Environmental Statement

Volume 2i: Scheme-wide Assessment

Chapter 11: Water environment

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11. WATER ENVIRONMENT

Summary of principal findings

This chapter presents the water environment assessment associated with the construction and operation of the Huddersfield to Westtown (Dewsbury) section of the Transpennine Route Upgrade (TRU) Programme. This chapter covers the assessment of the entirety of the Huddersfield to Westtown (Dewsbury) Route (the "Scheme").

This water environment assessment has considered impacts to:

- Surface water quality;
- Hydromorphology;
- Flood risk; and
- Groundwater quantity and flow associated with the Scheme.

Following the baseline review, 32 receptors have been taken forward for assessment, comprising of:

- 17 surface watercourses;
- Two surface water features;
- One groundwater body; and
- 12 culverts.

Of the surface watercourses, six are identified as Water Framework Directive (WFD) reportable watercourses. The groundwater body is a WFD groundwater body.

Prior to the implementation of mitigation, five significant effects (all Moderate adverse) during construction have been identified. These relate to:

- Risk of contamination from adjacent construction compounds;
- Increase in flood risk from canal during construction of new outfall arrangements;
- Increase in unattenuated surface water runoff (within areas of contaminated land) during construction;
- Construction of Baker Viaduct Underbridge (RBA/2) across the River Calder, including the installation of in-channel river training walls; and
- Changes in floodplain functionality and capacity resulting from construction of piled embankment associated with new track alignment and construction compounds.

Prior to mitigation, only one significant effect (Moderate adverse) during operation has been identified, relating to the following two elements:

- Permanent presence of Baker Viaduct Underbridge (RBA/2) across the Calder, including the presence of in-channel river training walls; and
- Change in floodplain functionality and capacity resulting from construction of piled embankment associated with new track alignment.

In addition to adherence to the Code of Construction Practice (CoCP) and Scheme-wide drainage strategy, additional mitigation measures include:

- The use of best practice guidelines within the construction compounds and areas of in-channel works;
- Use of on-line continuous water quality monitoring prior to where high risks (dependant on receptor sensitivity and construction activity scale) from in-channel works are expected;

- Use appropriate measures to ensure contaminants, including fine sediments, from construction activities do not enter the watercourse;
- Provision of compensatory flood storage on a level for level and volume for volume basis; and
- Prepare site-specific responses for potential pollution incidents (e.g. spillages) or extreme weather events (e.g. storms) which may cause an increase in sediment runoff.

With the implementation of the CoCP, Scheme-wide drainage strategy and additional specific mitigation measures, no significant adverse (or beneficial) residual effects on any identified area of assessment within the water environment are predicted during either construction or operation of the Scheme.

11.1 Introduction

11.1.1 This chapter presents the water environment assessment associated with the construction and operation of the Huddersfield to Westtown (Dewsbury) section of the Transpennine Route Upgrade (TRU) Programme. This chapter covers the assessment of the entirety of the Huddersfield to Westtown (Dewsbury) Route (herein referred to as the 'Scheme').

11.1.2 This chapter is set out as follows:

- Legislative and policy context – relevant international, national and local policy requirements, legal requirements and guidance which have been used to define the assessment approach are outlined;
- Assessment methodology – the methodology the assessment follows is defined including the justification for the study area and the approach for determining significance of effects;
- Baseline – a summary of the water environment baseline within the Scheme is provided;
- Potential effects – the potential impacts and effects (both beneficial and adverse) during construction and operation are characterised;
- Mitigation measures – agreed avoidance, mitigation, compensation and enhancement measures are described;
- Residual effects – the significance of residual effects (both beneficial and adverse) following the implementation of mitigation measures are assessed; and
- Assessment of cumulative effects with committed developments relevant to the Scheme.

11.1.3 The water environment assessment is further broken down into six Route Section Assessments in Volume 2ii of this Environmental Statement (ES) which provide additional detail to this chapter.

11.1.4 A detailed description of the Scheme is provided in Chapter 2 (Scheme description) of this ES and all appendices and figures referred to in this chapter are provided in Volumes 3 and 4 of this ES respectively.

11.1.5 The scope of this chapter will comprise impacts to surface water features, groundwater features and flood risk predominantly associated with the creation of surface-borne pollutants, works within surface water features, surface water runoff and works within areas identified to be at risk of flooding. With regards to surface water features the impact assessment will consider surface water quality, hydromorphology, flood risk and groundwater separately.

11.1.6 A Flood Risk Assessment (FRA) has been undertaken in accordance with the National Planning Policy Framework (NPPF) and local planning policy and is presented in Appendix 11-1. For clarity the ES and FRA define fluvial flooding as all flood risk associated with Main Rivers and Ordinary Watercourses. This includes where flood risk from the Risk of Flooding from Surface Water (RoFSW) maps[1] has been used to define the Ordinary Watercourse flood extents (owing to a lack of hydrological and hydraulic model data in these areas).

11.1.7 The sensitivity of each receptor has been categorised in accordance with assessment methodology set out in Section 11.3 using the Environment Agency's (EA) Flood Map for Planning[2] and the EA's RoFSW maps to indicate the baseline flood risk.

11.1.8 The chapter also meets the objectives of the Water Framework Directive (WFD) by providing an assessment of likely significant effects of the Scheme in accordance with the WFD and

[1] https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode
[2] https://flood-map-for-planning.service.gov.uk/

considering opportunities for betterment to help meet the objectives of the WFD (to protect the water environment) where appropriate. The WFD compliance assessment for the Scheme is presented in Appendix 11-2.

11.1.9 Impacts to groundwater quality are addressed in Chapter 12 (Geology, soils and land contamination) and impacts to aquatic ecology in Chapter 9 (Biodiversity) in the respective chapters in Volumes 2i and 2ii of the ES.

11.2 Legislative and policy context

11.2.1 This assessment of the water environment has been prepared taking account of legislation and guidance at European, national and local levels. A summary of these requirements, specific to the water environment, is set out in the following section.

UK and European[3]

11.2.2 The Department for Environment, Food and Rural Affairs (Defra) manages the coordination of policies for the water environment. Many flood risk and water quality requirements are set at European level, and then transposed into UK law. The EA manages the enforcement of flood risk and water quality requirements in England. The assessments have due regard to the European legislation and guidance, summarised in Table 11-1.

Table 11-1 Summary of European legislation

Legislation	Description
Water Framework Directive (WFD) (2000/60/EC)[4] The WFD Directive is transposed in English and Welsh law by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, amended by Floods and Water (Amendment etc.) (EU Exit) Regulations 2019. The Reduction and Prevention of Agricultural Diffuse Pollution (England) Regulations 2018 implement Article 11(3)(h) of the WFD,	The WFD legislation requires that all inland waters within defined river basin districts must reach at least Good status by 2015 and defines how this should be achieved through the establishment of environmental objectives and ecological targets for surface waters. Any new project must not cause deterioration of the water environment or prevent the future attainment of Good status. The WFD requires that surface water discharges are managed so that their impact on the receiving environment is mitigated. The objective is to protect the aquatic environment and control pollution from diffuse sources such as urban drainage – a key aspect that effectively precludes use of the traditional approach to drainage.
Environmental Quality Standards Directive (2008/105/EC). Aspects of this Directive are transposed by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, amended by the Floods and Water (Amendment etc.) (EU Exit) Regulations 2019	Lists environmental quality standards (EQS) for priority substances and certain other pollutants as provided for in Article 16 of the Water Framework Directive 2000/60/EC (WFD), with the aim of achieving Good surface water chemical status. It includes

[3] It is noted that the impact of European legislation may need to be revised following the UK's exit from the European Union but much of this has been transposed into UK law in any event.
[4] Reg 27 *Environment (Legislative Functions from Directives) (EU Exit) Regulations 2019* creates legislative powers for the Secretary of State or the appropriate devolved authority, in order to replace the functions previously conferred upon the Commission.

Legislation	Description
	certain metals that are associated with runoff from highways.
Groundwater Directive (2006/118/EC). This Directive is transposed into English and Welsh Law by the Environmental Permitting (England and Wales) Regulations 2016 Aspects of the Directive are also transposed by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017, amended by Floods and Water (Amendment etc.) (EU Exit) Regulations 2019	Complements the WFD. It requires measures to prevent or limit inputs of pollutants into groundwater to be operational so that WFD environmental objectives can be achieved.
Habitats Directive (92/43/EEC). This Directive was transposed into UK law by the Conservation of Habitats and Species Regulations 2017 and has been subsequently amended by the Conservation of Habitats and Species (Amendment) (EU Exit) Regulations 2019.	To promote the maintenance of biodiversity by taking measures to maintain or restore natural habitats and wild species at a favourable conservation status, introducing robust protection for those habitats and species of European importance. Sites or species that come under this Directive will heighten the importance of water features that sustain them.
Floods Directive (2007/60/EC). This is transposed into UK Law by Transposed by Flood Risk Regulations 2009.	The aim of this Directive is to reduce and manage the risks that floods pose to human health, the environment, cultural heritage and economic activity. It sets the strategic level for flood risk that any development will need to comply with.

National

11.2.3 The aim of water policy in England is to protect both public health and the environment by maintaining and improving the quality of natural waters. These include surface water bodies (e.g. rivers, streams, lakes, and ponds) and groundwater. European legislation is implemented in the UK through specific sets of Regulations (e.g. Flood Risk Regulations 2009, Groundwater (England and Wales) Regulations 2009, Private Water Supplies Regulations 2009). DEFRA is responsible for all aspects of water policy in England. Management and enforcement of water policy is the responsibility of Regulators, principally the EA, but also Lead Local Flood Authorities (LLFA). There is extensive domestic legislation which regulates the water environment, as summarised in Table 11-2.

Table 11-2 National legislation summary

Legislation	Description
Act	
Environment Act 1995	The Act provides for the establishment of a Corporate body to be known as the EA, the key regulator for the water environment.
Environmental Protection Act 1990	This Act brings in a system of integrated pollution control for the disposal of wastes to land, water and air.
Flood and Water Management Act 2010	The key areas covered by this Act are: Roles and responsibilities for flood and coastal erosion risk management; and, improving reservoir safety.

Legislation	Description
Highways Act 1980	The Act deals with the management and operation of the road network in England and Wales including the drainage of highways into environmental waters and sewers.
The Land Drainage Act 1991	This requires that a watercourse be maintained in such a condition that the free flow of water is not impeded. The 1994 Land Drainage Act amends it in relation to the functions of internal drainage boards (IDB) and local authorities
Water Act 2003 and Water Act 2014	These Acts aim to improve water conservation, protect public health and the environment, and improve the service offered to consumers. The Acts relate to water resources, regulation of the water industry and other provisions.
Water Framework Directive (Standards and Classification) Directives (England and Wales) 2015	These Regulations set out the environmental standards to be used for the second cycle of river basin plans. They transpose Directive 2013/39/EC on environmental quality standards for priority substances
Water Industry Act 1991	This sets out the responsibilities of the EA in relation to water pollution, resource management, flood defence, fisheries, and in some areas, navigation. The Act regulates discharges to controlled waters, namely rivers, estuaries, coastal waters, lakes and groundwaters
Water Resources Act 1991 (as amended by the Water Resources Act 1991 (Amendment) (England and Wales) Regulations (2009))	The Act to regulate water resources, water quality and pollution, and flood defence. Sets out standards for Controlled Waters
Environment Bill (likely implementation in 2021 but currently under development)	At the time of writing, this Bill has not yet received Royal Assent but has been started in the House of Commons (at the Report Stage in the House of Commons at the time of writing (26 January 2021). It makes provision for targets, plans and policies for improving the natural environment; for statements and reports about environmental protection; for the Office for Environmental Protection; about waste and resource efficiency; about air quality; for the recall of products that fail to meet environmental standards; about water; about nature and biodiversity; for conservation covenants; about the regulation of chemicals; and for connected purposes. All European Directives need to be followed and continued to be complied with post-Brexit where transposed into UK legislation, unless otherwise amended in legislation.
Regulations	
Anti-Pollution Works Regulations 1999	Where pollution occurs, or is likely to occur, the EA can serve a works notice under Section 161A of the Water Resources Act 1991 on any person who has caused or knowingly permitted the pollution (or risk of pollution) to controlled waters, requiring them to carry out anti-pollution/preventative works and operations. The EA can also recover the costs of any investigation and anti-pollution works carried out. The Anti-Pollution Works Regulations prescribe the content of anti-pollution works notices. They also prescribe the information to be placed on the pollution control registers maintained by the EA.

Legislation	Description
Control of Pollution (Oil Storage) (England) Regulations 2001	Regulations for the storage of more than 200 litres of oil above ground at an industrial, commercial or institutional site not used in refining or distribution oil. The Regulations apply in England only.
Environmental Damage (Prevention and Remediation) Regulations (England) 2015	The emphasis of these Regulations is proactively putting in place appropriate pollution prevention measures to reduce risks to the environment.
Environmental Permitting (England and Wales) Regulations 2016	These provide a consolidated system of environmental permitting in England and Wales and transpose the provisions of 15 European Union (EU) Directives, which impose obligations requiring delivery through permits or which are capable of being delivered through permits. These cover EA permits for flood risk (on Main Rivers) and certain discharges to watercourses.
Flood Risk Regulations 2009 Amended SI2011/2880 transpose directive 2007/60/EC	These aim to provide a consistent approach to managing flood risk. The EA are responsible for managing flood risk from main rivers, the sea and reservoirs. LLFAs are responsible for local sources of flood risk from surface water, groundwater and ordinary watercourses.
Environmental Permitting (England and Wales) Regulations 2016	These transpose the Groundwater Directive (2006/118/EC) into law in England and Wales.
Water Environment (Water Framework Directive) (England and Wales) Regulations 2017	These outline the duties of regulators (EA in England) in relation to environmental permitting, abstraction and impoundment of water.
The Water Resources (Environmental Impact Assessment) (England and Wales) Regulations 2003	These impose procedural requirements in relation to the consideration of applications or proposals for an abstraction or impounding licence under Chapter II of Part II of the Water Resources Act 1991 and require consent in other cases.

Technical guidance and standards and National Policy

11.2.4 The assessment will also take into account the following, technical guidance and standards as summarised in Table 11-3. In addition to these, the National Planning Policy Framework (NPPF) (Department for Communities and Local Government (DCLG), 2019) needs to be taken into account. The NPPF sets strict tests to protect people and property from flooding which all local planning authorities are expected to follow. It forms the basis of assessment of flood risk for this Scheme.

