Stonestreet Green Solar

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## Outline Operational Surface Water Drainage Strategy

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## Revision History

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# 1 Introduction

## 1.1 Introduction

1.1.1 SLR Consulting Limited ('SLR') has been appointed by EPL 001 Limited (the 'Applicant') to prepare an Outline Operational Surface Water Drainage Strategy ('Outline OSWDS') in support of the Development Consent Order ('DCO') application for Stonestreet Green Solar (the 'Project').

1.1.2 This Outline OSWDS has been prepared under the direction of a Technical Director of Hydrology at SLR who specialises in flood risk, drainage and associated planning matters.

1.1.3 The Site is within the administrative boundaries of Ashford Borough Council ('ABC') and Kent County Council ('KCC').

## 1.2 The Project

1.2.1 The Project comprises the construction, operation and maintenance, and decommissioning of solar photovoltaic ('PV') arrays and energy storage, together with associated infrastructure and an underground cable connection to the existing National Grid Sellindge Substation.

1.2.2 The Project will include a generating station (incorporating solar arrays) with a total capacity exceeding 50 megawatts ('MW'). The agreed grid connection for the Project will allow the export and import of up to 99.9 MW of electricity to the grid. The Project will connect to the existing National Grid Sellindge Substation via a new 132 kilovolt ('kV') substation constructed as part of the Project and cable connection under the Network Rail and High Speed 1 ('HS1') railway.

1.2.3 The location of the Project is shown on **Environmental Statement ('ES') Volume 3, Figure 1.1: Site Location Plan (Doc Ref. 5.3)**. The Project will be located within the Order limits (the land shown on the **Works Plans (Doc Ref. 2.3)** within which the Project can be carried out). The Order limits plan is provided as **ES Volume 3, Figure 1.2: Order Limits (Doc Ref. 5.3)**. Land within the Order limits is known as the 'Site'.

1.2.4 Areas where infrastructure development is proposed are identified by field numbers, which are shown on **ES Volume 3, Figure 2.1: Field Boundaries and Site Area Plan (Doc Ref. 5.3)**. The areas of the Site where infrastructure development is proposed are referred to as follows:

- South Western Area (Fields 1 to 9);
- Central Area (Fields 10 to 19 and 23 to 25);
- South Eastern Area (Fields 20 to 22);

- Northern Area (Fields 26 to 29);
- Project Substation (location of the Project Substation, in the north western section of Field 26);
- 'Cable Route Corridor' (export of electricity from the Project at 132kV via underground cables (the 'Grid Connection Cable') to the Sellindge Substation) and 'Cable Route Crossing' (use of an existing cable duct under the HS1 railway or through Horizontal Directional Drilling ('HDD') beneath HS1 for the Grid Connection Cable); and
- Sellindge Substation (location of the existing Sellindge Substation).

## 1.3 Document Structure

1.3.1 Following this introduction, this Outline OSWDS is structured as follows:

- Section 2: Site Appraisal;
- Section 3: Policy and Guidance;
- Section 4: Outline Surface Water Drainage Strategy; and
- Section 5: Conclusions.

# 2 Site Appraisal

## 2.1 Introduction

2.1.1 A full description of the hydrological context of the Site is provided in the Hydraulic Modelling Report ('HMR') within **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)**. A summary of the hydrological context relevant to this Outline OSWDS is provided below.

### Land Use

2.1.2 The Site is situated in a largely rural area with the village of Aldington present immediately to the south. Areas of greenfield land across the Site are used predominantly for agriculture and arable farming. The Site is bound to the north by the HS1 railway line and to the east and west by arable fields.

### Topography

2.1.3 Topographic data from on and around the Site, gathered using Light Detection and Ranging ('LiDAR') aerial photogrammetric techniques, has been downloaded from the Environment Agency open data website[1] and is included as **ES Volume 3, Figure 10.2: Site Topography (Doc Ref. 5.3)**. The data presented is a Digital Terrain Model ('DTM'). This is a bare earth model and thus excludes features such as built development and vegetation.

2.1.4 Ground levels locally are dominated by the local hydrology, particularly the East Stour River which flows in a westerly direction through the Site. The highest ground levels are present in the south and west of the Site due to a linear topographic ridge. The Goldwell Lane site entrance is situated on the crest of this ridge and has a maximum elevation of 76.0m Above Ordnance Datum ('AOD'). Lower ground levels are situated on and around watercourses. Field 19 is located in a low-lying area with ground levels falling to a Site minimum of 44.4m AOD.

2.1.5 Water levels in the East Stour River fall as it passes through the Site. Typically, in-channel water levels are around 1m lower than the immediately adjacent fields.

2.1.6 Ground levels in Field 26 fall from 61m AOD in the northwest of the Field to 47.6m AOD in the south of the Field on the northern bank of the East Stour River.

### Hydrology

2.1.7 The East Stour River is an Environment Agency ('EA') Main River which flows from east to west through and away from the Site. Upstream of the Site, the East Stour River drains a catchment area of approximately 33.7km$^2$. The East Stour River on its approach to the Site is joined by a number of unnamed tributaries.

2.1.8 Unnamed Tributary 1 rises in Brabourne, 3.7km north of the Site. The channel flows in a south westerly direction towards the Site to discharge into the East Stour River via a culvert beneath the railway line, to the west of Sellindge Substation. Upstream of the Site, the channel drains a catchment area[2] of approximately 8.18km$^2$ of predominantly arable land and grassland with some rural settlements including Brabourne and Brabourne Lees.

2.1.9 Unnamed Tributary 2 flows in a south westerly direction towards the Site and discharges into the East Stour River via a culvert beneath the railway line immediately east of Sellindge Substation. Upstream of the confluence, Unnamed Tributary 2 drains a catchment area[2] of approximately 13.1km$^2$ of predominantly grassland and arable land with some smallholdings present throughout.

2.1.10 Unnamed Tributary 3 rises from a small woodland area (Burch's Rough) approximately 2km south east of the Site and flows in a north westerly direction through the Aldington Flood Storage Area ('AFSA') towards the East Stour River, joining at a confluence approximately 200m downstream of the Mill House impoundment. Unnamed Tributary 3 drains a total catchment area[2] of approximately 4.94km$^2$ which is predominantly undeveloped arable land, woodland areas and some small farm holdings.

2.1.11 The embankment of the AFSA is located along the East Stour River between the Northern Area and Central Area. Only limited flows are allowed to pass through the embankment with excess water backing up and filling the upstream flood storage area ('FSA'). Once the FSA is full water over tops the embankment via an engineered spillway and renter the channel and floodplain of the East Stour River.

2.1.12 The Main Rivers and Ordinary Watercourses on and in the vicinity of the Site are shown in **ES Volume 3, Figure 10.3: Local Hydrology (Doc Ref. 5.3)**.

### Geology and Hydrogeology

#### Geology

2.1.13 The National Soils Resources Institute, Soilscapes website[3], indicates that soils across the Site comprise of *"Slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils"; "Loamy and clayey floodplain soils with naturally high groundwater"* and *"Freely draining slightly acid but base-rich soils".*

2.1.14 British Geology Survey ('BGS') mapping[4] indicates that the area is predominantly underlain by the Weald Clay Formation (Mudstone). Outcrops of the Hythe Formation (Sandstone and Limestone) are present in the west, east and south of the Site bound by the Atherfield Clay Formation. Superficial deposits of Alluvium are identified around the East Stour River in correspondence with the loamy and clayey floodplain soils.

2.1.15 Mapping of the bedrock and superficial geology are presented in **ES Volume 3, Figures 10.5: Superficial Geology (Doc Ref. 5.3)** and **10.6: Bedrock Geology (Doc Ref. 5.3)**.

### Hydrogeology

2.1.16 The Hythe Formation is classified as a "Principal" [5] aquifer system, which is defined as *"geology that exhibit high permeability and / or provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale".*

2.1.17 The remaining bedrock types locally are classified as unproductive aquifers which are rocks which have negligible significance for water supply.

2.1.18 The superficial Alluvium deposits are designated as a 'Secondary A' aquifer, defined as *"aquifers which comprise permeable layers that can support local water supplies and may form an important source of base flow to rivers".*

2.1.19 The Site is not located in a Source Protection Zone associated with groundwater abstractions.

## Flood Risk

2.1.20 A detailed assessment of flood risk has been undertaken in support of the Project. This is contained in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)**. This assessment, and the design of the Project, was supported by detailed hydraulic modelling of the East Stour River.

