Thurrock Flexible Generation Plant

Preliminary Environmental Information Report
Chapter 15: Hydrology and Flood Risk

Date: September 2018

Environmental Impact Assessment

Preliminary Environmental Information Report

Volume 3

Chapter 15

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Summary

This chapter reports the assessment of potential impacts on hydrology and flood risk, both to and from the proposed development. Supporting information on hydrology and flood risk can be found in the chapter appendices.

Qualifications

This document has been prepared by Jonathan Morley, a Principal Consultant, who has 12 years’ experience of environmental impact assessment.

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1. Introduction

1.1 Purpose of this chapter

1.1.1 This chapter of the Preliminary Environmental Information Report (PEIR) presents the findings of Environmental Impact Assessment (EIA) work undertaken to date concerning potential impacts of Thurrock Flexible Generation Plant (hereafter referred to as the proposed development) on hydrology and flood risk.

1.1.2 The PEIR is being published to inform pre-application consultation. Following consultation, comments on the PEIR will be reviewed and taken into account in preparation of the Environmental Statement (ES) that will accompany the application to the Planning Inspectorate (PINS) for development consent.

1.1.3 Specifically, this chapter considers the potential hydrology and flood risk impacts of the proposed development during its construction, operation and maintenance, and decommissioning phases.

1.1.4 Potential impacts of the proposed development on geology and ground conditions (including groundwater abstractions) are assessed in Volume 3, Chapter 16: Geology, Hydrogeology and Ground Conditions, whilst potential impacts on ecology and nature conservation are assessed in Volume 3, Chapter 9: Ecology.

1.1.5 This chapter summarises information from technical reports and publicly available data which are included at Volume 6, Appendix 15.1: Flood Risk Assessment, Appendix 15.2 Flood Zones and model data, and Appendix 15.3: Surface Water Abstraction Licences, Discharge Consents and Pollution Incidents..

1.1.6 In particular this PEIR chapter:

- presents the existing environmental baseline established from desk studies, surveys and consultation to date;
- presents the potential environmental effects on hydrology and flood risk arising from Thurrock Flexible Generation Plant, based on the information gathered and the analysis and assessments undertaken to date;
- identifies any assumptions and limitations encountered in compiling the environmental information; and
- highlights any necessary monitoring and/or mitigation measures that could prevent, minimise, reduce or offset the possible environmental effects identified in the EIA process

1.2 Planning policy context

National Policy Statements

1.2.1 Planning policy on renewable energy Nationally Significant Infrastructure Projects (NSIPs), specifically in relation to hydrology and flood risk, is contained in the Overarching National Policy Statement (NPS) for Energy (EN-1) (Department of Energy and Climate Change (DECC), 2011a), the NPS for Renewable Energy Infrastructure EN-3 (DECC, 2011b) and the NPS for Electricity Networks Infrastructure EN-5 (DECC, 2011c).

1.2.2 Specifically, the guidance provided within NPS EN-1, NPS EN-3 and NPS EN-5 was considered. Paragraph 4.8.6 (NPS EN-1) specifically identifies that applicants should have regard to climate change and should assess the resilience of their project to climate change. Paragraph 2.4.1 of NPS EN-5 specifically identifies the potential issues applicants should consider in terms of resilience to climate change. These are summarised in Table 1.1

Table 1.1: Summary of NPS EN-1, EN-3 and EN-5 provisions relevant to hydrology and flood risk.

Summary of NPS EN-1, NPS EN-3 and NPS EN-5 policy relevant to the assessment of hydrology and flood risk	How and where considered in the Environmental Statement
Climate change adaption	
Applicants for new energy infrastructure must take into account the potential impacts of climate change using the latest UK Climate Projections available at the time the Environmental Statement was prepared to ensure they have identified appropriate mitigation or adaptation measures. This should cover the estimated lifetime of the new infrastructure. Should a new set of UK Climate Projections become available after the preparation of the Environmental Statement, the decision maker should consider whether they need to request further information from the applicant (paragraph 4.8.6 NPS, EN-1).	The characterisation of the flood risk baseline and future baseline has been established using the Environment Agency (EA) Flood Map for Planners and Strategic Flood Risk Assessments, which take into account climate change. A site specific flood risk assessment FRA has been undertaken for the Thurrock Flexible Generation Plant in line with the National Planning Policy Framework (NPPF), Planning Practice Guidance (PPG) ID7 – Flood Risk and Coastal Change and includes a climate change allowance based on findings EA Climate Change allowances (February 2016).
Offshore and onshore wind farms are less likely to be affected by flooding, but applicants should particularly set out how the proposal would be resilient to storms (paragraph 2.3.4, of NPS EN-3).	The resilience to flood risk is set out within this chapter, Table 2.6) and Volume 6, Appendix 15.1: FRA.
As climate change is likely to increase risks to the resilience of some electricity infrastructure from flooding, for example, in situations where it is located near the coast or is underground, applicants should in particular set out to what extent the proposed development is expected to be vulnerable, and as appropriate, how it would be resilient to flooding, particularly for substations that are vital for the	A Flood Risk Assessments (FRA) has been prepared for the proposed Thurrock Flexible Generation Plant. The FRA forms Volume 6, Appendix 15.1: FRA.

Summary of NPS EN-1, NPS EN-3 and NPS EN-5 policy relevant to the assessment of hydrology and flood risk	How and where considered in the Environmental Statement
electricity transmission and distribution network (paragraph 4.4.1, NPS EN-5).	
Flood risk	
Applications for energy projects of 1 ha or greater in Flood Zone 1 in England and all proposals for energy projects located on Flood Zone 2 and 3 in England should be accompanied by an FRA. An FRA will also be required where an energy project less than 1 ha may be subject to sources of flooding other than rivers and the sea (for example surface water), or where the EA, Drainage Board (DB) or other body have indicated that there may be drainage problems. The FRA should identify and assess the risks of all forms of flooding to and from the project and demonstrate how these flood risks will be managed, taking climate change into account (paragraph 5.7.4, of NPS EN-1).	An FRA has been prepared for the proposed Thurrock Flexible Generation Plant as the site exceeds 1 ha or is partially located within Flood Zone 2 and 3. The FRA is contained in Volume 6, Appendix 15.1: FRA.
The minimum requirements for FRAs provided by applicants are that they should: • Be proportionate to the risk and appropriate to the scale, nature and location of the project; • Consider the risk of flooding arising from the project in addition to the risk of flooding to the project; • Take the impacts of climate change into account, clearly stating the development lifetime over which the assessment has been made; • Be undertaken by competent people, as early as possible in the process of preparing the proposal; • Consider both the potential adverse and beneficial effects of flood risk management infrastructure, including raised defences, flow channels, flood storage areas and other artificial features, together with the consequences of their failure; • Consider the vulnerability of those using the site, including arrangements for safe access; • Consider and quantify the different types of flooding (whether from natural and human sources and including joint and cumulative effects) and identify flood risk reduction measures, so that assessments are fit for the purpose of the decisions being made; • Consider the effects of a range of flooding events including extreme events on people, property, the natural and historic environment and river and coastal processes; • Include the assessment of the remaining (known as 'residual') risk after risk reduction measures have been taken into account and demonstrate that this is acceptable for the particular project; • Consider how the ability of water to soak into the ground may change with development, along with how the proposed layout of the project may affect drainage systems; • Consider if there is a need to be safe and remain operational during a worst case flood event over the development's lifetime; and • Be supported by appropriate data and information, including historical information on previous events. (paragraph 5.7.5, NPS EN-1)	An FRA fulfilling the requirements stipulated within NPS EN-1 has been prepared. The FRA is contained in Volume 6, Appendix 15.1: FRA.
Further guidance can be found in Practice Guide which accompanies Planning Policy Statement 25 (PPS25) or successor documents (paragraph 5.7.6, NPS EN-1).	An FRA has been prepared taking into account the requirements of NPPF and PPG ID7 on flood risk. The FRA is contained in Volume 6, Appendix 15.1: FRA.
Applicants for the projects which may be affected by, or may add to, flood risk should arrange pre-application discussions with the EA and, where relevant other bodies such as DBs, sewerage undertakers, highways authority and reservoir owners and operators (paragraph 5.7.7, of NPS EN-1).	The EA and Essex CC (Lead Local Flood Authority (LLFA)) have been consulted as detailed in Table 1.4.
Consultation on the assessment methodologies should be undertaken at early stages with the EA (paragraph 5.7.8, of NPS EN-1).	The EA and the LLFA have been consulted as detailed in Table 1.4.
Water quality and resources	
The applicant should undertake an assessment of the existing status of, and impacts of the proposed project on water quality, water resources and physical modifications to the water environment (paragraph 5.15.2, of NPS EN-1).	The baseline environment is described for the Thurrock Flexible Generation Plant hydrology and flood risk study area. An assessment of the impacts on water quality, resources and physical characteristics is provided in paragraphs 2.9.1 to 2.9.53.
The Environmental Statement should in particular describe: The existing quality of waters affected by the proposed project and the impacts of the proposed project on water quality, noting any relevant existing discharges, proposed new discharges and proposed changes to discharges; • Existing water resources affected by the proposed project and the impacts of the proposed project on water resources, noting any relevant existing abstraction rates, proposed new abstraction rates and proposed changes to abstraction rates (including any impact on or use of mains supplies and reference to Catchment Abstraction Management Strategies); • • Existing physical characteristics of the water environment (including quantity and dynamics of flow) affected by the proposed project and any impact of physical modifications to these characteristics; and • • Any impacts of the proposed project on water bodies or protected areas under the Water Framework	Baseline water quality and resources for the Thurrock Flexible Generation Plant hydrology and flood risk study area are described in section 202.8. Watercourses in the Thurrock Flexible Generation Plant hydrology and flood risk study area have been identified and information on abstractions, discharges, pollution incidents and water quality has been obtained. The impacts on surface water courses are described in section 2.8. The impacts on SPZs are covered in Volume 3, Chapter 16: Geology, Hydrogeology and Ground Conditions. A review of the WFD classifications for watercourses within the Thurrock Flexible Generation Plant hydrology and flood risk study area has been undertaken (see Table 2.10).

Summary of NPS EN-1, NPS EN-3 and NPS EN-5 policy relevant to the assessment of hydrology and flood risk	How and where considered in the Environmental Statement
Directive (WFD) and Source Protection Zones (SPZs) around potable groundwater abstractions. (paragraph 5.15.3, NPS EN-1)	

1.2.3 NPS EN-1 and NPS EN-3 also highlight a number of points relating to the determination of an application and in relation to mitigation. These are summarised in Table 1.2.

Table 1.2: Summary of NPS EN-1 and NPS EN-3 policy on decision making relevant to this chapter.

Summary of NPS EN-1 policy on decision making (and mitigation) in relation to hydrology and flood risk	How and where considered in the Environmental Statement
Climate change adaption	
The decision maker should be satisfied that there are no features of the design of new energy infrastructure critical to its operation which may be seriously affected by more radical changes to the climate beyond that projected in the latest set of UK climate projections, taking account of the latest credible scientific evidence on, for example, sea level rise (for example by referring to additional maximum credible scenarios – i.e. from the Intergovernmental Panel on Climate Change or EA) and that necessary action can be taken to ensure the operation of the infrastructure over its estimated lifetime (paragraph 4.8.8, NPS EN-1).	Climate change has been taken into account in the characterisation of the baseline and future baseline environment. Climate change is also considered in the FRA (see Volume 6, Appendix 15.1: FRA).
Flood risk	
The decision maker should be satisfied that where relevant: the application is supported by an appropriate FRA; the Sequential Test has been applied as part of site selection; a sequential approach has been applied at the site level to minimise risk by directing the most vulnerable uses to areas of lowest flood risk; the proposal is in line with any relevant national and local flood risk management strategy; priority has been given to the use of Sustainable urban Drainage Systems (SuDS) (as required in the next paragraph on National Standards); and in flood risk areas the project is appropriately flood resilient and resistant, including safe access and escape routes where required, and that any residual risk can be safely managed over the lifetime of the development (paragraph 5.7.9, NPS EN-1).	An FRA has been prepared, (see Volume 6, Appendix 15.1: FRA) which consider the flood risks from the Thurrock Flexible Generation Plant. The FRA notes that the development is sequentially acceptable and been subject to an Alternative sites assessment (Volume 2, Chapter 3: Consideration of Alternatives). The FRA has been undertaken in line with NPS EN-1, NPPF and PPG ID7 - Flood Risk and Coastal Change. A high level drainage concept has also been prepared in line with SuDS, the key points of which are summarised in Volume 6, Appendix 15.1: FRA.
The decision maker will need to be satisfied that the proposed drainage system complies with any National Standards published by Ministers under Paragraph 5(1) of Schedule 3 to the Flood and Water Management Act 2010. In addition, the DCO, or any associated planning obligations, will need to make provision for the adoption and maintenance of any SuDS, including any necessary access rights to property. The decision maker should be satisfied that the most appropriate body is being given the responsibility for maintaining any SuDS, taking into account the nature and security of the infrastructure on the proposed site. The responsible body could include, for example, the applicant, the landowner, the relevant local authority, or another body, such as a DB (paragraph 5.7.10, NPS EN-1).	A high level drainage concept has been prepared and supports Volume 6, Appendix 15.1: FRA. The proposed drainage strategies have been developed in accordance with the NPS, NPPF, PPG ID7 and the SuDS Manual, whereby sufficient attenuation storage is provided for 1 in 100 year plus climate change worst case storm event. Drainage provisions will be set out in an agreement with the relevant LLFA.
The decision maker should not consent development in Flood Zone 2 in England unless it is satisfied that the Sequential Test requirements have been met. It should not consent development in Flood Zone 3 or Zone C unless it is satisfied that the Sequential and Exception Test requirements have been met. The technology-specific NPSs set out some exceptions to the application of the Sequential Test. However, when seeking development consent on a site allocated in a development plan through the application of the Sequential Test, informed by a strategic flood risk assessment, applicants need not apply the Sequential Test, but should apply the sequential approach to locating development within the site. (Paragraph 5.7.12, NPS EN-1).	The Thurrock Flexible Generation Plant has been subject to an Alternative sites assessment (Volume 2, Chapter 3: Consideration of Alternatives). Therefore, on this basis, the Sequential Test is considered to be passed. The approach to flood risk and the assessment are described in the FRA (see Volume 6, Appendix 15.1: FRA volume 6,) and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9).
Preference should be given to locating projects in Flood Zone 1 in England. If there is no reasonably available site in Flood Zone 1, then projects can be located in Flood Zone 2. If there is no reasonably available site in Flood Zones 1 or 2, then nationally significant energy infrastructure projects can be located in Flood Zone 3 subject to the Exception Test. Consideration of alternative sites should take account of the policy on alternatives (paragraph 5.7.13, NPS EN-1).	The approach to flood risk and the assessment are described in the FRA (see volume 6, appendix 15.1: FRA) and has been summarised in this chapter (see paragraphs 2.1.7 to 2.1.9). Alternative sites are discussed in Volume 2, Chapter 3: Consideration of Alternatives.
The decision maker will find an Exception Test to be only appropriate for use where the Sequential Test alone cannot deliver an acceptable site, taking into account the need for energy infrastructure to remain operational during floods. It may also be appropriate to use it where as a result of the alternative site(s) at lower risk of flooding being subject to national designations such as landscape, heritage and nature conservation designations, for example Areas of Outstanding Natural Beauty, Sites of Special Scientific Interest (SSSIs) and World Heritage Sites it would not be appropriate to require the development to be located on the alternative site(s) (paragraph 5.7.15, NPS EN-1).	The approach to flood risk and the assessment are described in the FRA (see Volume 6, Appendix 15.1: FRA) and has been summarised in this chapter (see paragraphs 2.1.7 to 2.1.9). Alternative sites are discussed in Volume 2, Chapter 3: Consideration of Alternatives.
If an Exception Test is required, the decision maker will have to be satisfied that all three elements of the test will have to be passed for development to be consented. For the Exception Test to be passed: • "It must be demonstrated that the project provides wider	An Exception Test is not required as the Sequential Test demonstrated that the Thurrock Flexible Generation Plant is considered acceptable as described in the FRA (see Volume 6, Appendix 15.1: FRA).

