highways england

A1 Birtley to Coal House

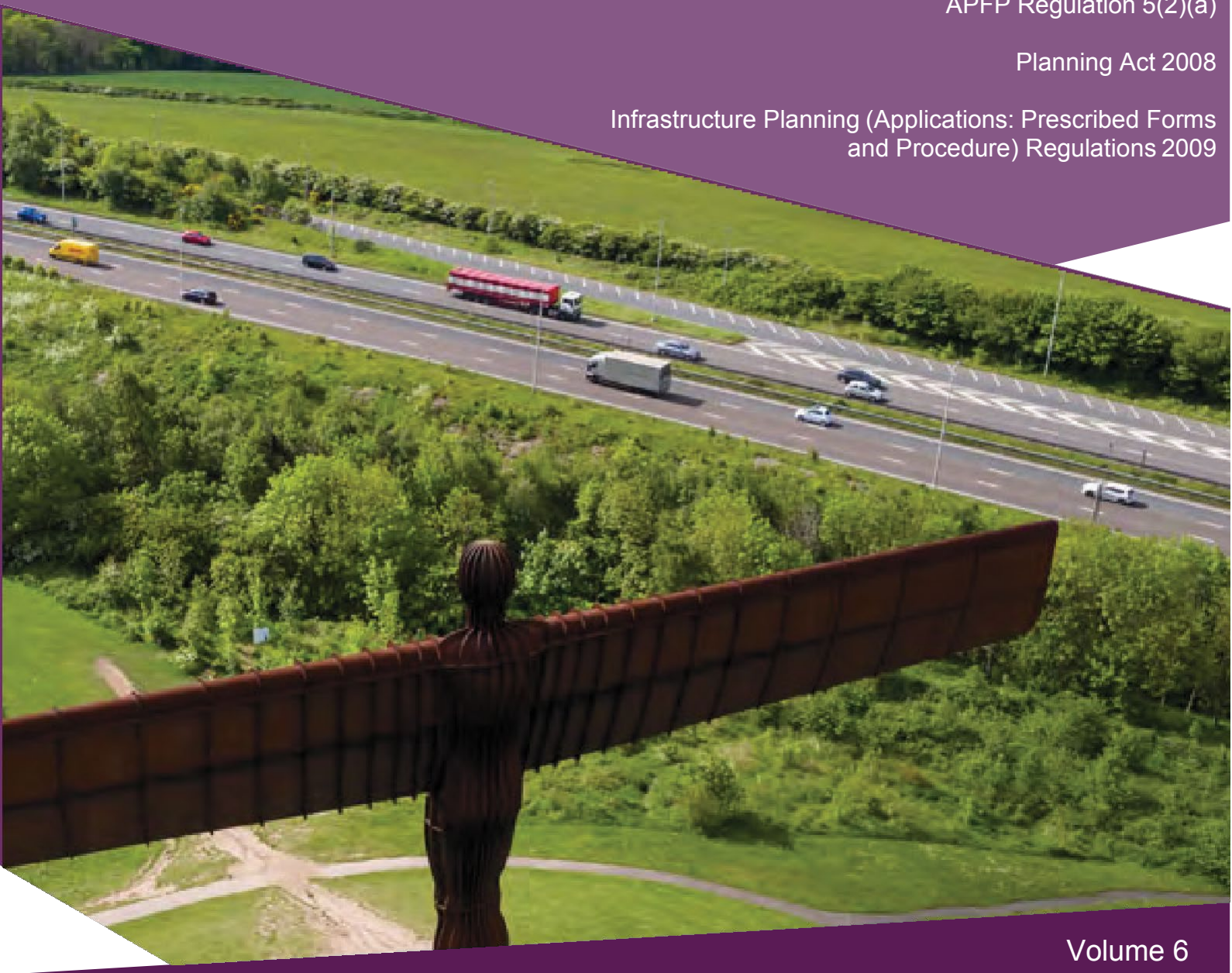
Scheme Number: TR010031

6.1 Environmental Statement Chapter 13 Road Drainage and The Water Environment

APFP Regulation 5(2)(a)

Planning Act 2008

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



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Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedures) Regulations 2009

A1 Birtley to Coal House

Development Consent Order 20[xx]

Environmental Statement

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CONTENTS

TABLES

13. ROAD DRAINAGE AND THE WATER ENVIRONMENT

13.1. INTRODUCTION

13.1.1. This chapter provides an assessment of the potential significant environmental effects that the Scheme may have on road drainage and the water environment. This is in accordance with the principles set out in Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09) (**Ref 13.1**).

13.1.2. The assessment has been conducted in accordance with relevant legislation, planning policy, guidance and the recommended approach as discussed with the Environment Agency and Gateshead Council.

13.1.3. This chapter is intended to be read as part of the wider Environmental Statement (ES) and the Flood Risk Assessment (FRA) and Water Framework Directive (WFD) Assessment which are included as technical appendices in **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)** and **Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3)** respectively.

13.1.4. A full description of the Scheme is in **Chapter 2 The Scheme** in this ES **(Application Document Reference: TR010031/APP/6.1)**.

