Rampion 2 Wind Farm

Category 7: Other Documents

Outline Operational Drainage Plan (tracked changes)

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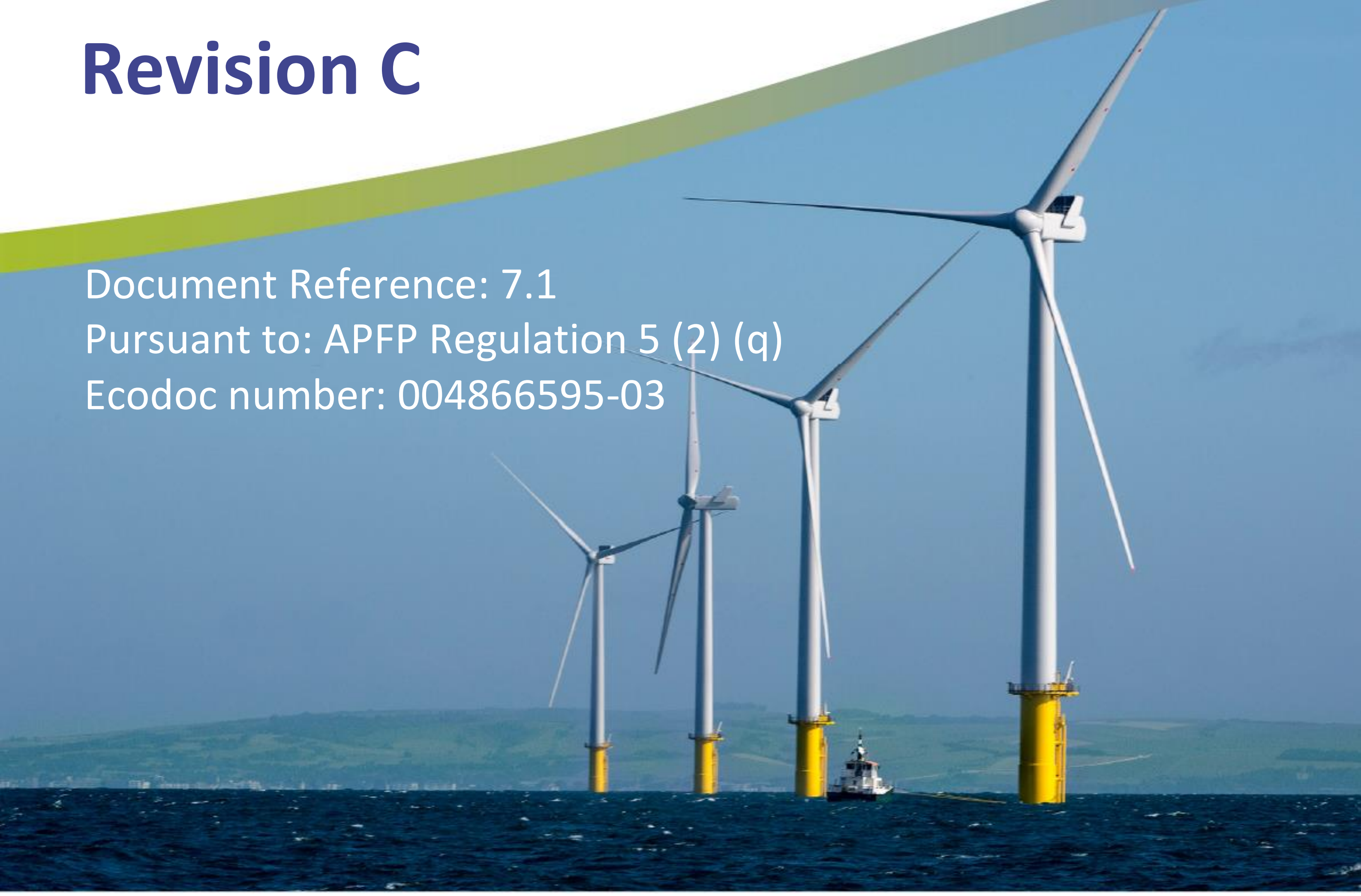

Document revisions

Revision	Date	Status/reason for issue	Author	Checked by	Approved by
A	04/08/2023	Final for DCO Application	WSP	RED	RED
B	25/04/2024	Updated to reflect new commitment.	WSP	RED	RED
C	03/06/2024	Paragraph 2.4.8 updated at Deadline 4	WSP	RED	RED

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Executive Summary

This Outline Operational Drainage Plan has been prepared to provide the outline proposals for drainage required for the operations of the relevant onshore elements of the Proposed Development. This plan covers the proposed onshore substation at Oakendene and the National Grid Bolney substation extension. This is part of a suite of plans supporting development into the operations phase of Rampion 2.

The Outline Operational Drainage Plan has been produced following flood modelling and drainage assessments carried out in **Chapter 26: Water Environment, Volume 2** of the ES (Document Reference: 6.2.26). This has informed the embedded environmental measures secured within this document.

This Outline Operational Drainage Plan includes information on the drainage system requirements and results of surface water modelling. It also includes details on the proposed surface water and foul water drainage solutions at each site.

A detailed Operational Drainage Plan will be produced following the grant of the Development Consent Order (DCO) and prior to the construction of these works. This will be produced in accordance with this Outline Operational Drainage Plan.

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1. Introduction

1.1 Overview of the Proposed Development

1.1.1 Rampion Extension Development Limited (hereafter referred to as ‘RED’) (the Applicant) is developing the Rampion 2 Offshore Wind Farm Project (‘Rampion 2’) located adjacent to the existing Rampion Offshore Wind Farm Project (‘Rampion 1’) in the English Channel.

1.1.2 Rampion 2 will be located between 13km and 26km from the Sussex Coast in the English Channel and the offshore array area will occupy an area of approximately 160km^2.

1.1.3 The key offshore elements of the Proposed Development will be as follows:

- up to 90 offshore wind turbine generators (WTGs) and associated foundations;
- blade tip of the WTGs will be up to 325m above Lowest Astronomical Tide (LAT) and will have a 22m minimum air gap above Mean High Water Springs (MHWS);
- inter-array cables connecting the WTGs to up to three offshore substations;
- up to two offshore interconnector export cables between the offshore substations; and
- up to four offshore export cables each in its own trench, will be buried under the seabed within the final cable corridor;
- the export cable circuits will be High Voltage Alternating Current (HVAC), with a voltage of up to 275kV.

