The Droves Solar Farm

Preliminary Environmental Information Report

Volume I, Chapter 12: Water Resources

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12.1 Introduction

12.1.1 This chapter of the PEIR presents the findings of a preliminary assessment of the likely significant effects in relation to water resources. The information presented within this chapter has been informed by the design information of the Scheme provided in **Volume I, Chapter 5: Scheme Description**.

12.1.2 Information considered in this chapter includes relevant water resources policy and guidance, baseline climate conditions, sets out the methodologies and approaches intended to be used to inform the Water Resources chapter of the Environmental Statement (ES) for the Scheme. This is realised through a description of the water resources conditions (as they are understood at time of writing in April 2025). This chapter details the findings of work undertaken to date and presents a preliminary assessment of the likely significant effects arising from the Construction, Operational and Decommissioning Phases of the Scheme upon water resources. The chapter also considers proposed avoidance, mitigation and compensation measures and any residual effects following the implementation of such measures.

12.1.3 Embedded mitigation measures are presented, where necessary, and discussed to minimise the impacts of the Scheme to an acceptable level (i.e. to a residual minor or negligible effect), during the Construction, Operational and Decommissioning Phases.

12.1.4 This chapter should be viewed as a preliminary assessment that will be updated and refined as necessary, particularly as the results of further evaluation become available and as the Scheme design evolves. The PEIR does not replicate or act as a draft ES but rather aims to enable consultees to understand the likely environmental effects of the Scheme and helps to inform consultation responses during the pre-application stage.

Consultation

12.1.5 The content and assessment methodology contained within this chapter has been informed by the Scoping Opinion from the Planning Inspectorate (PINS) dated 18 December 2024 (**Volume III, Appendix 2.2**) as well as further updated and informed, following consultation with key stakeholders in relation to water resources matters, in particular including further consultation with EA, Anglian Water and other consultees.

12.1.6 Consultation feedback received throughout the pre-application phase of the Scheme has been considered in preparing this PEIR chapter. Further detail on consultation undertaken is included at **Volume III, Appendix 12.1.**

12.1.7 The following sections provide a summary of the consultation responses received and outline how the transport and access assessment has considered and addressed comments raised by consultation.

Legislation, Planning Policy, and Guidance

12.1.8 A review of the Legislation, Policy and Guidance that is relevant to the water resources assessment of the Scheme is included at **Volume III, Appendix 12.1**. The review demonstrates that the Scheme has been developed in accordance with the requirements identified in the **Volume III, Appendix 12.1**.

12.2 Assessment Methodology

Assessment Scope

12.2.1 The key issues for the assessment of potential hydrological and hydrogeological effects relating to the Scheme are likely to be:

- Short-term effects arising from the Construction or Decommissioning Phase, such as potential chemical pollution and sedimentation; and
- Long term effects, effects that last for the Operational Phase only.

12.2.2 The final assessment of likely significant effects will be reported in the ES. **Table 12.1** below presents a summary of the aspects agreed to be scoped in and out to the PEIR, as set out in the Environmental Impact Assessment (EIA) Scoping Report, PINS Scoping Opinion, and the Scoping Opinion Response (**Volume III, Appendix 2.1. 2.2 and 2.3**), which includes area proposed to be scoped out of the ES but included in the PEIR to further justify the lack of potential for significant effects. These will be amended as necessary for the ES as the design of the Scheme evolves.

12.2.3 The water resources assessment follows the general approach to undertaking EIA, as detailed in **Volume I, Chapter 2: EIA Process and Methodology** of the PEIR, albeit it has been modified to take account of relevant industry guidelines and best practice (see above). The methodology for attributing sensitivity of receptors, magnitude of impacts and the significance of effects in relation to water resources is described further below in this chapter.

12.2.4 The potential impacts considered within this assessment are:

- Potential chemical pollution effects on the hydrological environment
- Potential erosion and sedimentation effects on the hydrological environment
- Potential impediments to stream flow
- Potential effects on private water supplies
- Potential changes in soil interflow patterns
- Potential for the compaction of soils; and
- Potential for an increase in runoff and flood risk.

12.2.5 The significance of the potential effects of the Scheme will be classified by professional consideration of the sensitivity of the receptor and the magnitude of the potential effect.

12.2.6 The assessment will be based on a source-pathway-receptor methodology, where the sensitivity of the receptors and the magnitude of potential change (effect) upon those receptors is identified within the Study Areas identified in Section 12.2.

12.2.7 Whilst no parts of the Core Study Area (CSA) are located within Flood Zone 2 and 3a the Flood Risk Assessment (FRA), **Volume III, Appendix 12.2**, is needed to be undertaken to demonstrate that, where development is proposed in areas with identified risk of flooding from all sources (e.g. fluvial or surface water flooding), it passes the Sequential and Exception tests outlined in National Policy Statement (NPS) EN-1 and the National Planning Policy Framework (NPPF).

12.2.8 The climate change allowance data has been obtained from the EA Climate Change Allowances for Peak River Flow in England (2022) for the North West Norfolk Management Catchment. As the Scheme is classed as Essential Infrastructure as per Annex 3: Flood risk vulnerability classification of the NPPF and will be operational between the 2050's and 2080's epochs the Higher Central band of 33 % will be used to assess fluvial flows.

12.2.9 The FRA provided as Technical **Volume III, Appendix 12.2** focuses on the following elements:

- The risk of flooding to the Scheme from fluvial, pluvial, groundwater and artificial (reservoir and drainage infrastructure) source
- Assessment of the introduction of new hardstanding and impermeable ground areas on the greenfield run-off rates, using InfoDrainage software
- Storage requirement calculations to accommodate the 3.33 % and the 1 % AEP storm events including an allowance for climate change i.e. 25 % for the Central Allowance for the 2070s epoch (2061 to 2125) as the Scheme has a proposed Operational Phase of 60 years. In accordance with Paragraph 13.1.5 of the Norfolk LLFA Statutory Consultee Guidance (Document Version 7.1, June 2024) [Ref 12-6] the SuDS design for the Battery Energy Storage System (BESS), Customer Substation and Access Tracks[1] will be sensitivity tested applying a 40 % climate change allowance
- The management of surface water run-off rates using Rural Sustainable Drainage Systems (RSuDS) techniques, such as grassland under the drip lines, for the Photovoltaic (PV) Tables
- The FRA concludes how the Scheme complies with local planning policy, the BDC Level 1 Strategic Flood Risk Assessment Update and Section 5.8 of the NPS EN-1
- The FRA utilises fluvial data and results from the Eastern Rivers Modelling Report – Upper Nar flood study. It is not proposed to model fluvial and tidal flooding based on the validity and acceptance of published flood studies by the LLFA and the EA and are considered suitable for use to inform the FRA
- Compliance with the Sequential and Exception Tests; and
- Due to the underlying chalk geology across the CSA, the potential for an infiltration-based SuDS solution for the Customer Substation and BESS to cause dissolution of the soluble rocks will be investigated through infiltration testing and intrusive ground investigations. Given the absence of watercourses, the next disposal solution compliant with the SuDS

[1] LLFA verbal advice to treat Access Tracks as impermeable

hierarchy would be to dispose of water to Anglian Water assets, which will be investigated if required.

Scoped In

12.2.10 The following potential effects, for all phases of the Scheme, will be scoped into the assessment:

- Chemical pollution
- Erosion and sedimentation
- Impediments to surface water flow
- Changes in soil interflow patterns
- Changes in groundwater flow
- Compaction of soils
- Increase in surface water run-off rates
- Displacement of flood storage
- Water need
- Changes in quality or quantity of supply (PWS and PuWS); and
- Migration of Pollutants from Contaminated Land.

Scoped Out

12.2.11 As the Scheme is not located within 6 km of a tidally-influenced stretch of the River Nar, the risk of flooding from tidal sources have been scoped out of the PEIR and accompanying FRA, as PINS in the Scoping Opinion (**Volume III, Appendix 2.2**) agreed that tidal influences could be scoped out of the assessment.

12.2.12 Potential effects from historic landfill sites have also been scoped out of the assessment, due to the absence of landfill sites within 3 km of the CSA.

Scoping Summary

Table 12.1 Water resources Scoping summary

Aspect	Construction	Operational	Decommissioning
Surface Water Quality and Quantity	Scoped In	Scoped In	Scoped In
Groundwater Quality and Quantity	Scoped In	Scoped In	Scoped In
Water consumption	Scoped In	Scoped In	Scoped In

Ground Conditions	Scoped Out	Scoped Out	Scoped Out
Effects from historic landfills	Scoped Out	Scoped Out	Scoped Out
Flood Risk: Fluvial Pluvial Groundwater	Scoped In	Scoped In	Scoped In
Flood Risk: Tidal	Scoped Out	Scoped Out	Scoped Out
Drainage / SuDS	Scoped In	Scoped In	Scoped In

Determining Significance of Effect

Receptor Sensitivity

12.2.13 The sensitivity of the Baseline Conditions, including the importance of environmental features on or near to the Scheme or the sensitivity of potentially affected receptors, will be assessed in line with best practice guidance, legislation, statutory designations and / or professional judgement.

12.2.14 **Table 12.2** details the proposed framework for determining the sensitivity of receptors.