Table 11-3 Guidance summary

Guidance	Description
A Green Future: Our 25 Year Plan to Improve the Environment (HM Government, 2018)	This 25 Year Environment Plan sets out government action to help the natural world regain and retain good health. It aims to deliver cleaner air and water in our cities and rural landscapes, protect threatened species and provide richer wildlife habitats. It calls for an approach to agriculture, forestry, land use and fishing that puts the environment first. The aim is to work with nature to protect communities from flooding, slowing rivers and creating and sustaining more wetlands to reduce flood risk and offer valuable habitats. Policies relevant to flood risk include expanding the use of natural flood management solutions, putting in place more sustainable drainage systems, aiming to

Guidance	Description
	protect and grow our natural capital, making 'at-risk' properties more resilient to flooding, and tackling climate change.
EA Groundwater Protection (previously known as GP3)	Guidance on the protection of groundwater for those proposing an activity which may cause groundwater impacts. The guidance aims to protect groundwater and prevent pollution. It covers requirements, permissions, risk assessments and controls.
National Planning Practice Guidance (NPPG) DCLG 2019	Guidance to accompany the NPPF. This advises on how local planning authorities can ensure water quality and the delivery of adequate water infrastructure and take account of the risks associated with flooding in the plan-making and the planning application process: • Meeting the challenge of climate change, flooding and coastal change; and • Conserving and enhancing the natural environment
Catchment Flood Management Plans (CFMPs) (EA)	CFMPs provide a large scale, strategic planning framework for the integrated management of flood risks to people, property and the environment in a sustainable manner over the next 50 to 100 years.
Design Manual for Roads and Bridges (DMRB) LA 113 Road drainage and the water environment (formerly HD 45/09)	Description of the requirements for assessment and management of the impacts that road projects can have on the water environment. (Document used for reference towards assessment as relates specifically to road schemes).
Transport Analysis Guidance (TAG), Department for Transport) Unit A3 Environmental Impact Assessment (May 2019)	Guidance on tailoring level of detail for assessment to the stage of development of the Scheme; the relationship between environmental impact appraisal (as set out in this manual) and Environmental Impact Assessment (EIA); the differing types of environmental impact and reporting requirements.
Guidance for Pollution Prevention (GPPs)	GPPs provide environmental good practice guidance for the whole of the UK, relevant guidance to this Scheme cover: • Pollution Prevention Guidance[5] (PPG) 1: Understanding your environmental responsibilities – good environmental practices; • PPG 3: Use and design of oil separators in surface water drainage systems; • GPP 4: Treatment and disposal of wastewater where there is no connection to the public foul sewer; and • GPP 5: Works and maintenance in or near water.
GPP for businesses (GOV.UK)	Guidance for businesses and organisations on prevention of pollution from oil and chemical storage, car washing, construction and other activities. These guidelines are specific to England.

Local

11.2.5 Local plan policies and Supplementary Planning Guidance state what is acceptable in terms of drainage, landscape, water quality and amenity within new development. Policy guidance is available from the various local authority websites. The Scheme lies entirely within the

[5] PPGs are no longer considered as formal guidance, but it is good practice to meet requirements set out within these documents.

boundary of the Kirklees Council LLFA and is not within any IDB districts.

11.2.6 The Kirklees Local Plan was adopted on 27 February 2019. Planning applications must be determined in accordance with the development plan unless material considerations indicate otherwise.

11.2.7 Policy LP34 of the Local Plan is concerned with conserving and enhancing the water environment, proposals will need to:

- Ensure no deterioration of watercourses or water bodies (including groundwater) by conserving and, where practicable, enhancing:
  - the natural geomorphology of watercourses, including reinstating watercourses to their natural state through removal of modifications resulting from past industrial uses;
  - water quality; and
  - the ecological value of the water environment, including the functionality of habitat networks.
- Ensure Source Protection Zones (SPZs) are protected from contamination as a result of the proposal in line with national guidance.
- Dispose of surface water appropriately (in accordance with the Local Plan drainage policy) adhering to the following networks in order of preference:
  - to an infiltration-based system wherever possible (such as soakaways);
  - discharge into a watercourse with the prior approval of the landowner, navigation authority[6] LLFA or EA, where applicable. To comply with part 1 of this policy, discharge must be following treatment where necessary to prevent pollution of the receiving watercourse; and
  - discharge to public sewer.

11.2.8 Proposals are encouraged to:

- Make positive progress towards achieving 'Good status or potential' under the WFD in surface and groundwater bodies;
- Manage water demand and improve water efficiency through appropriate water conservation techniques including rainwater harvesting and grey-water recycling as well as considering water availability from surface water and groundwater sources; and
- Improve water quality through the incorporation of appropriately constructed and maintained Sustainable Drainage Systems and surface water management techniques taking into account the sensitivity of groundwater.

[6] A navigation authority is a company or statutory body which is concerned with the management of a navigable canal or river (e.g. Canal & River Trust)

11.3 Assessment methodology

Study area

11.3.1 The study area takes into consideration all water features and associated floodplain[7] physically impacted by the Scheme and those watercourses in direct hydraulic connectivity within 1km of the Scheme boundary. These, together with the WFD water bodies, are shown in Figure 11-1. A 1km buffer around the Scheme boundary was selected as professional judgement and understanding of the local watercourse connectivity considers 1km to be an appropriate distance for any significant effects unlikely to be identified beyond this point (for example, dilution of pollutants).

Data sources

11.3.2 Information for the baseline conditions was collected from a detailed desk-based study, a site visit and consultation with relevant stakeholders.

11.3.3 Hydromorphological walkover surveys were performed on 20 August 2019, 21 August 2019, 29 October 2019 and 8 September 2020 to assess bed and bank characteristics (materials, forms and features), flow conditions and fluvial processes. Flood risk walkover surveys were undertaken on 14 August 2019 and 8 September 2020.

11.3.4 The following sources of information have been used to inform the assessment. As these are all live websites it has been assumed that data presented here is current at the time of writing/when accessed:

- Ordnance Survey (OS) OpenData[8];
- The EA website[9];
- The EA Flood Map for Planning website[10];
- The Flood Mapping Service (rivers/sea, surface water, reservoirs) website[11];
- The EA Catchment Data Explorer website[12];
- Multi-Agency Geographic Information for the Countryside (MAGIC) Map[13];
- Groundsure's Enviro Insight Report;
- British Geological Survey (BGS) Geology of Britain viewer map[14];
- The EA Water Quality Data archive website[15];
- Online historic mapping resources, e.g. National Library of Scotland (NLS[16]); and
- High-resolution aerial photography, e.g. Google Earth.

11.3.5 The following flood risk models have been provided by the EA and used to inform the FRA:

- 2010 ASM Colne and Holme Pre-feasibility model;
- 2011 Huddersfield Study model; and

[7] A floodplain is the area of land adjacent to a stream or river which is subject to flooding when river levels are high
[8] https://osdatahub.os.uk/downloads/open
[9] www.gov.uk/government/organisations/environmentagency
[10] www.flood-map-forplanning.service.gov.uk
[11] https://flood-warning-information.service.gov.uk/long-term-flood-risk/postcode
[12] https://environment.data.gov.uk/catchment-planning/
[13] https://magic.defra.gov.uk/magicmap.aspx
[14] http://mapapps.bgs.ac.uk/geologyofbritain/home.htm
[15] https://environment.data.gov.uk/water-quality/view/landing
[16] https://maps.nls.uk/

- 2015 Calder and Canals model.

Data limitations

11.3.6 The majority of the datasets were obtained and/or viewed online in summer 2020. There is a possibility that after the data was purchased/viewed, the primary datasets could have been updated. Any new data are unlikely to alter the conclusions of the ES.

Environment Agency water quality data

11.3.7 The water quality assessments undertaken have relied upon the accuracy and level of detail of the documented data sources.

11.3.8 Several sample locations did not have current data available for assessment. Data is not available for all watercourses.

Hydromorphology surveys

11.3.9 Best efforts were made to access each watercourse within the study area to complete hydromorphological walkover surveys. Where access was not available, a detailed desk study was undertaken in order to understand the functioning of the watercourse, which has been deemed sufficient to inform this assessment.

11.3.10 Not all watercourses (including culverted reaches) are included in the data layers available.

Flood risk data and surveys

11.3.11 This assessment has relied upon the accuracy and level of detail of the documented data sources. Detailed topographical survey data was not available for many of the watercourse locations where crossings and outfalls are proposed.

11.3.12 The watercourse features and processes observed may vary over time/seasons and high flow events. Site surveys were undertaken under relatively dry conditions, and the overall watercourse function and stability were inferred through professional judgement and the interpretation of features on site.

11.3.13 The accuracy of hydraulic modelling is primarily dependent on the quality of hydrological and topographical data, such as LiDAR[17] data. Key factors include the resolution of the topographic data, the accuracy of surveys of hydraulic structures, the availability of data on past flooding and the limitations of the modelling software.

Groundwater

11.3.14 The groundwater assessments undertaken have relied upon the accuracy and level of detail of the documented data sources.

Approach

Water environment

11.3.15 The water environment covers water quality, hydrology, flood risk and groundwater.

11.3.16 The method of assessment and reporting of significant effects will be predominantly qualitative

[17] LiDAR is a method of measuring distances using laser light which can be used to make digital 3-D representations of the target

based on the methodology set out in Chapter 4 (EIA methodology) of this ES. This will involve the following steps:

- Categorisation of importance (sensitivity) of receptor;
- Categorisation of magnitude of the impact; and
- Assessment of the significance of the effect based on the importance of the receptor and magnitude of the impact.

11.3.17 Estimation of importance of the receptor will be based on the data collected as part of the baseline study, taking into consideration designations, publicly available data, site walkover surveys and consultations with stakeholders. Estimation of magnitude of impacts is a primarily semi-qualitative description based on professional judgement.

11.3.18 This assessment will consider the following water environment technical areas; water quality, flood risk, hydromorphology and groundwater and the likely significant effects associated with the Scheme on identified receptors. As a conservative (worst-case) approach; the overall assessment is based on the water environment technical area as a whole (i.e. water quality, hydromorphology, flood risk or groundwater) with the most adverse significant effect resulting from construction and operational activity assessed. This “worst-case” information is presented in each Route Section Assessment in the ‘potential effects’ section; the data is within the table column labelled as ‘Significance of effect driven by’. An example of how this works is if a significance of effect to a receptor for water quality and hydromorphology is identified as “Minor” but “Major” for flood, the overall impact will be “Major”.

11.3.19 This chapter has a further two associated standalone assessments, which are provided as appendices:

- FRA (Level 3)[18] (Appendix 11-1); and
- WFD compliance assessment (Appendix 11-2).

11.3.20 Methodologies for these standalone assessments are also provided within this chapter and the results have fed into the overall impact assessment.

11.3.21 Chapter 9 (Biodiversity) and Chapter 12 (Geology, soils and land contamination) will also be used to inform the assessment within this chapter.

WFD assessment

11.3.22 The overall aim of the WFD compliance assessment is to identify and assess potential impacts of the Scheme upon the water environment, and to determine if the Scheme is compliant with WFD legislation. Where appropriate, this WFD assessment also identifies mitigation measures (both embedded into the design and site-specific) to ensure no deterioration to any WFD surface water body or groundwater body.

11.3.23 A detailed WFD compliance assessment and its associated assessment methodology is provided in Appendix 11-2.

11.3.24 The WFD assessment follows guidance produced by The Planning Inspectorate (PINS) in Advice Note 18 on the Water Framework Directive (PINS, 2017[19]). Whilst this Advice Note relates primarily to Nationally Significant Infrastructure Projects (NSIPs), it is still considered to

[18] Level 3 FRA (Detailed Study): Undertaken if quantitative analysis is required to assess flood risk issues related to the development site. This may include detailed hydraulic modelling of rivers or drainage systems
[19] Planning Inspectorate (PINS), 2017. Advice Note 18: The Water Framework Directive. Available from: https://infrastructure.planninginspectorate.gov.uk/wp-content/uploads/2017/06/advice_note_18.pdf

provide relevant guidance on the WFD assessment process for this Scheme. This includes three phases of work:

- Stage 1 (WFD Screening);
- Stage 2 (WFD Scoping); and
- Stage 3 (WFD Impact Assessment).

11.3.25 Stage 1 (WFD Screening) included a desk-based study to consider activities associated with the Scheme and the identification of water receptors which have the potential to be affected by the Scheme. A more detailed desk-study was undertaken at Stage 2 (WFD Scoping) to review the baseline characteristics of the identified WFD surface and groundwater bodies (e.g. examination of aerial photography and old maps, review of EA WFD, fisheries, and water quality data), and also to consider the potential risks from the Scheme to water receptors.

11.3.26 Stage 3 (WFD Impact Assessment) comprised:

- Field surveys by experienced geomorphologists and aquatic ecologists to further assess the character of watercourses potentially impacted by the Scheme;
- Identification of specific works associated with the Scheme and which receptor(s) may be impacted;
- A thorough matrix-based approach WFD impact assessment for each quality element within each individual WFD water body with the potential to be impacted by the Scheme;
- Identification of site-specific mitigation measures required as a result of the Scheme; and
- Synthesis of all assessments to assess the cumulative impact of the Scheme on potentially affected WFD water bodies in order to determine compliance of the Scheme with WFD legislation.

11.3.27 Consultation with key stakeholders (EA, Canal & River Trust and Kirklees Council) has been undertaken throughout the WFD compliance assessment process. A summary of this is provided in Table 11-7.

Flood Risk Assessment

11.3.28 The FRA in Appendix 11-1 considers the risk associated with all sources of flooding. Scheme features affecting surface water drainage include the proportion of impermeable (e.g. roads, roofs and hardstanding) and permeable areas; and the distribution of different land uses within these areas, i.e. whether for recreational, commercial, industrial or residential use. This combination of surface types and land use will determine how the current drainage systems affect environmental receptors.

11.3.29 The approach uses hydraulic modelling or other quantitative assessment to better understand likely significant effects and what measures are planned to manage flood risk effectively.

11.3.30 The approach assesses what measures are planned to avoid or minimise flood risk; both to the Scheme and receptors in the catchments through which it passes. The approach finally describes the key residual Scheme-wide flood risks. Full details are provided within the FRA.

11.3.31 The assessment will consider receptors for flood risk and include the Scheme and committed developments (i.e. cumulative assessment) within the study area. Receptor vulnerability is classified in accordance with NPPF and flood risk and coastal change planning practice guidance.

11.3.32 The assessment makes consideration of the vulnerability of the receptor with reference to the flood risk category, which is categorised by assessing the design elements of the Scheme. This assessment aims to identify whether the Scheme has any potential to influence or alter the risk of flooding to each receptor.

11.3.33 Receptors considered in this assessment include the Scheme and areas at risk of flooding. In this regard, the receptors are each watercourse and their floodplains; and each surface water flood route, both of which may hold developments and assets of various type. For clarity, receptors are described by their source watercourse.

11.3.34 Flood risk is assessed using the source-pathway-receptor model. In this model, individual sources of flooding within the study area are identified.

11.3.35 For there to be a risk of flooding at an individual receptor there must be a pathway linking it to the source of flooding. The pathways within the study area are assessed by reviewing datasets that show the spatial distribution of flood risk. The associated risk magnitude is then categorised.

11.3.36 The primary source of flooding is rainfall, which is a direct source in the short-term (direct surface water runoff) and can lead to flooding from watercourses (river flooding) and overloaded artificial collection systems (sewers) in the short or medium-term. Stored rainfall, either naturally in below ground aquifers and natural lakes or artificially in impounded reservoirs and canals, can lead to flooding when the storage capacity of the system is exceeded or if failure occurs.

11.3.37 Surface water drainage is effectively a pathway through which some of the potential effects of the Scheme can affect other surface water receptors. The surface water methodology assesses the potential change in the following:

- Rates of surface water runoff; and
- Volumes of surface water runoff.

11.3.38 The appraisal of flood risk impacts associated with the Scheme has considered:

- Increases in upstream water level caused by any restriction in flow;
- Loss of floodplain storage due to infrastructure occupying areas which were previously available for flood storage or flows;
- Loss of floodplain conveyance due to infrastructure crossing existing floodplain and forming a barrier to flow or modifying existing hydraulic links between channel and floodplain;
- Impediment of water flow caused by infrastructure crossing existing drainage channels, causing potential blockage and altering local catchment area boundaries;
- The diversion of watercourses and drains causing changes in catchment boundaries, channel flow capacities and floodplain storage; and
- Scheme-wide drainage strategy.

11.3.39 The detailed FRA and its associated assessment methodology are based upon the requirements of the NPPF and flood risk and coastal change planning practice guidance. The overall aim of the FRA is to understand flood risk to and from the proposed development and the management of flood risk through mitigation if required.