Allerdene Bridge Options

13.1.5. In the Road Drainage and the Water Environment assessment the differences between Allerdene embankment option and Allerdene viaduct option, as detailed in **paragraphs 2.7.11-2.7.18** of this ES, does affect the assessment. This is because the two options need to be, and have been, modelled separately to incorporate an extension to the existing Allerdene Culvert and replacement of the existing drainage channel (Allerdene embankment option); or daylighting of the existing culvert and replacement and realignment of the existing drainage channel to accommodate a new viaduct over the existing railway line (Allerdene viaduct option).

13.2. COMPETENT EXPERT EVIDENCE

13.2.1. **Table 13-1** demonstrates that the professionals contributing to the production of this ES chapter have sufficient expertise to ensure the completeness and quality of this assessment.

Table 13-1 - Road drainage and water professional competence

Name	Role	Qualifications and Professional Membership	Expertise and Professional Qualification
Sarah Hamilton	Author	PhD MCIWEM C.WEM Chartered Environmentalist (CEnv)	Over 10 years' experience in producing water related ES chapters, including for the following projects: – Dissington Garden Village – Yorkshire Energy Park – Rolls Royce, Hucknall
Andy Smith	Reviewer	BSc, MSc, C.WEM CSci Chartered Environmentalist (CEnv)	Over 13 years' experience in producing water related ES chapters, including for the following projects: – A19/A1058 Coast Road Junction Improvements – Stansted Surface Access – Yorkshire Energy Park

13.3. LEGISLATIVE AND POLICY FRAMEWORK

LEGISLATION

13.3.1. The management of water resources is governed by a range of legislative guidance. This assessment has been prepared whilst taking these plans and policies into account.

13.3.2. The coordination of legislation for the water environment is managed by the UK Government. Many flood risk and water quality requirements are set at European level, which are then transposed into UK law. The Environment Agency (EA) has a strategic overview regarding the management of all the sources of flooding and an operational responsibility for managing the risk of flooding from main rivers,

reservoirs, estuaries and tidal sources. Lead Local Flood Authorities (LLFA's) are responsible for managing the risk of flooding from local sources, comprising surface water, groundwater and ordinary watercourses

13.3.3. The applicable legislative framework is summarised below.

International

The EU Water Framework Directive (2000/60/EC)

13.3.4. The overall objective of the WFD is to bring about the effective co-ordination of water environment policy and regulation across Europe. The main aims of the legislation are to ensure that all surface water and groundwater reaches 'good' status (in terms of ecological and chemical quality and water quantity, as appropriate), promote sustainable water use, reduce pollution and contribute to the mitigation of flood and droughts. The WFD is transposed into law in England and Wales by the Water Environment (WFD) (England and Wales) Regulations 2017.

13.3.5. The WFD also contains provisions for controlling discharges of dangerous substances to surface waters and groundwater and includes a 'List of Priority Substances'. Various substances are listed as either List I or List II substances, with List I substances considered the most harmful to human health and the aquatic environment. The purpose of the Directive is to eliminate pollution from List I substances and reduce pollution from List II substances.

The Groundwater Daughter Directive to WFD (2006/118/EC)

13.3.6. The Groundwater Daughter Directive aims to set groundwater quality standards and introduce measures to prevent or limit pollution of groundwater, including those listed within the 'List of Priority Substances'. The Directive has been developed in response to the requirements of Article 17 of the WFD, specifically the assessment of the chemical status of groundwater and objectives to achieve 'good' status.

National

Land Drainage Act 1991

13.3.7. Local Authorities and Internal Drainage Boards have additional duties and powers associated with the management of flood risk under the Land Drainage Act 1991. As Land Drainage Authorities, consent must be given for any permanent or temporary works that could affect the flow within an ordinary watercourse under their jurisdiction in order to ensure that local flood risk is not increased.

13.3.8. The Land Drainage Act 1991 specifies that the following works will require formal consent from the appropriate authority:

a. Construction, raising or alteration of any mill dam, weir or other similar obstructions to the flow of a watercourse.
b. Construction of a new culvert.
c. Any alterations to an existing culvert that would affect the flow of water within a watercourse.

13.3.9. The Land Drainage Act 1991 also sets out the maintenance responsibilities riparian owners have in order to reduce local flood risks. Riparian owners, who are land owners with a watercourse either running through their land or adjacent to, have the responsibility to ensure that the free flow of water is not impeded by any obstruction or build-up of material within the watercourse.

The Environment Act 1995

13.3.10. The Environment Act 1995 establishes and outlines the duties of the Environment Agency in respect to (amongst other matters) water quality and flooding.

The Flood and Water Management Act 2010

13.3.11. The Flood and Water Management Act 2010 aims to improve flood risk management and the way in which water resources are managed. The Act defines clearer roles and responsibilities and instils a more risk-based approach than the previous regime. This includes a new lead role for local authorities in managing local flood risk (from surface water, groundwater and ordinary watercourses) and a strategic overview role for all flood risk for the Environment Agency.

The Environmental Permitting (England and Wales) Regulations 2010

13.3.12. The Environmental Permitting (England and Wales) Regulations 2010 replaced the Water Resources Act 1991 as the key legislation for water pollution in the UK. Under these Regulations, it is an offence to cause or knowingly permit a water discharge activity, including the discharge of polluting materials to freshwater, coastal waters, relevant territorial waters or groundwater, unless complying with an environmental permit or exemption. Highways England is exempt from the need to apply for discharge consents for road runoff.

