Lime Down Solar Park

# Environmental Statement

## Volume 3, Appendix 11-8: Flood Risk Assessment and Outline Drainage Strategy – Lime Down E2 (Clean)

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# Appendix 11-8: Flood Risk Assessment and Outline Drainage Strategy – Lime Down E2

For: Lime Down Solar Park Ltd

Site: Lime Down Solar Park

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# 1. Site Details

1.1.1 The aim of this section of the report is to outline key environmental information associated with the baseline environment of Lime Down E2.

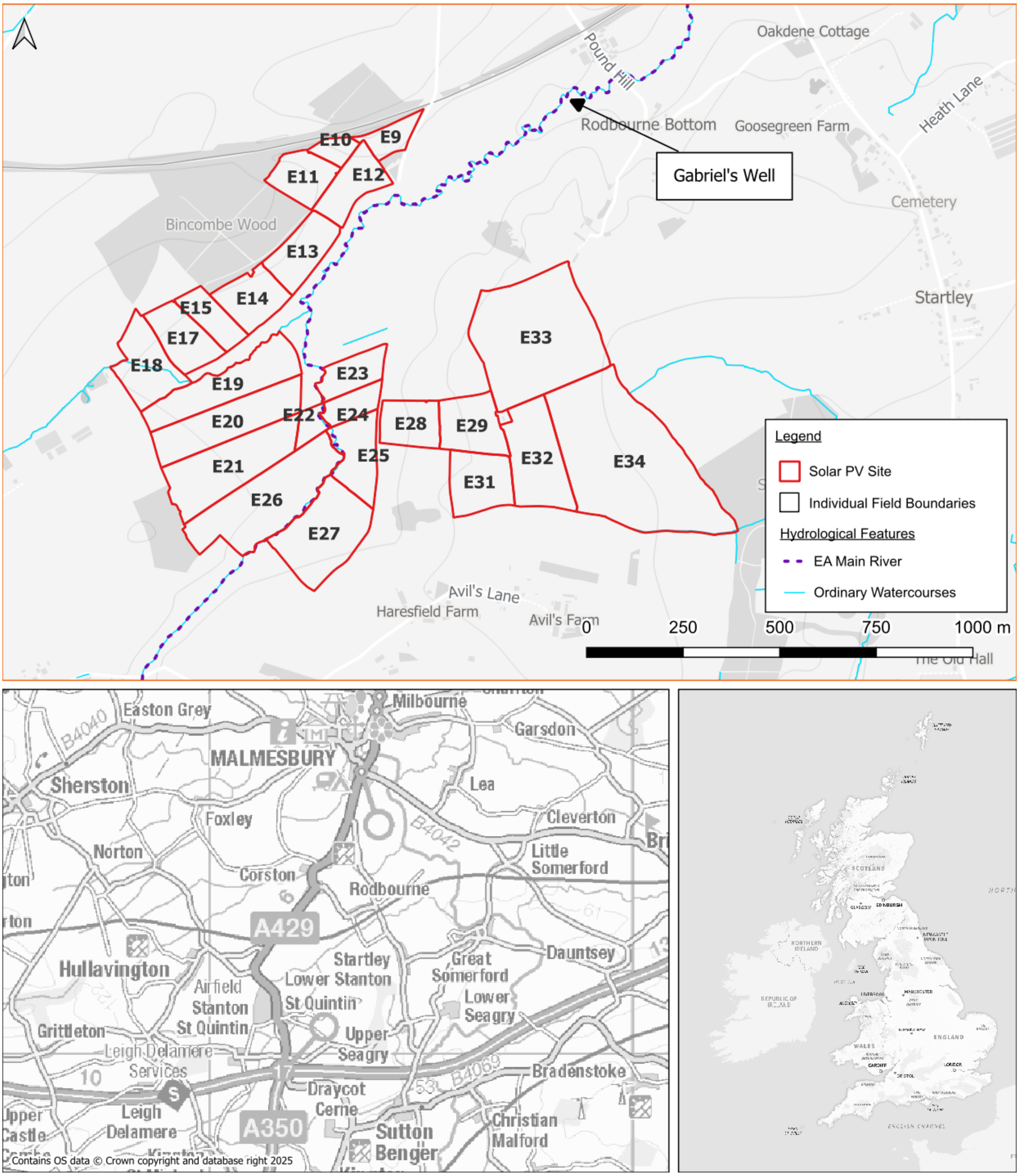



**Figure 1: Site Location**

## 1.2 Site Location

1.2.1 Lime Down E2 located to the east of Stanton St Quintin in the north-west of Wiltshire County and is approximately 2km north of the M4. The national grid references are 392840E, 182670N (north), to 393770E, 181450N (south).

## 1.3 Existing Site Conditions

1.3.1 Online mapping (including Google Maps / Google Streetview imagery[i] (accessed May 2025) shows that Lime Down E2 comprises agricultural / arable fields. Lime Down E2 is bordered by more rural land in all orientations. Access is provided via an unnamed access road off Pound Hill.

## 1.4 Topography

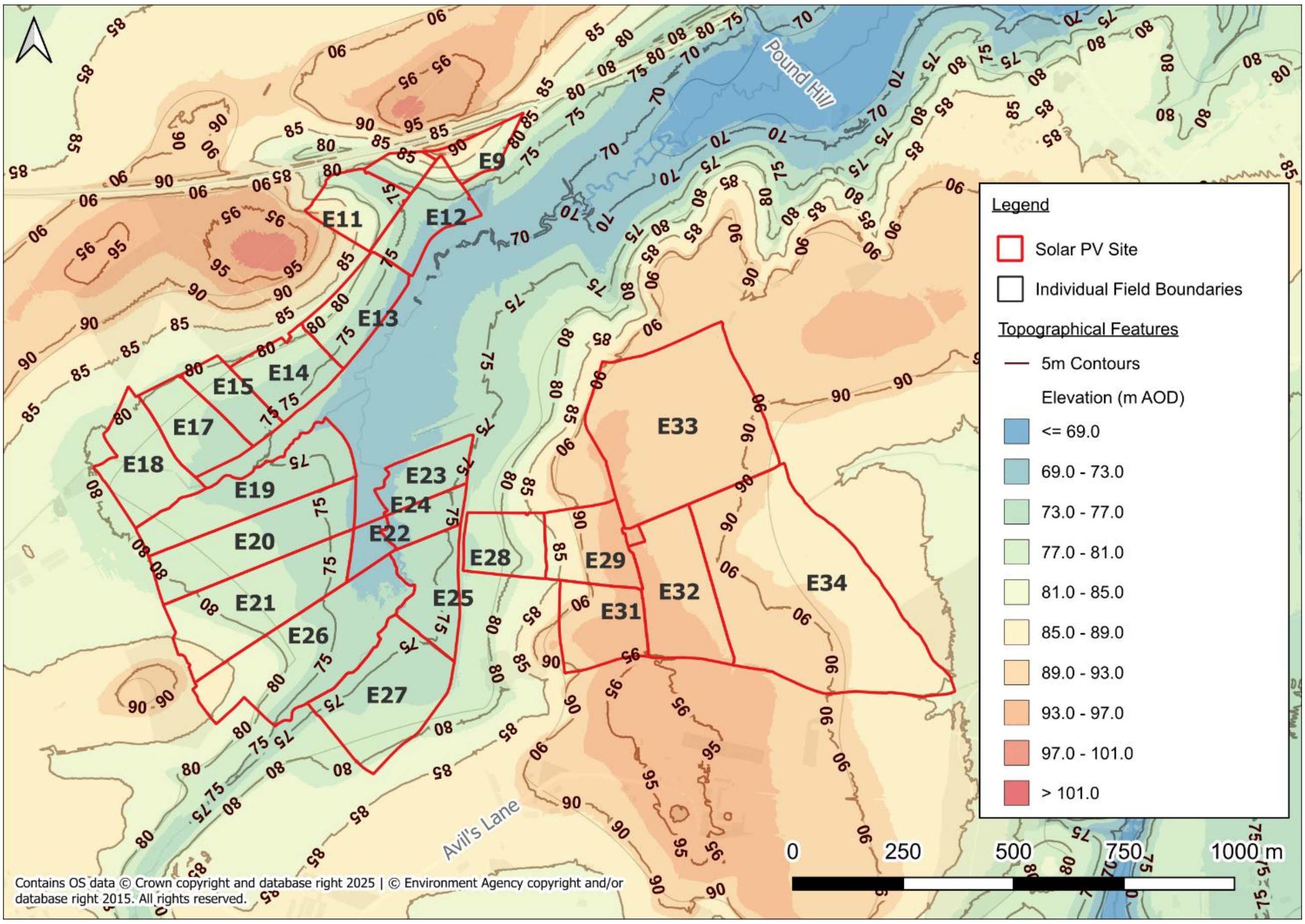



**Figure 2: LiDAR Plan**

1.4.1 Topographic levels to metres Above Ordnance Datum (m AOD) have been derived from a 1m resolution Environment Agency (EA) composite 'Light Detecting and Ranging' (LiDAR) Digital Terrain Model (DTM). A review of LiDAR ground elevation data shows that Lime Down E2 slopes from approximately 90m AOD in the south-west to approximately 72m AOD in the centre of Lime Down E2 before sloping in the northern sections to approximately 92.5m (Figure 2).

## 1.5 Hydrology

1.5.1 Gabriel's Well, a Main River is located through the centre of Lime Down E2, south-west to north. Gabriel's Well also has a tributary which runs from the western boundary in an eastward direction before joining Gabriel's Well in the central-western extent of Lime Down E2. Other watercourses in the area include two tributaries of an unnamed Ordinary Watercourse at the south-eastern boundary of Lime Down E2.

1.5.2 Main Rivers are within the jurisdiction of the Environment Agency (EA), whereas Ordinary Watercourses fall within the jurisdiction of the Wiltshire County Council Lead Local Flood Authority.

## 1.6 Water Framework Directive Status

1.6.1 Lime Down E2 is located within the Avon Bristal Rural Catchment, largely within the Rodbourne BK – source to conf R Avon (Brist) Water Body Catchment and partially within the Sutton Benger Bk – source to conf R Avon (Brist) Water Body Catchment.

1.6.2 The Rodbourne BK – source to conf R Avon (Brist) Water Body catchment has a Cycle 3 Ecological status of Moderate in 2019 and 2022 and a Failing chemical status in 2019 (no data in 2022).The Sutton Benger Bk – source to conf R Avon (Brist) Water Body catchment has a Cycle 3 Ecological status of Good in 2019 and 2022 and a Failing chemical status in 2019 (no data in 2022).A summary of the Water Body Classifications can be found in Annex A.

## 1.7 Geology

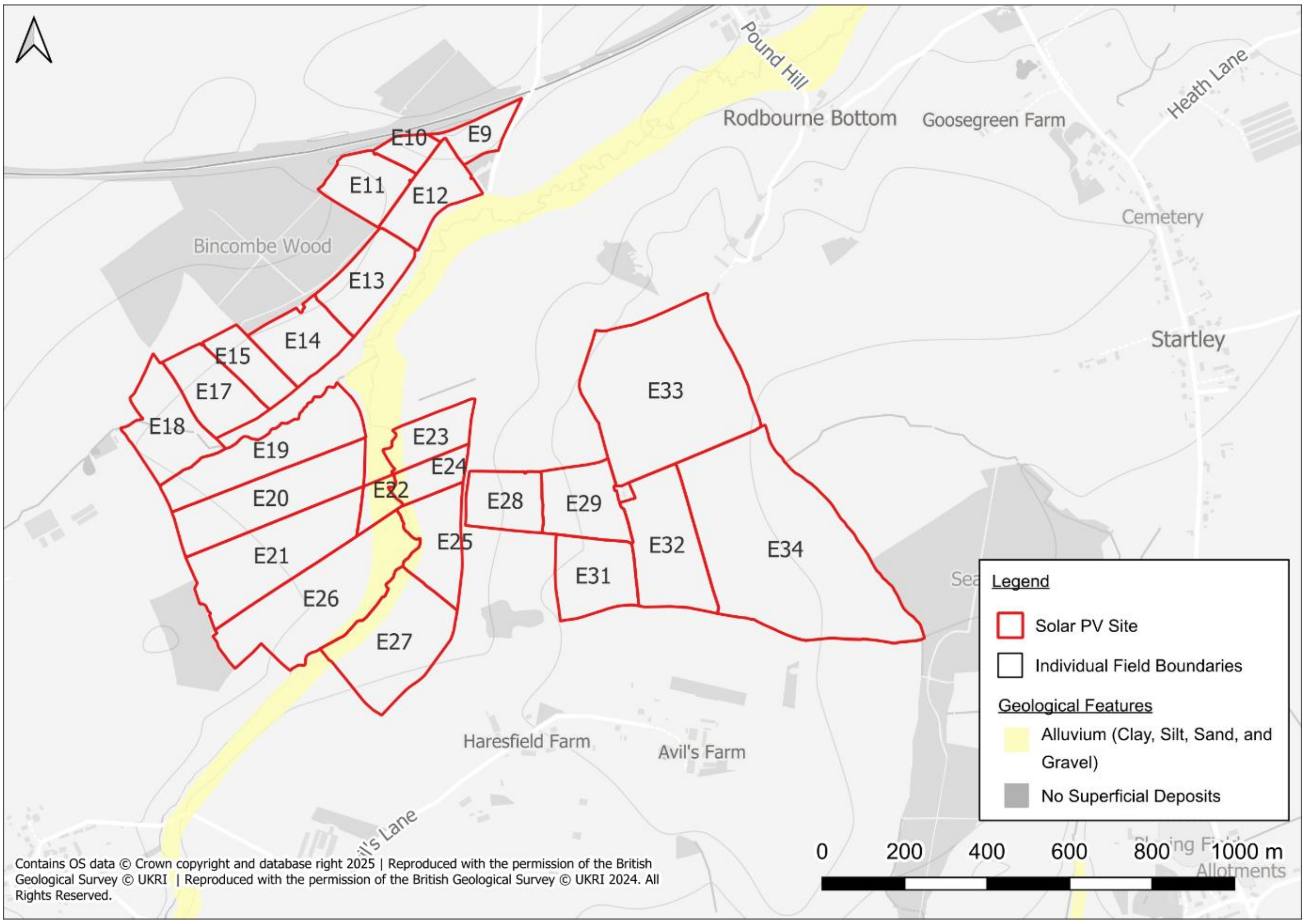



**Figure 3: Superficial Deposits**

1.7.1 Reference to the British Geological Survey (BGS) online mapping[ii] (1:50,000 scale) indicates that Lime Down E2 is largely not underlain by superficial deposits, aside from an area of Alluvium, comprising clay, silt sand and gravel superficial deposits (see **Error! Reference source not found.** for the deposit location).

1.7.2 Lime Down E2 is identified as being underlain by the following bedrock deposits (see **Figure** 4 for the locations of the varying deposits):

- Kellyways Clay Member – Mudstone;
- Kellways Sand Member – Sandstone and Siltstone, interbedded;
- Cornbrash Formation – Limestone;
- Forest Marble Formation – Mudstone; and
- Oxford Clay Formation – Mudstone.

1.7.3 The geological mapping is available at a scale of 1:50,000 and as such may not be accurate on a site-specific basis.

1.7.4 There are no BGS boreholes at Lime Down E2 or within the immediate vicinity of Lime Down E2.

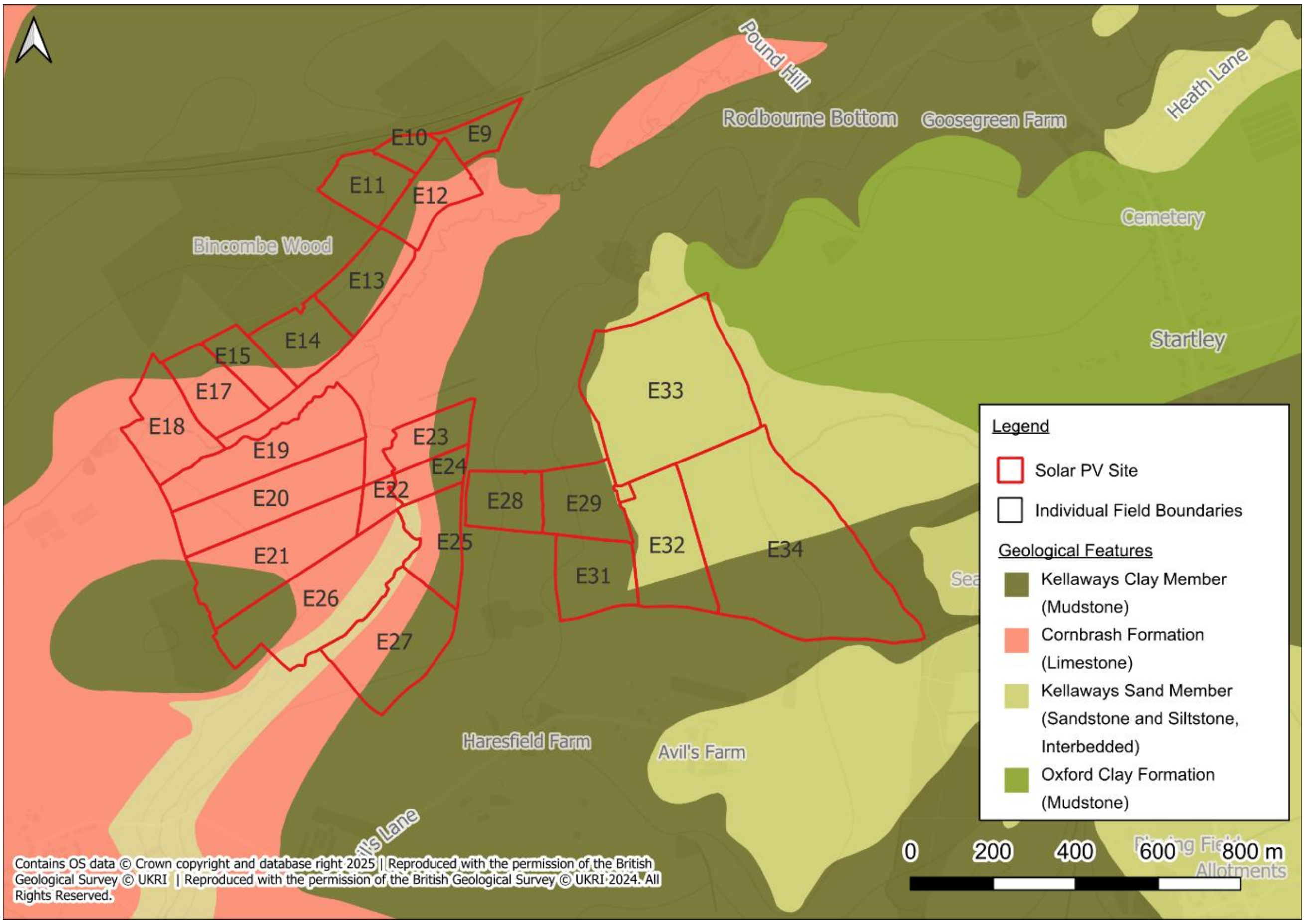



**Figure 4: Bedrock Deposits**

## 1.8 Hydrogeology

1.8.1 According to the EA's Aquifer Designation data, obtained from MAGIC Map's online mapping[iii] [accessed 02/06/25], the Alluvium Formation is described as a Secondary A Aquifer.

1.8.2 The underlying the Cornbrash Formation, Forest Marbie Formation and Kellaways Sand Member Deposits are classified as a Secondary A Aquifers. The Kellaways Clay Member and Oxford Clay Formation are classified as unproductive aquifers.

1.8.3 The EA's 'Source Protection Zones' data, obtained from MAGIC Map's online mapping [accessed 02/06/25], indicates that Lime Down E2 is located within a Groundwater Source Protection Zone (Zone I-Subsurface Activity).

## 1.9 Proposed Site Conditions

1.9.1 Lime Down E2 proposes a ground mounted solar photo-voltaic plant and associated electrical infrastructure and access. See Chapter 3: Scheme Description of the ES.

1.9.2 An **Outline Landscape and Ecological Management Plan (LEMP) [EN010168/APP/7.18]** has been developed to support the DCO application, and details that the vast majority of the Site is proposed to be utilised for Solar PV Pannels, supporting infrastructure, internal access and peripheral areas will comprise landscaped buffers in line with the embedded mitigation described throughout the ES.

# 2. Assessment of Flood Risk

2.1.1 The aim of this section of the report is to assess and summarise the existing flood risk at Lime Down E2.

## 2.2 Tidal Flood Risk

2.2.1 Lime Down E2 is situated at a minimum of approximately 72m AOD and is significantly above sea level. Therefore, there is **Negligible** risk from tidal flooding.

## 2.3 Fluvial Flood Risk

2.3.1 According to the EA's Flood Map for Planning (updated in March 2025)[iv], Lime Down E2 is situated largely within Flood Zone 1 (meaning it is an area considered to have <0.1% annual probability of flooding from rivers or the sea) with the exception of Fields E20 – E27 which are located in Flood Zones 2 and 3. The extent of Flood Zone 3 is considered to be associated with Gabriel's Well (which flows in a north-easterly direction). Flood maps are included as Figure 5 below and **ES Volume 2, Figure 11-7: Lime Down E2 Fluvial and Surface Water Risk Map [EN010168/EXAM/6.2] (Rev 2)** produced at Deadline 3 of Examination

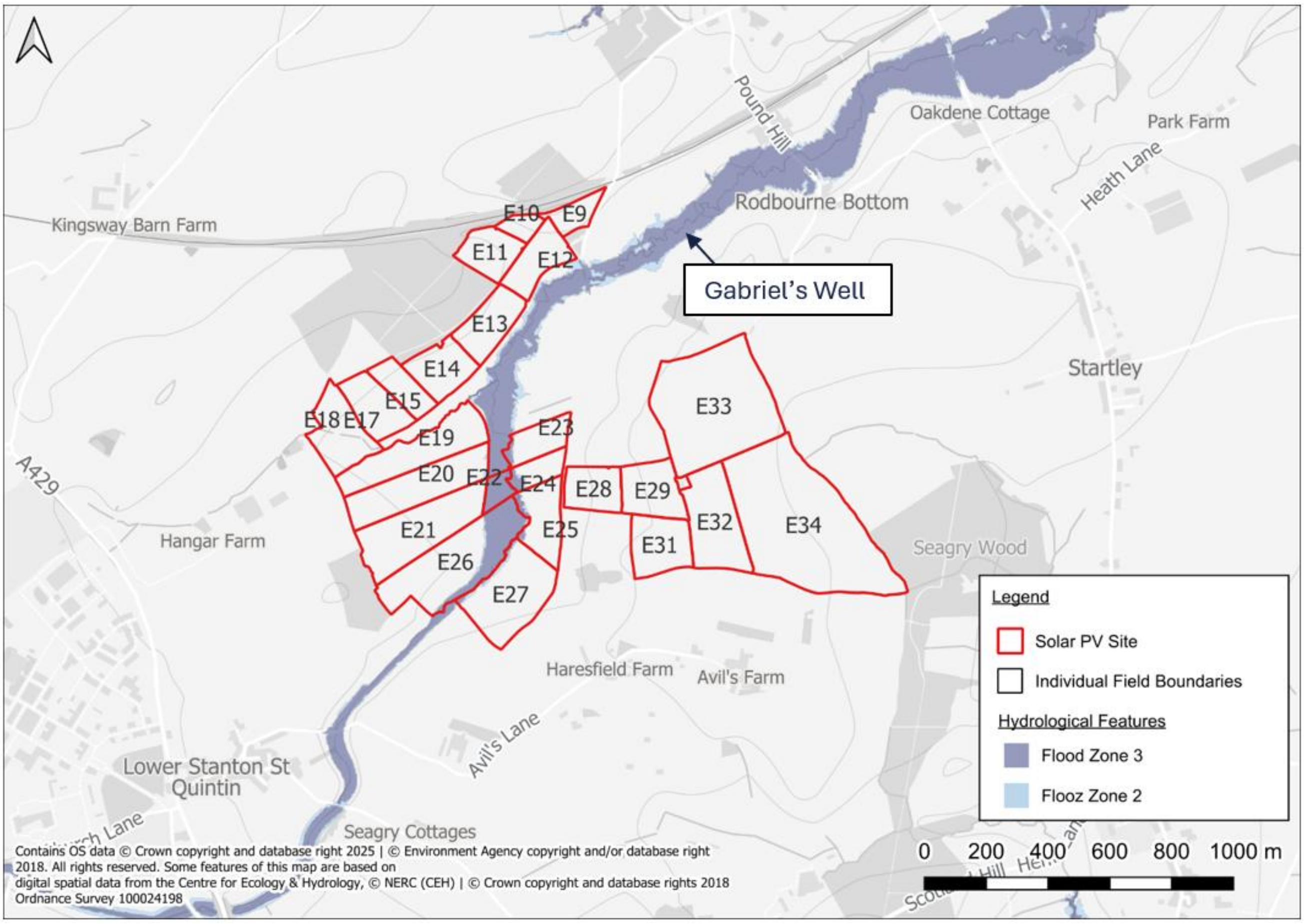



**Figure 5: EA's Flood Map for Planning**

## Local Watercourses and Flooding Mechanisms

2.3.2 Gabriel's Well is designated as a Main River and flows through the centre of Lime Down E2. The mapped floodplain extents correspond largely with areas below approximately 74m AOD. Fluvial flooding could occur in these areas if Gabriel's Well overtopped its banks or became restricted by debris or sediment accumulation during or following extreme rainfall events.

2.3.3 According to the Environment Agency's Spatial Flood Defences with Standardised Attributes dataset, a natural high ground feature is present adjacent to Gabriel's Well. No engineered defences or defined crest levels are recorded, and the Standard of Protection and condition of this feature are unknown.