Table 12.2 Framework for Determining Sensitivity of Receptors

Sensitivity of Receptor	Definition
High	A watercourse or water body with a Water Framework Directive (WFD) Overall Water Body Class of “Good”; • The receptor and associated downstream environment has limited capacity to attenuate fluctuations in hydrochemistry and cannot buffer further changes without profoundly altering its characteristics or natural processes • The hydrological receptor is designated as having international importance, such as Special Areas of Conservation (SACs) and Special Protection Areas (SPAs) • Groundwater Vulnerability Class of High

Sensitivity of Receptor	Definition
	• Water abstractions used for the production of mass-produced consumables (food and drink) or for public water supply • Areas classed as a Drinking Water Protected Area • Areas classed as Functional Floodplain (Flood Zone 3b) and flood storage areas not protected by flood defences; and • Flood defences.
Medium	A watercourse or water body with a WFD Overall Water Body Class of "Moderate"; • The receptor and associated downstream environment has some capacity to attenuate fluctuations in hydrochemistry but cannot absorb prolonged changes without profoundly altering its baseline characteristics / natural processes • The hydrological receptor is of high environmental importance or is designated as having national importance, such as SSSIs • Areas classed as Flood Zone 3a • Groundwater Vulnerability Class of Medium - High or Medium; and • Areas containing geological features of designated regional importance including Regionally Important Geological/geomorphological Sites (RIGS).
Low	A watercourse or water body with a WFD Overall Water Body Class of "Poor" or "Bad" and / or a Current Chemical Quality classification of "Fail" excluding ubiquitous, persistent, bioaccumulative and toxic substances (uPBTs); • Heavily modified watercourses or manmade drainage ditches • The receptor is not of regional, national or international environmental importance • Groundwater Vulnerability Class of Medium – Low or Low • The hydrological receptor does not support abstractions for public water supply or private water abstractions

Sensitivity of Receptor	Definition
	• Poor groundwater quality and / or very low permeability make exploitation of groundwater unfeasible; and • Areas classed as Flood Zone 2.
Negligible	The receptor is resistant to change and / or is of little environmental value; • Groundwater Vulnerability Class of Unproductive; and • Areas classed as Flood Zone 1.

Magnitude of Impact

12.2.15 The magnitude of potential effects will be identified through consideration of the Scheme, the degree of change to Baseline Conditions predicted as a result of the Scheme, the duration and reversibility of an effect and professional judgement, best practice guidance and legislation.

12.2.16 The criteria for assessing the magnitude of an effect are presented in **Table 12.3.**

Table 12.3 Framework for Determining Magnitude of Effects

Magnitude of Effect	Definition
High	• A major shift in hydrochemistry or hydrological conditions sufficient to negatively change the function of the receptor. This change would result in a downgrading of an WFD Quality classification by two classes, e.g., from “High” to “Moderate” • A material increase in the probability of flooding onsite and offsite, adding to the extent which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water (in accordance with NPPF paragraphs 170 to 182) i.e., loss of functional floodplain (Flood Zone 3b) storage • A permanent or long-term degradation of quality to groundwater quality or a long term reduction in the available yield; and / or • A greater than 50 % loss of a hydrogeological receptor or peat habitat site, or where there would be complete severance of a site such as to fundamentally affect the integrity of that site (e.g., severing hydrological connectivity).

Magnitude of Effect	Definition
Medium	• A fundamental change to the hydrochemistry or hydrological environment, resulting in a change in ecological status. This change would result in a downgrading of a EA water quality classification by one class, e.g., from "Good" to "Moderate" • A loss of between 15 % to 50 % of a hydrogeological receptor or peat habitat site, complete or substantial severance and effects to its integrity as a feature, or disturbance such that the value of that site would be affected, but could still function • The yield or quality of PWS or PuWS may be temporarily reduced; and / or • A moderate increase in the probability of flooding onsite and offsite, adding to the area of land which requires protection by flood prevention measures or affecting the ability of the functional flood plain to attenuate the effects of flooding by storing flood water i.e., moderate loss of storage within Flood Zone 3a.
Low	• A detectable non-detrimental change to the baseline hydrochemistry or hydrological environment. This change would not reduce the WFD status of the receptor • Loss of storage within Flood Zone 2 • Interaction with the groundwater table which will marginally alter local ecology or will lead to a slight detectable displacement of groundwater; and / or • A detectable but non-material effect on the receptor or a moderate effect on its integrity as a feature or where there would be a minor severance or disturbance such that the functionality of the receptor would not be affected.
Negligible[2]	• No detectible changes to the baseline hydrochemistry or hydrological environment; and • No increase in the probability of flooding onsite and offsite.

[2] Negligible magnitude of change also includes magnitude of effects that are assessed as no change to the baseline scenario

Significance of Effect

12.2.17 The sensitivity of the receptor and the magnitude of the predicted effect will be used as a guide, in addition to professional judgement, to predict the significance of the likely effect. **Table 12.4** summarises guideline criteria for assessing the significance of effects.

Table 12.4 Framework for Assessment of the Significance of Effects

Magnitude of Effects	Sensitivity of Resource or Receptor			
	High	Medium	Low	Negligible
High	Major	Moderate	Moderate	Minor
Medium	Moderate	Moderate	Minor	Negligible
Low	Minor	Minor	Negligible	Negligible
Negligible	Negligible	Negligible	Negligible	Negligible

Sensitivity of Receptors to Effects

12.2.18 The sensitivities of the identified receptors, and their relationship to the potential effects from all Phases of the Scheme, are outlined in **Table 12.5**.

Table 12.5 Sensitivity of Hydrological Receptors

Receptor	Potential Effects	Sensitivity	Comment
Watercourses and Drainage Ditches	Increased run-off, erosion and sedimentation, stream flow impediments and pollution as a result of construction groundworks and chemical handling / storage.	Medium	The receiving waterbody (River Nar) in which the Scheme is located has a WFD Overall Water Body Class of "Moderate", Ecological classification of "Moderate" and a Chemical classification of "Good" (excluding uPBTs). Watercourses downstream of the Scheme within the WSA are not designated as having international importance.
Groundwater	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills	High	Considered High sensitivity as hydrocarbon pollution in bedrock fissures has a lengthy attenuation period.

Receptor	Potential Effects	Sensitivity	Comment
	from chemical handling / storage.		Groundwater unit classified as having 'Good' status under WFD. Groundwater is also used for potable and agricultural supply.
Near-surface water	Diversion of near-surface flows as a result of track construction and the installation of foundations / hardstanding.	High	Considered High sensitivity as near-surface water supplies flow to groundwater and in turn to the River Nar.
PWS	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills from chemical handling / storage. Depletion or displacement of PWS source as a result of Development infrastructure.	Medium	Considered Medium sensitivity as the individual supplies support abstraction for up to 25 people.
PuWS	Pollution as a result of erosion and sedimentation from construction activities and uncontained spills from chemical handling / storage. Depletion or displacement of PWS source as a result of Development infrastructure.	High	Considered High sensitivity as the supplies support abstraction public supply.

12.3 Study Area

12.3.1 The Site, see **Volume II, Figure 12.1**, forms the Core Study Area (CSA) for this chapter. The Core Study Area is a defined term specific to this chapter and is defined as the Site boundary.

12.3.2 Baseline data has been used to assess potential effects of the Scheme on hydrological and hydrogeological resources within a 5 km Study Area of the Site (the Wider Study Area (WSA). This WSA is based on the hydrological and hydrogeological connectivity of water bodies located downstream of the Scheme.

12.3.3 The Core Study Area and Wider Study Area are shown on **Volume II, Figure 12.1**, Hydrology Study Areas.

12.3.4 The WSSA distance is based on Paragraph 2.15 of guidance issued by the Scottish Environmental Protection Agency (SEPA), in the absence of guidance relating to Study Area distance issued by the EA or the British Geological Survey (BGS).

12.3.5 These Study Areas are defined based on the author's professional judgement and experience assessing similar scale developments (Development Consent Order (DCO) solar developments) within lowland agricultural environments and similar hydrological catchments in England. Study areas were not raised as an issue during the Scoping stage.

12.3.6 At distances greater than 5 km, it is considered that solar developments in low lying catchments are unlikely to contribute to chemical or sedimentation effects due to attenuation, dilution and deposition.

12.3.7 The WSA will also be used for the cumulative assessment, at the ES stage.

12.3.8 A smaller 1 km Study Area based upon the CSA will be applied to assess private water supplies (PWS) and public water supplies (PuWS) abstractions and will be termed the Water Supplies Study Area (WSSA). The Water Supplies Study Area is a defined term specific to this chapter and is shown on **Volume II, Figure 12.1**, Hydrology Study Areas.

12.4 Baseline Conditions

Survey Work

12.4.1 A desk-based study was undertaken in September 2024 and updated in February 2025 to provide an overview of the Baseline Conditions for water resources and ground conditions within the CSA.

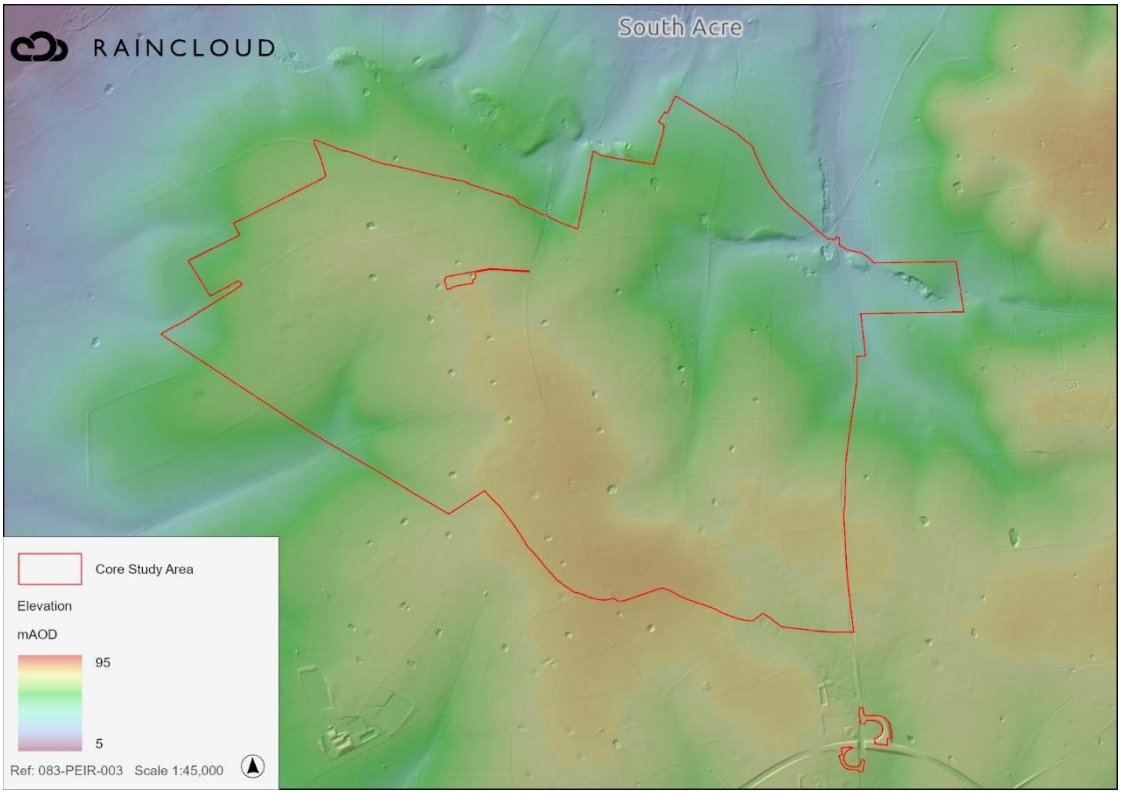
12.4.2 Site walkovers were undertaken on 1st October 2024. Additional walkovers will be undertaken to supervise infiltration testing post-PEIR submission.

