Scottish & Southern Electricity Networks

RIIO ED2 Engineering Justification Paper (EJP)

Flood Mitigation

Investment Reference No: 7/SSEPD/ENV/FLOOD

Contents

1 Executive Summary

Our ***Environmental Action Plan (EAP) (Annex 13.1)*** sets out our methodology that we propose to undertake during the RIIO-ED2 period in response to increasingly ambitious environmental drivers and stakeholder expectations.

This paper sets out our plans to implement flood mitigation measures highlighting the requirement to follow a systematic approach to ensure the resilience of grid and primary substations from flooding. The primary driver for flood mitigation investment is to ensure measures are put in place meet the recommended specifications of Engineering Technical Report 138 Issue 3 2018 (ETR 138).

Following optioneering and detailed analysis, as set out in this paper, the proposed scope of works is:

SEPD

- 47 sites identified for further flood risk assessment surveys and mitigation works.
  4 sites for which detailed FRAs have taken place and the extent of the works required to mitigate the impact of potential flooding have been established.

SHEPD

- 30 site surveys identified for flood risk assessment surveys
- 14 sites estimated for flood mitigation work

The aggregate cost to deliver the preferred solution across both licence areas is £[redacted] and the works are planned to be completed in 2028.

This scheme delivers the following outputs and benefits:

- Safe and Reliable Network – undertaking risk management of floods at grid and primary substations ensuring we operate a safe, resilient and reliable network mitigating against power outages due to flooding of substations.
- Climate Change – ensuring risks and impacts of climate change are assessed on our network and appropriate steps towards mitigation and adaptation are undertaken.

2 Summary Table

Name of Scheme/Programme	Flood Mitigation Works (ETR 138, Issue 3 2018)
Primary Investment Driver	The primary investment driver is to meet licence obligations. • ETR 138 requires DNOs to defend grid and primary substations against flood risk in line with licence obligations
Scheme reference/ mechanism or category	7/SSEPD/ENV/FLOOD
Output references/type	7/SSEPD/ENV/FLOOD This links to EAP Output table S10 and is a PCD and LO
Delivery Year	RIIO-ED2
Reporting Table	Business Plan Data Tables

	• CV16 - Flood Mitigation			
Outputs included in RIIO ED1 Business Plan	Yes - Comparison to RIIO-ED1			
Cost	£[redacted]m			
Spend Apportionment	**Licenced Area**	**ED1 (£m)**	**ED2 (£m)**	**ED3+ (£m)**
	SEPD		£[redacted]m	
	SHEPD		£[redacted]m	
Delivery Year	RIIIO-ED2 (2024-28)			

3 Introduction to Flood Mitigation

3.1 Background to Investment

This engineering justification paper (EJP) highlights the requirement to follow a systematic approach to ensure the resilience of grid and primary substations from flooding. The paper requests funding for RIIO-ED2 to undertake surveys and flood mitigation works. The flood mitigation works are proposed to be completed by the end of RIIO-ED2 in 2028 for the sites identified. High level cost estimates of the flood mitigation works have been used for the purposes of this paper and will be refined on completion of the surveys. For 4 of the substations identified within SEPD we have already undertaken detailed flood assessments and therefore have greater certainty over the costs for delivering flood defence works at these sites. These costs are separated out in table 5 below.

3.2 Investment Drivers

This EJP is intended to inform the proposed investment for Flood Mitigation works. Flood mitigation forms part of our Environmental Action Plan (EAP) and Climate Resilience Strategy. Flood mitigation investment should ensure the measures put in place meet the recommended specifications of Engineering Technical Report 138 (ETR 138).

The primary investment driver for this justification is to implement the guidance introduced in the update to ETR 138 Issue 3 in 2018, where Distribution primary sites with more than 10,000 unrecoverable customers have flood risk assessments undertaken and, where required, flood protection measures implemented to defend them against up to 1/1000 flood risk events.

Secondary investment drivers are:

- **Safe and Reliable Network –** undertaking risk management of floods at grid and primary substations due to coastal, river and surface water flooding to ensure we operate a safe, resilient and reliable network mitigating against power outages due to flooding of substations.
- **Climate Change –** as a network we need ensure risks and impacts of climate change are assessed on our network and take appropriate steps towards mitigation and adaptation.

Additionally, our Stakeholders have requested us to go above minimum requirements and ranked flood resilience as a top priority.

3.3 Reasons for the Timing

The surveys for sites located in flood risk areas need to be completed at the start of RIIO-ED2 to confirm the flood defence works required and associated costs. The flood defence works then need to be implemented by the end of RIIO-ED2 in 2028 to meet the guidance of ETR 138.

3.4 Expected Outputs and Year of Delivery

3.4.1 SHEPD Flood Mitigation

For our network in the north, SHEPD, flood mitigation costs have been estimated for the following work:

- 30 site surveys @ £[redacted] per survey
- 14 sites for flood mitigation work at £[redacted] per site
- **Total £[redacted]**

As the cost for SHEPD are estimated to be below the £2 million threshold, no further analysis has been carried out for flood mitigation works for SHEPD.

3.4.2 SEPD Flood Mitigation

For our network in the south, SEPD, desktop analysis has been undertaken and identified 47 sites at risk of flooding. Site surveys will be carried out during the early part of RIIO-ED2 for these sites to confirm the risk level and flood defence work required.

Due to the high number of sites requiring flood interventions, we commissioned external consultants (Cluttons) to undertake a desk-top assessment to provide a more detailed estimate of potential flood defence works and costs. The outputs of this work detailed suggested delivery measures ranging from increasing wall heights, protecting switchboards to protecting the whole site over the course of RIIO-ED2.

Costs for work in SEPD are shown in further detail in section 5.1 Analysis and Costs.

4 Background Information

4.1 Flood Mitigation

Substations can be particularly vulnerable if water reaches certain critical depths. During flooding incidents, the impact on society can be severe due to the combination of the flooding and loss of electricity supplies to a large community, especially if this also affects other critical infrastructure such as water, gas, sewage, or telecommunications.