### Fluvial Flood Risk

2.1.21 The Site lies in an area designated as Flood Zones 1, 2 and 3a and 3b. The more detailed modelling undertaken in support of the Project confirms that this mapping, which presents the undefended situation, is broadly accurate.

2.1.22 The detailed modelling also included defended scenarios that include the function of the AFSA. This work indicated that:

- All fields within the Northern Area as well as land along the Cable Route Corridor, the Cable Route Crossing and the Sellindge Substation are shown to be at risk of flooding from floodwaters impounded behind the AFSA embankment. Such flooding will occur fairly frequently and for any moderately severe event the AFSA will reach capacity resulting in deep flood water in some areas and over topping of the embankment spillway. No flooding is however predicted within the area of Field 26 where the Project Substation will be located.
- Within the Central Area, Fields 15, 16, 18, 19, 23 and 24 are shown to be at risk of inundation. During both the design flood event and the extreme 0.1% Annual Exceedance Probability ('AEP') flood event, flood depths within the Central Area are however shown to remain below 0.8m.
- No fluvial flooding is predicted in the South Western or South Eastern Areas.

### Surface Water Flood Risk

2.1.23 With reference to the Long-Term Flood Risk[6] mapping, the risk of surface water flooding to the majority of the Site is shown to be 'Very Low' defined as 'a less than

0.1% AEP (1 in 1,000 chance) of flooding in any given year'. However, parts of the Site are shown to lie in areas considered to be at 'Low', 'Medium' and 'High' risk of surface water flooding.

2.1.24 A detailed review within **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** concludes that the large majority of the areas of elevated surface water flood risk relate to area within the fluvial floodplain and flow that are progressing along the corridor of the East Stour River. The risk associated with this is best represented by the fluvial flood risk modelling discussed above.

2.1.25 In addition, the **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** notes that as the Site sits on the downslope of a northwest to southeast topographic ridge off-Site flows discharge onto the Site are typically limited by small upgradient catchment areas.

2.1.26 Further management of surface water runoff from the Site is detailed within **Section 4** of this Outline OSWDS.

### Existing Drainage Regime

2.1.27 The Site currently comprises undeveloped greenfield land and therefore any rainfall onto the Site is either infiltrated to ground or discharges overland in line with the local topography to the southeast and into the East Stour River.

2.1.28 Given the prevailing ground conditions, water infiltrating to the ground will mostly be stored in the shallow sub-surface, or conveyed towards the local channel as shallow interflow. Deeper infiltration will be limited, but will occur in some areas, particularly on the high ground to the south which is underlain by the more permeable Hythe formation.

# 3 Policy and Guidance

## 3.1 Introduction

3.1.1 This Outline OSWDS has been produced in accordance with the following policy and guidance:

- Overarching National Policy Statement ('NPS') for Energy (EN-1) (2023)[7];
- NPS for Renewable Energy Infrastructure (EN-3) (2023)[8];
- National Planning Policy Framework (2023)[9];
- Ashford Local Plan 2030[10], including Policy ENV9 - Sustainable Drainage;
- Ashford Sustainable Drainage Supplementary Planning Document (2010)[11];
- Guide for Masterplanning Sustainable Drainage into Developments, Kent County Council (2013)[12];
- Construction Industry Research and Information Association ('CIRIA') C753 The SuDS Manual (2015)[13]; and
- Department for Environment, Food and Rural Affairs ('DEFRA'), Sustainable Drainage Systems: Non-Statutory Technical Standards1[14].

## 3.2 Policy and Guidance

### National Policy Statements

3.2.1 On 17 January 2024, NPS EN-1, NPS EN-3 and NPS EN-5[15] came into force. These NPSs are the relevant NPSs that have effect for the DCO application for the Project. Section 5.8 of NPS EN-1 relates to flood risk and sets out the requirements for an applicant's assessment.

3.2.2 While the primary basis for making decisions on applications for development consent is the relevant NPSs, other matters which the Secretary of State may consider to be important and relevant in decision making may include the development plan policies of the "Host" local authorities.

3.2.3 NPS EN-1 states in paragraph 4.1.12 that *"Other matters that the Secretary of State may consider both important and relevant to their decision-making may include Development Plan documents or other documents in the Local Development Framework".* However, it must also be noted that paragraph 4.1.15 states that *"In the event of a conflict between these documents and an NPS, the NPS prevails for the purposes of Secretary of State decision making given the national significance of the infrastructure"*.

3.2.4 Paragraph 5.8.36 of NPS EN-1 also states:

*"In determining an application for development consent, the Secretary of State should be satisfied that where relevant:*

- *the application is supported by an appropriate FRA*
- *the Sequential Test has been applied and satisfied as part of site selection*
- *a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk*
- *the proposal is in line with any relevant national and local flood risk management strategy*
- *SuDS (as required in the next paragraph on National Standards) have been used unless there is clear evidence that their use would be inappropriate*
- *in flood risk areas the project is designed and constructed to remain safe and operational during its lifetime, without increasing flood risk elsewhere (subject to the exceptions set out in paragraph 5.8.42)*
- *the project includes safe access and escape routes where required, as part of an agreed emergency plan, and that any residual risk can be safely managed over the lifetime of the development*
- *land that is likely to be needed for present or future flood risk management infrastructure has been appropriately safeguarded from development to the extent that development would not prevent or hinder its construction, operation or maintenance"*

3.2.5 NPS EN-1 provides further guidance that *"the Development Consent Order, or any associated planning obligations, will need to make provision for appropriate operation and maintenance of any SuDS throughout the project's lifetime. Where this is secured through the adoption of any SuDS features, any necessary access rights to property will need to be granted."* (paragraph 5.8.38)

3.2.6 NPS EN-3 states in specific reference to Solar PV, *"Where access tracks need to be provided, permeable tracks should be used, and localised Sustainable Drainage Systems (SuDS), such as swales and infiltration trenches, should be used to control any run-off where recommended."* (paragraph 2.10.85)

3.2.7 Furthermore, paragraph 2.10.154 of NPS EN-3 states *"Water management is a critical component of site design for ground mount solar plants. Where previous management of the site has involved intensive agricultural practice, solar sites can deliver significant ecosystem services value in the form of drainage, flood attenuation, natural wetland habitat, and water quality management."*

3.2.8 Current national planning policy guidance and best practice, namely the National Planning Policy Framework ('NPPF') and Planning Practice Guidance ('PPG'), require development proposals in all Flood Zones to seek opportunities to reduce the overall level of flood risk in the area and beyond through the layout and form of the development, and the appropriate application of SuDS.

3.2.9 The ABC Local Plan was adopted in February 2019, and includes a policy relating to Storm Water Management, as set out below.

***"Policy ENV9 – Sustainable Drainage***

*All development should include appropriate sustainable drainage systems (SuDS) for the disposal of surface water, in order to avoid any increase in flood risk or adverse impact on water quality, and to mimic the drainage from the pre-developed site.*

*On greenfield sites, development should discharge at a maximum of 4l/s/ha, or 10% below current greenfield rates for the existing 1:100 storm event, whichever is lower. There must be no increase in discharge rate from less severe rainfall events, with evidence submitted to demonstrate this principle.*

*On Previously Developed Land, development must endeavour to achieve 4 l/s/ha runoff or seek to achieve 50% reduction of existing peak runoff rates for the site where existing discharge rates can be established.*

*On smaller sites (less than 0.25ha), development should achieve a maximum discharge of 2l/s.*

*Any SuDS scheme must demonstrate regard to the adopted Sustainable Drainage SPD and any subsequent revisions.*

*SuDS features should always be the preferred option and provided onsite wherever practicable.*

*All development proposals will be required to:*

*a) Ensure all new developments are designed to reduce the risk of flooding, and maximise environmental gain, such as: water quality, water resources, biodiversity, landscape and recreational open space;*

*b) Ensure that all new developments are designed to mitigate and adapt to the effects of climate change;*

*c) Lower runoff flow rates, reducing the impact of urbanisation on flooding;*

*d) Protect or enhance water quality. Incorporating appropriate pollution control measures, to ensure there are no adverse impacts on the water quality of receiving waters, both during construction and in operation;*

*e) Be sympathetic to the environmental setting and the needs of the local community;*

*f) Incorporate a SuDS scheme that is coherent with the surrounding landscape and/or townscape;*

*g) Provide a habitat for wildlife in urban watercourses; and encourage natural groundwater recharge (where appropriate);*

*h) Demonstrate that opportunities have been taken to integrate sustainable drainage with biodiversity enhancements through appropriately designed surface water systems, as well as contribute to amenity and open spaces;*

*i) Demonstrate that the first 5mm of any rainfall event can be accommodated and disposed of on-site; and,*

*j) Demonstrate that clear arrangements have been established for the operation and maintenance of the SuDS component for the lifetime of the development."*

### Guidance

3.2.10 The Ashford Sustainable Drainage Supplementary Planning Document ('SPD') was adopted in 2010 to support relevant sustainable drainage policies in the Core Strategy (now superseded by the Local Plan). The SPD provides guidance to help planning and development integrate surface water management into the proposed development. The guidance provided in the SPD compliments national and local drainage requirements published in The SuDS Manual (CIRIA Report C753))[13], and the Local Plan policy.