The Water Act 2014

13.3.13. The Water Act 2014 formalises the Government's commitment to the sustainable management and use of water resources.

POLICY

13.3.14. National policy relevant to the Road Drainage and the Water Environment assessment is outlined in **Table 13-2.**

Table 13-2 - National planning policy relevant to the Road Drainage and the Water Environment assessment

Policy	Relevant Policy Objectives	Significance of impact of the Scheme on policy objective
National Policy Statement for National Networks	Flood risk is covered as a specific generic impact in paragraphs 5.90 to 5.115, which outline that:	A FRA has been prepared which includes the sequential and exception test and a surface water drainage strategy (**Appendix 13.1** of this ES

Policy	Relevant Policy Objectives	Significance of impact of the Scheme on policy objective
(NPS NN) (2014)	– The Scheme should be supported by a FRA in accordance with the National Planning Policy Framework (NPPF) (2019) – Surface water discharge should be such that the volumes and peak flow rates of surface water leaving the site are no greater than the rates prior to the proposed project, – Opportunities can be taken to lower flood risk by improving flow routes, flood storage capacity and using SuDS. Road drainage and the water environment is also referred to in the following sections of the NPS NN: – Pollution control and other environmental protection regimes: paragraphs 4.48 to 4.56. Whilst water quality and resource is discussed in paragraphs 5.219 to 5.231.	**(Application Document Reference: TR010031/APP/6.3)**). The potential impacts of spillages and routine runoff have also been assessed (**Appendix 13.3** of this ES **(Application Document Reference: TR010031/APP/6.3)**).
National Planning Policy Framework (NPPF) (2019)	Section 14 – 'Meeting the challenge of climate change, flooding and coastal change' of the NPPF requires a FRA to be prepared to assess the potential impacts of flooding on and as a result of the scheme and ensure that the scheme is sequentially appropriate which may involve passing the exception test if required.	A FRA has been prepared to assess the risks of flooding to and from the Scheme, and provides the Sequential and Exception tests to demonstrate that the Scheme is sequentially acceptable and complies with the NPPF requirements.

Policy	Relevant Policy Objectives	Significance of impact of the Scheme on policy objective
	The NPPF is supported by a series of Planning Practise Guidance, of which two are key for this Chapter these are: 1. Flood risk and coastal change 2. Water supply, wastewater and water quality.	
Infrastructure Act and Highways England Licence (2015)	This outlines the requirements in terms of the water environment for: – Protecting and enhancing the environment. – Ensuring best practicable environmental outcomes. – Cumulative impacts and partnership working. This is covered in paragraph 5.23 which states Highways England should protect the environment, mitigate any impacts and improve environmental performance along with adapting the network for a changing climate.	The Scheme will meet the requirements of the Highways England licence. This is detailed in the FRA which considers the impacts of climate change and the drainage strategy which outlines measures to improve the environment through incorporating water quality mitigation measures into the Scheme.

13.3.15. Local planning policy relevant to the Road Drainage and the Water Environment assessment is outlined in **Table 13-3**.

Table 13-3 - Local planning policy relevant to the Road Drainage and the Water Environment assessment

Policy	Relevant Policy Objectives	Significance of impact of the Scheme on policy objective
Planning for the Future: Core Strategy and Urban Core Plan for Gateshead and Newcastle upon Tyne 2010-2030	Policy CS17 refers to Flood Risk and Water Management and states that: "Development will avoid and manage flood risk from all sources, taking into account the impact of climate change over its lifetime. Development will: – Avoid and manage flood risk to people and property by: • Locating new development in areas with the lowest risk, where appropriate by applying the Sequential Test. • Managing flood risk from development to ensure that the risk is not increased on site and/or elsewhere, where appropriate by applying the Exception Test. • Ensuring opportunities for development to contribute to the mitigation of flooding elsewhere are taken. • Prioritise the use of SuDS, given the multifunctional benefits to water quality, green space and habitat enhancement, • Ensuring development is in accordance with the Council's Strategic Flood Risk Assessment, and • Requiring a Flood Risk Assessment for sites over 0.5ha in Critical Drainage Areas as identified in the Council's Strategic Flood Risk Assessments. – Ensure water supply and foul and surface water infrastructure are provided with adequate capacity. – Not adversely affect water quality and where possible seek to improve water quality.	The FRA details how the Scheme has been developed to avoid and manage flood risk, through the location of aspects into the lowest flood zone, use of a surface water strategy that incorporates SuDS to manage off site flows.

Policy	Relevant Policy Objectives	Significance of impact of the Scheme on policy objective
	– Separate, minimise and control surface water runoff, discharging in order of priority to: • Infiltration based Sustainable Drainage Systems • A watercourse • A surface water sewer. • A combined sewer.	

13.4. ASSESSMENT METHODOLOGY

13.4.1. The assessment utilises the methodology outlined within DMRB Volume 11, Section 3, Part 10: Road Drainage and the Water Environment HD 45/09, November 2009. The assessment has taken into account both the construction and operational phases through:

a. Estimation of the importance of the attribute.
b. Estimation of the magnitude of the impact.
c. Assessment of the significance of effects based on the importance of the attribute and magnitude of the impact.