1.1.4 The key onshore elements of the Proposed Development will be as follows:

- a single landfall site near Climping, Arun District, connecting offshore and onshore cables using Horizontal Directional Drilling (HDD) installation techniques;
- buried onshore cables in a single corridor for the maximum route length of up to 38.8km using:
- trenching and backfilling installation techniques;
- trenchless and open cut crossings;
- a new onshore substation, proposed near Cowfold, Horsham District, which will connect to an extension to the existing National Grid Bolney substation, Mid Sussex, via buried onshore cables; and
- extension to and additional infrastructure at the existing National Grid Bolney substation, Mid Sussex District to connect Rampion 2 to the national grid electrical network.

1.1.5 A full description of the Proposed Development is provided in **Chapter 4: The Proposed Development, Volume 2** of the ES (Document Reference: 6.2.4).

1.2 Purpose

1.2.1 This Outline Operational Drainage Plan (ODP) defines the basis of design for the operational drainage at the onshore substation at Oakendene and the National Grid Bolney substation extension works based on the information available at the time of application.

1.2.2 An ODP will be produced for each site prior to construction of the onshore substation or extension works for the approval of the lead local flood authority and will be developed in accordance with this Outline ODP.

2. Oakendene Substation

2.1 Site description

2.1.1 The onshore substation at Oakendene is located on greenfield land near to Oakendene Industrial Estate (National Grid Reference (NGR) TQ 230223), approximately 1.6km east of Cowfold. Access to the onshore substation is from the north via Bolney Road (A272).

2.1.2 The onshore substation footprint covers an area of 6.00 hectares (ha), whilst the wider proposed DCO Order Limits cover a total area of approximately 22ha around the onshore substation (referred to hereafter as 'the Site'). Based on the onshore substation indicative layout plan, the total hardstanding area will be approximately 1.70ha and the remaining 4.30ha will typically be covered by a 225mm layer of Ministry of Transport (MOT) Type 1 granular material with 75mm of stone chippings on top.

2.1.3 The existing land-use across the onshore substation site is predominantly open pasture, though several tree rows intersect the onshore substation footprint and border the wider site boundaries.

2.1.4 Elevations across the onshore substation site typically range from 15-17m Above Ordnance Datum (AOD), sloping from north to south. The onshore substation site naturally drains via existing ditches running along the tree and hedgerows through the centre of the site and along the eastern boundary, into a minor watercourse (tributary of the Cowfold Stream) that flows east to west along the southern boundary of the site.

2.1.5 The Environment Agency Risk of Flooding from Surface Water (RoFSW) (Environment Agency 2023a) mapping maps a surface water flowpath intersecting the northern boundary of the onshore substation site, which flows initially south along the indicative proposed access road before turning east, and flowing south via an existing ditch along Kent Street which forms the eastern boundary of the site. A second, less significant flowpath intersects the western portion of the onshore substation site, flowing from north to south along the existing tree rows. These flow paths are addressed in this plan for the onshore substation site.

2.2 Requirements of the drainage system

2.2.1 The need for sustainable surface water management is set out in the National Policy Statement for Energy (NPS EN-1 (Department of Energy and Climate Change (DECC), 2011), National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021) and accompanying Planning Practice Guidance (PPG) (MHCLG, 2022) and the Defra Non-Statutory Technical Standards for Sustainable Drainage Systems (SuDS) (Defra, 2015). Best practice guidance is provided in the Chartered Industry Research and Information Association (CIRIA) SuDS manual (Woods-Ballard et al., 2015).

Quantity – Flow rates and volume requirements

2.2.2 As set out in the Environment Agency's climate change allowances for flood risk assessments (Environment Agency, 2022b), for developments with lifetimes between 2061 and 2100 (decommissioning is anticipated to extend to 2065) developments should be designed so that for the central allowance in the one percent annual exceedance probability event:

- there is no increase in flood risk elsewhere; and
- the development itself should be safe from surface water flooding.

2.2.3 The design requirement for attenuation volume storage is therefore deemed to be the one percent annual exceedance probability (AEP) plus 25 percent climate change allowance for increase in peak rainfall intensity, as per the guidance for the Adur and Ouse management catchment.

2.2.4 For the purposes of estimating attenuation storage volume requirements for this assessment, a conservative approach of assuming that the entire onshore substation site is entirely impermeable has been taken. This is on the basis that the proposed granular material, whilst not impermeable themselves, is likely to form part of the attenuation storage serving the site, so any rainfall will be entering the attenuation storage medium directly.

2.2.5 Furthermore, a conservative 'attenuation' approach has been taken to demonstrate that the increase in volume of run-off associated with an increase in hardstanding footprint can be addressed without the need to incorporate long-term storage into the design (an approach rarely implemented in practice). This conservative attenuation approach has been to assume no infiltration and discharges being limited to greenfield Q_{BAR} (mean annual flood) rates and/or two l/s/ha, whichever is greater. Such an approach involves a more-straightforward design, but slightly larger storage volumes overall (than a long-term storage approach). Therefore, in demonstrating that such an approach can be achieved, it has been demonstrated that the worst-case in terms of storage volumes is achievable with the proposed onshore substation site layout.

Flood resilience

2.2.6 The Oakendene substation will have a flood resilience level of the 0.1 percent AEP event plus climate change and a further 300mm allowance for freeboard, consistent with National Grid's design guidance for substations (National Grid, 2016), as outlined in the **Design and Access Statement** (Document Reference 5.8)**.**

Quality – Treatment requirements

2.2.7 The proposals for managing surface water quality is based on the Management Train approach as outlined in the CIRIA SuDS manual (Woods-Ballard et al., 2015). This approach aims to manage surface water close to source and, as the water is conveyed through the Site, sequential SuDS techniques reduce the intensity of flow and to enhance the quality of flow by removing pollutants.