Topography and Land Use

12.4.3 The CSA and WSA are generally in arable use with areas in the north and south of the CSA used for pig farming and poultry farming. Agricultural land is interspersed with woodland.

12.4.4 1m resolution Lidar data shows that land within the CSA is generally gently sloping, with elevations from 37 m above ordnance datum (AOD) in the south to 85 m AOD in the northeast, as shown in **Image 12.1.**

Image 12.1 Topography within CSA



12.4.5 Most of the CSA is located on land with slopes of less than 6% with only a small area located on land between 6-12% slopes, largely concentred on the area surrounding Fincham Drove in the north of the CSA.

Geology and Ground Conditions

12.4.6 BGS datasets show that the majority (approximately 95 %) of the CSA is underlain by chalk of the Lewes Nodular Chalk Formation. The western section of the CSA is underlain by chalk of the Holywell Nodular Chalk Formation and New Pit Chalk Formation, as shown on **Volume II, Figure 12.2: Solid Geology**.

12.4.7 Superficial deposits, including sensitive receptors such as peatland, are mapped to be largely absent across the CSA, with the exception of minor areas of till (diamicton) and sand and gravels from the Lowestoft Formation in the northern and southern sections of the CSA, as shown on **Volume II, Figure 12.3: Superficial Geology**.

12.4.8 A BGS borehole record in the north of the CSA shows chalk was encountered at 0.9 m below ground level (BGL), suggesting a very thin superficial geology covering, which is consistent with Photograph 7 of **Volume I, Chapter 11: Agricultural Land and Soils**, where chalk was encountered at a depth of 0.36 m.

12.4.9 No geological faulting or linear features are noted within the CSA on the BGS dataset.

12.4.10 The Soilscapes dataset [Ref 12-1] indicates that superficial cover across the majority of the CSA is classed as 'freely draining sandy Breckland soils' (Soilscapes ref 11) which are freely

draining. The northern section of the CSA is classed as a mix of shallow lime-rich soils over chalk or limestone (Soilscapes ref 3) and freely draining slightly acid sandy soils (Soilscapes ref 10).

12.4.11 The BGS Minerals and Quarries dataset shows there to be several marl pits (clay removed for agricultural fertiliser) throughout the CSA, none of which are active and are generally filled with standing water.

Hydrogeological Setting

12.4.12 The Hydrogeology 625,000 digital hydrogeological map of the UK (BGS) shows that the CSA is underlain by chalk of the white chalk subgroup, characterised as a High Productivity Aquifer where flow is virtually all through fractures and other discontinuities.

12.4.13 The Aquifer Designation Map (Bedrock) (England) identifies that the Study Area is underlain by aquifers classed as a Principal Aquifer.

12.4.14 The CSA is not located within a Drinking Water Safeguard Zone (Groundwater).

12.4.15 The Groundwater Vulnerability Map shows that the CSA is classed as having High to Medium-High vulnerability and geology classed as Soluble Rock Risk.

12.4.16 The majority of the CSA is located in Source Protection Zone (SPZ) 2 and the western section located in SPZ 1, as shown in **Volume II, Figure 12.4**, associated with an Anglian Water abstraction at Marham, approximately 5.8 km west of the CSA.

12.4.17 BGS boreholes (TF71SW192) at Marham are recorded to draw groundwater from approximately 9 m below ground level (BGL).

12.4.18 The CSA is located within the Norfolk Bradenham Water Resource Zone (WRZ) where water is supplied from groundwater abstractions from the Norfolk Chalk aquifer. The Anglian Water region is also identified as ‘seriously water stressed’ in the EA’s 2021 classification of water stressed areas.

12.4.19 The EA River Basin Management Plan (RBMP) shows that the North West Norfolk Chalk groundwater body has characteristics as outlined in **Table 12.6**.

Table 12.6 WFD Groundwater body Characteristics

WFD Indicator	Nar upstream of Abbey Farm
Water body ID	GB40501G400200
Chemical Status	Poor
Quantitative Status	Poor
Chemical Objective	Poor by 2015
Quantitative Objective	Good by 2027 - Low confidence

12.4.20 The EA note that groundwater abstraction, poor nutrient management and sewage discharge as reasons for the groundwater body not achieving good status.

12.4.21 The Norfolk Rivers Trust "The River Nar - A Water Framework Directive Local Catchment Plan" (2014) [Ref 12-2] notes that the general chemical failures of the chalk groundwater bodies under the CSA are a result of widespread elevated nitrate concentrations. Based upon known pollutant linkages and conceptual knowledge of the catchment the predominant source of leached nitrate is a result of diffuse agricultural pollution.

12.4.22 The Norfolk Rivers Trust Catchment Plan also notes that groundwater abstracted from boreholes at Marham shows high concentrations of nitrate significantly above the drinking water standard of 50 mg/l (as NO_3), largely due to diffuse agricultural pollution.

12.4.23 The Scheme is located within the Norfolk Bradenham Water Resource Zone (WRZ) where water is supplied from groundwater abstractions from the Norfolk Chalk aquifer. The Anglian Water region is also identified as 'seriously water stressed' in the Environment Agency's 2021 classification of water stressed areas.

12.4.24 Photographs 1 to 8 of **Volume I, Chapter 11: Agricultural Land and Soils**, show that groundwater was not present in shallow excavations (approximately 0.5 m depth) across the CSA.

12.4.25 BGS borehole logs (TF81SW4 and TF81SW3) in the east of the CSA and (TF81SW2) in the north of the CSA show that groundwater was not stuck to a depth of 6 m and 9 m respectively.

12.4.26 A borehole log (TF71SE68) in the west of the CSA shows that groundwater was encountered at 41.34 m BGL.

12.4.27 The Cockley Cley Estate groundwater level monitor approximately 4.5 km south of the CSA recorded a maximum level of 32.531 m AOD (2 m BGL), while the Washpit Farm monitor, approximately 5.5 km north of the CSA, recorded a maximum level of approximately 44 m AOD (36 m BGL).

Private Water Supplies

12.4.28 Data requests were sent to Breckland Council (BC) and the Borough Council of King's Lynn & West Norfolk Environmental Health departments.

12.4.29 The Borough Council of King's Lynn & West Norfolk responded with records of PWS, however only partial details on the locations of the PWS were provided. **Table 12.7** outlines the information provided at the time of writing.

Table 12.7 PWS Data

Reference	Type	Use	Postcode	Area
P230SD006	Borehole	single domestic	PE32 1	Pentney
P230SD018	Spring	single domestic	PE32 1	West Acre
P230SD019	Spring	single domestic	PE32 1	West Acre

Reference	Type	Use	Postcode	Area
P230LC036H	Borehole	large/commercial	PE32 2	Castle Acre

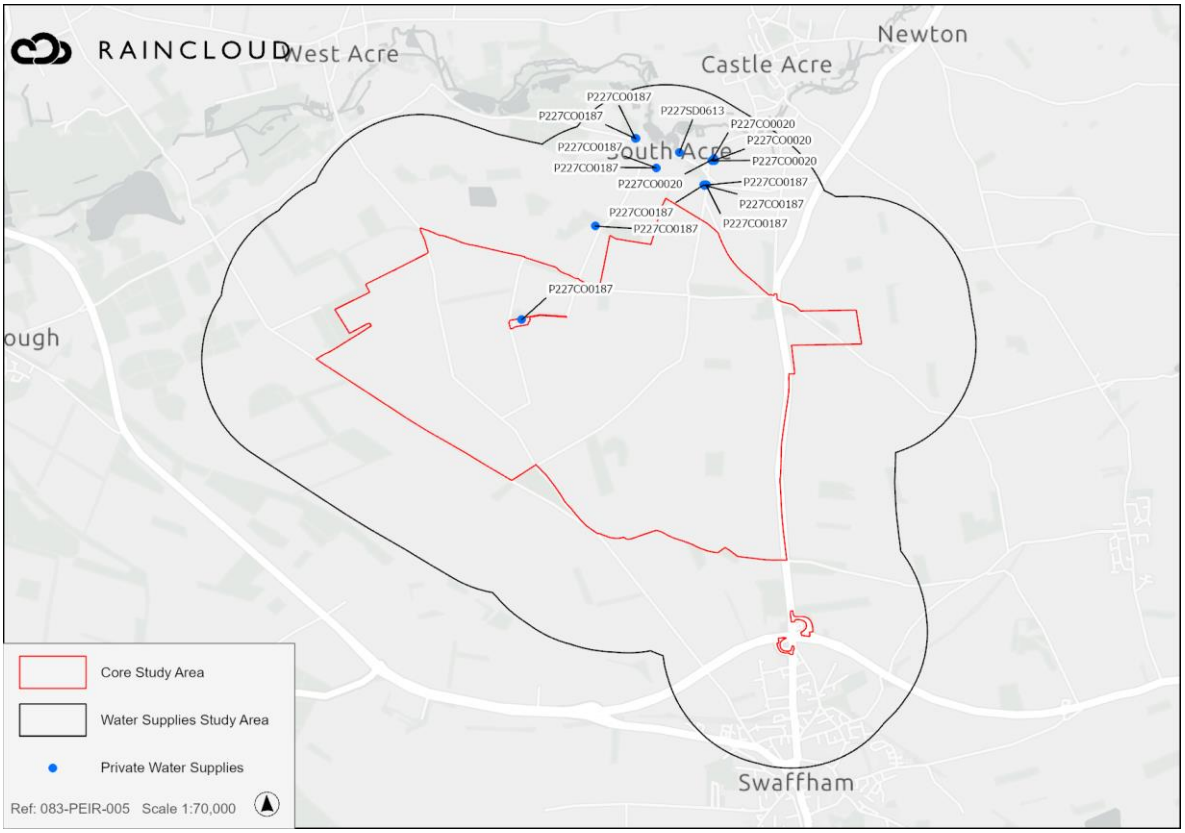
12.4.30 BC confirmed 15 PWS within WSSA, and none are located within the CSA, as outlined in **Table 12.8**.