SCOPE OF ASSESSMENT

13.4.2. A detailed assessment has been carried out following the guidance defined in DMRB, Volume 11, Section 3, Part 10 (H45/09). This includes a desk based review of existing information and an assessment of the Scheme effects in relation to flood risk and water quality. The assessment covers the following aspects:

a. The impacts of the Scheme on the water quality of the receiving watercourses for construction and operation for both the River Team and the ordinary watercourse in the Longacre Dene.
b. The impacts of the construction stage on flood risk.
c. The impacts of the operation of the Scheme on fluvial flood risk from the River Team.
d. The flood risk and water quality impacts associated with modifications to the Allerdene Burn.
e. The risk of pluvial flooding including an assessment of the risks to human safety.
f. The risk of changes to surface water runoff including an assessment of the risks to human safety.
g. The impact of and to the scheme from groundwater (excluding routine runoff and licenced abstractions, for the reasons detailed in **pargraphs 13.4.5 and 13.4.7** respectively). With a focus on the impact of the construction stage on

groundwaters in relation to the piling activities required for bridge pier extension at the River Team crossing.

The features that have been scoped out of further assessment are outlined in **Table 13-4** along with a justification for not including them in the assessment. The reasons for this are either that they have no hydraulic connectivity to the Scheme, or are located upstream/gradient of the Scheme (so would not be impacted). Additionally a detailed drainage design has been prepared which confirms the locations where the Scheme's surface water outfalls are to be located, therefore confirming which water features would not be impacted. Following the Scoping Opinion, a Closed-Circuit Television (CCTV) survey was undertaken and carried out the drainage design to confirm the features identified can be scoped out due to having no hydraulic connectivity. Their locations are shown on **Figure 13.2** of this ES **(Application Document Reference: TR010031/APP/6.2)**.

Table 13-4 – Water features that have been scoped out

Feature	Reason for scoping out
Bowes Lake, Lookout Lake, Bassets Pond, Dunkirk Pond LWS and Springwell Ponds LWS which are ponds located to the north of junction 65 (Birtley)	These ponds are located at a higher elevation than the ground levels adjacent to the A1.
Foxpond Fishery	This is located outside of the Scheme extents and upgradient.
Ponds to the west of the River Team	Given that downstream of the Scheme the River Team flows in a canalised section through an industrial estate the ponds are upstream and outside of the influence of the Scheme.
Norwood Nature Park Local Nature Reserve	Whilst a link exists to the Norwood Nature Reserve as the Scheme discharges to the River Team, which in turn flows through it albeit 2.5km downstream from the last surface water outfall. This is significantly greater than the 1km outlined in paragraph 5.33 of HD45/09. Additionally, given that the Scheme is improving the quality of the water discharged, it is considered appropriate to scope this site out from further assessment.
The Northumbria Coast SPA and SAC	The HD45/09 guidance is to consider sites within 1km downstream of the discharge location. In this instance there is a

Feature	Reason for scoping out
	substantial distance downstream, betterment measures are being put in place and the River Tyne will provide large dilution capacity should any pollutants be discharged to the River Team. The River Team flows into the River Tyne (5km downstream) with the SPA/SAC being a further 15km.
Northside Farm Culvert, Culverted drains/watercourses between junction 66 (Eighton Lodge) and 67 (Coal House) and to the north of junction 67 (Coal House).	As these drains are in culvert there is no interaction with the A1 as the CCTV drainage survey has not identified an outfall from the current A1 drainage system and none are proposed.

13.4.3. Since the preparation of the scoping report a CCTV survey has been undertaken to confirm the surface water outfalls, this has resulted in the following watercourses being scoped back into the assessment:

a. Leyburnhold Gill
b. Bowes View
c. Longacre Dene Watercourse
d. Smithy Lane Watercourse
e. Allerdene Burn

13.4.4. These watercourses are however largely ephemeral and therefore have negligible flows during most periods of the year and therefore cannot be assessed within the Highways Agency's (now Highways England) Water Risk Assessment Tool (HAWRAT).

13.4.5. No assessment of the impact of routine runoff on groundwater, in accordance with Method C of the DMRB guidance, is required as no discharges to ground are currently in place or are proposed. However, the impacts associated with groundwater in terms of flood risk and human health are scoped in.

13.4.6. Reservoir flood risk is scoped out of further assessment as the Environment Agency's Risk of Flooding from Reservoirs maps (**Ref 13.2**) show that chances the Scheme flooding due to reservoir failure is assessed to be negligible.

13.4.7. There are no licensed groundwater or surface water abstractions within the Study Area and, as such, these have been scoped out from further assessment.

13.4.8. The Scoping Opinion outlines that further information should be provided on the methodology for assessing deep excavations for the construction works. However, since the submission of the Scoping Report the design has progressed and is now based upon piling and not deep excavations. Therefore, an assessment of the

impacts of deep excavations have been scoped out of further assessment, but the potential impacts resulting from piling activities have been scoped in.

METHODOLOGY

Assessment of Water Quality effects

Construction

13.4.9. Changes in water quality have been assessed qualitatively for the construction phase using professional judgement. The assessment has been undertaken in line with the Environmental Permitting (England and Wales) Regulations 2010 and Water Environment (Water Framework Directive) Regulations 2017. The potential impacts on groundwater resulting from the pier construction for extension of the River Team Viaduct have been assessed assuming that the foundations will be piled whilst considering that mobile contaminants have not been identified along the Scheme Footprint at concentrations considered to pose a risk to controlled water receptors in areas likely to be piled/improved.

