Riverside Energy Park

Environmental Statement

Chapter 12: Hydrology, Flood Risk and Water Resources

VOLUME NUMBER:

06

PLANNING INSPECTORATE REFERENCE NUMBER:

EN010093

DOCUMENT REFERENCE:

6.1

November 2018 | Revision 0 | APFP Regulation 5(2)(a)

Planning Act 2008 | Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

CORY
RIVERSIDE ENERGY

Contents

Tables

Document Reference 6.2 – Figures

Document Reference 6.3 - Appendices

12 Hydrology, Flood Risk and Water Resources

12.1 Introduction

12.1.1 This Chapter presents the assessment of likely significant effects of the Proposed Development upon hydrology, flood risk and water resources arising from the construction, operation and decommissioning. It summarises the relevant legislation, policy, guidance and standards, the consultation undertaken to support and inform the assessment, the assessment methodology and the baseline conditions both at and in the vicinity of the Riverside Energy Park (REP) site, the Main Temporary Construction Compounds and the Electrical Connection. It then considers the mitigation measures required to prevent, reduce or offset effects.

12.1.2 This Chapter has been prepared by Peter Brett Associates LLP (PBA). In accordance with Regulation 14(4) of the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (as amended) (the Infrastructure EIA Regulations 2017), a statement outlining the relevant expertise and qualifications of the competent experts appointed to prepare the Environmental Statement (ES) is provided in **Appendix A.2**.

12.2 Legislation, Policy, Guidance and Standards

Legislation

The Flood Risk Regulations 2009

12.2.1 The Flood Risk Regulations 2009 transpose the European Commission (EC) Floods Directive (Directive 2007/60/EC) into domestic law. The regulations require that Preliminary Flood Risk Assessments (PFRAs) are prepared by the Environment Agency (EA) and Unitary/County Authorities (Lead Local Flood Authorities (LLFA)) that identifies areas at significant potential risk of flooding. For these "*significant risk*" areas, hazard maps must be produced and flood risk management plans developed to reduce flood risk.

Flood and Water Management Act 2010 & Sustainable Drainage Systems: Written Statement – HCWS161

12.2.2 The Flood and Water Management Act (FWMA) 2010 takes forward some of the proposals set out in three previous strategy documents published by the UK Government: Future Water, Making Space for Water and the UK Government's response to the Sir Michael Pitt Review of the summer 2007 floods. In doing so, it gives the EA a strategic overview of flood risk and gives local authorities responsibility for preparing and putting in place strategies for managing flood risk from groundwater, surface water and ordinary watercourses in their areas.

12.2.3 The FWMA 2010 (Schedule 3) proposed the establishment of Sustainable drainage systems (SuDS) Approval Bodies (the SAB) at county or unitary local

authority levels. The role of the SAB was envisaged as implementing the recommendations of the Pitt Review (2008) in promoting the use of SuDS within future development.

12.2.4 Following a period of consultation, the proposed role of the SAB has been amended, with the promotion of SuDS being incorporated into the planning process. This has been achieved by designating LLFA's as statutory consultees with regards to 'local' sources of flood risk and surface water management. The Ministerial Written Statement HCWS161 details this change in policy, which came into effect in April 2015.

12.2.5 The FWMA 2010 also amends Section 106 of the Water Industry Act 1991 (WIA) in respect of the right of connection to a public sewer. As the role of the SAB has been removed following HCWS161, this process is now subsumed into the planning process under the purview of the LLFA.

Water Environment (Water Framework Directive) (England and Wales) Regulations 2017

12.2.6 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 ('WFD Regulations 2017') consolidate, revoke and replace the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003, which transpose the European Union (EU) Water Framework Directive (WFD) into national law. The WFD is a wide-ranging piece of European legislation that establishes a new legal framework for the protection, improvement and sustainable use of surface waters, coastal waters and groundwater across Europe in order to:

- Promote sustainable water use;
- Contribute to the mitigation of floods and droughts;
- Prevent deterioration and enhance status of aquatic ecosystems, including groundwater; and
- Reduce pollution.

12.2.7 Water management has historically been co-ordinated according to administrative or political boundaries. The WFD promotes a new approach based upon management by river basin - the natural geographical and hydrological unit. River basin management plans, published by the EA and Defra, include clear objectives in respect of water quality and pollution control and a detailed account of how objectives are to be met within a prescribed timeframe.

The Environmental Permitting (England and Wales) Regulations 2016

12.2.8 The Environmental Permitting Regulations 2016 consolidate and replace the 2010 Regulations and the 15 associated amendments. The permitting regime

covers a range of activities that release emissions to land, air or water or that involve waste. The regime covers facilities previously regulated under the Pollution Prevention and Control Regulations 2000 and Waste Management Licensing and exemptions schemes, some parts of the Water Resources Act 1991 (WRA) and the Groundwater Regulations 2009.

12.2.9 Schedule 21 relates to water discharge activities and Schedule 25 relates to flood risk activities. Schedule 22 to the Regulations relates to Groundwater activities and the regulations place a duty on regulating authorities to implement the Water Framework Directive and the Groundwater Daughter Drainage Directive and exercise their relevant function to ensure all necessary measures are taken to:

> *"(a) prevent the input of any hazardous substance to groundwater; and*
>
> *(b) limit the input of non-hazardous pollutants to groundwater so as to ensure that such inputs do not cause pollution of groundwater*" (Paragraph 6, Schedule 22).

The Water Resources Act 1991

12.2.10 The WRA 1991 sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The WRA 1991 regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwater. Discharge to controlled waters is only permitted with the consent of the EA. Similarly, a licence is required to abstract from controlled waters.

Land Drainage Act

12.2.11 The Land Drainage Act 1991 consolidates various enactments relating to Internal Drainage Boards and the functions of these Boards and local authorities, including Lead Local Flood Authorities, in relation to land drainage. Amongst other matters, the Act sets out provisions and powers in respect of the control of flow of watercourses and watercourse restoration/improvement works.

The Building Regulations 2010

12.2.12 The guidance document H3 'Drainage and waste disposal' (2015 edition) issued by the Government in respect of the requirements of the Building Regulations 2010 stipulates that rainwater from roofs and paved areas is required to be carried away from the surface to discharge to one of the following, listed in order of priority:

- an adequate soakaway or some other adequate infiltration system, or where that is not reasonably practicable;
- a watercourse; or where that is not practicable;

- a sewer.

National Planning Policy and Strategies

National Policy Statements

12.2.13 As outlined in **Chapter 2**, the relevant National Policy Statements (NPS) provide the primary basis for decisions by the Secretary of State on development consent applications for Nationally Significant Infrastructure Projects (NSIPs).

Table 12.1: Relevant requirements of NPSs

Requirement of NPS EN-1, Overarching National Policy Statement for Energy	Response within this ES
The Overarching National Policy Statement for Energy (NPS EN-1) identifies both water quality and resources and flood risk as topics requiring consideration/assessment as part of energy related projects and requires that: ■ Where the Project is likely to have effects on the water environment, the applicant should undertake an assessment of the existing status of, and impacts of the Project on, water quality, water resources and physical characteristics of the water environment (Paragraph 5.15.2); ■ An application should be accompanied by a Flood Risk Assessment (FRA) for energy projects of 1ha or greater in Flood Zone 1 and all energy projects in Flood Zones 2 and 3 (Paragraph 5.7.4); ■ Where a project may be affected by or may increase flood risk, pre-application discussions should be undertaken with the Environment Agency (EA) and other bodies (Paragraph 5.7.7);	■ A Water Framework Directive Compliance Statement has been produced which addresses these points (see **Appendix H.1**). Further details of the assessment are included in Section 12.9. ■ A FRA has been produced (**Document Reference 5.2**). ■ Correspondence with the EA (and others) is summarised in **Table 12.2**. ■ REP lies within an area allocated for development in development plans therefore, in accordance with Paragraph 162 of the revised NPPF, does not require the Sequential Test to be applied again, as detailed within the FRA (**Document Reference 5.2**). ■ A Drainage Design Strategy has been produced which prioritises the use of SuDS (**Document Reference 5.2**).