Severe historical flood events demonstrate the need to understand and improve the resilience of substations to flooding and led to the publication of Engineering Technical Report 138– Resilience to Flooding of Grid and Primary Substations (ETR 138).

4.2 Engineering Technical Report 138 – Resilience to Flooding of Grid and Primary Substations (ETR 138)

The serious incidents of flooding in the South Midlands and South Yorkshire during the summer of 2007, and the incident at Carlisle in 2005 highlighted the potential vulnerability of electricity

substations to major flood incidents. Following these events, the Energy Minister requested a comprehensive assessment of the resilience to flooding of primary and higher voltage substations.

From this the Engineering Technical Report 138 (ETR138) – Resilience to Flooding of Grid and Primary Substations Issue 1 was published by Energy Networks Association in October 2009. ETR 138 addresses the risk management of flooding at grid and primary substations in England, Scotland and Wales. It outlines a systematic approach and requirement to protect against coastal, river and surface water flooding.

An updated version of ETR 138 (Issue 2) was issued in April 2016 and included recommendations on the management of surface water (pluvial) flooding and flooding due to reservoir dam failures and canal bank bursts.

During December 2015, exceptional flooding occurred in areas of the UK, overtopping several public flood defences. Following this, the Environment Secretary announced a National Flood Resilience Review to better protect the UK from future flooding and increasingly extreme weather events. One recommendation led to ETR138 Issue 3 2018 which notably includes the resilience of service provision to sites supplying significant local communities.

Prior to the issue of ETR 138 there was no specific guidance on acceptable levels of flood risk or any regulatory impact assessment, however, flood mitigation work has been carried out on our network to monitor and assess flood risks and mitigation measures have been undertaken to prevent flood incidences on our network. Flood mitigation work has been included in our yearly reporting to Ofgem for both DPCR5 and RIIO-ED1.

4.3 Licence Obligations and Environmental Action Plan Minimum Requirements

The current version of ETR 138(Issue 3) advises that DNOs deliver flood mitigation for distribution grid sites and distribution primary sites with less than 10,000 unrecoverable customers by the end of RIIO-ED1. The update to ETR 138 Issue 3 in 2018 added guidance for sites with more than 10,000 unrecoverable customers, requiring these sites to be resilient against a 1/1000 flood event by the end of RIIO-ED2. This is summarised in the table below. The resilience measures put in place must meet the recommended specifications of ETR 138 to drive consistent approaches across GB.

Table 1 Flood resilience implementation dates and target level of resilience summarised from ETR 138

Type of Substation	Implementation date for establishment of resilience to flooding from rivers, the sea and surface water	Target Level of resilience
Distribution grid sites	The end of the RIIO-ED1 price control period, finishing in 2023.	Level 1. Protect sites up to a 1/1000-year flood risk.
Distribution primary sites with less than 10,000 unrecoverable customers	The end of the RIIO-ED1 price control period, finishing in 2023.	Level 2/3. Protect sites up to a 1:100-year flood risk for fluvial and pluvial and 1:200 for coastal.
Distribution primary sites with more than 10,000 unrecoverable customers	Under assessment by individual network operators.	Level 1. Protect sites up to a 1/1000-year flood risk.

ETR 138 applies to all DNOs and is covered by Licence Condition 24 Distribution System Planning Standard and Quality of Performance Reporting, which states we must adhere to a standard no less than set out in P2/7 or any subsequent Engineering Recommendation (which includes ETRs).

The Sector Specific Methodology Decision (SSMD) Annex 1 Flood Mitigation Decision table also states that '[the DNO must] ensure DNO assets are protected against the risk of flooding to maintain security of supply'.

Furthermore, flood mitigation is a strategic objective for Distribution. We have developed a Climate Resilience Strategy (CRS), as part of our Sustainability Strategy, which emphasises the need to improve the flood resilience of assets. The CRS identified key climate risks between now and 2050 and the most severe risk is flooding which is already in its highest level at current climate and this risk cannot go any higher in the climate risk matrix, although its severity and probability are highly likely to increase. The strategy emphasises the need to defend and future proof the network. Our Environmental Action Plan (EAP) is also aligned to comply with the obligations of Ofgem and ETR 138, set out above.

4.4 Investment Drivers

The primary investment driver for this EJP is to improve the resilience of assets to flooding creating a safer and more reliable network. Alignment with the licence obligations of ETR 138 will help to achieve this. Our investment drivers are listed below:

1. **Meet Licence Obligations**

   Flood resilience to defend grid and primary substations as per our Climate Resilience strategy, which is aligned to ETR 138, is a licence obligation that must be met.

2. **Safe and Reliable Network**

   Our Climate Resilience strategy (CRS) highlights the impacts of climate change on the network. For SEPD, predictions emphasise hotter drier summers, warmer wetter winters and more frequent intense storms. This increases the risk of flash flooding in urban areas. Increased rainfall also means river flooding in the Thames Valley is considered 'Almost Certain' and 'Extreme' in the CRS. For SHEPD more intense snowstorms followed by melting water creates fluvial flooding. Sea flooding is also a risk to coastal areas with Southern regions likely to be more severely affected. Undertaking risk management at grid and primary substations against coastal, river and surface water flooding mitigates the impacts of climate change. This helps to ensure we operate a safe, resilient and reliable network and minimise customer interruptions and minutes lost.

3. **Environmental Impact**

   Due to the amount of Oil filled Plants present in Substations there is a Risk of water contamination in the event of a flood. In addition to having major societal impacts it would also be devastating for surrounding wildlife.

4. **Stakeholder priority**

Flood resilience was a key priority for stakeholders when they were asked to rank its importance. This was due to the devastating impact flooding can have, cutting off electricity supply, in addition to the wider impacts flooding can have on an area. Stakeholder responses were that we should look to achieve above the minimum requirements. This is detailed further in the stakeholder feedback section below.