Summary of NPS EN-1 policy on decision making (and mitigation) in relation to hydrology and flood risk	How and where considered in the Environmental Statement
sustainability benefits to the community that outweigh flood risk; • The project should be on developable, previously developed land or, if it is not on previously developed land, that there are no reasonable alternative sites on developable, previously developed land subject to any exceptions set out in the technology-specific NPSs; and • An FRA must demonstrate that the project will be safe, without increasing flood risk elsewhere subject to the exception below and, where possible, will reduce flood risk overall". (paragraph 5.7.16, NP EN-1)	
To satisfactorily manage flood risk, arrangements are required to manage surface water and the impact of the natural water cycle on people and property. The term SuDS refers to the whole range of sustainable approaches to surface water drainage management including, where appropriate: • Source control measures including rainwater recycling and drainage; infiltration devices to allow water to soak into the ground, that can include: • Individual soakaways and communal facilities; • Filter strips and swales, which are vegetated features that hold and drain water downhill mimicking natural drainage patterns; • Filter drains and porous pavements to allow rainwater and runoff to infiltrate into permeable material below ground and provide storage if needed; • Basins ponds and tanks to hold excess water after rain and allow controlled discharge that avoids flooding; and • Flood routes to carry and direct excess water through developments to minimise the impact of severe rainfall flooding. Site layout and surface water drainage systems should cope with events that exceed the design capacity of the system, so that excess water can be safely stored on or conveyed from the site without adverse impacts. The surface water drainage arrangements for any project should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, unless specific off-site arrangements are made and result in the same net effect. It may be necessary to provide surface water storage and infiltration to limit and reduce both the peak rate of discharge from the site and the total volume discharged from the site. There may be circumstances where it is appropriate for infiltration facilities or attenuation storage to be provided outside the project site, if necessary through the use of a planning obligation (paragraph 5.7.18 to 5.7.22,	Drainage strategies have been developed in accordance with the NPS, NPPF, PPG ID7 and the SuDS Manual, whereby sufficient attenuation storage is provided for 1 in 100 year plus climate change worst case storm event The approach to flood risk is presented in Volume 6, Appendix 15.1: FRA and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9).

Summary of NPS EN-1 policy on decision making (and mitigation) in relation to hydrology and flood risk	How and where considered in the Environmental Statement
NPS EN-1).	
The sequential approach should be applied to the layout and design of the project. More vulnerable uses should be located on parts of the site at lower probability and residual risk of flooding. Applicants should seek opportunities to use open space for multiple purposes such as amenity, wildlife habitat and flood storage uses. Opportunities should be taken to lower flood risk by reducing the built footprint of previously developed sites and using SuDS. Essential energy infrastructure which has to be located in flood risk areas should be designed to remain operational when floods occur. In addition, any energy projects proposed in Flood Zone 3b the Functional Floodplain (where water has to flow or be stored in times of flood), or Zone C2 in Wales, should only be permitted if the development will not result in a net loss of floodplain storage, and will not impede water flows. The receipt of and response to warnings of floods is an essential element in the management of the residual risk of flooding. Flood warning and evacuation plans should be in place for those areas at an identified risk of flooding. The applicant should take advice from the emergency services when producing an evacuation plan for a manned energy project as part of the FRA. Any emergency planning documents, flood warning and evacuation procedures that are required should be identified in the FRA (paragraph 5.7.23 to 5.7.25, NPS EN-1).	The drainage design will incorporate drainage measures in line with the requirements of NPS EN-1 and the NPPF. The approach to flood risk and the proposed outline drainage strategy is presented in Volume 6, Appendix 15.1: FRA and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9).
Water quality and resources	
The decision maker should satisfy itself that a proposal has regard to the River Basin Management Plans and meets the requirements of the WFD and its daughter directives, including those on priority substances and groundwater. The specific objectives for particular river basins are set out in River Basin Management Plans. The decision maker should also consider the interactions of the proposed project with other plans such as Water Resources Management Plans (WRMPs) and Shoreline/Estuary Management Plans (paragraph 5.15.6, NPS EN-1).	The assessment and the proposed mitigation measures have taken into account the requirements of the River Basin Management Plan and WFD to ensure all potential impacts on the water environment are mitigated to within acceptable levels (see Table 2.6).
The decision maker should consider whether appropriate requirements should be attached to any development consent and/or planning obligations entered into to mitigate adverse effects on the water environment (paragraph 5.15.7, NPS EN-1).	This has been described and considered in relation to the site flood risk and hydrology within the assessment of Thurrock Flexible Generation Plant.
The decision maker considers whether mitigation measures are needed over and above any which may form part of the project application. A construction management plan may help codify mitigation at that stage.	The approach to flood risk is presented in volume 6, appendix 15.1: FRA and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9). Appropriate mitigation measures are set out in Table 2.6and Volume 5, Chapter 2.2: Code of

Summary of NPS EN-1 policy on decision making (and mitigation) in relation to hydrology and flood risk	How and where considered in the Environmental Statement
The risk of impacts on the water environment can be reduced through careful design to facilitate adherence to good pollution control practice. For example, designated areas for storage and unloading, with appropriate drainage facilities, should be clearly marked. The impact on local water resources can be minimised through planning and design for the efficient use of water, including water recycling (paragraphs 5.15.8 to 5.15.10, NPS EN-1).	Construction Practice (CoCP) (has been prepared as part of the DCO application.

1.3 Key national policy and legislation

1.3.1 The Applicant and their appointed contractors will comply with legislation associated with the construction of the proposed development. An outline of the relevant legislation specific to water resources & hydrology are provided below.

National Planning Policy Framework

1.3.2 The National Planning Policy Framework (NPPF) sets out Government planning policies for England and how these are expected to be applied. The framework acts as guidance for local planning authorities and decision-takers, both in drawing up plans and making decisions about planning applications.

1.3.3 Paragraphs 163 -165 set out the need for an appropriate assessment of flood risk on a site specific basis. Guidance on the minimum requirements for such an assessment is contained in PPG ID7.

1.3.4 The NPPF requires the application of a sequential, risk-based approach to determining the suitability of land for development in flood risk areas, and that flood risk assessment should be carried out to the appropriate degree, at all levels of the planning process.

Planning Practice Guidance, online

1.3.5 PPG ID7 Flood Risk and Coastal Change provides guidance to ensure the effective implementation of the NPPF planning policy for development in areas at risk of flooding.

1.3.6 PPG ID7 states that a site-specific FRA is required for all proposals for new development in Flood Zones 2 and 3 and for any proposal of 1 hectare or greater in Flood Zone 1. An FRA should consider vulnerability to flooding from other sources as well as from river and sea flooding, and also the potential for any increased risk of flooding elsewhere resulting from a development.

Flood and Water Management Act 2010

1.3.7 The Flood and Water Management Act 2010 implements the recommendations from Sir Michel Pitt's Review of the floods in 2007 and places a series of responsibilities on councils. The main aim of the Act is to improve flood risk management.

1.3.8 The Act designates councils as a LLFA with a ‘lead’ role in managing flood risk from surface water, groundwater and ordinary watercourses across their jurisdictional area. This involves closely working with partners involved in flood and water management, namely the EA, Thurrock Borough Council (BC) and Essex County Council (CC).

Land Drainage Act 1991

1.3.9 Under Section 23 of the Land Drainage Act 1991 (LDA 1991) consent is required from the relevant IDB for any works likely to obstruct, or affect the flow of, a watercourse. The relevant drainage authorities in respect of the proposed development are the EA and Essex CC (LLFA). Section 66 of the LDA 1991 makes provisions for the creation of byelaws considered necessary for securing the efficient working of the drainage system. Under the byelaws consent is required from the relevant drainage authority for any development within a particular distance of a drainage work.

Water Resources Act 1991

1.3.10 The Water Resources Act 1991 (WRA 1991) makes provision for the creation of byelaws by the EA. Paragraph 5 of Schedule 25 allows for the EA to create byelaws for flood defence and drainage purposes. Paragraph 6 allows for byelaws for purposes of fisheries functions to be made. Paragraph 6A makes provision for the creation of fisheries byelaws for marine or aquatic environmental purposes.

The Environmental Permitting (England and Wales) Regulations 2016

1.3.11 Schedule 25 of the Environmental Permitting (England and Wales) Regulation 2016 applies in relation to flood risk activity in, over or under a watercourse. Under the regulations, consent is required from the EA to undertake works or to erect structures within 8 m of a non-tidal water body (and 16 m of a tidal body).

1.4 Local policy

1.4.1 Key provisions of the Thurrock Local Development Framework, Core Strategy policies are set out in Table 1.3 along with details as to how these have been addressed within the assessment.

1.5 Consultation

1.5.1 Key issues raised during scoping and consultation to date specific to hydrology and flood risk are listed in Table 1.4, together with how details of how these issues have been considered in the production of this PEIR and cross-references to where this information may be found.

Table 1.3: Summary of other relevant policies relevant to hydrology and flood risk.

Summary of local planning polices relevant to the assessment of hydrology and flood risk	How and where considered in the PEIR
Thurrock Local Development Framework, Core Strategy and Policies for Management of Development. Development Plan Document	
CSTP27 – Management and Reduction of Flood Risk • The Council will ensure that flood risk management is implemented and supported through effective land use planning. The Sequential, and where necessary Exception Test, as set out in PPS25 will be employed when allocating sites for development and an Emergency Plan for the Borough will be completed. • The Council will also continue to work collaboratively with the Environment Agency by supporting the area based policy approach adopted in the Thames Estuary 2100 Project. In particular the Council will seek to safeguard existing flood defences and new areas for flood defences, water storage and drainage areas, as well as seeking secondary defences for key assets. • The Council will support the work of the Environment Agency in the Environmental Enhancement Project for the Mucking Flats and Marshes to ensure the delivery of appropriate flood mitigation and environmental enhancement measures. • The Council will work with the Environment Agency and other main stakeholders to ensure that fluvial and surface water flood risk is managed within Thurrock. This will include supporting the policies identified in the South Essex Catchment Flood Management Plan, such as identifying and safeguarding areas of land for existing and future areas of water storage in Policy Units 9, 10, 11 & 12 and in formulating System Asset Management Plans (SAMP) and the Integrated Urban Drainage Plans for Stanford-le-Hope, Tilbury and Purfleet. A Surface Water Management Plan will also be carried out to assist in the identification and mapping of areas susceptible to surface water flooding as recommended by Defra and the Pitt Review. Development proposals that will affect these locations will be expected to contribute towards infrastructure improvements in these locations to enable the development to proceed. • The Council will ensure that, where necessary, new development throughout the Borough contains space for water including naturalisation and environmental enhancement. • Developers will be required to contribute towards flood risk management infrastructure where appropriate. • Planning applications received for sites within Flood Zone 3 will be treated in accordance with PPS25, this policy and Policy PMD15.	The approach to flood risk is presented in Volume 6, Appendix 15.1FRA and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9). Alternative sites are discussed in Volume 2, Chapter 3: Consideration of Alternatives.
Policy PMD15 – Flood Risk Assessment • Sites not covered by the Thurrock Sequential Test will be required to provide a site-specific Sequential Test to demonstrate compliance with PPS25 or any successor to be provided by the applicant. To reflect the nature of Thurrock's defended floodplain, particular reference should be made to the hazard rating for each site where covered by the Thurrock Strategic Flood Risk Assessment. • Only those applications classified under the 'minor development' or 'changes of use' categories will be exempt from applying the Sequential Test but will still be expected to meet the requirements for Flood Risk Assessments and flood risk reduction as set out in Annex E of PPS25 and the associated Design and Sustainability SPD. • Development proposals subject to the Exception Test in Thurrock must show that the following criteria have been met (in addition to FRA requirements outlined in PPS25): • To assist with part a) of the Exception Test, reference should be made to the main assessment criteria outlined in the Thurrock Sustainability Appraisal and any opportunities to reduce the overall flood risk posed to the community, including schemes to make space for water; • The FRA must demonstrate that the development will be 'safe', without increasing flood risk elsewhere, and where possible will reduce flood risk overall. For Thurrock, this will mean addressing the following points in particular: • Flood hazard must be fully considered and reference should be made in the site-specific FRA to the SFRA, or site-specific modelling. This should be used to inform a sequential approach to planning within the site; • Where it is deemed acceptable to reduce flood storage as a result of development, level for level compensation storage must be provided to ensure that there is no increased flood risk elsewhere; • Where appropriate, an emergency plan for the development must be submitted that is consistent with the emergency plan for the area. This will include evidence that 'more vulnerable' development can achieve safe access/egress to a communal refuge point or unaffected area accessible to the emergency services. In highly exceptional cases where access/egress to a place of safe refuge cannot be achieved, these will be considered on their individual merits; • Where appropriate, flood avoidance, flood resistance and flood resilience measures must be incorporated into the design of any development; • Evidence that surface water management schemes, and other flood defence measures that are required on-site in order to allow a development to take place will be adequately maintained for the lifetime of that development by the site owner; • Evidence that the proposed development will not interfere with the potential for future maintenance or improvements to flood defences. • Developers may be required to provide Developer Contributions towards the improvement of Emergency Planning services and flood defence measures within Thurrock as part of flood management mitigation. • Developments will be expected to incorporate Sustainable Drainage Systems (SUDS) to reduce the risk of surface water flooding, both to the site in question and to the surrounding area. Where the potential for surface water flooding has been identified, site specific Flood • Risk Assessments should ensure that suitable SUDS techniques are incorporated as part of the redevelopment.	The approach to flood risk is presented in Volume 6, Appendix 15.1 FRA and has been summarised in this chapter (see paragraph 2.1.7 to 2.1.9). Alternative sites are discussed in Volume 2, Chapter 3: Consideration of Alternatives

Table 1.4: Key points raised during scoping and consultation to date.

Date	Consultee and type of response	Issues raised	Response to issues raised and/or where considered in this chapter
20 September 2018	The Planning Inspectorate Scoping Opinion	Thames Estuary 2100 (TE2100) plan The Inspectorate has had regard to the consultation response from the Environment Agency regarding the TE2100 plan for maintaining or improving the current standards of flood protection on the estuary. The Applicant should make effort to consult with the Environment Agency regarding interactions between the Proposed Development and the TE2100. Where significant environmental effects are likely these should be assessed within the PEIR	Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur.
		Data If any additional site specific hydrological data is acquired from site reconnaissance or consultation with another body, this information should be included within the PEIR.	Data sources utilised to inform the chapter are presented in Table 2.1, Volume 6 Appendix 15.1, 15.2 and 15.3.
		Scope of the assessment The Inspectorate notes that only 'temporary changes' to surface water flows within Flood Zone 3 during construction will be assessed. The Scoping Report does not define the term 'temporary changes'. For the avoidance of doubt the PEIR should assess any likely significant effects resulting from changes to surface water flows within Flood Zone 2 during relevant stages of construction.	Temporary impacts are associated with short term construction and decommissioning works. Further assessment is undertaken on the long term impacts associated with the operation of the proposed development over its lifetime.
		Scope of the assessment As the proposed development is located within Flood Zone 3, an assessment of whether the proposed development can remain safe and operational during a worst case flood event should be undertaken and included within the PEIR.	A review of the flood levels taking into account local flood defences as well as the residual flood risk as a consequence of a breach has been undertaken (section 2.9).
		Loss of floodplain storage The proposed development is situated within a floodplain storage area, but the Scoping Report has not stated whether the proposed development will result in a net loss of floodplain storage. The PEIR should quantify and assess the impacts from the proposed development to floodplain storage.	No above ground structures or ground profiling is proposed within the area designated as flood zone 3b.
		Water Framework Directive (WFD) bodies. Paragraph 8.154 of the Scoping Report confirms that the PEIR will consider potential impacts on WFD water bodies. The Applicant's attention is drawn to the Inspectorate's Advice Note Eighteen: The WFD in this regard. The Applicant should make effort to discuss and agree the approach to the assessment of water quality and the need for additional sampling (further to that set out in Table 8.6 of the Scoping Report) with the Environment Agency. The PEIR should explain the relationship between the proposed development and any relevant water bodies in relation to the current relevant River Basin Management Plan. If the decision regarding the cooling water infrastructure cannot be made prior to submission of the DCO application, the PEIR should describe and assess all possible scenarios likely to result in significant effects on relevant water bodies	A review of local surface water bodies and associated WFD status is outlined in paragraphs 2.1.3to 2.1.4 and impacts assessed in section 3.