## Historical Flooding

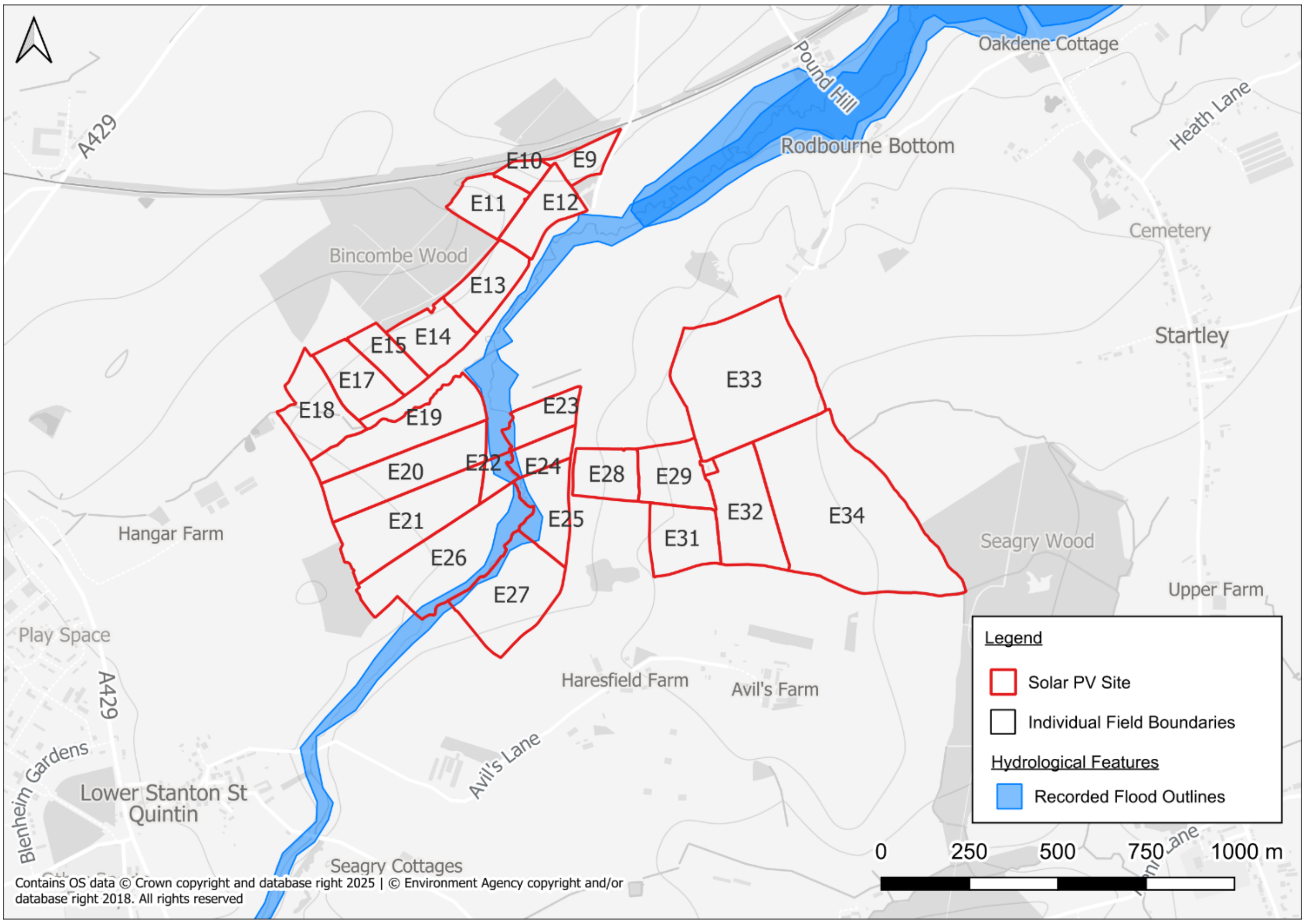



**Figure 6: Historic Flood Map**

2.3.4 The Environment Agency's Historical Flood Map (Figure 6) records a fluvial flood event in January 1925, understood to have resulted from overtopping of Gabriel's Well during prolonged rainfall. No additional site-specific records of historic fluvial flooding have been identified from Environment Agency datasets or third-party sources.

## Hydraulic Model

2.3.5 Given the Site is potentially at risk of fluvial flooding and noting that the EA's flood data for Gabriel's Well is based on a strategic level assessment, site-specific detailed hydraulic modelling has been carried out to more accurately assess potential fluvial flood extents and flood depths at the Site. Full details of the hydraulic modelling study and results are provided in **Lime Down E2 - Hydraulic Modelling Report [EN010168/EXAM/9.53]** submitted at Deadline 4; however, key results are summarised below.

2.3.6 Assessment of the 3.3%, 1% and 0.1% AEP events for the present-day scenario reaffirms the current EA's flood maps, showing flooding to be isolated to the lower lying floodplain corridor located along the watercourse's route, with the majority of the Site remaining free from fluvial flooding. Assessment of the future climate change scenario, accounting for a 39% and 71% uplift during the 1% AEP eventsv, shows similar flooding mechanisms but with small increases to extent.

2.3.7 Modelled flood depths and extents, provided in Annex B, show that only small areas of field boundaries bordering the watercourse (E20, E21, E22, E23, E24, E25, E26, and E27) are potentially at risk during the present day and future climate change scenarios. Additional comparison of the development proposals and predicted flood extent during the worst-case present day 0.1% AEP event, illustrated in Figure 7, shows the closest proposed Conversion Units / 33kV sub distribution switch rooms are located outside areas at risk of flooding. Potential impacts to the solar arrays are limited to small areas within field boundaries E23, E24 and E26.

2.3.8 Flood depth and extent plots for all assessed AEP events are provided in Annex B.

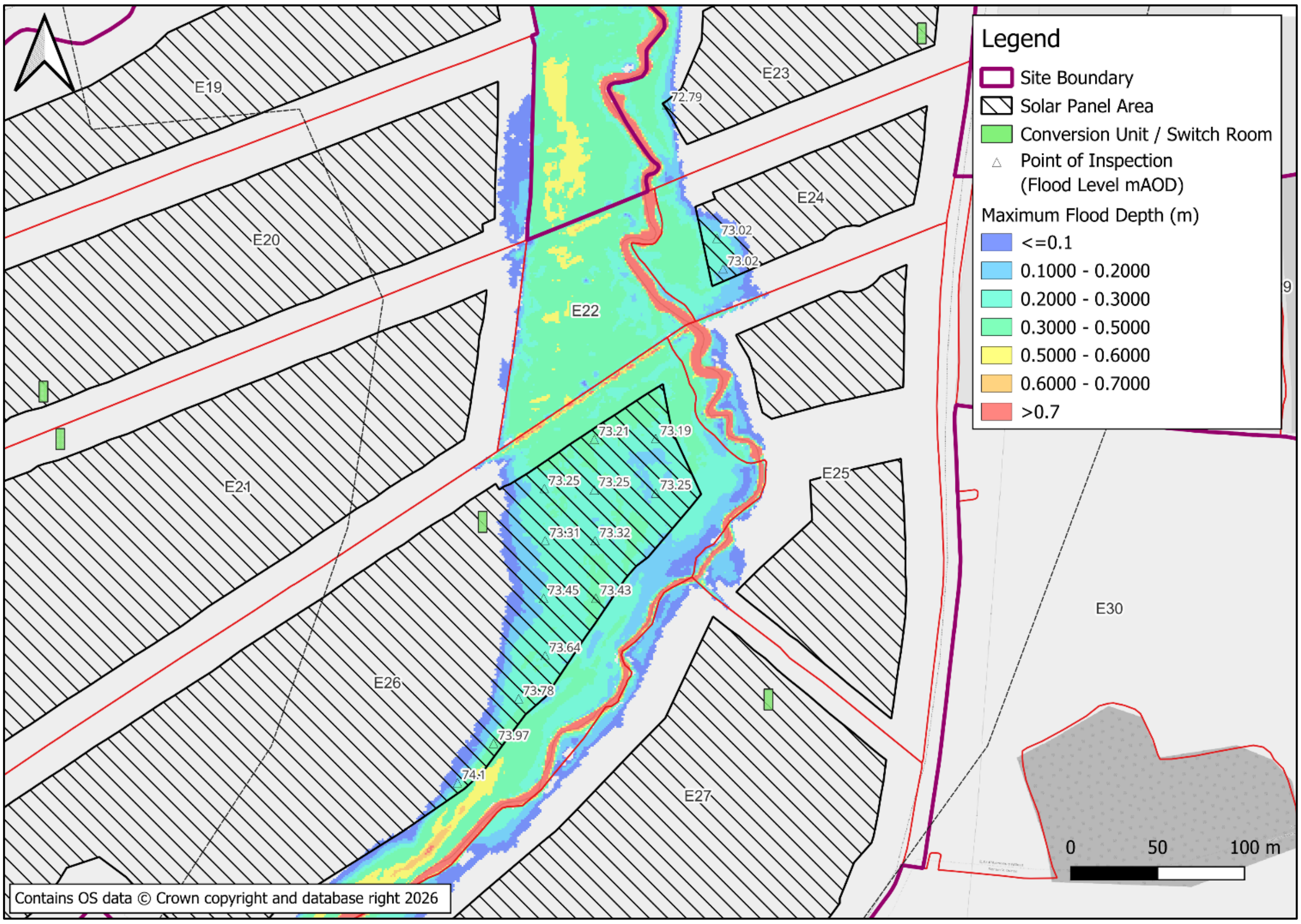



**Figure 7: Water Level and Depth Map – 0.1% AEP**

2.3.9 In line with the embedded mitigation strategy set out in **Appendix 11.1: Flood Risk Assessment and Drainage Strategy – Covering Report [EN010168/APP/6.3],** the proposed solar panels and associated infrastructure have been designed to remain resilient to fluvial flood risk. Electrical infrastructure, including inverters, transformers and substations, together with all sensitive electrical equipment associated with the Solar PV Panels, will either be located outside of Flood Zone 3b / functional floodplain and modelled flood extents or raised above a minimum freeboard of 600mm above the design flood level including climate change allowance. The lowest leading edge of the Solar PV Panels themselves does not comprise sensitive electrical equipment and may therefore sit lower depending on the final panel configuration and mounting arrangement. Smaller components such as conversion units and switchgear, where present, will be minor in scale and made resilient through elevation or localised waterproofing. This ensures that all above-ground infrastructure remains operational during fluvial flood events and does not obstruct floodplain flow routes.

### Assessment of Minor Watercourses and Ephemeral Drains

2.3.10 Detailed hydraulic modelling has been undertaken for Gabriel's Well. This model does not explicitly assess flood risk associated with the smaller watercourses, land drains and ephemeral drains within Lime Down E2.

2.3.11 A separate, proportionate assessment has therefore been undertaken for these features using Manning's open channel flow formula. This provides an estimate of flood levels for the 1% + CC (71%) event based on channel shape, gradient and roughness. The calculation, including the data sources and coefficients used, is provided in Annex C and is informed by cross-sectional data derived from EA LiDAR captured in Q1 2020.

2.3.12 The EA's surface water flood mapping has also been reviewed as a precautionary indication of potential flow routes associated with the smaller watercourses and ephemeral drains. The mapping identifies localised flow routes broadly corresponding with these features, with mapped depths generally not exceeding 0.3 m.

2.3.13 The flood extents derived from the Manning's assessment are more limited than those shown on the EA's 0.1% surface water mapping. The surface water mapping has therefore been used only to indicate potential exceedance flow routes and extents. The 1% + CC (71%) Manning's assessment forms the basis of the design event assessment for the smaller watercourses and ephemeral drains.

2.3.14 The Manning's assessment was completed before the updated NaFRA2 mapping was published in January 2025. The updated mapping shows a reduction in surface water flood extents across the Site. This does not alter the assessment and supports the conclusion that the Manning's approach remains suitably conservative.

### Floodplain Storage Compensation

2.3.15 Flood Zone 2 and 3 extents are expected to impact the Site and solar areas in Fields E23, E24, and E26. Based on the available Flood Map for Planning information, detailed hydraulic modelling, and the Manning's-based assessment undertaken for this Annex, the layout of panelled development within Lime Down E2 has sought to avoid higher-risk areas and the main functional floodplain extent. The panelled areas that interact with mapped flood extents comprise flood-compatible development only and are not expected to give rise to material loss of floodplain storage or material obstruction of flood flow routes within the meaning of NPS EN-1 Section 5.8.12.

2.3.16 The potential for floodwaters to interact materially with the solar PV panels or their supports is limited, as the development in impacted areas is raised above the design flood level with an appropriate freeboard allowance. Where Solar PV Panels are located within the 1% AEP plus climate change design flood extent, the lowest leading edge of the panels will be set no less than 600mm above the design flood level, with the final panel mounting height, tilt or tracker arrangement confirmed at detailed design. As a result, any associated displacement of floodplain storage is only associated with the solar panel supports and is considered negligible. Therefore, the implementation of specific flood compensation measures in these locations is not considered necessary or proportionate.

2.3.17 While negligible impacts are expected, the EA has advised that, for any development located within Flood Zone 3a (i.e. the 1 in 100-year plus climate change flood extent) and Flood Zone 3b (i.e. the 1 in 30-year plus climate change flood extent), floodplain storage compensation should be incorporated into the design. Compensation should be provided on a level-for-level and volume-for-volume basis, ensuring direct replacement of any lost storage. To demonstrate negligible loss of storage volume from the solar panel supports, and flood compensation measures are not necessary or proportionate, a flood compensation analysis has been carried out and is detailed below.

2.3.18 Noting that approximately 10 supports are required per 100m of panels, equating to approximately 608 supports across the total area of 0.661km$^2$ proposed for solar PV panels, the number of supports identified as potential at risk of flooding during the assessed AEP events has been calculated. Taking a support cross-sectional area of 28.65cm$^2$ and modelled maximum flood depths for the areas located within the flood extents, the potential displaced volume for the respective solar panel areas has been calculated.

2.3.19 Results for the 0.1% AEP event, outlined in Table 1, indicate that during this worst case present day scenario, a minimal volume of 0.0198m$^3$ is displaced and results in a negligible loss of flood plain storage. During the more frequent 3.3% and 1% AEP events, maximum displaced volumes of 0.0119m$^3$ and 0.0136m$^3$ are displaced, respectively. When accounting for the potential impacts of climate change, during the 1%+CC(39%) and 1%+CC(71%), maximum displaced volumes are still minimal, equalling 0.0188m$^3$ and 0.0204m$^3$ respectively. Tables outlining results for all the aforenoted events are provided in Annex D.

**Table 1: Potential Maximum Displaced Volume – 0.1% AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent (m$^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area (m$^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume (m$^3$) |
|---|---|---|---|---|---|
| E23 | 58 | 1 | 0.002865 | 0.22 | 0.0006 |
| E24 | 863 | 1 | 0.002865 | 0.29 | 0.0007 |
| E26 | 12804 | 12 | 0.002865 | 0.55 | 0.0186 |

2.3.20 To ensure a precautionary approach has been adopted, maximum displaced volumes have been assessed using the maximum predicted flood depth recorded within each respective solar panel area. In practice, however, flood depths will vary across these areas, with average depths being considerably lower than the maximum values applied in the assessment. Consequently, the calculated maximum displaced volumes are conservative and will exceed the volumes that would occur in reality.

2.3.21 Furthermore, although the approximate number of supports within the flood extent was determined by applying the ratio of the solar panel area located within the flood extent to the Site's total solar panel area (0.661 $km^2$) to the total number of panel supports (608), the results presented in Table 1 demonstrate that the calculated displaced volume is largely insensitive to variations in support numbers due to the supports' extremely small cross-sectional profile. For example, even if the number of supports were increased tenfold, the resulting change in potential floodwater displacement would be negligible.

2.3.22 To assess the potential increase in flood levels resulting from the loss of floodplain storage, a deliberately conservative approach has also been adopted. The total combined displaced volume for each AEP event has been assumed to be redistributed uniformly across the modelled flood extents within the Site only. This approach is intentionally precautionary, as it assumes that all displaced floodwater is retained within the Site boundary, whereas in reality floodwaters are hydraulically connected to a wider floodplain and any displacement would be distributed over a substantially larger area.

2.3.23 On site flood extents and the resulting theoretical increase in flood levels are outlined in Table 2, which highlights that any potential increase on site is effectively zero for all the assessed AEP events. This increase is several orders of magnitude below the precision at which flood levels can be meaningfully defined, and is well within the inherent uncertainty of hydraulic modelling, topographic data, and natural floodplain variability. The effect is therefore imperceptible and would not result in any measurable change to flood levels, flood extents, flow routes, or flood risk to third parties.

**Table 2: Potential Increase in Flood Level**

| AEP | Combined Displaced Volume from areas E23, E24, and E26 ($m^3$) | Site Flood Extent Area ($m^2$) | Increase in Flood level (m) |
|---|---|---|---|
| 3.3% | 0.0119 | 41959 | $2.84 \times 10^{-7}$ |
| 1% | 0.0136 | 43850 | $3.10 \times 10^{-7}$ |
| 1%+CC (39%) | 0.0188 | 47974 | $3.92 \times 10^{-7}$ |
| 1%+CC (71%) | 0.0204 | 50293 | $4.06 \times 10^{-7}$ |
| 0.1% | 0.0198 | 49969 | $3.96 \times 10^{-7}$ |

2.3.24 Furthermore, the proposed solar panel supports comprise discrete, widely spaced elements with a negligible cumulative footprint relative to the floodplain area. As such, they would not materially affect floodplain conveyance or flow paths. Where perimeter fencing is required within the mapped Flood Zone 2 or Flood Zone 3 extents, it will comprise post and wire mesh fencing specified with the widest mesh aperture available within the selected fencing system, so as to maximise the passage of floodwater and debris and avoid obstruction of flood flows. Fencing in these locations will not be solid, close-boarded or fine-mesh. The detailed fencing specification will be confirmed at the detailed design stage in accordance with this principle.

2.3.25 Given the extremely limited displacement, the conservative assumptions applied, and the imperceptible increase in flood depth, the impact on flood storage capacity is considered de minimis. On this basis, it is concluded that further consideration or provision of compensatory flood storage resulting from panelled areas encroaching into the flood extents is not necessary or proportionate for the proposed development. The potential increase of flood depths are considered **negligible** and well within the natural variability of floodplain behaviour, and would result in no perceptible change in flood levels or flow routes. It therefore represents a highly conservative assessment of worst-case impacts.

### Consultation

2.3.26 The EA were consulted in October 2024 regarding the availability of any site-specific flood data and hydraulic modelling for Lime Down E2. A formal response was received on 13 November 2024, included in Annex E.

2.3.27 The Product 4 data provided for the Site were generated using the EA's National Generalised Model (JFLOW). This dataset is suitable for defining indicative Flood Zones; however, it is not based on a detailed channel survey or locally calibrated model inputs. Model results produced as a part of the site-specific detailed modelling, outlined in the preceding section, therefore provide a more accurate and reliable assessment of potential flood risk at the Site and has been used to inform this reports assessment.

2.3.28 Consultation has been undertaken throughout the EIA process with the EA and Wiltshire Council. Comments and recommendations received during this engagement have been considered and incorporated, where appropriate, into this Flood Risk Assessment and Drainage Strategy. A record of consultation and Arthian's responses is provided in ES Chapter 11: Hydrology, Flood Risk and Drainage.

2.3.29 Lime Down E2 is not located within an Internal Drainage Board (IDB).

2.3.30 There is no site-specific information within third party reports relating to fluvial flood risk.

### Summary

2.3.31 Given the above and the nature of the Scheme, Lime Down E2 is therefore considered to be at **Low** risk of fluvial flooding.

## 2.4 Surface Water Flood Risk

2.4.1 The EA's National Flood Risk Assessment Mapping (NaFRA), known as the 'Long Term Flood Risk Map' (Surface Water)[vi], was updated in January 2025. The NaFRA mapping provides an updated view of surface water flooding across the Site, however it should be noted that at the time of writing, the NaFRA mapping only delivers climate change insight up to the year 2060.

2.4.2 According to the EA's Long Term Flood Risk Map (Surface Water) the majority of Lime Down E2 is at Very Low risk of surface water flooding, meaning it has a <0.1% annual probability of flooding. However, there are some small areas of Low to High risk (0.1 - >3.3% annual chance of flooding), particularly in areas associated with the presence of Gabriel's Well which flows in a north-easterly direction.

2.4.3 With reference to the depth mapping provided by the NaFRA data, flood depths are anticipated to be low, with depths remaining largely below 0.3m which is considered passable to people and vehicles. Some depths between 0.3 and 0.6m are anticipated in Fields E10 – E12, E14 – E18, E22, E25 – E26, and E33 – E34, however as above, these depths are associated with the presence of Gabriel's Well.

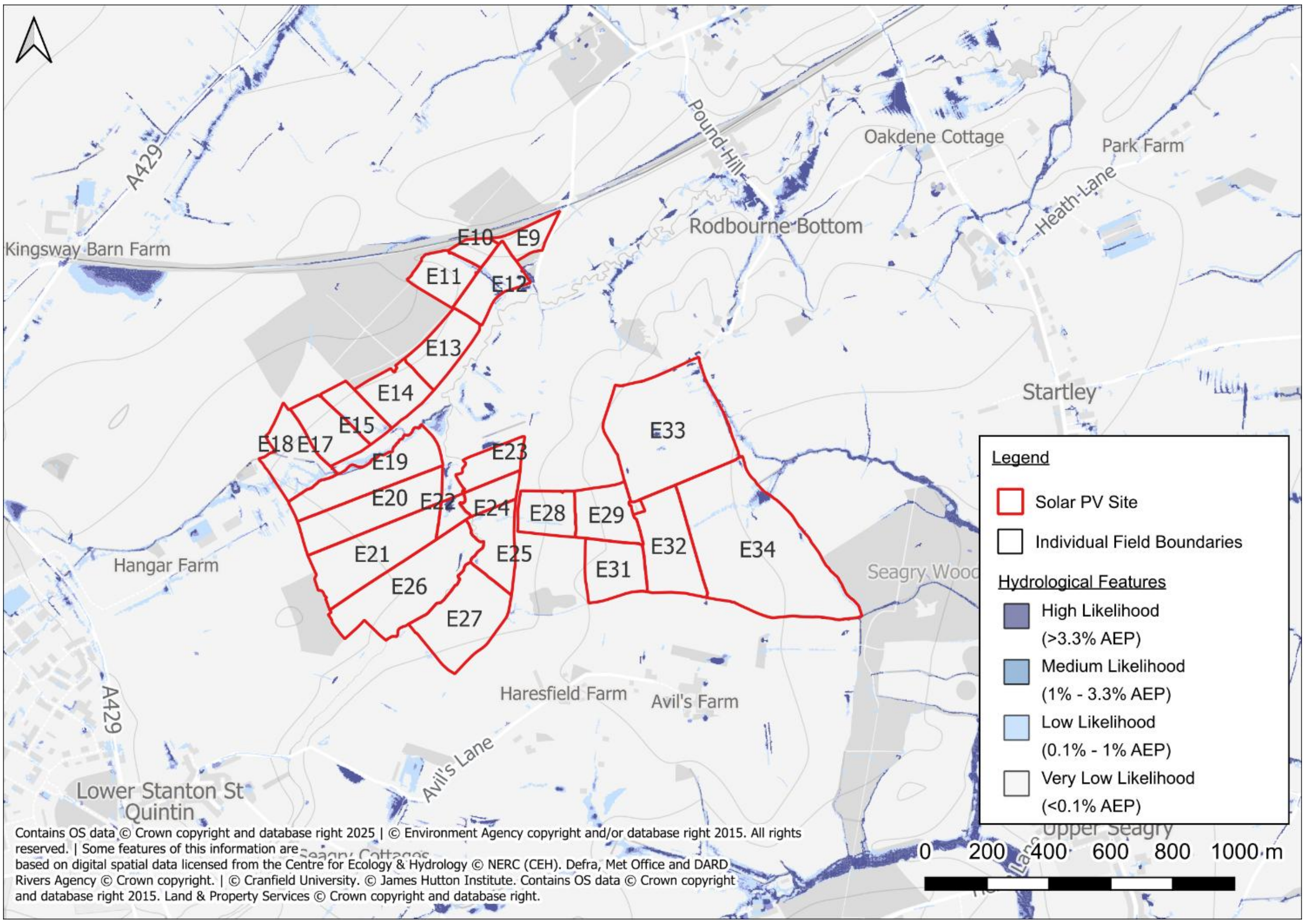



**Figure 8: EA's Long-Term Flood Risk Map (Flood Risk from Surface Water)**

2.4.4 There is no indication within relevant third-party reports (listed in 'Sources of Information' in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) to suggest that Lime Down E2 has historically experienced surface water flooding.

2.4.5 Based on the above and considering the embedded mitigation as part of the design of the solar PV Panels, the overall risk of surface water flooding is considered to be **Low**. The proposed solar PV Panels and all other electrical infrastructure will be raised above surrounding ground levels and will be appropriately waterproofed thereby reducing the potential to be impacted in the event of surface water flooding.

2.4.6 Associated electrical infrastructure, such as inverters, transformers, cabling and substations, will be located outside mapped flood extents where feasible, or otherwise elevated above a minimum freeboard of 600 mm above the design flood level, in line with the embedded mitigation strategy outlined in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3].**

2.4.7 Smaller electrical components such as switchgear and conversion units, where present, are minor in scale and will be protected through elevation or localised resilience measures, consistent with the approach set out in the Covering Report. This ensures that all above-ground infrastructure will remain operational during fluvial or surface water flood events, and will not obstruct overland flow paths or exacerbate off-site flood risk.

2.4.8 The impact of the Scheme on surface water risk is covered in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**, to ensure that surface water risk is not exacerbated through appropriate SuDS measures.

## 2.5 Groundwater Flood Risk

2.5.1 The geology is identified above in Section 1.0. There were no legible boreholes in the near vicinity.

2.5.2 The 2015 SFRA interactive mapping[vii] details that Lime Down E2 largely is identified as having 'No risk' from groundwater flooding. The western areas underlain by Cornbrash Formation and Forest Marble Formation are classified as having groundwater levels of between 0.025m and 0.5m below ground level (bgl) or 0.5m and 5m bgl. There is no further information within relevant third party reports (listed 'Sources of Information' in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3]**) to suggest that Lime Down E2 has experienced historical groundwater flooding.