Table 12.8 PWS Data

Reference	Type	Approximate distance and direction from CSA
P227CO0187	Borehole	13 m south
P227CO0187	Borehole	150 m northwest
P227CO0187	Borehole	280 m north
P227CO0187	Borehole	281 m north
P227SD0613	Borehole	419 m north
P227CO0020	Borehole	503 m north
P227CO0187	Borehole	271 m north
P227CO0020	Borehole	497 m north
P227CO0187	Borehole	587 m north
P227CO0187	Borehole	274 m north
P227CO0020	Borehole	492 m north
P227CO0187	Borehole	590 m north
P227CO0187	Borehole	283 m north
P227CO0020	Borehole	518 m north
P227CO0187	Borehole	281 m north

12.4.31 The locations of the supplies are shown **Image 12.2.**

Image 12.2 PWS Locations



12.4.32 BGS borehole records at PWS P227CO0187 (BGS Ref TF81SW12) records groundwater within the bore shaft as resting at 32 feet (9.7 m) BGL, while records for PWS P227CO0020 show groundwater at 18 m BGL (BGS Ref TF81SW26).

12.4.33 An irrigation main has been identified in the northern section of the CSA, located between Fields 33 and 35.

Public Water Supplies

12.4.34 Anglian Water agreed that the SPZ1 boundary is associated with their water abstraction at Marham Water Treatment Works, approximately 5.8 km to the west of the CSA.

12.4.35 At the time of writing, potable water supply infrastructure has been identified within the CSA. This will be updated should further public water supply infrastructure be identified within the CSA prior to submission of the ES.

Water Utilities

12.4.36 Initial searches show that a foul water sewer runs parallel to the A1065 in the eastern section of the CSA. This will be updated should further water utilities be identified within the CSA prior to submission of the ES.

Contaminated Land

12.4.37 The EA's Permitted Waste Sites - Authorised Landfill Site Boundaries dataset identifies that no active landfill sites are present within the CSA.

12.4.38 The EA dataset shows that there are no historic landfill sites within the CSA.

Surface Hydrology

12.4.39 The Core and Wider Study Areas are located within the primary catchment of the River Nar, which is located approximately 540 m north of the CSA at its nearest point.

12.4.40 The River Nar flows west towards King's Lynn and discharges to the Tidal River Ouse, approximately 17 km northwest of the CSA. The River Nar is part of the North West Norfolk Management Catchment.

12.4.41 At West Acre the River Nar flows over the river valley gravels and then over alluvial silt from Narborough through the fens. The river water is base-rich, alkaline and recharged by clear springs flowing from the underlying chalk.

12.4.42 The River Nar has Water Framework Directive (WFD) classifications as outlined in **Table 12.9**.

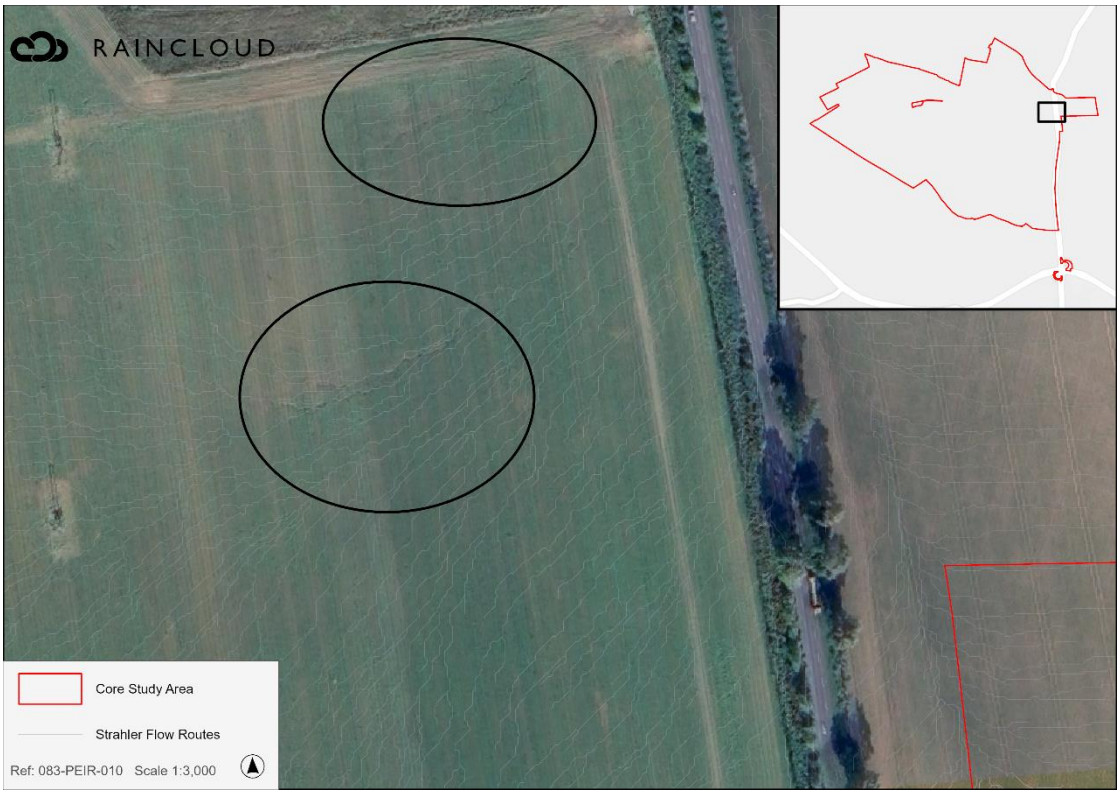
Table 12.9 WFD Waterbody Characteristics

WFD Indicator	Nar upstream of Abbey Farm
Water body ID	GB105033047791
Cycle	3
Hydro-morphological designation	Not designated artificial or heavily modified
Ecological Status	Moderate
Chemical Status including uPBTs	Fail (2019) Does not require assessment (2022)
Chemical Status excluding uPBTs	Good
Ecological Objective	Good by 2015
Chemical Objective	Good by 2063

12.4.43 There are no natural watercourses within the CSA and site observations from the Ecology site walkovers confirm that shallow agricultural ditches have been persistently dry. As such, there are no obvious natural watercourses or surface water flow pathways within the CSA to the River Nar, with rainwater anticipated to infiltrate rapidly, rather than generate substantial run-off.

12.4.44 The EA identified that a minor section in the east if the CSA shows small fluvial 'gulleys' within the crops of Field 26. Strahler analysis in GIS suggests the gullies (circled on Image 12.3) are likely to be caused by Hortonian flow rather than groundwater emergence, as shown in **Image 12.1.**

Image 12.3 Strahler flow analysis at fluvial gulleys



12.4.45 The majority of the CSA is located within a Drinking Water Protected Area (Nar upstream of Abbey Farm - EA ID GB105033047791), as shown in **Volume II, Figure 12.5.**

12.4.46 There is one open / above ground reservoir located in the northern sections of the CSA, within the mitigation and enhancement area.

Flood Zones

12.4.47 The CSA is located entirely within Flood Zone 1 as shown on **Volume II, Figure 12.6**.

12.4.48 The area of Flood Zone 2 and 3a in the east of the CSA is associated with a land drain, which runs parallel to Southacre Road before it discharges to a pond approximate 670 m northeast of the CSA.

12.4.49 The SFRA identifies that no section of the CSA is located within Flood Zone 3b.

12.4.50 Whilst there are areas of Flood Zone 2 and 3 located in the eastern section of the CSA, the Recorded Flood Outlines (EA) dataset shows that no section of the CSA has previously flooded. The nearest recorded flooding from the River Nar is located approximately 10 km west (north of Wormegay) and was associated with the 1993 event, where Section 3.4.2 Historic Records of River Flooding of the Strategic Flood Risk Assessment (SFRA) [Ref 12-3], notes that the cause of flooding was a breach of flood defences.

12.4.51 The Norfolk County Council (NCC) Flood Investigation Reports for the Breckland Area (2014-2021) and Countywide (2022) [Ref 12-4] do not identify any incidents of flooding within the CSA or within close proximity to the CSA.

12.4.52 The SFRA also notes that hydraulic modelling of the River Nar upstream as far as Marham (downstream of the Breckland Council) has been undertaken. Royal Haskoning confirmed that even with a major tidal event on the Great Ouse coincident with a fluvial event on the Nar causing it to back up behind the tidal outfall structure, water levels would not be affected as far upstream as Marham, due to the nature of the river gradient (Mott MacDonald 2007).

12.4.53 Flood data was provided by the EA on 25th September 2024. Outputs from the Eastern Rivers Modelling Report - Nar (v1.0 May 2015), show that the 1 % - Annual Exceedance Probability (AEP) + 20 % climate change, the 0.5 % AEP and the 0.1 % AEP flood outlines do not encroach into the CSA, as shown on Plate 6 within the FRA.

12.4.54 Flows used within the River Nar model are 56 % higher for the 0.1 % AEP than the 1 % AEP and, therefore, in the absence of a scenario showing the 33 % AEP of CC required for the 2080's Higher Central allowance for the North West Norfolk Management Catchment peak river flow, the 0.1 % AEP has been used as a proxy.

12.4.55 The EA Surface Water Flood Map shows that the modelled surface water flooding extent for the 1 % AEP event is largely absent across the entire CSA with the exception of a small area in the north which is confined to a topographical depression and an area in proximity to Fincham Drove.

12.4.56 Figure 7 of the SFRA (Areas Susceptible to Groundwater Flooding) shows that the majority of the CSA is located outside an area classified as at risk of groundwater flooding, with minor areas in the north of the CSA classed as having a 25-50 % and 50-75 % risk of groundwater emergence. Areas identified at risk of flooding from groundwater are mostly within the Mitigation and Enhancement Areas.

12.4.57 The CSA is located outside the extents of the Fluvial Contribution and Wet Day scenarios should the retaining walls of Manor Farm Reservoir (Wells) fail.