Date	Consultee and type of response	Issues raised	Response to issues raised and/or where considered in this chapter
		Methodology for: • probability of harm; and • magnitude of impact. The Scoping Report does not define the term 'probability of harm' or describe how a probability of harm will be assigned to receptors. The PEIR should provide a definition of this term and include a detailed description of the methodology used to determine the 'probability of harm' to a receptor. Scoping Report paragraph 8.157 states that the significance of predicted effects will be determined in part by the magnitude of predicted impact. The methodology used to determine the magnitude of the predicted impact should also be set out within the PEIR.	The assessment methodology utilised to inform the assessment is detailed in section 2.
		Flood Risk Assessment (FRA) All potential sources of flooding which could result in likely significant effects should be assessed in the PEIR.	A development specific FRA to support the DCO is presented in Volume 6 Appendix 15.1: FRA.
		Drainage The Scoping Report indicates that a drainage strategy including new drainage features will be developed.	A development specific FRA to support the DCO is presented in Volume 6, Appendix 15.1: Flood Risk Assessment. A high-level drainage concept is presented in the FRA. An outline drainage strategy will be produced following development of the indicative site layout and submitted with the ES
		Climate change allowance Any uncertainties or assumptions encountered when using the climate change model to assess impacts to water resources and flood risk should be stated within the PEIR.	Climate change is reviewed in section 2.10 and impacts associated with climate change included within the development specific FRA is presented in Volume 6, Appendix 15.1: Flood Risk Assessment.
		Future baseline The Scoping Report does not state the timeframe for the future baseline. The Inspectorate assumes that the timeframe for the future baseline will be the 12 month construction period from 2021-2022; however, this should be clearly stated within the PEIR.	A high-level drainage concept is presented in Volume 6 Appendix 15.1 FRA. An outline drainage strategy will be produced following development of the indicative site layout and submitted with the ES.
		Mitigation measures The Scoping Report (paragraph 8.161) refers to the sufficiency of proposed mitigation. Paragraph 3.11 of the Scoping Report does state that Sustainable Drainage (SuDS) feature will be used as a mitigation measure to prevent surface water flooding. The location of SuDS and an assessment of their efficacy should be included within the PEIR.	Design-in mitigation measures are presented in Table 2.6. A high-level drainage concept is presented in Volume 6 Appendix 15.1 FRA. An outline drainage strategy will be produced following development of the indicative site layout and submitted with the ES.
		Tidal flood risk The Scoping Report does not address any potential changes in tidal flooding caused by the Proposed Development.	Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur
		Public highway adjustments The Inspectorate notes that the public highway adjustments have not been referenced within the aspect chapter. The PEIR should include an assessment into how water resources and flood risk may be affected by the public highway adjustments taking into account relevant guidance. If any mitigation measures are required to prevent significant effects occurring to the water resources and flood risk arising from the public highway adjustments, a description and efficacy assessment of the proposed mitigation measures should be included within the PEIR.	Details are being developed in consultation with regulators. In the event any works encroach within 8 m of the top of bank of a Main River or ordinary watercourse this will be identified and the appropriate FRAP submitted or protective provision incorporated into the DCO.

Date	Consultee and type of response	Issues raised	Response to issues raised and/or where considered in this chapter
05 September 2018	Environment Agency EIA Scoping Response	Flood Risk The EIA scoping report (section Water Resources and Flood Risk pages 103-107) highlights that a Flood Risk Assessment (FRA) is required and will consider risks to the proposed development from flooding as well as the potential for the proposed development to increase flood risk elsewhere. A Flood Response Plan (FRP) will be required for the proposed development. The FRP should account for all sources of flooding experienced at the site with the correct actions specified for the given inundation time. It should be drawn up in close liaison with Thurrock Council's Emergency Planner, the Emergency Services and us to ensure it includes appropriate actions related to potential site circumstance and that it is compliant with the wider emergency plans for the District.	A high-level drainage concept is presented in Volume 6 Appendix 15.1 FRA. An outline drainage strategy and flood evacuation plan will be produced following development of the indicative site layout and submitted with the ES.
		Environmental Permitting Regulations 2016 A Flood Risk Activity Permit will be required for any works in, under, over or within 8 metres (m) from a fluvial main river and 16m from a tidal main river and from any flood defence structure.	One EA designated Main River crossing (West Tilbury Main) is proposed. A FRAP will be submitted for any works within 8 m of the top of bank of the watercourse. Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur
		Thames Estuary 2100 Plan / TEAM2100 A point to clarify in section 8.145 is that we have permissive powers available to us via section 165 of the Water Resources Act 1991 as amended by the Floods and Water Management Act 2010 which allow us to maintain and improve existing works as well as to construct new works on a designated main river watercourse or tidal flood defence.	One EA designated Main River crossing (West Tilbury Main) is proposed. A FRAP will be submitted for any works within 8 m of the top of bank of the watercourse. Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur
		Future Thames Flood Barrier We would therefore expect to see consideration given to how the TE2100 plan requirements can be taken into account as part of this proposal. Given the proposed nature of the application the impact of a future barrier maybe minimal, but we would welcome further discussions on how to incorporate space for any potential future barrier within the proposals. We are unlikely to have any construction or operational need over land along this frontage for over 40 years. We acknowledge that the proposed lifespan of the development and so this may not be an issue however we would be pleased to provide any further information you may require from us to help facilitate our aspirations under the TE2100 plan.	Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur.
		Water Quality We believe Water Framework Directive (WFD) risk assessments should be a standalone chapter within the EIA/ES, containing all relevant supporting detail, not simply references to other parts of the ES. The evidence presented in a WFD assessment needs to be an integral part of the WFD document.	Zone K has now been removed from the proposed development. No works directly impacting on the Thames flood defence would occur. The nearest EA designated Main River is West Tilbury Main c.500 m to the east of the proposed development. A review of local surface water bodies and associated WFD status is outlined in paragraphs 2.1.3 to 2.1.4 and impacts assessed in section 3.
06 September 2018	Essex County Council Scoping Response	Lead Local Flood Authority – Flood and Water Management If a surface water drainage strategy is to be developed in discussions with the Environment Agency, ECC as a neighbouring LLFA and Risk Management Authority (RMA) should be included in these discussions. This should be clearly identified and the role that will be played should be transparent from the earliest opportunity. Paragraph 8.158 - ECC as LLFA wishes to be consulted in relation to water quality. The impact on groundwater and groundwater movement should be included in the assessments. The assessments should also consider infiltration potential. Pluvial flood risk should be explicitly considered and be presented as a separate section of the PEIR. At present it appears to be focused on fluvial flood risk.	The Applicants consultant has forwarded a number of email correspondence to Essex County Council and associated SuDS department. To date no response has been received. A development specific FRA is presented in Volume 6, Appendix15.1: Flood Risk Assessment.

Date	Consultee and type of response	Issues raised	Response to issues raised and/or where considered in this chapter
29 August 2018	Thurrock Borough Council Scoping Response	Flood Risk We acknowledge the EIA Scoping Report submitted dated July 2018 by RPS Group. From emergency planning perceptive, two main areas of interest to us in this development were: • Flood Risk- Section 8.143-8.162 of the scoping report proposed to consider the effects of flood risk during the construction, operation and decommission phase which will be outlined in the Flood Risk Assessment (FRA). • Emergency Management Response Plan- Section 9.5 of the scoping report will considered the off-site impacts. We conclude that the scoping report document has covered these two areas.	Flood risk during the construction, operation and decommission phases has been assessed in Section 3 and a development specific FRA is presented in Volume 6, Appendix 15.1: Flood Risk Assessment.
August 2018	Applicant's consultants (RPS)	Thurrock BC environmental information request	Applicants consultants (RPS) directed to Essex CC and associated Essex SuDS department for hydrology and flood risk related information and data.
August 2018	Applicant's consultants (RPS)	Essex CC environmental information request	No response.
July 2018	Applicant's consultants (RPS)	EA environmental information request	EA response August 2018. Flood data, flood zone mapping, flood defence records, historical flood extents and event information.
September 2018	Applicant's consultants (RPS)	EA environmental information request. Main River outfalls	EA response September 2018. Outfall levels and locations

2. Assessment Approach

Desktop study

2.1.1 Information on hydrology and flood risk within the proposed development hydrology and flood risk study area was collected through a detailed desktop review of existing studies and datasets. These are summarised in Table 2.1.

Table 2.1: Summary of key desktop reports.

Title	Source	Year	Author
BGS 1:50,000 and 1:10,000 digital geological mapping	BGS via Groundsure GeoInsight Report	2018	BGS
SPZs/Aquifer Designations	EA via Groundsure EnviroInsight Report Correspondence with the EA	2018	GroundSure EA
Groundsure Environmental Search (Ref: RPS_542618).	Groundsure	September 2018	Groundsure Limited
Climate data	Met Office	2018	Met Office
WRMP	Essex & Suffolk Water	2014	Essex & Suffolk Water
Flood Zone and Watercourse Map	EA	2018	EA
Thames Estuary 2100, Managing flood risk through London and the Thames estuary TE2100 Plan	EA	November 2012	EA
Thames river basin district River basin management plan.	EA	December 2015	EA
South Essex Catchment Flood Management Plan	EA	December 2009	EA
Thurrock Local Flood Risk Management Strategic Environment Assessment Screening report	Thurrock Borough Council	December 2014	JBA Consulting
Thurrock Local Flood Risk Management Strategy	Thurrock Local Flood Risk Management Strategy Final December 2015	December 2015	Thurrock Borough Council
South Essex Catchment Plan 2015-2018	South Essex Catchment Partnership	c.2012	South Essex Catchment Partnership
Thurrock Strategic Flood Risk Assessment Level 2 Report Final Report February 2010	Thurrock Borough Council	2010	Scott Wilson

Identification of designated sites

2.1.2 A review of desktop reports, publicly available information and information requests (as identified in Table 2.1) did not identify any hydrologically designated sites within the proposed development hydrology and flood risk study area. Watercourses designated for their ecological interest are identified in Volume 3, Chapter 9: Ecology.

Water Framework Directive

2.1.3 The current overall WFD status for watercourses potentially affected by the proposed development has been identified via the publicly available EA's Catchment Data Search. The open access database provides the most up to date (2016) Current Status classifications for a number of main rivers within the Thames, Essex South River Basin District and the proposed development hydrology and flood risk study area. The WFD classification is not site specific but classifies a defined river reach based on site samples.

2.1.4 For surface waters, the WFD objectives are based on the ecological and chemical status of the waterbody (i.e. the predicted future status if technically feasible measures are implemented). These measures are required to prevent deterioration in the current status of the waterbody and (once implemented) produce more benefits than they cost to implement. The date to achieve the objective status is determined by the type of measures which are needed in order to improve the status of the waterbody (i.e. the cost of the measures (are they affordable) and the time taken for the status to improve once the measures have been implemented).

2.1.5 Due to the distance (c.500 m) to the nearest EA designated Main River a watercourse specific WFD assessment has been scoped out of the hydrology and flood risk chapter.

Site specific surveys

2.1.6 In order to inform the EIA, site-specific surveys were undertaken. This primarily comprised a walkover survey undertaken as part of the hydrological characterisation of the main development area and a visual inspection of local watercourses.

Flood Risk Assessment

2.1.7 The Gas Engine and Battery Storage facilities will each cover an area of more than 1 hectare (ha), and the cable and pipeline corridor will pass through areas designated as Flood Zone 2 and 3. In accordance with the guidance in the NPPF (and PPG ID7 – Flood Risk and Coastal Change) and NPS EN-1 site-specific FRA have been undertaken. This is included in Volume 6, Appendix 15.1: Flood Risk Assessment.

2.1.8 The key components of the site specific FRAs are as follows:

- Review of publicly available EA documentation, local flood management plans and future flood management schemes;
- Review of Strategic FRAs;
- Assessment of the flood risk to the existing conditions and future conditions;
- A site-specific assessment of flood risk at the proposed Gas Engine and Battery Storage facilities, and cable and pipeline corridors; and
- A hydrological assessment of the surface water flows for the proposed Gas Engine and Battery Storage facilities, and cable and pipeline corridors.

2.1.9 The approach of the FRA for the proposed development was agreed with the EA and Thurrock Council. Whilst the proposed development pipeline corridor will exceed 1 ha when considering the full length of the assessment corridor, which will cross areas at risk flooding (Flood Zone 2 and 3). Given that the pipeline would be below ground the potential impact on permanent flood risk is negligible. However, the report identifies locations where the corridor was within Flood Zones 2 and 3 (i.e. crossing locations of main rivers and ordinary watercourses).

2.2 Study Area

2.2.1 The proposed development hydrology and flood risk study area is shown on Figure 2.1.

2.2.2 and comprises a 250 m buffer around the proposed development (namely the Thurrock Flexible Generation Plant (Gas Engines and Battery Storage), the electrical cable corridor, the gas pipeline connection corridor), as well as the storage areas, compounds and permanent access road. The proposed development hydrology and flood risk study area also includes a 1 km buffer area around the proposed development Gas Engines and Battery Storage facilities.

2.2.3 The 250 m buffer is considered appropriate for data collection taking into account the nature of the development and likely zone of influence on hydrological receptors. Given the landscape surrounding the proposed development and local land use activities, it would be difficult to ascertain the exact source of any impacts on water quality beyond 250 m. The 1 km buffer for the proposed development Gas Engines and Battery Storage facilities was chosen primarily to identify any existing assets, infrastructure or receptors that have the potential to be affected by the long-term presence of infrastructure constructed above ground in terms of flood risk.

2.3 Uncertainties and/or data limitations

2.3.1 The assessment within this chapter is based on publicly available data obtained from the EA, Thurrock Borough Council, Essex County Council and commercial data supply companies, as well as additional information supplied from stakeholders during the scoping and consultation stages. The information has been supplemented with publicly available data, Groundsure searches and public consultation such that it is considered sufficient to characterise the baseline environment.

2.3.2 It is also noted that the EA Flood Zone risk maps do not take into account the impact of local flood defences and climate change on flooding, and do not provide information on flood depth, speed or volume of flow. The maps do not show flooding from other sources such as groundwater, direct runoff from fields or overflowing sewers. However, a description of these sources of flooding is provided in the FRA (see Volume 6, Appendix 15.1: Flood Risk Assessment), such that sufficient baseline information is available.

2.3.3 The assessment is limited by a lack of detailed information on:

- Flow data for watercourses and drainage channels; and
- Water quality data for specific locations.

2.3.4 Notwithstanding the above, overall a moderate to high level of certainty has been applied to the baseline and assessment presented in this chapter. Where available, catchment data regarding water quality has been used to inform the assessment, with a hydrological site walkover undertaken for all EA designated main rivers and ordinary watercourse crossings within the proposed development hydrology and flood risk study area. The information which was available is considered sufficient to establish the baseline within the proposed development hydrology and flood risk study area, therefore, there are no data limitations that would affect the conclusions of this assessment.