4.5 Stakeholder Engagement Feedback

The following Stakeholder events helped shape our approach to Flood Mitigation. Flood Resilience was a topic of discussion during these events and a summary is provided below of the key responses. The full reports from these events are available.

Stakeholder Event	Date	Relevant Topics	# Stakeholders Attending
Distribution Annual Workshop North	24th September 2020 1 October 2020	Sustainability – helping the UK meet its net zero emissions targets Maintaining a reliable and resilient network for the future	84
Distribution Annual Workshop South	23rd September 2020 30th September 2020	Sustainability – helping the UK meet its net zero emissions targets Maintaining a reliable and resilient network for the future	109

Question: SSEN's Environment Action Plan – Flood Resilience

On a scale of 1-5, how ambitious do you think SSEN should be in the following the following environmental areas?

1 = Remain as we are (in RIIO-ED1), 3 = Pace with the Paris Agreement, 5 = Accelerating Net Zero

Stakeholder Feedback:

Flood resilience score 4.14/5

Flood resilience was deemed as a hugely important priority across both licence areas. In SHEPD, delegates highlighted the issue of coastal erosion, and in England, the issue was discussed as an impact of climate change. There was clear consensus that we should go beyond the Ofgem minimum requirements in this area.

Question: Maintaining a Reliable and Resilient Network for the Future

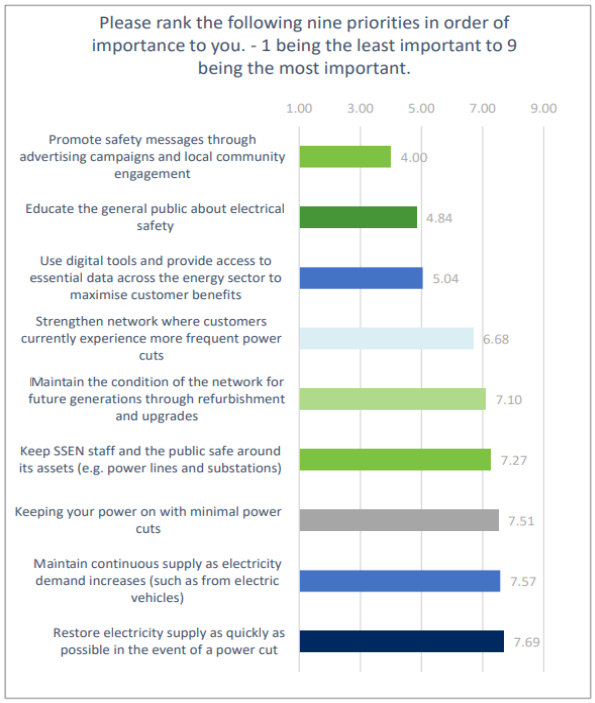
Do you agree with the order of priorities? Why/why not? Which are the most important ones for you?

Stakeholder Feedback:

Restore electricity supply as quickly as possible ranked 1st

Stakeholders in both licence areas agreed with the top priorities under reliability and resilience, where 'restoring electricity supply as quickly as possible in the event of a power cut' had been placed as number one. This was reflected in the electronic voting, where delegates from both licence areas ranked this as the top priority. Keeping power on with minimal power cuts was ranked as priority 3.

In Scotland a more rural network 'keeping your power on' was ranked higher, particularly where there are remote islands.



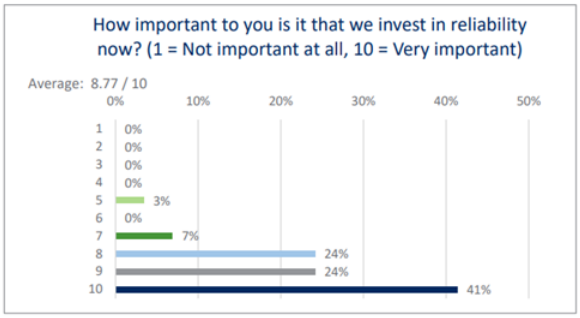
This emphasises the importance of delivering the planned flood resilience works. Defending primary and grid substations will minimise the impact of a flooding event and limit supply interruptions to only those customers who are supplied via the secondary distribution substations in the area impacted by flood waters. By defending the primary grid substation this allows quick restoration of electricity supply when the flood waters subside.

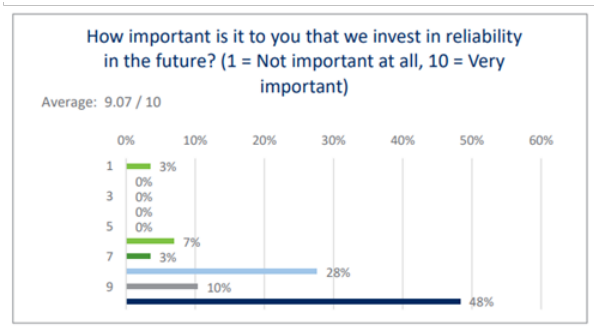
Question: Maintaining a Reliable and Resilient Network for the Future

How important is it that we invest in reliability now & in the future? (1= not important at all, 10 = very important)

Stakeholder Feedback:

There was widespread consensus that it was critical for us to invest in reliability now to guarantee future service. In the electronic voting, on average stakeholders felt it was very important to invest in reliability both now and in future, with stakeholders giving 'now' an average of 8.77 out of 10 and 'future' an average of 9.07 out of 10. In addition, 41% and 48% of respondents respectively scored investing in reliability 10/10.





This highlights the importance of early action undertaking surveys and flood defence works to mitigate the impacts of climate change on the network.