2.5.3 Soilscapes[viii] indicates that Lime Down E2 is partially '*freely draining*', with areas of '*impeded drainage*'.

2.5.4 No buildings and no basement levels are identified on plans which may otherwise be at increased risk from groundwater seepage.

2.5.5 It can be concluded that the risk of groundwater flooding is **Low** and no specific mitigation measures are required.

## 2.6 Sewer Flooding

2.6.1 No site-specific incidents of sewer flooding have been identified from relevant third-party reports.

2.6.2 On the basis of Lime Down E2's rural setting, the presence of sewerage infrastructure is unlikely. Utility records have been checked and do not identify any public sewers within Lime Down E2.

2.6.3 It can therefore be concluded that the risk of sewer flooding is **Negligible.**

## 2.7 Reservoir and Canal Flooding

2.7.1 There are no canals within the vicinity of Lime Down E2, therefore there is no associated risk.

2.7.2 The EA 'Flood Risk from Reservoirs' map shows that Lime Down E2 is not at risk of flooding from reservoirs.

2.7.3 It can therefore be concluded that there is **Negligible** risk of flooding from artificial sources.

## 2.8 Residual Flood Risks

2.8.1 A residual risk is an exceedance event, such as the 1 in 1000 year (0.1% AEP) flood event that would overtop the Gabriel's Well and potentially impact Lime Down E2. As the probability of a 1 in 1000 year flood event occurring is 0.1% in any given year, the probability is low and, therefore, no additional mitigation beyond the embedded mitigation measures of the Scheme is required.

2.8.2 In the event of the defences failing or an exceedance event occurring, the residual risk to people working or present in the vicinity, as construction workers, residents, or public right of way (PRoW) users, within Lime Down E2 can be managed through the implementation of an appropriate Site management plan. This plan will recognise the residual risks and outline the actions to be taken by staff in the event of a flood to ensure that occupants are placed in a place of safety.

## 2.9 Summary of Flood Risk

2.9.1 It can be concluded that the risk to Lime Down E2 from all sources of flooding is **Negligible to Low**.

## 2.10 Embedded Mitigation

2.10.1 Embedded Mitigation is detailed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3],** in which the FRA has informed.

## 2.11 Impact on Off-Site Flood Risk

2.11.1 The solar PV Panels and other electrical infrastructure, such as inverters, transformers, cabling and substations, which are to be sat on a concrete foundation/pad that will be mounted on frames and raised above ground level allowing flood water to flow freely underneath. Therefore, there will be no loss of floodplain volume as a result of the Scheme and no increase in flood risk elsewhere.

2.11.2 Associated Scheme, such as switch gears, inverters and conversion units, are insignificant in size. The various components dimensions can be found in detail in **ES Volume 1, Chapter 3: The Scheme [EN010168/APP/6.1]**. Given the embedded mitigation detailed above, including locating infrastructure outside of any areas considered to be at risk, there should be no increase in flood risk elsewhere.

2.11.3 Surface water management has been considered in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [EN010168/APP/6.3].**

# 3. Outline Drainage Strategy

3.1.1 Lime Down E2 forms part of the wider Scheme and includes Solar PV Panelled Areas, Solar PV Site Access Tracks and fourteen Conversion Units / 33kV Sub-distribution Switch Rooms. This section provides the Outline Drainage Strategy for Lime Down E2. It identifies the areas requiring formal drainage consideration, sets out the basis of the runoff and attenuation calculations, and demonstrates that a feasible drainage solution can be accommodated within the assessed design envelope. Excluding the Conversion Unit / 33kV Sub-distribution Switch Room equipment pads, Lime Down E2 will remain largely permeable following development. Solar PV infrastructure is not treated as contributing to the overall extent of positively drained hardstanding surfaces for the purposes of this Outline Drainage Strategy.

3.1.2 For the purpose of this assessment, this Outline Drainage Strategy is split as follows:

- A description of surface water drainage from the Solar PV Panelled Areas, excluding the Conversion Units / 33kV Sub-distribution Switch Rooms; and
- An outline drainage strategy for the positively drained hardstanding surfaces, comprising the Conversion Units / 33kV Sub-distribution Switch Rooms.

3.1.3 The detailed drainage layout, final SuDS components, conveyance routes, levels, outfalls, flow controls, treatment train, isolation arrangements and maintenance regime will be confirmed at detailed design and secured through the relevant DCO drainage requirement.

## 3.2 Solar PV Panelled Areas

3.2.1 Solar PV panelled areas are not treated as formal impermeable drainage catchments within this Outline Drainage Strategy. The panels are elevated above ground level, drain to the existing ground, are not sealed into a drainage network, and do not create a connected impermeable surface.

3.2.2 This approach is supported by national policy and the submitted evidence base. **NPS EN-3 paragraph 2.10.84** recognises that solar PV panels drain to the existing ground and that the drainage impact will not, in general, be significant. This position is also addressed in **ES Volume 1, Chapter 11: Hydrology, Flood Risk and Drainage [REP3-015], ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy - Covering Report [REP3-039]** and the **Applicant's Response to the Lead Local Flood Authority on Hydraulic Modelling Requirements [REP2-045]**.

3.2.3 The Applicant's review of the relevant research and guidance confirms that, where vegetated ground cover is established and maintained, soil compaction is avoided or remediated, and connected preferential flow routes are not created, solar PV panels are not predicted to increase surface water runoff rates or volumes in a manner that requires formal attenuation.

3.2.4 The principal effect of the panels is local redistribution of rainfall within the same field, including potential concentration at panel drip-lines. This does not generate additional rainfall volume. Whether redistributed rainfall becomes runoff is governed by the condition of the receiving ground, including vegetation cover, soil structure, compaction, surface roughness, slope and hydrological connectivity.

3.2.5 Those controlling factors are addressed through the embedded mitigation secured for the Scheme. Construction phase controls are secured through **the Outline Construction Environmental Management Plan [REP3-092] and Outline Soil Resources Management Plan [REP3-098]**, including controls on construction trafficking, soil handling, temporary drainage, decompaction and reinstatement. Operational ground cover and land management controls are secured through the **Outline Landscape and Ecological Management Plan [REP3-100]** and **Outline Operational**

**Environmental Management Plan [REP3-094]**, including the establishment and maintenance of vegetated ground cover beneath and between the arrays.

3.2.6 On this basis, no formal attenuation storage is proposed for the solar PV panelled areas. Additional built SuDS across the panelled fields would not be proportionate, as the policy and evidence base indicate that solar PV panels do not materially increase surface water runoff where the relevant ground condition, vegetation and flow connectivity controls are secured. The Outline Drainage Strategy for these areas is therefore to maintain diffuse drainage to the existing ground, preserve existing field-scale flow behaviour, protect existing drainage features, and manage soil and vegetation condition through the secured construction and operational controls. Internal access tracks within the Solar PV Panelled Areas will be formed using permeable materials and, where practicable, maintained at existing ground levels. These tracks are not treated as positively drained hardstanding surfaces requiring formal attenuation, except where specifically and conservatively assessed within this Outline Drainage Strategy, such as the Solar PV Site Access Tracks assessed in Table 1.

## 3.3 Drainage Strategy – Proposed Hardstanding Surfaces

3.3.1 Lime Down E2 currently comprises agricultural land. For the purposes of the runoff calculations, the undeveloped areas are treated as greenfield and permeable, with existing field drainage and local drainage features forming part of the baseline drainage regime. Table 1 identifies the assessed hardstanding surfaces within Lime Down E2. These areas have been included within this Outline Drainage Strategy because they would either be positively drained or have been conservatively assessed as requiring positive drainage.

**Table 3: Proposed Hardstanding Surfaces**

| Hardstanding Infrastructure | Hardstanding Area ($m^2$) |
|---|---|
| Conversion Units / 33kV Sub-Distribution Switch Rooms | 1,050 (14 × 75 $m^2$) |

3.3.2 The assessed hardstanding surfaces have been identified using the indicative infrastructure areas currently proposed for Lime Down E2, or, where the final equipment layout is not fixed, the relevant maximum design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055].** Where the Works Plan envelope or indicative infrastructure area is smaller than the relevant Chapter 3 maximum parameter, the assessed area has been limited to the area that can feasibly be accommodated within Lime Down E2. This provides a conservative but realistic basis for demonstrating that the required drainage infrastructure can be delivered within the assessed design envelope.

3.3.3 The assessed hardstanding surfaces have the potential to increase surface water runoff rates and volumes if unmanaged. Surface water runoff from these areas will therefore be controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere.

3.3.4 Wiltshire Council Sustainable Drainage Systems (SuDS) Guidance[1] states the following:

"*With regards the control of surface water discharges from new development, Wiltshire Council requires post development discharges from greenfield sites to provide 30% betterment over pre-development*

[1] https://www.wiltshire.gov.uk/media/13768/Wiltshire-Council-Drainage-Betterment-Strategy/pdf/Wiltshire_Council_Drainage_Betterment_Strategy__June_2024.pdf?m=1731336788693

*discharges for all storm events between the 1 in 1year and 1 in 100year return period events."*

3.3.5 A fixed detailed drainage layout drawing or sketch is not submitted at this outline stage. The purpose of this Outline Drainage Strategy is to demonstrate that a feasible drainage solution can be accommodated within Lime Down E2 based on the assessed hardstanding surfaces, greenfield runoff rates, controlled discharge rates, indicative attenuation volumes, SuDS options, treatment requirements and maintenance arrangements. The detailed drainage design, including the final layout, levels, outfall arrangement, isolation measures and maintenance access, will be submitted and approved in accordance with the relevant DCO drainage requirement before the relevant part of the authorised development commences.

## 3.4 Drainage Hierarchy

3.4.1 The proposed surface water drainage strategy has been prepared in accordance with the drainage hierarchy set out in the National Standards for Sustainable Drainage Systems (SuDS) and in line with Paragraph 080 of the National Planning Practice Guidance (NPPG): Flood Risk and Coastal Change. The hierarchy prioritises reuse and infiltration where feasible, followed by discharge to an above-ground surface water body, discharge to a surface water sewer or other surface water drainage system, and finally discharge to a combined sewer.

3.4.2 The following drainage hierarchy review considers normal operation. In the event of a potential pollution incident, any relevant drainage controls would be operated in accordance with the final drainage design and operational management procedures.

3.4.3 The hierarchy establishes the following order of preference for runoff destinations:

- Priority 1: Collect surface water for reuse within the development (e.g. irrigation or non-potable supply).
- Priority 2: Infiltrate runoff to the ground, where ground conditions and groundwater levels permit.
- Priority 3: Discharge runoff to an above-ground surface water body such as a watercourse, pond or wetland.
- Priority 4: Discharge runoff to a surface water sewer, highway drain or other drainage system.
- Priority 5: Discharge runoff to a combined sewer.

3.4.4 Where higher levels of the hierarchy cannot be achieved, proportionate justification must be provided to demonstrate compliance with national policy while ensuring effective flood risk management and long-term sustainability.

3.4.5 Priority 1: Surface Water Collected for non-Potable Use

3.4.6 Rainwater harvesting has been considered for the proposed development. However, Lime Down E2 does not include a sustained non-potable demand capable of receiving and using runoff from the positively drained hardstanding surfaces during design rainfall events. Reuse therefore cannot provide the sole means of disposal, and a secondary discharge route is required.

**Priority 2: Surface Water Infiltrated to Ground**

3.4.7 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, the next consideration is infiltration (soakaways and permeable surfaces).

3.4.8 As described above, the Site is largely not underlain by superficial deposits, aside from an area of Alluvium (comprising clay, silt, sand and gravel) through the centre of the Site. The underlying bedrock comprises the Kellaways Clay Member (mudstone), Kellaways Sand Member (sandstone and siltstone), Cornbrash (limestone) and Oxford Clay Formation (mudstone). Soilscapes mapping describes the majority of the Site, as having "*slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils with impeded drainage*".

3.4.9 In line with the National Standards for SuDS, infiltration should only be used where ground conditions are suitable, groundwater is protected, and land stability is not compromised. The available ground condition information indicates that infiltration potential is likely to be limited, with impeded drainage soils and mudstone bedrock reducing the likelihood of reliable long-term soakaway performance.

3.4.10 Infiltration is therefore not considered suitable as the primary method of surface water disposal for the Solar PV Site Access Track drainage catchment. This avoids relying on soakaways where ground conditions are unlikely to provide adequate infiltration capacity, particularly during prolonged or high intensity rainfall.

3.4.11 This does not preclude the use of permeable surfaces, shallow filter drains or local French drain arrangements as source-control features for small, discrete areas of supporting infrastructure, where appropriate. Such features would manage small volumes locally and would not be relied upon as the primary outfall for the drainage catchment.

3.4.12 Surface water from the Solar PV Site Access Tracks and other positively drained hardstanding surfaces will therefore be managed through a controlled drainage system, with attenuation and restricted discharge to an appropriate receiving drainage feature or watercourse.

**Priority 3: Discharge to an Above Ground Surface Water Body**

3.4.13 Where surface water collected for non-potable use (Priority 1) cannot be the sole method of disposal, and infiltration to ground (Priority 2) has been demonstrated to be unsuitable, discharge to an above ground waterbody should be the next consideration.

3.4.14 The nearest watercourse is Gabriel's Well, which is located through the centre of Lime Down E2. Discharge to this watercourse at controlled rates is considered feasible by gravity, subject to detailed design of the outfall arrangement and any necessary approvals.

**Priority 4: Discharged to a Surface Water Sewer, or Another Piped Surface Water Drainage System**

3.4.15 As described above, discharge to Gabriel's Well appears feasible; therefore, a connection to a public surface water sewer is not proposed. Should detailed design demonstrate that direct discharge to the watercourse is not feasible, alternative lower-priority destinations would be reviewed in accordance with the drainage hierarchy and subject to the relevant approvals.

**Priority 5: Discharge to a Combined Sewer**

3.4.16 As described above, discharge to Gabriel's Well appears feasible; therefore, discharge to a combined sewer is not proposed.

### 3.5 Surface Water Discharge

3.5.1 In accordance with the 2025 National Standards for SuDS in England Guidance, runoff destinations have been assessed following the required hierarchy.

3.5.2 As infiltration is not considered suitable as the primary discharge route for the drainage catchment, runoff from the positively drained hardstanding surfaces will be attenuated on site and discharged at controlled rates to Gabriel's Well in line with greenfield runoff principles and the LLFA requirement for 30% betterment.

3.5.3 Greenfield runoff rates have been calculated for each assessed hardstanding surface using the FEH Statistical (2025) method and are summarised in Table 2. The proposed discharge rates and associated attenuation volumes are indicative and have been prepared using the indicative infrastructure areas currently proposed, or the maximum relevant design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]** where the final equipment layout is not fixed. Greenfield calculation input parameters and results are provided in Annex F.

3.5.4 This approach demonstrates that a feasible drainage solution can be accommodated within Lime Down E2 and that peak runoff from positively drained hardstanding surfaces can be controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere. The attenuation volumes are indicative and are provided to demonstrate the feasibility of the Outline Drainage Strategy. The final drainage design may rationalise the number, location and form of SuDS components, provided the detailed design remains within the assessed design envelope and achieves the drainage principles secured through the relevant DCO drainage requirement.

**Table 4: Greenfield Runoff Rates**

| Infrastructure | 1 in 2 year (l/s) | 1 in 30 year (l/s) | 1 in 100 year (l/s) | 1 in 2 year +30% betterment (l/s) | Proposed Discharge Rate (l/s) | Attenuation ($m^3$) |
|---|---|---|---|---|---|---|
| Conversion Units / 33kV Sub-distribution Switch Rooms | 0.6 | 1.3 | 1.7 | 0.4 | 0.4 | 3.2 per unit; 44.8 cumulative |

### 3.6 Sustainable Drainage Systems

3.6.1 The SuDS appraisal approach outlined in the SuDS Manual (C753) has been applied to determine the most suitable methods for achieving sustainable surface water attenuation and conveyance to support the proposed development. The SuDS options summarised in Table 5 below have been considered:

**Table 5: SuDS Options for Proposed Development**

| SuDS Measure | Amenity Benefit | Biodiversity Benefit | Suitability for Proposed Development | Reasoning |
|---|---|---|---|---|
| Soakaways | Although soakaways are typically below ground, they can contribute to amenity by allowing the land above to be used for landscaping or recreation. When integrated with visible SuDS features or planting, they can enhance the visual quality of a site and support multifunctional, attractive spaces. | Soakaways support biodiversity indirectly by promoting groundwater recharge and maintaining natural hydrological conditions. When combined with vegetated SuDS components, they can enhance habitat connectivity and contribute to ecological networks across a site. | ✗ | As described above, the use of soakaways is not considered to be feasible. |
| Swales, Detention Basins and Ponds | Swales, detention basins and ponds contribute positively to site amenity by providing visually attractive, multifunctional spaces that enhance the quality and character of a development. These features can be integrated within the landscape as green corridors, linking open spaces and promoting interaction between people and water. When appropriately designed, they offer opportunities for recreation, education and visual interest, creating a more appealing and liveable environment. | Swales, detention basins and ponds deliver significant biodiversity value through the provision of varied and connected habitats. Swales function as linear green corridors, enabling wildlife movement and supporting diverse vegetation. Detention basins create temporary wetland conditions that benefit a range of species, while ponds provide permanent aquatic and marginal habitats supporting invertebrates, amphibians and birds. Collectively, these features enhance habitat diversity, strengthen ecological | ✓ | Sufficient space is available on site to utilise a pond, basin or swale as an above ground attenuation feature. In order to facilitate gravity drainage, attenuation features should be located towards the topographic lower levels. |

| | | | | |
|---|---|---|---|---|
| | | connectivity and contribute to the establishment of a resilient green-blue network across the site. | | |
| Filter Drains/ Strips | Filter drains and filter strips can contribute to site amenity by creating attractive, vegetated edges that soften hard surfaces and integrate drainage within the landscape. When aligned along roads or paths, they form part of functional green corridors that enhance visual quality and support a sense of place. | These features provide ecological value through vegetated zones that support invertebrates and small fauna. When linked with other SuDS components, they strengthen habitat connectivity and contribute to the wider green-blue network promoted within the SuDS approach. | ✓ | Filter drains are trenches filled with stone/gravel that create temporary subsurface storage for the filtration, attenuation, and conveyance of surface water runoff. Ideally, filter drains receive lateral inflow from adjacent impermeable surfaces pretreated over a filter strip. Filter drains can help manage peak flows by naturally limiting rates of conveyance through the filter medium and by providing attenuation storage when the rate of flow at the outlet is controlled. |
| Bioretention Systems | Bioretention systems, including rain gardens and bioretention planters, provide attractive, vegetated features that enhance the streetscape and create visually appealing focal points within developments. They contribute to high-quality, multifunctional spaces by integrating drainage into the landscape and improving the relationship between people, water and planting. | These systems deliver biodiversity value through diverse planting and soil conditions that support pollinators, invertebrates and small fauna. They also play a key role in improving water quality by filtering and treating pollutants from surface runoff before infiltration or discharge. Collectively, they enhance ecological connectivity and contribute to the wider green-blue infrastructure. | ✓ | Bioretention systems (including rain gardens and raised box planters) are shallow landscaped depressions that can reduce runoff rates and volumes and treat pollution. They also provide attractive landscape features and biodiversity. Bioretention systems can help reduce flow rates from a site by promoting infiltration / evapotranspiration and providing some attenuation storage. Bioretention systems can also provide very effective treatment functionality. Bioretention systems are a very flexible surface water management component that can be integrated into a wide variety of developments / densities using different shapes, materials, planting, and dimensions.<br>Bioretention systems (including rain gardens) should be considered within the detailed drainage design stage. |

| | | | | |
|---|---|---|---|---|
| Rainwater Harvesting | Rainwater harvesting systems can contribute to site amenity by visibly demonstrating sustainable water management and promoting environmental awareness. When integrated within building or landscape design, they can enhance the character of a development by supporting water features, irrigation, or other non-potable uses that add functional and aesthetic value to spaces. | By reducing surface water runoff, rainwater harvesting systems help protect downstream SuDS features and receiving watercourses from pollution and erosion. Stored water can also be used to support planting and green infrastructure, indirectly benefiting biodiversity through improved vegetation health and habitat provision. | ✗ | The attenuation benefits provided through the use of rainwater harvesting are considered to be limited and would only be realised when the tanks were not full. Water usage on site is unlikely to be significant and therefore the benefit of retaining water is limited. |
| Green Roofs | Green roofs enhance the visual quality of buildings and contribute to the creation of more attractive and liveable urban environments. They can provide accessible or visual green spaces within dense developments, offering opportunities for recreation, relaxation, and improved wellbeing while demonstrating sustainable design in practice. | Green roofs support biodiversity by providing valuable habitats for invertebrates, birds, and pollinators, particularly where native or species-rich planting is used. They also improve water quality and reduce runoff rates by capturing, filtering, and slowly releasing rainfall, supporting the wider SuDS objectives of managing water quantity, quality, and ecology. | ✗ | Green roofs are not identified on development plans. Given the nature of the Scheme, green roofs are not considered a practical option. The benefits achieved through installing a green roof would be disproportionate to the significant ongoing maintenance and construction costs involved. |
| Porous/ Permeable Surfacing (infiltration) | Porous and permeable surfaces can enhance the quality and functionality of developed areas by integrating drainage directly into hardstanding such as car parks, footpaths and access roads. They maintain a natural appearance, reduce surface water ponding, and | Infiltration-based permeable surfaces promote natural groundwater recharge and improve water quality by filtering and retaining pollutants within the sub-base before infiltration. When combined with adjacent vegetated SuDS features, they can contribute to | ✗ | Where permeable surfacing is proposed, infiltration to ground would only be relied upon where supported by detailed design, local ground conditions and groundwater protection considerations. Given the variable geology, impeded drainage soils and Source Protection Zone sensitivity, infiltration-based permeable surfacing is not relied upon as the primary |

| | | | | |
|---|---|---|---|---|
| | contribute to safer, more attractive public spaces while supporting the seamless integration of SuDS within the built environment. | habitat connectivity and support the wider green-blue network across a site. | | disposal method within this Outline Drainage Strategy. |
| Porous/ Permeable Surfacing (Lined) | Lined porous and permeable surfaces provide an attractive, functional drainage solution that manages runoff close to source while maintaining the appearance and usability of hardstanding areas such as car parks, courtyards and footpaths. They support high-quality, multi-functional urban design by integrating water management within the built environment without detracting from site amenity. | Although infiltration is prevented, lined permeable surfaces still contribute to SuDS objectives by providing effective pollutant removal through filtration and sedimentation within the surface and sub-base layers. By controlling and treating runoff before discharge to other SuDS components, they protect downstream water quality and can indirectly support biodiversity by maintaining cleaner flows to connected green-blue infrastructure. | ✓ | The final extent, depth and configuration of any lined permeable surfacing or lined sub-base storage will be confirmed at detailed design. Where such storage is used, the available storage volume will be calculated based on the surface area, proposed depth and appropriate void ratio for the selected material. Typically, the storage offered can be calculated by multiplying the surface area of the permeable surfacing ($m^2$) by the proposed depth (m) by a porosity ratio of 0.3.<br><br>Lined permeable surfacing may be suitable for Solar PV Site Access Tracks or local hardstanding where infiltration to ground is not appropriate. It can provide source control, treatment and temporary storage while preventing uncontrolled infiltration to ground. The final use of lined permeable surfacing will be confirmed at detailed design. |
| Underground Attenuation Tanks / Geocellular Storage / Oversized Pipes | Underground attenuation tanks and geocellular storage systems provide essential runoff control while preserving the use and appearance of surface areas. By locating storage below ground, they enable land above to be used for landscaping, parking, or recreation, supporting efficient | These systems offer limited direct biodiversity value but can contribute indirectly by facilitating above-ground green spaces and protecting downstream SuDS features. When designed with pre-treatment measures, they assist in pollutant removal, improving water quality prior to discharge and supporting the | ✗ | Underground attenuation storage is not proposed, as alternative SuDS features have been selected that provide sufficient on-site attenuation while offering additional water quality, amenity, and biodiversity benefits. |

| | | | | |
|---|---|---|---|---|
| | land use and maintaining overall site amenity. | performance of connected ecological SuDS components. | | |

## 3.7 Attenuation Storage

**Extreme Rainfall**

3.7.1 Attenuation storage will be required to manage surface water runoff from the positively drained hardstanding surfaces and achieve the controlled discharge rates set out below. A combination of SuDS features, and flow control devices is proposed to manage surface water runoff at Lime Down E2.

3.7.2 The hardstanding surfaces requiring positive drainage have been identified using either the indicative area of the infrastructure proposed at Lime Down E2, or, where the final equipment layout is not fixed, the relevant maximum design parameters for that equipment set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]**. The calculations are therefore conservative and are provided for illustrative purposes to demonstrate that a feasible drainage solution can be accommodated within Lime Down E2 and within the assessed design envelope.

3.7.3 Greenfield runoff rates have been calculated for each assessed hardstanding surface. The proposed discharge rates have then been restricted in accordance with the LLFA drainage requirement, with attenuation storage sized to manage runoff up to and including the 1% AEP plus 45% climate change event.

3.7.4 The larger hardstanding surfaces, including the Solar PV Site Access Tracks where conservatively assessed as hardstanding surfaces, will be collected and conveyed to formal attenuation and flow control features prior to discharge at the restricted rate.

3.7.5 The Conversion Units / 33kV Sub-distribution Switch Rooms comprise small, discrete areas of supporting electrical infrastructure. Switchgear comprises electrical disconnect switches, fuses and circuit breakers used to control, protect and isolate electrical equipment. For the purposes of this assessment, runoff calculations have been based on the maximum 15m by 5m footprint for Integrated Conversion Units / 33kV Sub-distribution Switch Rooms defined **in ES Volume 1, Chapter 3: The Scheme [APP-055],** equivalent to 75m$^2$ per unit. This provides a conservative basis for assessment.