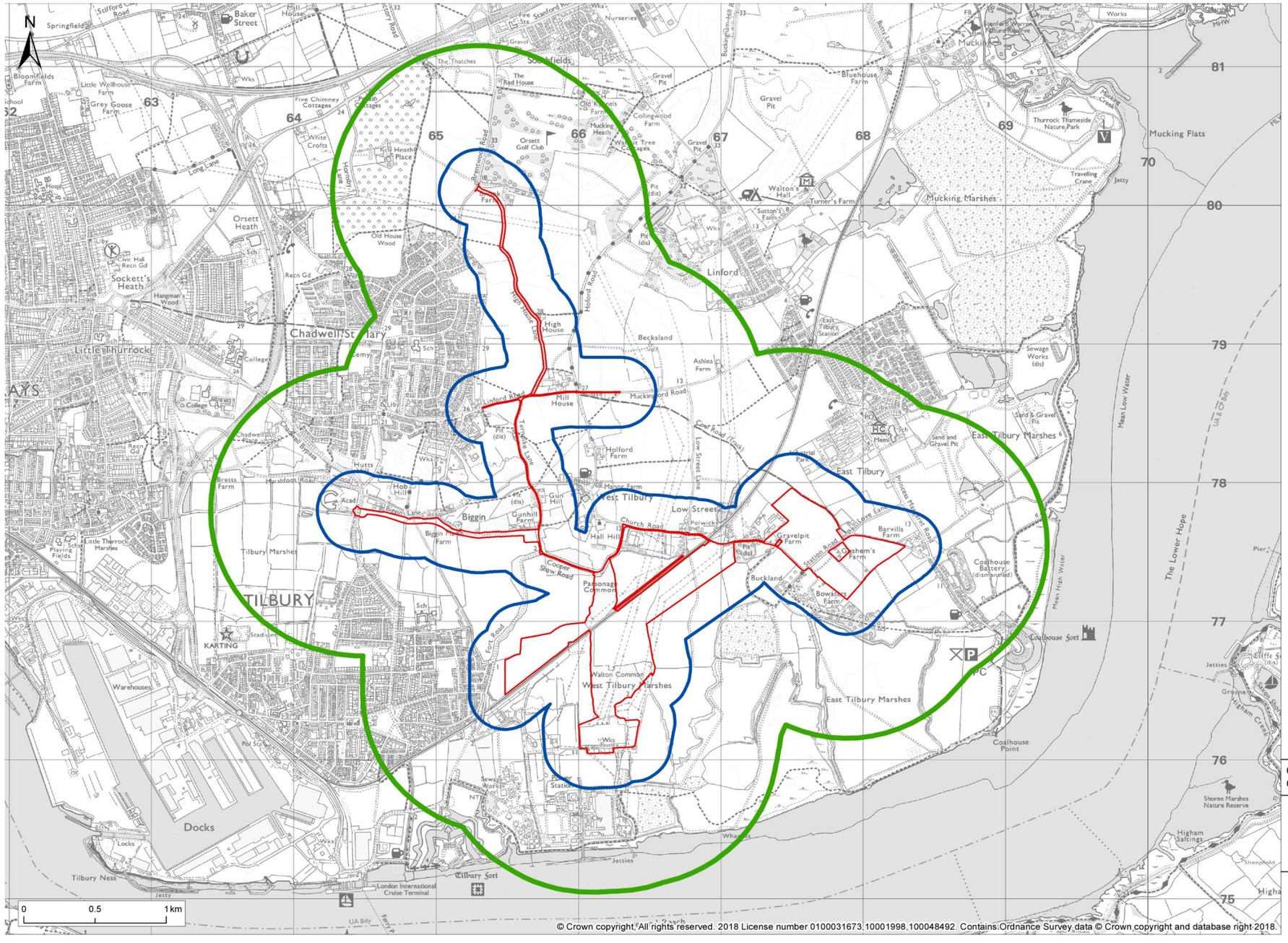

Figure 2.1: Hydrology and flood risk study area.

2.4 Impact assessment criteria

2.4.1 The significance of an effect is determined based on the magnitude of an impact and the sensitivity of the receptor affected by the impact of that magnitude. This section describes the criteria applied in this chapter to characterise the magnitude of potential impacts and sensitivity of receptors. The terms used to define magnitude and sensitivity are based on those used in the DMRB methodology, which is described in further detail in Volume 2, Chapter 4: Environmental Impact Assessment Methodology.

2.4.2 The criteria for defining magnitude in this chapter are outlined in Table 2.2.

Table 2.2: Definition of terms relating to the magnitude of an impact.

Magnitude of impact	Definition used in this chapter
Major	Total loss of ability to carry on activities. Impact is of extended temporal or physical extent and of long term duration (i.e., up to 10 years duration).
	Significant observable degradation in water resource quality and/or increase in flood risk (i.e., up to 10 years duration).
Moderate	Loss of or alteration to significant portions of key components of current activity. Impact is of moderate temporal or physical extent and of medium term duration (i.e., up to 5 years).
	Observable degradation in water resource quality and/or increase in flood risk (i.e., up to 5 years).
Minor	Small reduction in baseline conditions, leading to a reduction in level of activity that may be undertaken. Impact is of limited temporal or physical extent and of short term duration (i.e., up to 2 years).
	Degradation in water resource quality and/or slight increase in flood risk (i.e., up to 2 years).
Negligible	Very small reduction in baseline condition. Physical extent of impact is negligible and of short term duration (i.e., less than 1 year).
	No observable degradation in water resource quality and/or flood risk (i.e., less than 1 year).
No change	No change from baseline conditions.

2.4.3 The criteria for determining the significance of effects is a two stage process that involves defining the sensitivity of the receptors and the magnitude of the impacts on those receptors. This section describes the criteria applied in this chapter to assign values to the sensitivity of receptors and the magnitude of potential impacts. The terms used to define sensitivity and magnitude are based on those used in the Design Manual for Road and Bridges methodology (DMRB, 2009), which is described in further detail in Volume 2, Chapter 4: Environmental Impact Assessment Methodology. The criteria for defining sensitivity in this chapter are outlined in Table 2.3.

Table 2.3: Definition of terms relating to the sensitivity of the receptor.

Sensitivity	Definition used in this chapter
Very High	Receptor is high value or critical importance to local, regional or national economy. Receptor is highly vulnerable to impacts that may arise from the project and recoverability is long term or not possible. Surface water: WFD Current Overall Status of High. Flood risk: Land within Flood Zone 3 or more than one hundred residential properties protected from flooding by flood defence infrastructure or by natural floodplain storage.
High	Receptor is of moderate value with reasonable contribution to local, regional or national economy. Receptor is generally vulnerable to impacts that may arise from the project and recoverability is slow and/or costly. Surface water: WFD Current Overall Status of Good. Flood risk: Land within Flood Zone 3 and/or 2 or between one and one hundred residential properties or industrial premises protected from flooding by flood defence infrastructure or by natural floodplain storage.
Medium	Receptor is of minor value with small levels of contribution to local, regional or national economy. Receptor is somewhat vulnerable to impacts that may arise from the project and has moderate to high levels of recoverability. Surface water: WFD Current Overall Status of Moderate. Flood risk: Flood plain within Flood Zone 2 and/or 1 or limited constraints and a low probability of flooding of residential and industrial properties.
Low	Receptor is of low value with little contribution to local, regional or national economy. Receptor is not generally vulnerable to impacts that may arise from the project and/or has high recoverability. Surface water: WFD Current Overall Status of Poor. Flood risk: Flood plain within Flood Zone 2 and/or 1 or limited constraints and a very low probability of flooding of residential and industrial properties.
Negligible	Receptor is of negligible value with no contribution to local, regional or national economy. Receptor is not vulnerable to impacts that may arise from the project and/or has high recoverability. Surface water: WFD Current Overall Status of Bad. Flood risk: Area

2.4.4 The significance of the effect upon hydrology and flood risk is determined by correlating the magnitude of the impact and sensitivity of the receptor. The particular method employed for this assessment is presented in Table 2.4. Where a range of significance is presented in Table 2.4, the final assessment for each effect is based upon expert judgement.

2.4.5 For the purpose of this assessment, any effects with a significance level of minor or less are considered to be **not significant** in EIA terms.

Table 2.4: Matrix used for the assessment of the significance of an effect.

		Magnitude of impact				
Sensitivity of receptor		***No change***	***Negligible***	***Minor***	***Moderate***	***Major***
	Negligible	No change	Negligible	Negligible or minor	Negligible or minor	Minor
	Low	No change	Negligible or minor	Negligible or minor	Minor	Minor or moderate
	Medium	No change	Negligible or minor	Minor	Moderate	Moderate or major
	High	No change	Minor	Minor or moderate	Moderate or major	Major or substantial
	Very high	No change	Minor	Moderate or major	Major or substantial	Substantial

2.5 Maximum design envelope parameters for assessment

2.5.1 This section of the chapter presents the basis of assessment in relation to the proposed development during construction, operation and decommissioning in respect of effects on water resources & hydrology.

2.5.2 The realistic worst case engineering design assumptions are presented in line with the 'maximum design envelope' approach (base scheme design) and are incorporated into a base scheme design (worst case limit of deviation (LoD)). For each element of this chapter the design assumptions have been selected as those having the potential to result in the greatest effect on an identified receptor or receptor group.

2.5.3 The assessment is based on the design of the proposed gas engine, battery storage, proposed cable route, proposed pipeline route and permanent access road described in Volume 2, Chapter 2: Project Description. The assessment considers a realistic worst case based on the maximum scale of the elements and as a result no effects greater than those assessed are likely. As the assessment has been based on a realistic worst case scenario approach (base scheme design), effects of greater significance than those assessed in this chapter will not occur.

2.6 Impacts scoped out of the assessment

2.6.1 It is proposed to scope out the requirement for a watercourse specific WFD assessment, based on the distance (c.500 m) to the closest EA designated Main River.

2.6.2 Zone K and associated cooling water outlet has now been removed from the proposed development. Therefore, the impacts on the Thames tidal flood defence(s) has been scoped out.

Table 2.5: Maximum design envelope parameters assessed.

Potential impact	Maximum design scenario	Justification
Construction		
The construction of permanent assets may lead to increased flood risk	Main development site (Zone A) buildings and *low permeable (hardstand) surfacing* up to 17 ha in total Above ground installation for NTS connection (within Zone E) buildings and *low permeable (hardstand) surfacing* up to 0.25 ha in total Permanent access road (within Zone C) *low permeable (hardstand) surfacing* up to 1 ha in total	Reasonable maximum low-permeability area would generate greatest surface runoff rate with potential to increase flood risk compared to greenfield rate
	Ground floor/base height of buildings and other structures of main development site (Zone A) and above ground installation (within Zone E) 1 m above ground level.	To ensure assets are designed to be flood resilient and/or resistant to remain operational during a major flood event, including a breach in flood defences.
Temporary construction may lead to increased flood risk	Gas pipeline construction: 20 m wide working corridor; pipeline crosses all fields of 'Zone D'; total length up to 3 km Access road(s) for construction: 20 m wide working corridor(s); route(s) not shared with gas pipe Up to 1 acre within Zone I used for laydown; up to 2 ha used for laydown or temporary construction compounds in other areas within the application boundary outside the main development site (Zone A)	Reasonable maximum low-permeability areas within working zones for temporary construction would generate greatest surface runoff rate with potential to increase flood risk compared to greenfield rate during construction period
Construction may cause risk of leaks and spills to surface watercourses	Storage of fuel and refuelling or minor maintenance of construction plant within main development site (Zone A)	Reasonable maximum design scenario as Zone A would be the main working area for construction
The impacts of trenchless construction techniques may affect major surface watercourses	Trenchless techniques used for 1 no. major surface watercourse crossings	The maximum design scenario for indirect effects to surface water quality would result from the use of trenchless techniques. *Trenchless crossing techniques present a risk of indirectly contaminating surface watercourses where they are hydraulically connected with surface runoff caused by spillages and the movement of sediment.*
The impacts of open cut, temporary bridging and culverts may affect surface watercourses	Open cut used for 8 no. minor watercourse crossings, construction at each lasting for up to one month Temporary bridging or culverting of up to 4no. minor watercourse crossings, remaining in place for six year construction programme	The maximum design scenario for disturbance to surface water resources would result from the use of open cut, temporary bridging and culverts.
The construction of permanent assets may affect field drainage and irrigation	Up to 500 m of existing field drainage channels and surface water systems removed permanently	A loss of the drainage network would lead to the backing up of field drainage channels and surface water systems leading to potential surcharging and flood risk.
Temporary construction may affect field drainage and irrigation	Open cut used for 8 no. minor watercourse crossings, construction at each lasting for up to one month	The maximum design scenario for disturbance to surface water resources would result from the use of open cut, temporary bridging and culverts which may temporary causes a blockage of field drainage and/or irrigation channels
Operation and maintenance		
The impact of flexible generation plant operation and maintenance may affect main or ordinary surface watercourses	Up to one major maintenance period (duration three weeks) and four minor maintenance visits (duration one week) per annum	Storage of potentially contaminating substances and frequency of maintenance or repair activities are reasonable maximum design scenario for risk of surface watercourse contamination

Potential impact	Maximum design scenario	Justification
The impact of pipeline maintenance may affect main or ordinary surface watercourses	No excavation or machinery access required for routine inspection of pipeline Possible repair or replacement of any pipeline section not planned during operating lifetime; unplanned repair or maintenance maximum design scenario no greater than construction	Reasonable maximum design scenario based on applicant's expected operation of pipeline infrastructure
Decommissioning		
The impacts of decommissioning may affect temporary flood risk.	Removal of all infrastructure including areas of hardstanding and flood attenuation, with the exception of buried pipeline and cable assets.	The removal of attenuation storage associated with the development could affect flood risk as it would take the natural environment a period of time to re-establish itself and regenerate to providing natural attenuation.
The impacts of decommissioning may affect main surface watercourses.	Removal of all infrastructure including areas of hardstanding and flood attenuation, with the exception of buried pipeline and cable assets.	The maximum design scenario for water quality of main watercourses during decommissioning is the removal of all associated infrastructure as this presents the greatest disturbance and potential risk of sediment and contaminants being released. It is not expected that buried pipeline assets would be removed.
The impacts of decommissioning may affect ordinary watercourses.	Removal of all infrastructure including areas of hardstanding and flood attenuation, with the exception of buried pipeline and cable assets.	The maximum design scenario for water quality of main watercourses during decommissioning is the removal of all associated infrastructure as this presents the greatest disturbance and potential risk of sediment and contaminants being released. It is not expected that buried pipeline assets would be removed.

2.7 Measures adopted as part of Thurrock Flexible Generation Plant

2.7.1 Potential impacts to the water environment will be avoided where practicable through careful consideration of the drainage design, construction techniques and operational best practices of the gas, battery facility and associated infrastructure. The EA and LLFA will be consulted through the construction works and planning process to ensure appropriate permits and consents are in place. Designed mitigation and construction mitigation measures are outlined below and featured in the CEMP.

2.7.2 These are measures incorporated into the base scheme design such as the design of the gas engines, battery storage, the layout of Zone A and onsite drainage. Design mitigation for the proposed development are identified in Volume 4, Chapter 19: Summary of Further Mitigation, Residual Effects and Monitoring and Volume 5, Chapter 2.1: Enhancement, Mitigation and Monitoring Commitments.

2.7.3 As part of the design process, a number of design mitigation measures have been proposed to reduce the potential for impacts on water resources & hydrology. These measures are considered standard industry practice for this type of development and therefore have been incorporated in the base scheme design as assessed within the potential impacts.

2.7.4 A number of measures have been designed in to the Flexible Generation Plant to reduce the potential for impacts on hydrology and flood risk. These are listed in Table 2.6: Designed-in measures.