2.2.8 Substations are not explicitly identified in Section 26.7 and Table 26.2 of the SuDS manual (Woods-Ballard et al., 2015) with respect to their pollution hazard level. It is anticipated that the pollution hazard would be determined prior to detailed design, so at this outline design stage a precautionary approach has been taken of considering high pollution hazard (whether or not that is later identified to be appropriate in practice) and using the Simple Index Approach set out in the CIRIA SuDS Manual.

2.2.9 A number of potential treatment measures have been identified at this outline stage which in combination will exceed the indices identified, to ensure flexibility for delivery is available at the subsequent detailed design stage.

SuDS selection

2.2.10 A high-level assessment has been made by considering the SuDS hierarchy and choosing suitable techniques in line with the main objectives of Quantity (Flood Reduction), Quality (Pollution Reduction) and Amenity/Biodiversity (Landscape and Wildlife Benefit). It is worth noting that the amenity benefit of the Proposed Development are likely to be limited given its proposed use in serving an onshore substation, and anticipated lack of public access. However, the wet woodland planting integrated within the SuDS basins will provide a landscape function.

Surface water drainage hierarchy

2.2.11 Before disposal of surface water is considered, opportunities for reuse on-site should be considered. Where a development would have a water demand, rainwater harvesting of roofwater can provide a supply of grey water to reduce the potable water demand. This is particularly advantageous for developments located in water stressed areas such as this.

2.2.12 In this case however, the need for water supply at the onshore substation site is considered to be low given the substation will be unmanned. Rainwater harvesting will be utilised wherever practicable in order to further reduce negligible operational water usage at the site. This will be considered further at detailed design stage.

2.2.13 Disposal of surface water should be considered sequentially using the surface water disposal hierarchy, as set out below. Evidence should be provided to demonstrate that the preferred options in the hierarchy have been explored before moving onto subsequent options. The disposal hierarchy is as follows:

- Discharge by infiltration to the ground;
- Discharge to an open surface water body;
- Discharge to a surface water sewer; and
- Discharge to a combined sewer.

2.2.14 Based on the National Policy Planning Framework (NPPF) guidance (MHCLG, 2021), each of the drainage options are examined in detail in order to assess the feasibility of using a combination of SuDS.

Discharge via infiltration to the ground

2.2.15 No soil infiltration testing has been undertaken at the onshore substation site to date. Reference to the British Geological Survey (BGS) mapping (BGS 2023) indicates that the onshore substation is underlain by Weald Clay formation and some sparse coverage of river terrace deposits to the west. Soilscapes soil mapping (Cranfield University, 2023) indicates that the onshore substation site is underlain by slowly permeable seasonally wet soils with impeded drainage.

2.2.16 Given the presence of clay and the poorly drained soils, discharge of surface water to the ground is not considered feasible. If deemed necessary by the Lead Local Flood Authority (LLFA), soakage testing could be undertaken post-granting of DCO consent to demonstrate this, but this would be considered unnecessary if ground investigation undertaken to support the wider detailed design of the onshore substation indicates ground conditions unsuitable for infiltration, clay is expected from the desk-based information available at this stage.

Discharge to an open surface water body

2.2.17 An unnamed Ordinary Watercourse (a tributary of the Cowfold Stream) flows east to west along the southern boundary of the onshore substation site (into which the former ditch flows into). This open watercourse provides a suitable location for discharge of surface water from the onshore substation site.

Discharge to a surface water sewer

2.2.18 Given the greenfield location of the onshore substation site, it is unlikely that any public sewers intersect the site and no sewer records were available for the purposes of this study. Discharge to a surface water sewer has not been considered on the basis that an open watercourse is available for discharge.

Discharge to a combined sewer

2.2.19 As described in **paragraphs 2.2.17** and **2.2.18**, an open watercourse is available for discharge of surface water and therefore, discharge to a combined sewer would not be appropriate.

2.3 Surface water modelling

Climate change

2.3.1 The Environment Agency's online climate change allowances for flood risk assessments (Environment Agency 2022a) provides national guidance on peak rainfall intensity allowances that should be used for drainage of new developments.

2.3.2 The PPG guidance (MHCLG, 2022) states that for developments with a lifetime between 2061 and 2100, the central allowance (25 percent) should be applied for the 2070s epoch (2061 to 2125). However, NPS EN-1 (DECC, 2011a; DESNZ, 2023) states that where energy infrastructure has safety critical elements, a credible maximum climate change scenario should be considered. Therefore, to ensure a precautionary approach is taken to the initial attenuation storage volume assessment undertaken to support this plan, the Upper End climate change allowance for peak rainfall intensity of 45 percent for the Adur and Ouse management catchment has been considered.

2.3.3 This assumption is precautionary in that for the final design the 45 percent allowance need only be considered with respect to flood risk to safety critical elements, rather than consideration of flood risk to off-site third parties. In addition, the Environment Agency guidance (2022a) does not explicitly state how the maximum credible scenario should be considered with respect to peak rainfall intensity. However, this approach has been taken at this outline stage to demonstrate that the outline design presented will be capable of addressing a more-extreme event than explicitly required by current guidance.

Greenfield runoff rates

2.3.4 The undeveloped greenfield runoff rate for the site (5.9 ha) has been estimated using the Revitalised Flood Hydrograph 2 (ReFH2) method in accordance with the Environment Agency flood estimation guidelines (Environment Agency 2022b). Greenfield runoff rates are provided in **Table 2-1**.

Table 2-1 Site Greenfield runoff rates

AEP (%)	Return period (yrs)	Greenfield Runoff Rate (l/s)	Unit Greenfield Runoff Rate (l/s per Ha)
100	1	45.87	7.77
Q_{BAR}	2.3	59.75	10.13
3.33	30	115.97	19.66
1	100	147.94	25.07

Storage volume estimation

2.3.5 The UKSuDS tool (HR Wallingford, 2023) has been used to estimate the surface water attention storage volume requirements for the onshore substation site, limiting discharges to the ReFH2 greenfield rate calculated above.