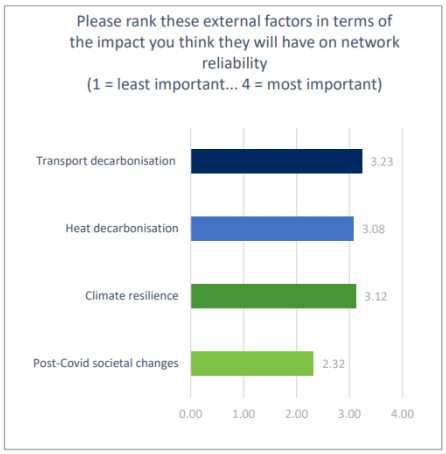
Question: Maintaining a Reliable and Resilient Network for the Future

Please rank these external factors in terms of the impact you think they will have on network reliability. (1 = least important... 4 = most important)

Stakeholder Feedback:

Climate Resilience ranked 2nd

Stakeholders voted on external factors affecting reliability. In Scotland the most important factor was climate resilience, with an average score of 3.21 on a scale of 1 to 4, where 4 was most important. Overall Climate resilience was ranked second.



Flooding is identified in the Climate Resilience strategy as the most significant risk from climate change to the network supporting the need for flood mitigation of the network.

Stakeholder comments:

"There isn't a core theme of practising resilience in the face of current climate change issues such as flooding. Keeping the lights on is SSEN's only responsibility. Climate resilience is the only thing SSEN should be looking at as far as sustainability goes." Scottish Utility, 2020

4.6 Sites Requiring Further Investigation/Flood Protection

The ETR 138 report sets out a process for reviewing sites and identifying flood mitigation measures required as shown below:

Step 1 – completed

As set out in ETR 138, we have reviewed the Environmental Agency Flood Maps and overlayed the locations of their SEPD substations to produce a list of substations in the areas at risk of flooding. This list has been reviewed by our flood experts which resulted in a list of 47 sites at risk and requiring further investigation to establish the flood mitigation work required in RIIO-ED2. It should be noted that the number of sites located in the flood plain could increase with Environmental Agency models updated every 6 months. The sites currently at risk are summarised below:

SEPD

- 47 sites identified as at risk of flooding
    - 30 substations with 10,000+ customers reassessed for requiring protection of 1:1000 level flood risk as stated in ETR 138.
    - 17 substations newly at risk to flooding based on Environmental Agency data.

Table 2 - List of SEPD substations requiring further investigation of flood resilience

Substation Name	No. of Customers	ETR 138 Requirement
ARDLEY LANDFILL GENERATION		1in100
ARGYLE ROAD	10271	1in1000
ASHFORD COMMON	1	1in100
BOGNOR BRIDGE	8038	1in100
BOWERDEAN	14322	1in1000
BRAMLEY GREEN	2826	1in100
BRANDON ROAD	15966	1in1000
BRENTFORD	14049	1in1000
BUTTS ASH	11074	1in1000
COCKLEBURY	8647	1in100
COPLEY DENE	19441	1in1000

DOWN GRANGE	16361	1in1000
DRAYTON	44727	1in1000
FARNBOROUGH	10444	1in1000
FRYERS LANE	10789	1in1000
FYFIELD	3878	1in100
HAYES	17097	1in1000
HITCHES LANE	11524	1in1000
IRONBRIDGE	14210	1in1000
LABURNUM ROAD	10950	1in1000
LAKESIDE	2	1in100
LOCKERLEY	1	1in1000
MANCHESTER ROAD	12756	1in1000
MEYRICK ROAD	12402	1in1000
MINETY VILLAGE	2245	1in100
NORTHARBOUR ROAD GENERATION		1in100
PARKSTONE NORTH	16176	1in1000
PEACOCK FARM	1454	1in100
PINGEWOOD	2	1in100
READING	67986	1in1000
RYDE	14469	1in1000
SHAFTESBURY	33193	1in1000
SILVER STREET	10617	1in1000
SOUTHBOURNE	12084	1in1000
ST JOHNS	10995	1in1000
STANWELL	4351	1in100
STANWELL MOOR	1	1in100
SUNBURY CROSS	18535	1in1000
SUTTON LANE	4932	1in100
TRADING ESTATE	3011	1in100
UNION STREET	9067	1in100

VOLT AVENUE	2	1in1000
WATERLOOVILLE	14581	1in1000
WHITELEY	4690	1in100
WILSON ROAD	10635	1in1000
WIMBORNE	11564	1in1000
ZETLAND ROAD	14352	1in1000

Steps 2, 3, 4 and 5 – require funding for site surveys

Funding is required to undertake site surveys in order to complete steps 2-5. These site surveys will establish the flood risk for each substation, identify societal impacts, the options for flood protection and the proposed solution.

The results of the desktop analysis undertaken by [redacted] provides a high-level understanding of the flood risk, options for flood protection and potential costs (steps 2-5).

At this stage [redacted] high-level assessment does not consider the criticality of each substation (step 3). Additionally, [redacted] costs are a high-level indication of civil works only.

In depth studies of each substation would be required to establish criticality. This assessment would include factors such as the customers supplied by the substation and their activities, i.e. hospitals or critical national infrastructure, the potential duration of any failure & the availability of backup generators. This would provide a clear understanding of the societal impacts for at risk substations (step 3). Additionally, to establish options for flood protection and the actual costs for each site, surveys will need to be undertaken during RIIO-ED2. Appropriate costs for surveys, design, outage planning and senior authorised person resource have been added to estimated costs.

4.7 Sites Requiring Flood Protection

There are four sites in SEPD which have had already had further investigation and surveys undertaken to establish the flood mitigation work required. All four of these projects involve extensive civil and electrical works to mitigate the impact of flooding. The high-water table level at Wycombe Marsh substation also presents a further challenge to this particular project. The four sites and estimated costs for delivering the works are shown in table 3 below.

Table 3 - Sites with defined flood mitigation work

Substation Name	Cost of works
Dunbridge	£2.0m
Wycombe Marsh	£3.3m
Little Marlow	£3.2m
Central Bridge	£2.3m

5 Optioneering – Investment Under Consideration

The table below summarises the options considered for flood mitigation.