3.2.11 This is similarly the case with regards to the 'Guide for Master planning Sustainable Drainage into Developments' provided by KCC, in their role as the Lead Local Flood Authority ('LLFA').

3.2.12 Current best practice guidance document, The Sustainable Drainage System ('SuDS') Manual (CIRIA Report C753))[13], promotes sustainable water management through the use of SuDS. There are four main categories of SuDS which are referred to as the 'four pillars of SuDS design'.

3.2.13 The SuDS Manual identifies a hierarchy of SuDS for managing runoff, which is commonly referred to as a 'management train'. The hierarchy of techniques is identified as:

- Prevention – the use of good site design and housekeeping measures on individual sites to prevent runoff and pollution (e.g. minimise areas of hard standing).
- Source Control – control of runoff at or very near its source (such as the use of rainwater harvesting).
- Site Control – management of water from several sub-catchments (including routing water from roofs and car parks to one/several large soakaways for the whole Site).
- Regional Control – management of runoff from several sites, typically in a retention pond or wetland.

3.2.14 It is generally accepted that the implementation of SuDS, as opposed to conventional drainage systems, provides a number of benefits by:

- Reducing peak flows to watercourses or sewers and potentially reducing the risk of flooding downstream;
- Reducing the volumes and frequency of water flowing directly to watercourses or sewers from developed sites;
- Improving water quality over conventional surface water sewers by removing pollutants from diffuse pollutant sources;
- Improving amenity through the provision of public open spaces and providing biodiversity and wildlife habitat enhancements; and
- Replicating natural drainage patterns, including the recharge of groundwater so that base flows are maintained.

3.2.15 The non statutory technical standards for SuDS published by DEFRA contain guidance for the design, maintenance and operation of sustainable drainage systems. This includes systems to drain surface water from housing, non-residential or mixed-use developments for the lifetime of the developments.

## 3.3 Climate Change

3.3.1 In February 2016, the Environment Agency issued updated guidance on the impacts of climate change on flood risk in the UK to support the NPPF[16]. This was most recently updated in May 2022 and sets out that peak rainfall intensity, sea level, peak river flow, offshore wind speed and extreme wave heights are all expected to increase in the future as a result of climate change. Consideration of the changes to these parameters should use the allowances outlined below based on the anticipated lifetime of the development. Changes to peak fluvial flows is the only factor of direct relevance to this Outline OSWDS.

3.3.2 The guidance acknowledges that there is considerable uncertainty with respect to the absolute level of change that is likely to occur. As such, the document provides estimates of possible changes that reflect a range of different emission scenarios. Updates issued in December 2019 brought the advice in line with the finding of UK Climate Projections 2018.

3.3.3 For peak rainfall intensity the guidance states that for a development with a project end of development lifetime between 2061 and 2100 (in this instance, 2067), the central allowance for the 2070s epoch should be used to assess the impacts of climate change on surface water flood risk and similarly drainage design. As detailed in **Table 3.1**, this equates to an uplift of 20%. Ashford Local Plan Policy ENV9 require that the upper end allowance is used for drainage design and therefore the allowance of 45% on the 1% AEP storm and 40% of the 3.3% AEP storm has been adopted for the Project.

Table 3.1: Peak Rainfall Intensity Allowance by Management Catchment

| Management Catchment | Annual Exceedance Probability (%) | Allowance Category | Total potential change anticipated for the 2050s | Total potential change for the 2070s |
|---|---|---|---|---|
| Stour | 3.3% | Upper End | 40% | 40% |
| | | Central | 20% | 20% |
| | 1% | Upper End | 45% | 45% |
| | | Central | 20% | 20% |

# 4 Outline Surface Water Drainage Strategy

## 4.1 Overview

4.1.1 This Outline OSWDS sets out principles and an outline design for managing storm water on the Site in line with best practice and the requirements of KCC, the LLFA for the area. This Outline OSWDS has been developed following consultation with KCC and reflects their comments raised through the DCO consultation process. Detail of their previous comments and how the Project responds to these are set out in **ES Volume 2, Chapter 10: Water Environment (Doc Ref. 5.2)**.

4.1.2 This Outline OSWDS considers the arrangements for managing storm water during the operational phase of the Project. Consideration of measures for managing storm water during construction and decommissioning are discussed in the **Outline Construction Environmental Management Plan ('Outline CEMP') (Doc Ref. 7.8)** and the **Outline Decommissioning Environmental Management Plan ('Outline DEMP') (Doc Ref. 7.12)**. Where appropriate consideration will however be given to delivering aspects of this Outline OSWDS at an early stage of construction to enhance pollution control during the construction phase.

4.1.3 This Outline OSWDS is intended to demonstrate that, given the nature and quantum of development proposed, it will be feasible to drain the Site in line with planning requirements using the proposed methodology.

4.1.4 The strategy focuses on three key areas of the Project. These are:

- the Project Substation for which an illustrative drainage design is presented in **Drawing 10.3.0001** in **Appendix B** ;
- the Inverter Stations (including BESS) for which a generic concept drainage design is presented in **Drawing 10.3.0002** in **Appendix B**; this design would be applied to each grouping; and
- the wider Site including the PV panel area (Work No.1) for which a concept layout showing drainage connectivity and the location of depression storage is provided in **Drawing 10.3.003** and across **Drawings 10.3.003A – 10.3.003L** in **Appendix B**.

4.1.5 While the proposed strategy follows required SuDS principles, in common with most drainage strategies put forward in support of planning applications, the drainage scheme presented here will be subject to any relevant consents and approval of the detailed design (secured by Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)**). The potential consents are identified in the **Schedule of Other Consents and Licences (Doc Ref. 3.4)**.

4.1.6 The PV panel area (Work No.1) will comprise rows of PV panels affixed to a metal frame supported by piles driven into the ground, minimizing the footprint (see **ES Volume 2, Chapter 3: Project Description (Doc Ref. 5.2)** for further details). The panels will be mounted at a minimum height of 0.8m AOD from the ground, ascending to a maximum height of 3.5m AOD. Installation of the PV panels does not involve the introduction of hardstanding at ground level meaning the superficial cover for the PV panels area will remain the same as the baseline.

4.1.7 Additionally, the PV panels will have regular rainwater gaps to prevent water being concentrated along a single drip line. Rainfall landing on the PV panels will drain through rainwater gaps and infiltrate into the ground beneath and between each row of panels.

4.1.8 The landscaping and biodiversity works do not entail the addition of hardstanding ensuring that there will be no alteration to the baseline conditions in these areas.

## 4.2 Pre-Development Runoff Rates

4.2.1 Greenfield runoff rates for the Site have been estimated through application of the Revitalised Flood Hydrograph Model (ReFH2). ReFH2 is recommended by the Environment Agency as the methodology for estimating flood peaks and hydrographs for small catchments[17].

4.2.2 SLR's Standard Order of Procedure for calculating greenfield runoff rates at the Site is provided as **Appendix A**.

4.2.3 In addition to the Flood Estimation Handbook ('FEH') parameters (obtained from FEH webservice for 1km grid) the following parameters were incorporated:

- Project Substation Impermeable Area: 0.788ha
- Inverter Station Impermeable Area: 0.097ha

4.2.4 The parameters obtained from FEH webservice have been reviewed with understanding of the local geological context and are considered suitable for the pre-development drained area. The greenfield runoff results are summarised in **Table 4.1** and the full results are included as **Appendix A**.