▪ Any requirements for sequential testing are satisfied (Paragraph 5.7.9); and ▪ Priority is given to the use of Sustainable Drainage Systems (SuDS) (Paragraph 5.7.9).	
Requirement of NPS EN-3, Overarching National Policy Statement for Renewable Energy Infrastructure	**Response within this ES**
NPS EN-3 addresses climate change adaptation and requires that applicants set out how proposals would be resilient to rising sea levels and increased risk of flooding. In respect of water quality and resources, NPS EN-3 refers to assessment requirements set out in NPS EN-1 and highlights the requirement to identify measures to avoid or minimise the adverse impacts of abstraction and discharge of cooling water.	▪ The FRA (**Document Reference 5.2**) utilised modelled flood levels which included an appropriate allowance for climate change. ▪ The Drainage Design Strategy (Document **Reference 5.2**) includes appropriate allowance for climate change. ▪ REP would use recycled water and an Air Cooled Condenserand, as required potable mains water on a top up basis, in compliance with NPS EN-1 and EN-3.
Requirement of NPS EN-5, Overarching National Policy Statement for Electricity Networks Infrastructure	**Response within this ES**
NPS EN-5 provides the primary basis for decisions taken by the Secretary of State on applications received for electricity networks infrastructure and sets out the factors influencing route selection and the impacts that may arise from such development. However, NPS EN-5 refers back to NPS EN-1 regarding the assessment of flood risk and consideration of resilience to climate	▪ Requirements of NPS EN-5 delivered as part of requirements under NPS EN-1. No additional response required or included in ES.

change and does not therefore set out additional policy in respect of flood risk.	

12.2.14 It is considered that this Chapter fully addresses the relevant requirements of the NPSs as outlined above in **Table 12.1**.

12.2.15 Discussion on the below listed National, Regional and Local policy specific to this Chapter is located in **Appendix A.3**.

- Revised National Planning Policy Framework (2018);
- Planning Practice Guidance (online resource); and
- National Planning Policy for Waste (2014).

Regional Planning Policy and Strategies

- The London Plan (2016);
- The London Plan – Sustainable Design and Construction Supplementary Planning Guidance (SPG) (2014);
- Thames Estuary 2100 Plan (2012);
- London's Wasted Resource, The Mayor's Municipal Waste Management Strategy (2011);
- Managing Risks and Increasing Resilience, The Mayor's Climate Change Adaptation Strategy (2011); and
- London Environment Strategy (2018).

Emerging Regional Planning Policy and Strategies

- Draft New London Plan showing Minor Suggested Changes (2018).

Local Planning Policy and Strategies

- London Borough of Bexley Core Strategy (2012);
- Bexley Growth Strategy (2017);
- Dartford Borough Council Core Strategy (2011);
- Dartford Borough Council Development Policies Plan (2017); and
- Kent Minerals and Waste Local Plan2013-2030 (2016).

Guidance and Standards

Sewers for Adoption 7th Edition

12.2.16 'Sewers for Adoption' is the standard in England and Wales for the design and construction of sewers to adoptable standards. It is a guide to assist developers in preparing their submission to a Sewerage Undertaker prior to entering an Adoption Agreement under Section 104 of the Water Industry Act 1991.

Non-statutory Technical Standards for Sustainable Drainage Systems

12.2.17 This document contains non-statutory technical standards for the design, maintenance and operation of sustainable drainage systems serving housing, non-residential or mixed use developments and was published by Defra in March 2015.

Rainfall Runoff Management for Developments (Report SC030219/R, October 2013)

12.2.18 This document advises regulators, developers and local authorities on the requirements for storm water drainage design for new developments and sets out recommended methods for the sizing of storage measures for the control and treatment of storm water runoff.

The SuDS Manual

12.2.19 The SuDS Manual (C753) expands upon the framework set out by the Government's Non-Statutory Technical Standards for SuDS and sets out the latest industry practice and guidance regarding the planning, design, construction, management and maintenance of SuDS.

Flood Risk Assessments: climate change allowances

12.2.20 This guidance was published by the EA in February 2016 and should be used as the basis for preparing FRAs. The guidance sets out the climate change allowances for peak river flow, peak rainfall intensity, sea level rise, off-shore wind speeds and extreme wave height.

12.2.21 Allowances in respect of peak river flow vary according to River Basin District, flood zone and proposed land-use (and therefore the lifetime of the development). The Application Site lies within the Thames River Basin District.

PINS Advice Note 18 – Water Framework Directive

12.2.22 The purpose of this Advice Note is to alert Applicants to the requirements of the WFD and WFD Regulations 2017, as applicable to NSIPs under the PA2008. This Advice Note explains the information that the Inspectorate considers an Applicant must provide with their application in order to clearly demonstrate that the WFD and the WFD Regulations 2017 have been appropriately considered.

12.3 Consultation

12.3.1 The following stakeholders have been consulted to acquire local/site-specific information on hydrology, flood risk and water resources, to assist with characterising the baseline water environment and to agree the methodology for the technical assessments/analysis required to inform the Environmental Impact Assessment (EIA) process:

- EA;
- London Borough of Bexley (LBB) (as LLFA); and
- Dartford Borough Council (DBC).

12.3.2 The Applicant and PBA met with representatives from the EA in February 2018 to introduce REP, identify the principal issues requiring consideration/assessment from a hydrology, flood risk and water resources perspective and to define the broad scope of work to be undertaken in support of the EIA process.

Table 12.2: Summary of Key Consultation Responses in Relation to Hydrology, Flood Risk and Water Resources

Reference	Comment	Response
Secretary of State Scoping Opinion		
Section 4.9 – ID 1	The Inspectorate agrees that given the location and operational nature of the electrical connection, significant effects during operation are unlikely and this can be scoped out of the ES.	Noted. The EIA has been prepared accordingly.
Section 4.9 – ID 2	The Inspectorate requires that the source and quantity of all water required for the Proposed Development is identified within the ES. Similarly, the location of discharge points and the quantity and composition of the discharge must be detailed.	See response to 4.9 ID 3 below. It is anticipated that REP would require up to 36 m^3 of water per day during peak operations (approximately 4 weeks per year), however under normal operating conditions it is anticipated REP would require up to 16 m^3 per day based on the Applicant's own source data. Industrial process effluent will be collected in a sedimentation tank and re-used within the

Reference	Comment	Response
		facility (as opposed to being discharged to watercourses or sewers off-site). The majority of daily water demand will therefore be met by recycling process effluent. Sediment accumulating within the sedimentation tank will be removed by tanker. Provisions for the treatment and disposal of foul effluent arising from welfare facilities are detailed in the FRA (**Document Reference 5.2**)
Section 4.9 – ID 3	A draft version of the surface water strategy should be provided with the ES.	Details regarding proposals for surface water management are set out in the FRA (**Document Reference 5.2**).
Section 4.9 – ID 4	The Applicant should consider the flood risk implications of the construction of the electrical connection within the ES.	The nature of flood risk impacts associated with the Electrical Connection are addressed within the FRA (**Document Reference 5.2)**.
Section 4.9 – ID 5	Impacts of climate change upon flood levels and surface water run-off should be considered. This should include the anticipated UKCP18 projections where appropriate.	The potential impacts of climate change are addressed within the FRA in accordance with guidance provided by the EA and LLFA. The UKCP18 projections are (at the time of writing) not available, however would be reviewed when available.
Section 4.9 – ID 6	The ES should include appropriate cross-referencing between the Ground Conditions and Hydrology, Flood Risk and Water Resources chapters.	Noted. Cross-referencing is made as appropriate in respect of flood risk and water quality matters.
Section 4.9 – ID 7	The ES should assess the potential impacts of the Proposed Development on the existing flood defences, in particular any effects resulting from changes to	As a result of design evolution, temporary works within the marine environment are no longer required. Consideration of potential effects upon the marine environment has

Reference	Comment	Response
	the hydrodynamic and sedimentary regime from the temporary marine infrastructure.	therefore been scoped out of this EIA (as agreed with the PINs). The Proposed Development will not affect the existing flood defences. A flood defence condition survey has been completed which is summarised in **Document Reference 5.2**.
Section 4.9 – ID 8	The study area should be described and justified within the ES.	The study area is identified and justified in Section 12.5.
Section 4.9 – ID 9	The assessment should take into account emissions to air from the Proposed Development and the potential implications of deposition on the quality of watercourses.	The Applicant has consulted the EA, who noted that emissions to air would be regulated in accordance with the Environmental Permitting Regulations. It has therefore been agreed that the impact of emissions upon water quality does not need to be assessed as part of this EIA as the limits set by the Environmental Permit would result in negligible concentrations of pollutants depositing to ground level.
Environment Agency		
Flood Risk	Any new development at this location is to have finished floor levels set no lower than the breach flood event at this site.	Noted. Design of the infrastructure has been prepared on this basis and details regarding breach flood levels and finished floor levels (FFL) are set out in the FRA (**Document Reference 5.2**).
Thames Tidal Flood Defences	The condition grade of the flood defence is currently 'fair' with some sections 'poor', as such a flood defence condition survey will be necessary to identify remedial works required to improve the	Noted. A flood defence condition survey has been undertaken with details incorporated within the FRA.