11.3.40 A high-level review of the risk of flooding and potential impacts is undertaken based on these datasets across all flood sources. Where this review indicates potentially significant impacts on the risk of flooding, or a risk of flooding to the Scheme, hydraulic modelling was undertaken.

11.3.41 The FRA draws on a range of disciplines work and designs, including drainage, earthworks, culverts, and previous hydrological and hydraulic modelling to ensure all sources of flood risk are assessed as part of the FRA.

11.3.42 The FRA will also consider impacts of climate change, as set out in the NPPF.

Assessment criteria

Assessment of sensitivity

11.3.43 The sensitivity of receptors is detailed in Table 11-4 and has referred to the DMRB Table 3.70 (Volume 11, Part 10 Annex IV), with criteria relating to the water environment used where appropriate. This guidance, which was published in August 2019, is an update from DMRB Volume 11, Section 3, Part 10 (HD 45/09 Road Drainage and the Water Environment). Both sets of guidance have been used to define the assessment criteria for this Scheme. Each water environment technical area will identify sensitivity (for surface waters) on the criteria shown in Table 11-4, the highest level of sensitivity will be selected for the watercourse assessment. Sensitivity criteria for the FRA will consider receptors i.e. the properties at risk, A-roads or agricultural land rather than the waterbody itself.

Table 11-4 Sensitivity descriptors

Importance	Criteria/descriptors	Surface water			Groundwater
		Water quality	Hydromorphology	Flood risk	
Very High	Very high importance and rarity, international scale and very limited (i.e. no potential for substitution/replacement)	• WFD waterbody with High status for water quality related Classification elements (e.g. Physico-chemical quality elements) • Water quality supports protected/ designated habitats under EU habitat legislation (e.g. Special Area of Conservation (SAC)) • Water quality supports waterbody of high amenity value, including areas of bathing and where water immersion sports are regularly practised • Watercourse is used for potable water supply	• WFD hydromorphological designation "not designated artificial or heavily modified" • Hydromorphological Supporting Elements of WFD status "High" • Conforms most closely to natural, unaltered state and will often exhibit signs of free meandering and possess well-developed bedforms (point bars and pool-riffle sequences) and abundant bank side vegetation: Conservation Status score of 8-10 (High)	• Floodplain or defence protecting more than 100 residential properties from flooding • Areas which are highly vulnerable. These can include essential infrastructure, emergency services and basement dwellings.	• Principal aquifer providing a regionally important resource and/or supporting a site protected under European Commission (EC) and UK legislation for ecology and nature conservation • Groundwater locally supports Groundwater Dependent Terrestrial Ecosystems (GWDTE) • Groundwater SPZ1[20]
High	High importance and rarity, national scale, and limited potential for substitution/replacement	• WFD waterbody with Good status for water quality related Classification elements (e.g. Physico-chemical quality elements) • Water quality supports protected/ designated habitats under UK habitat legislation (e.g. Local Nature Reserves (LNR)) • Water quality supports waterbody of a moderate amenity value including public parks, boating, non-contact water sports, popular footpaths adjacent to watercourses, or watercourses running through housing developments/town centres • Waterbody is used for non-potable water supply	• WFD hydromorphological designation "not designated artificial or heavily modified" • Hydromorphological Supporting Elements of WFD status "Supports Good" • Shows signs of previous alteration but still retains many natural features or may be recovering towards conditions indicative of the higher category: Conservation Status score of 5-7 (Moderate)	• Floodplain or defence protecting between 1 and 100 residential properties or industrial premises from flooding. • Areas which are more vulnerable. These can include hospitals, residential units, educational facilities and waste management sites.	• Principal aquifer providing locally important resource or supporting a river ecosystem • Groundwater supports a GWDTE • SPZ2[20]
Medium	High or medium importance and rarity, regional scale and limited potential for substitution/replacement	• WFD waterbody with Moderate status for water quality related Classification elements (e.g. Physico-chemical quality elements) • Water quality supports waterbody of particular local social/cultural/educational interest. Water body of low amenity value with only casual access, e.g. along a road or bridge in a rural area	• WFD hydromorphological designation "heavily modified" • Hydromorphological Supporting Elements of WFD status "Supports Good" • Substantially modified by previous engineering works and likely to possess an artificial cross-section (e.g. trapezoidal) and will probably be deficient in bedforms and bankside vegetation: Conservation Status score of 2-4 (Low)	• Floodplain or defence protecting 10 or fewer industrial properties from flooding • Areas which are less vulnerable. These can include retail, commercial and general industrial units, agricultural/forestry sites and water/sewage treatment plants.	• Aquifer providing water for agricultural or industrial use with limited connection to surface water • SPZ3[20]
Low	Low or medium importance and rarity, local scale and considerable potential for substitution/replacement	• Non-WFD waterbody or WFD waterbody with Poor/Bad status for water quality related Classification elements (e.g. Physico-chemical quality elements) • Waterbody of no amenity value, seldom used for amenity purposes, in a remote or inaccessible area	• WFD hydromorphological designation "heavily modified" or "artificial" • Hydromorphological Supporting Elements of WFD status "Does Not Support Good" • Channelised (reaches whose bed and banks have hard protection (e.g. concrete walls or sheet piling): Conservation Status score of 1 • Culverted (totally enclosed by hard protection): Conservation Status score of N/A (navigable)	• Floodplain with limited constraints and a low probability of flooding of residential and industrial properties. • Areas considered to be water compatible. These can include flood control infrastructure, docks/marinas, pumping stations and recreational/landscape areas.	• Unproductive strata

[20] Source Protection Zone 1- 3 – For groundwater sources such as wells, boreholes and springs used for public drinking water supply. These zones show the risk of contamination from any activities that might cause pollution in the area. The closer the activity, the greater the risk.

Assessment of magnitude of impact

11.3.44 The magnitude of impacts is further detailed in Table 11-5 with specific examples relating to the water environment.

Table 11-5 Criteria for assessing potential magnitude of impact

Magnitude	Criteria	Example
High Adverse	Results in loss of attribute and/or quality and integrity of the attribute	• Loss or extensive change to a fishery/designated nature conservation site; • Loss of, or extensive change to, an aquifer/groundwater supported designated wetlands; • Change to the environmental status/classification of a water feature, including water quality classification; • Changes to site resulting in an increase in discharge/runoff of >75% with flood/sewerage exceedance potential; • Increase in peak flood level (1% annual probability event) >100mm; and • Loss of flood storage areas.
Moderate adverse	Affects integrity of attribute, or loss of part of attribute	• Partial loss or change to a fishery/designated nature conservation site. Loss in the productivity of a fishery; • Partial loss or change to an aquifer/groundwater supported designated wetlands; • Pollution of a receiving water body, but insufficient to change the environmental status/classification, including water quality classification; • Changes to site resulting in an increase in discharge/runoff of >50% with flood/sewerage exceedance potential; and • Increase in peak flood level (1% annual probability event) >50mm.
Low adverse	Results in some measurable change in attribute's quality or vulnerability	• Potential low risk of some pollution to a surface water or groundwater body, but insufficient to cause loss in quality, fishery productivity or biodiversity; • Changes to site resulting in an increase in discharge/runoff of >25% with flood/sewerage exceedance potential; and • Increase in peak flood level (1% annual probability event) >10mm.
Very Low adverse	Affects attribute, but of insufficient magnitude to affect the use of integrity	• The Scheme may adversely affect the integrity of the water environment, but this is not considered measurable; • No measurable impact upon an aquifer; and • Negligible change in peak flood level (1% annual probability event) <10mm.
No Change	Results in no change to the receptor	• No predicted adverse or beneficial impact to the receptor.
Very Low beneficial	Beneficial to attribute, but of insufficient magnitude to	• The Scheme may beneficially affect the integrity of the water environment, but this is not considered measurable; and • No measurable impact upon an aquifer.

Magnitude	Criteria	Example
	affect the use of integrity	
Low beneficial	Beneficial to attribute or a reduced risk of negative impact occurring	• Negligible change in peak flood level (1% annual probability event) <10mm
Moderate beneficial	Results in moderate improvement of attribute quality	• Moderate improvement to a fishery/designated nature conservation site. Potential increase in the productivity of a fishery; • Reduced pollution of a receiving water body, but insufficient to change the environmental status/classification, including water quality classification; • Changes to site resulting in a decrease in discharge/runoff >50%; and • Reduction in peak flood level (1% annual probability event) >50mm.
High beneficial	Results in major improvement of attribute quality	• Significant improvement to a fishery/designated nature conservation site; • Removal of existing polluting discharge or removing the likelihood of polluting discharges occurring; • Change to the environmental status/classification of a water feature, including water quality classification; • Changes to site resulting in a decrease in discharge/runoff of >75%; and • Reduction in peak flood level (1% annual probability event) >100mm.

11.3.45 Identification of the impacts of the Scheme will consider whether the impacts are:

- Direct or indirect;
- Secondary or cumulative;
- Short, medium or long term;
- Permanent or temporary;
- Reversible or irreversible; and
- Beneficial or adverse.

Assessment of significance of effect

11.3.46 Once the sensitivity of receptors and magnitude of impacts have been established, the overall significance of effects will be assessed using the matrix in Table 11-6.

Table 11-6 Significance of effect

		Receptor/resource sensitivity/importance			
		Very high	High	Medium	Low
Impact magnitud	High	Major	Major	Moderate	Moderate
	Moderate	Major	Moderate	Minor	Minor
	Low	Moderate	Minor	Minor	Minor
	Very low	Minor	Negligible	Negligible	Negligible
	No change	None	None	None	None

11.3.47 For the purpose of this assessment, all effects assessed as being of Moderate significance or above are considered to be significant in EIA terms. Effects of Minor or Negligible significance are not considered to be significant and will therefore not be reported as significant residual effects.

11.3.48 The design process has enabled the development of appropriate design adaptations, referred to as embedded mitigation. These remove the risk of impacts to the water environment and, where this is not possible, they reduce these risks and minimise the associated consequences to acceptable levels. Examples of embedded mitigation are seen through the preferred design of Baker Viaduct Underbridge (RBA/2) where measure include; the removal for the requirement for in-channel piers and a reduction in the required deck width over the Hebble and Calder Navigation and the River Calder. Further details are included in Chapter 3 (Consideration of alternatives).

11.3.49 The following assessment is undertaken with consideration of embedded mitigation.

11.3.50 Appropriate additional mitigation measures to reduce and, wherever possible, avoid identified adverse effects will be explored and discussed in Section 11.6 (Mitigation measures).

11.3.51 During construction, many of these measures are likely to be associated with good site practice and preparation of robust work packages. Such measures are incorporated into a Code of Construction Practice (CoCP). Part A of the CoCP is provided in Appendix 2-1.

11.3.52 During operation, the detailed design of the Scheme will look to provide betterment where possible. For example, additional measures can include maintaining channel capacity and enhancing watercourse habitats which will be derived as part of the WFD assessment and through discussions with the specialists carrying out the biodiversity assessment.

11.3.53 Any residual effects of the Scheme on the water environment and flood risk following the inclusion of mitigation measures will be identified.

Consultation

11.3.54 The Environmental Scoping Report and the subsequent Scoping Opinion informed the approach to the assessment reported in this ES, as presented in Section 11-3. Comments raised by stakeholders have been considered in the water environment assessment. Consultation has been ongoing throughout the EIA process and further details are provided in Table 11-7.

Table 11-7 Stakeholder consultation

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
31 July 2019	Scoping opinion	Department for Transport	"Any supporting Flood Risk Assessment must include a comprehensive analysis of how it is predicted that the Scheme will alter flood risk near the site and what measures are required to mitigate risk to neighbouring land. Separate modelling for river flood risk and surface water flood risk should be undertaken, including an assessment of reservoir flooding and an analysis of public sewer flooding and how this may be affected by the Scheme. The Lead Local Flood Authority and Yorkshire Water should be contacted prior to the preparation of the Environmental Statement so that all available relevant Flood Risk Data is available to inform the ES."	The points raised have been considered as part of the assessment. Flood risk data was obtained from Kirklees Council and the EA to inform the assessment.
31 July 2019	Scoping opinion	Canal & River Trust	"All works that 'affect' the Trust must comply with the Code of Practice (Code of Practice for Works Affecting the Canal & River Trust). This includes but is not limited to construction works on the property of the Trust, works undertaken on neighbouring property, works requiring access across the property of the Trust and works that over sail the property of the Trust."	Canal & River Trust have been consulted throughout the development of the Scheme.
31 July 2019	Scoping opinion	Environment Agency	"The Scoping Report identifies an appropriate range of flood risk impacts and the EA does not wish to add to this information at this stage. Flood Risk Activity Permit The Environmental Permitting (England and Wales) Regulations 2016 require a permit to be obtained for any activities which will take place: • on or within 8 metres of a main river (16 metres if tidal) • on or within 8 metres of a flood defence structure or culverted main river (16 metres if tidal) • on or within 16 metres of a sea defence • involving quarrying or excavation within 16 metres of any main river, flood defence (including a remote defence) or culvert • in a floodplain more than 8 metres from the riverbank, culvert or flood defence structure (16 metres if it's a tidal main river) and you don't already have planning permission. For further guidance please visit https://www.gov.uk/guidance/flood-risk-activitiesenvironmental-permits or contact our National Customer Contact Centre on 03708 506 506. The applicant should not assume that a permit will automatically be forthcoming once planning permission has been granted, and we advise them to consult with us at the earliest opportunity."	The EA have been fully consulted throughout the production of the ES. Minutes of the meeting dated 30 July 2020 set out the following position "It should be noted that the meeting made reference to permit requirements in relation to the Scheme. As previously discussed, the Transport and Works Act Order (TWAO) would give the Alliance[21] the powers to carry out the Scheme works. The order, if granted, gives the Alliance the required planning permission and deemed consent for the works. The EA does, however, retain protective provisions which means that the Scheme would have to submit detailed designs for relevant works and seek the EA's agreement, but that the agreement cannot be unreasonably withheld. No further permits would be required".
31 July 2019	Scoping opinion	Kirklees Council	"Any supporting FRA must include: • A comprehensive analysis of how it is predicted the Scheme will alter flood risk in the vicinity of the site and what measures will be required to mitigate this and dose not simply relate to flood risk relating to the Scheme itself. • Overland surface water flow paths from existing surface water flood risk mapping and planned drainage, how any works may alter such paths, how it is proposed to mitigate such risk and not increase flood risk to neighbouring land and uses. • Separate modelling for river flood risk and surface water flood risk • An assessment of reservoir flooding and how this could be affected by the Scheme • An analysis of public sewer flooding and how this may be affected by infrastructure provided as part of this Scheme and any mitigation proposed It is strongly recommended that both the Lead Local Flood Authority and Yorkshire Water are contacted prior to the production of the ES to ensure that all relevant available Flood Risk Data is used to inform the ES".	This has been considered as part of the FRA.
25 September 2019	Face to face meeting	EA	• Presentation of Scheme design and expected impacts on the water environment. • FRA and modelling approach discussed with EA Flooding Officer. Approach and required models agreed. • Water Framework Directive assessment approach discussed, although EA Biodiversity and Geomorphology Officers were not present at this meeting. Further email communications with officers following this meeting regarding review of WFD assessment approach and example WFD water body impact assessment. • Requirements for water quality monitoring raised, followed up by email via EA Planning Officer.	No compulsory requirement for water quality monitoring as in-channel works are not expected. Consultation with the EA has been undertaken throughout the production of the WFD assessment, including their review of the

[21] A group of rail firms comprising Network Rail, Amey, BAM Nuttall and Arup who have been awarded a contract to design infrastructure options for the Transpennine Route between York and Manchester.