Table 4.1: Greenfield Runoff Rates

| Annual Probability | Greenfield Runoff Rate (l/s/ha) | Project Substation Area Runoff Rate (l/s/0.788ha) | Inverter Station Area Runoff Rate (l/s/0.097ha) |
|---|---|---|---|
| 100% | 4.00 | 3.2 | 0.4 |
| 50% | 4.50 | 3.5 | 0.4 |
| 3.3% | 9.40 | 7.4 | 0.9 |
| 1% | 12.00 | 9.5 | 1.2 |

4.2.5 The 100% annual probability rainfall runoff rate of 4l/s/ha matches Policy ENV9 – Sustainable Drainage in Ashford Borough Council's Local Plan 2030[120] which states that *'On greenfield sites, development should discharge at a maximum of 4l/s/ha, or 10% below current greenfield rates for the existing 1:100 storm event, whichever is lower'.* On this basis, runoff from developed areas will be restricted to 4l/s/ha, mimicking the 100% annual probability runoff rate for the area.

4.2.6 This results in a maximum permissible discharge rate of 3.2l/s for the Project Substation, and 0.4l/s for each Inverter Station.

## 4.3 Constraints on the Use of SuDS

### Topography

#### Project Substation

4.3.1 Ground levels across Field 26 fall in a southerly direction towards the East Stour River. The Project Substation will be located in the north western corner of Field 26 on a level platform. SuDS features will need to be downgradient of the Project Substation to allow for a drainage scheme via gravity.

#### Other Infrastructure (including Inverter Stations)

4.3.2 More generally ground levels on the Site tend to slope towards the course of the East Stour River. Any features intended to receive runoff will need to be located downgradient of infrastructure.

### Geology and Hydrogeology

#### Project Substation

4.3.3 The bedrock geology underneath Field 26 is predominantly clay which has low permeability and therefore would not support the discharge of surface water runoff to ground. Whilst there are more permeable alluvium deposits locally, groundwater flows are likely perched above the underlying clay aquitard. During periods of prolonged heavy rainfall or when the East Stour River is in flood, groundwater levels in the alluvium are likely shallow (in continuum with fluvial flood levels) and therefore not appropriate for infiltration of surface water flow.

#### Inverter Stations

4.3.4 SuDS Guidance published by KCC[12] requires that the first 5mm of any rainfall event is infiltrated to ground. Procedures must be in place to prevent discharge from the Site when necessary due to the potential for contamination following fire. Allowing flows to therefore discharge to ground at the source (i.e., through gravel subbases) is not appropriate.

#### Other Infrastructure

4.3.5 All other SuDS features will remain unlined to allow for the infiltration of the first 5mm of rainfall.

### Hydrology

#### Project Substation

4.3.6 Field 26 is bound to the south by the East Stour River and to the east by Unnamed Tributary 1. There are two potential watercourses that surface water flows from the Site can reasonably discharge to dependant on the location of SuDS. These watercourses join at a confluence to the south of the Site and attenuation would be provided to greenfield rates to ensure that discharge rates into the local watercourse network do not exceed existing.

#### Other Infrastructure (including Inverter Stations)

4.3.7 The Project proposes a series of new ditches within hedgerows and filter drains which will improve connectivity through the Site and convey flow towards the East Stour River or its tributaries. Surface water runoff shed from other infrastructure could therefore be routed into the local watercourse network.

### Flood Risk

4.3.8 SuDS features which are used for hydraulic control will all be located outside of the design flood extent.

4.3.9 The Flood Risk Assessment at **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4)** concludes that the Project Substation and all Inverter Stations are located in areas not considered to be at risk of flooding under design flood conditions (1% AEP plus 55% climate change).

### Pollution Control

#### Project Substation and Inverter Stations

4.3.10 Guidance exists relating to pollution control, associated with use of oil within transformers and water and foams[18] used to suppress fire in the event of a failure. To comply with this guidance direct infiltration from the Project Substation area and from the Inverter Stations will not be permitted and measures will be provided to ensure that flows can be contained and held back in these areas in the event of a pollution incident.

#### Other Infrastructure

4.3.11 Pollution control measures are not required for all other infrastructure within the Site.

## 4.4 Proposed Catchment Area Schedule

4.4.1 Based on the **Illustrative Project Layout** (see the **Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6)**), the contributing catchment areas on-Site which require a positive drainage connection and flow control are:

- the Project Substation; and
- each of the Inverter Stations.

4.4.2 It is proposed that runoff shed from the Sellindge Substation extension works will tie into the existing drainage infrastructure. Rainfall onto all other areas of the Site will mimic the existing greenfield regime and infiltrate to ground or flow overland accordingly.

4.4.3 The Project will not result in new impermeable surfaces within any of the remaining areas of the Site. Rainfall on these areas, which include the area of PV arrays, will either infiltrate to ground or generate runoff at existing greenfield rates.

#### Project Substation

4.4.4 The contributing area of the Project Substation is 0.788ha, however this will be split between impermeable development areas, gravel (permeable, but lined) compound and areas for the proposed SuDS features. The breakdown between the land use types is 1,870m$^2$ impermeable, 4,930m$^2$ permeable, but lined areas and 1,080m$^2$ for open SuDS features (swale).

#### Inverter Stations

4.4.5 The Inverter Stations which are distributed across the Site are of variable sizes however typical dimensions are approximately 0.097ha / 970m$^2$ with approximately 0.048ha / 485m$^2$ impermeable area. The remaining 0.048ha / 485m$^2$ is available within the Inverter Station footprint for permeable gravel cover (underlined to prevent infiltration).

### 4.5 Proposed Discharge Arrangement

4.5.1 With reference to the SuDS Manual, the hierarchy of preferred disposal options for surface water runoff from development sites in decreasing order of sustainability is as follows:

- Infiltration to Ground;
- Discharge to Surface Waters; and
- Discharge to Sewer.

4.5.2 **Table 4.2** summarises the suitability of disposal methods in the context of the Site and the Project. Based on the SuDS Manual drainage hierarchy and the site-specific suitability, discharging to surface water is the preferred approach as outlined in **Table 4.3**.

Table 4.2: Suitability of Surface Water Disposal Methods

| Surface Water Disposal Method (in Order of Preference) | Suitability Description |
|---|---|
| Infiltration to Ground | Bedrock geology around the Project Substation comprises of unproductive clay which does not have sufficient permeability to support infiltration to ground. |

| Surface Water Disposal Method (in Order of Preference) | Suitability Description |
|---|---|
| | Groundwater flows in alluvium deposits locally are likely perched above the underlying clay aquitard and may be present at shallow depths during periods of fluvial flooding. On this basis, infiltration to ground is not achievable around the Project Substation.<br><br>The Inverter Stations are located throughout the Site, including areas where more permeable geology prevails. In these areas infiltration may be possible; however concern about pollution control precludes direct infiltration from the Inverter Stations.<br><br>Runoff which is shed from the PV panels will mimic the existing greenfield regime and infiltrate to ground where possible. |
| Surface Water Discharge | The East Stour River and tributaries of the main river are present within the Order limits. Surface water disposal into these watercourses is possible at the Site. |
| Sewer Discharge | Surface water sewers locally (if available) are likely routed along local road networks (i.e., raised above Field 26) and outfall into the East Stour River. Given that there are more preferred options for discharge this scenario has not been explored further. |

4.5.3 It is envisaged that surface water runoff from the Project Substation and Inverter Stations will be routed into the surface water network within the Order limits.

4.5.4 Rainfall which is shed from the PV panels will mimic the existing regime and infiltrate to ground or flow overland into local watercourses.

4.5.5 Runoff from the Sellindge Substation extension works will tie into the existing surface water drainage system which likely outfalls into a watercourse.

## 4.6 Conceptual Surface Water Drainage Strategy

4.6.1 As outlined within paragraph 4.1.4, the strategy is based on the **Illustrative Project Layout (Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6)**).

4.6.2 The conceptual surface water drainage strategy has been developed in such a way that the proposed drainage arrangements can be constructed and operated without adversely affecting the operation of the AFSA or the ability for the Environment Agency to access their assets. This is discussed in greater detail within **ES Volume 4, Appendix 10.4: AFSA Risk Assessment (Doc Ref. 5.4)**.