Table 2.6: Designed-in measures.

Measures adopted as part of Thurrock Flexible Generation Plant	Justification
Outline Drainage Strategy The proposed development would result in the construction of low permeable surfacing, increasing the rate of surface water run-off. A surface water management plan is required to ensure the existing run-off rates to the surrounding water environment are maintained at pre development rates. The detailed design of the surface water management strategy would be based on a series of infiltration / soakaway tests carried out on proposed development gas and battery facility and the worst case attenuation volumes outlined in the FRA. The tests would be undertaken prior to construction and in accordance with the BRE Digest 365 Guidelines. The strategy would ensure that the mean annual run-off rate is maintained at the current greenfield run-off rate. Measures to mitigate against water pollution would also apply and would include measures set out below	To address the NPPF, EA and Essex CC surface water run-off requirements.
Best Practice Measures Construction work would be undertaken in accordance with the Code of Construction Practice which will inform the Construction Environmental Management Plan (CEMP), and guidance including: • EA guidance for discharges to surface water and groundwater: environmental permits; • EA guidance for oil storage regulations for businesses; • EA guidance for work on a river, flood defence or sea defence; • EA Pollution Prevention Guidance, which have been withdrawn. However, still provide useful best practice guidance: • EA, Pollution Prevention Guidance Note 6: Pollution Prevention Guidelines – Working at Construction and Demolition Sites; • EA, Pollution Prevention Guidance Note 5:– Working in, near or liable to affect watercourses; • Control of Water Pollution from Construction Sites – Guidance for Consultants and Contractors CIRIA (C532); CIRIA – SuDS Manual; • CIRIA (C741) Environmental good practice on site guide; • CIRIA (C648) Control of water pollution from linear construction projects; • Prevent surface water being affected during earthwork operations. No discharge to surface watercourses will occur without permission from the EA (SuDS Manual); • Wheel washers and dust suppression measures to be used as appropriate to prevent the migration of pollutants(SuDS Manual); • Regular cleaning of roads of any construction waste and dirt to be carried out (SuDS Manual); • A construction method statement to be submitted for approval by the responsibly (SuDS Manual); and • Defra / Environment Agency, October 2005. Flood Risk Assessment Guidance for New Development, Phase 2 FD2320/TR2.	To accord with guidance and best practice for constructional works.
Pollution Prevention Measures Refuelling of machinery would be undertaken within designated areas where spillages can be easily contained. Machinery would be routinely checked to ensure it is in good working condition. Any tanks and associated pipe work containing substances included in List 1 of the Groundwater Directive would be double skinned and be provided with intermediate leak detection equipment. The following specific mitigation measures for the protection of surface water during construction activates would be implemented: Management of construction works to comply with the necessary standards and consent conditions as identified by the EA and LLFA (Essex CC); A briefing for all staff highlighting the importance of water quality, the location of watercourses and pollution prevention included within the site induction; Areas with prevalent run-off to be identified and drainage actively managed, e.g. through bunding and / or temporary drainage; Areas at risk of spillage, such as vehicle maintenance areas and hazardous substance stores (including fuel, oils and chemicals) to be bunded and carefully sited to minimise the risk of hazardous substances entering the drainage system or the local watercourses. Additionally the bunded areas will have impermeable bases	To accord with guidance and best practice for constructional works.

Measures adopted as part of Thurrock Flexible Generation Plant	Justification
to limit the potential for migration of contaminants into groundwater following any leakage / spillage. Bunds used to store fuel, oil etc. to have a 110% capacity of the volume of fuel, oil etc. to be stored; Disturbance to areas close to watercourses reduced to the minimum necessary for the work; Excavated material to be placed in such a way as to avoid any disturbance of areas near to the banks of watercourses and any spillage into the watercourses; Construction materials to be managed in such a way as to effectively minimise the risk posed to the aquatic environment; Plant machinery and vehicles to be maintained in a good condition to reduce the risk of fuel leaks; Drainage works to be constructed to relevant statutory guidance and approved via the LLA prior to the commencement of construction; and Consultation with the EA to be ongoing throughout the construction period to promote best practice and to implement proposed mitigation measures.	
Operational practices within the proposed development to incorporate measures to prevent pollution and increased flood risk, to include emergency spill response procedures, clean up and remediation of contaminated water run-off.	To reduce the risk of surface water pollution based on guidance in e.g. Guidance on discharges to surface water and groundwater; Guidance on work on a river, flood defence or sea defence; and Best practice guidance EA PPG22: Pollution Prevention Guidelines – Dealing with Spills (Withdrawn use as guidelines).

2.8 Baseline environment

2.8.1 This section describes the hydrological resources and flood risk within the proposed development hydrology and flood risk study area.

2.9 Current baseline

2.9.1 The proposed development lies entirely within Thurrock BC, defined as industrial and agricultural in the vicinity of the proposed gas and battery facility and associated infrastructure, where much of the land is drained for agriculture.

2.9.2 The Main Development Site (Zone A) encompasses c.17 ha of agricultural land. Zone A is split into two distinct fields, North and South. The North field is defined to the north by an embankment railway line, and to the east, south and west by a field drainage network. A localised isolated field drain arches around the perimeter of the site directing runoff to a channel which flows in a general southerly direction on the western boundary of the site. Water within this channel is shown to discharge into EA designated main river West Tilbury Main c.500 m to the east of Zone A.

2.9.3 The southern field is bound on all side by field drainage with a gentle slope falling southwards.

2.9.4 The proposed development hydrology and flood risk study area runs through the Thames River Basin District and Mardyke operational catchment (as designated by the EA), which covers 44 km^2 from Basildon in the north to Dartford in the south. The river basin district is a rough split of rural and urban setting.

2.9.5 The closest EA designated Main River is West Tilbury Main located c.500 m east of the proposed development. West Tilbury Main is fed by a complex network of ordinary watercourses, drainage ditches and irrigation channels with many falling within the 1 km buffer of the proposed development and associated infrastructure. The channel flows in a general southerly direction towards the River Thames and discharges into the Thames c.1.5 km to the southeast of the proposed development.

2.9.6 The permanent access road and proposed pipeline route cross a number of designated Main Rivers and ordinary watercourses, including West Tilbury Drain.

2.9.7 Responsibility for ordinary watercourses which feed West Tilbury Drain fall under the jurisdiction of Essex CC acting as the Lead Local Flood Authority (LLFA) under the Water and Flood Management Act 2010 and Land Drainage Act 1991.

2.9.8 Further descriptions of the key hydrological and flood risk characteristics within the study areas are set out below.

Hydrological setting

2.9.9 The proposed development hydrology and flood risk study area includes a number of catchments associated with EA designated main rivers and local authority ordinary watercourses. Definitions of these hydrological features are provided below and their locations are identified below:

- Main rivers – watercourses where the EA has permissive powers over their management; and
- Ordinary watercourses – includes rivers, streams, ditches, drains which do not form part of a main river and are managed by Essex CC, as LLFA.

2.9.10 The main water feature in close proximity to the Site is the River Thames.

River Thames

2.9.11 The River Thames drains a catchment area of over 12,000 km^2, tidally influenced for about 90 km of its length all the way up to the town of Teddington in Middlesex.

2.9.12 The Thames has posed a risk of flooding to London for as long as the settlement has been there. As London has grown, the river has become more and more constrained by the urban development. The natural floodplain of the River Thames within London is now almost fully developed and is heavily dependent upon manmade flood defences to protect it against the risk of flooding.

2.9.13 The southern boundary of Thurrock Council administrative boundary sits immediately adjacent to the River Thames. Historically, the River Thames floodplain in this area was substantially wider than it is today and the dense urban area of Greater London heavily constrains the passage of the river corridor as it winds its way towards the sea.

2.9.14 The River Thames has been heavily modified over time with the growth of London, including the construction of raised defences along much of its length. As a result, the direct risk to the proposed development as a result of fluvial flooding alone from the River Thames is negligible. Ordnance Survey mapping indicates that the proposed development is surrounded by a number of unnamed drains, shallow ditches and water features. Surface water within the main body of the proposed development flows in a general southerly direction to drainage channels which defined field boundaries.

2.9.15 The majority of the proposed development drains into artificial channels which outfall into open land drains which border the proposed development, eventually discharging into the River Thames.

West Tilbury Main

2.9.16 West Tilbury Main flows in a general southerly direction c.500m to the east of the site at closest orientation.

2.9.17 The channel is feed by a number of irrigation and field drainage channels to the north of the proposed development, culverted beneath the embanked railway line. The channel is then fed further by a number of streams in close proximity to the proposed development before out falling into the River Thames at -1m AOD(N) at Bowaters Sluice. The EA notes that the sluice has suffered from subsidence and the centre of the pipe is lower than the ends. Investigation works are ongoing as part of the TEAM2100 programme.

Unnamed watercourses/stream

2.9.18 The proposed development hydrology and flood risk study area covers a number of existing field drains, ditches and irrigation channels. The majority of the surface water channels crossed are privately owned and maintained. Several channels fall under the jurisdiction of the LLFA or EA and therefore, fall under the requirements of the Environmental Permitting Regulations 2016. The crossing schedule (Table 2.9) identifies all crossings within the study area.

Fluvial and Tidal Flood Risk

2.9.19 The EA Flood Zone risk maps use four categories to describe the risk of flooding. These categories are set out in Table 2.7 below.

Table 2.7: EA Flood Zone definitions

Flood Zone	Flood Zone definition
Flood Zone 1	This land comprises land assessed as having a less than 1 in 1,000 annual probability of river or sea flooding (<0.1%).
Flood Zone 2	This zone comprises land assessed as having between a 1 in 100 and 1 in 1,000 annual probability of river flooding (1% - 0.1%), or between a 1 in 200 and 1 in 1,000 annual probability of sea flooding (0.5 – 0.1%) in any year.
Flood Zone 3(a)	This zone comprises land assessed as having a 1 in 100 or greater annual probability of river flooding (>1%), or a 1 in 200 or greater annual probability of flooding from the sea (>0.5%) in any year.
Flood Zone 3(b)	This zone comprises land where water has to flow or be stored in times of flood.

2.9.20 The EA flood zone mapping (Volume 6 Appendix Figure 15.2: Flood Zones/model data) indicates that the majority of the proposed development is situated within undefended Flood Zone 2 and 3a.

2.9.21 Volume 6, Appendix 15.2: Flood Zones/model data shows the EA flood zone risk map for the proposed development hydrology and flood risk study area. The maps are the first stage in identifying the flood risk for a particular location and depict the ‘no defence’ scenario. A description of other flood sources (i.e. groundwater, direct runoff from fields or overflowing sewers) is presented in Volume 6, Appendix 15.1: Flood Risk Assessment.

2.9.22 The flood maps (see Volume 6, Appendix 15.2: Flood Zones/model data) indicate that over 90% of the proposed development and flood risk study area is located within NPPF Undefended Flood Zone 2 and 3, medium to high risk of flooding.

2.9.23 EA flood risk from rivers or the sea maps indicate that the Zone A is at low risk of flooding, defined the area having between 0.1% and 1% chance of flooding. This takes into account the effect of any flood defences in the area.

Flood defences

2.9.24 The proposed development is located within an area benefiting from flood defences (Volume 6, Appendix 15.2: Flood Zones/model data). Areas benefiting from flood defences are defined as those areas which benefit from formal flood defences specifically in the event of flooding from rivers with a 1% (1 in 100) chance in any given year, or flooding from the sea with a 0.5% (1 in 200) chance in any given year.

2.9.25 EA records indicate that the standard of protection of the flood defences in close proximity to the Site is 0.1% Annual Event Probability (AEP); designed to defend London up to a 1 in 1,000 year tidal flood event. The crest height of the flood defence wall protecting the Site ranges from 6.66m AOD for the eastern defences to 6.86m AOD for the western defences. The defence includes a minimum freeboard of 630 mm and 120 mm above the 1 in 200 and 1 in 1,000 year tidal events respectively.

2.9.26 The current condition grade for defences in the area ranges from fair to very poor, with the potential for severe defects resulting in complete performance failure, although it is noted that the Environment Agency has a duty to maintain these defences. The potential consequences of flood defence breach and design resilience measures have been assessed in Volume 6, Appendix 15.1: Flood Risk Assessment.

2.9.27 Considerable investment has been made in the provision of the Thames Tidal Defences (TTD) to protect Greater London from tidal flooding. The tidal defences downstream of the Thames Barrier are maintained to a level of 7mAOD, which, at the current time, provides a Standard of Protection (SoP) equivalent to the 0.1% AEP (1 in 1,000 year) tidal event.

2.9.28 The South Essex CFMP indicates that the Scheme is located within an area designated as CFMP Policy Option 4 defined as… *"Areas of low, moderate or high flood risk where we [EA] are already managing the flood risk effectively but where we may need to take further actions to keep pace with climate change."*

Fluvial Flooding

2.9.29 EA data and previous flood reporting outlines that water levels in the Thames Estuary is dominated by tidal forces, with fluvial flows within the catchment generating a minimal impact. Extreme tidal water levels are far higher than those resulting from a major fluvial event, therefore fluvial flood risk is not considered any further.

Tidal Flooding

2.9.30 No above ground permanent assets or ground profiling is proposed within areas of designated floodplain (Flood Zone 3b) located to the north of the railway line, as shown on Tilbury BC SFRA Level 2 flood zones (2109) Volume, 6 Appendix: 15.2 Flood Zones/model data.

2.9.31 Taking into account the presence of tidal flood defence, which provide a SoP for events with up to a 1 in 1,000 year return period the tidal flood risk posed to the Site is considered to be low.

2.9.32 Flood data extracted from the Thurrock SFRA Breach Modelling Study (2011) and the publicly available Tilbury 2 ES Appendix 16.B Level 3 Flood Risk Assessment presents a number of model simulations including a tidal breach within flood defences in close proximity to the proposed development. The results are summarised in Table 2.8.

2.9.33 The breach location was informed by Thurrock Council SFRA (Volume 6, Appendix 15.2: Flood Zones/model data) and represents the 'worst-case' breach scenario for the proposed development.

Table 2.8: Summary of Breach model outputs (Tilbury2)

Run period	Flood Depth (m)	Hazard Rating	Time to Inundation (hours)
1 in 200 year (2017)	0.5 – 1.0	Significant	4 to 12
1 in 200 year (2117)	0.5 – 1.5	Significant	1 to 8
1 in 1,000 year (2017)	0.5 – 1.5	Significant	N/A
1 in 1,000 year (2117)	0.5 – 1.5	Significant	N/A

2.9.34 The proposed development would incorporate flood resilience and/or resistance measures to ensure critical assets are afforded an appropriate level of flood protection.

Existing Drainage

2.9.35 The proposed development crosses a number of existing field drains, ditches and irrigation channels. The majority of the surface water channels crossed are privately owned and maintained. Several channels fall under the jurisdiction of the Essex CC or EA and therefore, fall under the requirements of the LDA 1991.

2.9.36 Zone A of the Thurrock Flexible Generation Plant is utilised as agricultural land, which is drained by a complex network of buried land drains. Full details of these networks are presently unknown.

2.9.37 Schedule 25 of the Environmental Permitting (England and Wales) Regulations 2016 stipulate that consent is required from the relevant authority for any works within 8 m of a non-tidal water body (8 m starts from the toe of any flood defence of raised embankment) and 16 m of a tidal body.

2.9.38 Asset management plans indicate that the proposed development would cross Essex & Suffolk Water owned and maintained infrastructure at a number of locations.

2.9.39 Drainage Byelaws indicate that;

"no person shall, without the previous consent of the LLFA, take any action, or knowingly permit or aid or abet any person to take any action to stop up any watercourse or divert or impede or alter the level of or direction of the flow of water in, into or out of any watercourse".

