Visual Impact Provision (VIP) - Peak District (East) Project

EAR Volume 1 Chapter 9: Water Resources

Appendix 9J SuDS Strategy

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1 EXECUTIVE SUMMARY

This Sustainable Drainage (SuDS) Strategy is to be considered alongside the Flood Risk Assessment (FRA) (located within Appendix 9I of the Peak District (East) Environmental Assessment Report (EAR)) and presents SuDS solutions for those components of National Grid's VIP project in the Peak District (East) that will introduce permanent new impermeable areas.

In addition to complying with the requirements of national planning policy, this SuDS Strategy meets the requirements of local planning policies, which are to:

- Promote appropriate development within and outside areas at risk of flooding;
- Improve flood resilience in Barnsley; and
- Promote sustainability through all flood risk work.

Furthermore, National Grid follows technical specification TS 2.10.09 on Site Drainage, which is part of the Generic Electricity Substation Design Manual for civil, structural and building engineering. This manual outlines the drainage requirements for new and existing electricity substations and relevant operational sites.

Within this in mind, the specific objectives of this strategy are to:

- Quantify the surface water runoff generated from the Proposed Project;
- Quantify the volume of attenuation storage required to ensure that the Proposed Project does not increase flood risk elsewhere;
- Account for the likely impacts of climate change on rainfall intensity over the lifetime of the Proposed Project; and
- Produce a concept drainage design to indicate how surface water will be sustainably managed over the lifetime of the Proposed Project to ensure that flood risk elsewhere is not increased, whilst taking climate change into account.

SuDS solutions are already intrinsically included in the Proposed Project design. The SuDS solutions involve the use of gravel surfaces or permeable surfaces with freely draining sub-base areas. The sub-base areas will provide sufficient storage to accommodate all runoff from each component of the Proposed Project under a 1 in 100-year (6-hour duration) rainfall event, with a 40% uplift for climate change. The use of a free-draining sub-base will also encourage infiltration to ground, where local conditions permit. As a result, it is not anticipated that the proposed SuDS solutions would need to discharge to off-site drainage receptors.

This SuDS Strategy demonstrates that the proposed SuDS solutions:

- Will be effective and fit-for-purpose;
- Could be taken forward to the detailed design stage; and
- Would ensure that the Proposed Project would not result in an increase in surface water flood risk elsewhere, whilst taking climate change into consideration over its design lifetime.

Finally, National Grid will be responsible for the management and maintenance of the main SuDS solutions over the intended lifetime of the Proposed Project.

2 INTRODUCTION

2.1 Project Background

National Grid's Visual Impact Provision (VIP) Project represents a major opportunity to conserve and enhance the natural beauty, wildlife and environmental heritage within Great Britain's most protected landscapes. The VIP Project will make use of a £500m allocation by Ofgem to carry out work to help reduce the impact of existing transmission lines in English and Welsh Areas of Outstanding Natural Beauty (AONBs) and National Parks.

Following the results of a landscape and visual impact assessment undertaken in 2014, covering 571km of overhead line (OHL) within the scope of the VIP Project, twelve transmission lines in eight AONBs and National Parks were identified as having the most significant visual impact. In September 2015, the VIP Project's Stakeholder Advisory Group considered a wide range of factors and recommended four projects to be taken forward for potential engineering work, one of which is within the Peak District National Park (for further explanation of the Stakeholder Advisory Group see EAR Chapter 4 (Consultation).

National Grid is proposing to underground a section of the existing OHL within the Peak District National Park. The project is referred to as the Peak District (East) Project (hereafter referred to as the Proposed Project) and forms part of the wider VIP Project.

As outlined within the EAR (Chapter 1 (Introduction)) the Proposed Project will be subject to a number of consenting regimes.

2.2 Details of the Proposed Project

2.2.1 Trans Pennine Trail Diversion – Subject to Planning Application

Construction and subsequent removal of a temporary Trans Pennine Trail diversion for use during the construction phase of the Proposed Project. The diversion will involve the use of two bridges, one being a permanent replacement of an existing bridge; the other a temporary bridge to cross over the River Don. The diversion is proposed in farmland immediately north of the River Don.

2.2.2 Sealing End Compound - Subject to Planning Application

Construction of a new SEC within Wogden Foot Local Wildlife Site (LWS) and a separate replacement tension pylon located approximately 40m north east of the SEC on the northern side of the River Don, close to the location of the existing Pylon 4ZO157. Within the SEC the circuits will terminate onto two full tension gantries to connect the cable Corridor to the remaining existing OHL. A permanent access off the Trans Pennine Trail will be required to the proposed SEC and associated laydown areas.