Reference	Comment	Response
	condition of the flood defence.	
Thames Tidal Flood Defences	Development should be set back from the defences to allow for maintenance, emergency access and to allow for the defences to be raised in the future.	Noted. Design of the Proposed Development has been prepared on this basis.
Thames Tidal Flood Defences	It will need to be demonstrated that the flood defence can be raised in line with the Thames Estuary 2100 Plan levels.	Noted. Details are set out in the FRA (**Document Reference 5.2**).
Thames Tidal Flood Defences	Due to the level of flood risk that the site faces and the proximity to the tidal flood defence, flood risk should be scoped into the EIA.	Noted. A FRA has been prepared (**Document Reference 5.2**).
Water Quality and the Water Framework Directive	The EA agreed that the 'Clearing the Waters for All' methodology should be used for the purposes of WFD Assessment.	Noted. The WFD compliance Statement has been prepared accordingly (**Document Reference 5.2**).
Water Quality and the Water Framework Directive	The EA agreed that scoping out shellfish and bathing waters from water quality assessment is appropriate.	Noted. The EIA has been prepared accordingly.
Letter dated 11th April 2018	No development should be located over the defences with all new development including temporary structures being set back from the defences.	Noted. Design of the Proposed Development has been prepared on this basis (see **Figure 1.4**).
Letter dated 11th April 2018	A flood defence condition survey would have to be undertaken and remedial works identified carried out to improve the flood defences.	Noted. A flood defence condition survey has been undertaken with details incorporated within the FRA (**Document Reference 5.2**).

Reference	Comment	Response
Letter dated 11th April 2018	We are satisfied that emissions impacts to water quality will not need to form part of the WFD assessment as the potential emissions should be regulated to an acceptable level under the EPR.	Noted. Consideration of the impact of pollutant drop out upon the water and sediment environments is therefore scoped out of the EIA.
Letter dated 27th April 2018	We note that the in-river works component of the development, including dredging has now been removed from the proposal. We therefore have no Water Framework Directive (WFD) water quality interests to consider as the airborne deposition levels will be regulated by air quality legislation.	Noted. The EIA has been prepared accordingly.
Letter dated 27th April 2018	Section 1.6 of the Flood Defence Condition Survey Specification report outlines the objectives of the flood defence condition survey; the objective should include ascertaining the required remedial works to ensure the flood defences are commensurate with the lifetime of the development rather than the probability of breaching and overtopping.	Noted. Details are incorporated within the FRA (**Document Reference 5.2**).
Letter dated 27th April 2018	We note that the condition survey does not confirm if the recommendations of the previous 2007 condition survey report were carried out.	Noted. The Flood Defence Condition Survey states that it was unclear whether the recommendations of the previous report were completed. Recommended remedial measures based upon the 2018 survey are provided in Appendix E of the

Reference	Comment	Response
		FRA (**Document Reference 5.2**.)
Letter dated 27th April 2018	We are support the plan for the finished floor levels in regard to them being set well above the current breach model.	Noted. The EIA has been prepared accordingly.
Letter dated 27th April 2018	We note and agree with the proposal to dismiss the use of SUDs for surface water disposal due to the high water table and potential risk of groundwater contamination.	Noted. The EIA has been prepared accordingly.
Letter dated 27th April 2018	The document makes clear that there will be no discharges from the site of any potentially contaminated water/effluent. We accept these proposals, but would like to see and review confirmed details in due course.	Noted. The Drainage Design Strategy clarifies this point and outlines a SuDS management strategy which would be implemented (subject to appropriate constraints of the site).
Letter dated 21st August 2018	We have reviewed the revised Floor Level Strategy and support the approach to set most of the floor level of the new developed area above the modelled breach level.	Noted.
Letter dated 21st August 2018	We confirm that we accept the landward extent of the tie bar and anchorage plate arrangement being identified as the landward extent of the flood defences. We would recommend that the results of the survey are submitted to us for review once completed so that we can comment on the	Noted. The River Wall Condition Survey is provided as an appendix to the FRA (**Document Reference 5.2**).

Reference	Comment	Response
	conclusions and recommendations	
Kent County Council		
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Notes that KCC should be consulted as Lead Local Flood Authority (for Dartford Borough)	As detailed within Section 7 of the FRA (**Document Reference 5.2**), it was not considered necessary to undertake further consultation with KCC because the nature of the proposed works at the Littlebrook substation, was not considered to have impacts upon the local surface water drainage regime within their administrative boundary.
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Consideration should be given to the Dartford Surface Water Management Plan, Stage 2 (November 2016)	Noted. The plan has been considered as part of the FRA (**Document Reference 5.2**).
Letter dated 21st December 2017, 7.10 Hydrology, Flood Risk and Water Resources	Reference should be made to the KCC Drainage and Planning Policy Statement (June 2017)	Noted. Considered as part of the FRA (**Document Reference 5.2**).
London Borough of Bexley		
Letter dated 21st December 2017	Recommended that the EIA deals with flood risk assessment and that a SuDS hierarchy is brought forward for surface water run-off.	A FRA has been prepared and forms an appendix (**Document Reference 5.2**) to the ES. Details regarding proposals for surface water management are set out in the FRA.
Section 42 Consultation Responses		

Reference	Comment	Response
Kent County Council	The PEIR is comprehensive and covers issues relating to flood risk. […] KCC also recognises that the report states appropriate measures are proposed to manage surface water during the construction stage. KCC supports the proposal to monitor and manage ground and surface water quality to mitigate or prevent contamination of water.	Noted. The Drainage Design Strategy and outline Code of Construction Practice (CoCP) **(Document Reference 7.5)** have been prepared accordingly.
London Borough of Bexley	The following issues should also be covered in the final assessments (i). the developments demand for Sewage Treatment and network infrastructure both on and off site and can it be met; (ii). The surface water drainage requirements and flood risk of the development both on and off site and can it be met; (iii). The development's demand for water supply and network infrastructure both on and off site and can it be met; (iv). Build-out/phasing details to ensure infrastructure can be delivered ahead of occupation; & (v). any piling methodology and will it adversely affect neighbouring utility services.	Noted. The FRA, Drainage Design Strategy and outline CoCP **(Document Reference 7.5)** have been prepared accordingly: (i). **Document Reference 5.2**, FRA Appendix G, paragraphs 9.6-9.7. (ii). **Document Reference 5.2.** Section 7 and FRA Appendix G paragraphs 9.2-9.5. (iii). REP would be connected to the local water main network. (iv). Section 3 of the outline CoCP (v). Section 3 of the outline CoCP
Port of London Authority	The PLA considers that as part of the CoCP, consideration must be given to any measures required to prevent	Noted. The outline CoCP **(Document Reference 7.5)** has been prepared accordingly.

Reference	Comment	Response
	materials entering the Thames during the construction phase of the development.	
Environment Agency	No mention is made within the PEIR as to the requirements for a FRAP from the Environment Agency. It has previously been indicated that the applicant may seek to disapply the need for a FRAP through the DCO process.	Noted. The need for a Flood Risk Activity Permit (FRAP) is disapplied through the DCO process, and the EA has now been engaged with regards to the Protective Provisions.
Environment Agency	The PEIR acknowledges the poor condition of some of the flood defences and commits to undertake a condition survey and demonstrating that the defences can be raised in line with the Thames Estuary 2100 Plan.	The flood defence condition survey has been completed, and is summarised and provided as Appendix E to the FRA (**Document Reference 5.2**).
Environment Agency	The new cable should pass under the watercourse deep enough to avoid the risk of damage. There are earth flood defences at the River Darent and the integrity of the embankments must not be compromised by the cable installation.	Noted. The ES has been prepared accordingly, see the outline CoCP (**Document Reference 7.5**).
Environment Agency	We will expect to see full Water Framework Directive (WFD) compliance assessments for all marine works that would ordinarily require marine licences.	Marine works are not proposed, therefore marine licences are not required.
Canal and River Trust	The Trust has reviewed your proposals, and on the basis that they appear unlikely to have any impact at all on our waterway we have no comment to make at this time.	Noted.

12.4 Reasonable Worst Case Parameters Used for Assessment

12.4.1 The potential construction, operation, maintenance and decommissioning effects of the Proposed Development have been considered on a reasonable worst-case basis.

12.4.2 In respect of hydrology, flood risk and water resources, the reasonable worst-case scenario for the Proposed Development relates to that associated with the maximum parameters of the Main REP Building envelope (see **Figure 1.4**). The reason this represents the reasonable worst-case assessment scenario for hydrology, flood risk and water resources is that the largest building footprint will result in the greatest impermeable area and therefore the greatest impacts upon the surface water drainage regime.

12.5 Assessment Methodology and Significance Criteria

Study Area

12.5.1 The study area has been defined to reflect the nature and extent of activities associated with the construction, operation and decommissioning of the Proposed Development. It extends to include the reaches of watercourse and surface water drainage infrastructure shown in **Figure 12.1**, as (in the professional opinion of the assessor) these have the potential for significant interaction with the Proposed Development. The study area has also been defined following consultation with the EA and LLFAs.