Date	Type	Organisation	Key issues/outcomes	Outcomes/agreements
				proposed WFD approach and WFD compliance assessment. Approach to the development to the FRA was discussed with EA and agreement on methodology with required models identified and provided.
25 October 2019	Face to face meeting	Kirklees Council LLFA	• FRA and modelling approach discussed. • Drainage designers present to discuss surface water drainage strategy for track, outfalls and new stations. • Ordinary watercourse crossings discussed. • Flooding at Mirfield and sensitivity of area discussed.	Kirklees Council accepted approach to agreement in relation to consent to works on these Ordinary Watercourses.
December 2019	Face to face meeting	Canal & River Trust	• Culvert drainage to canals discussed.	No outcomes/agreements following consultation. No comments made by Canal & River Trust during or after this meeting.
23 January 2020	Face to Face meeting	EA	• Presentation of preliminary Baker Viaduct Underbridge (RBA/2) options. • Implications on flood risk, WFD and water quality raised.	Verbal agreement regarding WFD assessment approach. Confirmed in writing by EA Planning Officer following this meeting (letter received 10 March 2020). Implications on flood risk raised and discussed with flood risk officer. No change in agreement to approach made in previous consultations with the EA.
21 May 2020	Teleconference	EA	• Update to Baker Viaduct Underbridge (RBA/2) discussed. • Further details on Baker Viaduct Underbridge (RBA/2) options presented. • Environmental constraints and preferred options discussed for each discipline (flood risk, hydromorphology, water quality, aquatic ecology). • Requirement for water quality monitoring raised as in-channel works are now expected.	The final designs have been assessed and whilst water quality monitoring is not compulsory, monitoring has been included (as additional mitigation) within the EIA at Baker Viaduct Underbridge (RBA/2) due to the nature of in-channel works at this location.
30 July 2020	Teleconference	EA	• WFD-specific consultation meeting (teleconference) with EA Planning Officer and Geomorphology Officer. • Presented proposed designs and potential implications on the watercourse baselines (in terms of hydromorphology, water quality and aquatic ecology). • Also presented proposed mitigation measures for agreement with EA, with additional examples of opportunistic measures which EA would like to see considered as design progresses. • Ongoing discussion between around Biodiversity Net Gain, which will be communicated with the EA.	Overall agreement from EA regarding WFD assessment and proposed mitigation measures. Agreement with the EA that the Scheme is considered to be WFD compliant with no risk of derogation to any of the impacted WFD water bodies. No more consultation required with EA regarding WFD assessment at this stage of design.
22 October 2020	Teleconference	EA	• Presented proposed designs and potential implications on the flood risk. • Also presented proposed mitigation measures for agreement with EA.	Overall agreement from EA regarding the Flood Risk Assessment and proposed mitigation measures.
19 November 2020	Teleconference	Canal & River Trust	• Presented summary of ES and FRA findings including proposed mitigation measures	No formal feedback received to date (10 December 2020)

Cumulative effects

11.3.55 The approach for the Cumulative Impact Assessment (CIA) is detailed in Chapter 22 (Cumulative effects) of this ES.

11.3.56 The CIA considers both the in-combination effects of the Scheme within and between environmental topics (intra-Scheme) and also the cumulative effects of the Scheme with other nearby developments (inter-Scheme).

11.3.57 The inter-Scheme section of the CIA considers Reasonably Foreseeable Future Projects (RFFPs) which were agreed with the Local Authority in October 2020 and updated in January 2021. Further detail is provided in Chapter 22 (Cumulative effects).

Assessment statements

11.3.58 The assessment has been undertaken based on the Scheme drawings presented in Figures 2-1, and the Scheme-wide drainage strategy[22]. The design will continue to be refined in the time up to construction within the parameters of the Scheme assessed by the EIA and reported in the ES.

11.4 Baseline

11.4.1 Surface watercourses within the study area generally flow from west to east and fall within the Humber River Basin District (RBD)[23], as set out in the Humber River Basin Management Plan (RBMP).

11.4.2 There are 13 WFD water bodies which fall spatially within the study area, comprising:

- Nine WFD river water bodies;
- Three WFD canal water bodies; and
- One WFD groundwater body.

11.4.3 Within these WFD water bodies, individual watercourses have been identified based on the following criteria:

- Designated as a WFD reportable watercourse;
- Designated as an EA statutory Main River; and
- Included in the OS Open Rivers database.

11.4.4 If an individual watercourse does not fall into any of the above categories but is directly crossed or affected by the Scheme, and appears on OS 1:25,000 scale base mapping, then this watercourse has also been identified for inclusion in the assessment.

11.4.5 Those other watercourses which do not fall into any of the above categories, do appear on the OS 1:25,000 scale base mapping within the study area, but are not directly crossed or affected by the Scheme have not been individually listed and are not explicitly included in the assessment.

11.4.6 Therefore, as per the above criteria, 25 individual watercourses (including three canals as noted above) have been identified for assessment, plus four lakes/ponds/reservoirs, as set out

[22] Transpennine Route Upgrade, Drainage Strategy, Work Package W3, Huddersfield to Westtown (Dewsbury), 16/1/2020
[23] The area of land and sea made up of one or more neighbouring river basins together with their associated groundwaters and coastal waters. River Basin Districts have been delineated by using River Catchments as “building blocks”

in Table 11-8. For those watercourses which are not named on OS 1:25,000 scale base mapping, they have been provided with a name based on the following: "Unnamed Watercourse at <structure name>", where <structure name> is the descriptive name of the railway structure at which they are located within the Scheme boundary.

11.4.7 An Ordinary Watercourse is defined as "every river, stream, ditch, drain, cut, dyke, sluice, sewer (other than a public sewer) and passage through which water flows and which does not form part of a Main River". Main Rivers fall under the legal powers and responsibility of the EA, whereas Ordinary Watercourses are the responsibility of the LLFA.

11.4.8 In relation to flood risk from the Scheme, the EA has operational jurisdiction over main rivers and the LLFA have jurisdiction over flooding from surface water, groundwater and ordinary watercourses.

11.4.9 Flood zones are defined by the EA based on the likelihood of an area flooding[24], with Flood Zone 1 areas least likely to flood and Flood Zone 3 areas more likely to flood. The Scheme crosses both Flood Zones 2 and 3 associated with several waterbodies. In addition to the designation of flood zones along the Scheme, other critical flood management infrastructure is present within the study area, specifically EA flood storage provision.

Surface waters WFD status

11.4.10 The WFD is implemented through RBMPs which set out statutory objectives for river, canal, lake, groundwater, estuarine and coastal water bodies and summarise the measures needed to achieve them. The study area is covered by the Humber RBMP[25], and 12 surface water WFD water bodies (nine river and three canal) and one groundwater WFD water body discussed further as follows.

11.4.11 WFD reportable watercourses are assessed under the WFD, assigned a classification and are designated as Statutory Main Rivers (i.e. the responsibility of the EA). Other watercourses within the WFD surface water body are reportable to the WFD watercourse and consideration should still be given to their impact upon the status of the wider water body. These other watercourses may either be designated as Statutory Main River or Ordinary Watercourse (i.e. the responsibility of the LLFA).

11.4.12 Table 11-8 provides a summary of the overall status of the WFD surface water bodies within the study area and Figure 11-1 illustrates the location of the water bodies. The Route Section Assessments in Volume 2ii of the ES provide further details of ecological and chemical status, and the elements that make up these classifications.

11.4.13 All the river water bodies, apart from Smithy Brook from source to River Calder, are designated as Heavily Modified Waterbodies (HMWB), which means that they are substantially altered. Consequently, rather than achieving a 'status' they aspire to achieving a 'potential'. Currently all nine river water bodies have an overall status/potential of Moderate and Moderate ecological status/potential.

11.4.14 All the canal water bodies are Artificial Waterbodies (AWB), which means that they have been created where no water body existed previously. All the canal water bodies have Moderate overall potential.

11.4.15 As stated, there are 25 watercourses identified within the study area, how they relate to the

[24] These areas have been defined following a national scale modelling project for the EA and are regularly updated using recorded flood extents and local detailed modelling.
[25] https://www.gov.uk/government/publications/humber-river-basin-district-river-basin-management-plan

WFD waterbodies is provided in Table 11-8 which also includes summarises the status of each of these WFD waterbodies.

11.4.16 The largest rivers within the Scheme are the Rivers Colne and Calder, which flow generally in a north-easterly (River Colne) and easterly (River Calder) direction through the study area.

11.4.17 There are three canals within the study area, Huddersfield Broad Canal, Huddersfield Narrow Canal and Calder and Hebble Navigation, with the Huddersfield canals present alongside the River Colne and the Calder and Hebble Navigation present alongside the River Calder.

11.4.18 The other watercourses are tributaries of the Rivers Colne and Calder or the canals. There are two fishing ponds, Patterson's Ponds and Ladywood Lakes, present alongside the River Calder, and two ponds at the Thornhill Quarry site.

Table 11-8 Surface watercourses and WFD water bodies

Table key (WFD status) for WFD tables:

High	Good	Moderate	Poor	Bad

Surface watercourse	WFD reportable watercourse	Main River/Ordinary Watercourse	Route Section	Overall WFD status (2019)
Holme from New Mill Dike to R Colne (GB104027063301)			**1 – Huddersfield**	**Moderate**
River Holme	**Yes**	**Main River**	**1 – Huddersfield**	
Colne from Wessenden Brook to R Holme (GB104027063330)			**1 – Huddersfield**	**Moderate**
Gledholt Beck	No	Ordinary Watercourse	1 – Huddersfield	
River Colne	Yes	Main River	1 – Huddersfield	
Colne from River Holme to River Calder (GB104027062550)			**1 – Huddersfield** **2 – Hillhouse and Fartown** **3 – Deighton and Bradley** **4 – Colne Bridge and Battyeford**	**Moderate**
Blackhouse Dike	No	Main River	2 – Hillhouse and Fartown	
Hebble Beck (Grimescar Dike)	Yes	Main River	1 – Huddersfield 2 – Hillhouse and Fartown	
River Colne	Yes	Main River	1 – Huddersfield 2 – Hillhouse and Fartown 3 – Deighton and Bradley	
Unnamed Watercourse at Bradley Culvert	No	Ordinary Watercourse	2 – Hillhouse and Fartown 3 – Deighton and Bradley	
Unnamed Watercourse at Field House Culvert	No	Ordinary Watercourse	2 – Hillhouse and Fartown	
Mill Race	No	Ordinary Watercourse	1 – Huddersfield	
Penny Spring Beck	No	Ordinary Watercourse	1 – Huddersfield	
Fenay Beck from Source to River Colne (GB104027063340)			**1 – Huddersfield** **2 – Hillhouse and Fartown** **3 – Deighton and Bradley**	**Moderate**
Fenay Beck (Lees Beck)	Yes	Main River	2 – Hillhouse and Fartown	
Calder from Ryburn confluence to River Colne (GB104027062642)			**4 – Colne Bridge and Battyeford**	**Moderate**
River Calder	Yes	Main River	4 – Colne Bridge and Battyeford	

Surface watercourse	WFD reportable watercourse	Main River/Ordinary Watercourse	Route Section	Overall WFD status (2019)
Calder from River Colne to River Chald (GB104027062631)			**3 – Deighton and Bradley 4 – Colne Bridge and Battyeford 5 – Mirfield and Lower Hopton**	**Moderate**
Nun Brook	No	Ordinary Watercourse	4 – Colne Bridge and Battyeford	
River Calder	Yes	Main River	4 – Colne Bridge and Battyeford 5 – Mirfield and Lower Hopton 6 – Ravensthorpe and Westtown	
Unnamed Watercourse at Chadwick Close Culvert	No	Ordinary Watercourse	4 – Colne Bridge and Battyeford 6 – Mirfield and Lower Hopton	
Unnamed Watercourse at Colnebridge Culvert	No	Ordinary Watercourse	4 – Colne Bridge and Battyeford	
Unnamed Watercourse at Heaton Lodge Junction	No	Ordinary Watercourse	4 – Colne Bridge and Battyeford	
Unnamed Watercourse at Steanard Lane Culvert	No	Ordinary Watercourse	5 – Mirfield and Lower Hopton	
Unnamed Watercourse at Long Plantation	No	Ordinary Watercourse	6 – Ravensthorpe and Westtown	
Ladywood Lakes	No	N/A	5 – Mirfield and Lower Hopton	
Patterson's Ponds	No	N/A	4 – Colne Bridge and Battyeford	
Thornhill Quarry site ponds	No	N/A	6 – Ravensthorpe and Westtown	
Smithy Brook from Source to River Calder (GB104027062510)			**5 – Mirfield and Lower Hopton 6 – Ravensthorpe and Westtown**	**Moderate**
Howroyd Beck	Yes	Ordinary Watercourse	5 – Mirfield and Lower Hopton 6 – Ravensthorpe and Westtown	
Whitley Reservoir	No	N/A	5 – Mirfield and Lower Hopton	
Spen Beck from Source to River Calder (GB104027062710)			**6 – Ravensthorpe and Westtown**	**Moderate**
Spen Beck	Yes	Main River	6 – Ravensthorpe and Westtown	
Batley Beck from Source to River Calder (GB104027062670)			**6 – Ravensthorpe and Westtown**	**Moderate**
Batley Beck	Yes	Main River	6 – Ravensthorpe and Westtown	
Huddersfield Broad Canal (GB70410176)			**1 – Huddersfield 2 – Hillhouse and Fartown 3 – Deighton and Bradley**	**Moderate**
Huddersfield Broad Canal	Yes	Ordinary Watercourse	1 – Huddersfield 2 – Hillhouse and Fartown	
Huddersfield Narrow Canal east section (GB70410269)			**1 – Huddersfield**	**Moderate**

Surface watercourse	WFD reportable watercourse	Main River/Ordinary Watercourse	Route Section	Overall WFD status (2019)
Huddersfield Narrow Canal	Yes	Ordinary Watercourse	1 – Huddersfield	
Calder and Hebble Navigation (river and canal sections) (GB70410521)			**4 – Colne Bridge and Battyeford 5 – Mirfield and Lower Hopton 6 – Ravensthorpe and Westtown**	**Moderate**
Calder and Hebble Navigation	Yes	Ordinary Watercourse	4 – Colne Bridge and Battyeford 5 – Mirfield and Lower Hopton 6 – Ravensthorpe and Westtown	

WFD pressures

11.4.19 The RBMP details the pressures that exist for each WFD water body which are causing the water body to not achieve Good status. These are summarised as follows:

River water bodies

- **Holme from New Mill Dike to R Colne (GB104027063301):** Continuous and intermittent sewage discharges from the water industry; and, diffuse pollution from transport drainage;
- **Colne from Wessenden Brook to R Holme (GB104027063330):** point source pollution from /industry; physical modification from urbanisation and local/central government;
- **Colne from River Holme to River Calder (GB104027062550):** continuous and intermittent sewage discharges from the water industry; and, physical modification from local/central government and urban and transport;
- **Fenay Beck from Source to River Calder (GB104027063340):** physical modification from local/central government, urban and transport, flood protection structures, urbanisation and barriers to ecological continuity; and, diffuse pollution from contaminated land;
- **Calder from Ryburn confluence to River Colne (GB104027062642):** continuous and intermittent sewage discharges from the water industry; and, physical modification from urbanisation, local/central government, navigation and urban and transportation;
- **Calder from River Colne to River Chald (GB104027062631):** continuous and intermittent sewage discharges from the water industry; and, point source pollution incidents;
- **Smithy Brook from Source to River Calder (GB104027062510)**: diffuse pollution from abandoned mine;
- **Spen Beck from Source to River Calder (GB104027062710):** intermittent sewage discharges from the water industry; physical modification from local/central government, urban and transport, flood protection structures and urbanisation; point source trade/industry discharges; and, diffuse pollution from urbanisation and contaminated land; and
- **Batley Beck from Source to River Calder (GB104027062670):** physical modification from local/central government, urban and transport, flood protection structures and urbanisation; intermittent sewage discharges from the water industry; and, diffuse source pollution from urban and transport.