2.3.6 Flow control for the system to a maximum of Q_{BAR} (or 2 l/s/ha, whichever is greater) was used for the design criteria. The onshore substation site has been considered entirely impermeable, as discussed above. A total storage attenuation volume of approximately 3,800m^3 has been estimated as being required for the entire onshore substation footprint. An outline plan which will deliver this attenuation, and meet the other requirements for the drainage system, is set out in **Section 2.4: Proposed surface water drainage**.

2.4 Proposed surface water drainage

Outline SuDS plan

2.4.1 The final SuDS features will be identified as part of the Operational Drainage Plan (ODP), to be developed post-granting of the DCO. The outline plan is intended to be indicative and demonstrate that it is possible to manage surface water using a SuDS approach on site to provide the required volume of attenuation storage and treatment before discharge within the proposed onshore substation site layout.

2.4.2 The outline SuDS plan for the onshore substation site is indicated in the onshore substation layout plan (shown in **Appendix A**). This outline plan includes:

- Capturing and managing overland flow running-on the site to reduce on-site flood risk;
- Managing surface water run-off to ensure no increase in flood risk elsewhere by provided attenuation storage for the one percent AEP plus climate change event;
- Flood resilience up to the 0.1 percent AEP plus climate change plus 300 mm freeboard;
- A SuDS plan which focuses on surface SuDS components, as follows:
  - four basins;
  - four filter drains;
  - 1 x swale up to 4m in width; and
  - Granular material at the ground surface to provide source control (contributing towards interception of the first 10mm of rainfall) and supplementary attenuation volume.
- Treatment via a SuDS management train prior to discharge in accordance with the CIRIA SuDS Manual Simple Index Approach; and
- Discharging to the open watercourse to the south;
  - under gravity; and
  - limited to the greenfield Q_{BAR} rate or two l/s (whichever is greater).

2.4.3 It is proposed that the existing surface water flowpath intersecting the onshore substation site from north to south (as shown in **Figure 26.2.6a, Annex B** in **Appendix 26.2**: **Flood Risk Assessment, Volume 4** of the ES (Document Reference 6.4.26.2)) will be captured and managed by the proposed filter drain which will run alongside the proposed access road. The intent is to control the run-on flow by diverting into an attenuation basin ('P1' in **Table 2-2** and shown in **Appendix A - Oakendene Onshore Substation - Indicative SuDS plan**) to the northeast of the onshore substation footprint. This basin will be designed to attenuate these surface water run-on flows, and release at a controlled rate under gravity into a swale running along the eastern boundary of the onshore substation footprint. In doing so, the existing surface water flood risk at the site will be managed such that the onshore substation will be at negligible flood risk from surface water flooding during extreme storm events.

2.4.4 The swale would then discharge into a secondary basin ('P2' shown in **Appendix A - Oakendene Onshore Substation - Indicative SuDS plan**) in the south eastern corner of the onshore substation site, the primary purpose of which is to provide attenuation for run-off from the onshore substation itself (discussed further below), before finally discharging to the existing stream / unnamed Ordinary Watercourse running along the southern boundary of the onshore substation site. 'Spare' capacity in basin P1 and the swale could be used to contribute to the run-off attenuation requirements, but for the initial assessment undertaken below, it was assumed that none of the capacity of P1 would be available, to demonstrate that the plan would not rely on this.

2.4.5 In terms of drainage of the onshore substation itself, the first SuDS element would be the granular material covering much of the ground surface, which would provide source control and a first element of attenuation capacity. The eastern and north-eastern portion of the onshore substation footprint would discharge to the swale (or basin P1 if capacity exists) mentioned previously running along the eastern boundary of the onshore substation, before discharging into basin 'P2'.

2.4.6 Southern and southwest portions of the onshore substation would be served by a filter drain and basin 'P3' (shown in **Appendix A - Oakendene Onshore Substation - Indicative SuDS plan**) and the west and northwest portions of the onshore substation would discharge via a filter drain to basin 'P4' (shown in **Appendix A - Oakendene Onshore Substation - Indicative SuDS plan**). The granular material, swale and/or filter drains and basins would provide multiple stages of attenuation and treatment before discharge under gravity at controlled rates (Q_{BAR}) to the stream to the south.

2.4.7 All basin footprints are situated outside of the 0.1 percent AEP RoFSW flood extent for the watercourse to the south, which as agreed with West Sussex County Council (WSCC), has been used as a proxy for the fluvial one percent AEP plus climate change event for that watercourse.

2.4.8 As indicated above, the system would discharge to the ordinary watercourse to the south, the outfalls for which would be located along the banks of the watercourse, and thus within the fluvial one percent AEP plus climate change event for the watercourse. The potential impact of surcharged outfalls (during a fluvial flood event in the watercourse) on the attenuation capacities required will be considered when developing the detailed design as part of the ODP.

~~Detailed hydraulic modelling of the watercourse will be undertaken at the detailed in accordance with the DCO Requirement for surface and foul drainage to confirm design flood levels for the watercourse, in addition to detailed drainage modelling to inform the final ODP. The detailed drainage modelling will incorporate flood hydrograph results for the watercourse output from the hydraulic model to account for the impact of surcharged outfalls during a fluvial flood event in the watercourse in the final design of the ODP.~~

2.4.9 The basins have been indicated in the Indicative Landscape Plan provided in Appendix D of the and **Design and Access Statement** (Document Reference 5.8) as being wet woodland, which would maximise the biodiversity benefits of the outline plan, as well as improve the interception likely beyond the 10mm suggested by guidance. Given the current use of the onshore substation site, it is feasible that the proposals would result in a reduction in run-off from the site overall, and potentially help to reduce flood risk in Kent Street.

2.4.10 Estimated storage capacities for each of the basins is provided in **Table 2-2** Capacities have been estimated considering a number of assumptions, as detailed in the footnotes to the table.