Operation

13.4.10. A pollution impact assessment has been carried out to determine the potential detrimental effects, in association with routine runoff from the Scheme, on the water quality of the River Team.

13.4.11. Following guidelines for a Method A assessment as detailed within DMRB, Volume 11, Section 3, Part 10 (H45/09) the HAWRAT has been used to assess the potential ecological impact of routine runoff on the water environment. The parameters used for this assessment along with the results can be found in **Appendix 13.3** of this ES **(Application Document Reference: TR010031/APP/6.3)**. The Scheme compliance with the Water Framework Directive has been assessed and the results can be found in **Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3)**.

13.4.12. The HAWRAT tool calculates the short-term impacts associated with road runoff as:

a. Acute pollution impacts resulting from soluble pollutants, expressed as Event Mean Concentrations (EMCs) for dissolved copper and zinc.
b. Chronic pollution impacts resulting from sediment-bound pollutants, expressed as Event Mean Sediment Concentrations (EMSCs) for total copper, zinc, cadmium, pyrene, fluoranthene, anthracene, phenanthrene, and total polycyclic aromatic hydrocarbons (PAH).

13.4.13. The tool estimates these concentrations and compares them with the runoff specific thresholds (RSTs) in order to assess the short-term impact on the receiving water ecology. Additionally, the long-term impact has been assessed by comparing the annual average concentrations of dissolved copper and dissolved zinc generated by the tool with the published proposed standards (Department for Environment, Food and Rural Affairs, 2014 (**Ref 13.3**)).

13.4.14. As the calculated low flow (Q_{95}) of each watercourse were deemed to make the watercourses ephemeral and therefore not able to support aquatic life, the total Scheme area discharging to the River Team (to which they all discharge) has been assessed. This is a conservative assumption as it assumes a higher polluting loading at the single discharge point, thus negating any discharge/dilution that may occur upstream. The ephemeral watercourses in between are considered as conveyance/field drainage features. The results of this assessment can be found in **Appendix 13.3** of this ES **(Application Document Reference: TR010031/APP/6.3)**.

13.4.15. Increases in traffic flow throughout the lifecycle of the Scheme have the potential to lead to an increase in the pollutant load within routine runoff. This increase in traffic flow could also result in an increase in the risk of a spillage of polluting material and therefore the risk of a serious pollution event happening. Therefore, the operational assessment has been undertaken with the design year traffic flows.

13.4.16. The assessment of acute pollution risks associated with accidental spillage has also been undertaken using procedures set out in Method D of DMRB Volume 11 Section 3 Part 10 (HA 45/09) (**Ref 13.1**). This has been undertaken to calculate the spillage risk and the associated probability of a serious pollution incident occurring. The parameters used in this aspect of the assessment are detailed in **Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3)** and the results of this assessment can be found in **Appendix 13.3** of this ES **(Application Document Reference: TR010031/APP/6.3)**.

13.4.17. A WFD Assessment has been completed to assess the implications of the Scheme upon the WFD parameters of:

a. Biological quality (fish, benthic invertebrates, aquatic flora).
b. Hydromorphological quality (e.g. river bank structure, river continuity and substrate of the river bed).
c. Physical-chemical quality (e.g. temperature, oxygenation and nutrient conditions).

13.4.18. The WFD Assessment compares the baseline conditions and, where appropriate, identifies mitigation measures for any likely significant effects that may arise as part of the proposed works.

ASSESSMENT OF FLOOD RISK

Construction

13.4.19. Changes in flood risk during the construction phase have been assessed qualitatively based on professional judgement. The assessment has also considered the Outline Construction Environmental Management Plan (CEMP) and the construction drainage solution.

Operation

Flood Risk – River Team

13.4.20. Hydraulic modelling (detailed in Methods E and F of HD45/09) has been undertaken to assess the potential impacts associated with fluvial flooding from the River Team at junction 67 (Coal House) using the Environment Agency's InfoWorks ICM model (the Team Valley flood risk model) which models the river and watercourse as a 1D-2D model. The model has been updated to include the Scheme design and with the latest climate change rainfall allowance of 40%, in accordance with the NPPF. This approach of climate change allowances has been agreed with the Environment Agency. This is the upper end allowance when accounting for the total potential change anticipated for the '2080's (2070 to 2115), in accordance with Table 2 of the NPPF Flood risk assessments: climate change allowances (**Ref 13.4**).

13.4.21. The Scheme design avoids changes to the culverts at junction 67 (Coal House) but the main carriageway would be widened to accommodate additional lanes, leading to the widening of the existing Kingsway Viaduct at the River Team crossing. The widening would involve extension of the deck to the south of the structure only, which is substantially elevated above the floodplain. However, the substructure would also be extended with the construction of new reinforced concrete piers/abutments inside Flood Zones 2 and 3 of the River Team. It is these piers which are included within the post development flood model.

13.4.22. The FRA provides more detail on the methodology and is provided in **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**.

