
OX1 1ND

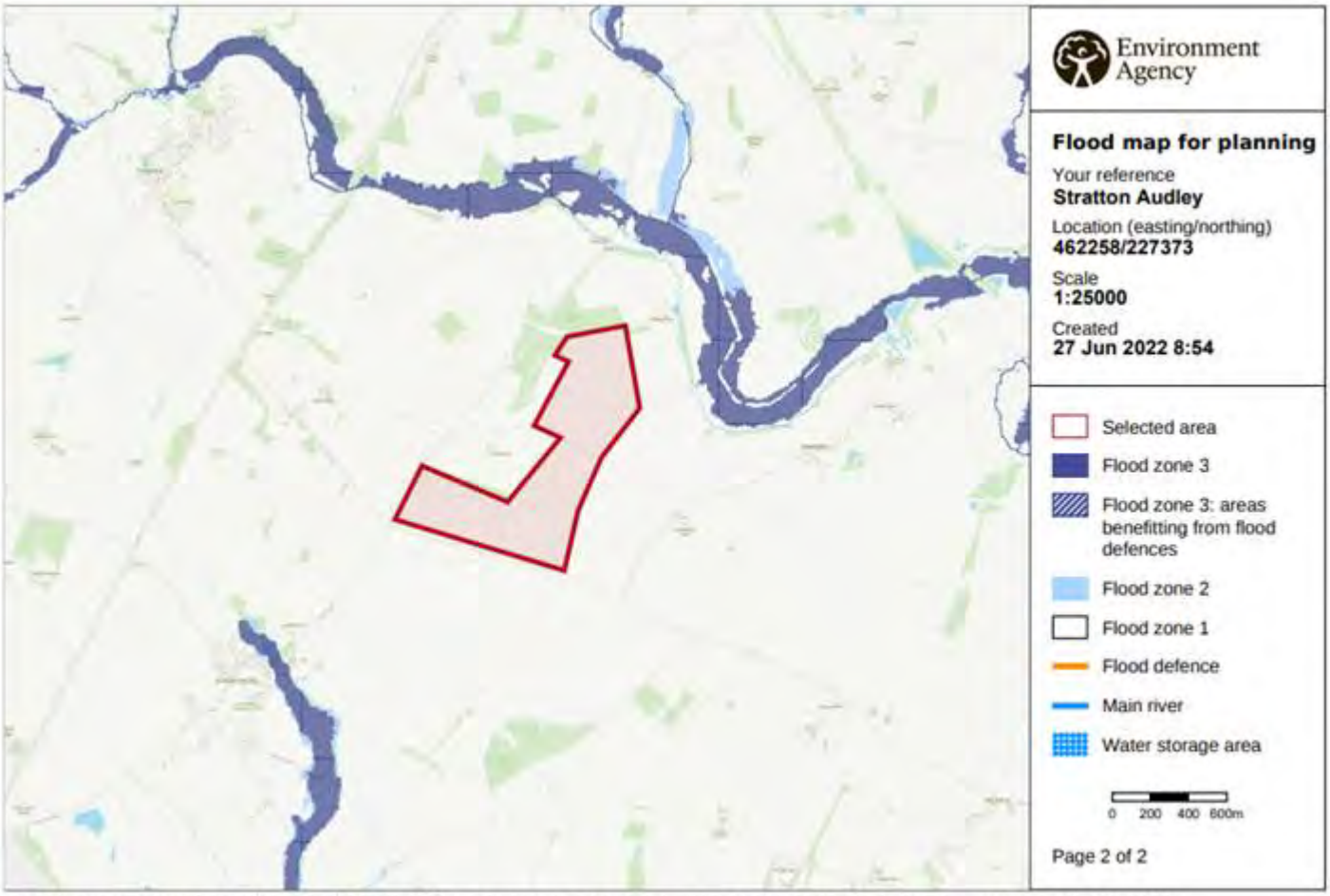
Did you know that we have a new pre-application service available for Lead Local Flood Authority advice? Find out more here .