Canal water body

- **Calder and Hebble Navigation (river and canal sections) (GB70410521):** continuous sewage discharge from the water industry.

Groundwater water body

- **Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures (GB40402G700400):** point source pollution from abandoned mine.

Water quality

EA surface water quality monitoring data

11.4.20 EA water quality data has been obtained from the Water Quality Data Archive[26] for sampling locations within the study area for the Scheme, as shown in Figure 11-2. A summary of all available data is provided in Appendix 11-3.

11.4.21 Selected data from sampling sites within the study area has been taken forward to inform the

[26] https://environment.data.gov.uk/water-quality/view/landing

baseline study. Sampling locations have been included where partial data is available in the last 10 years. Where a sampling location has no data from the last 10 years, these sites have not been brought forward for further data analysis. Analysis of data out with this time period may not be relevant due to localised changes. Data for physico-chemicals and parameters[27] of relevance to the Scheme have been selected to describe the baseline; a literature search identified metals, hydrocarbons and herbicides as parameters of interest around railways.

11.4.22 The sample points within the Scheme, with relevant data for assessment, are summarised in Table 11-9.

[27] Limited to those identified as Specific Pollutants or Priority Substances under the WFD.

Table 11-9 EA sample sites within the Scheme study area

Route Section	Site	Watercourse	EA descriptor	Notes
1 – Huddersfield	NE-49500662	River Holme	At Queens Mill	Routine monitoring
1 – Huddersfield	NE-49500506	River Holme	Colne Trib (Ad Hoc)	Unplanned reactive monitoring (pollution incidents)
1 – Huddersfield	NE-49500633	River Colne	At Kings Mill	Routine monitoring
1 – Huddersfield	NE-49500223	River Colne	Source to Holme (Ad Hoc)	Unplanned reactive monitoring (pollution incidents)
2 – Hillhouse and Fartown	NE-49500413	Huddersfield Broad Canal	Downstream Incinerator	No Specific Pollutants/Priority Substances
2 – Hillhouse and Fartown	NE-49500628	River Colne	Bradley Mills	Routine monitoring
2 – Hillhouse and Fartown	NE-49500367	Fenay Beck	Tributary of River Colne	Routine monitoring
3 – Deighton and Bradley	NE-49500644	River Colne	At Top Weir (Ashgrove Rd)	Routine monitoring
4 – Colne Bridge and Battyeford	NE-49500601	River Calder	At Cooper Bridge	Routine monitoring
4 – Colne Bridge and Battyeford	NE-49500187	River Calder	North Dene Bridge to Colne Confluence	Downstream Halifax Sewage Treatment Works (STW) to Upstream Huddersfield STW Includes unplanned pollution incident monitoring
4 – Colne Bridge and Battyeford	NE-49500617	River Calder	At Mirfield (Battyeford Iron Bridge)	Routine monitoring
4 – Colne Bridge and Battyeford	NE-49500221	River Colne	Holme to Calder (Ad hoc)	Unplanned pollution incident monitoring
5 – Mirfield and Lower Hopton	NE-49500619	River Calder	At Dr Reddy's Bridge	Routine monitoring
6 – Ravensthorpe and Westtown	NE-49500699	Spen Beck	At A644 Road Bridge	Routine monitoring
6 – Ravensthorpe and Westtown	NE-49500750	Spen Beck	Calder Trib (Ad hoc)	Unplanned pollution incident monitoring
6 – Ravensthorpe and Westtown	NE-49500607	River Calder	At Dewsbury	Routine monitoring
6 – Ravensthorpe and Westtown	NE-49500188	River Calder	Colne Confluence to Batley Beck	Unplanned pollution incident monitoring
6 – Ravensthorpe and Westtown	NE-49500020	Batley Beck	At Dewsbury	No Priority Substance or Specific Pollutant data
6 – Ravensthorpe and Westtown	NE-49500119	Batley Beck	Calder Trib (Ad hoc)	Unplanned pollution incident monitoring

Groundwater

11.4.23 The Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures (GB40402G700400) groundwater body is the only groundwater body underlying the study area, as shown in Figure 11-3.

11.4.24 This WFD groundwater body is situated within the Humber RBD and Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures Operational Catchment. The Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body covers 1,896km^2 of north-west England; stretching from Settle in the north of the catchment to Holmfirth in the south-west to Leeds in the east. This groundwater body incorporates several bedrock formations, from the Millstone Grit Group in the west to the Pennine Middle Coal Measures Formation in the east.

11.4.25 The current overall status is Poor, with quantitative[28] being Good and Chemical being Poor. There is a drinking water protected area and Nitrate Vulnerable Zone linked to the WFD groundwater body, however, these are not located within the study area.

Table 11-10 WFD 2019 status summary for Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures

Water body name:	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures
Water body ID:	**GB40402G700400**
Overall status	**Poor**
Quantitative	**Good**
Chemical	**Poor**
Linked protected area*	Drinking water protected area (UKGB40402G700400)

* Linked protected areas listed may not necessarily lie within the Scheme boundary

11.4.26 The 1:625,000 scale bedrock geology mapping indicates that the entire Scheme is underlain by Pennine Lower Coal Measures Formation and South Wales Lower Coal Measures Formation (undifferentiated). At a more detailed scale, the 1:50,000 scale geology mapping shows the area is underlain specifically by the interbedded siltstones, mudstones and sandstones of the Pennine Lower Coal Measures Formation, Middle Band Rock, Birstall Rock, Fallhouse Rock, Clifton Rock, Lepton Edge Rock and the Elland Flags. Faults and fissures are found across the study area.

11.4.27 Superficial geology is limited to Alluvium along the river corridors, and isolated areas of Head, Lacustrine Deposits, Alluvial Fan deposits and River Terrace Deposits.

11.4.28 The bedrock underlying the Scheme is classified as a Secondary A aquifer by the EA. The underlying superficial drift deposits are primarily Secondary A, mostly following the Main Rivers in the study area (River Colne, River Calder and others) with areas of Secondary (undifferentiated) around Huddersfield and Mirfield. Secondary A aquifers have permeable layers capable of supporting water supplies at a local rather than strategic scale and in some cases form an important source of baseflow to rivers. Secondary undifferentiated aquifers are defined as those previously designated as both minor and non-aquifer in different locations due to the variable characteristics of the rock type.

11.4.29 There are three small SPZs[20] within the study area which are located approximately 900m directly north of Huddersfield Station in Route Section 1. These are all designated as Zone I

[28] This includes assessments on water balance, dependent surface and terrestrial ecosystems and saline intrusion

(Inner Protection Zone) and are associated with abstraction licence 2/27/11/023. The abstraction licence was originally issued in 1965 for boreholes for potable water abstraction at a bottling factory on Willow Lane, Huddersfield. The bottling factory has since closed, and the licence was revoked in 2017. Therefore, for the purposes of this assessment, the SPZs are not considered to be active.

Water dependent designations

11.4.30 No European or Nationally designated sites including Special Areas of Conservation (SAC), Special Protected Areas (SPA), RAMSAR, Sites of Special Scientific Interest (SSSI), National Nature Reserves (NNR) or Areas of Outstanding Natural Beauty (AONB) have been identified within the study area. A total of four LNR sites and eight Local Wildlife Sites (LWS) are located within the study area as shown in Table 11-11.

Table 11-11 Water dependant designations within the Scheme study area

Route Section	Site	Designation	Notes
1 – Huddersfield	Gledholt Woods	LNR	Not a water dependent feature
1 – Huddersfield	Huddersfield Narrow Canal	LWS	Water dependent feature. Located within Huddersfield Narrow Canal east section WFD catchment.
1 – Huddersfield	Sir John Ramsden Canal	LWS	Water dependent feature. Also known as Huddersfield Broad Canal. Located within Huddersfield Broad Canal WFD catchment.
3 – Deighton and Bradley	Dalton Bank	LNR/LWS	Not a water dependent feature
3 – Deighton and Bradley and 4 – Colne Bridge and Battyeford	Bradley Park Woods	LWS	Not a water dependent feature
5 – Mirfield and Lower Hopton	Covey Clough Wood and Hepworth Wood	LWS	Not a water dependent feature
5 – Mirfield and Lower Hopton	Whitley Wood	LWS	Not a water dependent feature
5 – Mirfield and Lower Hopton	Briery Bank Wood	LWS	Not a water dependent feature
6 – Ravensthorpe and Westtown	Lower Spen Wildlife Area	LNR	Water dependent feature Located within Spen Beck from Source to River Calder WFD Catchment
6 – Ravensthorpe and Westtown	Sparrow Wood	LNR/LWS	Not a water dependent feature

Aquatic ecology

11.4.31 In addition to the designations identified above, floating water-plantain (*Luronium natans*), an Annex II Species, has been recorded in the Calder and Hebble Navigation, Huddersfield Broad Canal and Huddersfield Narrow Canal, reflecting specific water quality conditions. This is assessed further in Chapter 9 (Biodiversity) of this ES.

Flood risk

11.4.32 Full details of the hydrology and flood risk baseline are provided in the Route Section Assessments in Volume 2ii of the ES, and cover the following areas:

- Fluvial flood risk;
- Groundwater flood risk;
- Other flood risk sources;
- Drainage and culverts; and
- Key receptors.

11.4.33 Existing flood risk to the Scheme from fluvial, surface, groundwater, sewers and artificial sources has been assessed. Existing flood risk is predominantly associated with fluvial flood risk where the Scheme crosses existing watercourses, and surface water flooding because of water ponding against embankments or within cuttings. Table 11-12 provides a summary of the key flood risk issues across the Scheme by Route Section.

Table 11-12 Summary of flood risk to the Scheme

	Source of flood risk				
Route Section	Fluvial	Surface water	Groundwater	Sewers	Reservoirs
1 – Huddersfield	✓	✓	✓	✓	✓
2 – Hillhouse and Fartown	✓	✓	✓	✓	✓
3 – Deighton and Bradley	✗	✓	✗	✓	✗
4 – Colne Bridge and Battyeford	✓	✓	✓	✓	✓
5 – Mirfield and Lower Hopton	✓	✓	✓	✓	✓
6 – Ravensthorpe and Westtown	✓	✓	✓	✓	✓

11.4.34 Existing flood risk information has indicated that the Scheme passes through locations identified as being at risk of flooding from various sources. However, the flood risk is generally considered to be low with the most significant sources to be fluvial and surface water flooding.

11.4.35 The Scheme is classed as 'Essential transport infrastructure (including mass evacuation routes)'[29]. Parts of the Scheme lie in Flood Zones 2 and 3 (Figure 11-4) but in accordance with Technical Guidance to the NPPF (Table 2), "Essential Infrastructure", the Scheme is considered to be an acceptable development within these flood zones. Further details are provided in the FRA in Appendix 11-1.

Hydromorphology

11.4.36 The hydromorphology of a channel dictates, in part, the available habitat and associated ecological diversity found within a watercourse. As a component assessed under the WFD, it is a legal requirement to consider the impact of new Schemes on the hydromorphology of affected watercourses.

11.4.37 Under the WFD, the majority of the river water bodies (all apart from Smithy Brook) within the

[29] Technical Guidance to the National Planning Policy Framework, March 2012 https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/6000/2115548.pdf

study area are assessed as HMWBs, which means that they are substantially altered. The Rivers Colne and Calder are large, highly modified rivers, which have been realigned and reprofiled in many places and have many sections of bank protection. The three canals which are present within the study area; Huddersfield Narrow Canal, Huddersfield Broad Canal and the Calder and Hebble Navigation are AWBs, which means that they have been created where no water body existed previously. There are many other smaller watercourses within the study area which are also highly modified, with realignment, bed and bank protection and culverted stretches.

Value of environmental receptors

11.4.38 The water receptors within the Scheme to be assessed, their importance and the reason for their inclusion in the assessment, are provided in Table 11-13. Greater detail is provided in the individual Route Section Assessments in Volume 2ii of the ES.

Table 11-13 Water receptors and their importance

Receptor	Importance				Overall	Reason for inclusion in assessment
	Water quality	Hydro-morphology	Flood risk	Ground water		
Gledholt Beck	Low	Low	Medium	N/A	Medium	Flows through the Scheme boundary and beneath the railway at Gledholt Culvert (MVL3/84B)
Hebble Beck	Medium	Low	Medium	N/A	Medium	Flows through the Scheme boundary and beneath the railway at Hebble Beck Culvert (MVL3/93)
Blackhouse Dike Flood Zone 2 – Hillhouse Construction Compound/Sidings	Low	Low	Medium	N/A	Medium	Flows through the Scheme boundary and beneath the railway at Red Doles Culvert (MVL3/96A)
Unnamed Watercourse at Field House Culvert	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Field House Culvert (MVL3/98A)
Unnamed Watercourse at Bradley Culvert	Low	Low	Medium	N/A	Medium	Flows through the Scheme boundary and beneath the railway at Bradley Culvert (MVL3/102A)
Unnamed Watercourse at Colnebridge Culvert	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Colnebridge.Culvert (MVL3/110A)
Unnamed Watercourse at Heaton Lodge Junction	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Heaton Lodge Junction, Mirfield Culvert (MVN2/190A).
Unnamed Watercourse at Heaton Lodge Underpass	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Cooper Bridge Culvert (MVL4/3A).
Unnamed Watercourse at Chadwick Close Culvert	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Chadwick Close Culvert (MVN2/191A).
Unnamed Watercourse at Steanard Lane Culvert	Low	Low	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Steanard Lane Culvert (MVN2/198AA).
Unnamed Watercourse at Long Plantation	Low	Low	Low	N/A	Low	Flows through the Scheme boundary where overhead power line works are being undertaken.
River Colne	Medium	Medium	Route Section 1: N/A Route Section 4: **High**[1]	N/A	High	Flows through the Scheme boundary and beneath the railway at Colne Viaduct Underbridge (MVL3/109). Also, tributaries Gledholt Beck and Hebble Beck flow through the Scheme boundary and beneath the railway before flowing into the River Colne.
Mill Race	Low	Low	N/A	N/A	Low	Section of the River Colne which is within the Scheme boundary.
River Calder	Medium	Medium	High	N/A	High	Flows through the Scheme boundary and beneath the railway at Mirfield Viaduct Underbridge (MVN2/192), Wheatley's Underbridge (MVN2/196), River Calder Underbridge (MDL1/8) and Baker Viaduct Underbridge (RBA/2). Tributaries Unnamed Watercourse at Chadwick Close Culvert, Unnamed Watercourse at Steanard Lane Culvert, Unnamed Watercourse at Ladywood Culvert, Unnamed Watercourse at Colnebridge Culvert and Unnamed Watercourse at Heaton Lodge Junction all flow beneath the railway and discharge into the River Calder.
Topaz Close Culvert (MVL3/96AA)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Topaz Close Culvert (MVL3/96AA).
Deighton Culvert (MVL3/101A)	N/A	N/A	Medium	N/A	Medium	Culvert associated with the A62 Leeds Road Overbridge (MVL3/102) works and is being removed. Risk of increased runoff from new track.
Colnebridge Road Culvert (MVL3/110A (to be extended)))	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Colnebridge Road Culvert (MVL3/110A (to be extended)).
Cooper Bridge (MVL4/1A)	N/A	N/A	Low	N/A	Low	No works relating to Scheme.
Heaton Lodge (MVL4/4A)	N/A	N/A	Low	N/A	Low	No works relating to Scheme.
Bradley Culvert (MVL3/106A)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Bradley Culvert (MVL3/106A).
Mirfield No.1 Culvert (MVN2/190B)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Mirfield No.1 Culvert (MVN2/190B).
Mirfield No.2 Culvert (MVN2/190C)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath the railway at Mirfield No.2 Culvert (MVN2/190C).
Wood Lane Culvert (MVN2/191B)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath railway at Wood Lane Culvert (MVN2/191B).
Sands Lane Culvert (MVN2/198B)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath railway at Sands Lane Culvert (MVN2/198B).
Ladywood Road Culvert (MVN2/200)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath railway at Ladywood Road Culvert (MVN2/200). Connection to surface water drainage so assessment of capacity required.
Ladywood Culvert (MVN2/200C)	N/A	N/A	Low	N/A	Low	Flows through the Scheme boundary and beneath railway at Ladywood Culvert (MVN2/200C). Connection to surface water drainage so assessment of capacity required.