Flood Risk – Allerdene Embankment Option and Allerdene Viaduct Option

13.4.23. This assessment includes both the Allerdene embankment option and Allerdene viaduct option, as detailed in **paragraphs 2.7.11 - 2.7.18** of this ES which will require either:

a. The extension of the existing Allerdene Culvert and replacement of the existing drainage channel (Allerdene embankment option); or
b. Daylighting of the existing culvert and replacement and realignment of the existing drainage channel to accommodate a new viaduct over the existing railway line (Allerdene viaduct option).

13.4.24. Hydraulic models of both options above (in accordance with methods E and F of HD45/09) have been constructed in ICM, to assess potential for changes in flood risk associated with the Scheme with appropriate allowances for climate change for the Northumbrian River Basin District of 25% and 50%. This approach has been agreed with the Environment Agency.

Pluvial Flood Risk

13.4.25. Within the Study Area there are several areas at risk of surface water flooding. The locations of high and medium risk could represent a health and safety risk for

motorists if mitigation measures are not incorporated. The flood mechanisms, pathways and associated extents have been assessed and where required hydraulic models have been constructed in ICM to refine the understanding of the flood mechanisms as appropriate, as detailed within the FRA (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**). These models have been constructed in accordance with best practice and in accordance with the Environment Agency's guidance "*Fluvial design guide. Chapter 7*" (**Ref 13.5**) and *"Submitting locally produced information for updates to the Risk of Flooding from Surface Water map"* (**Ref 13.15**). The approach has been agreed with the Environment Agency.

Surface Water Runoff – Flood Risk

13.4.26. The increase in impermeable surfaces as a result of the Scheme along with the likely increase in rainfall as a result of climate change over the lifetime of the Scheme would increase flood risk if not mitigated. Therefore, a surface water drainage strategy has been developed and forms part of the FRA (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**). The FRA outlines that methodology for assessment provided by Highways England for the Scheme (provided via their Safety, Engineering and Standards team) is that:

a. The climate change rainfall intensities are to be increased by 20% in accordance with the NPPF.
b. Where there is no increase to paved area, the additional runoff (generated by application of the 20% increase to rainfall intensities for climate change) is to be attenuated, so that the proposed discharge rate does not exceed the existing.
c. Where it is proposed to increase the paved areas (e.g. nearside widening / hardening of the central reserve), the discharge rate can be increased above the existing by an amount equal to the Greenfield runoff rate for the additional paved area. Allowance for climate change is also to be applied for the entire catchment area inclusive of the new paved areas. Flows exceeding the revised discharge rate are to be attenuated and released at a rate which is identical to the existing.

Human Health

13.4.27. The methodology for the assessment of effects on human health associated with road drainage and the water environment takes the form of a risk assessment approach of the following:

a. Pollution on human health via potential impacts to surface water supplies of drinking water, taking into account the baseline condition of the waterbody. This is assessed through the HAWRAT calculations. The parameters used for this assessment along with the results can be found in **Appendix 13.3** of this ES **(Application Document Reference: TR010031/APP/6.3).**
b. Flood risk, whether to the Scheme, or to other areas as a result of the Scheme, using professional judgement to consider the combination of the baseline conditions, potential flood depths, mechanisms and vehicle speeds. This is

considered within the FRA and carried out with regard to the Environment Agency's FRA Guidance for New Development (FD2320/TR2) (**Ref 13.6**) and the associated supplementary note and Highways England guidance in HD33/16 (**Ref 13.7**).

SIGNIFICANCE OF EFFECTS

13.4.28. In order to assess the significance of effects from the Scheme on the road drainage and the water environment, the guidelines within Annex IV of DMRB Volume 11, Section 3, Part 10 (HD 45/09) (**Ref 13.1**) have been followed.

13.4.29. The magnitude of impact on receptors (major adverse, moderate adverse, minor adverse, negligible, minor beneficial, moderate beneficial, major beneficial) have been described using the criteria and examples as outlined in Table A4.4 of the guidance.

13.4.30. The identification of the significance of effects follows the matrix in Table A4.5 of the guidance.

DATA SOURCES

13.4.31. The following data sets have been used to inform this assessment:

a. Environment Agency's Hydraulic Model of the River Team
b. LiDAR
c. Flood Mapping Data Sets (**Ref. 13.2 and Ref 13.8**)
d. Catchment Data Explorer (**Ref. 13.14**)
e. Topographical Survey
f. Channel Survey
g. CCTV Survey
h. MAGIC online mapping (**Ref. 13.9**)
i. Ordnance Survey (OS) mapping
j. Gateshead Council's Strategic Flood Risk Assessment (SFRA) (**Ref. 13.10**)
k. British Geological Society (BGS) Geology of Britain viewer (**Ref. 13.11**)
l. BGS Geoindex online dataset (**Ref. 13.12**)
m. Review of Highways Agency Drainage Data Management System (HADDMS).

POLICY AND GUIDANCE

13.4.32. The following guidance documents have been used during the preparation of this chapter.

Design Manual for Road and Bridges

13.4.33. The assessment has been undertaken in accordance with the methodology detailed within DMRB Volume 11, Section 3, Part 10 (HD 45/09) (**Ref 13.1**), which sets out the recommended approach to the assessment of road schemes on the water environment. Guidance is provided on determining the importance of receptors and the likely magnitude of impact. Specifically, it provides a framework for assessing

risks associated with polluted surface water runoff, accidental spillages and flood risk, and provides guidance on mitigation to manage these risks.