### Project Substation

4.6.3 Runoff from the Project Substation will be attenuated and discharged to a tributary of the East Stour River for all events up to and including the 1% AEP with a 20% uplift to account for increases in peak rainfall intensity.

4.6.4 Runoff that is shed from impermeable areas within the Project Substation will discharge onto adjacent gravelled areas and percolate into the void space of the gravel.

4.6.5 The gravel compound will be lined and fitted with a penstock to prevent flow discharging to ground or onward towards a watercourse in the event of a pollution incident or contaminated firewater.

4.6.6 Flows will be partially restricted within the gravel by an orifice which will allow runoff via a number of rocky cascades (for energy dissipation) into a lined swale at the toe of the Project Substation platform.

4.6.7 Discharge from the swale will be restricted to the 100% annual probability greenfield runoff rate. These flows will pass into a shallow unlined wetland area located within the FSA (Field 26). There would be no uplift in ground level in this area (the FSA) as a result of the unlined wetland area. This is not required for hydraulic control and is being created for amenity, biodiversity and water quality benefit. Flows from the wetland area will overtop into a tributary of the East Stour River along the south eastern boundary of the Project Substation.

4.6.8 The wetland area also provides the benefit of creating additional storage within the Aldington Flood Storage Area. This effect is quantified in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4).** The final detailed design for this feature, and other small ecological ponds and scrapes, will ensure that there is a net increase in flood storage provided within the Aldington Flood Storage Area.

4.6.9 The proposed approach for discharge surface runoff from the Project Substation avoids the need for engineering works to the East Stour River and will ensure that the outfall connection to the tributary is naturalised and sympathetic with any hard structures required (overflow weir for wetland) set back from the channel.

4.6.10 For larger storms this system will provide a significant reduction in runoff rates from the Project Substation area. The wetland area provided within the FSA will also increase the volume of storage and further contribute towards alleviating downstream fluvial flood risk.

4.6.11 The outline surface water drainage for the Project Substation is presented in **Drawing 10.3.001** in **Appendix B**.

### Inverter Stations

4.6.12 The Inverter Stations will comprise inverters, transformers and switchgear as well as BESS units. These will be located on concrete plinths surrounded by gravels. Runoff which is shed from the hard surfaces will percolate into the gravel which provide capacity to hold and slow flows prior to onward discharge.

4.6.13 The gravel compounds will be lined and fitted with a penstock to prevent flow discharging to the ground or watercourses in the event of a pollution incident or contaminated firewater.

4.6.14 Water within the gravels will be allowed to discharge through the surrounding raised bunding via a hydrobrake at a restricted rate of 0.4l/s.

4.6.15 A generic outline surface water drainage for a typical Inverter Station is presented in **Drawing 10.3.002** in **Appendix B.**

4.6.16 To allow for positive discharge from all of these areas a number of new ditches and filter drains will be constructed. The proposed alignment of these features is shown on **Drawings 10.3.003** and across **Drawings 10.3.003A – 10.3.003L** in **Appendix B**. The new ditches will be formed beneath proposed hedge lines where connectivity to the existing watercourse network is possible via gravity. These new ditches and filter drains will receive the attenuated flows from the Inverter Stations and will be unlined to encourage infiltration. These features will provide additional storage capacity for water within the Site whilst providing ecological enhancement in some areas.

4.6.17 The proposed approach for discharging stormwater runoff from the Inverter Stations avoids the need for engineering works to the East Stour River and will ensure that the outfall connection to existing waterbodies is naturalised and sympathetic with any hard structures required (pipe outlets) set back from the channel.

### PV Panels

4.6.18 Following the 2022 Statutory Consultation, KCC's response stated *'The County Council recommends that the Operational Surface Water Plan (OSWP) considers not only how surface water from the ancillary structures will be dealt with, but how rainfall upon the solar arrays themselves will be managed. […] It is essential that runoff is not increased to safeguard neighbouring areas of land.'*

4.6.19 Storm water falling on the PV panels will discharge to the ground immediately beneath which will be vegetated. Careful land management will be used to retain and enhance natural vegetation such that storm water continues to be able to discharge into the soils at or immediately downgradient of the PV panels. This will recreate the natural runoff patterns and ensure no uplift in discharge from these areas.

4.6.20 Noting however the concerns raised by KCC, and also the Internal Drainage Board ('IDB'), depression storage features are proposed in areas down gradient of the PV panels throughout the Site.  These will intercept any surface runoff from the land on around the PV panels and encourage infiltration and evaporation through formation of lush wetland habitat. These will help ensure that adverse impacts on Site runoff are avoided.

4.6.21 The depression features will not have formal outfalls and once full, will overtop and discharge downgradient into the local ditch network. The depression storage will remain unlined to enhance runoff to ground where applicable. The depression storage has been located in downgradient areas where access is not required preventing the creation of saturated ground conditions in areas where vehicle access is required.

4.6.22 As part of the process of detail design testing will be undertaken to confirm that the areas of depression storage, once constructed, will be free draining (i.e. water levels will drop to 50% of capacity within 24 hours) as a result of seepage and infiltration into the shallow alluvium and soils. In any locations where the test results indicate that this will not readily be achieved the depression storage design will be amended to ensure it is free draining. This will involve excavating a slot drain on the downgradient side of the depression which will be backfilled with permeable sand and gravel and turfed over. This will then provide a permeable preferential sub surface discharge route and allow water to gradually discharge at a seepage face on the undeveloped down gradient slope.

4.6.23 Ensuring that all of the depression storage created is free draining will provide capacity for repeat storms and prevent longer term water logging and flooding and associated uplifts in runoff rates.

4.6.24 The depression storage also provides the function of offsetting minor losses in flood storage associated with the volume of the PV array frames. This effect is quantified in **ES Volume 4, Appendix 10.2: Flood Risk Assessment (Doc Ref. 5.4).** The final detailed design for these areas of depression storage will ensure that there is no net loss in flood storage in the area downstream of the Aldington Flood Storage Area.

4.6.25 If infrastructure such as access routes are required through areas where waterlogging currently occurs due to the existing topography and geology, shallow filter drains will be installed. These would intercept runoff and shallow sub surface flows and route these via depression storage where water can infiltrate or over top into surface water features. The act of reducing water logging of the ground should mean that runoff rates during large winter storms are slightly reduced.

4.6.26 A conceptual surface water drainage layout for the Site showing the location of the proposed depression storage is provided in **Drawings 10.3.0003** and **10.3.003A – 10.3.003I** in **Appendix B**. A detail showing the arrangement for ensuring that the depression storage areas are free draining is provided on **Drawing 011998.00001_002** in **Appendix B**.

### SuDS Attenuation Storage

4.6.27 Temporary storage volumes were estimated using Flow+[1]; an appropriate methodology for Planning and Masterplanning purposes.

4.6.28 The FEH 22 rainfall model was used with a design standard return period of 1% AEP (1 in 100-year return period) plus an allowance for climate change as

[1] Flow+ v10.6.234, Causeway Technologies Ltd, Copyright 1988-2023

recommended within the NPPF and requested by KCC (applied as a 45% uplift in peak rainfall intensity).

### Project Substation

4.6.29 The following parameters have been incorporated into the modelling for the Project Substation:

- Contributing Area: 0.788ha (0.187ha impermeable, 0.493ha lined permeable/gravel compound and 0.108ha open SuDS)

*Gravel Compound*

- Cover Level: 56.0m AOD
- Invert Level: 55.5m AOD
- Porosity: 0.3
- Surface Area: 4,930m$^2$ (70.2m x 70.2m)
- Slope: 1:9999
- Orifice Outflow Control:
  - Design Depth: 0.5m
  - Diameter: 0.1m
  - Discharge Coefficient: 0.6

*Swale*

- Cover Level: 50.5m AOD
- Invert Level:49.5m AOD
- Base Area: 264m$^2$
- Top of Bank Area: 1,080m$^2$
- Hydrobrake Outflow Control:
  - Invert Level: 49.5m AOD
  - Design Depth: 1m
  - Design Flow: 3.2l/s

4.6.30 Outputs from the modelling are provided as **Appendix C** which demonstrate sufficient capacity in the gravel area of the compound and within the swale for all events up to and including the 1% AEP plus 45% climate change whilst reducing flows to 3.2l/s; mimicking the 100% AEP greenfield runoff rate.