Baseline Data Collection

12.5.2 Existing studies/documents, including evidence base studies undertaken in support of the preparation of the LBB Core Strategy, the emerging LBB Local Plan and the DBC Core Strategy (e.g. Strategic Flood Risk Assessment and Preliminary Flood Risk Assessment), have been reviewed. In addition, the following sources of information have been used to assist with characterising the baseline water environment:

- https://flood-map-for-planning.service.gov.uk/;
- https://flood-warning-information.service.gov.uk/long-term-flood-risk/;
- http://maps.environment-agency.gov.uk/wiyby;
- http://www.natureonthemap.naturalengland.org.uk/MagicMap.aspx; and
- http://environment.data.gov.uk/catchment-planning.

12.5.3 As set out in Section 12.3 above, the EA, LBB and KCC have been consulted to acquire local/site-specific information on hydrology, flood risk and water resources, to assist with characterising the baseline water environment and to

agree the methodology for the technical assessments/analysis required to inform the EIA process. The EA provided 'Product 4' flood risk data (dated June 2018), which includes flood zone maps, historic flood outlines and details regarding the location/alignment of flood defences.

12.5.4 A walkover survey has been undertaken (May 2018) to facilitate an understanding of the baseline water environment and the general landform of the REP site and surrounding area and to define the scope/specifications of technical assessments/surveys. This survey included the Electrical Connection route options.

12.5.5 A topographic survey was completed in February 2018 and this data confirms the crest level of tidal flood defences and the general landform of the REP site and surrounding area.

Assessment

12.5.6 In the absence of 'industry standard' significance criteria for the consideration of hydrology, flood risk and water resources impacts, a qualitative approach, based upon available knowledge, experience and professional judgement, is employed.

12.5.7 The EIA assessment methodology identifies the significance of an effect by firstly considering the sensitivity of the receptor (i.e. its importance and ability to tolerate and recover from change) and, secondly, by considering the likely magnitude of the impact (i.e. its spatial extent and duration). By combining sensitivity and magnitude, the significance of the effect is established. Where significant negative effects are identified, mitigation measures are proposed to reduce the significance.

12.5.8 **Table 12.3** outlines the criteria used to determine receptor sensitivity, which as discussed in paragraph 12.5.6 is based on available knowledge and professional judgement.

Table 12.3: Sensitivity/Value of Receptor

Sensitivity/Value of Receptor	Description	Example
High	Attribute with a high quality and rarity, local scale and limited potential for substitution. Attribute with a medium quality and rarity, regional or national scale and	Examples include: Receiving watercourse classified as High or Good Ecological status/potential under WFD Site protected under EU or UK wildlife legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI)).

Sensitivity/Value of Receptor	Description	Example
	limited potential for substitution. Attribute highly sensitive to change.	Species protected under EU or UK wildlife legislation Site located within a Groundwater Source Protection Zone (SPZ) inner or outer protection zone (Zone 1), NPPF Flood Risk Vulnerability Classification “Essential Infrastructure” or “Highly Vulnerable” EA current groundwater quantitative and chemical qualities defined as Good Human receptors (construction workers and future residents)
Medium	Attribute with a medium quality and rarity, local scale and limited potential for substitution. Attribute reasonably tolerant of change.	Examples include: Floodplain providing a moderate volume of storage Receiving watercourse classified as Good or Moderate Ecological status/potential under WFD NPPF Flood Risk Vulnerability Classification “More Vulnerable”
Low	Attribute with a low quality and rarity, local scale and limited potential for substitution. Attribute tolerant of modest change.	Examples include: EA current river ecological quality defined as Poor / Bad and chemical quality defined as Fail Floodplain with limited existing development. Receiving watercourse classified as Poor Ecological status/potential under WFD NPPF Flood Risk Vulnerability Classification “Less Vulnerable”

Sensitivity/Value of Receptor	Description	Example
Negligible	Attribute of very limited quality and tolerant of substantial change.	Examples include: Floodplain essentially rural in nature, characterised by agricultural land use NPPF Flood Risk Vulnerability Classification "Water Compatible"

12.5.9 The magnitude of change arising as a result of the Proposed Development has been assessed using the criteria set out in **Table 12.4.**

Table 12.4: Magnitude of impact

Magnitude of Impact	Description	Example
Large	Results in a loss of attribute and/or quality and integrity of the attribute. Following development, the baseline situation is fundamentally changed.	Examples include: Change in ecological and/or chemical qualities of the surface water. Loss of flood storage/increased flood risk. Large change in: ▪ water quality of receiving watercourse; ▪ NPPF Flood Risk Vulnerability Classification; ▪ surface water flood risk; ▪ fluvial flood risk; ▪ water supply volume; and ▪ foul drainage volume.
Moderate	Results in impact on integrity of attribute, or loss of part of attribute. Following development, the baseline situation is	Examples include: Contribution of a significant proportion of the effluent in the receiving river, but insufficient to change its qualities. Moderate change in: ▪ water quality of receiving watercourse;

Magnitude of Impact	Description	Example
	noticeably changed.	▪ NPPF Flood Risk Vulnerability Classification; ▪ surface water flood risk; ▪ fluvial flood risk; ▪ water supply volume; and ▪ foul drainage volume.
Small	Results in some measurable change in attribute's quality or vulnerability. Following development, the baseline situation is largely unchanged with barely discernible differences.	Examples include: Measurable changes in attribute, but of limited extent/duration. Small change in: ▪ water quality of receiving watercourse; ▪ NPPF Flood Risk Vulnerability Classification; ▪ surface water flood risk; ▪ fluvial flood risk; ▪ water supply volume; and ▪ foul drainage volume.
Negligible	The impacts are unlikely to be detectable or outside the norms of natural variation.	

12.5.10 The significance of an effect is derived based upon the sensitivity of the receptor and the magnitude of the impact using the matrix presented at **Table 12.5**. The significance of an effect can be beneficial, neutral or adverse.

Table 12.5: Determining Significance of Effect

		Sensitivity of Receptor			
		High	**Medium**	**Low**	**Negligible**
Magnitude of Impact	**Large**	Substantial	Major	Moderate	Minor
	Moderate	Major	Moderate	Minor	Negligible
	Small	Moderate	Minor	Minor	Negligible
	Negligible	Minor	Negligible	Negligible	Negligible

12.5.11 For the purpose of undertaking the assessment in accordance with the Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 (the Infrastructure EIA Regulations 2017), effects determined to be moderate or greater are considered significant in EIA terms.

12.5.12 Examples of how the significance of effect (**Table 12.5**) are applied to hydrology, flood risk and water resources are set out below in **Table 12.6.**

Table 12.6: Examples of how significance of effect are applied to Hydrology, Flood Risk and Water Resources

Significance Level	Significance Level Criteria	Typical Examples
Substantial Beneficial	Substantial improvements at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water run-off from the Site. Fundamental improvement in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Major Beneficial	Major improvements at catchment scale	Fundamental changes to the regional hydrological regime. Fundamental reduction in volume and/or peak discharge of surface water run-off from the Site. Fundamental improvement in surface water quality.

Significance Level	Significance Level Criteria	Typical Examples
		Fundamental changes to flow conveyance and floodplain storage.
Moderate Beneficial	Improvements at local scale	Moderate changes to the local hydrological regime. Moderate reduction in volume and/or peak discharge of surface water run-off from the Site. Moderate improvement in surface water quality. Moderate changes to flow conveyance and floodplain storage.
Minor Beneficial	Limited improvements at local scale	Some noticeable changes to the local hydrological regime. Some noticeable reduction in volume and/or peak discharge of surface water run-off from the Site. Some noticeable improvement in surface water quality. Some noticeable changes to flow conveyance and floodplain storage.
Negligible	No appreciable impact	No noticeable changes to the local hydrological regime. No noticeable change in volume and/or peak discharge of surface water run-off from the Site. No noticeable changes in surface water quality. No noticeable changes to flow conveyance and floodplain storage.
Minor Adverse	Limited detrimental effects at local scale	Some noticeable changes to the local hydrological regime. Some noticeable increase in volume and/or peak discharge of surface water run-off from the Site. Some noticeable deterioration in surface water quality.

Significance Level	Significance Level Criteria	Typical Examples
		Some noticeable changes to flow conveyance and floodplain storage.
Moderate Adverse	Detrimental effects at local scale	Moderate changes to the local hydrological regime. Moderate increase in volume and/or peak discharge of surface water run-off from the Site. Moderate deterioration in surface water quality. Moderate changes to flow conveyance and floodplain storage
Major Adverse	Important detrimental effects at catchment scale which may become key factors in the decision-making process	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water run-off from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.
Substantial Adverse	Substantial detrimental effects at catchment scale associated with sites and features of national or regional importance	Fundamental changes to the regional hydrological regime. Pollution of potable sources of water abstraction. Fundamental increase in volume and/or peak discharge of surface water run-off from the Site. Fundamental deterioration in surface water quality. Fundamental changes to flow conveyance and floodplain storage.