2.9.40 The Byelaws also indicate that no obstructions should be placed within 8 m of the edge of a watercourse. Consent will be sought from the LLFA and/or EA for any obstruction which may need to be placed within the 8 m restriction of a watercourse.

2.9.41 Gas pipeline construction works will cross watercourses. Table 2.9 lists the crossings and the watercourse type. No surface water flow data has been provided by consultees for rivers and streams in the study area to date. The project description (Volume 2, Chapter 2: Project Description) states that main rivers crossed by the pipeline i.e. those with significant flow rates may be crossed either via trenchless techniques or open cut methods dependant on the situation.

2.9.42 Watercourse crossings will be designed in line with the requirements of the EA and LLFA. In accordance with the Environmental Permitting (England and Wales) Regulations 2016, no works within 8 m from the top of the bank or toe of a flood defence will be undertaken on any watercourse without prior consent from the relevant stakeholder (i.e. the EA or LLFA) and subject to requirements or protective provisions within the DCO.

2.9.43 As presented within Table 2.9, open cut trenchless techniques will be used to cross the majority of surface water locations. Designated Main Rivers would be assessed individually and crossed by either open cut or trenchless techniques as appropriate to the situation.

Table 2.9:Summary of surface water crossing locations and techniques

Crossing Location	Grid Reference		Main/ Ordinary watercourse	Operator (Consenting Body)
	Eastings	Northings		
1	566199	176307	Ordinary	LLFA
2	566109	176802	Ordinary	LLFA
3	566297	176677	Ordinary	LLFA
4	566408	176642	Ordinary	LLFA
5	566506	176671	Ordinary	LLFA
6	566531	177142	Ordinary	LLFA
7	566801	177352	Ordinary	LLFA
8	566999	177397	Main	EA
9	567049	177555	Ordinary	LLFA
10	566052	176974	Ordinary	LLFA
11	565392	176437	Main	EA
12	566177	177369	Ordinary	LLFA
13	565693	177641	Ordinary	LLFA
14	565145	177644	Ordinary	LLFA
15	564790	177728	Ordinary	LLFA
16	564776	177730	Ordinary	LLFA
17	564466	177798	Ordinary	LLFA

Surface water flood risk

2.9.44 EA surface water mapping indicates that Zone A, which encompasses the Thurrock Flexible Generation Plant gas engines, battery facility and associated infrastructure, is shown to be on the whole at very low risk from surface water flooding. There are a number of isolated areas within Zone A which are at low to medium risk of surface water flooding. Given the localised natures of the flood risk, these areas have been assessed to be associated with low lying areas of the site.

Surface water abstractions

2.9.45 The abstraction licence records taken from Groundsure data records indicate that there are no surface water abstractions within the hydrology and flood risk study area.

Private water supply

2.9.46 Groundsure records identify a number of groundwater abstractions within the hydrology and flood risk study area. Private water abstractions in the hydrology and flood risk study area are typically from groundwater resources and are identified in Volume 6, Appendix: 15.3: Surface Water Abstraction Licences, Discharge Consents and Pollution Incidents.

Discharge consents

2.9.47 Discharges of liquid effluent or waste water into surface waters are regulated by the EA using discharge consents and environmental permits. A review of Groundsure data identified approximately one active consented discharge to surface waters within the proposed development hydrology and flood risk study area. The licence is for the discharge of treated sewage/effluent from Tilbury 275kV Substation 14 west of the proposed development.

2.9.48 Although the volume and parameters of the discharges are regulated (via the discharge consents and permits), the quality of the receiving surface water may potentially be affected.

2.9.49 The details and locations of the discharge consents and permits are provided within Volume 6, Appendix 15.3: Surface Water Abstraction Licences, Discharge Consents and Pollution Incidents

Pollution incidents

2.9.50 Pollution incident mapping has been used to identify if the quality of watercourses within the proposed development hydrology and flood risk study area may have been affected by pollution. A review of Groundsure data identified approximately 15 pollution incidents in the hydrology and flood risk study area, 13of the incidents were reported as category 4 (no impact) with 4 recorded as a category 3 (minor), see Volume 6, Appendix 15.3: Surface Water Abstraction Licences, Discharge Consents and Pollution Incidents. This is defined by the EA, under the common incident classification scheme, as a substantiated incident with no impact to water quality (Further details regarding the common incident classification scheme can be found at www.gov.uk/government/organisations/environment-agency).

Surface water quality

2.9.51 Table 2.10 lists the watercourses and associated WFD classification grade within the hydrology and flood risk study area. The objective dates in Table 2.10 are explained as follows:

- 2015: status matches the predicted future status or potential. The main environmental objective is to prevent deterioration in status between 2015 and 2021.
- 2021: there is confidence that as a result of the programme of measures, the water body will improve from its 2015 status to achieve the predicted future status by 2021. The environmental objective is for water bodies and elements to make an improvement from the reported 2015 status to achieve the predicted future status by 2021.
- 2027: the deadline for achieving the status or potential has been extended to 2027. For a 2027 date, there is currently not enough confidence that the improvement in status can be achieved by an earlier date.

Table 2.10: WFD water quality data.

Name of Catchment	Waterbody Specific	Waterbodies present within the proposed development hydrology and flood risk study area	Objective Status (2015)	Current Overall Status (2016) Objective
Essex South	Mardyke	West Tilbury Main.	Moderate	Moderate (Ecological Moderate, Chemical Good).
Thames	Thames Middle	N/A	Moderate	Moderate (Ecological Moderate, Chemical Fail).

2.9.52 In summary, the records show that the watercourses within the hydrology and flood risk study area have a WFD status of Moderate. However, all lower status waterbodies have objectives to improve, with most aiming to achieve Moderate to Good status by 2027, and many of the measures needed to achieve the improvement in status are either already in place or will be in place by 2021.

2.9.53 A full description of the WFD classification process and associated definitions are available at: https://www.gov.uk/government/consultations/river-basin-management-planning-ministerial-guidance-and-standards.

2.10 Future baseline

2.10.1 The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 requires that "an outline of the likely evolution thereof without implementation of the development as far as natural changes from the baseline scenario can be assessed with reasonable effort on the basis of the availability of environmental information and scientific knowledge" is included within the Environmental Statement.

2.10.2 In the event that the proposed development does not come forward, an assessment of the future baseline conditions has been carried out and is described within this section.

2.10.3 The main impact on the hydrology and flood risk future baseline is associated with the potential effects of climate change, which may impact on future peak river flow rates, rainfall intensity and sea levels. A summary of potential climate change allowances as outlined by the EA (February 2016, updated February 2017) is presented below. Further details of climate change allowances can be found at https://www.gov.uk/guidance/flood-risk-assessments-climate-change-allowances.

Climate change

2.10.4 The Met Office UK Carbon Projections ('UKCP09') dataset[1] provides probabilistic projections of change in climatic parameters over time for 25 km grid squares across the UK. Projected changes during low, medium and high future global greenhouse gas emissions scenarios have been reviewed for the period from 2020 up to 2069, encompassing the potential six year construction and 35 year operational periods of the proposed development.

2.10.5 The NPPF sets out how the planning system should help minimise vulnerability and provide resilience to the impacts of climate change. This includes demonstrating how flood risk will be managed now and over the development's lifetime, taking climate change into account. In response to this, EA guidance issued in February 2016, requires that FRAs and strategic FRAs assess both the central and upper end allowances (see Table 2.11 to understand the potential range of impacts associated with climate change).

2.10.6 The range of allowances (Table 2.11) is based on percentiles. The 50th percentile is the point at which half of the possible scenarios for peak rainfall intensity fall below it and half fall above it. The:

- central allowance is based on the 50th percentile; and
- upper end is based on the 90th percentile.

2.10.7 As an example, with a central allowance of 20%, scientific evidence suggests that it is just as likely that the increase in peak rainfall intensity will be more than 20% as less than 20%.

Table 2.11:Peak rainfall intensity allowance in small and urban catchments (use 1961 to 1990 baseline1).

Applies across all of England	Total potential change (increase) anticipated for 2010 to 2039	Total potential change anticipated for 2040 to 2059	Total potential change anticipated for 2060 to 2115
Upper End	10%	20%	40%
Central	5%	10%	20%

2.10.8 Guidance is also provided on increases in river flows as a consequence of climate change. The guidance provides central, upper central and higher central climate allowance bands which should be utilised within the assessment of flood risk, including the flood risk vulnerability classification, for sites in Flood Zones 2, 3a and 3b (at flood risk) (see Table 2.12).

Table 2.12: Peak river flow allowance by river basin district (use 1961 to 1990).

River basin district	Allowance category	Total potential change anticipated for the '2020s' (2015 to 2039)	Total potential change anticipated for the '2050s' (2040 to 2069)	Total potential change anticipated for the '2080s' (2070 to 2115)
Thames	Upper end	25%	35%	70%
	Higher central	15%	25%	35%
	Central	10%	15%	25%

2.10.9 Table 2.13 summaries potential se level rise over various epochs (periods of time) for the east, east midlands, London and the south east area as defined by the EA Sea Level Rise Boundaries maps (https://www.gov.uk/government/publications/flood-risk-assessments-river-basin-district-maps)

[1] CP09 is presently being updated to CP18, expected to be published in November 2018 (Met Office, 2018). CP09 remains the most up-to-date available data and remains an appropriate tool for adaptation planning (Met Office, 2017).

Table 2.13: Sea level allowance for each epoch in millimetres (mm) per year with cumulative sea level rise for each epoch in brackets (use 1990 baseline).

River basin district	**1990 to 2025**	**2026 to 2055**	**2056 to 2085**	**2086 to 2115**	**Cumulative rise 1990 to 2115**
East, East Midlands, London, south east.	4 (140 mm)	8.5 (255 mm)	12 (360 mm)	15 (450 mm)	1.21 m

3. Assessment of Effects

3.1 Construction phase

3.1.1 The impacts of construction of Thurrock Flexible Generation Plant have been assessed on hydrology and flood risk. The potential environmental impacts arising from the construction of the proposed development are listed in Table 2.5 along with the maximum design scenario against which each construction phase impact has been assessed.

3.1.2 A description of the potential effect on hydrology and flood risk receptors caused by each identified impact is given below.

The construction of permanent assets may lead to increased flood risk.

Magnitude of impact

3.1.3 The proposed development is situated within a mainly industrial and rural area, with limited residential properties within the surrounding area. The sensitivity of the receptor is therefore, considered to be medium.

3.1.4 The proposed development has been assessed as being at high risk of flooding from tidal sources in the event of a breach in defences. The proposed development areas are located on land presently defined as 'greenfield' with no hard standing. The proposed gas engine and battery facilities including the permanent access road has been assessed as at risk of flooding from tidal sources. A worst case 100% increase in low permeable surfacing as a consequence of the proposed development gas and battery facility would directly impact local flood risk.

3.1.5 The increase in low permeable area within the LoD would increase surface water runoff rates, in turn increasing channel flows and as a consequence flood risk. Construction of the proposed development gas and battery facility would require a degree of ground re-profiling and foundations excavation.

3.1.6 The excavation of the foundations and levelling associated with the proposed development is likely to change the natural hydrological characteristics of the site. The combination of construction works and the increase in low permeable surfacing could increase the surface water runoff rates, in turn increasing the flood risk to surrounding receptors.

3.1.7 The impacts on flood risk from the temporary change in runoff are only likely to affect the surrounding local receptors and, assuming that designed-in and construction measures (see Table 2.6) are implemented, there is unlikely to be any observable degradation in flood risk. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

3.1.8 The proposed development is situated within a mainly industrial and rural setting, with limited residential properties within the surrounding area. Due to the presence of substantial tidal flood defences and limited residential properties within the study area, the land adjoining the hydrology and flood risk study area is of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low.**

Significance of effect

3.1.9 The sensitivity for the rest of the study area is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms.

Temporary construction may lead to increased flood risk

Magnitude of impact

3.1.10 A temporary construction compound will be required to house construction vehicles, workers and associated equipment. The temporary compound will be constructed using permeable material underlain by a permeable geotextile membrane. Surface water runoff will be intercepted via a temporary drainage system. The system will manage surface water runoff from the construction compound in terms of both flow rate and water quality, in accordance with local policies and relevant permits.

3.1.11 West Tilbury Drain and a number of smaller drains will be crossed by the access road.

3.1.12 In other parts of the study area, impacts on flood risk would arise from any temporary change in runoff over the areas affected during construction, such as construction compounds, haul road, construction accesses, as well as the cable and pipeline corridors. Deigned-in measures (as set out in Table 2.6) will be implemented to ensure the risk of flooding is not increased (e.g. permeable gravel overlying a permeable geotextile membrane of an appropriate standard for construction compounds, haul road and construction accesses and drainage features to maintain land drainage flow). In terms of crossings, all major crossings (such as major roads, rivers and rail crossings) would be undertaken using Trenchless techniques (full details provided within the Volume 2, Chapter 2: Project Description). An outline method statement for the proposed crossing methodologies is included in the CoCP (Volume 5, Appendix 2.2: Code of Construction Practice). This method statement will be developed further (in discussion with the EA) during the detailed design stage.

3.1.13 The impacts on flood risk from the temporary change in runoff are only likely to affect the surrounding local receptors and, assuming that designed-in and construction measures (see Table 2.6) are implemented, there is unlikely to be any observable degradation in flood risk. The magnitude is therefore, considered to be **negligible**.

Sensitivity of the receptor

3.1.14 The proposed development is situated within a mainly industrial and rural setting, with limited residential properties within the surrounding area. Due to the presence of substantial tidal flood defences and limited residential properties within the study area, the land adjoining the proposed development hydrology and flood risk study area is of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of effect

3.1.15 The sensitivity for the rest of the Thurrock Flexible Generation Plant hydrology and flood risk study area is considered to be low and the magnitude of the impact is deemed to be negligible. The effect will, therefore, be of **negligible significance**, which is not significant in EIA terms

The impacts of trenchless construction techniques may affect major surface watercourses

Magnitude of impact

3.1.16 All major watercourses will be crossed using an appropriate techniques in consultation with regulators (see Volume 2, Chapter 2: Project Description). The impacts on major watercourses from construction activities involving the use of trenchless techniques and associated machinery could lead to an increase in turbid runoff, bentonite breakouts during drilling and spillages/leaks of fuel, oil etc. affecting nearby watercourses. There is the potential for this to impact on water quality and therefore cause a reduction in the WFD classification.

3.1.17 Similarly, the Thurrock Flexible Generation Plant cable and pipeline corridor itself could act as a drainage channel, leading to runoff from construction areas affecting nearby watercourses. However, the construction process will include measures to intercept runoff and ensure that discharges are controlled in quality and volume causing no degradation in WFD classification. This would include the use of settling tanks or ponds to remove sediment, temporary interceptors and a hydraulic brake, as set out in Table 2.6. The impact is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be **negligible.**

Sensitivity of receptor

3.1.18 As noted in 2.1.3 taking a precautionary approach in assuming all watercourses have achieved ‘Good’ status at the time when construction begins, the surface watercourses within the Thurrock Flexible Generation Plant hydrology and flood risk study area have been assessed with a WFD status of ‘Good’. The watercourses crossed via trenchless techniques are therefore, considered to be highly vulnerable in relation to WFD classification status, but of moderate recoverability and moderate value in relation to the local economy. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

3.1.19 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude of the impact is deemed to be **negligible**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Construction may cause risk of leaks and spills to surface watercourses

Magnitude of impact

3.1.20 The construction of the proposed gas engine and battery facility will involve the use of chemicals, oils and greases and therefore, there is the potential for spillages to occur which may affect the water quality of ordinary watercourses.