2.2.3 Access Point 7 and Northern Access Road - Subject to Planning Application

Temporary laydown areas, access tracks (including from the highway Windle Edge and Brook Hill Lane), to the pylons to be removed and along the Trans Pennine Trail to the SEC at Wogden Foot as well as site offices will be required to facilitate construction activities.

2.2.4 400kV Cable (Undergrounding)

An underground XLPE cable approximately 1.8km beneath the route of the Trans Pennine Trail from the entrance of the Woodhead Tunnel to a proposed new SEC. It includes works within the Existing Operational National Grid Compound at Dunford Bridge, works within the

existing Trans Pennine Trail and the cable undergrounding within Wogden Foot Local Wildlife Site, along with associated access tracks and laydown areas.

2.2.5 Removal of Existing Infrastructure (VIP subsection)

Removal of the existing VIP Subsection including eight pylons (one of which will be replaced, see Pylon 4ZO157R below) and 2km of OHLs.

2.2.6 Construction of replacement Pylon 4ZO157R

A new Tension Pylon 4ZO157R will be constructed to replace Pylon 4ZO157, including the replacement of conductors and connection to the SEC.

Refer to Chapter 2 (Project Description) for further details of each element.

2.3 Scope of Sustainable Drainage Systems (SuDS) Strategy

The impacts of the Proposed Project on the Water Environment (i.e. in terms of water resources, hydromorphology, water quality, and flooding and drainage) are covered in Chapter 9 (Water Resources) of the accompanying EAR, and also within the Flood Risk Assessment (FRA), which is included in Appendix 9I of the EAR.

This document constitutes a Sustainable Drainage Systems (SuDS) Strategy and serves to accompany both Chapter 9 (Water Resources) of the EAR and the FRA. Its aim is to demonstrate that the additional volume and rate of surface water runoff generated by the components of the Proposed Project that will introduce new areas of impermeable hardstanding will be sustainably managed over its intended lifetime and will not result in an increase in flood risk elsewhere, whilst taking climate change into account.

This SuDS Strategy only considers the operational phase of the Proposed Project. The requirements for the sustainable management of surface water during the construction and decommissioning phases will be outlined within the Construction Environmental Management Plan (CEMP) and associated construction and decommissioning phase drainage strategies (refer to Chapter 9 (Water Resources) of the EAR for further information).

As such, the following section describes those elements of the Proposed Project that will introduce new areas of impermeable hardstanding and will subsequently constitute the scope of this SuDS Strategy.

2.3.1 Trans Pennine Trail Diversion to the north of the River Don

This element of the Proposed Project will comprise the construction of a temporary walking trail that will mainly follow the route of an existing farm/field track. Its finished surface cover will be formed from hoggin, which is a compactable groundcover that is composed of a mixture of clay, gravel, and sand. It is more commonly seen at National Trust properties. The material is lower maintenance than gravel alone since it does not need regular raking. Once laid, the surface is somewhat permeable to water and therefore does not easily generate rapid surface runoff. Hoggin surface is designed to be permeable and as result limit or reduce surface water runoff. This diversion is a temporary element of the Proposed Project and is intended to be used as the Trans Pennine Trail for 12 to 18 months.

Although, the Trans Pennine Trail diversion will be in place for approximately 1 to 1.5 years and will be used by members of the public, this element of the Proposed Project is temporary, therefore, not assessed any further in this SuDS Strategy.

2.3.2 Proposed Sealing End Compound

This element of the Proposed Project will comprise the construction of a new SEC and a permanent access road within the Wodgen Foot LWS, which have the potential to cause an increase in the volume and rate of surface water runoff generated across these areas, which could potentially increase flood risk elsewhere.

This element of the Proposed Project is, therefore, included for further assessment as part of this SuDS Strategy.

2.3.3 Temporary Construction Compounds, Laydown Areas and Temporary Access Tracks (including northern access road)

This element of the Proposed Project will comprise the construction of temporary hardstanding areas and as such has the potential to cause an increase in the volume and rate of surface water runoff generated across these areas, which could potentially increase flood risk elsewhere.

However, due to the temporary nature of these elements of the Proposed Project, they will not be included for further assessment as part of this SuDS Strategy. The requirements for the sustainable management of surface water during the construction and decommissioning phases will be outlined within the Construction Environmental Management Plan (CEMP).