12.6 Assumptions and Limitations

12.6.1 As noted above, the EA provided ‘Product 4’ flood risk data, including flood levels derived through hydraulic modelling analysis. Although the hydraulic

model has been calibrated using observed/recorded data, there is a degree of uncertainty associated with the flood levels. However, the modelling has been undertaken using industry-standard methods and the EA considers the data to be sufficiently robust to inform the FRA and EIA process.

12.7 Baseline Conditions and Receptors

12.7.1 This assessment is concerned with (i) the REP site which includes the site of permanent works in the area adjacent to Riverside Resource Recovery Facility (RRRF) north of Norman Road, (ii) the Temporary Construction Compound and (iii) the construction of the Electrical Connection.

12.7.2 The REP site is currently used predominantly as an ancillary area for RRRF. Uses include ash container storage, compounds for operational plant maintenance activities, a non-designated Wasteland Habitat Area, circulation roads and car-parking. The REP site therefore comprises both permeable and impermeable surfaces and surface water run-off generally infiltrates into the ground or is routed to the watercourses located to the south and west.

12.7.3 The principal watercourse in the area is the River Thames which is tidally influenced along the reach adjacent to the REP site. The REP site is located on the south bank of the River Thames and occupies a river frontage position, being set back approximately 20 m from the Thames Path and the tidal flood defences.

12.7.4 According to topographic survey undertaken by Maltby Surveys Limited in February 2018 (provided in the FRA (**Document Reference 5.2**), Appendix B), levels across the REP site generally vary between 1 m Above Ordnance Datum (AOD) along the southern boundary and 3 m AOD along the northern boundary adjacent to the toe of the flood defence embankment. The defence embankment rises to a level of approximately 6 m AOD and the Thames Path and River Thames tidal flood defence wall are located on the crest of the embankment.

12.7.5 The River Thames tidal defences comprise a wall of c. 1 m height and the crest level of the defence wall immediately to the north of the REP site is 7.05 m AOD, according to site-specific topographic data. According to detailed flood risk information (known as 'Product 4') provided by the EA to the Applicant by way of email in June 2018, the defences currently offer a 1 in 1,000 year standard of protection. A Flood Defence Condition Survey was completed in August 2018, during which the defences were assigned a condition grade of 'fair' to 'good'. Further details are provided in the FRA (**Document Reference 5.2**).

12.7.6 Crossness Sewage Treatment Works is located approximately 200 m to the west of the REP site and the area to the east of the REP site is characterised by warehousing and distribution. Crossness Nature Reserve, owned and managed by Thames Water, is located adjacent to both the REP site and the Main Temporary Construction Compound. The reserve extends across approximately 25 ha and forms part of the Erith Marshes Site of Metropolitan

Importance for Nature Conservation. The reserve is characterised by a number of surface water features, including the Great Breach Dyke, which is classified as a Main River (under the jurisdiction of the EA) and receives surface water run-off from the Abbey Wood area to the south. Water levels in the dyke system are controlled by the Great Breach Pumping Station which is located just beyond the south-western corner of the REP site. A further drain/ditch is located immediately to the east of Norman Road and receives surface water run-off from a relatively localised catchment to the east of the REP site comprising warehousing and distribution uses.

12.7.7 The Electrical Connection route extends to the south-east of the REP site along the A2016 (Bronze Age Way) and subsequently the A206. It crosses over the River Cray and the River Darent approximately 3 km and 2 km to the west of the connection point at the Littlebrook substation respectively.

12.7.8 The connection point at Littlebrook substation is located approximately 10.5 km to the south-east of the REP site within DBC. The existing substation is set back approximately 500 m from the tidal flood defences which, according to data provided by the EA in February 2018, comprise an embankment with a crest level of 6.74 m AOD. The principal surface water features in the vicinity of the Littlebrook substation are the water bodies, located approximately 300 m to the west of the substation.

Flood Map for Planning

12.7.9 The EA publishes online floodplain maps (https://flood-map-for-planning.service.gov.uk/). These maps show the possible extent of fluvial flooding for a 1 in 100 year flood (1% probability of occurrence) and the possible extent of tidal flooding associated with a 1 in 200 year event (0.5% probability of occurrence), ignoring the presence of flood defences. Also shown is the possible extent of flooding arising from a 1 in 1,000 year event (0.1% probability).

12.7.10 The flood map indicates that the REP site is located within Flood Zone 3 (High Probability – land having a 1 in 200 or greater annual probability of sea flooding). However, the flood map also indicates that the REP site falls within an area that benefits from flood defences. In this instance, the standard of protection afforded by the defences is 1 in 1,000 years.

12.7.11 The north-western (between the REP site and Erith) and south-eastern (between Barns Cray and Littlebrook substation) parts of the Electrical Connection Route, together with the Electrical Connection Point at Littlebrook substation, are also shown to lie within Flood Zone 3. The central part of the Electrical Connection Route lies within Flood Zone 1 (Low Probability – land having less than a 1 in 1,000 annual probability of river or sea flooding).

Surface Water Flood Risk

12.7.12 The EA online 'Flood Risk from Surface Water Map' (https://flood-warning-information.service.gov.uk/long-term-flood-risk) shows areas that may be susceptible to surface water flooding following an extreme rainfall event. The map highlights a number of corridors within and adjacent to the REP site, along the Electrical Connection route and at the Electrical Connection Point at Littlebrook substation at high, medium and low risk of surface water flooding. These areas generally coincide with watercourses/ditches/drains and topographical 'low' points across the terrain (i.e. areas where surface water would naturally accumulate following rainfall).

12.7.13 Flood risk associated with the surface water drainage system serving the Thamesmead, Abbeywood and Belvedere areas, and comprising piped drainage, ditches, drains and dykes, has been assessed as part of '*The Erith Marshes Ditches and Dykes Modelling Study*' (Phase 1, 2009 and Phase 2, 2010), undertaken on behalf of the London Borough of Bexley.

12.7.14 The study identified a number of locations where capacity constraints were likely to give rise to localised flooding, these generally being associated with the point at which the piped drainage network serving the urban area outfalls to the system of ditches and dykes. However, these locations are over 1 km to the south of the REP site, such that it is unaffected by such flooding mechanisms.

Reservoir Flood Risk

12.7.15 The EA provides maps showing the area that may be affected by flooding as a result of the breach of a large, raised reservoir (i.e. capable of storing over 25,000 m^3 of water above the natural level of any part of the surrounding land).

12.7.16 According to EA records the nearest reservoir is located approximately 4 km to the south of the REP site, in the Northumberland Heath area. The area shown at risk of flooding following a breach of the reservoir extends to the east, crossing the Electrical Connection route and passing through the Slade Green area.

Groundwater

12.7.17 A description of the anticipated geological sequence of the REP site is presented in the Phase 1 Ground Conditions Assessment (GCA) (**Appendix I.1**) and summarised here.

12.7.18 The published geology indicates the sequence to comprise Alluvium over River Terrace Deposits and London Clay with Made Ground also likely to be present.

12.7.19 The previous and recent (2018) ground investigations (GI) generally confirms the anticipated geology and indicates the presence of Made Ground up to 5.95 m thick in localised areas (typically <1 m thick). In the recent GI the Made Ground was generally described as a soft to firm black mottled dark brownish

grey slightly sandy slightly gravelly to cobbly clay where the gravel/cobbles typically comprised brick, concrete and flint. Less commonly the Made Ground contained glass, metal, wire, plastic, textiles, string, ash, ceramic pieces, asphalt, 'slag', cables and rubber ducting.

12.7.20 In relation to hydrogeology and groundwater vulnerability, the Alluvium is considered to be a Secondary Undifferentiated aquifer and the River Terrace Deposits are considered to be a Secondary A aquifer. The London Clay is considered to be Unproductive Strata.

12.7.21 The REP site is not located within any part of a Groundwater Source Protection Zone (SPZ).

12.7.22 The Phase 2 GCA (**Appendix I.2**) indicates that shallow groundwater is present within the Alluvium, typically within 1 m of the ground surface. In addition, groundwater was also encountered within the River Terrace Deposits as sub artesian and it is likely that the groundwater in this deposit is also tidally influenced. Further groundwater strikes were encountered in the Harwich Formation beneath the London Clay and this aquifer also indicated sub artesian conditions.

12.7.23 It is considered likely that there is vertical continuity between any groundwater in the Made Ground and in the underlying Alluvium, and that there is horizontal continuity between groundwater in the Made Ground, Alluvium and River Terrace Deposits, with the tidal River Thames.

Water Quality

12.7.24 A programme of groundwater and surface water quality monitoring has been undertaken and the findings/observations are documented in **Chapter 13**.

Water Framework Directive

12.7.25 The REP site falls within the area administered by the Thames River Basin Management Plan (RBMP) and the relevant management catchments are the Thames Transitional and Coastal (TraC) Management Catchment and Thames Groundwater Management Catchment.