12.4.58 Borehole records (BGS borehole IDs 511123 and 509969) [Ref 12-5] in the north of the CSA show an absence of groundwater to a depth of 14 m BGL.

Designations

12.4.59 Designations located within the WSA (i.e., 5 km from the Site) are outlined in Table 12.10.

Table 12.10 Designations within Wider Study Area

Designation	Qualifying Interest	Approximate distance and direction from the CSA	Hydrological link to CSA?
River Nar SSSI	A variety of wetland species, including southern marsh orchid	175 m northeast	Yes – via chalk aquifer baseflow
Castle Acre Common SSSI	Unimproved grazing marsh on the banks of the River Nar has diverse grassland habitats, and the marshy conditions provide nesting sites for several wetland bird species. There are acidic flushes where springs emerge from sands in the bottom of the valley	435 m north	Yes – via chalk aquifer baseflow
East Walton and Adcock's Common SSSI and SAC	Chalk grassland, springs, open water and scrub	2.3 km northwest	Yes – via chalk aquifer baseflow
Breckland Forest SSSI	Breeding habitat for woodlark and nightjar	2.4 km south	Yes – via chalk aquifer baseflow
Narborough Railway Embankment SSSI	Diverse chalk grassland	2.5 km west	Yes – via chalk aquifer baseflow

12.4.60 Designations are shown on **Volume II, Figure 7.1**.

Future Baseline

12.4.61 The future baseline of the CSA and Wider Study Area without the implementation of the Scheme would be unlikely to change substantially. The CSA and Wider Study Area would continue to be intensively managed for agricultural purposes and there would likely be a continued deterioration in surface water and groundwater quality and quantity, through diffuse agricultural pollution and abstraction, contrary to the aims of the WFD.

12.4.62 In addition, other permitted developments outside of the CSA i.e. within the WSA are likely to be ongoing. These developments will be assessed for potential cumulative effects in the ES, at application-stage.

12.4.63 Without the Scheme, the baseline is unlikely to change substantially, however, there would be a natural evolution, including as a result of climate change. This may include impacts on rainfall, watercourse quality and increased flood risk.

12.5 Embedded Mitigation

12.5.1 Embedded development design measures will be set out within the Outline Construction Environmental Management Plan (oCEMP). The oCEMP will provide a framework for a final CEMP to be provided for approval as secured under the DCO, which will set out specific measures which relate to this Scheme. They will consist of good practice methods and works that are established and effective measures to which the Applicant will be committed through the DCO Requirements.

12.5.2 The following mitigation measures relating to the hydrological environment are embedded into the design of the Scheme:

- 10 m watercourse edge buffers for all construction works (i.e. solar PV panels and associated infrastructure, Temporary Construction Compounds, BESS and Substations (National Grid and Customer) with the exception of drain crossings for cables and Access Tracks
- 10 m buffer of IDB maintained watercourses
- The Scheme will utilise existing access road and tracks already in place where practicable, and this will help to minimise ground disturbance and requirement for further drain crossings
- Any tracks to be implemented will comprise a graded Type 2 or 3 washed / clean aggregate. Where new access points are required the bellmouth will typically be asphalt and would be limited in extent. This limits the potential for increased surface water runoff rates and sedimentation effects during rainfall events; and
- The Scheme has been sequentially designed to locate all electrically sensitive infrastructure (e.g., the Substation compounds (National Grid and Customer), Inverters and Transformers) outside of Flood Zones 2 and 3 to mitigate against the risk of flooding.

12.5.3 The oCEMP will describe water management measures to control surface water runoff and drain hardstanding and other structures during the Construction, Operational and Decommissioning Phases of the Scheme. A Pollution Prevention Plan (PPP) will also be part of a final CEMP.

12.5.4 As the Anglian Water region is identified as ‘seriously water stressed’ in the EA’s 2021 classification of water stressed areas, water used for the Scheme will not be sourced through a new abstraction and will be sourced offsite.

Good Practice

12.5.5 Good practice will be followed in all aspects of construction, Operational and decommissioning, specifically through a PPP.

12.5.6 The PPP will outline measures to be employed to avoid or mitigate potential pollution for all phases of the Scheme and will also include an Incident Plan to be followed should a pollution event occur. This plan will be produced following consultation and agreement with the EA and all appropriate personnel working on the construction site will be trained in its use. The Construction Project Manager will have specific responsibility for implementation of the CEMP.

12.5.7 Method statements will also be applied, which will follow the principles laid out in relevant CIRIA guidance [Ref 12-7] and the principles of the archived EA Pollution Prevention Guidelines [Ref 12-8].

12.6 Assessment of Likely Significant Effects

12.6.1 The potential effects of the Scheme on hydrological receptors have been assessed for the Construction, Operational and Decommissioning Phases. Effects occurring during Construction and Decommissioning Phases are considered to be short-term effects due to the duration of these phases (up to 24 months in total, though less in any one location due to phasing of the works), while those occurring as a result of the Operational Phase considered to be long-term effects (up to 60 years).

Potential Construction Effects

12.6.2 The nature and magnitude of effects that could result from construction activities are assessed in the following paragraphs, which includes:

- The use of existing agricultural Access Tracks from the current agricultural operations for the construction of the Scheme
- The installation of new tracks
- Installation of the PV module array and Mounting Structures
- Construction of new access roads and Access Tracks, hardstanding, security fencing, CCTV masts and permanent pyranometers
- Construction of the BESS compound
- Construction of Substations (National Grid and Customer), including foundations and a Temporary Construction Compound; and
- Installation of cabling linking the solar PV modules to Inverter/Transformer stations within solar PV areas at Low Voltage (LV), linking those to the intermediate substations at Medium Voltage (MV), linking those to the BESS compound.

12.6.3 The assessment of the nature and magnitude of effects that could result from construction activities during the Construction Phase is based on the information within **Volume I, Chapter 5: Scheme Description**.

Chemical Pollution

12.6.4 Potential effects involved with the management of construction are a risk management issue, with the effects being assessed should the risk be realised. Should the Scheme progress as described in **Volume I, Chapter 5: Scheme Description**, i.e., with no spills, then there would be no effects.

12.6.5 Potential risks include the spillage or leakage of chemicals, fresh concrete, foul water, fuel, coolant or oil, during use or storage onsite. These pollutants have the potential to adversely affect subsurface and surface water quality, and groundwater.

Surface Water Resources / Watercourses

12.6.6 Whilst there is an absence of natural watercourses within the CSA, there are a number of 'dry channel' pathways, such as Fincham Drove and the fluvial ‘gulleys’ to the east of the CSA, which may transfer surface water during heavy or prolonged precipitation to offsite surface water receptors such as the River Nar. Offsite watercourses, drainage ditches and water bodies could therefore be at risk from a pollution incident during the Construction Phase and these receptors are considered to be of **medium sensitivity**.

12.6.7 Buffer distances between proposed construction activities during the Construction Phase and watercourses and drainage ditches have been implemented for all works other than watercourse crossings by cables and Access Tracks, to reduce the potential for chemical pollutants to be transferred to the water environment.

12.6.8 Embedded design considerations such as absorbent spill pads / kits and other measures to be outlined within an oCEMP will effectively limit the uncontrolled release of chemicals to minor fugitive releases (if at all). These would be minimised through best practice construction methods such as vehicle speed limits and regular vehicle and machine maintenance.

12.6.9 As vegetation becomes established under the Solar PV Arrays there is likely to be a decrease in surface water runoff rates and a reduction in the potential for agricultural chemicals (e.g., phosphates and nitrates) to transfer into the wider hydrological catchment compared to the baseline scenario.

12.6.10 As such, there will be **negligible risk** of chemical pollution effects on watercourses and designations identified in Section 12.4. Therefore, the impact to surface water resources/watercourses from the Scheme during the Construction Phase is considered to be **not significant**.

Groundwater and Near-surface Water

12.6.11 Groundwater could be at risk from a pollution incident during the Construction Phase.

12.6.12 Pollutants interacting with bedrock also have the potential to alter the pH of the groundwater resource. Chemical and pH alterations to bedrock are difficult to rectify due to the fractured nature of the rock and the lengthy attenuation and dispersal of chemicals.

12.6.13 The Mounting Structure poles for the solar PV modules will be piled into the ground at a superficial level (anticipated to be driven into the ground to a depth of approximately 1 to 4 m) and will have limited potential to release pollutants into groundwater, as the groundwater

resource under the CSA is associated with the Lewes nodular, Seaford, Newhaven and Culver chalk formations at approximately 40 m BGL.

12.6.14 **Image 12.4** shows the thin nature and footprint of a typical PV Mounting System, which is likely to be used at the Scheme.

Image 12.4 Typical PV Mounting System pile and physical footprint [3]

12.6.15 Should concrete feet be required for isolated areas, these will be pre-cast and no concrete will be poured in-situ on-Site.

12.6.16 The National Grid Substation and Customer Substation and the BESS are the only Scheme infrastructure during the Construction Phase which has any potential to impact the

[3] Photograph Credit: R. Sutton – Cotswold Archaeology

groundwater resource due to the absence of concrete pouring and substantial excavation associated with other infrastructure which makes up the Scheme.

12.6.17 Due to the underlying groundwater at depths likely to be greater than 2 m (BGS Water Well References: TF81SW2 (immediately north of Field 33), TF81SW3, TF81SW4 (both in Field 26) and TF71SE68 (immediately west of Field 1), groundwater is unlikely to be present near the surface, meaning there is limited potential for pollutants to come into direct contact with groundwater. Intrusive investigations as part of the infiltration testing to be undertaken prior to the ES will confirmed the presence or absence of groundwater at depths which the Scheme may interact with.

12.6.18 Measures secured in the oCEMP such as spill pads and impermeable geotextile membranes will effectively limit the uncontained release of chemicals to minor fugitive releases. Further details of these measures will be set out in the oCEMP.

12.6.19 Therefore, impact of pollutants from the Scheme on groundwater and near-surface water resources a of high sensitivity and those which rely on groundwater, such as abstractions and associated SPZs (high sensitivity) is considered to be of **negligible magnitude** and therefore to have a **negligible significance of effect**. Therefore, the impact to groundwater and near-surface water resources from the Scheme during the Construction Phase is considered to be not significant.