3.7.6 For an individual 75 m$^2$ unit, the indicative local storage volume is approximately 3.2m$^3$. Across Lime Down E2, fourteen Conversion Units / 33kV Sub-distribution Switch Rooms are proposed, giving a cumulative assessed area of 1,050m$^2$ and a cumulative indicative local storage requirement of approximately 44.8m$^3$. The calculated greenfield runoff rates for the combined Conversion Unit / 33kV Sub-distribution Switch Room area are 0.6l/s for the 1 in 2 year event, 1.3l/s for the 1 in 30 year event and 1.7l/s for the 1 in 100 year event. Runoff from each unit will be managed locally through source-control SuDS, with final flow controls confirmed at detailed design.

3.7.7 Given the small contributing area, low calculated runoff volumes and dispersed nature of the infrastructure, it is not considered proportionate to provide long piped drainage connections from each unit to a formal outfall. Runoff from each unit will therefore be managed locally using a perimeter French drain, filter drain or equivalent source-control SuDS arrangement. These features will provide local storage and source control around the equipment pads and will not be relied upon as strategic attenuation basins or as part of a wider piped drainage network.

3.7.8 Final dimensions, aggregate specification, freeboard and maintenance requirements for the French drains will be confirmed at detailed design, having regard to the final equipment layout and local ground conditions. This approach is consistent with the drainage hierarchy and source control principles set out in CIRIA C753: The SuDS Manual, and avoids creating unnecessary point discharges from small, isolated areas of supporting electrical infrastructure.

3.7.9 Hydraulic calculations carried out in Causeway Flow demonstrate that the illustrative drainage approach has sufficient capacity to manage runoff from the assessed hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. Key details for the proposed attenuation storage and flow control required to manage surface water runoff are summarised in the tables below. Hydraulic calculations are provided in Annex G.

**Table 6: Conversion Unit/33kV Distribution Switch Room Attenuation Storage**

| | |
|---|---|
| **Contributing Area** | 75$m^2$ (per unit) |
| **Flow Rate** | 0.4l/s |
| **Flow Control** | HydroBrake |
| **Flow Control Design Head** | 0.75m |
| **Estimated Required Volume (1 in 100 year +45%CC)** | 3.2 $m^3$ (per unit) |

<u>**Everyday Rainfall**</u>

3.7.10 In addition to managing extreme rainfall events, measures should be implemented to ensure runoff generates during more frequent everyday rainfall events is sustainably managed. For these events, where practicable, the volume of runoff generated from the first 5mm of rainfall should not leave the Site.

**Table 7: Conversion Unit/33kV Distribution Switch Room Everyday Rainfall***

| | |
|---|---|
| **Contributing Area** | 75$m^2$ |
| **Rainfall Depth** | 0.005m |
| **Runoff Volume** | 0.4$m^3$ |
| **Required Additional Depth** | 0.02m |

**The calculations above assume that the storage is provided within a basin for the purposes of illustration. The final form of storage may differ depending on the detailed layout and may include other SuDS components capable of providing equivalent storage and treatment.*

3.7.11 As shown in the tables above, the everyday rainfall volumes are limited and can be accommodated within the preferred SuDS features by providing the required additional storage depth. This allows the first 5mm of rainfall to be retained and managed within the drainage system, through infiltration where local ground conditions permit, evaporation, evapotranspiration, or subsequent controlled release depending on the final SuDS arrangement.

## 3.8 Preferred Drainage Scheme

3.8.1 The viable SuDS features and associated hydraulic calculations have been reviewed above. The final extent and arrangement of hardstanding surfaces will be confirmed at detailed design; however, the calculations presented in this report have been prepared using the indicative infrastructure areas currently proposed, or the maximum relevant design parameters set out in **ES Volume 1, Chapter 3: The Scheme [APP-055]** where the final equipment layout is not fixed. The calculations are therefore conservative and are provided to demonstrate that a feasible drainage solution can be accommodated within Lime Down E2 and within the assessed design envelope.

3.8.2 Greenfield runoff rates have been calculated for the assessed hardstanding surfaces and the proposed discharge rates have been restricted in accordance with the LLFA drainage requirement. The identified receiving watercourse is Gabriel's Well through the centre of Lime Down E2, with the indicative cumulative controlled discharge rates provided within Table 6. The proposed SuDS features will attenuate surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. The final drainage design will confirm the detailed layout, attenuation volumes, flow controls, outfall arrangement, treatment train, isolation measures and maintenance requirements, and will ensure that peak runoff from positively drained hardstanding surfaces are controlled so that the Scheme does not result in a material increase in flood risk on-site or elsewhere.

## 3.9 Event Exceedance

3.9.1 The illustrative SuDS approach has been sized to manage surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. Storm events in excess of this design event may result in temporary shallow exceedance flooding within lower-risk areas of Lime Down E2.

3.9.2 Finished levels for sensitive electrical infrastructure and equipment plinths will be set above surrounding ground levels where practicable. Exceedance routes will be confirmed at detailed design and will direct residual flows away from critical equipment, buildings and access points where practicable, so that exceedance flooding does not result in a material increase in flood risk on-site or elsewhere.

## 3.10 Surface Water Treatment

3.10.1 In accordance with DEFRA's National standards for sustainable drainage systems and the Simple Index Approach as described in C753 The SuDS Manual (2015), other roofs have a 'low' pollution hazard level, with commercial yards classified as having a 'medium' pollution hazard level. The table below shows the pollution hazard indices for each land use.

**Table 8: Pollution Hazard Indices**

| Land Use | Pollution Hazard Level | Total Suspended Solids (TSS) | Metals | Hydrocarbons |
|---|---|---|---|---|
| **Other Roofs (typically commercial/industrial roofs)** | Low | 0.5 | 0.2** | 0.4 |

| | | | | |
|---|---|---|---|---|
| **Commercial Yard and Delivery Areas, Non-residential Car Parking and all roads except Low Traffic Roads** | Medium | 0.7 | 0.6 | 0.7 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' – Table 26.2
* Indices values range from 0-1.
** up to 0.8 where there is potential for metals to leach from the roof

3.10.2 Runoff from positively drained hardstanding surfaces will be routed through an appropriate SuDS treatment train before controlled discharge. Table 9 below demonstrates the mitigation indices for typical SuDS components that may be used within the final drainage design.

**Table 9: SuDS Mitigation Indices**

| | Mitigation Indices | | |
|---|---|---|---|
| **Type of SuDS** | **Total Suspended Solids (TSS)** | **Metals** | **Hydrocarbons** |
| **Permeable Surfacing** | 0.7 | 0.6 | 0.7 |
| **Swale** | 0.5 | 0.6 | 0.6 |
| **Detention basin** | 0.5 | 0.5 | 0.6 |
| **Pond** | 0.7 | 0.7 | 0.5 |

Table extract taken from the CIRIA C753 publication 'The SuDS Manual' -Table 26.3

3.10.3 It is concluded that a suitable combination of SuDS components, such as detention basins, ponds, swales, lined permeable surfacing and/or filter drains, can provide sufficient treatment for the assessed pollution hazard indices. The final treatment train will be confirmed at detailed design and will be coordinated with the required attenuation, isolation and maintenance arrangements.

## 3.11 Maintenance

3.11.1 Routine inspections and maintenance of the surface water drainage system will be required to ensure that the drainage infrastructure continues to operate effectively for the lifetime of the development, without increasing flood risk on or off site.

3.11.2 Maintenance of surface water drainage features will be the responsibility of the undertaker or operator. Maintenance of the operational drainage system will be carried out in accordance with the final drainage design and the principles set out in **Outline Operational Environmental Management Plan [REP3-094]**.

3.11.3 The final maintenance arrangements will be confirmed at detailed design and will reflect the final drainage components, flow controls, treatment measures, isolation valves and outfall arrangements.

# 4. Conclusions and Recommendations

4.1.1 Lime Down E2 comprises ground mounted Solar PV Panels, Solar PV Site Access Tracks, thirteen Conversion Units / 33kV Sub-distribution Switch Rooms and associated supporting infrastructure.

**Flood Risk**

4.1.2 Lime Down E2 is situated largely within Flood Zone 1 with the exception of Fields E20 – E27 which are located in Flood Zones 2 and 3. The extent of Flood Zone 3 is considered to be associated with Gabriel's Well (which flows in a north-easterly direction). All areas of proposed Scheme located within Flood Zones 2 / 3 have been included in floodplain storage compensation calculations and found the impact on flood depths to be negligible.

4.1.3 The majority of Lime Down E2 is at Very Low risk of surface water flooding. However, there are some small areas of Low to High risk, particularly in areas associated with the presence of Gabriel's Well which flows in a north-easterly direction.

4.1.4 The risk of flooding from all sources has been assessed and the flood risk is considered to be **Negligible to Low** and therefore does not require site-specific mitigation measures.

4.1.5 The solar PV Panels will be mounted on raised frames and therefore raised above surrounding ground level allowing flood water to flow freely underneath. The panel supports are discrete and widely spaced, and the floodplain storage assessment demonstrates that any displacement of floodplain volume would be negligible. The various components dimensions can be found in detail in Chapter 3: Scheme Description.

**Drainage Strategy**

4.1.6 Solar PV panelled areas are not treated as formal impermeable drainage catchments within this Outline Drainage Strategy. The panels are elevated above ground level, drain to the existing ground, are not sealed into a drainage network, and do not create a connected impermeable surface.

4.1.7 Greenfield runoff rates have been calculated for the assessed hardstanding surfaces and the proposed discharge rates have been restricted in accordance with the LLFA drainage requirement. The identified receiving watercourse is Gabriel's Well through the centre of Lime Down E2, with the indicative cumulative controlled discharge rates provided within Table 6. The proposed SuDS features will attenuate surface water runoff from the positively drained hardstanding surfaces up to and including the 1% AEP plus 45% climate change event. In addition, the everyday rainfall volumes are limited and can be accommodated within the preferred SuDS features by providing the required additional storage depth.

4.1.8 It is concluded that a suitable combination of SuDS components, such as detention basins, ponds, swales and/or permeable surfacing, can provide sufficient treatment for the assessed pollution hazard indices.

## 4.2 Recommendations

4.2.1 Embedded mitigation is detailed in **ES Volume 3, Appendix 11-1: Flood Risk Assessment and Outline Drainage Strategy – Covering Report [REP3-039].** The final drainage design for the Solar PV Site Access Tracks and supporting electrical infrastructure will be submitted and approved in accordance with the relevant DCO drainage requirement.

# Annexes

# Annex A- Water Body Catchment Classifications Summaries

## Rodbourne Bk – Source to Conf R Avon Water Body Catchment Classification Summary

| Classification Item | 2019 Classification | | 2022 Classification | Cycle 3 Objectives | | |
|---|---|---|---|---|---|---|
| | Cycle 2 | Cycle 3 | Cycle 3 | Status | Year | Reasons |
| Ecological | Moderate | Moderate | Moderate | Good | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Biological Quality Elements | Moderate | Moderate | Moderate | Good | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Invertebrates | Moderate | Moderate | Moderate | Good | 2015 | |
| Macrophytes and Phytobenthos Combined | Moderate | Moderate | Moderate | Good | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Macrophytes sub element | Moderate | Moderate | Moderate | | | |
| Physio-Chemical Quality Elements | High | High | High | Good | 2027 - Low Confidence | Disproportionately expensive: Disproportionate burdens |
| Ammonia (Phys-Chem) | High | High | High | Good | 2015 | |
| Dissolved Oxygen | High | High | High | Good | 2015 | |
| Phosphate | High | High | High | Good | 2015 | Disproportionately expensive: Disproportionate burdens |
| Temperature | High | High | High | Good | 2015 | |
| pH | High | High | High | Good | 2015 | |
| Hydromorphological Supporting Elements | Supports Good | Supports Good | Supports Good | Supports Good | 2015 | |
| Hydrological Regime | Supports Good | Supports Good | Supports Good | | 2015 | |
| Specific Pollutants | | | | N/A | 2015 | |
| Copper | | | | | | |
| Triclosan | | | | | | |
| Zinc | | | | | | |
| Chemical | Fail | Fail | N/A | Good | 2063 | Natural conditions: Chemical status recovery time |
| Priority Hazardous Substances | Fail | Fail | N/A | Good | 2063 | Natural conditions: Chemical status recovery time |
| Benzo(a)pyrene | Good | Good | | Good | 2015 | |
| Cadium and Its Compounds | | | | | | |
| Di(2-ethylhexyl)phthalate (Priority hazardous) | | | | | | |
| Dioxins and dioxin-like compounds | Good | Good | | Good | 2015 | |
| Heptachlor and cis-Heptachlor Epoxide | Good | Good | | Good | 2015 | |
| Hexabromocyclododecane | Good | Good | | Good | 2015 | |
| Hexachlorobenzene | Good | Good | | Good | 2015 | |
| Hexachlorobutadiene | Good | Good | | Good | 2015 | |
| Mercury and Its Compounds | Fail | Fail | | Good | 2040 | Natural conditions: Chemical status recovery time |
| Nonylphenol | | | | | | |
| Perfluorooctane sulphonate (PFOS) | Good | Good | | Good | 2015 | |
| Polybrominated diphenyl ethers (PBDE) | Fail | Fail | | Good | 2063 | Natural conditions: Chemical status recovery time |
| Tributyltin Compounds | | | | | | |
| Priority substances | Good | Good | N/A | Good | 2015 | |
| Cypermethrin (Priority) | Good | Good | | Good | 2015 | |
| Fluoranthene | Good | Good | | Good | 2015 | |
| Lead and Its Compounds | | | | | | |
| Nickel and Its Compounds | | | | | | |
| Other Pollutants | N/A | N/A | N/A | N/A | 2015 | Did not require assessment |

## Sutton Benger Bk – Source to Conf R Avon Catchment Classification Summary

| Classification Item | 2019 Classification | | 2022 Classification | Cycle 3 Objectives | | |
|---|---|---|---|---|---|---|
| | Cycle 2 | Cycle 3 | Cycle 3 | Status | Year | Reasons |
| Ecological | Good | Good | Good | Good | 2021 | Disproportionately expensive: Disproportionate burdens |
| Biological Quality Elements | Good | Good | Good | Good | 2021 | Disproportionately expensive: Disproportionate burdens |
| Invertebrates | High | High | High | Good | 2015 | |
| Macrophytes and Phytobenthos Combined | Good | Good | Good | Good | 2021 | Disproportionately expensive: Disproportionate burdens |
| Macrophytes sub element | Good | Good | Good | | | |
| Physio-Chemical Quality Elements | High | High | High | Good | 2015 | |
| Acid Neutralising Capacity | N/A | N/A | High | | 2015 | |
| Ammonia (Phys-Chem) | High | High | High | Good | 2015 | |
| Dissolved Oxygen | High | High | High | Good | 2015 | |
| Phosphate | High | High | High | Good | 2015 | |
| Temperature | High | High | High | Good | 2015 | |
| pH | High | High | High | Good | 2015 | |
| Hydromorphological Supporting Elements | Supports Good | Supports Good | Supports Good | Supports Good | 2015 | |
| Hydrological Regime | Supports Good | Supports Good | Supports Good | Supports Good | 2021 | Disproportionately expensive: Disproportionate burdens |
| Morphology | Supports Good | Supports Good | Supports Good | | | |
| Chemical | Fail | Fail | N/A | Good | 2063 | Natural conditions: Chemical status recovery time |
| Priority Hazardous Substances | Fail | Fail | N/A | Good | 2063 | Natural conditions: Chemical status recovery time |
| Benzo(a)pyrene | Good | Good | N/A | Good | 2015 | |
| Dioxins and dioxin-like compounds | Good | Good | | Good | 2015 | |
| Heptachlor and cis-Heptachlor Epoxide | Good | Good | | Good | 2015 | |
| Hexabromocyclododecane | Good | Good | | Good | 2015 | |
| Hexachlorobenzene | Good | Good | | Good | 2015 | |
| Hexachlorobutadiene | Good | Good | | Good | 2015 | |
| Mercury and Its Compounds | Fail | Fail | | Good | 2040 | Natural conditions: Chemical status recovery time |
| Perfluorooctane sulphonate (PFOS) | Good | Good | | Good | 2015 | |
| Polybrominated diphenyl ethers (PBDE) | Fail | Fail | | Good | 2063 | Natural conditions: Chemical status recovery time |
| Priority substances | Good | Good | N/A | Good | 2015 | |
| Cypermethrin (Priority) | Good | Good | | Good | 2015 | |
| Fluoranthene | Good | Good | | Good | 2015 | |
| Other Pollutants | N/A | N/A | N/A | N/A | 2015 | Did not require assessment |