Receptor	Importance				Overall	Reason for inclusion in assessment
	Water quality	Hydro-morphology	Flood risk	Ground water		
Huddersfield Narrow Canal	High	Low	N/A	N/A	High	Present alongside the Scheme boundary.
Huddersfield Broad Canal	Very High	Low	Low	N/A	Very High	Passes through the Scheme boundary and beneath the railway at Huddersfield Broad Canal Underbridge (MVL3/108). Blackhouse Dike, Unnamed Watercourse at Field House Culvert and Unnamed Watercourse at Bradley Culvert discharge into the canal alongside the Scheme boundary.
Calder and Hebble Navigation	High	Low	Low	N/A	High	Lies close to, and passes through, the Scheme boundary and beneath the railway at Calder & Hebble Canal Underbridge (MDL1/6). Connected to the River Calder.
Thornhill Quarry site ponds	N/A	N/A	Low	N/A	Low	Included for flood risk as within alignment of the Flyover Intersection (RBA/1) embankment.
Ladywood Lakes	Low	N/A	N/A	N/A	Low	Included for water quality as adjacent to construction compound.
Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	N/A	Route Sections 1, 2, 4, 5 and 6: Medium Route Section 3: N/A	Medium	Medium	Underlies the study area.

Table notes
1 - The River Colne is identified in two Route Section Assessments and has been assigned different Importance due to localised conditions.

11.5 Potential effects

11.5.1 Potential effects are split into construction and operation impacts. For the purpose of this assessment construction impacts are mainly reported to be short-term impacts (i.e. localised impacts, which are dependent on the technical area, will only impact the water receptor for a limited time but generally less than a month) which occur during the construction phase only. Operation impacts are long-term or permanent impacts affecting water receptors after the construction phase is complete. Structure locations are shown in Figure 11-5.

Construction

11.5.2 The potential impacts during construction to water quality are summarised in Table 11-14. These cover works to watercourses, vehicles and associated oil/fuel, which have the potential to impact water quality (via increased sediment loading and chemicals) and affect watercourse ecology and alter watercourse hydromorphology.

Table 11-14 Potential water quality impacts during construction

Activity	Potential impact
Direct works to/within watercourses and indirect/associated works such as earthworks, cuttings, embankments, culverts, bridge structures and realignments, including during temporary highways works	Increased risk of pollution to watercourses due to runoff containing elevated levels of suspended solids and resuspension of potentially contaminated sediments. Runoff with high sediment load can have direct adverse effects on adjacent watercourses through increasing turbidity (thus reducing light penetration and reducing plant growth) and by smothering vegetation and bed substrates.
Vehicles accessing compounds, refuelling, oil/fuel storage tanks and accidental spillage, including during temporary highways works	Risk of release of hydrocarbons and oils, leading to polluted runoff migrating to surface water. Hydrocarbons within surface water can chemically impair biological functions of freshwater fish.
Runoff from construction compounds – stockpiles, drainage, wheel washings and material movements	Construction compound runoff typically contains elevated suspended solids levels. Runoff with high sediment load can have direct adverse effects on adjacent watercourses through increasing turbidity (thus reducing light penetration and reducing plant growth) and by smothering vegetation and bed substrates.
Storage and use of construction materials/chemicals (e.g. solvents, degreasers) on site	Risk of accidental releases of contaminants to surface water and infiltration to groundwaters.

11.1.1 The potential impacts during construction to hydromorphology are summarised in Table 11-15. These cover construction compound activities, direct and indirect works to watercourses and temporary structures in watercourses, which have the potential to affect watercourse conveyance and fluvial processes.

Table 11-15 Potential hydromorphology impacts during construction

Activity	Potential impact
Works to watercourses, including temporary structures in-channel to facilitate structural works and works in the floodplain	In-channel structures can act as a barrier to flow which may cause local changes in velocities and cause increased erosional and depositional processes. This can limit available habitat for aquatic flora and fauna and may also impede the movement of any fish present within the

Activity	Potential impact
	watercourse. Construction activities in the floodplain may alter natural functioning (floodplain connectivity and storage), runoff rates and velocities which contribute to the adjacent watercourse and may also contain elevated levels of suspended solids which can cause increased turbidity and may smother vegetation and bed substrates.
Runoff from construction compounds – stockpiles, drainage, wheel washings and material movements	Construction compound runoff typically contains elevated suspended solids levels. Runoff with high sediment load can have direct adverse effects on adjacent watercourses through increasing turbidity (thus reducing light penetration and reducing plant growth) and by smothering vegetation and bed substrates.
Disturbance of groundwater flow paths	Where subsurface structures/foundations and dewatering are proposed these might intercept or alter groundwater flows/levels which may contribute to watercourse baseflow.

11.5.3 The potential impacts during construction to flood risk are summarised in Table 11-16. These cover temporary structures in watercourses, works in the floodplain, excavation/earthworks, drainage and increased areas of impermeable surfaces, which have the potential to affect watercourse conveyance, flood risk and flow pathways.

Table 11-16 Potential flood risk impacts during construction

Activity	Potential impact
Temporary structures in watercourses to facilitate works to bridges and culverts	Reduction in watercourse conveyance causing an increase in flood risk.
Works in the floodplain - localised ground-rising for temporary works, movement of materials, creation of stockpiles or development of construction compound.	Displacement of flood waters and changes to surface water runoff pathways increasing flood risk to surrounding area. Construction compounds could block existing drainage, modify flow pathways and increase runoff.
Works to culverts and bridges (upgrade, extension, replacement or new)	Watercourse diversions/pumping may increase flood risk through flows being more effectively conveyed downstream or water backing up due to insufficient capacity. Blockages may occur if materials/equipment are washed into the channel.
Excavation, earthworks and construction works	Culvert blockage, displacement of flood water, and/or severance of surface water drainage paths that could lead to localised flooding. Increased sediment load from earthworks reducing capacity of culverts.
Temporary drainage	Sever, and interception, of existing drainage, increasing surface water flooding
Temporary increase in areas of impermeable surfaces, for example temporary highways works	Increased surface water volume and rate of runoff, increasing flood risk.

11.5.4 The potential impacts to groundwater during construction are summarised in Table 11-17. These cover vehicles and associated oil/fuel, runoff and disturbance of groundwater flow paths, which have the potential to impact water quality (via increased sediment loading and chemicals) and alter groundwater flow or level.

11.5.5 No site-specific groundwater level monitoring data is currently available for the study area. Therefore, a precautionary assumption of a fully saturated aquifer (groundwater level is close to surface) has been applied.

Table 11-17 Potential groundwater impacts during construction

Activity	Potential impact
Temporary de-watering and installing deep foundations associated with new structures	Local changes to groundwater levels associated with pumping out of subterranean works areas (e.g. deep foundations, cuttings) and disposal of pumped water to surface water bodies. Installing deep foundations may also introduce a rapid vertical flow pathway into the aquifer for potentially contaminated runoff.
Vehicles accessing compounds, refuelling, oil/fuel storage tanks and accidental spillage, including during temporary highways works	Risk of untreated runoff from construction sites discharging through permeable surface geology direct to an aquifer.

11.5.6 Specific activities within each Route Section are detailed within the Route Section Assessments in Volume 2ii of the ES. These activities include impacts from works to or at culverts, bridges, stations, drainage/outfalls, construction compounds and other structures.

11.5.7 All technical areas of the water environment are taken into consideration within the Route Section Assessments. The overall assessment for significance of construction impacts is summarised in Table 11-18 and is based on the water environment technical area with the most adverse significant effect resulting from construction activity. This approach provides an assessment for the water receptor as a whole rather than by the technical area.

Table 11-18 Potential significance of effects during construction – overall

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
1 – Huddersfield	Gledholt Beck	Medium	No Change	None	No direct impacts upon water receptor
	River Colne	Medium	Very Low adverse	Negligible	Potential increase in run off due to construction compound and construction work. Construction compound at Longroyd Road is within Flood Zone 2.
	Hebble Beck	Medium	Very Low adverse	Negligible	No change in culvert arrangement or works in floodplain. Risk of increased runoff from new track
	Mill Race	Low	No Change	None	No direct impacts upon water receptor
	Huddersfield Broad Canal	Very High	No Change	None	No direct impacts upon water receptor
	Huddersfield Narrow Canal	High	Low adverse	Minor	Risk of contamination from adjacent construction compounds
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	Construction activities associated with the remodelling of Huddersfield Station and the retaining wall at Hillhouse Junction may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Groundwater levels and the depth below ground of the proposed works are unknown.
2 – Hillhouse and Fartown	Blackhouse Dike	Medium	Low adverse	Minor	Proposed works to culvert may impact water quality and hydromorphology and increase flood risk.
	Unnamed Watercourse at Field House Culvert	Low	No Change	None	No new drainage discharge proposed and no changes in flow volumes.
	Topaz Close Culvert (MVL3/96AA)	Low	Very Low adverse	Negligible	Culvert extension (10m) at this location associated with embankment widening and construction of new headwall. There is no drainage discharge to this location.
	Huddersfield Broad Canal	Very High	Low adverse	Moderate	Risk of contamination from adjacent construction compounds.
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	Construction activities for the retaining wall and earthworks may act as a barrier to groundwater and may affect local groundwater levels and flow in the underlying water-bearing strata. Groundwater levels and the depth below ground of the proposed works are unknown.
3 – Deighton and Bradley	Unnamed Watercourse at Bradley Culvert	Medium	Low adverse	Minor	Proposed works to culvert may impact water quality
	Huddersfield Broad Canal	Very High	Low adverse	Moderate	Adjacent to proposed construction compounds
	Deighton Culvert (MVL3/101A)	Medium	No Change	None	Culvert is assumed to be redundant and therefore not utilised as a drainage outfall. The culvert will be removed as part of works to A62 Leeds Road Overbridge (MVL3/102).
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	Construction activities for the proposed earthworks and retaining walls may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Groundwater levels and the depths below ground of the proposed works are unknown.
4 – Colne Bridge and Battyeford	Calder and Hebble Navigation	High	Low adverse	Minor	Risk of contamination from adjacent construction compound. Flood risk from canal will increase during construction
	Huddersfield Broad Canal	Very High	Low adverse	Moderate	Water quality risks from adjacent compounds and bridge works Flood risk from canal may increase during construction of new outfall arrangements
	River Colne	High	Low adverse	Minor	Risk of contamination from adjacent construction compounds. Disturbance/increased runoff of sediment and potential contamination from works at Colne Viaduct Underbridge (MVL3/109). Change in flood plain functionality.
	River Calder	High	Low adverse	Minor	Risk of contamination from adjacent construction compounds Change in floodplain functionality and capacity resulting from construction associated with new track alignment and construction compound
	Unnamed Watercourse at Colnebridge Culvert	Low	Low adverse	Minor	In channel culvert works may impact water quality. Risk of contamination from surrounding construction compound (Paul Lane). Temporary flood risk associated with construction.
	Unnamed Watercourse at Heaton Lodge Junction	Low	Low adverse	Minor	In channel culvert works may impact water quality and hydromorphology. Temporary flood risk associated with construction.
	Unnamed Watercourse at Heaton Lodge Underpass	Low	Low adverse	Minor	In channel culvert works may impact water quality and hydromorphology
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	The permanent presence of new bridge structures, earthworks and retaining walls may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Groundwater levels and the depth below ground of the proposed works are unknown.

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
	Cooper Bridge Culvert (MVL4/3A)	Low	No Change	None	No works proposed
	Heaton Lodge Culvert (MVL4/4A)	Low	Moderate adverse	Minor	No works proposed at this culvert; however, a new track drainage outfall may be located at a higher level close-by. Risk of increased runoff from new track and earthworks.
	Bradley Culvert (MVL3/106A)	Low	Very Low adverse	Negligible	The culvert will remain although requires extensive modification for the Scheme. The cross-sectional area of the new part will be similar to the existing. It is currently an outfall for railway track drainage, this will remain after the Scheme
	Mirfield No.1 Culvert (MVN2/190B)	Low	Moderate adverse	Minor	Culvert to be made redundant and diverted to join Mirfield No.2 Culvert (MVN2/190C).
	Mirfield No.2 Culvert (MVN2/190C)	Low	Moderate adverse	Minor	Extension of culvert by 2m is proposed as outfall is too close to the proposed railway.
5 – Mirfield and Lower Hopton	Calder and Hebble Navigation	High	No Change	None	No direct impacts on water receptor.
	River Calder	High	Low adverse	Minor	Works to Mirfield Viaduct Underbridge (MVN2/192) and Mirfield Viaduct (Steel Spans) (MVN2/192A) and Wheatley's Underbridge (MVN2/196) which span the River Calder. Risk of contamination from adjacent construction compounds.
	Unnamed Watercourse at Chadwick Close Culvert	Low	Very Low adverse	Negligible	Reduction in flow capacity of existing structure associated with proposed works relating to new track discharge outfall.
	Unnamed Watercourse at Steanard Lane Culvert	Low	No Change	None	No direct impacts upon water receptor.
	Ladywood Lakes	Low	Low adverse	Minor	Risk of contamination from adjacent construction compounds.
	Wood Lane Culvert (MVN2/191B)	Low	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Sands Lane Culvert (MVN2/198B)	Low	Very Low adverse	Negligible	The culvert will remain, although it requires repair and modification for the Scheme. It is currently an outfall for railway track drainage, this will remain after the Scheme. Risk of increased runoff from new track.
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	High Adverse	Moderate	Possible increase in surface water runoff (within areas of contaminated land) that is not attenuated during construction. Groundwater levels in this area and the depth below ground of the proposed works are unknown.
6 – Ravensthorpe and Westtown	Calder and Hebble Navigation	High	Low adverse	Minor	Construction of Baker Viaduct Underbridge (RBA/2) across the canal. Risk of contamination from adjacent construction compounds. Increase in run off due to construction compounds and construction works associated with the proposed piled embankment. Flood risk from canal may increase during construction of new outfall arrangement
	River Calder	High	Moderate adverse	Moderate	Construction of Baker Viaduct Underbridge (RBA/2) across the River Calder, including installation of in-channel river training walls. Change in floodplain functionality and capacity resulting from construction of piled embankment associated with new track alignment and construction compounds
	Unnamed Watercourse at Long Plantation	Low	Low adverse	Minor	Construction activities relating to excavations and below-ground works may cause pollution impacts to the Unnamed Watercourse and culverted reach.
	Ladywood Road Culvert (MVN2/200)	Low	No Change	None	The culvert will remain for the Scheme, although will require extending with a new headwall. The existing cross-sectional area will remain. It is currently an outfall for railway track drainage; this will remain during operation of the Scheme.
	Ladywood Culvert (MVN2/200C)	Low	No Change	None	The culvert will remain for the Scheme. It is not an outfall for railway drainage and will not be during operation of the Scheme. It will need extending by approximately 5m as part of the Scheme. The existing cross-sectional area will remain.
	Thornhill Quarry site ponds	Low	Moderate adverse	Minor	Displacement of waterbody
	Aire & Calder Carb. Limestone/Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	Construction activities relating to excavations and below-ground foundations may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Possible increase in surface water runoff that is not attenuated during construction.