Erosion and Sedimentation

Surface Hydrology

12.6.20 Erosion and sedimentation can occur from excavations, ground disturbance (such as soil stripping), de-watering (pumping of water from excavations), and overburden stockpiling (superficial geology / topsoil spoil heaps), the largest element of which would be with the construction of the National Grid Substation, Customer Substation, Cable Route Corridor and BESS. Sediment entering watercourses and drainage ditches has the potential to affect water quality, ecology and flood storage capacity.

12.6.21 The following embedded mitigation measures during the Construction Phase of the Scheme have been incorporated into the Scheme design, with detailed proposals and locations to be submitted with the DCO Application. Measures include but are not limited to planting and seeding with a suitable grass or wildflower mix to areas of the Site, silt traps and buffer strips to minimise sedimentation and erosion and construction drainage measures, such as the use of settlement lagoons, swales and interception bunds, to limit the potential for sediment entering offsite watercourses via overland flow.

12.6.22 The outline Soil Management Plan (oSMP) accompanying the DCO Application in addition to the overland separation distance between areas of the Site for construction related activities and drainage ditches as included in the Scheme design process and the general flat topography within the fields which comprise the Solar PV Site, will likely minimise overland flow generation and any silt generated during the Construction Phase will be entrained within cut off ditches before reaching watercourses and land drains.

12.6.23 Where new crossings and upgrades to existing crossings are required then works will be isolated from the water environment by coffer dams and over pumping, if works are undertaken when ephemeral ditches (ditches that sometimes have water in them and sometimes do not) have water in them. This will limit the potential for sediment and siltation

to be transferred into the watercourses or transferred downstream through direct disturbance.

12.6.24 Therefore, effects on watercourses and drainage ditches of **medium sensitivity** are considered to be of **negligible magnitude** and to have a **negligible significance of effect**. Therefore, the impact to surface hydrology from erosion and sedimentation from the Scheme during the Construction Phase is considered to be **not significant.**

Sub-surface Hydrology

12.6.25 Sediment has the potential to change near-surface water flows within superficial geology deposits by creating a physical barrier within naturally occurring drainage micropores. Sediment entering near-surface water in superficial deposits also has the potential to impact on groundwater quality within bedrock deposits.

12.6.26 Embedded mitigation measures during the Construction Phase of the Scheme include the implementation of managed vegetation growth which will assist in promoting the retainment of soil (at the surface) and increasing the strength of the soil mass (at depth) and reducing the potential for sediment to enter sub-surface hydrology compared to the baseline existing scenario of tilled agricultural arable fields at the Site. Additionally, embedded measures such as impermeable ground membrane layers and bunded areas, will effectively limit sediment entering sub-surface water in superficial deposits.

12.6.27 For these reasons, the magnitude of this effect is considered to be **negligible**. Given the **high sensitivity** of near-surface water and groundwater and **negligible magnitude** of impact, the significance of the effect associated with erosion and sedimentation is considered to be **negligible**. And therefore, the impact to sub-surface hydrology from the Scheme during the Construction Phase is considered to be not significant.

Impediments to Flow

12.6.28 New Access Tracks may require the installation of new watercourse crossings and the upgrade or reuse of existing crossings across all sections of the CSA. Existing access routes and agricultural tracks, where practicable, will be retained, limiting the requirement to install new watercourse crossings, therefore minimising the potential for impediments to flow. The minimisation of the number of proposed watercourse crossings reduces one of the main activities during Construction Phase that could give rise to impediment of flows.

12.6.29 Mitigation measures such as the use of a wide box or arch culverts, where appropriate, are likely to prevent impediments to flow being created and detailed design will be carried out at the Construction Phase and will be developed with the LLFA and the EA as the Scheme progresses, and will be secured through a Requirement.

12.6.30 No drainage ditch diversions are proposed as part of the Scheme.

12.6.31 As part of the Construction Phase, of the Scheme cables may also cross areas of the Site, in particular land drains between fields 29 and 30 on Site. The type of crossings will be determined during the detailed design phase prior to ES and with watercourse crossing strategies/techniques such as Horizontal Directional Drilling (HDD) or cable pipe (flume) method, small cable bridge, pipe or cut and cover with a temporary diversion, damming or pumping explored. Crossings which require the flume technique will be designed to be large enough so that they can accommodate increases in water flow resulting from future rainfall events.

12.6.32 Soil stripping will be required for areas of hardstanding such as adjacent to cable trenches. Associated sedimentation effects could occur during the excavation of the cable trench.

12.6.33 Any silty water generated during the Construction Phase on Site will be subject to a settlement process through drainage mitigation measures (silt traps, silt fencing etc.) and channelled into vegetated areas, to allow the settlement of solids.

12.6.34 All in-stream engineering works i.e. watercourse crossings, will be carried out in accordance with the EA Flood Risk Activities: Environmental Permits.

12.6.35 Detailed method statements and plans will be provided to the EA prior to the Construction Phase for all in stream construction works and all temporary watercourse diversions will be discussed in detail prior to the Construction Phase.

12.6.36 For these reasons, the magnitude of this effect will be **negligible**. Given the **medium sensitivity** of the watercourses and surface water, effects associated with erosion and sedimentation are assessed as being of **negligible significance**. Therefore, the impact to impediments to flow from the Scheme during the Construction Phase is considered to be **not significant.**

Compaction of Soils

12.6.37 The movement of construction traffic, in the absence of construction good practice, can lead to compaction of the soil. This can reduce soil permeability, potentially leading to increased run-off rates and increased erosion. The superficial geology underlying the Site is generally of low permeability and is in agricultural use, so the effects of compaction would not result in a substantial increase in runoff from existing conditions.

12.6.38 In order to maintain or improve on the current level, it is necessary to ensure that construction methods do not seriously disrupt the established drainage network and that no areas are surcharged, either by water discharge or spoil.

12.6.39 Maintenance of existing drainage infrastructure should be prioritised to avoid compaction of soils, therefore all existing drainage network channels will be maintained through measures such as plastic spanning under the Access Tracks to ensure conveyance of flows.

12.6.40 Existing Access Tracks or agricultural will be used in preference to making new ones, where practicable, further reducing the potential for soil compaction. Depending on weather conditions during construction, temporary roadways (e.g., plastic or metal track matting) may be utilised to access parts of the Scheme to avoid excessive soil disturbance or compaction.

12.6.41 Therefore, impact of compaction on surface water and sub-surface water of **medium and high sensitivity** receptors is considered to be of **negligible magnitude** and therefore to have a **negligible significance of effect**. And therefore, the impact to compaction of soil from the Scheme during the Construction Phase is considered to be **not significant**.

Changes in Soil Interflow Patterns

12.6.42 Some excavations, such as those for the National Grid Substation, BESS and Customer Substation may need temporary sub-surface water controls, such as physical cut-offs or de-watering. These temporarily divert flows away from the excavation and temporarily lower the local water table and sub-surface water levels in the superficial geology. Localised temporary changes to soil interflow patterns may therefore arise.

12.6.43 Foundations for the Substations (National Grid and Customer) and associated hardstanding also have the potential to change sub-surface water flow by creating physical barriers within naturally occurring drainage macropores in soil.

12.6.44 No substantial impediments to near-surface water flow will be created as the detailed drainage design for the Scheme will take into account any severance of saturated areas to ensure hydrological connectivity is maintained, as set out in in the CEMP secured by requirement of the DCO Application.

12.6.45 The Scheme will involve the installation of arrays of photovoltaic cells arranged on Mounting Structures. The racking system posts will be driven into the ground to a depth of maximum depth of 4 m.

12.6.46 It is considered that installing racking system posts to a depth of 4 m will have a negligible effect on the displacement or change in sub-surface water flow underlying the CSA due to the thin nature of the supporting frame, as shown in Image 12.6 shows the thin nature and footprint of a piled PV racking pile.

Image 12.5 Indicative thin racking system driven into ground

12.6.47 As outlined in Section 12.4 of this PEIR chapter there are several agricultural fields which may be served by a subsurface network of drainage pipes. Installation of the Ground mounted PV Modules has the potential to damage this network by piercing the pipework and impairing its functionality through blockage. Even in the absence of good construction

practice, such as a watching brief and pipe reinstatement, the artificial drainage network is likely to still be able to function, as water would gravitate around racking system and drain to the existing outfalls.

12.6.48 Cable trench excavations may require temporary sub-surface water controls, such as physical cut-offs or de-watering. Such controls temporarily divert flows away from the excavation, de-watering temporarily lowers the local water table and subsurface water levels in superficial geology deposits. Localised temporary changes to soil interflow patterns may therefore arise. Cable trench excavation also has the potential to change subsurface water flow by creating physical barriers within naturally occurring drainage macropores in soil. Given the shallow excavation depths of the cable trench (up to 2 m depth) and narrow width (a maximum of approximately 50 m width) no substantial impediments to subsurface water flow will be created and site drainage design will take into account any severance of saturated areas to ensure hydrological connectivity is maintained.

12.6.49 Should HDD be utilised, the physical disturbance through the trenchless technique will be less than the open cut method.

12.6.50 Consequently, effects on near-surface water of high **sensitivity** are considered to be of **negligible magnitude** and **negligible significance**. Therefore, the impact to changes in soil interflow patterns from the Scheme during the Construction Phase is considered to be **not significant**.

Effects on Private Water Supplies and other Abstractions

Private Water Supplies (PWS)

12.6.51 PWS could be at risk of a reduction in the quality or quantity of water serving a property from construction of the Scheme. At this PEIR stage of the Scheme, works in proximity to Keepers Cottage comprise of those as part of the 'mitigation, enhancement and/or retained agricultural land/buildings' and the Solar PV Site, the latter with potential to involve piling of the Ground Mounted PV modules to a depth of up to 4 m BGL into the superficial geology cover.

12.6.52 Given the borehole is anticipated to abstract from a depth of between 9 and 40 m BGL associated with groundwater from the chalk units underlying the WSA (see adjacent BGS borehole TF71SE68) there will be no direct effects on the groundwater resource being utilised for the supply. This also applies to other PWS to the north of the CSA, where groundwater was encountered at 9 to 18 m BGL.

12.6.53 The Mounting Structure poles will be made from high-grade aluminium and stainless steel and as such, there will be limited potential for degradation or bi-products to be leached to the soils and percolate to groundwater.