# Annex B – Model Results: Flood Depths and Extents

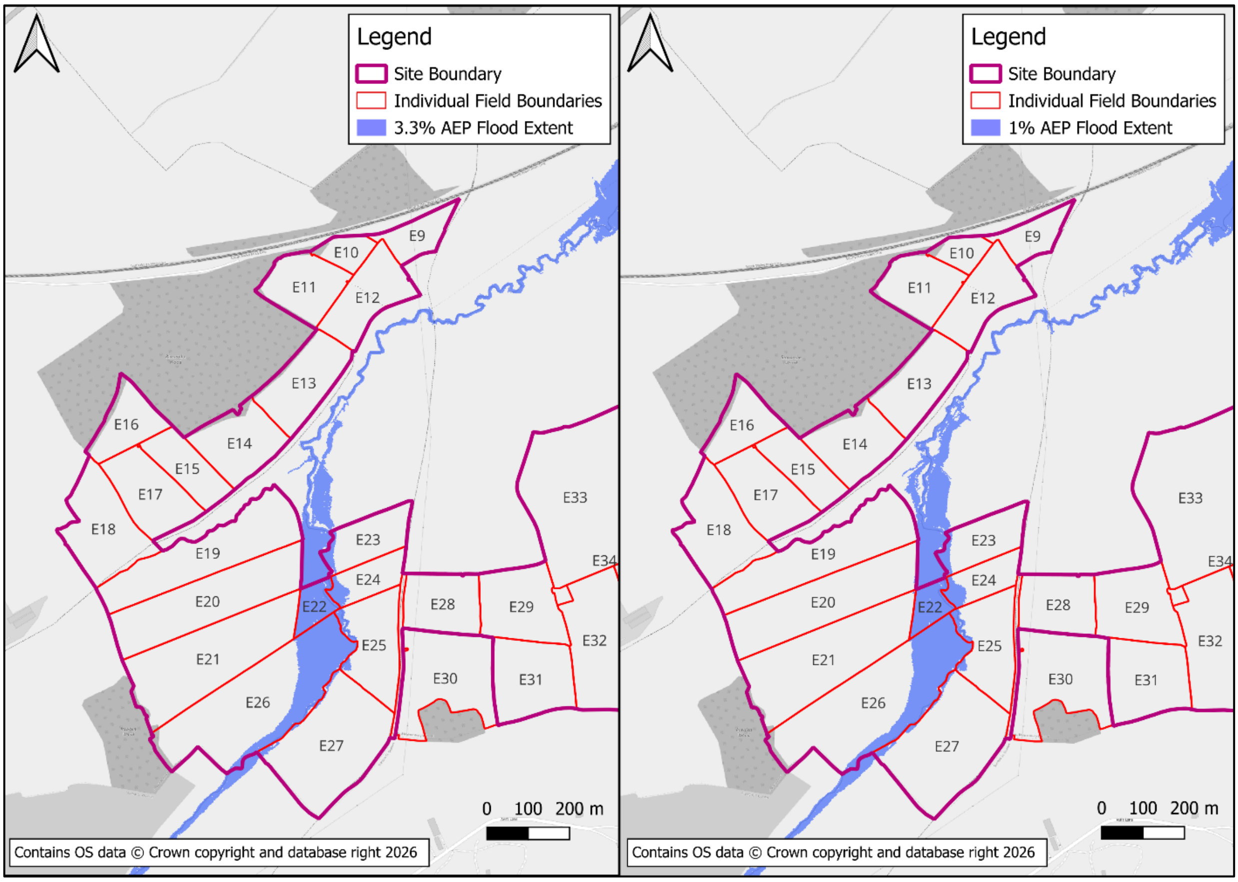



**Figure 9: Maximum Modelled Flood Extent – 3.3% AEP (left) and 1% AEP (right)**

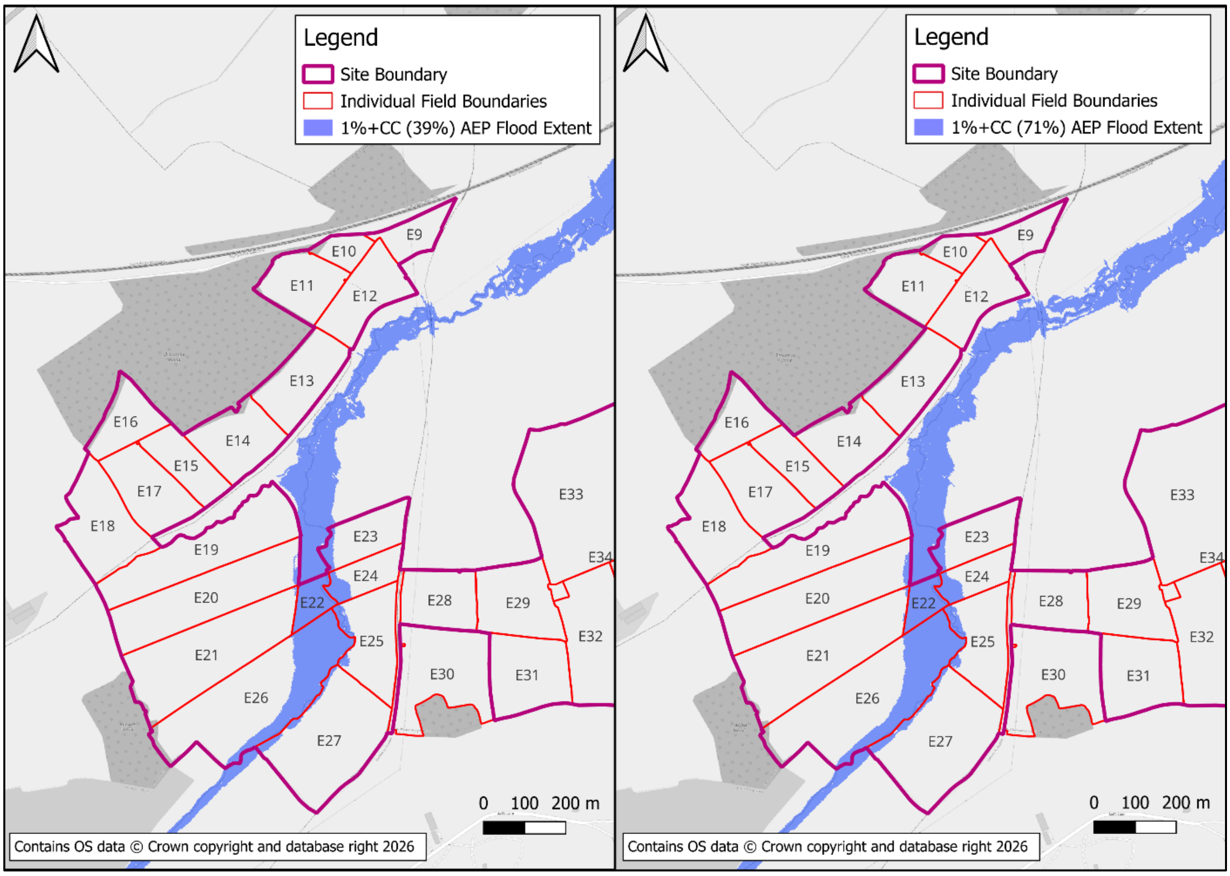



**Figure 10: Maximum Modelled Flood Extent – 1%+CC (39%) AEP (left) and 1%+CC (71%) AEP (right)**

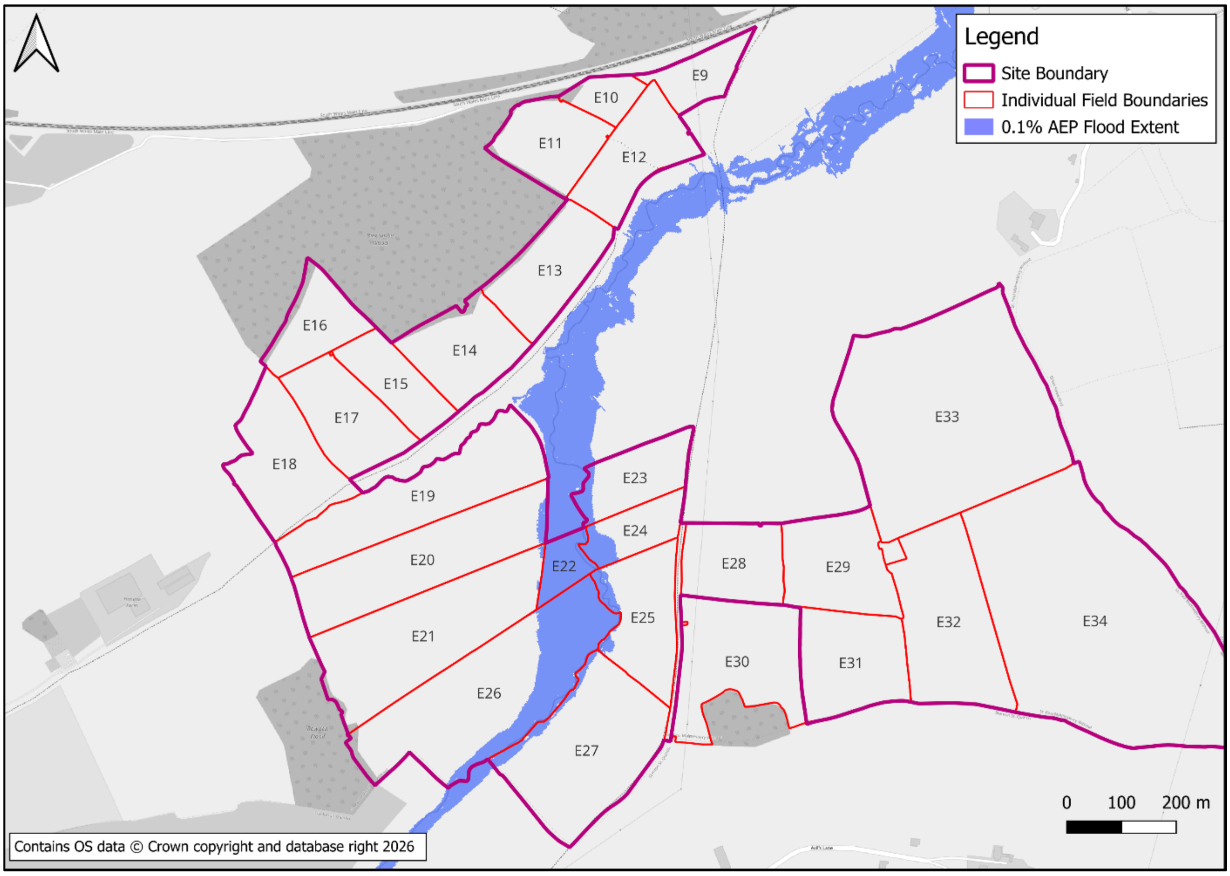



**Figure 11: Maximum Modelled Flood Extent – 0.1% AEP**

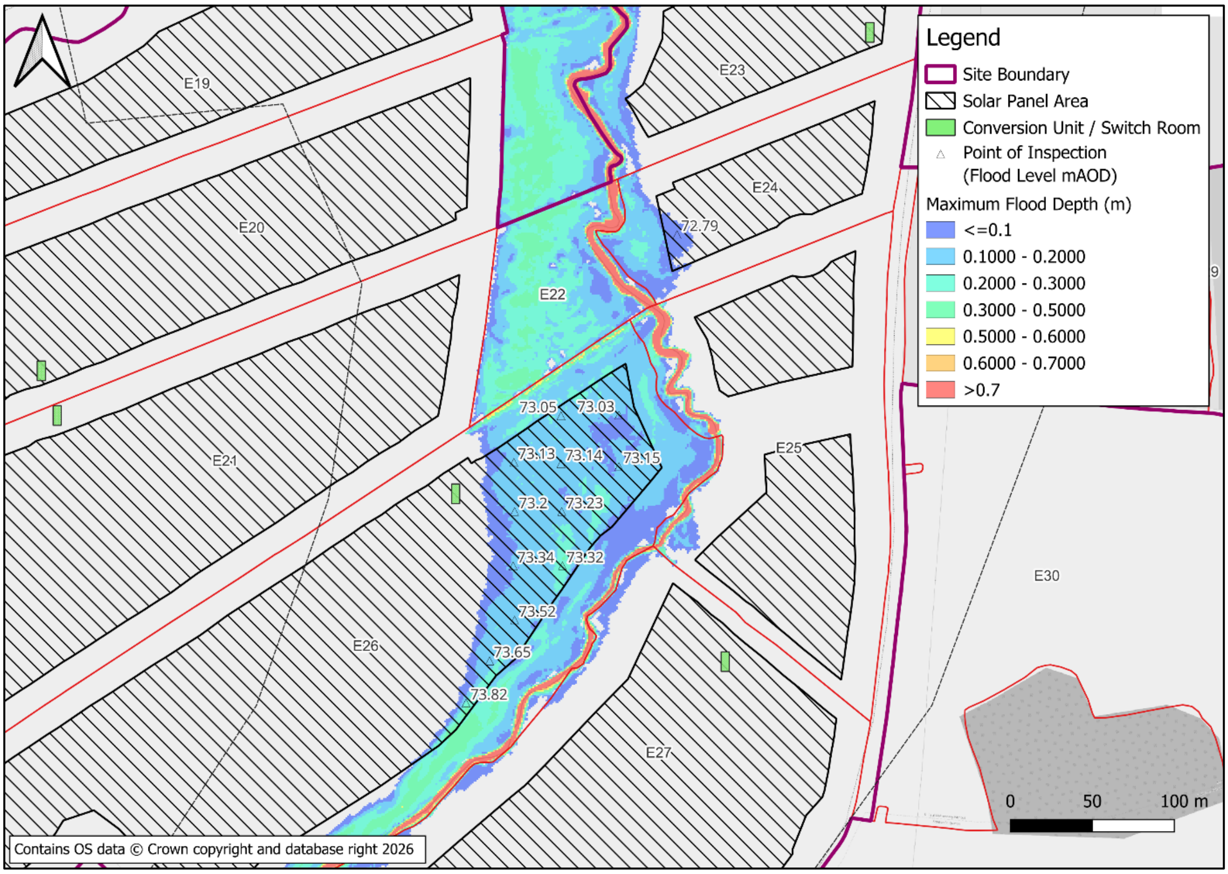



**Figure 12: Maximum Modelled Flood Depths – 3.3% AEP**

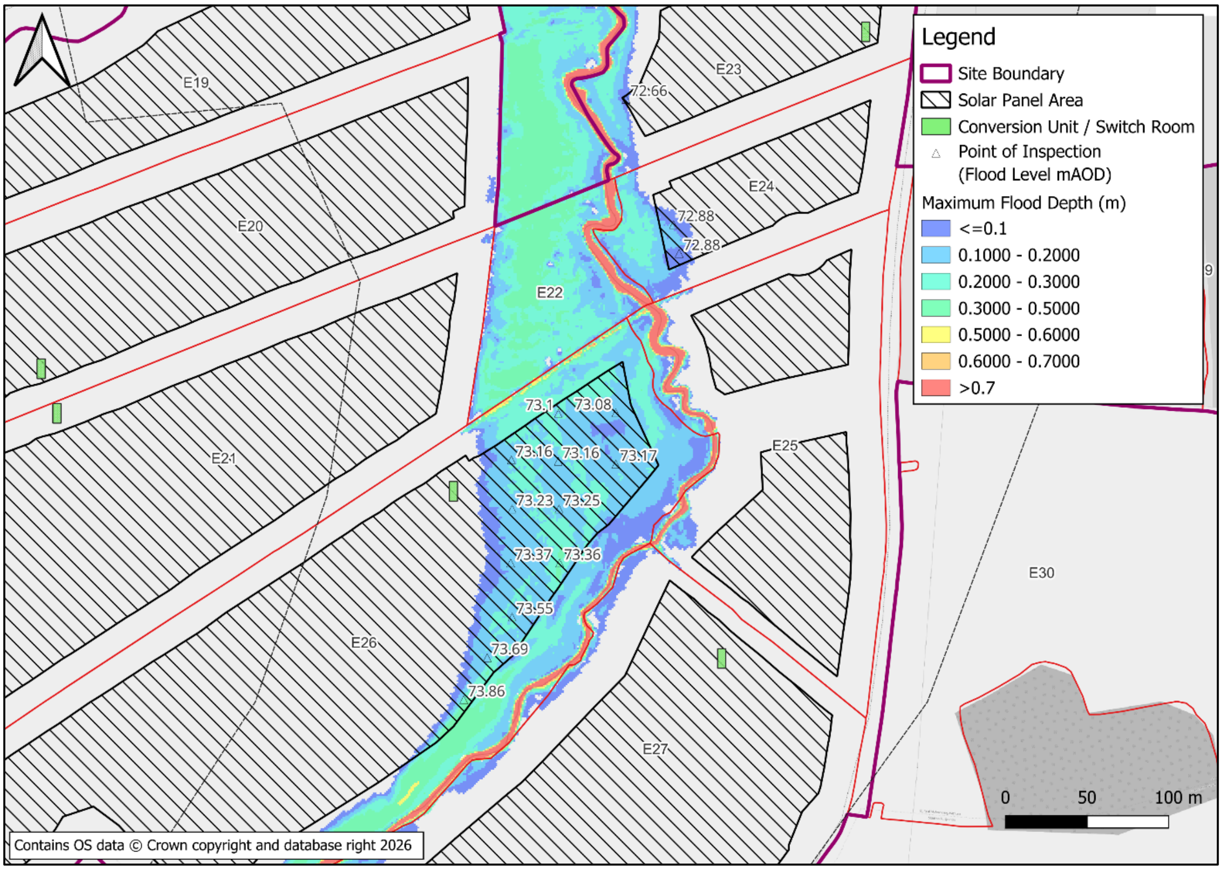



**Figure 13: Maximum Modelled Flood Depths – 1% AEP**

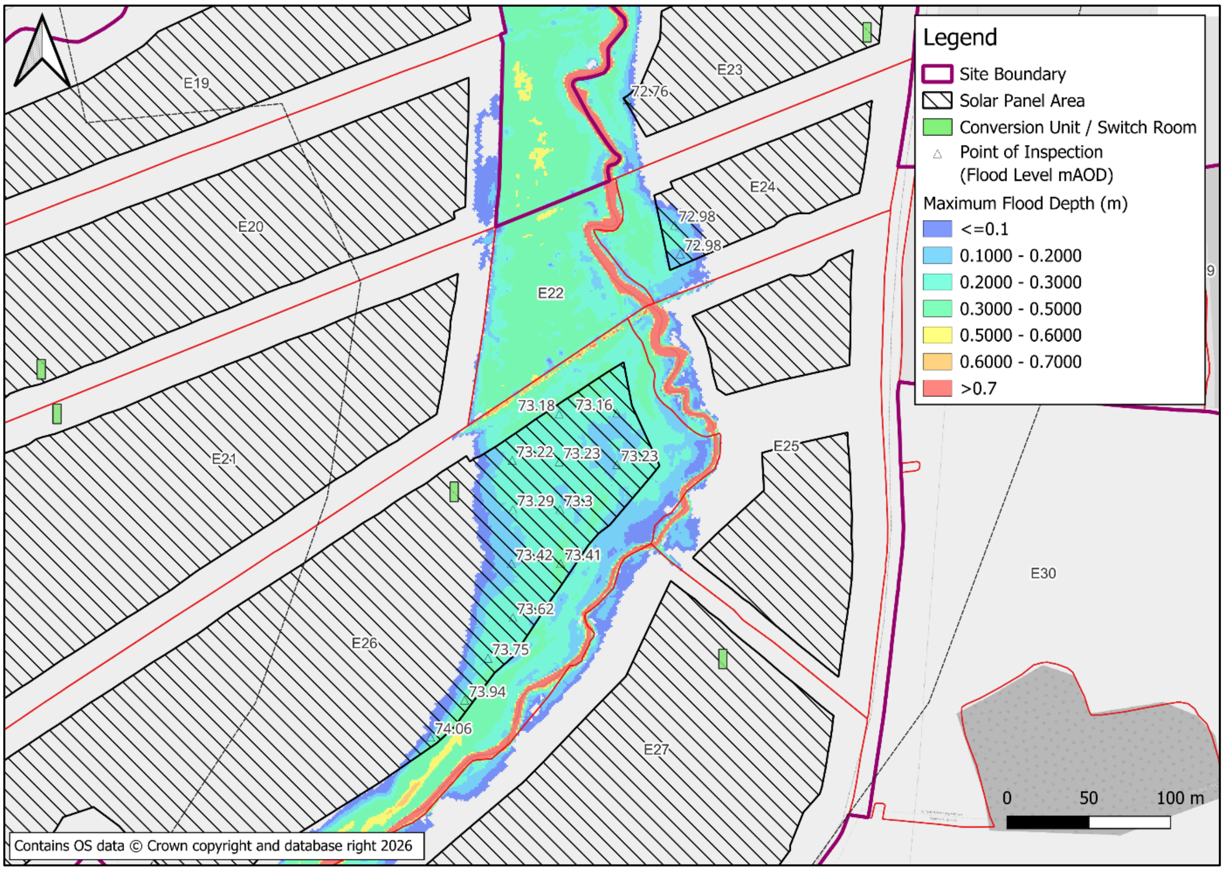



**Figure 14: Maximum Modelled Flood Depths – 1%+CC (39%) AEP**

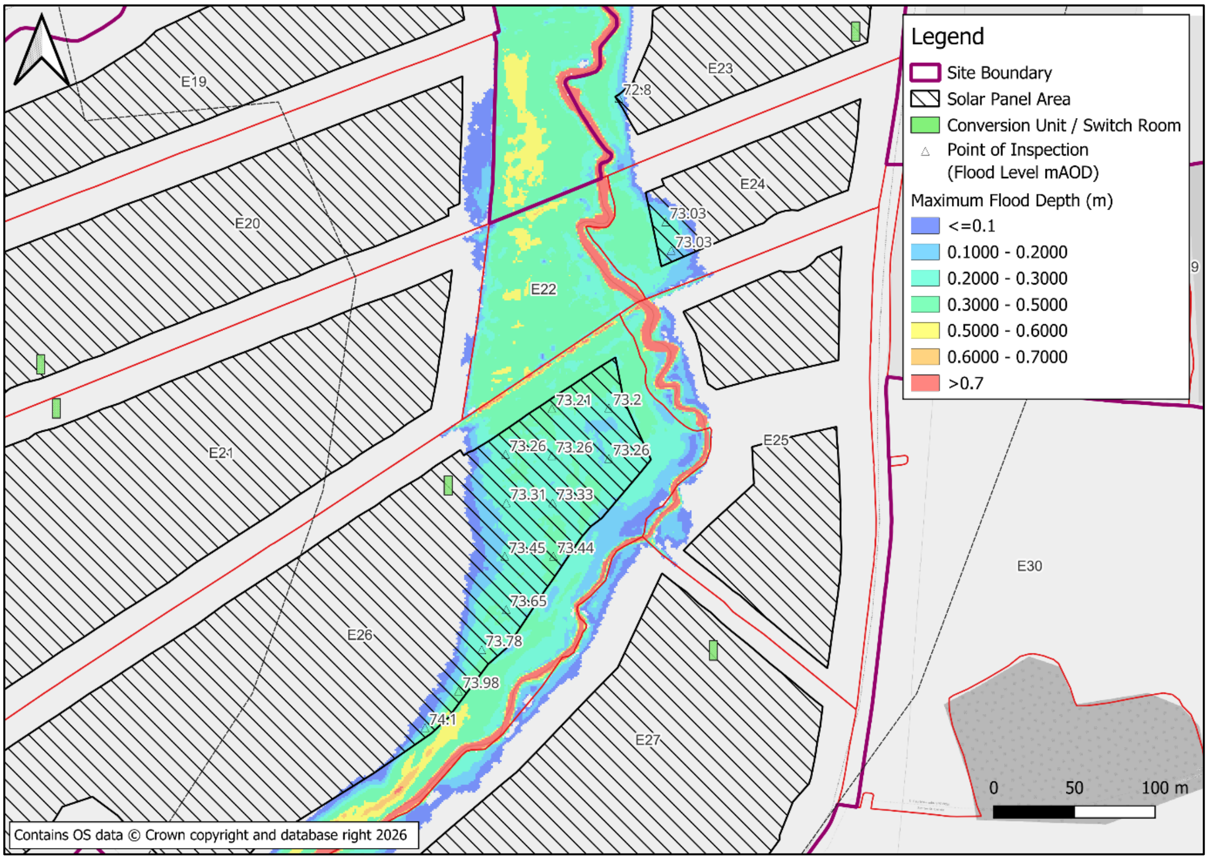



Figure 15: Maximum Modelled Flood Depths – 1%+CC (71%) AEP

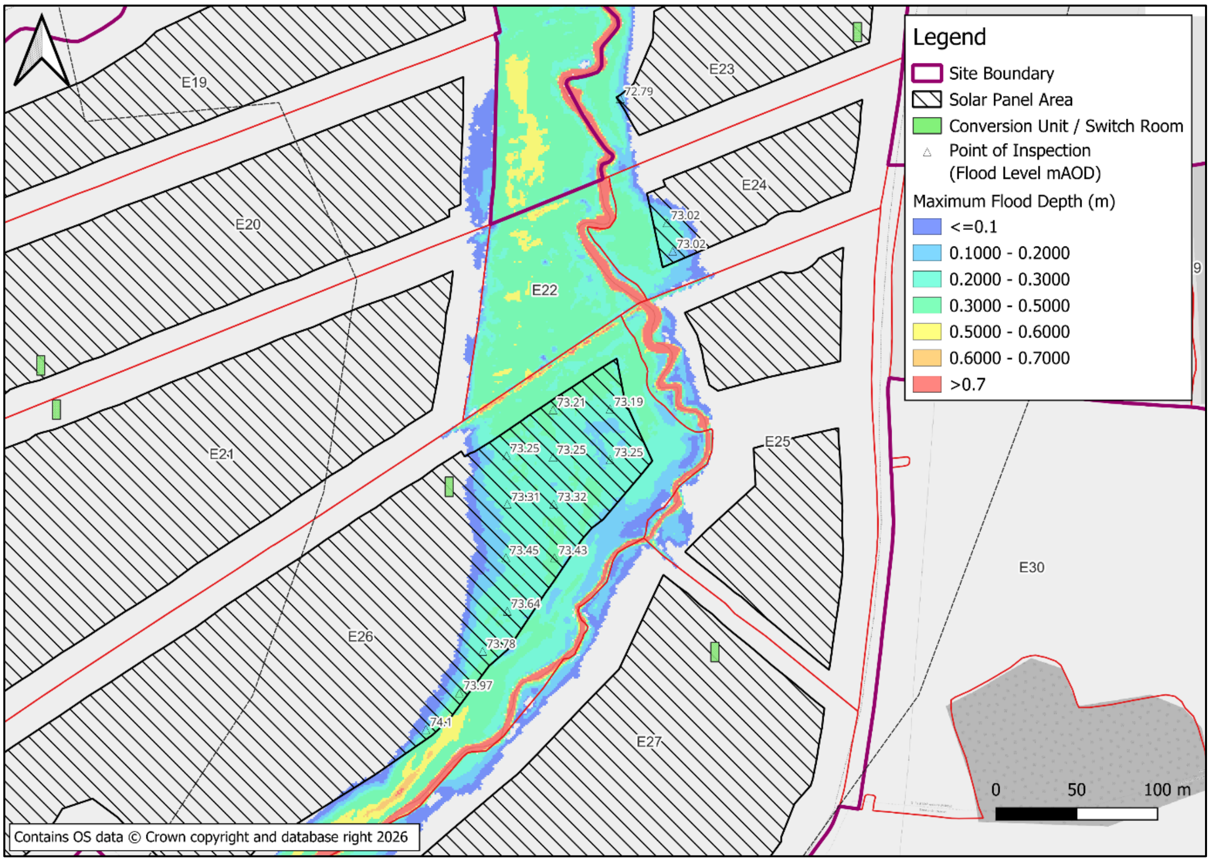



Figure 16: Maximum Modelled Flood Depths – 0.1% AEP

# Annex C - Manning's Open Channel Flow Mapping

317212 Lime Down Solar E2

# Manning's Open Channel Flow Calculation

### Methodology

Cross-sections through the floodplain were extracted from Environment Agency (EA) LiDAR DTM data (flown March 2020) at the locations shown in Figure 1. These cross-sections can be considered representative of the channel and general floodplain adjacent to the site and at the location of the proposed development. The cross-sections were imported into Flood Modeller and the "tabulate cross section properties" tool was utilised to establish the level-flow relationship for the channel and wider floodplain. This tool utilises the Manning's open channel flow equation. Manning's 'n' roughness was set to $0.03s/m^{1/3}$ for the channel and $0.04s/m^{1/3}$ for the floodplain. These values were chosen based on Chow (1959)* and aerial imagery. The channel slope was set for each cross-section based on underlying LiDAR.

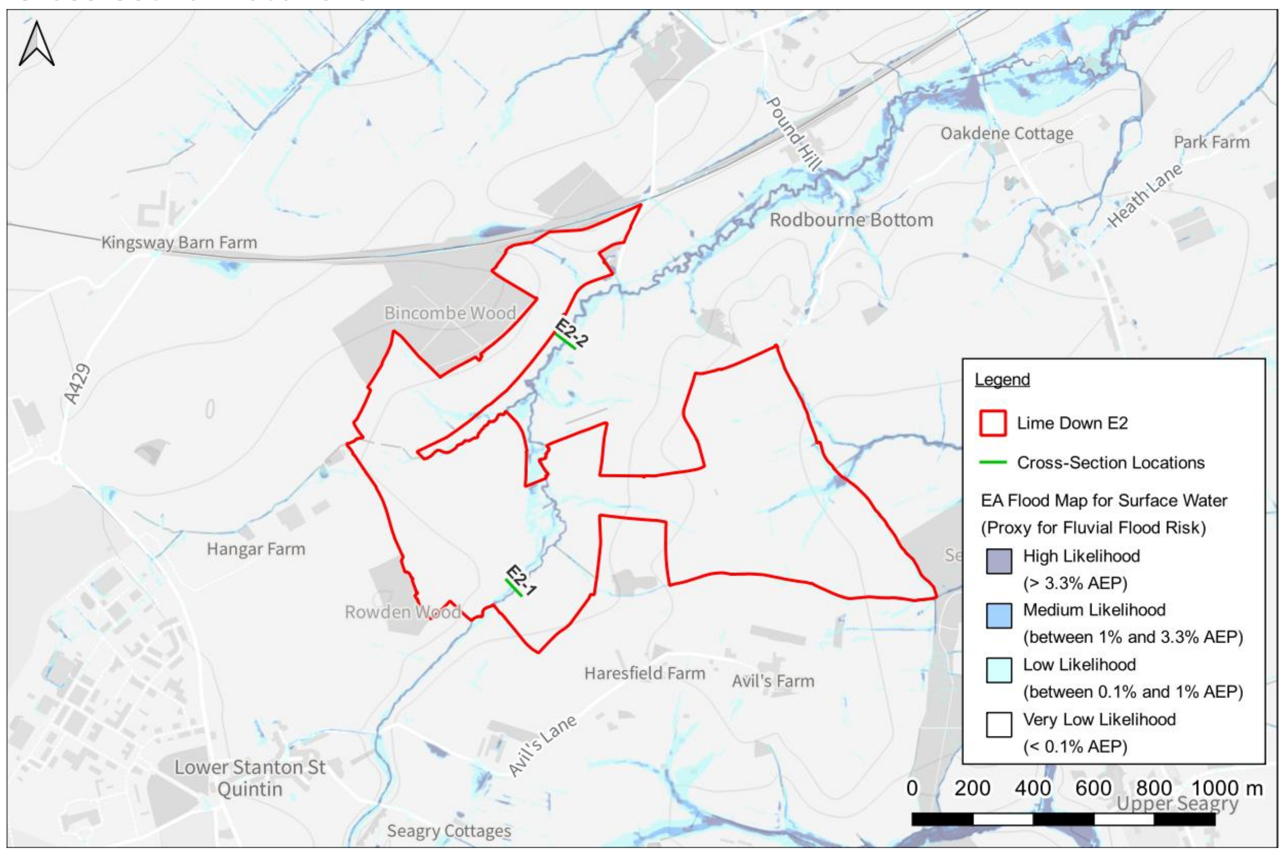
In the absence of detailed flood extent data covering the site, the extents of the EA surface water flood map (0.1% AEP event, present day) have been compared to underlying LiDAR data to provide an estimate of water levels. The surface water flood map has been used as a proxy for fluvial flooding given the similarity to the EA Flood Zone 2 extent and the additional detail it affords. The EA has since released the NaFRA2 mapping, however, a review of the flood extents indicates they are smaller across much of the study area. As such, the calculations presented here can be considered conservative.

Within this excel workbook, the xlookup function has been used along with the Flood Modeller level-flow relationship for the cross-sections to determine the equivalent flow for each estimated water level, rounding up where a direct match is not found. The appropriate climate change uplifts have then been applied to these flows and a second xlookup used to determine the equivalent level for the increased flow.

Cross-sections have been located at suitable locations throughtout the proposed development. Whilst it is acknowledged that the Manning's open channel flow equation used to determine the level-flow relationship does not constitute detailed hydraulic modelling, the calculation can still be considered suitable to demonstrate the scale of the changes in water level that can be expected when considering a +71% uplift in flows (Avon Bristol and North Somerset Streams Management Catchment, 2080's higher allowance).

*Chow, V.T. (1959). Open-Channel Hydraulics. New York, NY: McGraw-Hill.