2.3.4 400kV Cable (Undergrounding)

Once constructed, the cable corridor will be buried underground and the land surface of the cable corridor will be reinstated to ensure that it has the same runoff properties and is at the same elevation as existing (these measures constitute construction phase mitigation, as set out in Chapter 9 (Water Resources) of the EAR). As such, the cable corridor itself will not result in an increase in the volume and rate of surface water runoff generated.

This element of the Proposed Project is, therefore, not considered further in this SuDS Strategy.

The only permanent above ground elements of the proposed cable corridor will be the control cabinets. These elements of the Proposed Project will not introduce any significant new areas of impermeable hardstanding and as such will not have any significant impacts.

These elements of the Proposed Project are, therefore, not assessed any further in this SuDS Strategy.

2.3.5 Removal of Existing Infrastructure (VIP subsection) including overhead line (OHL) removal, dismantling of pylon structures and removal of pylon foundations

This element of the Proposed Project will not introduce any significant new areas of impermeable hardstanding and as such will not have any significant impact on surface water runoff and flood risk elsewhere.

This element of the Proposed Project is not, therefore, considered further in this SuDS Strategy.

2.3.6 Construction of Pylon 4ZO157R, replacement of conductors and connection to the SEC

This element of the Proposed Project will not introduce any significant new areas of impermeable hardstanding and as such will not have any significant impact on surface water runoff and flood risk elsewhere.

This element of the Proposed Project is not, therefore, considered further in this SuDS Strategy.

2.4 Aims and Objectives

This SuDS Strategy is intended to support the accompanying FRA, which in turn forms part of the EAR produced to support the planning application for the Proposed Project.

As described above, certain elements of the Proposed Project have the potential to result in an increase in both the volume and rate of surface runoff generated across their respective areas, which could result in an increase in flood risk elsewhere.

The overall aim of this SuDS Strategy is, therefore, to demonstrate that the additional surface water runoff generated by the Proposed Project will be sustainably managed over its intended lifetime and will not result in an increase in flood risk elsewhere, whilst taking climate change into account.

This SuDS Strategy also aims to ensure that the Proposed Project fully aligns with both national planning policy and Barnsley Metropolitan Borough Council's local planning policies, both of which require major developments to incorporate the principles of sustainable drainage, where practicable.

The specific objectives of the SuDS Strategy are to:

- Quantify the surface water runoff generated from the Proposed Project;
- Quantify the volume of attenuation storage required to ensure that the Proposed Project does not increase flood risk elsewhere;
- Account for the likely impacts of climate change on rainfall intensity over the lifetime of the Proposed Project; and
- Produce a concept drainage design to indicate how surface water will be sustainably managed over the lifetime of the Proposed Project to ensure that flood risk elsewhere is not increased, whilst taking climate change into account.

The SuDS Strategy will be submitted to Barnsley Metropolitan Borough Council, Lead Local Flood Authority (LLFA), for review.

3 SUSTAINABLE DRAINAGE SYSTEMS POLICIES AND GUIDANCE

3.1 National Policy

In the last few years the UK Government has been looking towards rationalising drainage policy as part of the government's continued commitment to protect people and property from increased flood risk. The Department for Environment, Food and Rural Affairs (DEFRA) and the Department for Communities and Local Government (DCLG) have recognised that the Town and Country Planning system is the best driver for change.

A new drainage policy came into effect on 6 April 2015[1]. This policy states that local planning policies and decisions on planning applications relating to major developments[2] are to ensure sustainable drainage systems for the management of runoff are put in place, unless demonstrated to be inappropriate.

Under the policy, Local Planning Authorities when considering planning applications are expected to:

- Consult the relevant Lead Local Flood Authority on the management of surface water;
- Satisfy themselves that the proposed minimum standards of operation are appropriate; and
- Ensure, through the use of planning conditions or planning obligations that there are clear arrangements in place for ongoing maintenance over the lifetime of the development.

Therefore, the Proposed Project should demonstrate that Sustainable Drainage Systems (SuDS) for the management of runoff will be put in place at appropriate locations, unless demonstrated to be inappropriate.

3.2 Local Planning Policy

Barnsley Metropolitan Borough Council is the Lead Local Flood Authority for the Proposed Project and is responsible for managing flood risk from local sources such as ordinary watercourses (not main rivers), surface water and groundwater. Its Local Flood Risk Management Strategy (LFRMS, September 2017[3]) sets out its vision for managing local flood risk across the Barnsley area and includes objectives to: promote appropriate development within and outside areas at risk of flooding; and to include effective and maintainable methods for the management of surface water, drainage systems, SuDS and watercourses throughout the Borough. More specifically, the LFRMS sets out that developers are to ensure that drainage on proposed developments is effectively managed and does not cause adverse flooding impacts on surrounding areas. Under this strategy, the LLFA has the responsibility to assess SuDS and the drainage implications of new building developments.