12.6.54 Measures will be implemented to manage the handling of chemicals and fuels will limit the potential for spillage or leakages to minimal fugitive releases (if any).

12.6.55 Consequently, effects on PWS identified as a medium sensitivity receptor are considered to be of **negligible magnitude** and **negligible significance**. Therefore, the impact to PWS from the Scheme during the Construction Phase is considered to be **not significant**.

Public Supplies (PuWS)

12.6.56 PuWS could also be at risk of a reduction in water quality or quantity during the Construction Phase of the Scheme if groundwater is affected.

12.6.57 Groundwater was encountered at 9 m BGL within boreholes at Marham, which has an existing Solar PV Array installed in the field immediately to the north of the treatment facility. At this depth it is very unlikely that subsurface water will be influenced by the Ground mounted PV Modules.

12.6.58 There is a potential for chemical effects from oil and fuel spillages or leakage, however these are at no greater than risk of occurring than from the baseline scenario as the highway network is utilised by public vehicles and there will be no direct effects on the groundwater resource being utilised for the supply. Measures to manage the handling of chemicals and fuels, such as designated refuelling points and bunds for storage, will be outlined in the oCEMP and will limit the potential for spillage or leakages to minimal fugitive releases (if any).

12.6.59 Where works are carried out within proximity to water distribution infrastructure, a 'Watching Brief' will be conducted during works by a Hydrologist or Engineer. The Watching Brief should be used to clearly mark and demarcate any sensitive areas around the pipes which serve the property and aim to isolate pipes from construction works and avoid impact on the pipe infrastructure. Employees will be briefed of the pipework and locations and be briefed on any controls and conditions put in place prior to the commencement of works. Should any works cross the pipes then measures will be implemented to prevent damage to the pipes, such as laying of steel matting or concrete above the pipework, and will be detailed in the oCEMP to be provided at the ES stage.

12.6.60 Consequently, effects on PuWS identified as a **high sensitivity** receptor are considered to be of **negligible magnitude** and **negligible significance**. Therefore, the impact to PuWS from the Scheme during the Construction Phase is considered to be **not significant**.

Water Frame Directive (WFD)

12.6.61 TA A12.2, WFD Assessment, concludes that with the implementation of good practice construction measures, there will be no degradation in the WFD status (chemical or ecological) of waterbodies which interact with the Scheme.

Potential Operational Phase Effects

12.6.62 Potential effects associated with the operation of the Scheme are:

- Increased or decreased surface water run-off rates
- Continued or decreased erosion and sedimentation from runoff from areas of hardstanding and areas under the Solar PV Arrays
- Alterations to natural flow pathways from runoff from areas of hardstanding
- Reduced chemical loading of watercourses associated with the cessation of fertiliser / nitrate application
- A risk of a pollution event from minor spills caused by maintenance vehicles
- Risk of pollution from infrastructure damage; and

- A risk of a pollution event in the rare event of a battery fire.

12.6.63 The nature of these effects, with the exception of a battery fire (discussed below in the relevant subsection of this chapter), have been discussed in relation to the Construction Phase. However, as there should be substantially less activity and ground disturbance within the Site boundary during the Operational Phase, it is expected that the magnitude of impact of many of these effects will be far less than in the Construction Phase. This is with the exception of rainfall run-off from the Solar PV Arrays, which is expected to remain the same as during the Construction Phase, as the Solar PV Arrays will be in place early during the Construction Phase. Due to the composition of PV panels, chemical pollution from damaged PV panels/ leakages from the PV panels has been assessed.

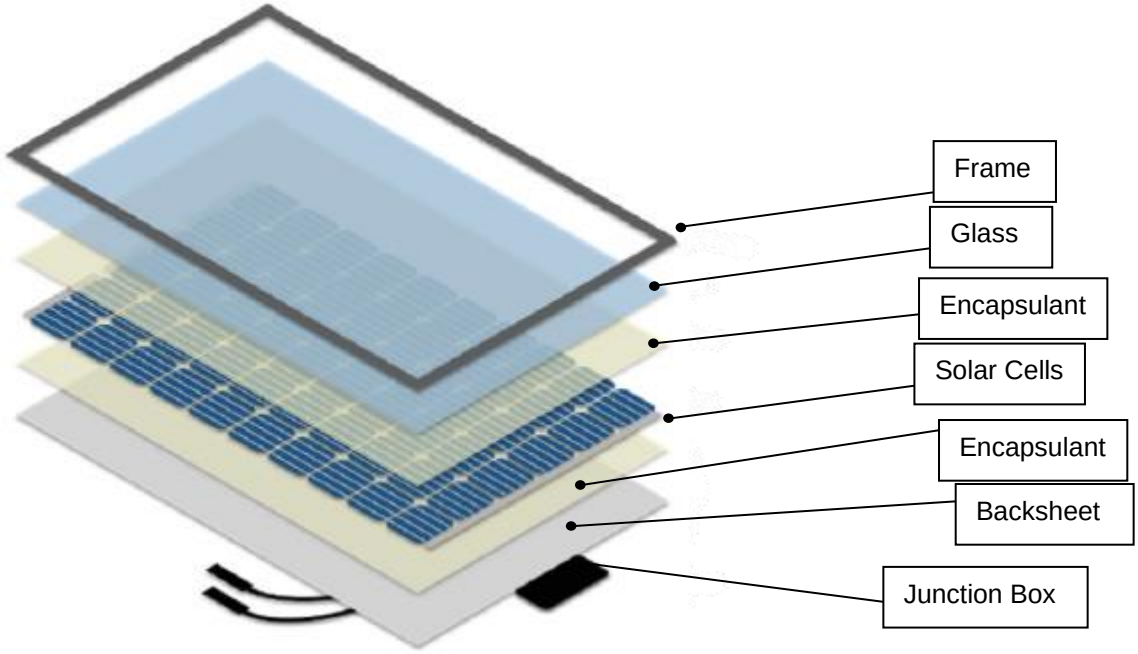
12.6.64 Raincloud staff have undertaken site walkovers on operational solar farms where vandalism has resulted in the PV panel surface being breached through impact from projectiles, as shown in **Images 12.6** and **12.7**

Image 12.6 and Image 12.7 Vandalised PV Arrays, Thorne Solar Farm, Doncaster (2024)

12.6.65 For illustrative purposes, PV panels can be laminated between two sheets of sealed transparent encapsulant, covered in tempered glass, fitted with another layer of plastic or glass at the back, and sealed in an aluminium frame / backsheet, as illustrated in **Image 12**.

12.6.66 The extensive impact from heavy and sharp projectiles shown in **Image 12.6** and **Image 12.7** did not penetrate the backsheet of the PV panel.

Image 12.8 Typical configurations of PV module[4]



12.6.67 Due to the composition of the surface of the Ground mounted PV Modules, they are likely to remain intact both at the surface and underside near the racking system, even in the event of damage / impact and not leak. As such, there is limited potential to transfer chemicals to the hydrological environment. This is supported by the Solar Energy Industries Association (SEIA) [Ref 12-9] who conclude that even in the event of the glass breaking and is left unrepaired, it would take years to extract any type of substance from the broken panels.

12.6.68 A programme of regular maintenance and inspection, as outlined in **Volume I, Chapter 5: Scheme Description**, will ensure that faulty or damaged PV panels are replaced promptly, further reducing the risk of a transfer of chemicals to the hydrological environment.

12.6.69 An outline Operational Environmental Management Plan (oOEMP) will be prepared in support of the ES, which will include control measures to ensure no significant impacts will arise during the maintenance and replacement activities.

12.6.70 This, therefore, represents a **negligible magnitude** of impact on watercourses, drainage ditches and waterbodies identified as a **medium sensitivity** receptor and therefore result in a **negligible significance** of effect. And therefore, the impact to chemical pollution from

[4] Reproduced from M. Aghaei *et al*. Review of degradation and failure phenomena in photovoltaic modules (2022). Renewable and Sustainable Energy Reviews Volume 159 , May 2022, 112160

Solar PV Arrays from the Scheme during the Operational Phase is considered to be **not significant**.

Chemical pollution from battery fire

12.6.71 Regarding the potential transfer of pollutants from a battery fire, watercourses and groundwater could be at risk of pollution through the application of firefighting water as a suppressant. Due to the composition of commercial battery units, an outline Fire Safety Management Plan (oFSMP) will be submitted in support of the DCO Application, which identifies that hydrofluoric acid could be created if cooling water for adjacent BESS units comes into contact with smoke from a battery fire.

12.6.72 In addition, an outline Battery Safety Management Plan (oBSMP) will also accompany the DCO Application which will outline that the Applicant will follow the strategy of allowing a battery related fire to self-consume, reducing unnecessary risk of injury to site and firefighting personnel. Should a fire occur, the affected enclosure will be allowed to self-consume until the fire is extinguished through consumption of the combustible materials within the battery container / enclosure. The firefighting procedure may include a suppression system and will be to apply water to adjacent BESS enclosures to keep them cool and further prevent their overheating. As water will not be directly applied to affected BESS container, there is reduced potential for water to become contaminated and the volume of water required during a firefighting event is reduced.

12.6.73 As outlined in TA A12.1, FRA, based on recommendations in NFPA 855 Standard for the Installation of Stationary Energy Storage Systems and the NFCC Grid Scale Energy Storage System Planning - Guidance for Fire and Rescue Services, a burn time of 2 hours and a requirement of 1,900 l/min of fire suppression water has been used to calculate the volume of fire suppressant water required to be stored onsite in the event of a container fire. This equates to 228 m^3 of storage.

12.6.74 Draft NFCC guidance requires a reduced fire suppression volume of 1,500 l/m equating to 180 m^3, however this has not been adopted at the time of writing.

12.6.75 The containment of spent firefighting water will either be captured within a dedicated contaminated water tank or, if infiltration is not feasible at the BESS area then the attenuation structures for surface water runoff will be dual function i.e. the SuDS structure will be sized to accommodate the worst case of either the 1 % AEP + 40 % CC or the full fire suppressant volume.

12.6.76 A penstock will be placed on the outlet of the contaminated water tank or SuDS unit and would be closed in the event of BESS containers needing to be cooled during a fire event. It would remain closed until testing of the captured water has taken place. Water will then either be removed offsite by tankers to a licenced facility or discharged to groundwater, subject to agreement with the EA. This will be confirmed at the ES stage.