Option	Description	Status
1	Do Nothing	Not viable
2	Deliver programme of flood mitigation to comply with ETR 138	Progressed – Licence Obligation

5.1 Option 1: Do nothing.

Do nothing / Remedial Action. Site based mitigation to control flooding as it occurs.

This option is not feasible as it does not address the risks associated with substation flooding and increased vulnerability of the network. Based on industry guidance, flooding of substations and loss of supply due to a flood event is unacceptable. Furthermore, doing nothing would also not meet licence obligations. Therefore, this option was rejected.

Rejected.

5.2 Option 2: Deliver programme of flood mitigation to comply with ETR 138.

Carry out site surveys followed by implementation of flood mitigation schemes identified for SEPD during RIIO-ED2.

47 sites have been identified as at risk of flooding in SEPD. Detailed Flood Risk Assessments should be carried out on these sites in order to identify the most appropriate flood mitigation solution and the associated cost, following ETR 138 guidance. The most appropriate measure will then need to be implemented during RIIO-ED2.

The flood risk assessments will be carried our per site and follow the guidance set out in ETR 138:

- Flooding impact for fluvial, pluvial and coastal. As well as the potential impact of groundwater, burst water mains, reservoir damn failures and canals bursting their banks
- Establishing if a site will be protected by a National flood protection scheme
- Identifying the most appropriate flood protection system for each site
- Levels of acceptable flood risk and implications for investment including a Cost / Benefit assessment that considers, Societal Risk

On completion of the surveys the required flood mitigation measures will then be implemented.

Implement sites with flood mitigation work identified and costed.

Progressed – License Obligation.

6 Analysis & Cost

Analysis and costs have been carried out for option 2: Minimum requirements for SEPD.

6.1 SEPD

For SEPD, more detailed analysis has been carried out as the costs and volume of work is anticipated to be substantially higher than SHEPD. A CBA has not been developed due to there only being one option viable – Deliver programme of flood mitigation to comply with ETR 138 and align with licence obligations.

A desktop assessment of the sites which have been identified as at risk of flooding has been undertaken to provide a preliminary view on the potential costs. The assessment scored the sites based on flood risk, proposed flood defence measures, and provided an indicative flood defence cost.

This was based on the below approach:

1. Obtain Environment Agency flood data
2. Review general information (google maps, local media)
3. Desk top review of Surface Water flooding
4. Review BGS ground conditions
5. Review available data on site levels provided
6. Review any information provided by local field engineer
7. Review lowest point of electrical risk provided by local field engineer or others
8. Review site drawings provided (plan - and sections if possible)
9. Consider likely flood defence measures based on Flood risk assessment and site details
10. Review previous and completed flood defence works cost information and reduce to rates
11. Undertake rough measure of site and apply rates to assumed flood defence scheme
12. Calculate budget costs per site to get weighted / factored civil cost estimate per site variances evened out over largest possible sample size)

The following assumptions were made to develop the costs for SEPD:

- **Physical site surveys** - £[redacted] per site. This includes geotechnical, topographical and GPR surveys.
- **Flood defence works** – based on Cluttons high-level desk-top assessment per site. The measures range from raising bund walls, protecting switchboards to protecting the whole substation. See appendix for details.
- **Assets that may require work** - Based on the high-level desk-top assessment, some sites are estimated not to require flood defences although they are in a flood risk area. Funding is required to complete sites surveys and confirm these sites are not at risk. A low risk cost has also been allowed for these sites.
- **Outage and SAP works** – Based on the 41 sites identified for potential flood mitigation works we have added estimated costs for Outage Planning, Senior Authorised Person (SAP) resource and Project Management costs. Civil works for the sites is outlined in Appendix A.

The total forecast cost for SEPD to be spent on flood mitigation works is £[redacted]m for 51 sites.

SEPD	# Substations	Cost (£)
Surveys	47	£[redacted]

Flood defence works (incl in house design following survey)	39 survey and work proposed	£[redacted]m
Low Risk		£0.6m
Flood works identified	4 sites with survey work completed	£10.8m
Totals	**51 sites visited and/or work proposed**	**£[redacted]m**

6.2 Summary Table SEPD

In total we are requesting funding for £[redacted]m for RIIO-ED2. £[redacted]m of costs requested for SHEPD flood mitigation work are outlined in CV16 and referenced in our Environmental Action Plan (EAP). As outlined above the costs include surveys and estimated costs for the flood defence works which also include estimates for Outage Planning and SAP resource.

	# Substations	Cost (£m)
SEPD	51 survey work and/or work identified	£[redacted]m

7 Deliverability & Risk

Our ***Ensuring Deliverability and a Resilient Workforce (Chapter 16)*** describes our approach to evidencing the deliverability of our overall plan as a package, and its individual components. Testing of our EJPs has prioritised assessment of efficiency and capacity, and this has ensured that we can demonstrate a credible plan to move from SSEN's ED1 performance to our target ED2 efficiency. We have also demonstrated that SSEN's in house and contractor options can, or will through investment or managed change, provide the capacity and skills at the right time, in the right locations. This assessment has been part of the regular assessment of our EJPs, IDPs and BPDTs, and we will further refine our bottom-up efficiencies and work plan phasing through the ongoing development of our ED2 Commercial & Deliverability Strategy and engagement with our supply chain.

Our deliverability testing has identified a major strategic opportunity which is relevant to all EJPs.

- In ED2 SSEN will change the way Capital Expenditure is delivered, maximising synergies within the network to minimise disruptions for our customers. This is particularly relevant for a Price Control period where volumes of work are increasing across all work types.
- The principle is to develop and deliver Programmes of work, manage risk and complexity at Programme level and to develop strategic relationships with our Suppliers and Partners to enable efficiency realisation.
- The Commercial strategy will explore the creation of Work Banks (WB) and identify key constraints. The Load work will be the primary driver for a WB, supplemented by Non-Load work at a given Primary Substation. This approach will capitalise on synergies between the Load and Non-Load work, whereby the associated downstream work from a Primary Substation will maximise outage utilisation, enabling the programme to touch the network in a controlled manner with the objective of touching the network once. Where there is no Primary Load scheme to support the Non-Load work, these will be considered

and packaged separately, either insourced or outsourced dependant on volume, size and complexity.