### Inverter Stations

4.6.31 The average area for the Inverter Station is approximately 970m$^2$ with around half of this area consisting of infrastructure (containers) on concrete plinths with the remaining area being the gravel compound. The concrete plinths will be raised 150mm above the gravel surface within the compound cover level.

4.6.32 Bunding around the Inverter Station, as well as raised ground along any other access points, will be watertight to 125mm above the gravel surface (i.e., standard kerb height), thus retaining exceedance flows to 125mm above the ground level. The 150mm freeboard provided for the concrete plinths will ensure all sensitive infrastructure will always remain flood free.

4.6.33 Flows discharging from the gravel will be restricted to 0.4l/s using a Hydrobrake vortex flow control device. To achieve this a hydrobrake with an aperture of 0.027m will be required. BS8582:2013[19] confirms that controls <25 mm are possible if protected. In this instance all water will be draining via the gravel subbase which will provide protection and prevent material that could result in blockages migrating towards the flow control. Enhanced maintenance checks are also specified in Section 4.9 to further manage the risk of blockage at these outlets.

4.6.34 Temporary storage volumes for a typical Inverter Station dimension were estimated using Flow+1. Modelled parameters are summarised below.

- Impermeable Area: 0.097ha (485m$^2$ impermeable area, 485m$^2$ gravel surface)
- Cover Level: 100.125m AOD
- Invert Level: 99.5m AOD
- Gravel Depth: 0.5m
- Gravel Porosity: 0.3
- Surface Area: 485m$^2$ (22m x 22m)
- Slope: 1:1,000
- Hydrobrake Outflow Control:
  - Invert Level: 99.5m AOD
  - Design Depth: 0.5m
  - Design Flow: 0.4l/s

*Note: Cover levels and invert levels within the model outputs are indicative only and should be adjusted for the relevant cover and invert levels of each convertor station.*

4.6.35 The Inverter Stations will each be individually modelled as part of the detailed surface water drainage design process.

4.6.36 Outputs from the modelling are provided as **Appendix D**, and demonstrate that excess runoff will be retained within the Inverter Station for all events up to and including the 1% AEP plus 45% climate change whilst reducing flows to 0.4l/s.

4.6.37 During a critical 1% AEP plus 45% climate change event, the model predicts that water will surcharge from the gravel compound resulting in standing water across the Inverter Station platform to a depth of 0.085m. As stated above, all infrastructure will be raised 150mm above the gravel surface and so would not be at risk of inundation.

### PV Arrays

4.6.38 As discussed above the construction of the PV panels will not adversely impact runoff rates. As such, it is not possible to undertake drainage modelling to quantify changes and the associated required attenuation volumes from the PV panels.

4.6.39 As set out in **Section 10.3** of **ES Volume 2, Chapter 10: Water Environment (Doc Ref. 5.2)** both KCC and the IDB have requested that measures are included to manage runoff off of the land where the PV panels will be installed. Depression storage will therefore be provided across the Site on the downslope of PV panels to intercept runoff from the land such that the Project should provide a small beneficial impact in terms of runoff rates progressing to the East Stour River. These measures are secured via this Outline OSWDS.

4.6.40 The precise dimension for the depression storage will be determined at the detailed design stage on a location-by-location basis. Typical dimensions are however provided below:

- Basal Width: 0.5m
- Top of Bank Width: 3.5m
- Depth: 0.5m
- Cross Sectional Area: 1m$^2$

## SuDS Performance

### Project Substation and Inverter Stations

4.6.41 The suite of SuDS features will provide attenuation of surface water runoff prior to discharge to surface water features around the Site. The design event of the 1% AEP plus 45% climate change event has been used to inform the drainage design.

4.6.42 Results from the modelling are summarised below in **Table 4.3**, which demonstrate that there is sufficient capacity in the swale and gravel compound for the design 1% AEP plus 45% climate change event.

Table 4.3: SuDS Performance

| | Annual Exceedance Probability | Critical Event | Peak Water Depth (m) | Post Development Runoff Rate (l/s) | Maximum Volume (m$^3$) |
|---|---|---|---|---|---|
| Project Substation (compound) | 1% plus 45% climate change | 5760 min Summer | 0.480 | - | 717 |
| Project Substation (swale) | | 2160 min Summer | 0.866 | 3.2 | 538 |

| | Annual Exceedance Probability | Critical Event | Peak Water Depth (m) | Post Development Runoff Rate (l/s) | Maximum Volume ($m^3$) |
|---|---|---|---|---|---|
| Inverter Station | | 2160 min Winter | 0.585 | 0.4 | 114.2 |

4.6.43 Runoff rates during extreme events will be reduced for both the Project Substation and Inverter Station. This is summarised per rainfall event in **Table 4.4**. Under design event conditions, the surface water drainage will not increase runoff from the Project and instead offers a reduction in runoff of up to 67%.

Table 4.4: Comparison of Pre and Post Development Runoff Rates

| Annual Exceedance Probability (%) | Greenfield Runoff Rate (l/s) | Post Development Runoff Rate (l/s) | Reduction in Runoff Rate | |
|---|---|---|---|---|
| | | | l/s | % |
| Project Substation | | | | |
| 50% | 3.5 | 2.7 | 0.8 | 23 |
| 3.3% | 7.4 | 3.2 | 4.2 | 57 |
| 3.3% + 40% CC | 7.4 | 3.2 | 4.2 | 57 |
| 1% | 9.5 | 3.2 | 6.3 | 66 |
| 1% + 45% CC | 9.5 | 3.2 | 6.3 | 66 |
| Inverter Station | | | | |
| 50% | 0.4 | 0.4 | 0 | 0 |
| 3.3% | 0.9 | 0.4 | 0.5 | 56 |
| 3.3% + 40% CC | 0.9 | 0.4 | 0.5 | 56 |
| 1% | 1.2 | 0.4 | 0.8 | 67 |
| 1% + 45% CC | 1.2 | 0.4 | 0.8 | 67 |

Comparison is made for the 3.3% + 40% CC and 1% AEP+ 45% CC rainfall events using the present day AEP runoff rate.

4.6.44 In line with NPS EN-1, **Table 4.5** below provides comparison between the pre-development and post-development 6-hour runoff volumes from the Site. The modelling predicts a small increase in discharge volume (4.4m$^3$) during the 50% AEP but reductions of up to 43% for rarer events.

Table 4.5: Comparison of Pre and Post Development 6-hour Runoff Volumes

| Annual Exceedance Probability (%) | 6-hour Greenfield Runoff Volume (m$^3$) | 6-hour Post Development Runoff Volume (m$^3$) | Reduction in Runoff Volume | |
|---|---|---|---|---|
| | | | m$^3$ | % |
| 50% | 59.9 | 64.3 | - | - |
| 3.3% | 126.8 | 89.8 | 37 | 29 |
| 3.3% + 40% CC | 126.8 | 97.6 | 29.2 | 23 |
| 1% | 166.4 | 95.6 | 70.8 | 43 |
| 1% + 45% CC | 166.4 | 102.3 | 64.1 | 39 |

Comparison is made for the 3.3% + 40% CC and 1% AEP+ 45% CC rainfall events using the present day 6-hour AEP runoff volume.

### SuDS Assessment of Water Quality

4.6.45 SuDS provide a number of water quality benefits, and the proposed surface water management strategy utilises gravel compounds for interception and attenuation of flows. A swale is provided to further attenuate flows from the Project Substation which outfalls into a wetland for water quality and biodiversity benefits.

4.6.46 The simple index method, as outlined within the SuDS Manual, provides a way of quantifying the benefit to water quality of the SuDS Management Train. The pollution hazard from the land use and the mitigation from the SuDS component are each assigned an index. The total mitigation index must be greater than the pollution hazard index for adequate treatment to be delivered.

Total SuDS mitigation index ≥ pollution hazard index

(for each contaminant type) (for each containment type)

4.6.47 The total SuDS mitigation is the summation of the first components mitigation index and half the mitigation index of any subsequent component.

4.6.48 With reference to the SuDS Manual, post-development surface water runoff generated from the scheme is considered to have a 'Low' Pollution Hazard Level respectively as presented in **Table 4.6**.

4.6.49 It is envisaged that the Project Substation will be largely unmanned with access required for primarily maintenance purposes. Drainage assumptions are based on the conservative scenario of the Project Substation providing a pollution hazard level equivalent to low trafficked roads.