Table 2-2 Indicative basin attenuation capacities

Pond/ Basin	Indicative footprint area (m^2)	Estimated capacity (m^3)[1]	Comments
P1	3,230	2,365	Primarily intended to attenuate surface water run-on from the north, prior to conveyance at controlled rates via the filter drain swale along the eastern boundary of the site but could provide supplementary run-off attenuation as well if required.
P2	3,550	2,700	For attenuation of surface water run-off from the eastern and north eastern portions of the site.
P3	2,830	1,010	For attenuation of surface water run-off from the southern and southwest portions of the site.
P4	2,230	1,220	For attenuation of surface water run-off from the west and north-western portion of the site.
Total[2]		4,930	

2.4.11 It is anticipated that sufficient volume is available within basins P2-P4 alone (4,930m^3) to provide the required attenuation volume to limit discharge of surface water to Q_{BAR} or 2 l/s (an attenuation requirement of 3,800m^3 was estimated above, using the precautionary climate change allowance of 45 percent increase in peak rainfall intensity, which is beyond that required by the final design).

2.4.12 Furthermore, the proposals offer further flexibility given the capacities considered above do not include that provided by the granular material which will be used across the ground surface across the majority of the site (the primary purpose of which is for electrical safety purposes), and the various swales and filter drains.

2.4.13 The outline design for the onshore substation assumes a granular material fill of approximately 75mm depth will cover approximately 70 percent of the onshore substation site, thereby providing an additional storage volume of approximately 950m^3 assuming MoT Type 3 (or similar) material and a void coefficient of 0.3 in accordance with the CIRIA SuDS Manual (Woods-Ballard et al., 2015). The depth of

[1] Storage volumes have been estimated assuming a permanent depth of 1.5 m and freeboard of 300mm, side slopes of 1:3 and a maintenance strip of 3 m.
[2] Total storage volume excludes basin 'P1', which for this outline plan has been assumed to provide attenuation for surface water run-on associated with the surface water flowpath flowing north to south through the onshore substation site only. At the detailed design stage, once the required volume to attenuate this run-on has been determined, it may be evident that there is remaining capacity available to accommodate surface run-off from the onshore substation in addition.

granular material could be increased as necessary to make up any shortfall in the attenuation volume requirements if required at detailed design stage.

2.4.14 This allows for significant flexibility in the final design of the onshore substation, which could be subject to further refinement for any number of reasons including reduction in the basin footprints and/or side slopes to improve the functioning of the SuDS system, and/or for the benefit of other environmental disciplines (shallower side slopes may achieve increased biodiversity benefits for example). Such matters will be considered further when preparing the ODP.

SuDS treatment

2.4.15 It is anticipated that pollution control measures would serve to limit the pollution potential of the onshore substation site, but some degree of pollutants would likely still be captured by the surface water run-off and require capture and/or treatment before discharge. The pollution hazard indices for a substation are not provided in Table 26.2 of the CIRIA SuDS manual (Woods-Ballard et al., 2015), but taking a precautionary approach of assuming a high pollution hazard level, would result in indices of 0.8 (total suspended solids), 0.8 (metals) and 0.9 (hydrocarbons). As discussed, industry standard pollution control measures may result in a lower hazard level in practice. The appropriate pollution hazard level for the onshore substation would be considered further at the detailed design stage during the preparation of the ODP. The precautionary approach has been taken to demonstrate that the worst-case treatment requirements would be addressed by the outline plan.

2.4.16 It is anticipated that the granular material (and subgrade) could provide a similar level of treatment as a permeable pavement (indices of 0.7, 0.6 and 0.7 respectively). Combined with the filter drains (0.4, 0.4 and 0.4) and/or swale (0.5, 0.6 and 0.6), and finally the basins containing wet woodland (minimum of 0.5, 0.5, and 0.6, but arguably 0.8, 0.8 and 0.8) it is anticipated that the proposed SuDS plan would provide sufficient treatment capacity (minimum total SuDS mitigation index of at least 1.05) regardless of any proprietary treatment systems, which could be implemented to make up any shortfall if required, or indeed could be required as standard for elements of the onshore substation as part of the pollution control requirements.

SuDS maintenance

2.4.17 The SuDS system will require maintenance to ensure continued functionality of the SuDS system, in accordance with best practice (for example, the SuDS manual). The maintenance responsibility will be held by the substation operator, and options for long-term maintenance will be considered further post-consent and secured through the DCO requirement for the ODP.

Groundwater level monitoring

2.4.18 Groundwater levels will be considered as part of the detailed design at the onshore substation at Oakendene, which will be informed by ground investigation. This is set out in commitment C-293 which states that: “RED will undertake ground investigation at the substation site at the detailed design stage, including groundwater monitoring in at least one appropriate location in close proximity to the watercourse to the south of the site, for one winter period (September to April). This would be carried out to inform the detailed design of the substation, including design of the drainage system and its associated landscaping and planting measures.

2.5 Outline foul drainage plan

2.5.1 The onshore substation at Oakendene will be unmanned however welfare facilities are planned.

2.5.2 Connection to the existing sewage network will be investigated during detailed design however due to the low frequency of use it is likely that a septic tank (Approximately 9000 litres) will be installed and emptied as required.

2.6 Conclusions

2.6.1 This outline plan set out above provides sufficient confidence that a SuDS approach to surface water drainage could be achieved at the onshore substation site to enable development consent to be granted, whilst retaining flexibility in design appropriate for the level of detail being applied for in the DCO in relation to the onshore substation design. The detailed design of the onshore substation's drainage is secured by the DCO requirement for surface and foul drainage, which will be required to accord with this Outline Operational Drainage Plan.

3. Bolney extension

3.1 Site description

3.1.1 The existing National Grid Bolney substation is located on greenfield land adjacent to Wineham Lane (NGR TQ 242209), approximately 1.5km north of Wineham.

3.1.2 Both Air Insulated Switchgear (AIS) and Gas Insulated Switchgear (GIS) infrastructure options are being considered as part of the extension works. The final choice of infrastructure and its design will be determined by National Grid Electricity Transmission (NGET). This outline drainage plan has been prepared considering the more conservative AIS option (in terms of footprint), which covers an area of 0.63ha. The footprint area has been refined since the initial drainage calculations and attenuation requirements were calculated, which were based on a more conservative area of 0.80ha.

3.1.3 The wider proposed DCO Order Limits cover a wider area encapsulating the accompanying temporary construction works. Based on the indicative existing National Grid Bolney substation extension works layout plan, the extension is to be covered by 225mm of MoT Type 1 granular material with 75mm of stone chippings on top.