Highways England Policies

13.4.34. Highways England is committed to reducing the risk of pollution to watercourses. The treatment of priority outfalls contributes to Highways England's Key Performance Indicator which is as follows:

'Mitigate the potentially adverse impact of strategic roads and take the opportunity to enhance the environment taking into account value for money'.

13.4.35. If a priority outfall is confirmed as posing a risk, then proposals should be put forward for improvement schemes. If an outfall is reclassified, the Priority Outfalls Register must be amended. Equally, if an outfall is shown to not pose a risk, the outfall should be removed from the Priority Outfalls Register.

13.4.36. If a new outfall is identified as posing a pollution risk and is not on the priority outfall register, steps should be taken as outlined in 'Highways Agency – Guidance for Assessing Priority Outfalls on Highways Agency Roads'. This includes assessing the outfall using Methods A, B and D.

13.4.37. No priority outfalls have been identified within the Extent of Works according to HADDMS.

Environment Agency Groundwater Protection Guides

13.4.38. The Environment Agency is the statutory body responsible for the protection and management of groundwater resources in England. The groundwater protection guides published in March 2017 set out the framework for Environment Agency regulation, and replaces Groundwater Protection: Principles and Practice GP3. Section C - Infrastructure of 'The Environment Agency's approach to groundwater protection' guidance document is of key importance to transport proposals. In summary, Section C sets out the Environment Agency's position statements and approach to managing and protecting groundwater in relation to infrastructure developments.

Guidance for Pollution Prevention (GPPs)

13.4.39. Guidance for Pollution Prevention (GPPs) are currently being developed and published in a progressive manner to provide environmental good practice guidance for the whole UK and replace the Environment Agency's PPGs, which have been withdrawn but in the instances where they have yet to be updated still provide good practice advice.

13.4.40. In particular, PPG1 provides practical advice on site drainage, PPG5 provides guidance for works in, near, or liable to affect watercourses, and PPG6 provides guidance on the control of water pollution during construction and demolition stages of works. Compliance with these GPPs/PPGs should be considered as part of the

environmental management documentation developed for construction and occupation phases of the Scheme.

The Planning Inspectorate, Advice Note 18 The Water Framework Directive

13.4.41. This provides guidance to ensure that the Examining Authority is in a position to report to the Secretary of State on the effects of the Scheme on the relevant River Basin Management Plan (RBMP) and whether or not the Scheme has implications for the UK's obligations under the WFD. The advice note therefore provides:

a. An introduction to the legal context and obligations placed on both the decision maker and the Applicant by the WFD and The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 Regulations.
b. An explanation of the relationship between the WFD assessment, the Environmental Impact Assessment (EIA) and Habitats Regulations Assessment (HRA).
c. Advice regarding the relevant bodies that should be consulted by the Applicant during the process of preparing a Development Consent Order (DCO) application in respect of the WFD, and the suggested timing and level of that engagement.
d. A clarification of the process and information to be provided with a DCO application with respect to WFD.
e. Advice on the presentation of the information using optional screening and assessment matrices.

Flood Risk to People

13.4.42. The Environment Agency and Defra produced this methodology (FD2321/TR1 and FD2321/TR2 along with the supplementary Note) to assist in improving flood risk management by enabling the completion of a multi-criteria assessment based on the concepts of flood hazard, area vulnerability and people vulnerability. This assists in raising awareness of the dangers of flood water, targeting flood warning, emergency planning, development control and flood mapping. The multi-criteria assessment is based upon factors that affect Flood Hazard, the chance of people in the floodplain being exposed to the hazard (Area Vulnerability) and ability of those affected to respond effectively to flooding (People Vulnerability).

Consultation

13.4.43. Meetings have been held with the Environment Agency and Gateshead Council as the Local Planning Authority (LPA) and LLFA on 31 October 2017, 15 March 2018, Gateshead Council on 12 March 2019 and the Environment Agency on 11 April 2019 and 24 July 2019. Further consultation as appropriate has been undertaken by email and telephone. Details of the consultation that has taken place is included in **Appendix 4.4** of this ES (**Application Document Reference: TR010031/APP/6.3**) and a summary of the key points of discussion is provided below:

a. Surface water outfalls:

i. The location and means of identification of the outfalls was discussed.

b. Surface Water issues at Longbank Bridleway Underpass:

i. The Highways England Asset Lead suggested the flooding recorded could be due to the change in ploughing of the fields.

c. River Team Construction:

i. Sheet piling would be adverse to the requirement to avoid further modification of the channel. Note that the construction methodology remains under review.

d. River Team WFD:

i. Compensatory mitigation measures would be required for any additional heavily modified elements and opportunities for betterment should be considered in order to achieve the required WFD objective to 2027.

e. River Team Flooding:

ii. Use of the Environment Agency's hydraulic model and the upcoming update to the Flood Map for planning.
iii. Flood plain compensation would be required for the loss of flood plain associated with the works to the piers.

f. Allerdene Burn:

i. Consideration should be given to opportunities upstream of the culvert to help reduce velocities within the culvert and flood risk downstream.

g. Surface Water Runoff:

i. Discussion over the location of the pond, drainage calculations and design advice.

h. Climate Change:

i. Agreement on the climate change allowances and discussion over the potential future updates of NPPF and how the Scheme will incorporate these.

i. Lamesley Pastures flood alleviation scheme

i. The location and aspirations of this scheme was discussed.

j. Ladypark Burn:

i. The risks during an extreme event combined with a blockage scenario were discussed and the potential involvement of Highways England in undertaking visual inspections were discussed.

k. WFD assessment:

i. The scope and approach to the WFD assessment was discussed.

l. Road Drainage and the Water Environment ES Chapter:

i. The Environment Agency stated in the meeting of 11th April 2019 that they were satisfied with the content of the ES chapter.