3.1.21 With the incorporation of mitigation measures outlined in Table 2.6, the impact to ordinary watercourses are predicted to be of local spatial extent only impacting on surrounding receptors, short term duration, intermittent occurrence and reversible. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

3.1.22 The ordinary watercourses in the vicinity of the proposed gas engine and battery facility are considered to be of high vulnerability, moderate recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

3.1.23 Overall, the sensitivity of the receptors is considered to be **high** and the magnitude of the impact is deemed to be **negligible**. The effect on main and ordinary watercourses will therefore be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

3.1.24 No hydrology and flood risk monitoring to test the predictions made within the operation and maintenance phase impact assessment is considered necessary.

The impacts of open cut, temporary bridging and culverts may affect surface watercourses.

Magnitude of impact

3.1.25 A number of minor watercourses and drains may be crossed by the proposed development, within which would be located up to one temporary haul road. Associated construction could lead to damage to the banks along the watercourses, an increase in turbid runoff, spillages/leaks of fuel, oil etc. and an alteration in surface water flow pathways that could affect nearby watercourses. Similarly, the proposed development cable and pipeline corridor itself could act as a drainage channel, leading to runoff from construction affecting nearby watercourses.

3.1.26 An outline method statement for crossing watercourses and other mitigation measures to reduce and manage runoff in terms of volume and quality have been outlined in Table 2.6 and the Outline CoCP and will be developed further in discussion with the EA and Essex CC during the detailed design stage. These measures would include the use of settling tanks or ponds to remove sediment and the installation of pre-installed culvert (flume) pipes in the watercourse under the construction accesses and haul road. The pipe would be of suitable size to accommodate the water volumes and flows, or temporary bridging may be installed. The accesses and haul roads would be removed at the end of the construction programme and measures would be implemented to ensure that watercourses, including their banks, are reinstated to their previous condition where possible.

3.1.27 The impact is predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

3.1.28 Minor watercourses' WFD status is determined by the WFD classifications of surrounding main waterbodies. Taking this into consideration, the minor watercourses are considered to be of high vulnerability, moderate recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

3.1.29 Overall, the sensitivity of the setting is considered to be high and the magnitude of the impacts is deemed to be negligible. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms.

The construction of permanent assets may affect field drainage and irrigation.

Magnitude of impact

3.1.30 The impact on drainage pipeline infrastructure from open cut and trenchless techniques (where required) during the construction phase could temporarily disrupt local drainage infrastructure, impacting on water quality, potential flow rates and local water supply networks.

3.1.31 The routing and refinement of the proposed development has taken into account the location of major services utilities (see Volume 2, Chapter 3: Consideration of Alternatives), however the presence of local drainage (e.g. soakaways) cannot be discounted as it is not always mapped by regulators.

3.1.32 Discussions with utility services and other service companies will be undertaken at the detailed design stage to confirm the location of local services. Micro-routing or appropriate construction techniques will be employed where required.

3.1.33 Any impacts of construction which affect drainage supply infrastructure are likely to cause temporary disruption of water supply to residents/businesses in the local surrounding area. The impact would be of limited temporal extent and short-term duration. It is predicted that any impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

3.1.34 Drainage pipeline infrastructure comprises water supply pipelines operated by Essex & Suffolk Water, which are considered to have a moderate value and contributes to the local and regional economy. It is vulnerable to the construction impacts of the proposed development and its recoverability may be costly. The sensitivity of the receptor is therefore considered to be **high**.

Significance of the effect

3.1.35 Overall, the sensitivity of the setting is considered to be **high** and the magnitude of the impact is deemed to be **minor**. The effect will, therefore, be of **minor** adverse significance, which is not significant in EIA terms. This is due to the short-term duration of the impact that receptors in the local area (i.e. local residents and businesses) would be affected with regards to water supply.

Temporary construction may affect field drainage and irrigation.

Magnitude of impact

3.1.36 The impact on field drainage and irrigation from open cut techniques during the construction phase could temporarily affect surface water flow pathways, impacting on water quality and potential flow rates.

3.1.37 The removal of field drains within the proposed development may cause a backup on surrounding field drains, in turn increasing the flood risk to the site and surrounding receptors. Measures to manage surface water flows include the restoration field drainage following the installation of the cable and pipeline corridor, and techniques to disrupt surface water runoff along the corridor. These measures are included in Table 2.6.

3.1.38 With the incorporation of appropriate construction mitigation techniques the impact is predicted to be of local spatial extent with a minor shift away from existing hydrological environment of local receptors, short term duration, intermittent occurrence and reversible with field drains to be re-established where appropriate. It is predicted that any impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

3.1.39 Field drains are considered to be of moderate vulnerability along the cable and pipeline corridor, moderate to high recoverability and minor value. The sensitivity of the receptor is therefore considered to be **medium**.

Significance of the effect

3.1.40 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of impact is deemed to be **minor**. The effect will therefore, be of **minor** adverse significance, which is not significant in EIA terms.

Future monitoring

3.1.41 No hydrology and flood risk monitoring to test the predictions made within the construction phase impact assessment is considered necessary.

3.2 Operational and maintenance phase

3.2.1 The impacts of the proposed development's operation and maintenance phase have been assessed on hydrology and flood risk conditions. The potential environmental impacts arising from the operation and maintenance of Thurrock Flexible Generation Plant are listed in Table 2.5 along with the maximum design scenario against which each operation and maintenance phase impact has been assessed.

3.2.2 A description of the potential effect on hydrology and flood risk receptors caused by each identified impact is given below.

Impacts of operation may lead to increased flood risk.

Magnitude of impact

3.2.3 Following construction and during the operation phase, the proposed gas engine and battery facility would result in an increase in low-permeable surface area, causing an increase to surface water run-off rates. However, with the incorporation of design mitigation (set out in Table 2.6 of this chapter) runoff will be intercepted and discharged at an agreed rate.

3.2.4 The proposed gas engine and battery facility has been subject to an FRA (Volume 6, Appendix 15.1: Flood Risk Assessment) in order to meet the requirements of planning policy and best practice. The proposed gas engine and battery facility would be designed to ensure no increase in the greenfield rate of runoff. With the incorporation of mitigation measures outlined in Table 2.6 and the outline drainage concept within the FRA, it has been determined that there will be no change from the baseline hydrological environment. The magnitude is therefore, considered to be **negligible**.

3.2.5 As the Thurrock Flexible Generation Plant cable and pipeline corridor will be underground and will incorporate drainage either side of the cable corridor to ensure existing land drainage flow is maintained, it is determined that there will be no increase in flood risk due to operation and maintenance of the cable or pipeline.

Sensitivity of receptor

3.2.6 The proposed development is located within NPPF and Planning Practice Guidance ID7 Flood Zone 2 and 3, defined as at medium to high risk of fluvial / tidal flooding.

3.2.7 The proposed development is situated within a mainly rural area, with limited residential properties within the surrounding area. The sensitivity of the receptor is therefore, considered to be **medium**.

3.2.8 The main development site is located within Flood Zone 3, but benefiting from flood defences with in excess of a 1 in 1,000 year SoP and therefore at low risk of flooding. The land adjoining the proposed development are of low flood risk vulnerability within the rural landscape, high recoverability and low value with limited residential property in the vicinity. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of the effect

3.2.9 Overall, the sensitivity of the receptor is considered to be **medium** and the magnitude of the impact is deemed to be **negligible** due to the incorporation of mitigation measures and an outline drainage strategy. The effect will therefore, be of **negligible** significance, which is not significant in EIA terms.

The impact of flexible generation plant operation and maintenance may affect main or ordinary surface watercourses

Magnitude of impact

3.2.10 The operation of the proposed gas engine and battery facility will involve routine maintenance. Maintenance may involve the use of chemicals, oils and greases and therefore, there is the potential for spillages to occur which may affect the water quality of ordinary watercourses.

3.2.11 With the incorporation of mitigation measures outlined in Table 2.6, the impact to ordinary watercourses are predicted to be of local spatial extent only impacting on surrounding receptors, short term duration, intermittent occurrence and reversible. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

3.2.12 The ordinary watercourses in the vicinity of the proposed gas engine and battery facility are considered to be of high vulnerability, moderate recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

3.2.13 Overall, the sensitivity of the receptors is considered to be **high** and the magnitude of the impact is deemed to be **negligible**. The effect on main and ordinary watercourses will therefore be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

3.2.14 No hydrology and flood risk monitoring to test the predictions made within the operation and maintenance phase impact assessment is considered necessary.

The impact of pipeline maintenance may affect main or ordinary surface watercourses

Magnitude of impact

3.2.15 The operation of the gas pipeline will involve routine maintenance. Maintenance may involve the use of chemicals, oils and greases and therefore, there is the potential for spillages to occur which may affect the water quality of ordinary watercourses.

3.2.16 With the incorporation of mitigation measures outlined in Table 2.6, the impact to ordinary watercourses are predicted to be of local spatial extent only impacting on surrounding receptors, short term duration, intermittent occurrence and reversible. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

3.2.17 The ordinary watercourses in the vicinity of the gas pipeline are considered to be of high vulnerability, moderate recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

3.2.18 Overall, the sensitivity of the receptors is considered to be **high** and the magnitude of the impact is deemed to be **negligible**. The effect on main and ordinary watercourses will therefore be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

3.2.19 No hydrology and flood risk monitoring to test the predictions made within the operation and maintenance phase impact assessment is considered necessary.

3.3 Decommissioning phase

3.3.1 The impacts of decommissioning of Thurrock Flexible Generation Plant have been assessed on hydrology and flood risk receptors. The potential impacts arising from the decommissioning exercise are listed in Table 2.5 along with the maximum design scenario against which each decommissioning phase impact has been assessed.

3.3.2 A description of the potential effects on hydrology and flood risk receptors caused by each identified impact is given below.

The impacts of decommissioning may affect temporary flood risk.

Magnitude of impact

3.3.3 The decommissioning of the Thurrock Flexible Generation Plant will involve the demolition of buildings as well as removal of foundations and the attenuation storage provided during construction and operation. The natural attenuation of the sites will be restored over time.

3.3.4 The impacts of decommissioning of the Thurrock Flexible Generation Plant components will be reduced through the incorporation of management measures (outlined in Table 2.6), including emergency spill response procedures including clean up and remediation of contaminated soils, appropriate water proofing of exposed cable ducts and the continued maintenance of on-site drainage and therefore are predicted to be of local spatial extent, short term duration, intermittent and high reversibility indicating that any impacts on decommissioning which affect flood risk vulnerability are likely to only affect the surrounding local receptors. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

3.3.5 Thurrock Flexible Generation Plant is situated within a mainly industrial and rural area, with limited residential properties within the surrounding area and protected by tidal flood defences with in excess of a 1 in 1,000 year SoP. Land is assessed a low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of the effect

3.3.6 Overall the magnitude of impact is considered **minor** and the sensitivity of receptors is considered **low**. The effect of decommissioning on flood risk will therefore be of **minor adverse** significance, which is not significant in EIA terms.

The impacts of decommissioning may affect main surface watercourses

3.3.7 The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore of minor adverse significance, which is not significant in EIA terms (see Section 2.4).

Future monitoring

3.3.8 No hydrology and flood risk monitoring to test the predictions made within the decommissioning phase impact assessment is considered necessary.

The impacts of decommissioning may affect ordinary watercourses

3.3.9 The effects of decommissioning activities are expected to be the same or similar to the effects from construction. The significance of effect is therefore of minor adverse significance, which is not significant in EIA terms (see section 2.4).

Future monitoring

3.3.10 No hydrology and flood risk monitoring to test the predictions made within the decommissioning phase impact assessment is considered necessary.

3.4 Transboundary effects

3.4.1 A screening of transboundary impacts has been carried out and is presented in Volume 5, Appendix 5.2: Transboundary Impacts Screening Note. This screening exercise identified that there was no potential for significant transboundary effects with regard to hydrology and flood risk from Thurrock Flexible Generation Plant upon the interests of other EEA States.

3.5 Inter-related effects

3.5.1 Inter-relationships are considered to be the impacts and associated effects of different aspects of the construction, operation or decommissioning of Thurrock Flexible Generation Plant on the same receptor. The following assessments have been made and a description of the likely inter-related effects on hydrology and flood risk is provided in Volume 4, Chapter 17: Summary of Inter-Related Effects.

Project lifetime effects

3.5.2 Assessment of the potential for effects that occur during more than one stage of the development's lifetime (construction, operation or decommissioning) to interact such that they may create a more significant effect on a receptor than when assessed in isolation for each stage

Receptor-led effects

3.5.3 Assessment of the potential for effects via multiple environmental or social pathways to interact, spatially and temporally, to create a greater inter-related effect on a receptor than is predicted for each pathway (in its respective topic chapter) individually.

4. Cumulative Effects Assessment

4.1 Introduction

4.1.1 The process of identifying other consented or proposed developments and screening to create a shortlist of those having potential for cumulative effects with Thurrock Flexible Generation Plant is described in Volume 2, Chapter 4: Environmental Impact Assessment Methodology and Volume 5, Appendix 4.1: Cumulative Developments and Screening. Appendix 4.1 lists the shortlisted cumulative developments and the tier they have been assigned (guiding the weight that the decision-maker may place on each development's likelihood of being realised) in accordance with PINS Guidance Note 17.

4.1.2 Cumulative developments shortlisted are those that have potential to contribute impacts affecting receptors also affected by the proposed development (for example, contributing significant additional traffic to the same road links), or that introduce additional sensitive receptors (for example, new residences or a school closer to the proposed development than at present), or both.

4.1.3 The cumulative effects assessment for hydrology and flood risk has been undertaken in two stages, reported as follows. In the first stage, cumulative effects of the proposed development have been considered in an overall scenario where the land surrounding the proposed development could be largely transformed by three adjacent NSIP developments and the possible expansion of nearby residential and employment uses to the east. This is referred to as the 'max development' scenario.

4.1.4 In the second stage, cumulative effects with specific individual development projects have been assessed where these would affect a particular environmental pathway or receptor for hydrology and flood risk. Only shortlisted developments with potential cumulative effects specific to hydrology and flood risk are assessed in this chapter.

4.2 Cumulative effects in 'max development' scenario

4.2.1 Three NSIP developments are proposed on land adjacent to and in some cases overlapping with the Thurrock Flexible Generation Plant application boundary. The Tilbury2 port expansion adjacent to the west is at examination stage (Tier 1). The Tilbury Energy Centre (TEC) power station to the south and Lower Thames Crossing (LTC) motorway and link road to the east and north are both at EIA scoping stage (Tier 2).

4.2.2 Outline planning permission has been granted for several residential and mixed-use developments expanding Linford and East Tilbury in the direction of Thurrock Flexible Generation Plant (Tier 1).

4.2.3 Should all of these developments proceed, Thurrock Flexible Generation Plant's main development site would be closely surrounded on all sides by the temporary or permanent works areas of the NSIPs. Its gas connection point to Feeder 18 could be adjacent to the expanded outskirts of East Tilbury and also potentially to the TEC gas connection, and the pipeline route could cross land to be developed for the LTC.

4.2.4 The Thurrock Core Strategy (2015) allocates land for possible strategic employment provision and sustainable economic growth to the west of the proposed development and to the east where there is existing industry at East Tilbury. Thurrock Borough Council is drafting a new Local Plan to replace the Core Strategy. The Issues and Options (Stage 2) consultation document proposals map of July 2018 (withdrawn temporarily due to recent NPPF changes) suggested possible zones for residential and commercial/employment development in areas east of the proposed development, where this would be facilitated by the Lower Thames Crossing project. However, these Tier 3 development possibilities are afforded only limited weight due to the early stage of this local plan development process.

4.2.5 In the 'max development' scenario set out in paragraphs 4.2.1 to 4.2.3 above, the hydrology and flood risk cumulative effects of Thurrock Flexible Generation Plant would be are predicted to result in effects of negligible or minor adverse significance.