Key objectives of the LFRMS are to:

- Promote appropriate development within and outside areas at risk of flooding;

[1]http://www.parliament.uk/documents/commons-vote-office/December%202014/18%20December/6.%20DCLG-sustainable-drainage-systems.pdf

[2] Waste developments and developments carried out on a site having an area of 1 hectare or more, as set out in Article 2(1) of the Town and Country Planning (Development Management Procedure) (England) Order 2015, accessible via http://www.legislation.gov.uk/uksi/2015/595/contents/made

[3] https://www.barnsley.gov.uk/media/7196/flood-risk-management-strategy.pdf

- Improve flood resilience in Barnsley; and
- Promote sustainability through all flood risk work.

Barnsley Metropolitan Borough Council adopted its Local Plan in January 2019.

Relevant policies within the Core Strategy include:

- CSP 1: Climate Change – this states that development will be expected to ensure existing and new communities are resilient to climate change, and that the council will take action to adapt to climate change by locating and designing development to reduce the risk of flooding and promoting the use of sustainable drainage systems.
- CSP 3: Sustainable Drainage Systems (SuDS) – this policy states that all new development will be expected to use Sustainable Drainage Systems (SuDS). Only in exceptional circumstances, where it can be demonstrated that all types of SuDS are impractical, will other drainage management systems be permitted. Planning applications must include an assessment to show that SuDS will work and will be maintained, with measures taken to avoid water contamination and the safeguarding of groundwater supply. Developers will also be required to contribute to the maintenance of SuDS.
- CSP 4: Flood Risk – states that new development will not be permitted where it would be at an unacceptable risk of flooding or would give rise to flooding elsewhere. It requires site-specific Flood Risk Assessments (FRAs) for proposals over 1 hectare in Flood Zone 1 and all proposals in Flood Zones 2 and 3, and the use SuDS in accordance with Policy CSP 3. It also states that the extent and impact of flooding will be reduced by avoiding culverting or building over watercourses and encouraging the removal of existing culverts wherever practicable. It also requires the use of flood resilient design in areas of high flood risk.
- CSP 40: Pollution Control and Protection – states that development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in surface water and groundwater pollution, which would unacceptably affect or cause a nuisance to the natural and built environment or to people. Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.

The Local Plan Publication Draft 2016 (published 30 June 2016) contains the following relevant policies:

- Policy CC3: Flood Risk – states that the extent and impact of flooding will be reduced by:
  - not permitting new development where it would be at an unacceptable risk of flooding from all sources, or would give rise to flooding elsewhere, and not allowing development in the Functional Floodplain (Flood Zone 3b) unless it can be demonstrated that there would not be a harmful effect on the ability of this land to store floodwater;
  - requiring developers with proposals in Flood Zones 2 and 3 to provide evidence of the sequential test and exception test where appropriate;
  - requiring site-specific Flood Risk Assessments (FRAs) for proposals over 1 hectare in Flood Zone 1 and all proposals in Flood Zones 2 and 3;
  - expecting proposals over 1000m^2 floor space or 0.4 hectares in Flood Zone 1 to demonstrate how the proposal will make a positive contribution to reducing or managing flood risk;

- expecting all development proposals on brownfield sites to reduce surface water runoff by at least 30% and development on greenfield sites to maintain or reduce existing runoff rates;
- requiring development proposals to use Sustainable Drainage Systems (SuDS) in accordance with policy CC4; and
- using flood resilient design in areas of high flood risk.

- Policy CC4: Sustainable Drainage Systems (SuDS) – states that all major development will be expected to use Sustainable Drainage Systems (SuDS) to manage surface water drainage, unless it can be demonstrated that all types of SuDS are inappropriate. The use of SuDS on minor development is also encouraged. To determine the suitability of a proposed SuDS scheme, all Outline Planning applications must be supported by a conceptual drainage plan and SuDS design statement, with Detailed Planning applications supported by a detailed drainage plan and SuDS design statement, which should contain information on how the SuDS will operate, be managed and maintained for the lifetime of the development.
- Policy CC AC1: Water Resource Management – states that to conserve and enhance water resources, proposals will be supported which:

- dispose of surface water appropriately and improve water quality through the incorporation of SuDS, in accordance with Policy CC4.