Table notes – Indicates significant effect

Operation

11.5.8 The potential impacts that may occur during operation to the water environment are summarised within the following section. These cover activities that have the potential to impact the water environment in terms of water quality, hydromorphology, flood risk and groundwater.

11.5.9 The potential impacts during operation to water quality are summarised in Table 11-19. These activities cover accidental spillages and drainage which have the potential to affect water quality and ecological quality.

Table 11-19 Potential water quality impacts during operation

Activity	Potential impact
Accidental spillage	Risk of release of hydrocarbons/oils/other chemicals from accidental spillages, leading to potentially polluted runoff migrating to local surface water and groundwater. Releases of hydrocarbons and other chemicals within surface water can chemically impair biological functions of freshwater fish.
Railway drainage into watercourses	Runoff from the railway may have increased levels of suspended sediments, oils, metals, de-icing fluids and herbicides which can have adverse impacts upon water quality and ecology.

11.1.2 The potential impacts to hydromorphology during operation are summarised in Table 11-20. These cover permanent works to watercourses and drainage discharge to watercourses which may cause alteration of natural fluvial processes.

Table 11-20 Potential hydromorphology impacts during operation

Activity	Potential impact
Permanent drainage into watercourses	Alteration to existing drainage and additional drainage into a watercourse can alter water levels and velocities which in turn may cause increased erosional/depositional processes. This may alter the habitat available for aquatic flora and fauna.
Railway drainage into watercourses	Increased drainage from the railway may have high levels of suspended sediments which may cause increased turbidity and may smother vegetation and bed sediments, causing a detrimental effect for aquatic fauna. Other pollutants may also be present in the railway runoff.
Permanent in-channel structures (including culvert extensions)	In-channel structures may act as a barrier to flow and cause local changes to velocities and cause increased erosional or depositional processes. Such structures may also impede the movement of any sediment and fish present in the watercourse. Disturbance and/or removal of bank vegetation and increased length of grey bank protection (heightened physical modification).
Disturbance of groundwater flow paths	Where subsurface structures/foundations are included as part of the design these shall remain after construction and therefore groundwater flow might be intercepted or altered during the operation phase causing changes to surface watercourse base flow.

11.5.10 The potential impacts during operation to flood risk are summarised in Table 11-21. These cover permanent watercourse diversions, works to culverts/bridges, drainage and increases in impermeable surface areas which have the potential to affect watercourse hydraulics and flood risk.

Table 11-21 Potential flood risk impacts during operation

Activity	Potential impact
Permanent watercourse diversion/realignment or works to culverts/bridges	Permanent changes in the hydraulics of existing watercourses could impact flood risk by increasing flood levels upstream of works, or conversely improve conveyance in watercourses. Reduction in culvert capacity could increase flood risk.
Permanent works in the floodplain	Permanent loss of floodplain storage or change in flood flow conveyance, which increases flood risk.
Permanent drainage into watercourses	Additional drainage increasing surface water flooding. Alteration to existing drainage, increasing discharge to a watercourse and flood risk.
Permanent increase in impermeable surface areas	Increased surface water volume and rate of runoff, increasing flood risk.

11.1.3 The potential impacts during operation to groundwater are summarised in Table 11-22. These cover accidental spillages, drainage and disturbance of groundwater flow paths which have the potential to affect water quality and groundwater flow.

Table 11-22 Potential groundwater impacts during operation

Activity	Potential impact
Deep foundations associated with new structures	Assuming the foundations will extend below the water table, there is potential for deep foundations to form a barrier to groundwater flow, potentially reducing groundwater contributions to adjacent watercourses and groundwater abstractions in the aquifer. The deep foundations may also introduce a rapid vertical flow pathway into the groundwater body for potentially contaminated runoff.
Accidental spillage from a rail accident	Risk of release of hydrocarbons and other chemicals through permeable surface geology direct to an aquifer. There is also potential for indirect effects to groundwater dependent surface water bodies.
Accidental spillage during operation and maintenance at stations	

11.5.11 Taking all areas of the water environment into consideration the overall assessment for significance of operation impacts are summarised in Table 11-23. The overall assessment is based on the water environment technical area with the most adverse significant effect resulting during operation. Table 11-23 shows that the majority of significance of effects are Negligible to Minor (i.e. not significant). Only one significant effect (Moderate) is identified, in Route Section 6, with regards to the impacts on floodplain functionality and in-channel training walls from Baker Viaduct Underbridge (RBA/2).

Table 11-23 Potential significance of effects during operation – overall

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
1 – Huddersfield	Gledholt Beck	Medium	No Change	None	No direct impacts upon water receptor
	River Colne	Medium	No Change	None	No direct impacts upon water receptor
	Hebble Beck	Medium	Very Low adverse	Negligible	No change in culvert arrangement or works in floodplain. Risk of increased runoff from new track.
	Mill Race	Low	No Change	None	No direct impacts upon water receptor
	Huddersfield Broad Canal	Very High	No Change	None	No direct impacts upon water receptor
	Huddersfield Narrow Canal	High	No Change	None	No direct impacts upon water receptor
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	The permanent presence of the remodelled Huddersfield Station and the retaining wall at Hillhouse Junction may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Groundwater levels and the depth below ground of the proposed works are unknown.
2 – Hillhouse and Fartown	Blackhouse Dike	Medium	Low adverse	Minor	Loss of open watercourse to accommodate the extension of Red Doles Culvert (MVL3/96A). The extension of the culvert at this location is associated with embankment widening. The sidings site and new extension to embankment at Red Doles Culvert (MVL3/96A) results in potential loss of floodplain. Risk of increased runoff from new track and construction hub compound footprint.
	Unnamed Watercourse at Field House Culvert	Low	No Change	None	There is no drainage discharge to this location and no new drainage discharge proposed. No change in flow volumes is anticipated.
	Topaz Close Culvert (MVL3/96AA)	Low	No Change	None	Culvert extension at this location associated with embankment widening. There is no proposed new drainage discharge to this location.
	Huddersfield Broad Canal	High	Very Low adverse	Minor	No change in culvert arrangement or works in floodplain. Risk of increased runoff from new track.

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater bod	Medium	Moderate adverse	Minor	The permanent presence of the retaining wall and earthworks may act as a barrier to groundwater and may affect local groundwater levels and flow in the underlying water-bearing strata. Groundwater levels and the depth below ground of the proposed works are unknown.
3 – Deighton and Bradley	Unnamed Watercourse at Bradley Culvert	Medium	Low adverse	Minor	Loss of watercourse to accommodate Bradley Culvert (MVL3/102A). Risk of increased runoff from proposed embankment widening and new track.
	Huddersfield Broad Canal	Very High	Very Low adverse	Minor	No change in culvert arrangement or works in floodplain. Risk of increased runoff from new track.
	Deighton Culvert (MVL3/101A)	Medium	No Change	None	The culvert will be removed as part of works to A62 Leeds Road Overbridge (MVL3/102).
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	The permanent presence of the proposed earthworks and retaining walls and the pipeline may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata. Groundwater levels and the depths below ground of the proposed works are unknown.
4 – Colne Bridge and Battyeford	Calder and Hebble Navigation	High	Very Low adverse	Negligible	Increase in run off due to new track alignment and filter drain at toe of cutting resulting in increased discharge.
	Huddersfield Broad Canal	Very High	Very Low adverse	Minor	Increase in run off due to new track alignment and filter drain at the toe of embankment resulting in increased discharge.
	River Colne	High	Low adverse	Minor	Change in floodplain functionality and capacity associated with new track alignment.
	River Calder	High	Low adverse	Minor	Change in floodplain functionality and capacity associated with new track alignment.
	Unnamed Watercourse at Colnebridge Culvert	Low	Low adverse	Minor	Changes to culvert discharge volumes which may impact water quality. Extension of Colnebridge Culvert (MVL3/110A). New length of culvert proposed. Risk of increased runoff from new track

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
	Unnamed Watercourse at Heaton Lodge Junction	Low	Very Low adverse	Negligible	Extension of Heaton Lodge Junction, Mirfield Culvert (MVN2/190A). Risk of increased runoff from new track and loss of open watercourse.
	Unnamed Watercourse at Heaton Lodge Underpass	Low	Very Low adverse	Negligible	Risk of increased runoff from new track
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	Heaton Lodge curve and associated cutting and subsurface engineering features associated with retaining walls into the attribute may increase risk of groundwater surface flows developing. The permanent presence of new bridge structures, earthworks and retaining walls and new locations of utilities and subways may act as a barrier to groundwater and may affect local groundwater levels, flow and quality in the underlying water-bearing strata.
	Cooper Bridge Culvert (MVL4/1A)	Low	Very Low adverse	Negligible	Risk of increased runoff
	Heaton Lodge Culvert (MVL4/4A)	Low	Moderate adverse	Minor	Risk of increased runoff
	Bradley Culvert (MVL3/106A)	Low	Very Low adverse	Negligible	Risk of increased runoff
	Mirfield No.1 Culvert (MVN2/190B)	Low	Moderate adverse	Minor	Connectivity to be removed, with flows diverted to Mirfield No.2 Culvert (MVN2/190C).
	Mirfield No.2 Culvert (MVN2/190C)	Low	Moderate adverse	Minor	Extension of Mirfield No.2 Culvert (MVN2/190C). Extension of 2m is proposed as outfalls too close to the proposed railway. Scheme-wide drainage strategy to be developed to manage any increase in runoff and additional flow from diverted Mirfield No.1 Culvert (MVN2/190B).
5 – Mirfield and Lower Hopton	Calder and Hebble Navigation	High	No Change	None	No direct impacts upon water receptor.

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
	River Calder	High	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Unnamed Watercourse at Chadwick Close Culvert	Low	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Unnamed Watercourse at Steanard Lane Culvert	Low	No Change	None	No direct impacts to water receptor.
	Ladywood Lakes	Low	No Change	None	No direct impacts to water receptor.
	Wood Lane Culvert (MVN2/191B)	Low	No Change	None	Risk of increased runoff from new track.
	Sands Lane Culvert (MVN2/198B)	Low	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	The permanent presence of sheet piling at Mirfield Station may act as a barrier to groundwater flow and may affect local groundwater levels and flow in the underlying aquifer. This may increase the risk of groundwater flooding and surface flows to develop. Groundwater levels and the depth below ground of the proposed works are unknown.
6 – Ravensthorpe and Westtown	Calder and Hebble Navigation	High	Very Low adverse	Negligible	Increase in run off due to new track alignment and filter drain at tow of embankment resulting in increased discharge. New viaduct crossing.
	River Calder and associated flood plain	High	Moderate adverse	Moderate	Permanent presence of Baker Viaduct Underbridge (RBA/2) across the Calder, including the presence of in-channel river training walls. Change in floodplain functionality and capacity resulting from construction of piled embankment associated with new track alignment.
	Unnamed watercourse at Long Plantation	Low	Low adverse	Minor	Underground power cables and possible relocation of culverted reach of the watercourse

Route Section	Water receptor	Receptor importance	Magnitude of impact	Significance of effect	Comments
	Ladywood Road Culvert (MVN2/200C)	Low	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Ladywood Culvert (MVN2/199B)	Low	Very Low adverse	Negligible	Risk of increased runoff from new track.
	Thornhill Quarry site ponds	Low	Moderate adverse	Minor	Displacement of waterbody.
	Aire & Calder Carb. Limestone/ Millstone Grit/Coal Measures WFD groundwater body	Medium	Moderate adverse	Minor	The permanent presence of below-ground deep foundations may cause a barrier to groundwater flow and increase risk of groundwater derived surface flows developing. Groundwater levels and the depth below ground of the proposed works are unknown.

Table note: Indicates significant effect

11.6 Mitigation measures

11.6.1 Additional mitigation measures are identified in the following section in order to manage any significant effects identified by the assessment. In accordance with the risk mitigation hierarchy these prioritise avoiding risks, reducing risks, rescuing or restoring the receptor, offsetting the impact and then compensation. Mitigation measures include those relating to operational and construction activities

11.6.2 Site-specific mitigation measures are detailed within each Route Section Assessment for each technical area.

Construction

11.6.3 The following construction mitigation measures are relevant to the Scheme and include implementation of best practice environmental management measures. This will be managed through adherence to the CoCP. Part A of the CoCP is provided in Appendix 2-1.

11.6.4 Part B of the CoCP will incorporate a Pollution Prevention and Incident Control Plan (PPICP) and an Environmental Design Plan (EDP) (Land Contamination and Hydrogeology). The contents of these documents will be submitted to and agreed by the Local Authority as part of a condition attached to the deemed planning permission[30] before construction works commence.

11.6.5 The following measures are detailed in Part A of the CoCP:

Water quality

- Oil or chemical storage areas should be bunded and lined in order to contain pollutants in the event of leakage;
- The drainage network serving the four main compound areas will include a cut-off chamber with a sluice valve, which will remain closed. The maintenance regime will include an agreed process for water quality monitoring (where deemed necessary) and managed discharge of water from each compound via a sluice valve;
- Any station tracks, drop-off points and associated access roads will incorporate, at least, oil interceptors before discharging to the receiving body of water to intercept potential oily substances that may build up on surfaces;
- Procedures will be put in place to deal with accidental leakages or spillages of hydrocarbons and oils, or accidental release of hazardous substances during construction works;
- Management processes will be in place for any polluting substances that are being brought on site and used as part of the construction process;
- Suitable settlement tanks will be used to remove silts and debris during the dewatering process. The discharge methodology will be agreed with the EA where discharge consents are required;
- Use of appropriate dust suppression/extraction to ensure minimal contamination to watercourse during blast cleaning; and
- All measures will be in line with the requirements set out within the EA's General Guide to Prevention of Pollution (PPG1), Works and maintenance in or near water (PPG5) and Maintenance of structures over water (PPG23) and Control of water pollution from

[30] On making an order under the Transport and Works Act 1992, the Secretary of State may direct that planning permission shall be deemed to be granted, subject to such conditions (if any) as may be specified in the direction.

construction sites CIRIA 532. The PPGs[31] contain a mix of regulatory requirements and good practice advice. They have been withdrawn by the EA but are still considered good practice advice to avoid pollution of watercourses.

11.6.6 For the temporary highways works on construction access routes, construction mitigation would include, but not be limited to the following:

- Measures to control and prevent polluted runoff; and
- All works are undertaken with regard to PPGs. These detail good practice advice for undertaking works which may have the potential to cause water pollution.

11.6.7 Alongside best practice guidelines, with particular regard to activities within the construction compounds and the proposed in-channel works (culverts and new viaduct), the following mitigation measures will be implemented. Details will be included within the PPICP and EDP (Land Contamination and Hydrogeology) under Part B of the CoCP:

- Use methods of work which reduce or eliminate working in the channel;
- Where in-channel works are necessary, use appropriate isolation techniques such as coffer dams and by-pass channels;
- On-line continuous water quality monitoring prior to where high risks (dependant on receptor sensitivity and construction activity scale) from in-channel works are expected. It is likely that this level of monitoring would only be required in relation to the construction activities at Baker Viaduct Underbridge (RBA/2). Monitoring would be undertaken during and following in-channel works to identify and assess magnitude of potential pollution events downstream of works and whether additional mitigation is required. Where risk from in-channel works is deemed low (dependant on receptor sensitivity and construction activity scale) monitoring would entail regular visual inspections only;
- Use appropriate measures to ensure contaminants from construction activities do not enter the watercourse; and
- Prepare site-specific responses for potential pollution incidents (e.g. spillages) or extreme weather events (e.g. storms) which may cause an increase in sediment runoff.