3.1.4 The existing land-use across the extension works site (referred to hereafter as 'the site') is predominantly open pasture, though a row of trees intersects the existing National Grid Bolney substation extension outline and border the site to the east.

3.1.5 Elevations across the site are relatively flat and typically range from 31 – 32m AOD. The site is situated on a minor summit, sloping to the north and south. The nearest watercourse to the site is an unnamed watercourse flowing west to east, approximately 350m north of the site. A minor drain immediately north of the site drains part of the existing National Grid Bolney substation, flowing north and into the watercourse.

3.1.6 The Environment Agency RoFSW (Environment Agency 2023a) mapping maps an isolated area of high risk intersecting the northern portion of the site. Based on review of aerial imagery, this is thought the coincident with a historic pond (where surface water would naturally accumulate), which has since been lost as a result of a previous extension of the existing National Grid Bolney substation in 2018.

3.2 Requirements of the drainage system

3.2.1 The need for sustainable surface water management is set out in the National Policy Statement for Energy (NPS EN-1) (Department of Energy and Climate Change (DECC), 2011a; Department for Energy Security and Net Zero (DESNZ), 2023), National Planning Policy Framework (NPPF) (Ministry of Housing, Communities and Local Government (MHCLG), 2021) and accompanying Planning Practice Guidance (PPG) (MHCLG, 2022) and the Department for Environment, Food and Rural Affairs (Defra) Non-Statutory Technical Standards for Sustainable Drainage Systems (Defra, 2015). Best practice guidance is provided in the

Construction Industry Research and Information Association (CIRIA) SuDS manual (Woods-Ballard et al., 2015).

Quantity – Flow rates and volume requirements

3.2.2 As set out in the Environment Agency's climate change allowances for flood risk assessments (Environment Agency 2022a), for developments with lifetimes between 2061 and 2100 (decommissioning is anticipated to extend to 2065) developments should be designed so that for the central allowance in the one percent AEP event:

- there is no increase in flood risk elsewhere; and
- the development itself should be safe from surface water flooding.

3.2.3 The design requirement for attenuation volume storage is therefore deemed to be the one percent AEP plus 25 percent climate change allowance for increase in peak rainfall intensity.

3.2.4 For the purposes of estimating attenuation storage volume requirements for this assessment, a conservative approach of assuming that the entire substation site is entirely impermeable has been taken. This is on the basis that the proposed stone chippings, whilst not impermeable themselves, will form part of the attenuation storage serving the site, so any rainfall will be entering the attenuation storage medium directly.

3.2.5 Furthermore, a conservative 'attenuation' approach has been taken to demonstrate that the increase in volume of run-off associated with an increase in hardstanding footprint can be addressed without the need to incorporate long-term storage into the design (an approach rarely implemented in practice), for example, discharges limited to greenfield Q_{BAR} rates or 2 l/s/ha, whichever is greater. Such an approach involves a more-straightforward design, but slightly larger storage volumes overall. Therefore, in demonstrating that such an approach can be achieved, it has been demonstrated that the worst case in terms of storage volumes is achievable with the proposed existing National Grid Bolney substation extension site layout.

Flood resilience

3.2.6 The existing National Grid Bolney substation extension will have a flood resilience level of the 0.1 percent AEP event plus climate change and a further 300mm allowance for freeboard, consistent with National Grid's design guidance for substations (National Grid 2016), as outlined in the **Design and access statement** (Document Reference 5.8).

Quality – Treatment requirements

3.2.7 The strategy for managing surface water quality is based on the Management Train approach as outlined in the CIRIA SuDS manual (Woods-Ballard et al., 2015). This approach aims to manage surface water close to source and, as the water is conveyed through the site, sequential SuDS techniques reduce the intensity of flow and to enhance the quality of flow by removing pollutants.

3.2.8 Section 26.7 and Table 26.2 of the SuDS manual indicates that the site would be classified as a low pollution hazard level. The manual recommends a simple index approach therefore to address the water quality requirements.

3.2.9 A number of potential treatment measures have been identified at this outline stage which in combination will exceed the initial indices provided, to ensure flexibility for delivery is available at the subsequent detailed design stage.

SuDS selection

3.2.10 A high-level assessment has been made by considering the SuDS hierarchy and choosing suitable techniques in line with the main objectives of Quantity (Flood Reduction), Quality (Pollution Reduction) and Amenity/Biodiversity (Landscape and Wildlife Benefit). It is worth noting that the amenity benefit of the proposals are likely to be limited given its proposed use in serving a substation, and anticipated lack of public access.

Surface water drainage hierarchy

3.2.11 Before disposal of surface water is considered, opportunities for reuse on-site should be considered. Where a development would have a water demand, rainwater harvesting of roofwater can provide a supply of grey water to reduce the potable water demand. However, as described in **Section 3.5: Outline foul drainage,** welfare facilities are not planned for the site and therefore options to reduce water demand are ruled out (considering the demand to be zero).

3.2.12 Disposal of surface water should be considered sequentially using the surface water disposal hierarchy, as set out below. Evidence should be provided to demonstrate that the preferred options in the hierarchy have been explored before moving onto subsequent options. The disposal hierarchy is as follows:

- Discharge by infiltration to the ground;
- Discharge to an open surface water body;
- Discharge to a surface water sewer; and
- Discharge to a combined sewer.

3.2.13 Based on the NPPF guidance (MHCLG, 2021), each of the drainage options are examined in detail to assess the feasibility of using a combination of SuDS as part of the existing National Grid Bolney substation extension drainage strategy.

Discharge via infiltration to the ground

3.2.14 No soil infiltration testing has been undertaken at the existing National Grid Bolney substation extension site to date. Reference to the BGS mapping (BGS 2023) indicates that the substation is underlain by Weald Clay formation. Soilscapes soil mapping (Cranfield University 2023) indicates that the existing National Grid Bolney substation extension site is underlain by slowly permeable seasonally wet soils with impeded drainage.

3.2.15 Given the presence of clay and the poorly drained soils, discharge of surface water to the ground is not considered feasible. If deemed necessary by the Lead Local

Flood Authority (LLFA), soakage testing could be undertaken post-granting of DCO consent to demonstrate this, but this is considered unnecessary if ground investigation undertaken to support the wider detailed design of the existing National Grid Bolney substation extension indicates ground conditions unsuitable for infiltration.