- Policy Poll1: Pollution Control and Protection – states that development will be expected to demonstrate that it is not likely to result, directly or indirectly, in an increase in surface water and groundwater pollution, which would unacceptably affect or cause a nuisance to the natural and built environment or to people. Developers will be expected to minimise the effects of any possible pollution and provide mitigation measures where appropriate.

The Peak District National Park Local Development Framework Core Strategy document, adopted in October 2011, sets out the vision, objectives and spatial strategy for the national park, and core policies to guide development and change in the National Park to 2026. The Peak District National Park Development Management Policies document, adopted in May 2019, will also guide and manage development across the National Park alongside the Core Strategy up to 2026. Relevant policies include:

- Policy CC1: Climate change mitigation and adaptation – states that development must be directed away from flood risk areas and seek to reduce overall risk from flooding within the National Park and areas outside it, upstream and downstream, and achieve the highest possible standards of water efficiency.
- Policy CC5: Flood risk and water conservation – states that:

- Development proposals which may have a harmful impact upon the functionality of floodwater storage, or surface water conveyance corridors, or which would otherwise unacceptably increase flood risk, will not be permitted unless net benefits can be secured for increased floodwater storage and surface water management from compensatory measures;
- Where flood management schemes are proposed to reduce the risk of flooding to established material assets, they should wherever possible secure wider benefits for the natural environment, such as habitat creation or landscape enhancement;
- Development which increases roof and hard surface areas must include adequate measures such as Sustainable Drainage Systems to deal with the runoff of surface water. Such measures must not increase the risk of a local water course flooding; and
- New development must allow an appropriate set-back distance for adequate maintenance of watercourses.

The Local Plan for the Peak District National Park (2001) contains a number of extant operational policies that have yet to be replaced by the Local Development Framework Core Strategy. Although Policy LC23 (Flood risk areas) has been replaced relevant policies that remain valid include:

- Policy LC21: Pollution and disturbance – states that development that presents a risk of pollution or disturbance that could adversely affect water supply, groundwater resources and the water environment will not be permitted unless adequate measures to control emissions within acceptable limits are put in place and (when the permitted use finishes) appropriate removal of any pollutants from the site is assured.
- Policy LC22: Surface water runoff – states that development will be permitted provided that adequate measures are included to deal with the runoff of surface water from the site. Such measures must not increase the risk of a local water course flooding.

The area of the Peak District (East) Proposed Project is not covered by an Internal Drainage Board (IDB).

3.3 National Grid technical guidance on site drainage (NG TS 2.10.09)

National Grid follows technical specification TS 2.10.09 on Site Drainage, which is part of the Generic Electricity Substation Design Manual for civil, structural and building engineering. This manual outlines the drainage requirements for new and existing electricity substations and relevant operational sites. The technical specification follows a series of drainage design principles relevant to the Proposed Project, which are presented below:

- Where appropriate and not in conflict with other parts of the specification, the drainage design shall consider the application of Sustainable Drainage Systems (SuDS) techniques as promoted by CIRIA;
- In the design of the site drainage system, the runoff flow shall be calculated in accordance with CIRIA C736[4];
- Volumetric flow shall be determined using the Wallingford Procedure or other established method; and
- Surface water from any adjacent access roads and car parking shall drain to the adjacent stone surfacing.

This Technical Specification is presented in Appendix 9J.A.

[4] CIRIA C736 includes:

a) The preferred method of estimating the rainfall depths is to use the depth-duration-frequency rainfall model contained on the Flood Estimation Handbook (FEH) CD-Rom (CEH, 2000) which provides location specific rainfall totals for given durations and return periods;

b) However, as a first estimate, it may be appropriate to refer to Figure 4.2 of CIRIA C736 which provides average annual rainfall depths and those for the 24-hours and eight days 10 per cent AEP events.

4 SUSTAINABLE DRAINAGE SYSTEMS (SUDS)

4.1 SuDS Definition

SuDS aim to mimic the natural drainage of the site prior to development, allowing as much water as possible to evaporate, or infiltrate into the ground, close to where it fell, then attenuating and conveying the rest to the nearest watercourse or sewer system to be released at the same rate as (or less than) the runoff from the existing site, thereby preventing any increase in flood risk downstream.

The SuDS management train (also known as the treatment train) approach is a four-stage process of best practice to mimic the natural drainage environment of a site. This is discussed further in Section 4.3 of this report.