Hydromorphology

- Use of appropriate measures to ensure contaminants (including fine sediments) from construction activities do not enter the watercourse;
- Use of appropriate erosion control and silt management measures to minimise the volume of sediment produced;
- Prepare site-specific responses for potential pollution incidents (e.g. spillages) or extreme weather events (e.g. storms) which may cause an increase in sediment runoff;
- Where the erection of temporary in-channel structures is required for construction, use appropriate isolation techniques. These measures should be in place for the minimum possible period of time in order to minimise disruption of flow, sediments and biota;
- Timing of any temporary in-channel works to consider seasonality for watercourse biota (see Chapter 9 (Biodiversity)). Details will also be set out in the Landscape and Ecological Management Plan (LEMP) to be submitted pursuant to a condition to be attached to the deemed planning permission and agreed with the local authority; and
- Any vegetation clearance in the riparian zone required for construction should be minimised.

[31] https://webarchive.nationalarchives.gov.uk/20140328090931/http://www.environment-agency.gov.uk/business/topics/pollution/39083.aspx

Flood risk

11.6.8 The Scheme design has sought to ensure that any adverse impacts will be avoided or minimised, as far as practicably possible, ensuring that there is no increase in flood risk to existing vulnerable receptors.

11.6.9 Appropriate construction site practice will be undertaken to minimise flood risk and drainage impacts. Surface water flows will be managed during construction.

11.6.10 Temporary drainage systems will be implemented to alleviate localised surface water flood risk and prevent obstruction of existing surface runoff pathways.

11.6.11 The principal purpose of the Scheme-wide drainage strategy and the flood risk mitigation measures is to maintain the existing hydrological behaviour as far is reasonably possible. The finalised plan for mitigating flood risk will fulfil the requirements of the EA and LLFA in accordance with Scheme-specific requirements discussed and agreed with the EA and LLFA.

Groundwater

11.6.12 The following construction mitigation measures will be implemented through the EDP (Land Contamination and Hydrogeology) submitted under Part B of the CoCP:

- Where deep foundations extending beneath the groundwater table are designed to be part of the Scheme, these will be designed in accordance with industry standards – taking into account the site-specific water level and flow monitoring data obtained from intrusive ground investigation for the Scheme;
- Boreholes and trial pits have been proposed across the Scheme to inform the detailed design of the Scheme and will include areas of notable groundwork activity (i.e. large cuttings, deep pilings/foundation). A hydrogeological risk assessment will be carried based on GI data, again to inform the design process;
- Where the hydrogeological risk assessment identifies particular areas of risk, monitoring of groundwater will be undertaken pre-, during and post-construction. Details of the monitoring regime will also be set out; and
- Where piling works are proposed a risk assessment will be undertaken in accordance with the EA's "Piling and Penetrative Ground Improvement Methods on Land Affected by Contamination: Guidance on Pollution Prevention National Groundwater", Report NC/99/77 dated 2001.

Operation

11.6.13 The following mitigation measures are relevant to the Scheme. Best practice guidance has been embedded into the design of any structures which may have an impact on the water environment, including consultation with the EA to ensure regulatory agreement.

Water quality

11.6.14 Adherence to the Scheme-wide drainage strategy, as summarised in Appendix 11-4, will be used to mitigate any potential water quality impacts to receiving watercourses.

Hydromorphology

11.6.15 A comprehensive list of mitigation measures and guidance for environmentally sensitive design is listed in the WFD compliance assessment in Appendix 11-2.

11.6.16 The following design considerations will be set out in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP:

- For culvert design, best practice measures will include minimising the length of watercourse culverted, using culverts which allow for a natural bed, creation of scour pools downstream of the culvert and designing the culvert to reflect the natural bed profile and ensure connectivity through the culvert;
- For bridge and viaduct design, such best practice measures will include minimising the length of watercourse affected, setting abutments back from the channel banks (where practicable) to retain connectivity and minimising the extent of in-channel structures as part of the design process;
- Where new or extended crossings associated with the Scheme require some adjustment of the watercourse planform to align through the proposed culvert or structure; any realignments required will be designed by an appropriately qualified fluvial geomorphologist to safeguard their long-term stability.

11.6.17 Where bed and bank reinforcement are required, “greener” measures will be used as priority over hard engineering which is to be detailed within the LEMP.

Flood risk

11.6.18 Adherence to the Scheme-wide drainage strategy, which provides detailed information on drainage across the Scheme for drainage outfalls, storm water strategy and foul water strategy, will mitigate flood risks during operation and incorporate any attenuation of runoff to minimise flood risk where required.

11.6.19 Compensatory flood storage will be provided on a level for level and volume for volume basis. Indicative provision for such storage has been made in Route Section 6 within the Thornhill Quarry site, as shown in Figure 11-4. Any required changes to this provision will be discussed with the EA prior to construction.

11.6.20 The principal purpose of the flood risk mitigation measures is to maintain the existing hydrological behaviour as far is reasonably possible. The finalised plan for mitigating flood risk will fulfil the requirements of the EA and LLFA.

11.6.21 The Scheme is to be undertaken in accordance with the FRA in Appendix 11-1.

Groundwater

11.6.22 Where the hydrogeological risk assessment identifies particular areas of risk, monitoring of groundwater will be undertaken pre-, during and post-construction. Details of the monitoring regime will be included in the EDP (Land Contamination and Hydrogeology) under Part B of the CoCP.

Drainage strategy

11.6.23 The Scheme-wide drainage strategy provides detailed information on drainage across the Scheme for drainage outfalls, storm water strategy and foul water strategy. The drainage strategy is summarised in Appendix 11-4.

11.7 Residual effects

Construction

11.7.1 The Route Section Assessments in Volume 2ii of the ES provide a summary of expected effects following mitigation measures being put into place for water quality, hydromorphology, flood risk and groundwater during construction. The results show that no significant effects remain, within any Route Section, for all technical areas during construction.

Operation

11.7.2 The Route Section Assessments provide a summary of expected effects following mitigation measures being put into place for water quality, hydromorphology, flood risk and groundwater during operation. The results show that no significant effects remain, within any Route Section, for all technical areas during operation.

11.8 Cumulative effects

15.1.1 Cumulative effects can include intra-Scheme effects and inter-Scheme effects.

- Intra-Scheme effects (or in-combination synergistic effects) are the combined impact from a single project on a single receptor or resource;
- Inter-Scheme effects are the combined impact of a number of different projects within the vicinity (in combination with the Scheme) on a single receptor.

11.8.1 Further consideration of cumulative effects is provided in Chapter 22 (Cumulative effects) of this ES.

Intra-Scheme (synergistic) impacts

15.1.2 Potential intra-Scheme effects may occur from interaction with other technical disciplines.

15.1.3 Potential synergistic impacts have been identified that correspond to the water environment particularly from the geology, soils and land contamination assessment.

15.1.4 The geology, soils and land contamination assessments have identified with mitigation, Neutral or Slight adverse effects are predicted during both the construction and operational phases. This chapter also identifies that mainly Neutral or Slight adverse residual effects are anticipated; it is therefore considered that no synergic impacts are likely to be generated.

Inter-Scheme effects

15.1.5 Inter-Scheme cumulative effects may occur from interaction with other proposed developments (Reasonably Foreseeable Future Projects (RFFPs) located near the Scheme. When combined with the works in the Scheme area these could cumulatively affect sensitive receptors. Inclusion of RFFPs includes their proximity to the Scheme, likely impacts and timing of construction and operation.

15.1.6 The potential inter-Scheme cumulative effects in relation to the water environment are set out in Table 11-24.

11.8.2 Given no significant changes to the Scheme drainage is proposed it is not anticipated that the Scheme and RFFPs will give rise significant effects during the operational phase.

Table 11-24 Inter-Scheme cumulative effects relating to the water environment

Route Section	Planning Application Ref.	Development description	Location	EIA available	Potential cumulative effects	
					Construction	Operation
1 - Huddersfield	2020/90014	Demolition of existing building and erection of car sales and speculative B1/B2 unit with associated parking and access	11, The Triangle, Market Street, Paddock, Huddersfield, HD1 4RN	No supporting environmental information	The RFFP site is within Flood Zone 1 and is circa 100m from nearest waterbody (Huddersfield narrow canal). No significant effects from the Scheme and particularly the Longroyd Lane compound were identified. No significant cumulative effects are therefore predicted.	No significant cumulative effects are predicted.
4 – Colne Bridge and Battyeford	2016/93896	Erection of 4 dwellings and associated works	Site off, Station Road, Bradley, Huddersfield, HD2 1US	No supporting environmental information	RFFP is a small-scale development within Flood zone 1. No significant cumulative effects are therefore predicted.	No significant cumulative effects are predicted.
4 – Colne Bridge and Battyeford	2017/91208	Outline application for erection of industrial development of up to 3684 sqm B1c/B2/B8, with means of access (to, but not within, the site) from Colnebridge Road.	Land adjacent to Colnebridge WWTW, Colnebridge Road, Bradley	No EIA but application is supported by environmental assessments as well as a FRA.	The application has been submitted in outline form with all matters reserved, except access. The site is regarded as being effectively within Flood Zone 1 and it is not considered that there will be any significant flooding caused either within the site or in the surrounding area by the future surface water run-off. Foul sewage will discharge to the sewage pumping station in Colne Bridge Road. No significant cumulative effects are therefore predicted.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	2017/94119	Demolition of existing building, erection of new building for educational classroom, cafe and toilets, upgraded access road, car parking, cycle parking, picnic and play areas.	Land off Sands Lane, Mirfield, WF14	No relevant environmental information submitted.	RFFP is a small-scale development. The application for which acknowledges the upgrade works planned for the railway and has therefore considered any cumulative effects. No specific issues or assessments have been submitted for the RFFP in respect of the water environment and as no significant effects have been identified for the Scheme then it is concluded that no significant cumulative effects are anticipated.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	2017/90443	Erection of 3 units for B1 (light industrial) and B8 use, erection of two storey office building and alterations to existing building	Ratcliffe Mills, Forge Lane, Thornhill Lees, Dewsbury, WF12 9BU	No EIA but application is supported by environmental assessments as well as a FRA sequential test.	The sequential test for the RFFP concluded that the development was acceptable in Flood Zone 2. The development is not at risk of flooding during the 1 in 100 year plus climate change flood level. However, to mitigate the risk of the units flooding, raised finished flood levels are proposed. Mitigation is proposed for the loss of flood plain from the RFFP. The site is not at risk of groundwater flooding. The site is not at risk from surface water flooding and the RFFP proposes to improve the surface water drainage system including on-site attenuation. Exact drainage outfalls are not yet confirmed but anticipated that SW will drain to the River Calder and foul water drainage will be to a Yorkshire Water sewer in Forge Lane. Minimal ground disturbance is anticipated within the Scheme at this location.	No significant cumulative effects are predicted.

Route Section	Planning Application Ref.	Development description	Location	EIA available	Potential cumulative effects	
					Construction	Operation
					No significant cumulative effects are predicted.	
6 – Ravensthorpe and Westtown	2016/94241	Non-Material Amendment to previous permission 2007/91742 for erection of 7 terraced industrial units	Calder Bank Road, Thornhill Lees, Dewsbury, WF12 9QB	No relevant environmental information submitted.	A new access road to a residential property is proposed within the Scheme, which will involve shallow ground excavations. It is unlikely sufficient contamination would be mobilised to adversely impact receptors. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	2016/94118	Outline application for residential development	Land off Ravensthorpe Road, Dewsbury	No EIA but application is supported by environmental assessments. A FRA has also been submitted.	This residential development partly coincides with the proposed Ravensthorpe Station forecourt area and the historical landfill in this location. It is assumed that the RFFP will consider issues such as water quality in any full planning application. Any assessments and associated mitigation by the developer should ensure the RFFP would not pose an unacceptable risk to humans or the environment. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	2016/94117	Outline application for 120 residential units at Lees Hall Road	Land off Lees Hall Road, Dewsbury	No EIA but application is supported by environmental assessments. A FRA has also been submitted.	The proposed development is located over 400m from the Scheme boundary. RFFP site is within Flood Zone 1 No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	2017/94080	Erection of precast concrete production unit, demolition of existing casting shed and ancillary buildings, associated site works to modify external storage areas and installation of gantry cranes – condition to vary plans and specs (2019/92570).	C R Longley And Co Ltd, Ravensthorpe Road, Thornhill Lees, WF12 9EF	No EIA but application is supported by environmental assessments. A FRA has also been submitted.	Minimal excavations are anticipated for the Scheme in this area. RFFP site is within Flood Zone 2 No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
1 – Huddersfield	Strategic highway scheme	A62 Smart Corridor (Leeds Road - Phase 1)	Kirklees Council	No environmental information available.	All of these highway works/junctions are located over 200m from the major areas of excavation/piling in Route Section 1. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
1 – Huddersfield	Strategic highway scheme	Highways improvements to the junction of Huddersfield Ring Road/Southgate/Northumberland Street.	Kirklees Council	No environmental information available.		No significant cumulative effects are predicted.
1 – Huddersfield; and 2 – Hillhouse and Fartown	Strategic highway scheme	Highways improvements to the junction of Leeds Road/Lower Fitzwilliam Street/Gasworks Street.	Kirklees Council	No environmental information available.		
2 – Hillhouse and Fartown	Strategic highway scheme	Highways improvements to the junction of Leeds Road/Thistle Street/Hillhouse Lane.	Kirklees Council	No environmental information available.		
4 – Colne Bridge and Battyeford	Strategic highway scheme	Highways improvements to the junction of Leeds Road/Old Fieldhouse Road.	Kirklees Council	No environmental information available.		
4 – Colne Bridge and Battyeford	Strategic housing scheme	A62/A644 Wakefield Road (Cooper Bridge)	Kirklees Council	No environmental information available.	The A62/A644 Wakefield Road (Cooper Bridge) development is located over 250m from the Scheme. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.
6 – Ravensthorpe and Westtown	Strategic housing scheme	Kirklees Local Plan Allocation	Land north of Bradley Road, Bradley	No environmental information available.	HS11 is located over 900m from the Scheme boundary. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.

Route Section	Planning Application Ref.	Development description	Location	EIA available	Potential cumulative effects	
					Construction	Operation
		HS11 – housing allocation for 1.460 dwellings with potential for a further 498 dwellings beyond the plan period				
1 – Huddersfield	Strategic highway scheme	Kirklees Local Plan Allocation HS61 (Dewsbury Riverside) – housing allocation for 4000 units (1869 units during plan period, with potential for a further 2131 beyond the plan period).	Land off Ravensthorpe Road, Dewsbury	No environmental information available.	This residential development partly coincides with the proposed Ravensthorpe Station forecourt area and the historical landfill in this location. It is assumed that the RFFP will consider issues such as water quality in any full planning application. Any assessments and associated mitigation by the developer should ensure the RFFP would not pose an unacceptable risk to humans or the environment. RFFP site is within Flood Zone 1. No significant cumulative effects are predicted.	No significant cumulative effects are predicted.

11.8.3 It is anticipated that any developments brought forward will be subject to National and Local Policy as well as legislative requirements and application of best practice measures and will be required to ensure that mitigation and control measures are adopted during construction and operation of the various developments.

11.8.4 There is a low potential for cumulative impacts during either construction or operation and therefore no significant cumulative effects are anticipated.