4.2.6 It is assumed that each development would be constructed in line with the requirements of the NPPF and PPG ID7 – Flood Risk and Coastal Change, (and where relevant the NPSs) requiring that new developments attenuate surface water runoff to where practicable to the greenfield runoff rate through a surface water management plan and/or drainage scheme. The impacts

4.3 Cumulative effects with specific developments

Construction phase

Impacts of construction may lead to increased flood risk.

Magnitude of impact

4.3.1 A review of the schemes against the EA Flood Zone Maps indicate that the majority of the schemes are either wholly or partly located within an area defined as Flood Zone 3, and therefore at higher risk of flooding. However, as part of their planning applications, all cumulative schemes within the 250 m hydrology and flood risk CEA study area would require a surface water drainage scheme/assessment to be conducted for the development in line with the NPSs (where relevant), the NPPF and PPG (ID7). Therefore, in line with national and local planning policy the developments will not increase flood risk to the site or the surrounding areas. Consequently, it is unlikely that these schemes would cause cumulative flood risk impacts on the construction of the Thurrock Flexible Generation Plant and/or the surrounding area.

4.3.2 The impact is predicted to be of local spatial extent and of short term duration during the construction period. It is also considered that the impact will be intermittent during the construction period and will be of high reversibility. All developments require a drainage strategy to be presented. It is predicted that the impact will affect surrounding local receptors directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

4.3.3 The land within the Thurrock Flexible Generation Plant hydrology and flood risk CEA study area crosses the LTC corridor primarily within farmland and therefore is of low vulnerability, high recoverability and low value. The sensitivity of the receptor is therefore, considered to be **low**.

Significance of Effect

4.3.4 Overall, the sensitivity of the surrounding areas is considered to be **low** and the magnitude of the impact is deemed to be **minor**. The significance of the effect on flood risk based on the scenario which includes measures adopted in Table 2.6 and those incorporated within the cumulative assessed projects under the NPPF and PPG is deemed to be **negligible** significance, which is not significant in EIA terms.

4.3.5 Overall, it is predicted that the sensitivity of the receptor is considered to be **no change** and the magnitude is deemed to be **low**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

The impacts of open cut may affect main surface watercourses.

4.3.6 As a scheme to construct/install pipelines and cables, TEC may use open cut and/or trenchless techniques to cross major surface watercourses. The scheme is in close proximity to crossing points within the Thurrock Flexible Generation Plant hydrology and flood risk study area and therefore has the potential to cause cumulative effects.

Magnitude of impact

4.3.7 The impact to main watercourses takes into account the WFD classification of surrounding watercourses and the mitigation measures presented within Table 2.6 and measures adopted within the TEC project. As a minimum requirement, TEC will require a surface water management strategy and drainage scheme to limit any dirty surface water runoff from the onshore scheme to surrounding watercourses. Therefore, the magnitude of impacts on major surface watercourses are predicted to be of local spatial extent, short term duration, intermittent occurrence and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

4.3.8 The sensitivity of watercourses is dependent on the nature of the specific watercourse. WFD classification obtained from the EA website and mapping for water quality (Table 2.10) shows that the main rivers ‘crossed’ are considered to be of medium sensitivity based on water quality data supplied by the EA. The watercourses crossed via open and/or trenchless techniques are considered to be highly vulnerable, but of moderate to high recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of Effect

4.3.9 Overall, the sensitivity of major watercourses/rivers is considered to be **high** and the magnitude of the impact is deemed to be **negligible**. The effect which includes the integration of measures adopted in Table 2.6 will, therefore be of **minor adverse** significance, which is not significant in EIA terms.

The impacts of open cut, temporary bridging and culverts may affect surface watercourses.

4.3.10 TEC, Tilbury 2 and LTC may also use open cut techniques to cross surface watercourses. The scheme is in close proximity to crossing points within Thurrock Flexible Generation Plant hydrology and flood risk study area and therefore has the potential to cause cumulative effects.

Magnitude of impact

4.3.11 The impact is predicted to be of local spatial extent, short to medium term duration, intermittent occurrence and high reversibility. The magnitude is therefore, considered to be **minor**.

4.3.12 The impact to surface watercourses from open cut techniques takes into account the WFD classification of surrounding main watercourses and the mitigation measures presented Table 2.6 and measures adopted within the TEC, Tilbury 2 and LTC projects. A cumulative impact caused by open cut techniques would only occur where excavations of a specific watercourse coincide. All projects as a minimum requirement will require a surface water management strategy and drainage scheme to limit any dirty surface water runoff from the scheme to surrounding watercourses. Thurrock Flexible Generation Plant crossing schedule will be designed so no overlap (in terms of construction duration at specific watercourses) with other corridor developments will occur. Therefore, the magnitude of impacts on major surface watercourses are predicted to be of local spatial extent, short to medium term duration, intermittent occurrence and high reversibility. It is predicted that the impact will affect the receptor indirectly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

4.3.13 Ordinary watercourses are generally considered to be of low to medium sensitivity based on EA WFD classifications. The ordinary watercourses are considered to be of high vulnerability, moderate recoverability and moderate value. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of effect

4.3.14 Overall, the sensitivities of surface watercourses are considered to be **high** and the magnitude of the impact is deemed to be **minor**. The effect including the integration measures adopted in Table 2.6, will therefore be of **minor adverse** significance, which is not significant in EIA terms.

The impacts of construction may affect drainage pipeline infrastructure.

Magnitude of impact

4.3.15 Cumulative impacts on drainage pipeline infrastructure would only occur where water and sewer pipelines were located in proximity to the onshore cable corridor of Thurrock Flexible Generation Plant, TEC, Tilbury 2 and LTC. Site selection seeks to avoid major pipelines, however impacts with local infrastructure may occur.

4.3.16 The impact is predicted to be of local spatial extent, of short term duration, of intermittent occurrence and high reversibility. It is predicted that the impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

4.3.17 Drainage pipeline infrastructure comprises water supply pipelines operated by Essex & Suffolk Water, which are considered to be of moderate vulnerability and high value, impacting the local and regional economy. The sensitivity of the receptor is therefore considered to be **high**.

Significance of Effect

4.3.18 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude is deemed to be **minor**. The effect will, therefore, be of **minor adverse** significance, which is not significant in EIA terms.

The impacts of construction may affect field drainage and irrigation.

Magnitude of impact

4.3.19 Cumulative impacts on field drainage and irrigation would only occur where development limits coincide. Projects as a minimum, require as surface water management strategy and drainage scheme to limit any increase in surface water runoff from the site, and to mimic (as close as practicable) the current hydrological regime. It is assumed that Thurrock Flexible Generation Plant, TEC, Tilbury 2 and LTC will be constructed using industry best practice and therefore should limit any effect on field drainage and irrigation.

4.3.20 The impact is predicted to be of local spatial extent, short term duration, of intermittent occurrence and reversible. It is predicted that any impact will affect the receptor directly. The magnitude is therefore, considered to be **minor**.

Sensitivity of receptor

4.3.21 Field drainage and irrigation which form part of the hydrological environment are deemed to be of moderate vulnerability, moderate to high recoverability and medium value. The sensitivity of the receptor is therefore, considered to be **medium**.

Significance of effects

4.3.22 Overall, the sensitivity of field drainage and irrigation is considered to be **medium** and the magnitude of impact is deemed to be **minor**. The effect will therefore, be of **minor adverse** significance, which is not significant in EIA terms.

Future monitoring

4.3.23 No hydrology and flood risk monitoring to test the predictions made within the construction phase cumulative impact assessment is considered necessary.

Operational and maintenance phase

The impacts of routine maintenance operations may affect main and ordinary surface watercourses.

Magnitude of impact

4.3.24 During the operation and maintenance phase the main impacts would be the accidental spillage of oils and/or chemicals. A cumulative impact would therefore only occur where a spillage event happened at the Thurrock Flexible Generation Plant and at a cumulative site at the same time. Mitigation measures outlined in Table 2.6 will be in place during the operation and maintenance phase of the Thurrock Flexible Generation Plant to limit any potential adverse impacts for spillage events. It is assumed that the cumulative sites identified within the 250 m hydrology and flood risk CEA study area will be designed to local and national planning policy and industry best practice and therefore are likely to incorporate mitigation measures. The impact is predicted to be of local spatial extent, short term duration, intermittent occurrence and reversible. The magnitude is therefore, considered to be **negligible**.

Sensitivity of receptor

4.3.25 The main and ordinary watercourses in the Thurrock Flexible Generation Plant hydrology and flood risk study area are assessed to be of high vulnerability, moderate to high recoverability and moderate value based on the EA's WFD classification. The sensitivity of the receptor is therefore, considered to be **high**.

Significance of the effect

4.3.26 Overall, the sensitivity of the receptor is considered to be **high** and the magnitude of impact is deemed to be **negligible**. The effect will, therefore, be of **minor adverse** significance which is not significant in EIA terms.

Future monitoring

4.3.27 No hydrology and flood risk monitoring to test the predictions made within the operation and maintenance phase cumulative impact assessment is considered necessary.

Decommissioning phase

4.3.28 As it has been assumed that the Thurrock Flexible Generation Plant would be removed and that the cables and pipes would remain in-situ, no additional effects above those detailed under the construction and operation and maintenance phase are predicted. It is therefore determined that the cumulative effects from decommissioning of the Thurrock Flexible Generation Plant would be similar and no worse than the construction and operation and maintenance phase effects of **minor adverse** significance to negligible, which is not significant in EIA terms.

Future monitoring

4.3.29 No hydrology and flood risk monitoring to test the predictions made within the decommissioning phase cumulative impact assessment is considered necessary.

5. Conclusion and summary

5.1.1 The Thurrock Flexible Generation Plant hydrology and flood risk study area is shown on EA flood maps as being located within Flood Zone 2 and 3 (i.e. medium to high probability of flooding). However, the proposed development benefits from flood defences providing a SoP in excess of 1 in 1,000 years. EA flood risk from rivers or the sea maps, which includes defences, indicates that the proposed development Zone A is at risk of flooding. The Applicant has reviewed the risk of flooding as a result of a modelled breach in flood defences for a number of return periods. Results indicate the Zone A would be at risk of residual flooding to a depth of 0.5 m to 1.5 m.

5.1.2 The proposed development hydrology and flood risk study area includes a number of catchments associated with EA designated main rivers and ordinary watercourses (see Volume 6, Appendix 15.2: Flood Zones/model data). Some of these rivers are associated with designated ecological habitats or are designated for their own ecological importance (see Volume 3, Chapter 9: Ecology). The effect is considered to be of minor adverse significance.

5.1.3 Although construction has the potential to cause a degradation of water quality to main and ordinary watercourses through increase in soil erosion and accidental release of sediment, appropriate mitigation measures have been identified within this chapter and within the Outline CoCP (volume 5, Chapter 2.2: Code of Construction Practice) which accompanies the DCO application to minimise potential impacts. Furthermore, trenchless techniques will be used to cross main rivers (see Volume 2, Chapter 2: Project Description). The effect is considered to be of minor adverse significance.

5.1.4 The operation of the development has the potential to increase the surface water runoff rate from the proposed gas engine, battery storage facility and associated above ground infrastructure, in turn increasing the flood risk to the site and the surrounding areas. Appropriate operational management measures will be incorporated into the construction process in order to mitigate against any increase in runoff, including an outline drainage strategy. The effects during the operation and maintenance phase are therefore considered to be of negligible significance.

5.1.5 The operation of the proposed gas engine, battery storage facility and associated above ground infrastructure would involve routine maintenance of key elements. Maintenance may involve the use of chemicals, oils and greases and therefore, there is the potential for spillages to occur which may affect the water quality of ordinary watercourses. Operational practices will involve management plans including spill procedures, clean up and remediation of contaminated water runoff and water quality monitoring (if required) in order to mitigate against any decrease in water quality status. The effects of operation maintenance are therefore considered to be minor adverse significance.

5.1.6 A FRA has been prepared for the proposed gas engine, battery storage facility and associated above ground infrastructure. The FRA indicates the site is located at tidal flooding risk from a breach in flood defences, low risk of surface water flooding and at no risk of flooding from reservoir failure. The proposed development has been defined as ‘Essential infrastructure’ and suitable for the present Flood Zones including climate change. Therefore, there is no requirement for either a Sequential or Exception Test.

5.1.7 The FRA demonstrates that appropriate mitigation measures will reduce the adverse impacts caused by the proposed development and an appropriate drainage strategy will be incorporated into the Thurrock Flexible Generation Plant design to attenuate any increase in surface water runoff, in turn increase in flood risk. The FRA’s therefore demonstrate that the Thurrock Flexible Generation Plant meets the requirements of NPS EN-1 and the NPPF.

5.1.8 The decommissioning of the proposed development will involve the demolition of buildings as well as removal of foundations and the attenuation storage provided during construction and operation. The impacts of decommissioning of the proposed development components will be reduced through the incorporation of management measures (outlined in Table 2.6). The effect is considered to be of minor adverse significance.

5.1.9 Cumulative impacts from projects screened into the assessment have been assessed using a tiered approach. It is assumed that each development would be constructed in line with the requirements of the NPPF and PPG ID7 – Flood Risk and Coastal Change, (and where relevant the NPSs) requiring that new developments attenuate surface water runoff to where practicable to the greenfield runoff rate through a surface water management plan and/or drainage scheme. The impacts are predicted to result in effects of negligible or minor adverse significance.

5.1.10 Screening of potential transboundary impacts (as presented in Volume 5, Appendix 4.2: Transboundary Impacts Screening Note) has identified that there was no potential for significant transboundary effects with regard to hydrology and flood risk.

5.2 Next Steps

5.2.1 As the development design progress a drainage scheme will be developed to support the hydrology and flood risk impact assessment, as well as the supporting FRA. This will include further consultation with Essex CC9 (as LLFA) and the EA.

Table 5.1: Summary of potential environment effects, mitigation and monitoring.

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
Construction							
The construction of permanent assets may lead to increased flood risk	Construction measures, surface water drainage scheme, best practice measures (see Table 2.6)	Minor	Low	Minor Adverse (not significant in EIA terms)	None.	N/A	None
Temporary construction may lead to increased flood risk	Construction measures, surface water drainage scheme, best practice measures (see Table 2.6)	Minor	Low	Minor Adverse (not significant in EIA terms)	None.	N/A	None
Construction may cause risk of leaks and spills to surface watercourses	Operational measures (see Table 2.6).	No change	Low	Negligible (not significant in EIA terms)	None	N/A	None
The impacts of trenchless construction techniques may affect major surface watercourses	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6).	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None
The impacts of open cut, temporary bridging and culverts may affect surface watercourses	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6)	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None
The construction of permanent assets may affect field drainage and irrigation	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6)	Minor	High	Minor Adverse (not significant in EIA terms)	None	N/A	None
Temporary construction may affect field drainage and irrigation	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6).	Minor	Medium	Minor Adverse (not significant in EIA terms)	None	N/A	None
Operation							
The impacts of operation and maintenance may lead to increased flood risk.	Operational measures (see Table 2.6).	No change	Low	Negligible (not significant in EIA terms)	None	N/A	None
The impact of flexible generation plant operation and maintenance may affect main or ordinary surface watercourses	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6)	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None

Description of impact	Measures adopted as part of the project	Magnitude of impact	Sensitivity of receptor	Significance of effect	Additional measures	Residual effect	Proposed monitoring
The impact of pipeline maintenance may affect main or ordinary surface watercourses	Surface water drainage scheme, pollution prevention measures, best practice measures (see Table 2.6)	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None
Decommissioning							
The impacts of decommissioning may affect temporary flood risk.	Decommissioning measures (see Table 2.6)	Minor	Low	Minor Adverse (not significant in EIA terms)	None	N/A	None
The impacts of decommissioning may affect main surface watercourses.	Decommissioning measures (see Table 2.6).	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None
The impacts of decommissioning may affect ordinary watercourses.	Decommissioning measures (see Table 2.6).	Negligible	High	Minor Adverse (not significant in EIA terms)	None	N/A	None

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