12.7.26 The principal water bodies within the vicinity of the REP site are as follows:

- Thames Middle transitional water body (water body ID GB530603911402) within the Tidal Thames Operational Catchment;
- Greenwich Tertiaries and Chalk groundwater body (water body ID GB40602G602500);
- South Essex Thurrock Chalk groundwater body (water body ID GB40601G401100); and

- West Kent Darent and Cray Chalk groundwater body (water body ID GB40601G501800).

12.7.27 The Thames Middle water body is designated as a heavily modified water body (HMWB). This denotes that it has been substantially changed in character as a result of physical alterations by human activity, such that it cannot achieve good ecological status. The environmental objective for the water body is therefore to achieve good ecological potential. The overall water body classification is currently 'Moderate' potential (Cycle 2, 2016), with 'Moderate' ecological potential, and 'Fail' chemical potential. This is the most up to date information available at the time of issue.

12.7.28 The overall water body WFD objective was to achieve 'Moderate' potential by 2015, therefore it is currently achieving its overall objective under the WFD.

12.7.29 The Greenwich Tertiaries and Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Poor' status, driven by the poor status of both the Quantitative Status element (saline intrusion and water balance) and the Chemical Status element (saline intrusion). The WFD objective for this groundwater body was to achieve 'Poor' by 2015, therefore the Greenwich Tertiaries and Chalk groundwater body is currently achieving its objectives under the WFD.

12.7.30 The West Kent Darent and Cray Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Poor' status, driven by the Quantitative Status element (quantitative dependent surface water body status and quantitative water balance) and the Chemical Status element (chemical drinking water protected area and general chemical test elements). The WFD objective for this groundwater body is to achieve 'Poor' status by 2015, therefore the West Kent Darent and Cray Chalk groundwater body is currently achieving its objectives under the WFD.

12.7.31 The South Essex Thurrock Chalk groundwater body is currently (Cycle 2, 2016) classified as 'Good' status. The groundwater body is therefore currently achieving its objectives under the WFD.

12.7.32 The principal receptors that may be potentially affected by REP are:

- The River Thames;
- The River Thames tidal flood defences;
- The Great Breach Dyke and associated drains/tributaries;
- Thames groundwater bodies;
- Crossness Nature Reserve;
- Future employees/operational staff; and

- Existing development/infrastructure/third party assets/land in the vicinity and downstream of REP.

Baseline Evolution

12.7.33 The land-use balance across the REP site is unlikely to change in the absence of the Proposed Development and, on this basis, the hydrological regime is unlikely to change.

12.7.34 **Appendix A.4** provides a full list of schemes which have been identified as being likely to be completed prior to the construction of the Proposed Development. Where relevant, these schemes therefore form part of the 'future baseline' scenario and have been taken account of in the assessment of likely significant impacts from the Proposed Development (construction and operation) presented in Section 12.9.

12.7.35 The hydrological regime may change as a result of the predicted impacts of climate change, irrespective of any development. River flows, tide levels and rainfall intensities are predicted to increase as a result of climate change. Should such changes materialise, rates of surface water run-off, flood flows within watercourses and flood levels associated with a breach of tidal flood defences would increase. The assessment has been completed to take account of the future changes in hydrological regime through incorporating appropriate allowances for climate change.

12.7.36 As noted above, a programme of groundwater and surface water quality monitoring has been undertaken as part of the EIA process. The findings/observations provide the basis for consideration of the evolution of the baseline in the absence of the Proposed Development.

12.8 Embedded Mitigation

12.8.1 The design philosophy that underpins REP includes measures to prevent, reduce and offset significant adverse effects upon hydrology, flood risk and water resources. Being 'built-in' to the proposals from the outset, the assessment of the significance of effects includes consideration of these embedded mitigation measures.

12.8.2 The REP DCO is accompanied by an outline Code of Construction Practice (CoCP, **Document Reference 7.5)** the implementation of which is secured through a DCO requirement. Mitigation measures in respect of impacts on hydrology, flood risk and water resources during the construction phase would be secured through implementation of the measures set out in this document. Details of the mitigation are outlined below:

Construction phase

- Management system would be in place to adequately manage works within the floodplain;

- Best practice working methods to prevent both water pollution and adverse impacts upon the surface water drainage regime;
- Appropriate storage of oil and chemical tanks in accordance with Control of Substances Hazardous to Health (COSHH) Regulations 2002 and Control of Pollution (Oil Storage) Regulations 2001;
- Any surface water potentially contaminated by hydrocarbons would be passed through oil/grit interceptors prior to discharge;
- Precautions would be in place to prevent silt laden run-off, arisings or chemicals entering watercourses; and
- Where required, cables would be laid at a sufficient depth beneath watercourses to avoid causing damage to the integrity of embankments during installation.

Operation phase

- EA set limits on quality of water discharged from the REP site under the Environmental Permit;
- Surface Water Management infrastructure would be designed in accordance with CIRIA C753 and guidance set out by the LLFA, such that the surface water run-off regime replicates that existing prior to development;
- Implementation of SuDS (i.e. interceptors and silt traps); and
- Finished floor levels would be, as outlined in parameters set out in the FRA, an appropriate freeboard above the modelled breach flood level of the River Thames, with flood sensitive equipment further raised compared to floor levels.

12.8.3 In addition to the anticipated measures embedded within the design process, development activities and associated effects are also controlled through ensuring legislative compliance and applying industry standard/best practice as set out in the outline CoCP. **(Document Reference 7.5)** (i.e. ensuring that the proposals do not increase flood risk elsewhere, thereby complying with the requirements of the NPPF). Operational compliance with industry standards/best practice for mitigating flood risk would be inherently secured through the granting of the REP DCO based upon the FRA (**Document Reference 5.2**)

12.9 Assessment of Likely Effects

12.9.1 This Section describes the findings of the assessment of potential effects of REP upon hydrology, flood risk and water resources during the construction, decommissioning and operational phases.

The REP Site and Main Temporary Construction Compound

Construction/Decommissioning

12.9.2 Development works, including earthworks operations, have the potential to impact upon the surface water drainage regime which, in turn, may impact upon sensitive locations in the vicinity of the REP site and the Main Temporary Construction Compound.

12.9.3 Construction activities at the REP site and the Main Temporary Construction Compounds would include the clearance of vegetation, topsoil stripping and stockpiling, establishment of compound areas, excavation and site levelling/re-profiling to create development platforms, preparation of site roads and construction of foundations (including piled foundations). Compaction of the ground caused by construction plant and an increase in the extent of impermeable surfaces associated with access roads and compound areas has the potential to impact upon the surface water drainage regime and increase surface water run-off from the REP site and the Main Temporary Construction Compound and potentially into nearby watercourses. However, such effects would be localised and temporary and controlled using measures set out within the outline CoCP **(Document Reference 7.5)**. Amongst other measures, the outline CoCP includes the provision of temporary measures to intercept and control surface water run-off from worked areas. The surface water drainage regime is considered to be of **Medium** sensitivity. The magnitude of impact is anticipated to be **Negligible** with regards to the REP site and the Main Temporary Construction Compound following implementation of the CoCP, and therefore of **Negligible** significance. The potential effects of construction activities on the surface water drainage regime are therefore **Not Significant**.

12.9.4 Construction activities also have the potential to give rise to the contamination of surface water and groundwater resulting from spilled hydrocarbons/petrochemicals from construction plant and the mobilisation of silts and contaminants during soil stripping and earthworks operations, potentially leading to increased silt loading in nearby watercourses. However, such effects would be localised and temporary and controlled using measures set out within the outline CoCP **(Document Reference 7.5)**. Amongst other measures, the outline CoCP **(Document Reference 7.5)** includes the installation of construction site drainage to intercept and control run-off from worked areas, siting stockpiles away from watercourses, and refuelling on areas of hardstanding only away from watercourses and surface water drains. Receiving watercourses and water bodies are considered to be of **Medium** sensitivity. The magnitude of impact is anticipated to be **Negligible** with regards to the REP site and the Main Temporary Construction Compound following implementation of the CoCP, and therefore of **Negligible** significance. The potential effects of construction activities on water quality and WFD are therefore **Not Significant**.

12.9.5 Construction works in close proximity to the River Thames tidal flood defences have the potential to affect the stability of the embankment and therefore the

structural integrity of the defences. The implementation of embedded mitigation measures including those within the outline CoCP **(Document Reference 7.5)**, those outlined in Section 12.8, and other measures which may be required by conditions imposed by the relevant authority upon approvals under the protective provisions for works in close proximity to flood defences would control the potential impacts of construction works. The flood defences are noted to be a combination of fair and good condition (see Section 12.7 and **Document Reference 5.2**) and are considered to be of **Medium** sensitivity. The magnitude of impact is anticipated to be **Negligible** with regards to the REP site and the Main Temporary Construction Compound following implementation of the CoCP, and therefore of **Negligible** significance. The potential effects of construction activities on flood defences are therefore **Not Significant**.