4.6.50 Internal access tracks will be provided for maintenance and emergency access to the BESS located in Work No. 2 with a minimum width of 3.7m and a carrying load in compliance with Building Regulations and NFCC Guidance. The internal access tracks will be constructed using a 90% permeable grass-paving hardstanding surface with foundations with an approximate depth of 300mm. Published industry standard guidance does not explicitly state a pollution hazard level for Inverter Stations and therefore this is assumed to be equivalent to industrial or commercial roofs.

Table 4.6: Pollution Hazard Potential of the Project

| Land Use | Pollution Hazard Level | Pollution Hazard Indices | | |
|---|---|---|---|---|
| | | Total Suspended Solids (TSS) | Metals | Hydro-Carbons |
| Project Substation<br>*(low traffic roads)* | Low | 0.5 | 0.4 | 0.4 |
| Inverter Station<br>*(Other roofs – industrial / commercial)* | Low | 0.3 | 0.2 | 0.05 |

4.6.51 The proposed drainage system is required to demonstrate sufficient treatment capability to manage the specified Pollution Hazard Indices.

4.6.52 As discussed above it is proposed that flows from the Project Substation will discharge through the gravel subbase of the compound, into a swale which then outfalls into a wetland feature. This system will provide 3 tiers of treatment.

4.6.53 Flows shed from the Inverter Station platform will percolate via the gravel subbase of the compound prior to discharge.

4.6.54 The SuDS mitigation indices for the proposed SuDS features discussed are provided in **Table 4.7**. It is assumed that the gravel compounds will have the equivalent mitigation indices of an infiltration trench.

Table 4.7: SuDS Mitigation Indices for the Project

| SuDS Component | Mitigation Indices | | |
|---|---|---|---|
| | Total Suspended Solids (TSS) | Metals | Hydro-Carbons |
| Gravel Subbase (Infiltration Trench) | 0.4 | 0.4 | 0.4 |
| Swale | 0.5 | 0.6 | 0.6 |
| Wetland | 0.8 | 0.8 | 0.8 |

4.6.55 **Table 4.8** compares the SuDS Mitigation Indices, provided by the proposed 'Source Control', 'Conveyance' and 'Site Control' measures against the Pollution Hazard Indices.

Table 4.8: SuDS Performance: Water Quality Indices

| Land Use | Pollution Hazard Indices | Pollution Hazard and SuDS Mitigation Indices Comparison | | | | | |
|---|---|---|---|---|---|---|---|
| | | Total Suspended Solids (TSS) | | Metals | | Hydro-Carbons | |
| | | Pollution Index | SuDS Mitigation Index | Pollution Index | SuDS Mitigation Index | Pollution Index | SuDS Mitigation Index |
| Substation *(low traffic roads)* | Low | 0.5 | 1.05 | 0.4 | 1.1 | 0.4 | 1.1 |
| Convertor Station *(Other roofs – industrial / commercial)* | Low | 0.3 | 0.4 | 0.2 | 0.4 | 0.05 | 0.4 |

4.6.56 As the SuDS Mitigation Index provided by the proposed SuDS measures are ≥ Pollution Hazard Index the water quality assessment criteria are satisfied for the Site.

## 4.7 SuDS Construction

4.7.1 A Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)** requires that prior to the operation of the authorised development an OSWDS for the operation of the authorised development must be submitted to and approved by the local planning authority, in consultation with KCC.

4.7.2 The information developed and submitted for approval as part of the detailed drainage design will include:

- Topographic and intrusive survey data as necessary to support designs;
- Full construction engineering drawings;
- Supporting calculations; and
- Details (if appropriate) of how and why the details presented vary from the outline strategy detailed in this report.

4.7.3 Where required outfalls to ordinary watercourses will be subject to land drainage consent from the IDB or ordinary watercourse consent from KCC.

4.7.4 No outfalls to the River East Stour are required and as such there will be no need for a Flood Risk Activity Permit to facilitate the delivery of the proposed surface water drainage system.

4.7.5 The construction of the SuDS features detailed and discussed will be subject to the controls and methodology set out in the **Outline CEMP (Doc Ref. 7.8)**. Further details will ultimately be provided within the detailed CEMP(s).

## 4.8 Firewater Storage

4.8.1 There is a potential for risk of fire at the BESS Units and to a lesser degree for other infrastructure within the Inverter Stations and at the Project Substation. The BESS will be designed with multiple layers of protection to minimise the chances of a fire or thermal runaway. This will include integrated fire detection with automated suppression systems to deal with electrical fires.

4.8.2 Water and foams applied to and around this infrastructure to control such an occurrence (i.e. fire water) pose a potential source of pollutants. The Inverter Stations and Project Substations compounds will be constructed with an impermeable lining and with stormwater storage provided above this within a gravel subbase.

4.8.3 A control point / shut off valve will be provided on the storm water outfall so that polluted flows from this source can be retained within the platform areas. The automated suppression system will include measures that ensure that the valves are shut in the event of a fire. Facility will also exist for manually shutting valves in the event of a different kind of pollution incident.

4.8.4 Polluted water, such as could arise following a fire, would be retained within the platforms of both the Inverter Stations and the Project Substation. Significant storage volumes are provided within the concept design and at the detailed design stage checks will be made to confirm that sufficient storage is provided to contain likely volumes of polluted water. If necessary, the volume of water that could be contained within the platform could readily be increased by raising the bunded height.

4.8.5 Firewater collected and retained within the affected compound area would be pumped to tanker and removed from Site for treatment and disposal at a suitable licenced facility. Following a fire event, the drainage network will require an assessment to confirm the absence of any contaminants prior to the penstock being released. The Project operator will be responsible for conducting a controlled flushing of the drainage network prior to opening the shut off valve.

## 4.9 SuDS Operation and Maintenance

4.9.1 A full SuDS maintenance plan will be produced as part of the detailed drainage design for the Project and included within the detailed OSWDS. The precise requirements will depend on manufacture specifications of the final design.

4.9.2 Within the indicative layout **(Illustrative Project Drawings - Not for Approval (Doc Ref. 2.6))** a minimum of 3m wide corridors are provided alongside and to route each SuDS feature to facilitate access for maintenance throughout the lifetime of the development.

4.9.3 The maintenance of all SuDS features will be the responsibility of the undertaker or an associated third-party contractor. Maintenance and operation of the Sellindge Substation will be the responsibility of National Grid and/or UKPN.

4.9.4 An outline of the typical maintenance requirements of each proposed SuDS feature is provided below.

### Gravel Compound

4.9.5 The anticipated maintenance and management for the gravel compounds associated with the surface water drainage system is outlined in **Table 4.9**.

Table 4.9: Typical Infiltration Trench / Gravel Compound Maintenance Requirements

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| Regular Maintenance | Remove litter (including leaf litter) and debris from drain surface, access chambers and pre-treatment devices | Monthly, or as required |

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| | Inspect surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage | Monthly |
| | Inspect pre-treatment systems, inlets, and perforated pipework for silt accumulation, and establish appropriate silt removal frequencies | Six monthly |
| Occasional Maintenance | Remove or control tree roots where they are encroaching the sides of the filter drain, using recommended methods (e.g., NJUG, 2007[20] or BS 3998:2010[21]) | As required |
| | Clear perforated pipework of blockages | As required |

### Swale and Depression Storage

4.9.6 The anticipated maintenance and management for the swale and depression storage associated with the surface water drainage system is outlined in **Table 4.10**.

Table 4.10: Typical Swale Maintenance Requirements

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| Regular Maintenance | Remove litter and debris | Monthly, or as required |
| | Cut grass to retain grass height within specified design range | Monthly (during growing season), or as required |
| | Manage other vegetation and remove nuisance plants | Monthly for first six months, then as required |
| | Inspect inlets and overflows for blockages, and clear if required | Monthly |

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| | Inspect infiltration surfaces for ponding, compaction, silt accumulation, record areas where water is ponding > 48 hours | Monthly, or when required |
| | Inspect vegetation coverage | Monthly for 6 months, quarterly for 2 years, then half yearly |
| | Inspect inlets and facility surface for silt accumulation, establish appropriate slit removal frequencies | As required or if bare soil is exposed over 10% or more of the swale treatment area |
| Occasional Maintenance | Reseed areas of poor vegetation growth, alter plan types to better suit conditions, if required | Annually |
| Remedial Actions | Repair erosion or other damage by re-turfing or reseeding | As required |
| | Relevel uneven surfaces and reinstate design levels | As required |
| | Scarify and spike topsoil layer to improve infiltration performance, break up silt deposits and prevent compaction of the soil surface | As required |
| | Remove build-up of sediment on upstream gravel trench, flow spreader or at top of filter strip | As required |
| | Remove and dispose of oils or petrol residues using safe standard practices | As required |

### Wetland

4.9.7 The anticipated maintenance and management for the wetland associated with the surface water drainage system is outlined in **Table 4.11**.