Discharge to an open surface water body

3.2.16 The existing National Grid Bolney substation extension site is situated on a watershed, with the potential to direct runoff to either the north or the south. An unnamed ditch runs northwards of the existing National Grid Bolney substation extension site (and within the proposed DCO Order Limits), draining into to an unnamed watercourse (tributary of the Adur eastern branch) that flows west to east approximately 380m north of the site.

3.2.17 To the southeast of the existing National Grid Bolney substation extension site, an unnamed drainage ditch drains south from Bob Lane and to the River Adur eastern branch. This ditch is located further from the Bolney extension than the existing drainage at the National Grid Bolney substation.

3.2.18 To the southwest of the extension site, an unnamed watercourse also drains south to the River Adur eastern branch. It is understood that this is the discharge point for surface water runoff from the existing National Grid Bolney substation, which is located in the topographic catchment of this watercourse immediately to the north. It is anticipated that discharge to this watercourse could be facilitated by connecting into the drainage for the existing National Grid Bolney substation, as discussed further below (discharge to surface water sewer).

3.2.19 As a result, two options for discharge of the existing National Grid Bolney substation extension have been identified and taken forward into this plan, which ensures flexibility in design has been retained for the detailed design stage and thus additional assurance that suitable drainage can be achieved without the need for detailed consideration at this outline stage.

Discharge to a surface water sewer

3.2.20 Given the greenfield location of the existing National Grid Bolney substation site, it is unlikely that any public sewers intersect the site. In addition, no sewer records were available for the purposes of this study.

3.2.21 However, the existing National Grid Bolney substation immediately west of the extension site is likely to be drained by a formal drainage system, ultimately discharging to the watercourse to the south of the existing National Grid Bolney substation (identified above). Connection into the existing drainage system is therefore an option that has been incorporated into this plan.

Discharge to a combined sewer

3.2.22 As described in **paragraphs 3.2.20** and **3.2.21**, no sewer records were available for the purposes of this study and it is unlikely that any sewers intersect the existing National Grid Bolney substation extension site. Therefore, discharge to a combined sewer has not been considered.

3.3 Surface water modelling

Climate change

3.3.1 As set out in the sub-section above, the Environment Agency's online climate change allowances for flood risk assessments (Environment Agency, 2022b) provides national guidance on peak rainfall intensity allowances that should be used for drainage of new developments. The existing National Grid Bolney substation extension site is located in the Adur and Ouse management catchment.

3.3.2 The PPG guidance states that for developments with a lifetime between 2061 and 2100, the central allowance (25 percent) should be applied for the 2070s epoch (2061 to 2125). However, NPS EN-1 (DECC, 2011a; DESNZ, 2023) states that where energy infrastructure has safety critical elements, a credible maximum climate change scenario should be considered. Therefore, to ensure a precautionary approach is taken to the initial attenuation storage volume assessment undertaken to support this plan, the Upper End climate change allowance for peak rainfall intensity of 45 percent for the Adur and Ouse management catchment has been considered.

3.3.3 This assumption is precautionary in that for the final design the 45 percent allowance need only be considered with respect to flood risk to safety critical elements, rather than consideration of flood risk to off-site third parties. In addition, the Environment Agency guidance (2022a) does not explicitly state how the maximum credible scenario should be considered with respect to peak rainfall intensity. However, this approach has been taken at this outline stage to demonstrate that the outline design presented would be capable of addressing a more-extreme event than explicitly required by current guidance.

Greenfield Runoff rates

3.3.4 The undeveloped greenfield runoff rate for the extension site (0.80ha) has been estimated using the IH124 method within the UKSuDS tool (HR Wallingford 2023) to provide an indicative greenfield runoff rate. Greenfield runoff rates are provided in **Table 3-1**.

Table 3-1 Site Greenfield runoff rates

AEP (%)	Return period (yrs)	Greenfield Runoff Rate (l/s)	Unit Greenfield Runoff Rate (l/s per Ha)
100	1	3.02	4.79
Q_{BAR}	2.3	3.55	5.63
3.33	30	8.17	12.97
1	100	11.33	17.98

Storage volume estimation

3.3.5 The UKSuDS storage estimation tool (HR Wallingford, 2023) was used to estimate the surface water storage volume requirements for the existing National Grid Bolney substation extension site, considering the IH124 greenfield rate calculated above. The existing National Grid Bolney substation extension site has been considered entirely impermeable.

3.3.6 Flow control for the system to a maximum of Q_{BAR} (or 2 l/s/ha, whichever is greater) was used for the design criteria. A total storage attenuation volume of approximately 590m^3 has been estimated for the entire existing National Grid Bolney substation extension site under the precautionary 45 percent climate change allowance scenario. An outline drainage plan which would deliver this attenuation, and meet the other requirements for the drainage system, is set out in **Section 3.4: Proposed surface water drainage**.

3.4 Proposed surface water drainage

Outline SuDS plan

3.4.1 The final SuDS options will be identified as part of the ODP, to be developed post-granting of the DCO. The outline plan is intended to be indicative and demonstrate that it is possible to manage surface water using an onsite storage to provide the required volume of attenuation storage and treatment before discharge within the proposed existing National Grid Bolney substation extension site layout.

3.4.2 The outline plan has been prepared to ensure that surface water generated on areas where there is a possibility of contaminants will be treated prior to discharge, and to limit discharge rate to a maximum of Q_{BAR} or 2 l/s (whichever is greater).

3.4.3 As outlined above, there are two feasible discharge points for surface water runoff from the extension site, which have both been considered in this outline drainage plan to retain flexibility to the contractor. These are:

- Connection into the existing National Grid Bolney substation drainage system (believed to drain to the watercourse to the south), and;
- Discharge into the drainage ditch located to the north of the existing National Grid Bolney substation extension site.