- Transparency with the Supplier in terms of constraints, challenges, outage planning and engineering standards will capitalise on efficiencies, supported by a robust contracting strategy.

The specific considerations for deliverability based on the scope of this EJP are detailed below:

- Training
- Location including access issues and civils
- Supply chain
- Work phasing and project interdependencies
- System interfaces for controls, Network operation and SCADA

7.1 RIIO-ED2 BPDT Figures

The outputs from the Flood Mitigation works will be surveys for all sites and the implementation of flood mitigation measures for the sites where they are required.

In RIIO-ED2 the total planned spend is £[redacted] for SEPD. This is proposed to be delivered over the course of RIIO-ED2. For SEPD the costs increase on year due to the requirement to carry out surveys and plan works at the start of RIIO-ED2 prior to their construction in the latter years. The assumption has been for survey costs over 2024/2025/2026 and implementation of flood defence works from 2025 onwards, spread evenly over the years.

SHEPD – CV16

RIIO-ED2						
Flood Mitigation	2024	2025	2026	2027	2028	**Total**
Costs	£[redacted]	£[redacted]	£[redacted]	£[redacted]	£[redacted]	**£[redacted]**
Survey Volumes	10	10	5	5	0	**30**
Flood Work Volumes	0	5	5	2	2	**14**

SEPD – CV16

RIIO- ED2						
Flood Mitigation	2024	2025	2026	2027	2028	**Total**
Costs	£[redacted]	£[redacted]	£[redacted]	£[redacted]	£[redacted]	**£[redacted]**
Survey Volumes	23	24				**47 (4 already surveyed)**
Flood Work Volumes	2	2	10	14	15	**43**

7.2 Comparison to RIIO-ED1

In RIIO-ED1 spend to date for Flood Mitigation is £11.5m for the SEPD and predicted costs for the total spend in RIIO-ED1 are £17.5m.

In RIIO-ED2 predicted spend is £[redacted] for SEPD, on a yearly basis, this is higher than RIIO-ED1 giving an estimated £[redacted] per year in RIIO-ED2 compared to RIIO-ED1 which is an average of £[redacted] spend per year.

As volumes are claimed as a single unit per site where flood resilience achieved, each volume can reflect significantly different costs. Take the two examples below:

Substation	Total Cost	Works Carried Out
Bagshot 33/11kV Substation	£48,266	Duct and cable entry point sealing, sump and pump installation.
Osney 33/11kV Substation	£3,326,744 (to date)	Primary substation relocation, works ongoing.

Each of these case studies will be reported as a volume of 1. As such run rate analysis cannot be used in the same manner for this workstream as applied to others.

7.3 Approach to Delivery of Volumes

Until the surveys are undertaken, priority of these sites is not known. Once the surveys have been undertaken the sites will be prioritised and to ensure flood mitigation for the most critical and at-risk assets are completed first.

Flood mitigation works are currently undertaken by external contractors led by Major Projects via the Investment Management Process.

Detailed design for flood mitigation work is carried out by internal resource with external contractors implementing flood mitigation measures with in-house Project Management.

8 Conclusion

The purpose of this Engineering Justification Paper (EJP) has been to describe the overarching investment strategy that we intend to take during RIIO-ED2 for the non-load related flood mitigation works.

A background into flood mitigation has been provided including the licence obligations of ETR 138. Following ETR 138 guidance assets have been assessed for flood risk. Assets located in flood plains have been put forward for sites surveys in order to establish further detail on the flood risk and the flood defences works and costs.

On-site surveys are required for 47 sites in SEPD and the investment for flood mitigation includes £[redacted] for these surveys and £[redacted] estimated for flood defence works giving a total of £[redacted]. For SHEPD investment is required for surveys for 30 sites and estimated flood mitigation works at 14 of these sites at a total cost of £[redacted]. The combined total being requested for flood mitigation for both licence areas is £[redacted].

Delivery of this programme of work will allow us to meet our licence obligations with respect to compliance with the recommended standard for resilience to flooding of grid and primary substations, as detailed in ETR 138 Issue 3.

Appendix A SEPD [redacted] desk-top assessment of estimated flood works and costs

Site	Flood risk	Flood Risk factor 0,1-3	Flood measures allowed for	Flood defence costs (per site)
				exc VAT
ARGR	Fluvial (FZ1) SW (Medium)	2	Protect switch house at perimeter Protect coolers raise bund walls Bund kiosks Sump and pump to serve kiosks	£127,350
ARLG	Fluvial (FZ1) SW (Unknown at this point)	0	Assume no risk arising from development due diligence pending further information	£0
ASHC	Fluvial (FZ1) SW (Medium) Reservoir (Low risk but would be catastrophic if it occurred)	1	Protect to 300mm above GL	£144,319
BOGB	Fluvial (High) SW (high)	3	Protect building to 500mm above GL	£77,254
BOWE	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 550mm above floor level	£315,575
BRAG	Fluvial (FZ1) SW (Medium)	2	Protect switch house and bunds to 300mm above GL	£90,820
BRAR	Fluvial & Tidal (High)	3	Protect switch house to 2.4m above floor level	£559,336
BREN	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 400mm above floor level Protect TXs to approx. 600mm above gl	£449,382
BUTA	Fluvial (FZ1) Low risk of all forms of flooding	1	Protect everything to 300mm above GL	£145,836
COCK	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm above GL	£187,024
COPD	Fluvial (FZ1) SW (Low)	1	Protect switch house to 200 >FL Dam boards to oil tanks Sump and pump Seal TX enclosure walls and slabs	£186,540
DOWG	Fluvial (FZ1) SW (Medium)	2	Protect 1 switch house to 380mm above FL Protect stores to 380mm above FL Protect 2 kiosks and 2 CBS	£92,673
DRAY	Fluvial (FZ1) SW (Low)	1	Protect 2 No switch houses to 300mm above GL Protect 4 No TX bays - one door each and cemprotec Allow for dam boards and sump to ne sensitive area	£107,225
FABO	Fluvial (Medium-Low)	1	Protect switch house to 200mm above fl Rebuild brick bund walls to TX bays	£107,850
FRYL	Fluvial risk reduced Fluvial (FZ1), SW (high)	3	Protect switch house to 500mm above FL Break out and replace bund walls with dam board to 1.2m high Wind posts to blast wall Sump and pump Seal TX bay masonry	£331,289
FYFI	Fluvial (FZ1) SW (Medium)	2	Protect everything to 500mm above GL	£164,510
HAYE	Fluvial (FZ1) Low risk from all forms of flooding	1	No works required	£0