### Cross-Section Locations






### Calculated Flows and Levels

| Cross-Section | Level Description | Estimated Flood Level (m AOD) | Estimated Equivalent Flow ($m^3/s$) | Flow +71% CC Uplift ($m^3/s$) | Equivalent Flood Level (m AOD) |
|---|---|---|---|---|---|
| E2-1 | 0.1% AEP EA FMfSW water level | 73.90 | 9.0 | 15.3 | 74.03 (+129mm) |
| E2-2 | 0.1% AEP EA FMfSW water level | 71.45 | 12.1 | 20.6 | 71.60 (+151mm) |

### Tabulated Cross-Section Properties // E2-1

*(Calculated by Flood Modeller)*

| Node | Flow ($m^3/s$) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area ($m^2$) | Conveyance ($m^3/s$) | Width (m) | W Perim. (m) | Slope |
|---|---|---|---|---|---|---|---|---|---|---|
| E2-1 | 0.000 | 73.245 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.0149 |
| E2-1 | 0.000 | 73.266 | 0.021 | 0.144 | 0.450 | 0.003 | 0.004 | 0.329 | 0.334 | 0.0149 |
| E2-1 | 0.003 | 73.287 | 0.042 | 0.228 | 0.505 | 0.014 | 0.026 | 0.658 | 0.668 | 0.0149 |
| E2-1 | 0.009 | 73.307 | 0.062 | 0.299 | 0.541 | 0.031 | 0.076 | 0.988 | 1.002 | 0.0149 |
| E2-1 | 0.020 | 73.328 | 0.083 | 0.362 | 0.567 | 0.055 | 0.163 | 1.317 | 1.335 | 0.0149 |
| E2-1 | 0.036 | 73.349 | 0.104 | 0.421 | 0.589 | 0.086 | 0.295 | 1.646 | 1.669 | 0.0149 |
| E2-1 | 0.064 | 73.372 | 0.127 | 0.513 | 0.618 | 0.125 | 0.527 | 1.787 | 1.818 | 0.0149 |
| E2-1 | 0.100 | 73.395 | 0.150 | 0.592 | 0.640 | 0.168 | 0.819 | 1.928 | 1.966 | 0.0149 |
| E2-1 | 0.143 | 73.419 | 0.174 | 0.663 | 0.657 | 0.215 | 1.169 | 2.069 | 2.115 | 0.0149 |
| E2-1 | 0.193 | 73.442 | 0.197 | 0.728 | 0.672 | 0.264 | 1.580 | 2.209 | 2.263 | 0.0149 |
| E2-1 | 0.250 | 73.465 | 0.220 | 0.788 | 0.685 | 0.317 | 2.053 | 2.350 | 2.412 | 0.0149 |
| E2-1 | 0.315 | 73.488 | 0.243 | 0.844 | 0.696 | 0.374 | 2.588 | 2.491 | 2.560 | 0.0149 |
| E2-1 | 0.389 | 73.511 | 0.266 | 0.897 | 0.707 | 0.433 | 3.188 | 2.632 | 2.709 | 0.0149 |
| E2-1 | 0.470 | 73.535 | 0.290 | 0.948 | 0.716 | 0.496 | 3.854 | 2.773 | 2.857 | 0.0149 |
| E2-1 | 0.559 | 73.558 | 0.313 | 0.996 | 0.724 | 0.562 | 4.589 | 2.914 | 3.006 | 0.0149 |
| E2-1 | 0.657 | 73.581 | 0.336 | 1.042 | 0.732 | 0.631 | 5.394 | 3.055 | 3.154 | 0.0149 |
| E2-1 | 0.775 | 73.606 | 0.361 | 1.077 | 0.818 | 0.720 | 6.361 | 4.076 | 4.185 | 0.0149 |
| E2-1 | 0.914 | 73.631 | 0.386 | 1.095 | 0.864 | 0.835 | 7.500 | 5.098 | 5.216 | 0.0149 |
| E2-1 | 1.080 | 73.656 | 0.411 | 1.108 | 0.887 | 0.975 | 8.864 | 6.119 | 6.248 | 0.0149 |
| E2-1 | 1.117 | 73.661 | 0.416 | 1.110 | 0.891 | 1.006 | 9.165 | 6.353 | 6.483 | 0.0149 |
| E2-1 | 1.148 | 73.665 | 0.420 | 1.112 | 0.908 | 1.032 | 9.415 | 6.762 | 6.894 | 0.0149 |
| E2-1 | 1.305 | 73.684 | 0.439 | 1.103 | 0.976 | 1.183 | 10.706 | 9.085 | 9.224 | 0.0149 |
| E2-1 | 1.499 | 73.703 | 0.458 | 1.088 | 1.000 | 1.378 | 12.298 | 11.407 | 11.554 | 0.0149 |
| E2-1 | 1.500 | 73.705 | 0.460 | 1.070 | 1.039 | 1.402 | 12.309 | 12.957 | 13.105 | 0.0149 |
| E2-1 | 1.563 | 73.710 | 0.465 | 1.065 | 1.035 | 1.468 | 12.827 | 13.596 | 13.745 | 0.0149 |
| E2-1 | 1.577 | 73.711 | 0.466 | 1.064 | 1.033 | 1.482 | 12.934 | 13.713 | 13.863 | 0.0149 |
| E2-1 | 1.603 | 73.713 | 0.468 | 1.062 | 1.032 | 1.510 | 13.151 | 13.994 | 14.145 | 0.0149 |
| E2-1 | 1.980 | 73.738 | 0.493 | 1.035 | 1.020 | 1.912 | 16.243 | 18.228 | 18.389 | 0.0149 |
| E2-1 | 1.990 | 73.739 | 0.494 | 1.031 | 1.013 | 1.931 | 16.327 | 18.304 | 18.465 | 0.0149 |
| E2-1 | 2.050 | 73.742 | 0.497 | 1.033 | 1.005 | 1.986 | 16.821 | 18.459 | 18.621 | 0.0149 |
| E2-1 | 2.434 | 73.760 | 0.515 | 1.046 | 0.965 | 2.327 | 19.973 | 19.436 | 19.604 | 0.0149 |
| E2-1 | 2.962 | 73.781 | 0.536 | 1.067 | 0.987 | 2.775 | 24.298 | 23.269 | 23.444 | 0.0149 |
| E2-1 | 2.989 | 73.782 | 0.537 | 1.068 | 0.990 | 2.799 | 24.522 | 23.583 | 23.758 | 0.0149 |
| E2-1 | 3.164 | 73.788 | 0.543 | 1.074 | 1.001 | 2.945 | 25.956 | 25.075 | 25.251 | 0.0149 |
| E2-1 | 3.196 | 73.789 | 0.544 | 1.076 | 0.999 | 2.970 | 26.217 | 25.099 | 25.275 | 0.0149 |

| Node | Flow ($m^3$/s) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area ($m^2$) | Conveyance ($m^3$/s) | Width (m) | W Perim. (m) | Slope |
|---|---|---|---|---|---|---|---|---|---|---|
| E2-1 | 4.078 | 73.814 | 0.569 | 1.132 | 0.962 | 3.603 | 33.457 | 25.527 | 25.706 | 0.0149 |
| E2-1 | 5.104 | 73.839 | 0.594 | 1.202 | 0.949 | 4.246 | 41.871 | 25.955 | 26.137 | 0.0149 |
| E2-1 | 6.262 | 73.864 | 0.619 | 1.278 | 0.947 | 4.900 | 51.375 | 26.383 | 26.568 | 0.0149 |
| E2-1 | 7.548 | 73.889 | 0.644 | 1.356 | 0.950 | 5.565 | 61.922 | 26.811 | 26.999 | 0.0149 |
| E2-1 | 8.955 | 73.914 | 0.669 | 1.435 | 0.957 | 6.241 | 73.471 | 27.239 | 27.431 | 0.0149 |
| E2-1 | 10.029 | 73.932 | 0.687 | 1.489 | 0.963 | 6.734 | 82.282 | 27.615 | 27.809 | 0.0149 |
| E2-1 | 11.164 | 73.950 | 0.705 | 1.543 | 0.969 | 7.235 | 91.591 | 27.992 | 28.188 | 0.0149 |
| E2-1 | 12.358 | 73.968 | 0.723 | 1.596 | 0.976 | 7.742 | 101.388 | 28.369 | 28.567 | 0.0149 |
| E2-1 | 13.773 | 73.988 | 0.743 | 1.659 | 0.990 | 8.301 | 112.995 | 28.982 | 29.181 | 0.0149 |
| E2-1 | 15.259 | 74.007 | 0.762 | 1.720 | 1.003 | 8.873 | 125.189 | 29.595 | 29.796 | 0.0149 |
| E2-1 | 16.994 | 74.029 | 0.784 | 1.783 | 1.016 | 9.532 | 139.422 | 30.376 | 30.578 | 0.0149 |
| E2-1 | 18.822 | 74.051 | 0.806 | 1.844 | 1.028 | 10.209 | 154.417 | 31.157 | 31.360 | 0.0149 |
| E2-1 | 20.203 | 74.067 | 0.822 | 1.884 | 1.053 | 10.721 | 165.753 | 32.837 | 33.040 | 0.0149 |
| E2-1 | 21.096 | 74.077 | 0.832 | 1.908 | 1.074 | 11.057 | 173.074 | 34.404 | 34.608 | 0.0149 |
| E2-1 | 21.371 | 74.080 | 0.835 | 1.915 | 1.075 | 11.161 | 175.333 | 34.532 | 34.736 | 0.0149 |
| E2-1 | 23.052 | 74.099 | 0.854 | 1.949 | 1.080 | 11.827 | 189.124 | 35.607 | 35.812 | 0.0149 |
| E2-1 | 24.821 | 74.118 | 0.873 | 1.984 | 1.084 | 12.513 | 203.637 | 36.682 | 36.888 | 0.0149 |
| E2-1 | 24.917 | 74.119 | 0.874 | 1.985 | 1.086 | 12.551 | 204.427 | 36.866 | 37.071 | 0.0149 |
| E2-1 | 25.206 | 74.122 | 0.877 | 1.991 | 1.095 | 12.662 | 206.791 | 37.607 | 37.813 | 0.0149 |
| E2-1 | 26.529 | 74.135 | 0.890 | 2.014 | 1.131 | 13.171 | 217.647 | 40.726 | 40.933 | 0.0149 |
| E2-1 | 27.973 | 74.149 | 0.904 | 2.034 | 1.143 | 13.755 | 229.497 | 42.617 | 42.825 | 0.0149 |
| E2-1 | 29.454 | 74.163 | 0.918 | 2.055 | 1.139 | 14.334 | 241.647 | 43.220 | 43.429 | 0.0149 |
| E2-1 | 31.014 | 74.176 | 0.931 | 2.078 | 1.137 | 14.922 | 254.442 | 43.823 | 44.032 | 0.0149 |
| E2-1 | 32.634 | 74.191 | 0.946 | 2.094 | 1.134 | 15.587 | 267.731 | 44.823 | 45.032 | 0.0149 |
| E2-1 | 33.401 | 74.198 | 0.953 | 2.100 | 1.135 | 15.903 | 274.029 | 45.557 | 45.767 | 0.0149 |
| E2-1 | 33.512 | 74.199 | 0.954 | 2.101 | 1.138 | 15.948 | 274.939 | 45.891 | 46.101 | 0.0149 |
| E2-1 | 34.187 | 74.205 | 0.960 | 2.106 | 1.163 | 16.232 | 280.475 | 48.561 | 48.771 | 0.0149 |
| E2-1 | 35.609 | 74.215 | 0.970 | 2.129 | 1.182 | 16.727 | 292.141 | 50.562 | 50.773 | 0.0149 |
| E2-1 | 39.322 | 74.240 | 0.995 | 2.183 | 1.184 | 18.009 | 322.600 | 51.976 | 52.188 | 0.0149 |
| E2-1 | 42.032 | 74.257 | 1.012 | 2.224 | 1.186 | 18.900 | 344.842 | 52.752 | 52.965 | 0.0149 |
| E2-1 | 44.913 | 74.275 | 1.030 | 2.265 | 1.190 | 19.832 | 368.474 | 53.754 | 53.967 | 0.0149 |
| E2-1 | 47.902 | 74.292 | 1.047 | 2.305 | 1.195 | 20.781 | 392.995 | 54.756 | 54.970 | 0.0149 |
| E2-1 | 48.601 | 74.296 | 1.051 | 2.314 | 1.214 | 21.004 | 398.727 | 56.707 | 56.921 | 0.0149 |
| E2-1 | 49.633 | 74.303 | 1.058 | 2.319 | 1.213 | 21.403 | 407.193 | 57.464 | 57.678 | 0.0149 |
| E2-1 | 50.500 | 74.308 | 1.063 | 2.328 | 1.219 | 21.693 | 414.307 | 58.387 | 58.601 | 0.0149 |
| E2-1 | 52.146 | 74.317 | 1.072 | 2.346 | 1.226 | 22.224 | 427.818 | 59.531 | 59.746 | 0.0149 |
| E2-1 | 55.875 | 74.337 | 1.091 | 2.388 | 1.226 | 23.394 | 458.406 | 60.450 | 60.665 | 0.0149 |
| E2-1 | 59.753 | 74.356 | 1.111 | 2.431 | 1.226 | 24.581 | 490.224 | 61.368 | 61.584 | 0.0149 |
| E2-1 | 63.235 | 74.373 | 1.128 | 2.467 | 1.228 | 25.632 | 518.793 | 62.298 | 62.514 | 0.0149 |
| E2-1 | 66.831 | 74.390 | 1.145 | 2.503 | 1.230 | 26.699 | 548.294 | 63.227 | 63.445 | 0.0149 |
| E2-1 | 67.262 | 74.392 | 1.147 | 2.507 | 1.244 | 26.827 | 551.825 | 64.834 | 65.052 | 0.0149 |
| E2-1 | 67.592 | 74.394 | 1.149 | 2.507 | 1.243 | 26.957 | 554.535 | 65.027 | 65.244 | 0.0149 |
| E2-1 | 71.811 | 74.413 | 1.168 | 2.546 | 1.249 | 28.208 | 589.150 | 66.602 | 66.821 | 0.0149 |
| E2-1 | 76.597 | 74.434 | 1.188 | 2.589 | 1.247 | 29.581 | 628.413 | 67.323 | 67.543 | 0.0149 |
| E2-1 | 81.557 | 74.454 | 1.209 | 2.634 | 1.246 | 30.968 | 669.104 | 68.044 | 68.265 | 0.0149 |
| E2-1 | 87.619 | 74.478 | 1.233 | 2.687 | 1.246 | 32.610 | 718.837 | 68.755 | 68.978 | 0.0149 |
| E2-1 | 93.912 | 74.502 | 1.257 | 2.741 | 1.246 | 34.268 | 770.473 | 69.467 | 69.691 | 0.0149 |
| E2-1 | 100.440 | 74.526 | 1.281 | 2.794 | 1.247 | 35.944 | 824.025 | 70.178 | 70.404 | 0.0149 |
| E2-1 | 102.402 | 74.533 | 1.288 | 2.811 | 1.246 | 36.435 | 840.119 | 70.300 | 70.526 | 0.0149 |

### Tabulated Cross-Section Properties // E2-2

*(Calculated by Flood Modeller)*

| Node | Flow ($m^3$/s) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area ($m^2$) | Conveyance ($m^3$/s) | Width (m) | W Perim. (m) | Slope |
|---|---|---|---|---|---|---|---|---|---|---|
| E2-2 | 0.000 | 70.518 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.000 | 0.0147 |
| E2-2 | 0.003 | 70.544 | 0.026 | 0.167 | 0.468 | 0.018 | 0.024 | 1.355 | 1.359 | 0.0147 |
| E2-2 | 0.021 | 70.574 | 0.056 | 0.339 | 0.557 | 0.063 | 0.175 | 1.666 | 1.676 | 0.0147 |
| E2-2 | 0.054 | 70.604 | 0.086 | 0.457 | 0.600 | 0.117 | 0.442 | 1.977 | 1.994 | 0.0147 |
| E2-2 | 0.100 | 70.633 | 0.116 | 0.553 | 0.629 | 0.181 | 0.825 | 2.288 | 2.311 | 0.0147 |
| E2-2 | 0.161 | 70.663 | 0.145 | 0.637 | 0.651 | 0.253 | 1.333 | 2.598 | 2.628 | 0.0147 |
| E2-2 | 0.239 | 70.693 | 0.175 | 0.712 | 0.669 | 0.336 | 1.972 | 2.909 | 2.946 | 0.0147 |
| E2-2 | 0.333 | 70.723 | 0.205 | 0.780 | 0.684 | 0.427 | 2.753 | 3.220 | 3.263 | 0.0147 |
| E2-2 | 0.443 | 70.752 | 0.234 | 0.843 | 0.697 | 0.525 | 3.655 | 3.522 | 3.571 | 0.0147 |
| E2-2 | 0.570 | 70.781 | 0.263 | 0.903 | 0.709 | 0.631 | 4.706 | 3.823 | 3.878 | 0.0147 |
| E2-2 | 0.716 | 70.810 | 0.292 | 0.959 | 0.720 | 0.747 | 5.914 | 4.124 | 4.186 | 0.0147 |
| E2-2 | 0.883 | 70.839 | 0.321 | 1.014 | 0.730 | 0.871 | 7.287 | 4.425 | 4.493 | 0.0147 |
| E2-2 | 1.070 | 70.868 | 0.350 | 1.066 | 0.739 | 1.003 | 8.833 | 4.727 | 4.801 | 0.0147 |
| E2-2 | 1.279 | 70.897 | 0.379 | 1.117 | 0.747 | 1.145 | 10.558 | 5.028 | 5.108 | 0.0147 |
| E2-2 | 1.325 | 70.903 | 0.385 | 1.128 | 0.749 | 1.175 | 10.940 | 5.088 | 5.170 | 0.0147 |
| E2-2 | 1.574 | 70.932 | 0.414 | 1.187 | 0.758 | 1.326 | 12.996 | 5.317 | 5.407 | 0.0147 |
| E2-2 | 1.845 | 70.961 | 0.443 | 1.243 | 0.767 | 1.485 | 15.237 | 5.546 | 5.644 | 0.0147 |
| E2-2 | 2.140 | 70.990 | 0.472 | 1.297 | 0.775 | 1.649 | 17.669 | 5.775 | 5.880 | 0.0147 |
| E2-2 | 2.458 | 71.019 | 0.501 | 1.350 | 0.783 | 1.821 | 20.294 | 6.005 | 6.117 | 0.0147 |
| E2-2 | 2.800 | 71.049 | 0.531 | 1.401 | 0.790 | 1.999 | 23.117 | 6.234 | 6.354 | 0.0147 |
| E2-2 | 3.166 | 71.078 | 0.560 | 1.450 | 0.796 | 2.184 | 26.142 | 6.463 | 6.591 | 0.0147 |
| E2-2 | 3.557 | 71.107 | 0.589 | 1.498 | 0.803 | 2.375 | 29.374 | 6.692 | 6.827 | 0.0147 |
| E2-2 | 3.974 | 71.136 | 0.618 | 1.544 | 0.809 | 2.573 | 32.816 | 6.921 | 7.064 | 0.0147 |
| E2-2 | 4.417 | 71.165 | 0.647 | 1.590 | 0.814 | 2.778 | 36.473 | 7.150 | 7.301 | 0.0147 |
| E2-2 | 4.885 | 71.195 | 0.677 | 1.630 | 0.819 | 2.997 | 40.334 | 7.429 | 7.587 | 0.0147 |
| E2-2 | 5.382 | 71.225 | 0.707 | 1.669 | 0.824 | 3.224 | 44.443 | 7.709 | 7.874 | 0.0147 |
| E2-2 | 5.911 | 71.255 | 0.737 | 1.709 | 0.829 | 3.459 | 48.807 | 7.988 | 8.160 | 0.0147 |
| E2-2 | 6.471 | 71.285 | 0.767 | 1.747 | 0.834 | 3.703 | 53.430 | 8.267 | 8.447 | 0.0147 |
| E2-2 | 7.063 | 71.315 | 0.797 | 1.786 | 0.838 | 3.955 | 58.320 | 8.547 | 8.733 | 0.0147 |
| E2-2 | 7.648 | 71.341 | 0.823 | 1.828 | 0.854 | 4.183 | 63.148 | 8.963 | 9.153 | 0.0147 |
| E2-2 | 8.259 | 71.367 | 0.849 | 1.868 | 0.869 | 4.422 | 68.197 | 9.380 | 9.573 | 0.0147 |
| E2-2 | 8.800 | 71.386 | 0.868 | 1.907 | 0.933 | 4.614 | 72.665 | 10.832 | 11.027 | 0.0147 |
| E2-2 | 8.917 | 71.390 | 0.872 | 1.915 | 0.941 | 4.657 | 73.632 | 11.029 | 11.224 | 0.0147 |
| E2-2 | 8.976 | 71.392 | 0.874 | 1.918 | 1.011 | 4.681 | 74.119 | 12.757 | 12.952 | 0.0147 |
| E2-2 | 9.127 | 71.397 | 0.879 | 1.921 | 1.096 | 4.751 | 75.361 | 15.178 | 15.374 | 0.0147 |
| E2-2 | 9.127 | 71.397 | 0.879 | 1.921 | 1.096 | 4.751 | 75.361 | 15.178 | 15.374 | 0.0147 |
| E2-2 | 9.806 | 71.418 | 0.900 | 1.922 | 1.163 | 5.103 | 80.967 | 18.347 | 18.544 | 0.0147 |
| E2-2 | 9.909 | 71.421 | 0.903 | 1.921 | 1.172 | 5.159 | 81.817 | 18.839 | 19.036 | 0.0147 |
| E2-2 | 9.978 | 71.423 | 0.905 | 1.920 | 1.175 | 5.197 | 82.394 | 19.083 | 19.281 | 0.0147 |
| E2-2 | 10.049 | 71.425 | 0.907 | 1.920 | 1.178 | 5.235 | 82.978 | 19.351 | 19.549 | 0.0147 |

| Node | Flow ($m^3/s$) | Stage (m AOD) | Depth (m) | Velocity (m/s) | Froude no. | Area ($m^2$) | Conveyance ($m^3/s$) | Width (m) | W Perim. (m) | Slope |
|---|---|---|---|---|---|---|---|---|---|---|
| E2-2 | 10.085 | 71.426 | 0.908 | 1.919 | 1.230 | 5.255 | 83.272 | 21.175 | 21.373 | 0.0147 |
| E2-2 | 10.157 | 71.428 | 0.910 | 1.917 | 1.257 | 5.299 | 83.865 | 22.341 | 22.540 | 0.0147 |
| E2-2 | 10.691 | 71.442 | 0.924 | 1.897 | 1.294 | 5.635 | 88.275 | 25.700 | 25.900 | 0.0147 |
| E2-2 | 10.772 | 71.444 | 0.926 | 1.894 | 1.297 | 5.687 | 88.943 | 26.145 | 26.345 | 0.0147 |
| E2-2 | 10.802 | 71.445 | 0.927 | 1.891 | 1.293 | 5.713 | 89.190 | 26.227 | 26.428 | 0.0147 |
| E2-2 | 12.075 | 71.473 | 0.955 | 1.863 | 1.251 | 6.482 | 99.707 | 28.695 | 28.899 | 0.0147 |
| E2-2 | 12.319 | 71.478 | 0.960 | 1.859 | 1.249 | 6.627 | 101.723 | 29.353 | 29.557 | 0.0147 |
| E2-2 | 12.975 | 71.491 | 0.973 | 1.848 | 1.250 | 7.023 | 107.137 | 31.520 | 31.725 | 0.0147 |
| E2-2 | 13.247 | 71.496 | 0.978 | 1.845 | 1.245 | 7.182 | 109.385 | 32.121 | 32.328 | 0.0147 |
| E2-2 | 14.225 | 71.513 | 0.995 | 1.836 | 1.233 | 7.746 | 117.458 | 34.237 | 34.445 | 0.0147 |
| E2-2 | 15.243 | 71.529 | 1.011 | 1.835 | 1.213 | 8.305 | 125.861 | 35.582 | 35.792 | 0.0147 |
| E2-2 | 15.805 | 71.538 | 1.020 | 1.831 | 1.218 | 8.633 | 130.507 | 37.471 | 37.681 | 0.0147 |
| E2-2 | 16.218 | 71.544 | 1.026 | 1.831 | 1.208 | 8.859 | 133.913 | 37.819 | 38.030 | 0.0147 |
| E2-2 | 16.660 | 71.550 | 1.032 | 1.833 | 1.199 | 9.087 | 137.561 | 38.158 | 38.369 | 0.0147 |
| E2-2 | 16.907 | 71.554 | 1.036 | 1.829 | 1.208 | 9.242 | 139.601 | 39.515 | 39.726 | 0.0147 |
| E2-2 | 19.420 | 71.585 | 1.067 | 1.850 | 1.174 | 10.498 | 160.350 | 41.471 | 41.683 | 0.0147 |
| E2-2 | 20.824 | 71.601 | 1.083 | 1.864 | 1.163 | 11.171 | 171.944 | 42.638 | 42.851 | 0.0147 |
| E2-2 | 21.634 | 71.610 | 1.092 | 1.872 | 1.158 | 11.558 | 178.639 | 43.421 | 43.634 | 0.0147 |
| E2-2 | 24.131 | 71.636 | 1.118 | 1.898 | 1.147 | 12.714 | 199.252 | 45.540 | 45.753 | 0.0147 |
| E2-2 | 24.320 | 71.638 | 1.120 | 1.899 | 1.146 | 12.806 | 200.815 | 45.779 | 45.992 | 0.0147 |
| E2-2 | 25.628 | 71.652 | 1.134 | 1.904 | 1.149 | 13.463 | 211.614 | 48.091 | 48.304 | 0.0147 |
| E2-2 | 25.730 | 71.653 | 1.135 | 1.904 | 1.148 | 13.511 | 212.458 | 48.195 | 48.409 | 0.0147 |
| E2-2 | 26.730 | 71.662 | 1.144 | 1.916 | 1.144 | 13.947 | 220.710 | 48.745 | 48.959 | 0.0147 |
| E2-2 | 28.692 | 71.679 | 1.161 | 1.939 | 1.152 | 14.797 | 236.917 | 51.278 | 51.494 | 0.0147 |
| E2-2 | 30.512 | 71.694 | 1.176 | 1.959 | 1.152 | 15.579 | 251.940 | 52.895 | 53.111 | 0.0147 |
| E2-2 | 30.512 | 71.694 | 1.176 | 1.959 | 1.152 | 15.579 | 251.940 | 52.895 | 53.111 | 0.0147 |
| E2-2 | 32.007 | 71.708 | 1.190 | 1.959 | 1.158 | 16.341 | 264.286 | 56.083 | 56.301 | 0.0147 |
| E2-2 | 32.007 | 71.708 | 1.190 | 1.959 | 1.158 | 16.341 | 264.286 | 56.083 | 56.301 | 0.0147 |
| E2-2 | 33.156 | 71.717 | 1.199 | 1.968 | 1.158 | 16.852 | 273.775 | 57.282 | 57.500 | 0.0147 |
| E2-2 | 33.933 | 71.723 | 1.205 | 1.973 | 1.168 | 17.201 | 280.193 | 59.148 | 59.366 | 0.0147 |
| E2-2 | 34.870 | 71.730 | 1.212 | 1.979 | 1.168 | 17.619 | 287.928 | 60.250 | 60.469 | 0.0147 |
| E2-2 | 35.784 | 71.738 | 1.220 | 1.976 | 1.170 | 18.109 | 295.477 | 62.314 | 62.534 | 0.0147 |
| E2-2 | 36.585 | 71.745 | 1.227 | 1.972 | 1.172 | 18.552 | 302.088 | 64.280 | 64.501 | 0.0147 |
| E2-2 | 37.705 | 71.752 | 1.234 | 1.984 | 1.168 | 19.003 | 311.336 | 64.575 | 64.796 | 0.0147 |
| E2-2 | 38.505 | 71.757 | 1.239 | 1.992 | 1.165 | 19.327 | 317.942 | 64.869 | 65.089 | 0.0147 |
| E2-2 | 42.338 | 71.780 | 1.262 | 2.032 | 1.154 | 20.831 | 349.589 | 65.910 | 66.131 | 0.0147 |
| E2-2 | 47.730 | 71.810 | 1.292 | 2.091 | 1.145 | 22.826 | 394.117 | 67.136 | 67.357 | 0.0147 |
| E2-2 | 47.917 | 71.811 | 1.293 | 2.093 | 1.156 | 22.894 | 395.658 | 68.480 | 68.702 | 0.0147 |
| E2-2 | 51.434 | 71.828 | 1.311 | 2.134 | 1.154 | 24.098 | 424.699 | 69.096 | 69.318 | 0.0147 |
| E2-2 | 55.097 | 71.846 | 1.328 | 2.177 | 1.153 | 25.313 | 454.945 | 69.712 | 69.934 | 0.0147 |
| E2-2 | 60.356 | 71.870 | 1.352 | 2.236 | 1.151 | 26.991 | 498.364 | 70.135 | 70.357 | 0.0147 |
| E2-2 | 65.875 | 71.894 | 1.376 | 2.297 | 1.150 | 28.679 | 543.937 | 70.557 | 70.780 | 0.0147 |
| E2-2 | 71.653 | 71.918 | 1.400 | 2.359 | 1.151 | 30.377 | 591.646 | 70.980 | 71.204 | 0.0147 |
| E2-2 | 77.597 | 71.942 | 1.424 | 2.420 | 1.153 | 32.062 | 640.729 | 71.402 | 71.627 | 0.0147 |
| E2-2 | 83.783 | 71.965 | 1.447 | 2.482 | 1.156 | 33.757 | 691.810 | 71.825 | 72.050 | 0.0147 |
| E2-2 | 90.209 | 71.989 | 1.471 | 2.544 | 1.159 | 35.462 | 744.865 | 72.247 | 72.473 | 0.0147 |
| E2-2 | 94.338 | 72.004 | 1.486 | 2.581 | 1.168 | 36.555 | 778.962 | 73.515 | 73.741 | 0.0147 |
| E2-2 | 98.913 | 72.020 | 1.502 | 2.621 | 1.173 | 37.737 | 816.741 | 74.149 | 74.375 | 0.0147 |
| E2-2 | 103.599 | 72.036 | 1.518 | 2.661 | 1.178 | 38.928 | 855.429 | 74.782 | 75.008 | 0.0147 |
| E2-2 | 109.164 | 72.055 | 1.537 | 2.708 | 1.182 | 40.318 | 901.385 | 75.416 | 75.643 | 0.0147 |
| E2-2 | 114.876 | 72.073 | 1.555 | 2.754 | 1.187 | 41.718 | 948.550 | 76.050 | 76.277 | 0.0147 |
| E2-2 | 120.523 | 72.091 | 1.573 | 2.796 | 1.196 | 43.099 | 995.178 | 77.317 | 77.544 | 0.0147 |
| E2-2 | 127.322 | 72.112 | 1.594 | 2.846 | 1.204 | 44.736 | 1051.312 | 78.585 | 78.812 | 0.0147 |