4.2 Assessment Approach

The SuDS Strategy will develop a concept surface water drainage system in-line with present policies and the SuDS management train approach. It will demonstrate that SuDS principles have been followed and provide justification for the concept drainage design proposed.

The methodology for this assessment involves an initial review of the baseline conditions relating to the surface water environment, which is presented in Section 5. In addition to co-ordinating with the Flood Risk Assessment, several sources of information, where available, will be used to inform the drainage strategy for the Proposed Project, this includes:

- Soil profiles from the Ground Investigation;
- Design rainfall for a 1 in 100-year (6-hour duration) rainfall event extracted from the FEH Depth Duration Frequency (DFF) rainfall model; and
- CAD drawings showing the site layout.

Reference will be made to the following guidance, where appropriate, to develop the drainage system concepts:

- New Planning Guidance: Sustainable Urban Drainage (SuDS) (2015);
- Planning Practice Guidance, e.g. Water supply, wastewater and water quality[5];
- National Planning Policy Framework (NPPF) (pages 23-26);
- Planning Practice Guidance (PPG) – Flood Risk and Coastal Change;
- BS8582 Surface Water Flood Risk Management;
- Environment Agency Guidance: Rainfall runoff management for developments (Report reference: SC030219, October 2013);
- Sewers for Adoption - 7th Edition (WRc plc, 2012);
- The SuDS Manual (version 6) (CIRIA C753, 2015); and
- Relevant Environment Agency Pollution Prevention Guidance notes, including the relevant replacement guidance series; Guidance for Pollution Prevention.

4.3 Approach to Conceptual Surface Water Drainage Options Appraisal

Section 3 of this document discusses current UK Policy for drainage design and the need for early stakeholder engagement. This section sets out the approach to the Conceptual Surface Water Drainage Options Appraisal, based on the baseline conditions of the Proposed Project and reported within this SuDS Strategy. The aim of the appraisal is to assist with discussions

[5] https://www.gov.uk/guidance/water-supply-wastewater-and-water-quality

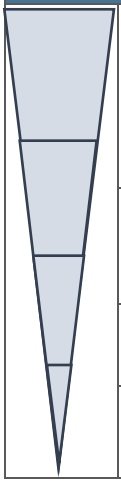
to obtain an agreement in principle from Barnsley Metropolitan Borough Council (BMBC), as Lead Local Flood Authority (LLFA), for the conceptual design proposed.

To determine a list of available surface water drainage system options, the SuDS management train has been followed. The principles of the SuDS management train are discussed in Table 1 Table 1 SuDS Management Train Hierarchy

below.

The preferred hierarchy for surface water disposal is by discharge to ground (via infiltration), to a watercourse, or to an adopted surface water sewer (in that priority order). This is in-line with current SuDS best practice.

Table 1 SuDS Management Train Hierarchy

Principle (In priority order)		Explanation
	**Prevention**	Technique prevents surface water runoff from areas. Techniques include reducing impermeable areas and good housekeeping measures for reducing pollution to prevent the need for treatment, so runoff can progress through system naturally.
	Source Control	Sustainable drainage systems that deal with surface water runoff from developments as close as possible to where it falls as rain.
	Site Control	Sustainable drainage systems that manage surface water runoff within a site boundary.
	Regional Control	Sustainable drainage systems that manage surface water regionally serving multiple sites.

In conjunction with the above table, Building Regulations 2000 Part H states that the hierarchy for discharging surface water runoff should adopt discharge to one of the following (in order of preference):

- Infiltration technique;
- Watercourse; and
- Surface water sewer.

Concept option appraisal has the greatest opportunity to assess the potential risks associated with the life cycle of the drainage design at the earliest possible stage.

The appraisal applied to this drainage strategy has used the ERIC (Eliminate, Reduce, Inform and Control) technique to develop the concept design whilst ensuring Safety in Design considerations are deployed in accordance with the Construction, Design & Management (CDM) regulations.

5 SITE DESCRIPTION

The site location, topography, hydrology, hydrogeology, soils and land use are described in Section 2.1 of the Flood Risk Assessment in Appendix J.

5.1 Summary of Flood Risk Issues

The FRA in Appendix 9I of the EAR and the table in Appendix 9J.B presents a summary of all flood risk issues.

5.2 Water Quality Issues

The Environmental Assessment provides details of the Water Framework Directive status and objectives of the water bodies with which the Proposed Project interacts (Chapter 9: Water Resources, Section 9.5).