3.4.4 Both connection points would be within the proposed DCO Order Limits.

3.4.5 Considering the connection into the existing National Grid Bolney substation drainage system, attenuation could be provided via the proposed stone chippings/granular fill (the primary purpose of which is for electrical safety purposes) used across the substation extension. A total depth of 300mm would be required to make up the entire attenuation requirements assuming MoT Type 3 (or similar) material and a void coefficient of 0.3 in accordance with the CIRIA SuDS Manual (Woods-Ballard et al., 2015). This could be supplemented, where necessary, with oversized pipes and proprietary treatment systems if deemed necessary at the detailed design stage to achieve treatment and/or attenuation requirements.

3.4.6 Discharge to the drainage ditch to the north could include the provision of additional SuDS features such as filter drains and/or an attenuation pond/basin prior to discharge, if deemed necessary. The requirements and locations of any additional SuDS features will be considered further at the detailed design stage. There is ample space in the proposed DCO Order Limits between the existing National Grid Bolney substation extension and the ditch to the north in which additional SuDS measures could be located.

SuDS treatment

3.4.7 It is anticipated that pollution control measures would serve to limit the pollution potential of the existing National Grid Bolney substation extension site, but some degree of pollutants would likely still be captured by the surface water run-off and require capture and/or treatment before discharge. The pollution hazard indices for a substation are not provided in Table 26.2 of the CIRIA SuDS manual (Woods-Ballard et al., 2015), but taking a precautionary approach of assuming a high pollution hazard level, would result in indices of 0.8 (total suspended soilds), 0.8 (metals) and 0.9 (hydrocarbons). As discussed, industry standard pollution control measures may result in a lower hazard level in practice. The appropriate pollution hazard level for the existing National Grid Bolney substation extension will be considered further at the detailed design stage during the preparation of the ODP.

3.4.8 It is anticipated that the stone chippings (and subgrade) could provide a similar level of treatment as a permeable pavement (indices of 0.7, 0.6 and 0.7 respectively). This could be further supplemented where required and identified at the detailed design stage (dependent on the discharge point taken forward) with the addition of proprietary systems and additional SuDS to make up any remaining shortfall.

SuDS maintenance

3.4.9 The SuDS system will require maintenance to ensure continued functionality of the SuDS system, in accordance with best practice (for example, the SuDS manual). It will be the responsibility of National Grid as the substation operator for maintenance of the SuDS and landscaped areas. Options for long-term maintenance will be considered further post-granting of DCO consent and secured through the DCO requirement for the ODP.

3.5 Outline foul drainage plan

3.5.1 The National Grid Bolney substation extension works will be unmanned. Welfare facilities are not planned for the site.

3.6 Conclusions

3.6.1 The outline plan set out above provides two feasible drainage strategies which could be delivered within the proposed DCO Order Limits to meet the various policy requirements and enable development consent to be granted. The two strategies outlined retains flexibility in design at the appropriate time for the detailed design of the existing National Grid Bolney substation extension, as secured by the DCO Requirement for surface and foul drainage (ODP for the Bolney extension).

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4. Glossary of terms and abbreviations

Table 4-1 Glossary of terms and abbreviations

Term (acronym)	Definition
Above Ordnance Datum (AOD)	Ordnance Datum is the vertical datum used by the Ordnance Survey as the basis for deriving the height of ground level on maps. Topography may be described using the level in comparison to 'above' ordnance datum.
AEP	Annual exceedance probability
BGS	British Geological Survey
CIRIA	Construction Industry Research and Information Association
Development Consent Order (DCO)	This is the means of obtaining permission for developments categorised as Nationally Significant Infrastructure Projects, under the Planning Act 2008.
Greenfield runoff	The runoff that would occur from the site it its undeveloped and undisturbed state. Greenfield runoff characteristics are described by peak flow and volumes of runoff for rainfall events of specified duration and return period (frequency of occurrence).
HVAC	High Voltage Alternating Current
HDD	Horizontal Directional Drilling
LLFA	Lead Local Flood Authority
LAT	Lowest Astronomical Tide
MHWS	Mean High Water Springs
Ministry of Transport (MoT) type 1	type of stone sub-base, compliant with Department of Transport Specification for Highway Works, clause 803 (SHW 803).
NGET	National Grid Electricity Transmission
NGR	National Grid Reference
National Policy Planning Framework (NPPF)	The National Policy Planning Framework sets out the Governments planning policies for England and how these are expected to be applied. It provides a framework within which local plans can be developed which reflect the community's needs.

ODP	Operational Drainage Plan
Onshore	Landward of MHWS
Ordinary Watercourse	Ordinary watercourses include every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a main river. Responsibility for permitting development lies with the lead local flood authority.
Q_{BAR} (mean annual flood)	Referred to as QBAR, or the mean annual flood, is the value of the average annual flood event recorded in a river. This flow rate is used to provide a measure of the Greenfield runoff performance of a site in its natural state to enable flow rate criteria to be set for post development surface water discharges for various return periods.
Rampion Extension Development Limited (RED)	Rampion Extension Development Ltd (the Applicant)
ReFH2	Revitalised Flood Hydrograph 2
RoFSW	Risk of Flooding from Surface Water
SuDS	Sustainable Drainage Systems
WSCC	West Sussex County Council
WTGs	Wind turbine generators

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Appendix A
Oakendene Onshore Substation - Indicative SuDS plan

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- Max. substation footprint (indicative layout)
- Retained woodland/vegetation (indicative)
- Existing parkland/standard trees
- New parkland trees
- Wet woodland planting
- Native scrub planting
- Native woodland planting
- Maintenance strip: mown grass
- Attenuation basin - extent
- Attenuation basin - 1m contours
- Filter drains
- Swale
- Retained view from Oakendene Manor
- Onshore cable route (indicative)
- Existing Public Rights of Way
- Proposed alignment of access road
- Advance planting

Rampion Extension Development Limited

Rampion 2 WIND FARM

Rampion 2 Offshore Wind Farm
Outline Operational Drainage Plan - Appendix A

Oakendene Onshore Substation - Indicative SuDS Plan

System Identifier:				Version:
42285-WSPE-ES-ON-FG-OY-7671				2.0
Company: WSP	Drawn By: S.VIAN	Chk/Aprvd: R.CARTLID	Drawn Date: 03/08/23	Status: FINAL

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Rampion 2
WIND FARM