# Annex D – Model Results: Displaced Volumes

**Table 10: Potential Maximum Displaced Volume – 3.3% AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent ($m^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area ($m^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume ($m^3$) |
|---|---|---|---|---|---|
| E23 | 0 | 0 | 0.002865 | 0 | 0.0000 |
| E24 | 367 | 1 | 0.002865 | 0.08 | 0.0002 |
| E26 | 11564 | 11 | 0.002865 | 0.37 | 0.0117 |

**Table 11: Potential Maximum Displaced Volume – 1% AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent ($m^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area ($m^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume ($m^3$) |
|---|---|---|---|---|---|
| E23 | 19 | 1 | 0.002865 | 0.08 | 0.0002 |
| E24 | 568 | 1 | 0.002865 | 0.15 | 0.0004 |
| E26 | 11876 | 11 | 0.002865 | 0.41 | 0.0129 |

**Table 12: Potential Maximum Displaced Volume – 1%+CC (39%) AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent ($m^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area ($m^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume ($m^3$) |
|---|---|---|---|---|---|
| E23 | 53 | 1 | 0.002865 | 0.18 | 0.0005 |
| E24 | 783 | 1 | 0.002865 | 0.26 | 0.0007 |
| E26 | 12529 | 12 | 0.002865 | 0.51 | 0.0175 |

**Table 13: Potential Maximum Displaced Volume – 1%+CC (71%) AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent ($m^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area ($m^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume ($m^3$) |
|---|---|---|---|---|---|
| E23 | 66 | 1 | 0.002865 | 0.22 | 0.0006 |
| E24 | 877 | 1 | 0.002865 | 0.3 | 0.0009 |
| E26 | 12854 | 12 | 0.002865 | 0.55 | 0.0189 |

**Table 14: Potential Maximum Displaced Volume – 0.1% AEP**

| Field Boundary ID / Solar Panel Area | Area in Flood Extent ($m^2$) | Number of Supports in Flood Extent | Support Cross-sectional Area ($m^2$) | Maximum Flood Depth (m) | Maximum Displaced Volume ($m^3$) |
|---|---|---|---|---|---|
| E23 | 58 | 1 | 0.002865 | 0.22 | 0.0006 |
| E24 | 863 | 1 | 0.002865 | 0.29 | 0.0007 |
| E26 | 12804 | 12 | 0.002865 | 0.55 | 0.0186 |

# Annex E - EA Product Data

[redacted]

[redacted]

- Lime Down C2: SPZ2c and SPZ3
- Lime Down D: SPZ1c and SPZ2c and SPZ3
- Lime Down E1: SPZ1c and SPZ2c
- Lime Down E2: SPZ1c and SPZ2c

The aquifer designations in the areas given are,

- Alluvium – Secondary A Aquifer with Medium to High Vulnerability
- Forest Marble limestone member - Principal Aquifer with High Vulnerability
- Forest Marble mudstone member - Secondary A Aquifer with High Vulnerability
- Cornbrash - Secondary A Aquifer with High Vulnerability
- Kellaways Clay – Unproductive Strata

**Provision of FRA Product 4**

Thank you for your recent request to use Environment Agency flood data. The information is attached.

If you have requested this information to help inform a development proposal, then you should note the information on GOV.UK on the use of Environment Agency Information for Flood Risk Assessments and our attached advisory text.
https://www.gov.uk/planning-applications-assessing-flood-risk
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Further details about the Environment Agency information supplied and the permitted use of this information can be found on the GOV.UK website:
https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather
http://www.nationalarchives.gov.uk/doc/open-government-licence/version/3

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

If you are not satisfied with our response to your request for information you can contact us within 2 calendar months to ask for our decision to be reviewed.

*We really value your thoughts on how we are doing and will always make changes where we can to improve our service. Please click on the link below and fill in our survey.*
http://www.smartsurvey.co.uk/s/EnvironmentAgencyCustomerSurvey/?a=DC *Thank you.*

Kind regards

[redacted]

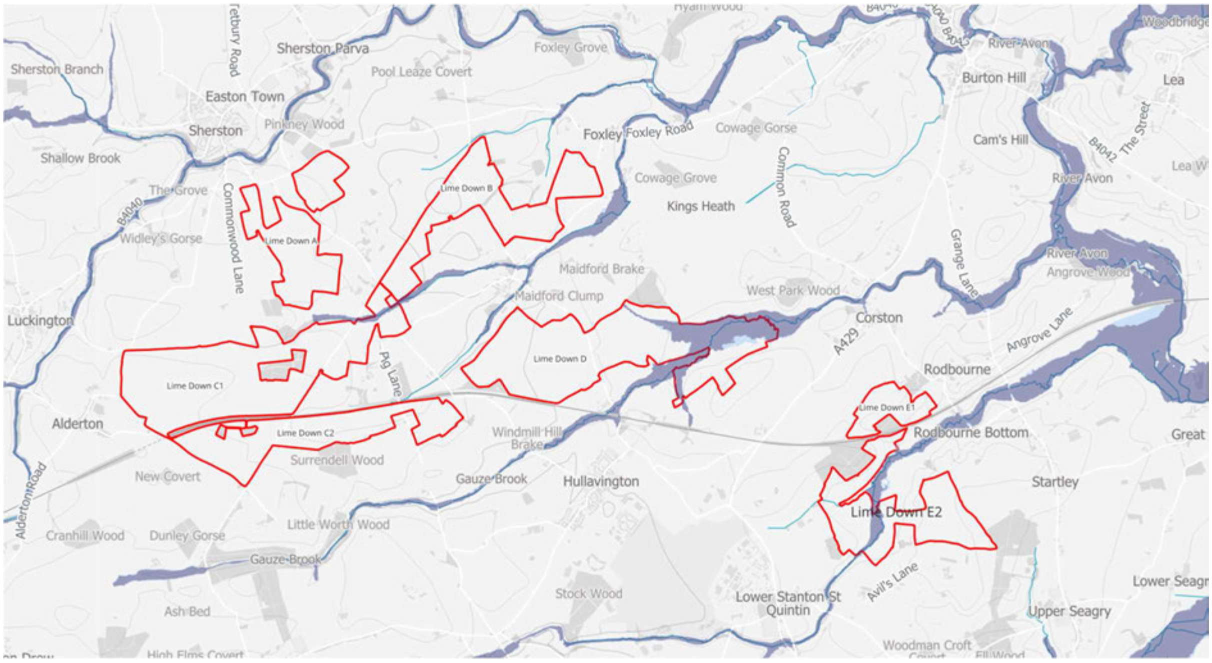
Environment Agency, Wessex Enquiries, Customer & Engagement Team

03708 506 506.- Wessex Enquiries

[redacted] mabbett.eu>
**Sent:** 15 October 2024 14:01
**To:** Enquiries, Unit <enquiries@environment-agency.gov.uk>
**Subject:** 317212 Lime Down Data Request

To whom it may concern,

Mabbett & Associates Ltd have been instructed to undertake a Flood Risk Assessment and Drainage Strategy in support of a proposed solar site in Wiltshire, known as the site hereon. I attach a site location plan and the site details below. The site has been split into parcels which can be seen below (Lime Down A, B, C1, C2, D, E1 and E2).




According to the EA online Flood M Planning, the Site is shown to be located within Flood Zones 1, 2 and 3, however we would be grateful if you could provide **any nearby modelled flood level data** in order to inform our assessment of the Site.

It would therefore be useful if you are able to confirm/provide the followiap forng where available:

**Site Details**

| | |
|---|---|
| **Site Name** | Lime Down SOlar |
| **Address** | Lime Down A: SN16 0PU (NGR: 385982, 184814) |
| | Lime Down B: SN16 0JS (NGR: 388179, 185419) |
| | Lime Down C1: SN14 6NL (NGR: 385300, 183486) |
| | Lime Down C2: SN16 0JZ (NGR: 386684, 182717) |
| | Lime Down D: SN14 6EU (NGR: 389526, 183654) |
| | Lime Down E1: SN16 0EX (NGR: 392655, 183066) |
| | Lime Down E2: SN14 6DA (NGR: 393123, 181766) |

**Data Request**

Please provide any of the following information to enable us to complete our assessment:

**Historical Flooding Information**

- Any records, photographs, flood extents from known historic events in the area

**Technical Data**

- Any hydraulic models covering the site
- Raw and processed results for the model(s) above
    - Hydraulic modelling report for the model(s) above
    - Modelled floodplain levels and flows for node points within and in the immediate vicinity of the Site taking into account the most recent climate change allowances (where these have been modelled);
- Hydrology report and/or flood estimation calculation records for the model(s) above
- Survey data used to build the model or inform nearby studies

**Supporting Data**

- Flood/coastal defence survey data
- Operational procedures for hydraulic structures
- Section 19 flood investigation reports
- The date and type of modelling that flood levels have been derived from;
- The technical report summarising the modelling methodology;
- Confirmation that the data is appropriate/relevant to inform flood risk within the Site;
- Details of any flood defences within the vicinity of the Site (i.e type, crest levels, Standard of Protection, condition, etc) and any associated breach and/or overtopping flood extents and depths;
- Hazard mapping detailing the depth, velocity and associated hazard rating for the Site;
- Any information in relation to surface water flooding including confirmation is located within or outside of a Critical Drainage Area;
- Any information in relation to on-Site drainage;
- Any information in relation to groundwater flooding in the area. Where possible, please provide borehole locations and ground water levels;
- Details of sensitive aquifers and known contamination issues;
- Any information/mapping of historical flooding events on Site from all sources of flooding (i.e fluvial, tidal, surface water, groundwater, sewer, reservoir, canal, etc).

Where available please can you provide flood levels, estimated return periods, photographs and other such data that may be relevant to our assessment;

We trust this request is acceptable but please do not hesitate to contact us if you require any further information to assist with your response or wish to discuss the Site in further detail.

We look forward to hearing from you.

Thanks,

[redacted]

Consultant | Water Environment Team

[redacted]

**IOSH & IEMA Training Course Provider**

---

**Anglesey | Belfast | Cardiff | Carlisle | Dublin | Dundee | Edinburgh | Forres | Glasgow | Inverness | Leicester | Manchester | Winchester**

[redacted]

**Our ref:** 381197-WX
**Date:** 4th November 2024

Thank you for your enquiry which was received on 15th October 2024. We respond to requests under the Freedom of Information Act 2000 and Environmental Information Regulations 2004.

**Abstract**

| | |
|---|---|
| Name | Product 4 |
| Description | Flood Risk Information for land at<br>**Lime Down**<br>NGR: ST9009082825 |
| Licence | Open Government Licence |
| Information Warnings | *The mapping of features provided as a background in this product is © Ordnance Survey. It is provided to give context to this product. The Open Government Licence does not apply.* |
| Attribution | Contains Environment Agency information © Environment Agency and/or database rights.<br><br>Contains Ordnance Survey data © Crown copyright 2023 Ordnance Survey *AC0000807064*. |

**Open Data**

The following Environment Agency published datasets are now available on the weblink below as part of the Government's 'Open Data' project and are available for you to download free of charge.

Environment Agency published datasets: https://data.gov.uk/data/search?publisher=environment-agency&unpublished=false

You will need to search and select the name of the following datasets to take you directly to the weblink to enable you to download the data:

- Flood Map for Planning (Rivers and the Sea) – Flood Zones 2 and 3
- Flood Map for Planning (Rivers and Sea) – Areas Benefiting from Defences
- Flood Map for Planning (Rivers and Sea) Spatial Flood Defences
- Flood Map for Planning (Rivers and Sea) Flood Storage Areas
- Recorded Flood Outlines
- Historic Flood Map
- Risk of Flooding from Surface Water Extent for:
  - → 3 percent annual chance
  - → 1 percent annual chance
  - → 0.5 percent annual chance

You can also access the Flood Map for Planning here: https://flood-map-for-planning.service.gov.uk/

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

You can also access the Risk of Flooding from Surface Water maps and Risk of Flooding from Reservoirs information here: [https://flood-warning-information.service.gov.uk/long-term-flood-risk/map](https://flood-warning-information.service.gov.uk/long-term-flood-risk/map)

**Recorded Historic Flood Events**

We no longer produce pdf copies of the Historic Flood Map. This information is available to search, select, and download free of charge as part of the Government's 'open data' as

- Recorded Flood Outlines
- the Historic Flood Map

Our historic records indicate that there was flooding in the area in **1925** (fluvial), **1932** (fluvial), **1954** (fluvial), **1979** (fluvial), **1999** (fluvial/unconfirmed source), **2007** (fluvial), **2009** (fluvial), **2012** (fluvial/unconfirmed source) and **2013** (fluvial).

Additionally, our historic records show a record of possible flooding pre 2012 for the area, however we are currently unable to confirm the date and source of this.

Please note - we cannot guarantee that this is an exhaustive list of all past flood events in this location. All reasonable care has been taken to ensure that the historical flood event data is as accurate as possible. The Environment Agency will update its records if new evidence emerges.

**Modelled Fluvial Water Levels**

We have not carried out any detailed fluvial flood risk modelling in this location.

The fluvial Flood Map in this area has been produced using our National Generalised Model (JFLOW). This modelling is fit for the purpose of the Flood Zones. However, it is not based on a specific channel survey. Neither water depths nor water levels were outputs specified when we commissioned this generalised modelling for the Flood Zones. Whilst the modelling process does provide some information on depth of water, it would have been possible to produce the flood extents without storing the water depth values, since water depth is only a 'by-product' of the calculation process. As this type of modelling was developed, tested and reviewed for production of the Flood Zone extents only, we have no information on the accuracy of the water depth data. Water depth or level outputs from this model are only suitable to be used for decision making at a broad catchment scale and is not fit for the purpose of a site-specific flood risk assessment.

For your information we have supplied maps showing the water depths derived from JFLOW for the 1% AEP (100yr) and 0.1% AEP (1000yr) fluvial modelled flood scenarios.

**Please note -** The Environment Agency is currently carrying out a project to update the National Generalised model (JFLOW). The New National Model outputs are expected in Spring 2025. Our published flood risk information for this area will be updated using outputs from the New National Model and this is expected to take place in late 2025 (current programme which may change). This will be carried out as part of the National project to update our National flood risk mapping and modelling information across England and will incorporate outputs from detailed local models together with updated National modelling.
New National Model Details.

The New National Modelling (NNM) is a set of models for rivers, surface water and the sea covering the whole of England. The NNM has been created to fill in gaps where we don't have local hydraulic models, our local models require updating or we need additional model scenarios such as climate change runs.

**Please also note -** we are currently carrying out a National project to update our flood risk information for the whole of England. We will be updating our flood risk information in 2025 as part of the new National Flood Risk Assessment (NaFRA2). This will include the data displayed on the Check Your Long-Term Flood Risk service and the data displayed in the Flood Map for Planning (Rivers and Sea).

This should result in improvements to our mapping products, especially where we do not currently have any detailed local modelling. This means there will be some changes to our flood risk information in many areas when the new data is published.

You can find further information on the NaFRA2 project here: https://www.gov.uk/guidance/updates-to-national-flood-and-coastal-erosion-risk-information

For more information on climate change allowances please see the guidance on the Gov.UK website here: Flood risk assessments: climate change allowances - GOV.UK. **Please be aware that this information is subject to change, please check the guidance regularly.**

**Environmental Permit for Flood Risk Activities**

In addition to any other permission(s) that you may have already obtained e.g. planning permission, you may need an environmental permit for flood risk activities (formerly known as Flood Defence Consent prior to 06 April 2016) if you want to do work:

- in, under, over or near a main river (including where the river is in a culvert)
- on or near a flood defence on a main river
- in the flood plain of a main river
- on or near a sea defence

For further information and to check whether a permit is required please visit: https://www.gov.uk/guidance/flood-risk-activities-environmental-permits.

For any further advice, please email Blandford.frap@environment-agency.gov.uk.

**Ordinary Watercourse**

Some of the watercourses adjoining this site are classed as an “Ordinary Watercourse” not a “Main River” under our control. Works to ordinary watercourses may require consent from either the Lead Local Flood Authorities or the Local Drainage Board.

**Flood Asset Information**

Please find enclosed details of Flood Assets within the area. This information has been taken from our Asset Information Management System database (AIMS).

Please note that flood defences can increase water levels elsewhere eg through channels being restricted by defences, or because defences prevent flood water flowing back into the river channel.

**Planning**

If you have questions regarding the planning nature of your enquiry, or require advice on floor levels, please contact our Sustainable Places team on wx.sp@environment-agency.gov.uk. Please be aware that we now charge for planning advice when consulted on pre-application enquiries. This new approach provides advice to developers in two ways. Firstly, there is the provision of ‘free’ advice available to everyone where we give a preliminary opinion on a proposed development. This sets out the environmental constraints together with any issues this raises for us. Should you wish us to review in detail any of these issues then we can do this through a chargeable scheme aimed at recovering our costs.

**Strategic Flood Risk Assessment (SFRA)**

When preparing a FRA to support a development proposal in this location you should refer to Wiltshire Council's SFRA Reports Level 1 which is available to download via the following link: https://www.wiltshire.gov.uk/media/5691/Strategic-Flood-Risk-Assessment-Level-1/pdf/Wiltshire_Council_Level_1_SFRA_v5.0.pdf?m=637459765054370000

The Wiltshire Council Local Plan is available via this link: https://www.wiltshire.gov.uk/planning-policy-local-plan-review-consultation

**Further Information**

We advise that you also contact the drainage engineer/ flood risk management team at Wiltshire Council by email: drainage@wiltshire.gov.uk, or by phone: 0300 456 0105, based at: Bythesea Road, Trowbridge, Wiltshire, BA14 8JN, as they may be able to provide further advice with respect to localised flooding and drainage issues.

Further details about the Environment Agency information supplied can be found on our website: https://www.gov.uk/browse/environment-countryside/flooding-extreme-weather

We hope you find this information helpful. It is provided subject to the attached notice 'Use of Environment Agency Information for Flood Risk Assessments', which we strongly recommend you read.

Yours sincerely

[redacted]

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk

**Enc:** Use of Environment Agency Information for Flood Risk Assessments (below)
381197-WX 100yr JFLOW Depth Map (1%AEP)
381197-WX 1000yr JFLOW Depth Map (0.1%AEP)
381197-WX Defence Map
381197-WX Defence Data

## Use of Environment Agency Information for Flood Risk Assessments (FRAs)

**Important**
Use of Environment Agency data: you should note that

1. Information supplied by the Environment Agency may be used to assist in producing a Flood Risk Assessment (FRA) where one is required, but the use of Environment Agency information does not constitute such an assessment on its own.

2. As part of your data request, we have provided all of the modelled data we hold for your location. Please note that some of our modelled information may have been produced for purposes other than for flood zone generation. This may mean that some of the modelled data you have been provided with has a lower confidence level, and has not been used in producing our flood map, nor definitively reflects the predicted flood water level at the property/development site scale. To check the suitability of the use of this information in your FRA please contact your local Partnership & Strategic Overview (PSO) team.

3. This information covers flood risk from main rivers and the sea, and you will need to consider other potential sources of flooding, such as groundwater or surface water runoff. The information produced by the Local Planning Authority and the Lead Local Flood Authority (LLFA) may assist in assessing other sources of flood risk.

4. Where a planning application requires a FRA and this is not submitted or deficient, the Environment Agency may well raise an objection.

5. For more significant proposals in higher flood risk areas, we would be pleased to discuss details with you ahead of making any planning application, and you should also discuss the matter with your Local Planning Authority.

**Pre-Planning Advice from the Environment Agency**
If you have requested this information to help inform a development proposal, then we recommend that you undertake a formal pre-application enquiry using the form available from our website:

Pre-application Preliminary Opinion:
https://www.gov.uk/government/publications/pre-planning-application-enquiry-form-preliminary-opinion

Pre-application Charged Service:
https://www.gov.uk/government/publications/planning-advice-environment-agency-standard-terms-and-conditions

Depending on the enquiry we may also provide advice on other issues related to our responsibilities, including flooding, waste, land contamination, water quality, biodiversity, navigation, pollution, water resources, foul drainage or Environmental Impact Assessment.