Table 4.11: Typical Wetland Maintenance Requirements

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| Regular Maintenance | Remove litter and debris | Monthly |
| | Cut grass- public areas | Monthly (during growing season) |
| | Cut the meadow grass | Half yearly (spring- before nesting season, and autumn) |
| | Inspect marginal and bankside vegetation and remove nuisance plants | Monthly for first 12 months, then as required |
| | Inspect inlets, outlets, banksides, structures, pipework etc for evidence of blockage and/or physical damage | Monthly |
| | Inspect water body for signs of poor water quality | Monthly (May – October) |
| | Inspect silt accumulation rates in any forebay and in main body of the pond and establish appropriate removal frequencies, undertake contamination testing once some build up has occurred, to inform management and disposal options | Half yearly |
| | Check any penstocks and other mechanical devices | Half yearly |
| | Hand cut submerged and emergent aquatic plants (at minimum 0.1m above pond | Annually |

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| | base; include max 25% of pond surface) | |
| | Remove 25% of bank vegetation from waters edge to a minimum of 1m above water level | Annually |
| | Tidy all dead growth (scrub clearance) before start of growing season (Note: tree maintenance is usually part of overall landscape management contract) | Annually |
| | Remove sediment from any forebay | Every 1-5 years, or as required |
| | Remove sediment and planting from one quadrant of the main body of ponds without sediment forebays | Every 5 years, or as required |
| Occasional Maintenance | Remove sediment from the main body of big ponds when the pool volume is reduced by 20% | With effective pre-treatment, this will only be required rarely, e.g., 25-50 years |
| Remedial Actions | Repair erosion or other damage | As required |
| | Replant, where necessary | As required |
| | Aerate pond when signs of eutrophication are detected | As required |
| | Realign rip-rap or repair other damage | As required |
| | Repair / rehabilitate inlets, outlets, and overflows | As required |

### Filter Drain

4.9.8 The anticipated maintenance and management for the filter drains provided on the Site as part of the surface water drainage system is outlined below in **Table 4.12**.

Table 4.12: Typical Maintenance Requirements for Filter Drain

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| Regular Maintenance | Remove litter (including leaf litter) and debris from filter drain surface, access chambers and pre-treatment devices | Monthly (or as required) |
| | Inspect filter drain surface, inlet/outlet pipework and control systems for blockages, clogging, standing water and structural damage | Monthly |
| | Inspect pre-treatment systems, inlets, perforated pipework and the silt trap for silt accumulation and establish appropriate silt removal frequencies | Six monthly |
| | Remove sediment from pre-treatment devices | Six monthly, or as required |
| Occasional Maintenance | At locations with high pollution loads, remove surface geotextile and replace, and wash or replace overlying filter medium | Five yearly, or as required |

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| | Clear any pipework of blockages | As required |

### Outflow Controls

4.9.9 The anticipated maintenance and management for the outflows (hydrobrake and orifice) associated with the surface water drainage system is outlined in **Table 4.13**. These will be refined in accordance with the manufacturer's specification upon installation.

Table 4.13: Typical Maintenance Requirements for Outflow Controls

| Maintenance Schedule | Required Action | Minimum Frequency |
|---|---|---|
| Regular Maintenance | Check smaller Hydrobreaks on Inverter Stations | Monthly |
| | Remove sedimentation that has become entrained into the outflow | Every 6 months or as required |
| Occasional Maintenance | Periodic measuring of the outflow bore size | Every 3 years |
| | Checking of the outflow for leakage issues | Annually |

## 4.10 Exceedance

4.10.1 This section assesses events in exceedance of the Site drainage strategy, i.e., those with a probability of occurrence less than the drainage design of 1% AEP plus 45% climate change.

### Project Substation

4.10.2 In the event of exceedance from the gravel compound within the Project Substation, flows would surcharge from the gravel resulting in shallow ponding. As this is a level compound, water levels would rise until flows overtopped the boundary wall and then would proceed in line with the local topography into the swale which will be at the toe the raised platform.

4.10.3 Exceedance from the swale would result in flows overtopping to the south east and discharging towards and into the wetland. The wetland is essentially designed to flood under extreme events and therefore exceedance of this would simply discharge south east into the adjacent East Stour tributary.

### Inverter Stations

4.10.4 With regard to the Inverter Stations, any exceedance flows would rise within the gravel compound and be retained above surface to a maximum depth of 0.125m. At this point, surface water would overtop the compound and flow overland towards surface water networks in line with the local topography.

4.10.5 All infrastructure within the Inverter Stations will be raised at least 150mm above the gravel surface and so would not be at risk of inundation.

### PV Panels

4.10.6 The exceedance flow pathways discussed mirror the natural flow pathways on and around the Site and direct flows towards the existing surface water network. No off-Site properties would be impacted by these flows and, as the PV panels will be raised, such flows would not affect the operation of the Project.

# 5 Conclusions

5.1.1 SLR has been appointed by the Applicant to provide an Outline OSWDS in support of the DCO application for the Project.

5.1.2 This Outline OSWDS has been developed to demonstrate that the requirements of national, regional, and local planning policy can be achieved at the Site given the nature and the quantum of development proposed. The drainage strategy has been devised following a review of local policy and having regard to consultation responses from KCC, the LLFA for the area.

### Project Substation

5.1.3 The Project Substation will comprise a platform containing concrete plinths surrounded by a lined gravel substrate. Flows which are shed from impermeable structures will percolate into the void space of the gravels and a penstock, or other similar equivalent valve, will be provided so that discharge can be stopped in the event of a pollution incident.

5.1.4 Under normal conditions flows will discharge through a series of rocky cascades (for energy dissipation) into a swale at the toe of the platform. Discharge from the swale will outfall into a wetland at restricted rates of 3.2l/s (i.e., below the 100% AEP greenfield rate) before overtopping into a tributary of the East Stour River.

5.1.5 The swale and wetland areas have both been designed to enhance biodiversity and ensure that there is no adverse impact on water quality. In addition, the wetland area, which will be sited within the AFSA, will increase the capacity of fluvial flood storage available. This will therefore contribute to a small reduction in downstream flood risk.

### Inverter Stations

5.1.6 The Inverter Stations, which will be distributed around the Site, will each be comprised of a small platform containing concrete plinths surrounded by a lined gravel substrate. Flows shed from the impermeable areas will percolate into the void space for attention, prior to discharge into a local ordinary watercourse at a peak rate of 1 l/s. A penstock, or other similar valve, will be provided at each Inverter Station so that discharge can be stopped in the event of a pollution incident.

5.1.7 This Outline OSWDS proposes a number of new ditches and filter drains to allow discharges from each Inverter Station to be converted into the existing surface water network. These features will be unlined and designed where possible to encourage infiltration and enhance biodiversity.

### PV Panels

5.1.8 The construction of the PV panels should have a neutral impact on runoff rates on the Site. As requested by KCC, depression storage will however be provided around the Site downstream of areas of PV panels to intercept runoff from the land. This should result in a small beneficial reduction in runoff rates and the depression storage will introduce additional wet habitat areas around the Site and provide additional flood storage that more than offsets the are lost as a result of the PV panel frames.

5.1.9 In common with most drainage strategies put forward in support of planning applications, the strategy presented here will need to be subject to approval of the detailed design (as secured by Requirement in the **Draft Development Consent Order (Doc Ref. 3.1)**) and any relevant consents.

# Appendix A: Greenfield Runoff Rates and Volumes

# Appendix B: Conceptual Surface Water Drainage Strategy Drawings

# Appendix C: Project Substation Drainage Modelling

This Appendix was updated in November 2024

# Appendix D: Inverter Station Drainage Modelling

This Appendix was updated in November 2024

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