12.9.6 At the end of its operational life, the decommissioning of REP is considered to have similar effects upon the environment as those during the construction stage and, therefore, similar measures to reduce effects are likely to be proposed. The potential effects of the decommissioning phase in respect of hydrology, flood risk and water resources are therefore anticipated to be **Not Significant**.

Operation/Maintenance

12.9.7 REP would give rise to an increase in the impermeable area within the catchment of the Great Breach Dyke which, in the absence of mitigation, has the potential to increase surface water run-off to the dyke and associated drains/tributaries. This has the potential to increase flood risk to existing development/infrastructure/third party assets/land in the vicinity and downstream of the REP site. However, such effects would be controlled by the embedded mitigation measures outlined above, specifically, a drainage design strategy that limits surface water outflows from the REP site to existing greenfield rates, thereby replicating the existing/prior to development surface water run-off regime. Details of the surface water management strategy are set out in the FRA (**Document Reference 5.2**). The surface water drainage regime is considered to be of **Medium** sensitivity. The magnitude of impact is anticipated to be **Negligible** with regards to REP on account of embedded mitigation measures, and therefore of **Negligible** significance. The potential effects of operation on the surface water drainage regime are therefore **Not Significant**.

12.9.8 There is the potential for the contamination of surface water entering the Great Breach Dyke and associated drains/tributaries, resulting from the flushing of silts and hydrocarbons from areas of hardstanding within the REP site. Such effects would be controlled by the embedded mitigation measures outlined above in Section 12.8. The receptors are considered to be of **Medium** sensitivity and the magnitude of impact is anticipated to be **Negligible** with regards to REP on account of embedded mitigation measures, and therefore of **Negligible** significance. The potential effects of operation on water quality and WFD are therefore **Not Significant**.

The Electrical Connection and the Cable Route Temporary Construction Compounds

Construction/Decommissioning

12.9.9 REP would require a new Electrical Connection to export power to the electricity network. The Electrical Connection will be routed predominantly via the existing road network and will be predominantly underground. The exception would be at the connection point with REP itself, at the connection point to the electricity network and at discreet locations along the Electrical Connection route where it might be attached to existing bridges or supported in new cable bridges over smaller watercourses.

12.9.10 Construction activities associated with installation of the underground cable have the potential to impact upon the surface water drainage regime and water quality as a result of earthworks operations and excavation of the cable trench. The surface water drainage regime and watercourses and water bodies are noted to be **Medium** sensitivity receptors. The effects would be localised and temporary and controlled using measures set out within the outline CoCP **(Document Reference 7.5)**. As a result, the magnitude of impact upon the surface water drainage regime and water quality during construction of the underground Electrical Connection element would be **Negligible**, which therefore results in the potential effects of the construction phase having a **Negligible** significance which is **Not Significant**.

12.9.11 Construction activities associated with installation of the above ground elements would be within the existing Littlebrook substation and in discreet locations at cable bridges over watercourses, and have very minor potential to impact upon the surface water drainage regime and water quality of receiving watercourses and water bodies as a result of small scale and localised earthworks operations. These are noted to be **Medium** sensitivity receptors. Such effects would be localised and temporary and controlled using measures set out within the outline CoCP **(Document Reference 7.5)**. As a result, the magnitude of impact upon the surface water drainage regime and water quality during construction of the above ground Electrical Connection element would be **Negligible**, which therefore results in the potential effects of the construction phase having a **Negligible** significance which is **Not Significant**.

12.9.12 At the end of its operational life, it is anticipated that the ducting for the Electrical Connection would be left in situ, such that there would be no decommissioning works and therefore no potential effects upon hydrology, flood risk and water resources.

Operation/Maintenance

12.9.13 As noted above, the Electrical Connection comprises a cable. During the operational phase, it would not therefore give rise to impacts upon hydrology, flood risk and water resources. As confirmed in the Scoping Opinion (see

Appendix A.1) dated January 2018, consideration of operational impacts associated with the Electrical Connection is scoped out of the assessment.

Summary of Assessment

Construction/Decommissioning

12.9.14 Based upon this assessment of the potential effects of construction and decommissioning activities at the REP site and Main Temporary Construction Compounds and the Electrical Connection and Cable Route Temporary Construction Compounds upon hydrology, flood risk and water resources, it is concluded that effects are likely to be localised and temporary and controlled by embedded mitigation measures. On this basis, the effects would be **Negligible** and therefore **Not Significant**.

Operation/Maintenance

12.9.15 As noted above, the Electrical Connection comprises a trefoil of cables which would not require water, nor be sensitive to flood risk. During the operational phase, it would not therefore give rise to impacts upon hydrology, flood risk and water resources.

12.9.16 Based upon this assessment of the potential effects of REP upon hydrology, flood risk and water resources during the operational phase, it is concluded that effects are likely to be controlled by embedded mitigation measures. On this basis, the effects would be **Negligible** and therefore **Not Significant**.

12.10 Cumulative Assessment

12.10.1 As identified in **Chapter 4**, and **Appendix A.4**, the zone of influence (ZOI) for consideration of cumulative effects for this topic is set to 2 km from the Application Site. This is considered appropriate as beyond this, based on professional opinion and due to connectivity of watercourses, it is not considered that the potential for likely significant cumulative effects would exist.

12.10.2 The threshold applied as detailed within **Chapter 4** excludes schemes that are smaller than 1 hectare (ha), or schemes falling within Flood Zone 1 'Low Probability'. 'Other Development' with a footprint larger than 1 ha has the potential to impact the local flood regime and thus would be considered cumulatively with REP. Additionally, only schemes located within an area at risk of flooding (i.e. Flood Zone 2 'Medium Probability', or Flood Zone 3 'High Probability') are considered to have the likelihood for significant cumulative effects upon hydrology, flood risk and water resources.

12.10.3 REP has been designed to be CHP enabled, meaning that there is the ability to supply waste heat generated from the combustion process to a local heat off-taker. It is acknowledged that any future supply of waste heat (e.g. to a district heat network scheme for a local residential area) could result in impacts to the local environment. However, given the nature of any such scheme (likely to

consist mainly of a network of buried pipes) any impacts would be limited to the temporary construction phase which is unlikely to overlap with construction of REP. Given that the network would most likely serve the local Thamesmead/Peabody area, impacts would likely be restricted to existing brownfield, urbanised land (e.g. burying pipes in roads). Such temporary impacts would be subject to a separate planning application which is anticipated to be bound by a CoCP or similar best practice working methods. It is therefore considered highly unlikely that there would be any likelihood of significant cumulative effects.

Construction/Decommissioning

12.10.4 Construction and decommissioning of REP could occur simultaneously with 'Other Developments' located in the vicinity of the Application Site. The 'Other Developments' with the most potential for simultaneous construction effects are identified in **Chapter 4**. For the purpose of assessment, it is assumed that all developments identified in **Chapter 4** will be under construction during the same time period as the REP construction phase. This includes committed sites (submitted and approved) and allocated sites (Development Plan Policy allocations) within the ZOI and over the threshold criteria; a total of 56 sites.

12.10.5 All 'Other Developments' under construction alongside REP would be subject to compliance with local and national policy, including NPS EN-1 (**Table 12.1**), the revised NPPF, PPG, London Plan, draft London Plan, LBB Core Strategy (**Appendix A.3**), and the WFD (Section 12.2). Under these policies and legislations, the schemes are required to demonstrate (amongst other matters) nil detriment in terms of water quality and WFD status/potential and no increased flood risk to the site or elsewhere. Without demonstrating compliance with these stringent requirements, planning permission will not be granted, and construction cannot commence.

12.10.6 The 'Other Developments' are therefore likely to be subject to embedded mitigation and additional mitigation, where applicable, as required by the specifics of the proposed schemes. This would result in the residual effects of the construction phases being classified as Not Significant or Beneficial. When combined with the Not Significant residual effects of REP construction phase, the cumulative effects of REP and 'Other Development' is likely to be Not Significant or Beneficial, depending on the extent of mitigation measures implemented to 'Other Developments'.

12.10.7 Notwithstanding the above, 'Other Developments' which have been granted planning permission which pose a potential risk to a watercourse or floodplain will also be subject to obtaining the relevant permits and consents prior to commencement of construction (Flood Risk Activity Permits, Land Drainage Consent etc.). Sufficient evidence and information will be required by the appropriate authority to demonstrate that the proposed works incorporate sufficient mitigation measures so that the scheme will not cause detriment to the water quality and WFD status/potential of nearby watercourses, and will not

increase flood risk to the site or the surrounding area as a result of construction activities.

12.10.8 It is therefore highly unlikely that there would be any likelihood of significant adverse cumulative effects during REP construction phase.