**Flood Risk Assessment (FRA) Guidance**
You should refer to the Planning Practice Guidance of the National Planning Policy Framework (NPPF) and the Environment Agency's Flood Risk Standing Advice for information about Flood Risk Assessment (FRA) for new development in the different Flood Zones. These documents can be accessed via:

National Planning Policy Framework Planning Practice Guidance:
http://planningguidance.planningportal.gov.uk/

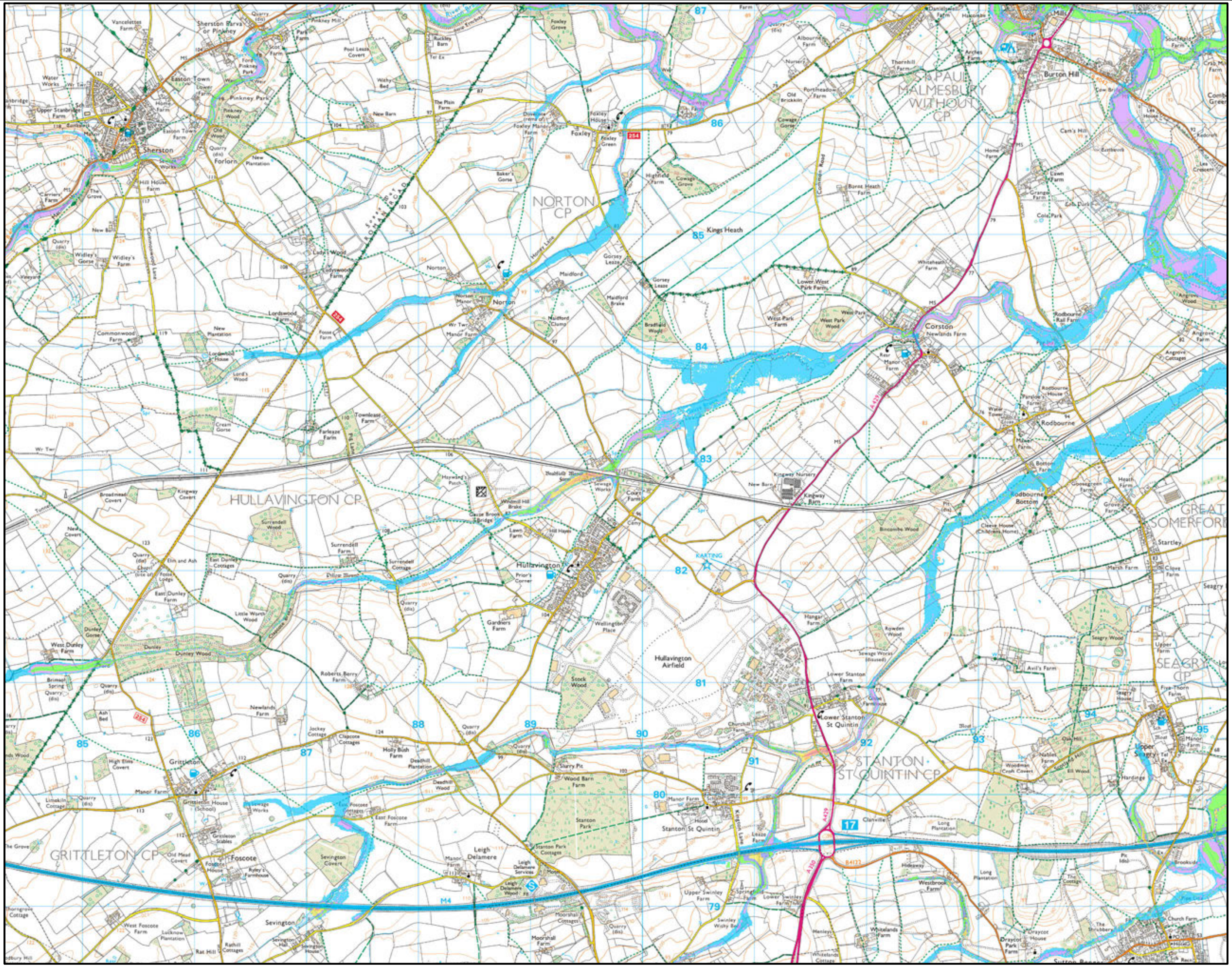
Environment Agency advice on FRAs:

Customer & Engagement, Wessex
Rivers House, East Quay, Bridgwater, Somerset, TA6 4YS
Email: wessexenquiries@environment-agency.gov.uk
www.environment-agency.gov.uk

https://www.gov.uk/flood-risk-assessment-for-planning-applications#when-to-follow-standing-advice

https://www.gov.uk/government/publications/planning-applications-assessing-flood-risk

381197-WX - JFLOW Fluvial Water depths (m) Without Flood Defences. 100 year (1% AEP) centred on land at Lime Down [390090,182825].
Created 01.11.2024




Environment Agency

Scale 1:50,000

N
W E
S

**Legend**

**100yr JFLOW Depth**

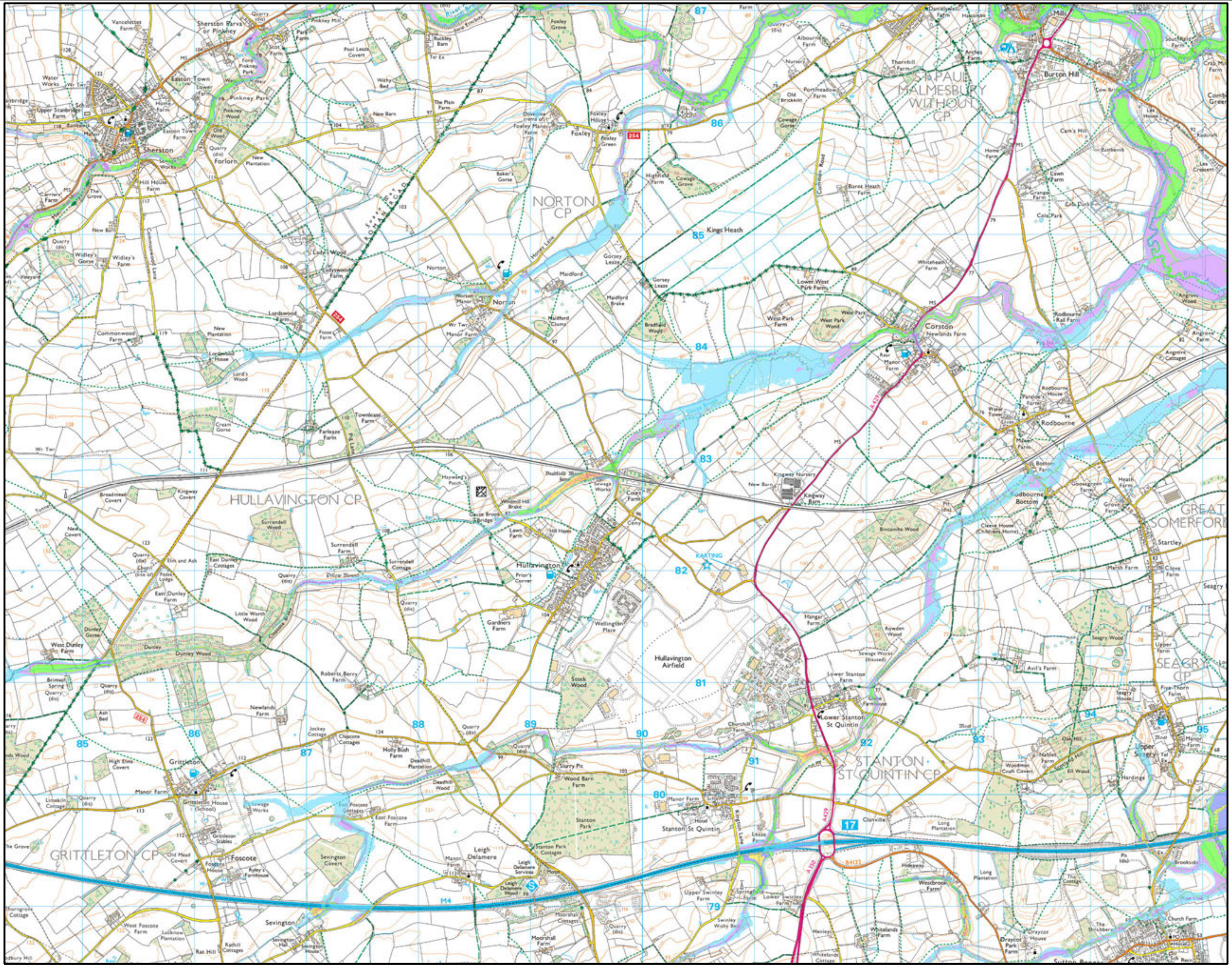
**Metres**

- 0 - 0.5
- 0.500000000 - 1
- 1.000000001 - 2
- 2.000000001 - 3
- 3.000000001 - 4
- 4.000000001 - 5
- 5.000000001 - 10
- 10.00000001 - 100

Information Warning
We do not recommend the use of water depths/levels derived from JFLOW for site specific investigations such as Flood Risk Assessments.


Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

381197-WX - JFLOW Fluvial Water depths (m) Without Flood Defences. 1000 year (0.1% AEP) centred on land at Lime Down [390090,182825].
Created 01.11.2024




Environment Agency

Scale 1:50,000

N
W E
S

**Legend**

**1000yr JFLOW Depth**

**Metres**

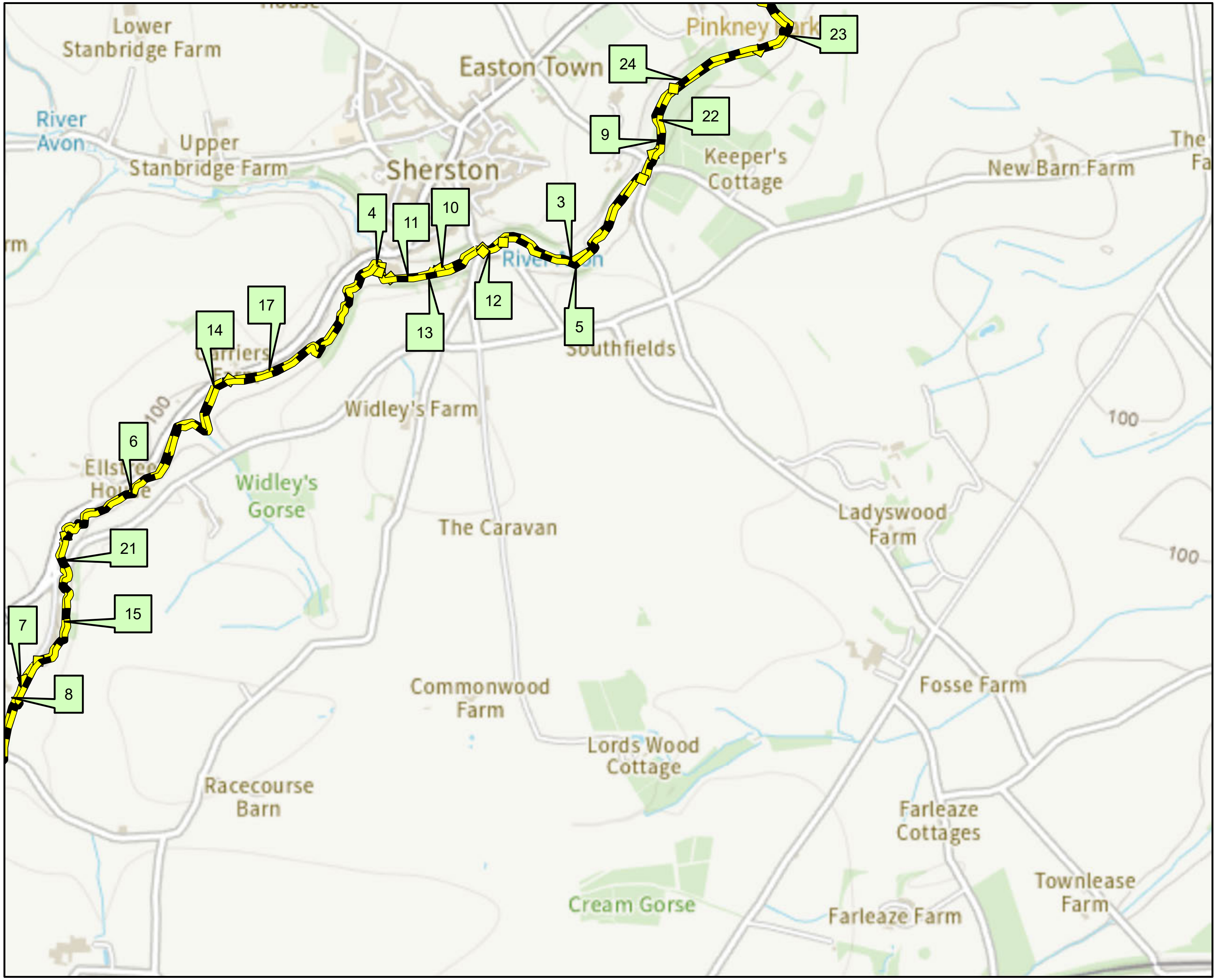
- 0 - 0.5
- 0.500000000 - 1
- 1.000000001 - 2
- 2.000000001 - 3
- 3.000000001 - 4
- 4.000000001 - 5
- 5.000000001 - 10
- 10.00000001 - 100

Information Warning
We do not recommend the use of water depths/levels derived from JFLOW for site specific investigations such as Flood Risk Assessments.



Contact Us: National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

## Current Flood Defences centered on NGR ST 85982 84814 Created 22/10/2024 Ref: 381197-WX




Scale: 1:20,000

N
W E
S

**Legend**

**Defences**

- Barrier Beach
- Beach
- Bridge Abutment
- Cliff
- Demountable Defence
- Dunes
- Embankment
- Engineered High Ground
- Flood Gate
- Natural High Ground
- Promenade
- Quay
- Spillway
- Wall

**This data has been extracted from the Asset Information Management System (AIMS OM) which was created to draw various data sources into one database and has been populated with information of varying quality.**



**Contact Us:** National Customer Contact Centre, PO Box 544, Rotherham, S60 1BY. Tel: 03708 506 506 (Mon-Fri 8-6). Email: enquiries@environment-agency.gov.uk

**Product 4 - AIMS Information** **381197-WX** **Date:** **22/10/2024**

| Map Ref | Asset ID | Asset Type | Right or left bank | Asset Description | Approx length (m) | Actual fluvial downstream crest level (mAOD) | Actual fluvial downstream crest level accuracy | Actual fluvial upstream crest level (mAOD) | Actual fluvial upstream crest level accuracy | Actual fluvial coastal crest level (mAOD) | Actual fluvial coastal crest level accuracy | NGR | Most recent inspection | Overall condition |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 3 | 40115 | Natural High Ground | Left | Natural Bank | 878.51 | DNR | DNR | DNR | DNR | DNR | DNR | ST8592785717 | 07/04/2009 | 2 - Good |
| 4 | 40116 | Natural High Ground | Left | Stone wall | 63.60 | DNR | DNR | DNR | DNR | DNR | DNR | ST85158562 | 07/04/2009 | 2 - Good |
| 5 | 40419 | Natural High Ground | Right | Natural Bank | 714.43 | DNR | DNR | DNR | DNR | DNR | DNR | ST85898565 | 07/04/2009 | 2 - Good |
| 6 | 40420 | Natural High Ground | Left | Natural Bank | 959.72 | DNR | DNR | DNR | DNR | DNR | DNR | ST84218478 | 19/12/2007 | 3 - Fair |
| 7 | 4605 | Natural High Ground | Left | Natural channel with masonry retaining wall | 89.38 | DNR | DNR | DNR | DNR | DNR | DNR | ST8389484163 | 23/10/1996 | 3 - Fair |
| 8 | 4606 | Natural High Ground | Left | Natural Bank | 1229.01 | DNR | DNR | DNR | DNR | DNR | DNR | ST83618359 | 19/12/2007 | 3 - Fair |
| 9 | 4730 | Natural High Ground | Left | Natural Bank | 275.81 | DNR | DNR | DNR | DNR | DNR | DNR | ST8615986133 | 07/04/2009 | 3 - Fair |
| 10 | 4731 | Natural High Ground | Left | Natural channel with stone retaining wall | 181.67 | DNR | DNR | DNR | DNR | DNR | DNR | ST85438562 | 07/04/2009 | 2 - Good |
| 11 | 4849 | Natural High Ground | Left | Natural Bank | 189.57 | DNR | DNR | DNR | DNR | DNR | DNR | ST8525585581 | 07/04/2009 | 2 - Good |
| 12 | 4851 | Natural High Ground | Right | Stone Wall | 83.61 | DNR | DNR | DNR | DNR | DNR | DNR | ST85568567 | 07/04/2009 | 2 - Good |
| 13 | 4852 | Natural High Ground | Right | Natural Bank | 425.87 | DNR | DNR | DNR | DNR | DNR | DNR | ST85348558 | 07/04/2009 | 2 - Good |
| 14 | 4853 | Natural High Ground | Left | Natural channel with gabion retaining wall | 35.34 | DNR | DNR | DNR | DNR | DNR | DNR | ST8458185202 | 23/10/1996 | 2 - Good |
| 15 | 4854 | Natural High Ground | Left | Masonry Wall | 537.87 | DNR | DNR | DNR | DNR | DNR | DNR | ST84028445 | 23/10/1996 | 3 - Fair |
| 17 | 88456 | Natural High Ground | Left | Natural Bank | 825.00 | DNR | DNR | DNR | DNR | DNR | DNR | ST8491285333 | 19/12/2007 | 3 - Fair |
| 21 | 89868 | Natural High Ground | Right | Natural Bank | 3685.06 | DNR | DNR | DNR | DNR | DNR | DNR | ST8404084431 | 19/12/2007 | 3 - Fair |
| 22 | 98384 | Natural High Ground | Right | Natural Bank | 708.60 | DNR | DNR | DNR | DNR | DNR | DNR | ST8619186219 | 07/04/2009 | 3 - Fair |
| 23 | 98385 | Natural High Ground | Right | Natural channel with stone retaining wall | 561.70 | DNR | DNR | DNR | DNR | DNR | DNR | ST86538659 | 07/04/2009 | 3 - Fair |
| 24 | 98386 | Natural High Ground | Left | Natural channel with masonry retaining wall | 1001.16 | DNR | DNR | DNR | DNR | DNR | DNR | ST8650586598 | 07/04/2009 | 2 - Good |

**Notes**
* Overall Condition has been taken from the most recent inspection
* Inspections are of a purely visual nature and do not necessarily reflect the true condition of the asset
* Condition: 1 = very good, Condtion 2 = good, Condition 3 = fair, Condition 4 = poor, Condition 5 = very poor
* Crest level accuracy:  1 = ± 0.01 to 0.05m, 2 = ± 0.05 to 0.15m, 3 = ± 0.15 to 0.75m, 4 = ± 0.75 or greater
* DNR = data not recorded

# Annex F – Greenfield Calculations

# Greenfield runoff rate estimation tool

www.uksuds.com | Greenfield runoff rate estimation tool (https://www.uksuds.com/)

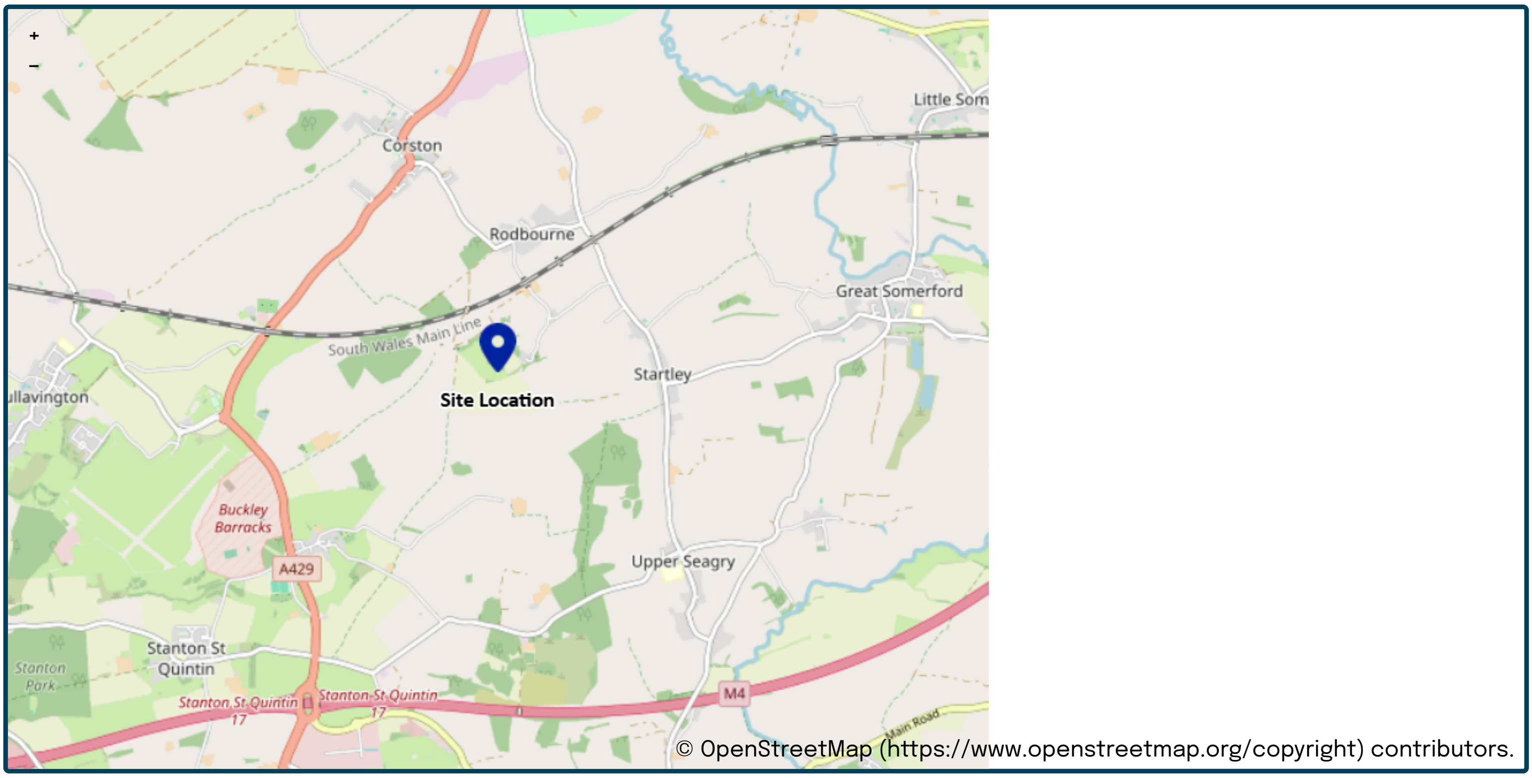
This is an estimation of the greenfield runoff rates that are used to meet normal best practice criteria in line with Environment Agency guidance "Rainfall runoff management for developments", SC030219 (2013), the SuDS Manual C753 (CIRIA, 2015) and the non-statutory standards for SuDS (Defra, 2015).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

## Project details

| | |
|---|---|
| Date | 23/06/2026 |
| Calculated by | GH |
| Reference | 317212 |
| Model version | 2.2.3 |

## Location

| | |
|---|---|
| Site name | Lime Down E2 |
| Site location | |



© OpenStreetMap (https://www.openstreetmap.org/copyright) contributors.

| | |
|---|---|
| Site easting (British National Grid) | 393199 |
| Site northing (British National Grid) | 182070 |

## Site details

| | | |
|---|---|---|
| Total site area (ha) | 0.105 | ha |

## Greenfield runoff

# Method

| | |
|---|---|
| Method | FEH statistical (2025) |

# FEH statistical (2025)

| | My value | | Map value |
|---|---|---|---|
| SAAR9120 (mm) | 821 mm | | |
| BFIHOST19scaled | 0.352 | | |
| QMed-QBar conversion | 1.075 | | 1.075 |
| QMed (l/s) | 0.6 l/s | | |
| QBar (FEH statistical 2025) (l/s) | 0.7 l/s | | |

# Growth curve factors

| | My value | | Map value |
|---|---|---|---|
| Hydrological region | 8 | | 8 |
| 1 year growth factor | 0.78 | | |
| 2 year growth factor | 0.93 | | |
| 10 year growth factor | 1.49 | | |
| 30 year growth factor | 1.95 | | |
| 100 year growth factor | 2.43 | | |
| 200 year growth factor | 2.78 | | |

## Results

| | |
|---|---|
| Method | FEH statistical (2025) |
| Flow rate 1 year (l/s) | 0.5 l/s |
| Flow rate 2 year (l/s) | 0.6 l/s |
| Flow rate 10 years (l/s) | 1.0 l/s |
| Flow rate 30 years (l/s) | 1.3 l/s |
| Flow rate 100 years (l/s) | 1.7 l/s |
| Flow rate 200 years (l/s) | 1.9 l/s |

Please note runoff estimation is subject to significant uncertainty. Results are therefore normally reported to only 1 decimal place. Where 2 decimal places are provided, this does not indicate accuracy to this level, it has been adopted to prevent 'zero' figures from being reported. Outputs less than 0.01 l/s are reported as 0.01 l/s.

### Disclaimer

# Annex G – Hydraulic Calculations

## Design Settings

| | | | |
|---|---|---|---|
| Rainfall Methodology | FEH-22 | Minimum Velocity (m/s) | 1.00 |
| Return Period (years) | 100 | Connection Type | Level Soffits |
| Additional Flow (%) | 0 | Minimum Backdrop Height (m) | 0.200 |
| CV | 1.000 | Preferred Cover Depth (m) | 1.200 |
| Time of Entry (mins) | 5.00 | Include Intermediate Ground | ✓ |
| Maximum Time of Concentration (mins) | 30.00 | Enforce best practice design rules | ✓ |
| Maximum Rainfall (mm/hr) | 50.0 | | |

## Nodes

| Name | Area (ha) | T of E (mins) | Cover Level (m) | Diameter (mm) | Easting (m) | Northing (m) | Depth (m) | Invert Level (m) |
|---|---|---|---|---|---|---|---|---|
| Storage | 0.008 | 5.00 | 100.000 | 1200 | 0.000 | 0.000 | 0.750 | 99.250 |

## Simulation Settings

| | | | | | |
|---|---|---|---|---|---|
| Rainfall Methodology | FEH-22 | Skip Steady State | x | Check Discharge Rate(s) | x |
| Rainfall Events | Singular | Drain Down Time (mins) | 1440 | Check Discharge Volume | x |
| Winter CV | 1.000 | Additional Storage (m³/ha) | 0.0 | | |
| Analysis Speed | Normal | Starting Level (m) | | | |

**Storm Durations**

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 15 | 30 | 60 | 120 | 180 | 240 | 360 | 480 | 600 | 720 | 960 | 1440 |

| Return Period (years) | Climate Change (CC %) | Additional Area (A %) | Additional Flow (Q %) |
|---|---|---|---|
| 100 | 45 | 0 | 0 |

## Node Storage Online Hydro-Brake® Control

| | | | |
|---|---|---|---|
| Flap Valve | x | Objective | (HE) Minimise upstream storage |
| Replaces Downstream Link | x | Sump Available | ✓ |
| Invert Level (m) | 99.250 | Product Number | CTL-SHE-0031-4000-0750-4000 |
| Design Depth (m) | 0.750 | Min Outlet Diameter (m) | 0.075 |
| Design Flow (l/s) | 0.4 | Min Node Diameter (mm) | 1200 |

## Node Storage Depth/Area Storage Structure

| | | | | | |
|---|---|---|---|---|---|
| Base Inf Coefficient (m/hr) | 0.00000 | Safety Factor | 2.0 | Invert Level (m) | 99.250 |
| Side Inf Coefficient (m/hr) | 0.00000 | Porosity | 1.00 | Time to half empty (mins) | 80 |

| Depth (m) | Area (m²) | Inf Area (m²) | Depth (m) | Area (m²) | Inf Area (m²) |
|---|---|---|---|---|---|
| 0.000 | 1.0 | 1.0 | 0.750 | 24.9 | 26.2 |

**Results for 100 year +45% CC Critical Storm Duration. Lowest mass balance: 100.00%**

| Node Event | US Node | Peak (mins) | Level (m) | Depth (m) | Inflow (l/s) | Node Vol (m³) | Flood (m³) | Status |
|---|---|---|---|---|---|---|---|---|
| 60 minute winter | Storage | 60 | 99.669 | 0.419 | 2.9 | 3.2164 | 0.0000 | OK |

| Link Event (Upstream Depth) | US Node | Link | Outflow (l/s) | Discharge Vol (m³) |
|---|---|---|---|---|
| 60 minute winter | Storage | Hydro-Brake® | 0.3 | 4.2 |

---

i [redacted]

iii https://magic.defra.gov.uk/

iv https://flood-map-for-planning.service.gov.uk/

v https://environment.data.gov.uk/hydrology/climate-change-allowances/river-flow

vi https://check-long-term-flood-risk.service.gov.uk/postcode

vii [redacted]

viii https://www.landis.org.uk/soilscapes/