6 SUDS ELEMENTS OF THE PROPOSED PROJECT

6.1 SuDS Principles

Appendix 9J.C lists the SuDS principles that have been at the heart of the Proposed Project since its early design stages. The design of the Proposed Project has sought to prevent the generation of additional surface water runoff through careful arrangement of the alignment and location of the project. Where the generation of additional surface water runoff has proved unavoidable, the Proposed Project incorporates source control principles to ensure the sustainable management of surface water over its design lifetime.

The following sections demonstrate how the Proposed Project will meet these principles of sustainable drainage.

6.2 New Permanent Impermeable Areas

The first step in the design of Sustainable Drainage Systems is to quantify the new permanent impermeable hardstanding areas that the Proposed Project will introduce.

Appendix 9J.D presents the new permanent impermeable areas for the relevant components of the Proposed Project along with their respective Brownfield/Greenfield classification and underlying soil type.

The impermeable area associated with the SEC is 202m^2 (based on drawing PDD_33492_LAY_002_P7) and the total new area associated with the new permanent access road to the SEC is 400m^2.

As shown in Appendix 9J.D, the total new impermeable area associated with the Proposed Project is, therefore, estimated to be 602m^2. The following sections demonstrate how the surface water runoff generated across this combined new area of hardstanding will be sustainably managed throughout the intended lifetime of the Proposed Project.

Further drainage design details for these elements will be provided at the detailed design stage.

6.3 Conceptual Design of the Proposed SuDS Strategy

The following section outlines the proposed SuDS Strategy and provides a conceptual drainage design for the following elements of the Proposed Project:

- The SEC; and
- The permanent access road to the SEC.

Depth-Duration-Frequency (DDF) data for the Proposed Project were extracted from the Flood Estimation Handbook (FEH) website service. The total design rainfall depth for a 1 in 100-year (6-hour duration) event was selected from these DDF data with which to undertake the conceptual SuDS design.

The FEH[6] DDF rainfall total for a 1 in 100-year (6-hour duration) event for the Proposed Project is 76.99mm.

The SuDS Strategy for the Proposed Project will also need to account for the likely impacts of climate change over its intended lifetime. The construction period of the Proposed Project is

[6] FEH 2013 results

estimated to end by 2022 and the life span of the cables and SECs is estimated to be approximately 50 years. The recommended climate change allowances for increases in rainfall intensity are reproduced in Table 2 below[7]. Accordingly, a 40% increase in rainfall intensity has been adopted in this SuDS Strategy to allow for climate change.

Table 2 Peak rainfall intensity allowances in small and urban catchments

Applies across all of England	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Upper end allowance	10%	20%	40%
Central allowance	5%	10%	20%

With a 40% allowance for climate change, the FEH DDF rainfall total for a 1 in 100-year (6-hour duration) event for the Proposed Project increases to 107.79mm. This value represents the 'design' rainfall depth for the purposes of this SuDS Strategy.

Applying this design rainfall depth, the total volume of runoff generated by each component of the Proposed Project was calculated. These volumes are presented in Table 3. Appendix 9J.E provides details of the supporting calculations.

Table 3 Total runoff volume generated from the new permanent impermeable areas of the Proposed Project

Components of the Proposed Project	New area (m^2)	'Design' Rainfall Depth (mm)	Total Runoff Volume (m^3)
SEC	202	107.79	21.77
Permanent access road to SEC	400	107.7	43.11

The volume totals presented in Table 3 above represent the runoff volumes that will be sustainably managed as part of this SuDS Strategy. The total runoff volumes were calculated by simply multiplying the design rainfall depth (in m) by the total impermeable area of each component (in m). It was not necessary to consider the residual runoff volumes that would normally need to be managed once an allowance has been made for discharge at Greenfield runoff rates or discharge to ground via infiltration. This is explained further below.

The SuDS solutions for the Proposed Project are as follows:

[7] https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances

For the Sealing End Compound:

- 75mm depth of clean stone graded at 14-20mm (Type 1 gravel) laid throughout all areas of each compound not occupied by SEC equipment; and
- A minimum thickness of 300mm unbound free draining sub-base beneath all areas of compacted Type 1 gravel.
- A layer of geogrid will be laid prior to the Type 1 gravel layer.

For the proposed permanent access road to the SEC:

- To be surfaced with a ca. 75mm thick grass-concrete (or similar) layer; and
- A minimum thickness of 300mm unbound free draining sub-base beneath all areas of grass-concrete.
- A layer of geogrid will be laid prior to the Type 1 gravel layer.