12.10.9 It is assumed for the purposes of this assessment that REP's generating equipment would be removed once the plant had ceased operations permanently. Any decommissioning phase is assumed to be of a similar or shorter duration to construction, and therefore environmental effects are considered to be of a similar level to those during the construction phase. It is assumed that the ducting for the Electrical Connection would remain in situ, but that the cables may be removed.

Operation/Maintenance

12.10.10 The operation of REP could occur simultaneously with other projects located in the vicinity of the Application Site. The 'Other Developments' with the most potential for simultaneous operational effects are identified in **Chapter 4**. For the purpose of assessment, it is assumed that all sites identified in **Chapter 4** will be in operation at the same time as REP's operational phase. This includes committed sites (submitted and approved) and allocated sites (Development Plan Policy allocations) within the ZOI and over the threshold criteria; a total of 56 sites.

12.10.11 All 'Other Developments' in operation simultaneously with REP would be subject to compliance with local and national policy, including NPS EN-1 (**Table 12.1**), the revised NPPF, PPG, London Plan, draft London Plan, LBB Core Strategy (**Appendix A.3**), and the WFD (Section 12.2). Under these policies and legislations, the schemes are required to demonstrate (amongst other matters) nil detriment in terms of water quality and WFD status/potential and no increased flood risk to the site or elsewhere. Without demonstrating compliance with these stringent requirements, planning permission for 'other development' will not be granted, and the schemes will not reach operational phase.

12.10.12 The 'Other Developments' are therefore likely to be subject to embedded mitigation and additional mitigation, where applicable, as required by the specifics of the proposed schemes. This would result in residual effects of the operational phases being classified as **Not Significant** or Beneficial. When combined with the Not Significant residual effects of REP operational phase, the cumulative effects of REP and 'Other Development' is likely to be Not Significant or Beneficial, depending on the extent of mitigation measures implemented to 'Other Developments'.

12.10.13 It is therefore highly unlikely that there would be any likelihood of significant adverse cumulative effects during REP operation.

12.11 Further Mitigation and Enhancement

Construction/Decommissioning

12.11.1 With the implementation of embedded mitigation measures and identified mitigation measures delivered through the outline CoCP **(Document Reference 7.5)** as set out above, the effects associated with construction and decommissioning of REP are **Negligible** and therefore **Not Significant**. On this basis, there is no requirement for additional mitigation measures over and above those already identified.

Operation/Maintenance

12.11.2 With the implementation of embedded mitigation measures as set out above, the effects associated with operation of REP are **Negligible** and therefore **Not Significant**. On this basis, there is no requirement for additional mitigation measures over and above those identified above.

12.12 Residual Effects and Monitoring

Construction/Decommissioning

12.12.1 With the implementation of embedded mitigation measures and identified mitigation measures delivered through the CoCP as set out above, the residual effects associated with construction and decommissioning of REP are **Not Significant**. On this basis, there is no requirement for monitoring in respect of hydrology, flood risk and water resources.

Operation/Maintenance

12.12.2 With the implementation of embedded mitigation measures as set out above, the residual effects associated with operation of REP are **Not Significant**. On this basis, there is no requirement for monitoring in respect of hydrology, flood risk and water resources.

Summary of Residual Effects

12.12.3 Residual effects are summarised in **Table 12.7** below:

Table 12.7: Residual Effects

	Receptor name and description	Potential mitigation	Assessment of Residual Effects
Proposed Development			

	Receptor name and description	Potential mitigation	Assessment of Residual Effects
Construction / decommissioning	The Great Breach Dyke and associated drains/tributaries – increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Construction / decommissioning	Thames groundwater bodies – water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Construction / decommissioning	Crossness Nature Reserve - increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Construction / decommissioning	The River Thames tidal flood defences – impact upon structural integrity	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Construction / decommissioning	Existing development/ infrastructure/ third party assets/ land in the vicinity and downstream – flood risk impacts	No specific mitigation is anticipated at this stage over and above the embedded	Residual effects are **Not Significant**

	Receptor name and description	Potential mitigation	Assessment of Residual Effects
		mitigation outlined	
Operation/maintenance	The Great Breach Dyke and associated drains/ tributaries – increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Operation/maintenance	Thames groundwater bodies – water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Operation/maintenance	Crossness Nature Reserve - increased surface water run-off and water quality impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**
Operation/maintenance	Existing development/ infrastructure/ third party assets/ and in the vicinity and downstream – flood risk impacts	No specific mitigation is anticipated at this stage over and above the embedded mitigation outlined	Residual effects are **Not Significant**

12.13 Summary and Conclusion

12.13.1 The baseline conditions at REP have been described and the principal receptors that may be affected by the Proposed Development identified.

12.13.2 Construction and decommissioning activities at the REP site and Main Temporary Construction Compound and the Electrical Connection and Cable Route Temporary Construction Compounds have the potential to impact upon the surface water drainage regime and both groundwater and surface water quality. However, the effects are likely to be localised, temporary and controlled by embedded mitigation measures, such that the residual effects would be **Negligible** and therefore **Not Significant**.

12.13.3 Similarly, the potential effects arising during the operational phase of REP would be controlled by embedded mitigation measures, such that the residual effects are likely to be **Negligible** and therefore **Not Significant**. The Electrical Connection would not give rise to impacts upon hydrology, flood risk and water resources during the operational phase.

12.13.4 Significant adverse cumulative effects are not anticipated on account of construction phase and operational phase mitigation measures being employed at REP and 'Other Developments' being constructed/operational simultaneously with REP.

12.14 References

Department of Energy and Climate Change, 2011, Overarching National Policy Statement for Energy (EN-1)

Department of Energy and Climate Change, 2011, National Policy Statement for Renewable Energy Infrastructure (EN-3)

Department of Energy and Climate Change, 2011, National Policy Statement for Electricity Networks Infrastructure (EN-5)

Ministry of Housing, Communities and Local Government, 2018, The National Planning Policy Framework

Ministry of Housing, Communities and Local Government, 2014, Planning Practice Guidance 'Flood Risk and Coastal Change'

Department for Communities and Local Government, 2014, National Planning Policy for Waste

The Flood Risk Regulations, 2009

The Flood and Water Management Act, 2010

Department for Communities and Local Government, 2014, House of Commons Written Statement HCWS161

Department for Environment, Food and Rural Affairs, 2017, The Water Environment (Water Framework Directive) (England and Wales) Regulations

Department for Environment, Food and Rural Affairs, 2016, The Environmental Permitting (England and Wales) Regulations

Water Resources Act, 1991

Land Drainage Act, 1991

Ministry of Housing, Communities and Local Government, 2010, The Building Regulations

WRc PLC, 2012, Sewers for Adoption 7th Edition

Department for Environment, Food and Rural Affairs, 2015, Non-statutory Technical Standards for Sustainable Drainage Systems

Department for Environment, Food and Rural Affairs, 2013, Rainfall runoff management for developments (Report SC030219)

Ciria, 2015, The SuDS Manual (C753)

Environment Agency, 2016, Flood Risk Assessments: Climate Change Allowances

Greater London Authority, 2016, The London Plan

Greater London Authority, 2014, Sustainable Design and Construction Supplementary Planning Guidance

Greater London Authority, 2011, London's Wasted Resource: The Mayor's Municipal Waste Management Strategy

Greater London Authority, 2011, Managing Risks and Increasing Resilience: The Mayor's Climate Change Adaptation Strategy

Greater London Authority, 2011, Delivering London's Energy Future: The Mayor's Climate Change Mitigation and Energy Strategy

Greater London Authority, 2011, Making Business Sense of Waste: The Mayor's Business Waste Strategy for London

Greater London Authority, 2015, London Riverside Opportunity Area Planning Framework

Greater London Authority, 2018, London Environment Strategy

London Borough of Bexley, 2012, London Borough of Bexley Core Strategy

London Borough of Bexley, 2009, Thamesmead and Abbey Wood Supplementary Planning Document

London Borough of Bexley, 2004, Unitary Development Plan (and 2012 Addendum)

London Borough of Bexley, 2015, Energy Masterplan

London Borough of Bexley, 2017, Bexley Growth Strategy

Dartford Borough Council, 2011, Dartford Borough Council Core Strategy

Dartford Borough Council, 2017, Dartford Development Policies Plan

Kent County Council, 2016, Kent Minerals and Waste Local Plan

Greater London Authority, August 2018, Draft New London Plan showing Minor Suggested Changes The London Plan – Draft for Public Consultation

Environment Agency, 2012, Thames Estuary 2100 Plan

London Borough of Bexley, 2009, The Erith Marshes Ditches and Dykes Modelling Study (Phase 1)

London Borough of Bexley, 2010, The Erith Marshes Ditches and Dykes Modelling Study (Phase 2)

Peter Brett Associates, 2018, Riverside Energy Park, Belvedere – Phase 1 Ground Condition Assessment