HITL	Fluvial (FZ1) Low risk from all forms of flooding	1	Protect anything below 300mm above GL Protect foul drainage Protect switch house front double doors Raise bund walls	£121,939
IRBR	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 300mm above GL	£99,875
LABU	Fluvial (FZ1) Low risk from all forms of flooding	1	Pump out basements and seal entries	£33,630
LAKE	Fluvial (FZ1) Reservoir Fluvial SW (Low)	1	Assume no risk arising from development due diligence pending further information	£0
LOCK	Fluvial (FZ1) SW (Medium)	2	Raise bund walls by 300mm	£58,399
MANR	Fluvial (FZ1) Low risk from all forms of flooding	1	Protect switch house and bunds to 300mm above GL	£238,146
MEYR	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 400mm above FL Raise bund walls to 600mm > GL	£158,200
MINV	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 300mm above GL Protect bunds to 300mm above GL	£118,731
NORTH	Fluvial (FZ1) SW (High)	3	Raise bund walls with dam boards and gate access	£156,994
PARN	Fluvial (FZ1) SW (Medium)	2	Protect house to 600mm >FL Protect isolator switches by LER with dam boards to 800mm above GL	£159,214
PEAF	Fluvial (FZ1) SW (High)	3	Protect switch house and TXs to 1200mm above GL	£525,374
PING	Fluvial (FZ1) SW (Medium -Low)	2	Protect switch house and TX bays to 300mm above GL	£218,962
READ	Fluvial (FZ1) SW (Medium)	2	Protect old switch house to 750mm above FL Protect new switch house to 45mm above FL Seal up old control room and add sump and pump Raise bund walls by 750mm	£521,783
RYDE	Fluvial (Medium) SW (High)	3	Protect bunds at bottom of slope Protect switch house from SW entry	£543,176
SBOU	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm >GL	£118,509
SHAF	Fluvial (FZ1) SW (Medium)	2	Protect TX bays and switch house to lower site to 500mm above GL	£225,137
SILS	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£0
STAM	Fluvial (FZ1) SW (Medium) Reservoir (Low risk of occurrence high risk of damage)	2	Protect to 500mm above GL	£246,147
STAN	Fluvial (FZ1) Reservoir (Low risk of occurrence high risk of damage)	1	Protect SW up to 300mm > Gl	£101,104
STJO	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£0
SUNX	Fluvial (FZ1) SW (Medium)	2	Switch House protect to 150mm above FFL Bunds raise wall height by 300mm average Renew and redo site surface water drainage due to issues with present arrangement	£218,465

SUTL	Fluvial (FZ1) SW (Medium -Low)	2	Protect everything to 300mm above GL	£109,461
TRAE	Fluvial (FZ1) SW (Medium-Low) Lagoon water body close to the site	2	Protect everything to 300mm above GL	£88,135
UNIS	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm above gl	£180,472
VOLA	Fluvial (FZ1) SW (Medium)	2	Protect to 300mm above GL	£271,118
WATE	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£0
WHLE	Fluvial (FZ1) SW (Medium)	2	Protect everything to 500mm above GL	£207,893
WILR	Fluvial (FZ1) SW (Medium -Low)	2	Protect switch house to 250 above FL, Incl. abutting TX enclosure	£145,426
WIMB	Fluvial (FZ1) Low risk from all forms of flooding	1	No Action	£0
ZETR	Fluvial (FZ1) Low risk from all forms of flooding	1	No Action	£0

Appendix B Defined Flood Schemes for Implementation

Project #	Site name	Cost £m
PS000552	DUNBRIDGE	£2.0m
PS002105	WYCOMBE MARSH	£3.3m
PS002358	LITTLE MARLOW	£3.2m
PS001996	CENTRAL BRIDGE	£2.3
Total		**£10.8m**

Appendix C Business Plan Data Table References

BPDT Reference No	BPDT Title	BPDT Revision	Date
CV16	7/SSEPD/ENV/FLOOD	-	01/10/2021

Appendix D SEPD [redacted] desk-top assessment of estimated flood works and costs