12.6.77 As a result, the magnitude and significance of all effects associated with chemical pollution for the operation of the Scheme on all receptors are assessed as being **negligible**. Therefore, the impact to chemical pollution from battery fire from the Scheme during the Operational Phase is considered to be **not significant**.

Foul Water

12.6.78 A decision regarding the storage method for foul water prior to disposal will depend on the number of staff likely to be onsite during the Operational Phase and the frequency of visits. The decision will be made prior to the Construction Phase by the appointed principal construction contractor, in discussion with the EA. The Operational Phase welfare facilities will drain to a contained cesspit, to be regularly emptied by a licensed contractor, or to a mains sewer connection, meaning and the potential pollution associated with soakaway disposal will not occur.

As a result, the magnitude and significance of all effects associated with foul water are assessed as being **negligible**. And therefore, the impact to foul water from the Scheme during the Operational Phase is considered to be **not significant**.

Cable Leakage

12.6.79 Regarding cables, the underground cables require minimal maintenance, although faults do occur which require the use of test equipment to locate the fault and potentially excavation to cut out and replace the faulted section with new joint bays required to be installed for the joints.

12.6.80 A small number of ad hoc and planned maintenance visits will be undertaken during the Operational Phase of the Scheme, refer to **Volume I, Chapter 5: Scheme Description** for more detail on replacement and maintenance schedule. These maintenance visits are not expected to involve excavation works beyond the foundations of buildings (such as the National Grid and Customer Substations) or below the cables. As such, there will be no interaction with the underlying groundwater unit and thus, no direct effects are predicted on the hydrogeology resource.

12.6.81 Based on typical fault rates encountered with similar cables [Ref 12-10 and Ref 12-11], statistically the Scheme will have an expected fault rate to be approximately 0.4 faults per 100 km per annum. In practice, this relates to approximately 0.0152 faults per annum (1 fault every 66 years). Additionally, any release of pollutant from the cable route will be a fugitive.

12.6.82 Therefore, the magnitude of this effect is considered to be **negligible** on groundwater identified as **high sensitivity** and watercourses identified as a **medium sensitivity** resources. As such, there will be **negligible** predicted significance on surface water and groundwater during the Operational Phase of the Scheme. Therefore, the impact form cable leakage to surface water and groundwater from the Scheme during the Operational Phase is considered to be **not significant**.

Increase in Surface Water Runoff

12.6.83 The Solar PV Arrays have the potential to concentrate rainfall under the drip lines (regular gaps between PV Tables). Once the rainfall has fallen off a PV panel, the water will be able to spread and flow along the ground under the PV Tables. Given the topography of the CSA is generally flat lying it is likely that rain falling on each PV Table would flow evenly into the rain-shadow of the row below, so as to mobilise the same percentage of the ground for infiltration as was available before the panels were installed. As a result, there is unlikely to be an increase in run-off as a result of the PV panels.

12.6.84 The area under the PV Tables will be seeded with a suitable grass/flower mix to prevent rilling (incisions in soil caused by concentrated water flow) and an increase in surface water

runoff rates. With the implementation of suitable planting, the ground cover is unlikely to generate surface water run-off rates beyond the baseline scenario.

12.6.85 The FRA **Volume III, Appendix 12.2** identifies that the installation of PV panels does not have the potential to substantially increase surface water runoff rates compared to the baseline scenario as vegetation (sown prior to construction) under the drip lines establishes and acts to slow the transfer of run-off to the hydrological catchment downslope.

12.6.86 As a result, the magnitude and significance of all effects associated with increased runoff are assessed as being **negligible** and therefore, the impact from the Scheme to the receiving hydrological environment during the Operational Phase is considered to be **not significant**.

Effects on Private Water Supplies and other Abstractions

Private Water Supplies (PWS)

12.6.87 The risk of chemical pollution and a reduction in yield to PWS is reduced during the Operational Phase as there is substantially less activity which would give rise to these effects i.e. occasional maintenance visits.

12.6.88 Consequently, effects on PWS identified as a **medium sensitivity** receptor are considered to be of **negligible magnitude** and **negligible significance**. Therefore, the impact to PWS from the Scheme during the Operational Phase is considered to be **not significant**.

Public Supplies (PuWS)

12.6.89 The risk of chemical pollution and a reduction in yield to PuWS is reduced during the Operational Phase as there is substantially less activity which would give rise to these effects i.e. occasional maintenance visits.

12.6.90 As vegetation becomes established under the Solar PV Arrays there is likely to be a decrease in surface water runoff rates and a reduction in the potential for agricultural chemicals (e.g., phosphates and nitrates) to transfer into the wider hydrological and hydrogeological environments compared to the baseline scenario.

12.6.91 Consequently, effects on PuWS identified as a **high sensitivity** receptor are considered to be of **negligible magnitude** and **negligible significance**. Therefore, the impact to PuWS from the Scheme during the Operational Phase is considered to be **not significant**.

Decommissioning

12.6.92 An outline Decommissioning Environmental Management Plan (oDEMP) will be prepared in support of the ES, which will set out embedded mitigation measures identified.

12.6.93 Potential effects of decommissioning the Scheme are similar in nature to those during Construction Phase, as some ground-work would be required to remove the Ground mounted PV Modules, possible foundations and hardstanding. These effects would be lesser in magnitude than during the Construction Phase as infrastructure to facilitate site movements etc. will already be in place and would be controlled by a detailed CEMP. Where infrastructure would be left in place e.g. foundations for onsite buildings, drainage features would also remain where this is compatible with the oCEMP.

12.6.94 As such, the impact effects of decommissioning activities receptors of high and medium sensitivity are considered to be of **negligible** magnitude and therefore to have a **negligible** significance of effect. This is considered **not significant**.

12.7 Additional Mitigation

12.7.1 With the embedded design measures to be provided in an oCEMP to be submitted in support of the DCO Application with the ES, all identified potential effects have been assessed as being of negligible significance, and therefore, the impact form the Scheme during the Construction, Operational, Decommissioning Phase is considered to be **not significant**.

12.7.2 No further additional mitigation is proposed.

12.8 Residual Effects

12.8.1 Given that only effects of moderate significance or greater are considered significant the potential residual effects on water resources are considered to be **not significant** following mitigation.

12.9 Cumulative Effects

12.9.1 The Applicant is actively engaging with the developer of the adjacent High Grove Solar DCO scheme (which is currently at the pre-application stage) proposed to the south of The Droves. It is intended that ongoing collaboration and information sharing between the two projects will ensure that both assessments are cognisant of each other and minimise likely significant effects arising in-combination as far as reasonably practicable.

12.9.2 Other developments including the Indigo Corporation Limited - 400,000 bird broiler farm (Scoping Opinion) approximately 1 km from the CSA and will be considered at the ES stage.

12.9.3 In combination effects include water pollution from increased ammonia levels. No hydrological link exists between the Site and the relevant designations or Indigo Corporation Limited site, such that cumulative effects in relation to hydrology can be ruled out. On this basis no cumulative effects are anticipated in relation to the proposals.

12.10 Assumptions and Limitations

12.10.1 Initial plans of the irrigation main in the northern section of the CSA and the foul main adjacent to the A1065 in the east of the CSA. The locations of these assets will be confirmed with the owners post-PEIR. This will be updated should further public water supply infrastructure and water utilities be identified within the CSA prior to submission of the ES.

12.10.2 All other data considered necessary to identify and assess the likely significant effects was available.

Table 0.1 Water Resources Significance of Effects

Receptor/Feature	Activity	Embedded Mitigation Measures	Nature and Duration of Effect	Sensitivity of Receptor	Magnitude of Impact	Preliminary Likely Significant Effects	Additional Mitigation Measures	Residual Effect Significance
Construction Phase								
Watercourses, drainage ditches, and near-surface water	Chemical Pollution	oCEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Watercourses, drainage ditches, and near-surface water	Erosion and Sedimentation	oCEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Watercourses, drainage ditches, and near-surface water	Impediments to Flow	oCEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Near-surface water	Changes in Soil Interflow Patterns	oCEMP	Adverse Short-Term	High	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)

Receptor/Feature	Activity	Embedded Mitigation Measures	Nature and Duration of Effect	Sensitivity of Receptor	Magnitude of Impact	Preliminary Likely Significant Effects	Additional Mitigation Measures	Residual Effect Significance
Watercourses and drainage ditches	Increase in Run-off	oCEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
PWS and PuWS	Changes in quality or quantity of supply	oCEMP	Adverse Short or Long Term	Medium and High	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Operational Phase								
Watercourses, drainage ditches, coastal waters and near-surface water	Chemical Pollution (e.g. PV cell leakage)	As part of PV panel	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Watercourses, drainage ditches, and near-surface water	Increased Run-off Rates / Volume	Grassland under Solar PV Arrays - oLEMP. Formal SuDS system for BESS.	Adverse Long-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)

Receptor/Feature	Activity	Embedded Mitigation Measures	Nature and Duration of Effect	Sensitivity of Receptor	Magnitude of Impact	Preliminary Likely Significant Effects	Additional Mitigation Measures	Residual Effect Significance
Watercourses, drainage ditches, and near-surface water	Erosion and Sedimentation	Grassland under Solar PV Arrays	Adverse Long-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Near-surface water	Alterations to natural flow pathways	As part of the design of the Ground mounted PV Modeules	Adverse Long-Term	High	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Watercourses, drainage ditches, and Near-surface water	Risk of a Pollution Event from Minor Spills from Maintenance Vehicles	oCEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Decommissioning Phase								

Receptor/Feature	Activity	Embedded Mitigation Measures	Nature and Duration of Effect	Sensitivity of Receptor	Magnitude of Impact	Preliminary Likely Significant Effects	Additional Mitigation Measures	Residual Effect Significance
Watercourses, drainage ditches, and Near-surface water	Chemical Pollution	DEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Watercourses, drainage ditches, and near-surface water	Erosion and Sedimentation	DEMP	Adverse Short-Term	Medium	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)
Near-surface water	Changes in Soil Interflow Patterns	DEMP	Adverse Short-Term	High	Negligible	Negligible (Not Significant)	None	Negligible (Not Significant)

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