For the purposes of the outline drainage calculations, it has been assumed that the unbound free draining sub-base and clean stone graded at 14-20mm have an effective storage (i.e. void space) ratio of 0.3.

On the basis of this assumption, Table 4 presents the available storage within the proposed SuDS areas for each component of the Proposed Project that will introduce permanent impermeable areas. Supporting calculations are presented in Appendix 9J.E.

Table 4 demonstrates that the SuDS solutions would be sufficient to accommodate and store all runoff generated by each component of the Proposed Project under the 1 in 100-year (6-hour duration) rainfall event with a 40% uplift to account for climate change.

However, the calculations presented in Table 4 should be considered conservative; no allowance has been made for the potential for infiltration to ground beneath the proposed SuDS solutions. As a result, it is not anticipated that the proposed SuDS solutions would need to discharge to off-site drainage receptors.

As such, it should be considered that the outline drainage design presented in this assessment provides sufficient confidence that the proposed SuDS solutions will be effective and fit-for-purpose and could be taken forward to the detailed design stage.

Table 4 Available storage within the proposed SuDS areas for each component of the Proposed Project that will introduce permanent impermeable areas

Components of the Proposed Project	Total runoff volume (m^3)	Total area SuDS solution (m^2)	Depth of SuDS solution (m)	Available storage within each SuDS solution (assumed effective volume ratio of 0.3) (m^3)
SEC	21.77	2404.43	0.375 (75mm of compacted Type 1+300mm of free draining sub-base)	270.50
Permanent access road to SEC	43.11	400	0.375 (75mm grass-concrete +300mm free-draining sub-base)	45.00

7 SUDS SUMMARY AND RECOMMENDATIONS

7.1 Review of Sustainable Options for the Proposed Project

This SuDS statement focuses on the components of the Proposed Project likely to generate surface water runoff as a result of an increase in permanent hardstanding areas, which are:

- The SEC; and
- The permanent access road to the SEC.

At these locations, the principles of source-control techniques have been applied. The source-control techniques comprise surface layers of graded 14-20mm stone with a gravel sub-base to provide storage and subsequent infiltration where possible (although the calculations presented here have demonstrated that the source-control techniques would be sufficient as designed even if infiltration to ground is not possible). Incorporating source-control techniques as part of the proposed new infrastructure is a sustainable option as it avoids the additional expense and carbon footprint associated with the creation of new surface water drainage infrastructure specific to the Proposed Project.

In addition, no requirement for specific water-quality control measures has been identified as part of this SuDS Strategy (other than the standard Pollution Prevention Control measures that National Grid would normally implement for its new SECs and access roads).

7.2 SuDS Maintenance and Management

National Grid will be responsible for the management and maintenance of the proposed SuDS solutions for the SEC and its permanent access road over the intended lifetime of the Proposed Project.

National Grid's SuDS maintenance and management plan will ensure the adequate upkeep of all graded stone surfaces, gravel sub-base and grass-concrete areas associated with the proposed SuDS to enable surface water to continue to be stored (and potentially infiltrate to ground) over the design lifetime of these elements of the Proposed Project.

8 CONCLUSION

This SuDS Strategy presents sustainable drainage solutions for those components of National Grid's VIP project in the Peak District (East) that will introduce permanent new impermeable areas.

The SuDS solutions involve the use of gravel surfaces or permeable surfaces with freely-draining sub-base areas. The sub-base areas will provide sufficient storage to accommodate all runoff from each component of the Proposed Project under a 1 in 100-year (6-hour duration) rainfall event, with a 40% uplift for climate change. The use of a free-draining sub-base will also encourage infiltration to ground, where local conditions permit. As a result, it is not anticipated that the proposed SuDS solutions would need to discharge to off-site drainage receptors.

This SuDS Strategy demonstrates that the proposed SuDS solutions:

- Will be effective and fit-for-purpose;
- Could be taken forward to the detailed design stage; and
- Would ensure that the Proposed Project would not result in an increase in surface water flood risk elsewhere, whilst taking climate change into consideration over its design lifetime.

Finally, National Grid will be responsible for the management and maintenance of the main SuDS solutions over the intended lifetime of the Proposed Project.

Appendix 9J.A - National Grid TS_2.10.09

Appendix 9J.B - Summary of Flood Risk Issues

Appendix 9J.C - Incorporation of SuDS principles

Appendix 9J.D - Total new hardstanding areas resulting from the Proposed Project

Appendix 9J.E - Peak District SUDS Calculations Rev3 spreadsheet