www.oxfordshire.gov.uk

Dear Sir/Madam,

Please could I request information on flooding and drainage for the following site in order to inform a Flood Risk Assessment:

Land near Stratton Audley, Cherwell District, Oxfordshire, England (OX27 9AL)



I would like all the flooding information and advice you have including the following, if available:

Information on the recently published climate change guidance for this area,
Information on surface water flood risk including flow pathways and depths,
Information on historic flooding from all sources,
Any data on existing surface water discharges to the surrounding watercourse or sewers,
Any data on groundwater flooding,
Any information on reservoir flooding; and,
Any information on culverted watercourses or privates sewers which you know of which do not show up on the public sewer records.

Finally, please could you provide any recommendation on how the surface water is to be managed; for example, restrictions in discharge rates the requirements for SuDS, possible discharge locations and attenuation requirements?

We have a relatively quick turn around on this project and would therefore appreciate a quick response.

If you have any queries please don't hesitate to contact me.

Kind regards,

Kris

Kristian Jackson BA (hons) MCD MCIWEM
Principal Hydrologist

www.rsklde.com
14 Beecham Court, Pemberton Business Park, Wigan, WN3 6PR, UK
Switchboard: +44 (0)1942 493255
Mobile: +44 (0)7464 595362

APPENDIX E
GREENFIELD RUNOFF CALCULATIONS

Print | Close Report

Greenfield runoff rate estimation for sites

www.uksuds.com | Greenfield runoff tool

Calculated by:	Kristian Jackson
Site name:	Padbury Brook Solar
Site location:	Bicester

This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013) , the SuDS Manual C753 (Ciria, 2015) and the non-statutory standards for SuDS (Defra, 2015). This information on greenfield runoff rates may be the basis for setting consents for the drainage of surface water runoff from sites.

Site Details

Latitude:	51.94133° N
Longitude:	1.09195° W
Reference:	4196459925
Date:	Nov 25 2022 11:46

Runoff estimation approach IH124

Site characteristics

Total site area (ha): 59.4

Methodology

Q_{BAR} estimation method:	Calculate from SPR and SAAR
SPR estimation method:	Calculate from SOIL type

Soil characteristics	Default	Edited
SOIL type:	1	1
HOST class:	N/A	N/A
SPR/SPRHOST:	0.1	0.1

Hydrological characteristics	Default	Edited
SAAR (mm):	632	632
Hydrological region:	5	5
Growth curve factor 1 year:	0.87	0.87
Growth curve factor 30 years:	2.45	2.45
Growth curve factor 100 years:	3.56	3.56
Growth curve factor 200 years:	4.21	4.21

Notes

(1) Is Q_{BAR} < 2.0 l/s/ha?

When Q_{BAR} is < 2.0 l/s/ha then limiting discharge rates are set at 2.0 l/s/ha.

(2) Are flow rates < 5.0 l/s?

Where flow rates are less than 5.0 l/s consent for discharge is usually set at 5.0 l/s if blockage from vegetation and other materials is possible. Lower consent flow rates may be set where the blockage risk is addressed by using appropriate drainage elements.

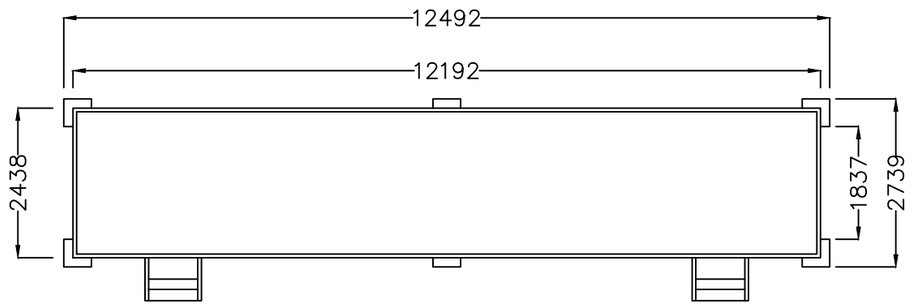
(3) Is SPR/SPRHOST ≤ 0.3?