Site	Flood risk	Flood Risk factor 0,1-3	Flood measures allowed for	Flood defence costs (per site)
				exc VAT
ARGR	Fluvial (FZ1) SW (Medium)	2	Protect switch house at perimeter Protect coolers raise bund walls Bund kiosks Sump and pump to serve kiosks	£[redacted]
ARLG	Fluvial (FZ1) SW (Unknown at this point)	0	Assume no risk arising from development due diligence pending further information	£[redacted]
ASHC	Fluvial (FZ1) SW (Medium) Reservoir (Low risk but would be catastrophic if it occurred)	1	Protect to 300mm above GL	£[redacted]
BOGB	Fluvial (High) SW (high)	3	Protect building to 500mm above GL	£[redacted]
BOWE	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 550mm above floor level	£[redacted]
BRAG	Fluvial (FZ1) SW (Medium)	2	Protect switch house and bunds to 300mm above GL	£[redacted]
BRAR	Fluvial & Tidal (High)	3	Protect switch house to 2.4m above floor level	£[redacted]
BREN	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 400mm above floor level Protect TXs to approx. 600mm above gl	£[redacted]
BUTA	Fluvial (FZ1) Low risk of all forms of flooding	1	Protect everything to 300mm above GL	£[redacted]
COCK	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm above GL	£[redacted]
COPD	Fluvial (FZ1) SW (Low)	1	Protect switch house to 200 >FL Dam boards to oil tanks Sump and pump Seal TX enclosure walls and slabs	£[redacted]
DOWG	Fluvial (FZ1) SW (Medium)	2	Protect 1 switch house to 380mm above FL Protect stores to 380mm above FL Protect 2 kiosks and 2 CBS	£[redacted]
DRAY	Fluvial (FZ1) SW (Low)	1	Protect 2 No switch houses to 300mm above GL Protect 4 No TX bays - one door each and cemprotec Allow for dam boards and sump to ne sensitive area	£[redacted]
FABO	Fluvial (Medium-Low)	1	Protect switch house to 200mm above fl Rebuild brick bund walls to TX bays	£[redacted]
FRYL	Fluvial risk reduced Fluvial (FZ1), SW (high)	3	Protect switch house to 500mm above FL Break out and replace bund walls with dam board to 1.2m high Wind posts to blast wall Sump and pump Seal TX bay masonry	£[redacted]
FYFI	Fluvial (FZ1) SW (Medium)	2	Protect everything to 500mm above GL	£[redacted]
HAYE	Fluvial (FZ1) Low risk from all forms of flooding	1	No works required	£[redacted]

HITL	Fluvial (FZ1) Low risk from all forms of flooding	1	Protect anything below 300mm above GL Protect foul drainage Protect switch house front double doors Raise bund walls	£[redacted]
IRBR	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 300mm above GL	£[redacted]
LABU	Fluvial (FZ1) Low risk from all forms of flooding	1	Pump out basements and seal entries	£[redacted]
LAKE	Fluvial (FZ1) Reservoir Fluvial SW (Low)	1	Assume no risk arising from development due diligence pending further information	£[redacted]
LOCK	Fluvial (FZ1) SW (Medium)	2	Raise bund walls by 300mm	£[redacted]
MANR	Fluvial (FZ1) Low risk from all forms of flooding	1	Protect switch house and bunds to 300mm above GL	£[redacted]
MEYR	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 400mm above FL Raise bund walls to 600mm > GL	£[redacted]
MINV	Fluvial (FZ1) SW (Medium)	2	Protect switch house to 300mm above GL Protect bunds to 300mm above GL	£[redacted]
NORTH	Fluvial (FZ1) SW (High)	3	Raise bund walls with dam boards and gate access	£[redacted]
PARN	Fluvial (FZ1) SW (Medium)	2	Protect house to 600mm >FL Protect isolator switches by LER with dam boards to 800mm above GL	£[redacted]
PEAF	Fluvial (FZ1) SW (High)	3	Protect switch house and TXs to 1200mm above GL	£[redacted]
PING	Fluvial (FZ1) SW (Medium -Low)	2	Protect switch house and TX bays to 300mm above GL	£[redacted]
READ	Fluvial (FZ1) SW (Medium)	2	Protect old switch house to 750mm above FL Protect new switch house to 45mm above FL Seal up old control room and add sump and pump Raise bund walls by 750mm	£[redacted]
RYDE	Fluvial (Medium) SW (High)	3	Protect bunds at bottom of slope Protect switch house from SW entry	£[redacted]
SBOU	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm >GL	£[redacted]
SHAF	Fluvial (FZ1) SW (Medium)	2	Protect TX bays and switch house to lower site to 500mm above GL	£[redacted]
SILS	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£[redacted]
STAM	Fluvial (FZ1) SW (Medium) Reservoir (Low risk of occurrence high risk of damage)	2	Protect to 500mm above GL	£[redacted]
STAN	Fluvial (FZ1) Reservoir (Low risk of occurrence high risk of damage)	1	Protect SW up to 300mm > Gl	£[redacted]
STJO	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£[redacted]
SUNX	Fluvial (FZ1) SW (Medium)	2	Switch House protect to 150mm above FFL Bunds raise wall height by 300mm average Renew and redo site surface water drainage due to issues with present arrangement	£[redacted]

SUTL	Fluvial (FZ1) SW (Medium -Low)	2	Protect everything to 300mm above GL	£[redacted]
TRAE	Fluvial (FZ1) SW (Medium-Low) Lagoon water body close to the site	2	Protect everything to 300mm above GL	£[redacted]
UNIS	Fluvial (FZ1) SW (Medium)	2	Protect everything to 300mm above gl	£[redacted]
VOLA	Fluvial (FZ1) SW (Medium)	2	Protect to 300mm above GL	£[redacted]
WATE	Fluvial (FZ1) Low risk from all forms of flooding	1	No action	£0
WHLE	Fluvial (FZ1) SW (Medium)	2	Protect everything to 500mm above GL	£[redacted]
WILR	Fluvial (FZ1) SW (Medium -Low)	2	Protect switch house to 250 above FL, Incl. abutting TX enclosure	£[redacted]
WIMB	Fluvial (FZ1) Low risk from all forms of flooding	1	No Action	£0
ZETR	Fluvial (FZ1) Low risk from all forms of flooding	1	No Action	£0

Appendix E Defined Flood Schemes for Implementation

Project #	Site name	Cost £m
PS000552	DUNBRIDGE	£2.0m
PS002105	WYCOMBE MARSH	£3.3m
PS002358	LITTLE MARLOW	£3.2m
PS001996	CENTRAL BRIDGE	£2.3
Total		**£10.8m**