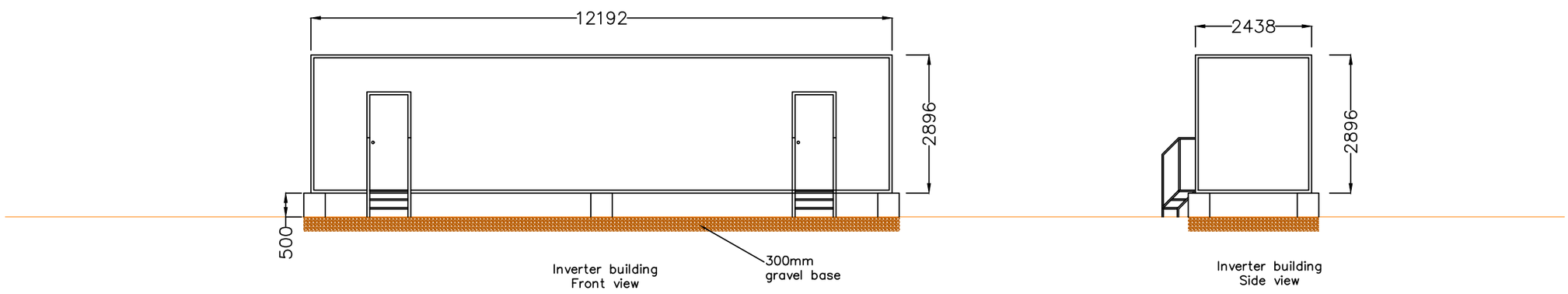
Where groundwater levels are low enough the use of soakaways to avoid discharge offsite would normally be preferred for disposal of surface water runoff.

Greenfield runoff rates	Default	Edited
Q_{BAR} (l/s):	8.69	8.69
1 in 1 year (l/s):	7.56	7.56
1 in 30 years (l/s):	21.29	21.29
1 in 100 year (l/s):	30.93	30.93
1 in 200 years (l/s):	36.58	36.58

APPENDIX F
EQUIPMENT HOUSING SPECIFICATIONS

Inverter building
Top view





Inverter building
Front view

Inverter building
Side view

SCALE A3 @ 1:100

0 1000 2000 3000 4000 5000

REVISIONS:

– Initial design

NOTES:

–

JBM SOLAR

DATE: 14 July 2021

TITLE:
Inverter Station Details

PROJECT TITLE:
Stoneshollow Solar

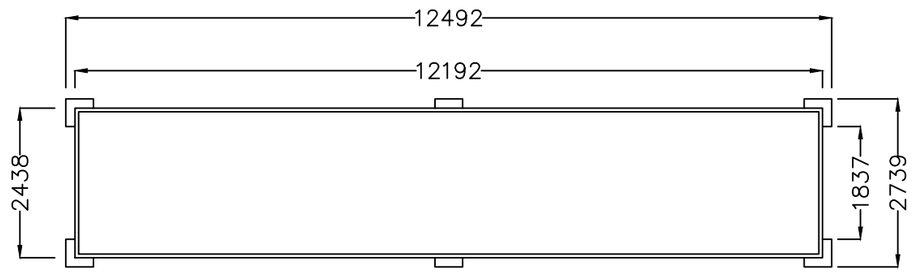
LOCATION:
CV13 0EH

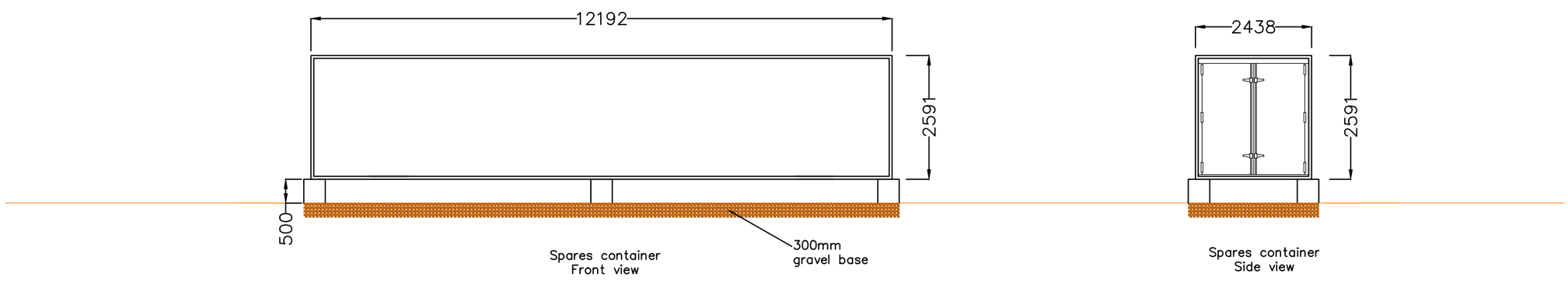
CONFIGURATION:
–

REV: A

FILENAME: Inverter Building.dwg

Spares container
Top view





Spares container
Front view

Spares container
Side view

SCALE A3 @ 1:100

0 1000 2000 3000 4000 5000

REVISIONS:

– Initial design

NOTES:

–

JBM SOLAR

DATE: 14 July 2021

TITLE:
Spares Container Details

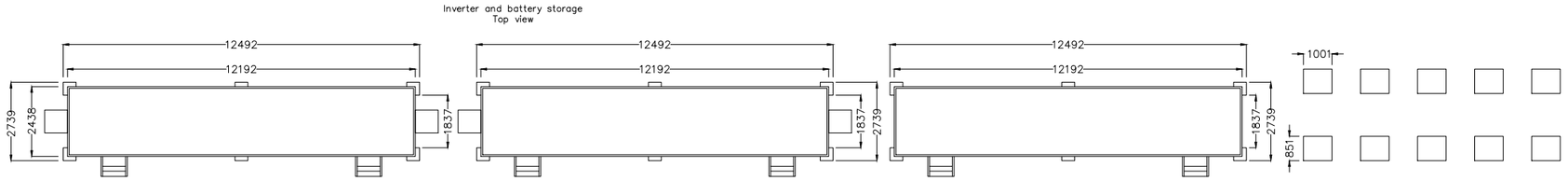
PROJECT TITLE:
Stoneshollow Solar

LOCATION:
CV13 0EH

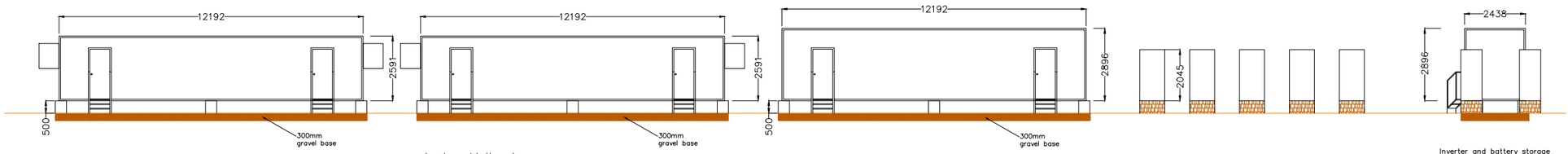
CONFIGURATION:
–

REV: A

FILENAME: Spares Container.dwg



Inverter and battery storage
Top view



Inverter and battery storage
Front view

Inverter and battery storage
Side view

SCALE A3 @ 1:200

0 2000 4000 6000 8000 10000

REVISIONS:

– Initial design

NOTES:

–

JBM SOLAR

DATE: 14 July 2021

TITLE:
Battery station details

PROJECT TITLE:
Stoneshollow Solar

LOCATION:
CV13 0EH

CONFIGURATION:
–

REV: A

FILENAME: Battery station details.dwg