13.5. ASSESSMENT ASSUMPTIONS AND LIMITATIONS

13.5.1. Final detailed information on the design of the drainage strategy, flood plain compensation and scour prevention are not available. Therefore, this assessment is based on preliminary design which will be the basis for the detailed design stage and where required design principles have been used to supplement the current design works. The flood risk associated with the relocated section of the Allerdene Burn would require further hydraulic modelling as part of detailed design, this would be utilised to optimise the size of the throttles and ensure that flood risk is not increased. Likewise, the Northern Gas Network (NGN) site would require a full surface water drainage strategy and setting of appropriate finished floor levels.

13.5.2. The construction methodology remains under review; therefore, further constraints may be identified at a later date, further information on the key construction assumptions are detailed in **Section 13.9** below. An Outline CEMP has been produced in a support of the DCO (**Application Document Reference: TR010031/APP/7.4**) to ensure that these constraints are given due consideration and managed through the Register of Environmental Actions and Commitments (REAC). Once further details of any additional constraints and construction methods are available the contractor would update these elements in the CEMP and REAC.

13.5.3. Consultation with the Statutory Consultees is well progressed, with agreement for some areas of detail yet to be finalised. In particular the Coal Authority and Environment Agency screening toolkit has been used to assess the potential for groundwater flood risk to the Scheme. WSP are awaiting formal feedback on the application of this toolkit to scope out groundwater flood risk. The assessment and reports have been updated to reflect information provided in the meetings with Gateshead Council on 12 March 2019 and the Environment Agency on 11 April 2019. The LLFA confirmed in an email on 18 June 2019 that they have no further comments. The Environment Agency are currently reviewing the hydraulic model. Any changes made in subsequent stages of the Scheme that could affect the outcome of the Road Drainage and Water Environment chapter of this ES would undergo a further assessment and this would be captured in the Evaluation of Change Register for the Scheme.

13.5.4. The draft DCO contains powers of lateral and vertical deviation. The EIA has taken the Limits of Deviation (LoD) into account and the approach taken is described in **Chapter 4 Environmental Assessment Methodology**, **paragraph 4.5.4** of this ES (**Application Document Reference: TR010031/APP/6.1**). The outputs of the assessment are not considered likely to change materially as a result of the power of deviation.

13.6. STUDY AREA

13.6.1. The Study Area as shown in **Figure 13.1** of this ES **(Application Document Reference: TR010031/APP/6.2)** comprises the ”Extent of Works”. The Scheme Footprint not only includes the Extent of Works but also the area to the north of

junction 67 (Coal House) where the only works taking place are the inclusion of signage, which would therefore not affect flood risk, water quality or drainage. The exclusion of this area is in accordance with HD45/09 which states that where the following scenarios do not apply, no assessment is required:

a. Will the project affect an existing watercourse or floodplain?
b. Will the project change either the road drainage or natural land drainage catchments?
c. Will the project lead to an increase in traffic flow of more than 20%?
d. Will the project change the number or type of junctions?
e. Is any of the project located within an Indicative Floodplain or an SPZ?
f. Will earthworks result in sediment being carried to watercourses?
g. Will the project allow drainage discharges to the ground?

13.6.2. Therefore, the Study Area is limited to the Extent of Works with a 1 km buffer in which the assessment is required in accordance with the scenarios above. This is shown on **Figure 13.1** of this ES **(Application Document Reference: TR010031/APP/6.2)**.

13.6.3. HD45/09 requires the Study Area to extend over 1km from the Scheme Footprint, in this case the Extent of Works, to ensure that any features which could be impacted are identified and assessed. Many of the features within this area have been scoped out as detailed in **Table 13-4**.

13.6.4. The mechanisms for assessing the impacts on the receiving waterbodies as a result of the Scheme differ for each of the assessed elements (surface water quality and flood risk). This has resulted in the same Study Area being adopted for the assessment but with a different focus area for each assessment element (this has been agreed with the Environment Agency and LLFA) as detailed below:

a. The water quality Study Area considered for this assessment is the permeable and impermeable areas of the Scheme draining into the highway drainage and receiving watercourses.
b. The flood risk Study Area covers the Extent of Works and the watercourses (fluvial flood risk) along with the land immediately adjacent to these extents which could convey surface water flows (pluvial flood risk) onto the Scheme.

13.7. BASELINE CONDITIONS

EXISTING DRAINAGE SYSTEMS

13.7.1. HADDMS does not show any outfalls draining the Extent of Works, therefore to ensure all outfalls have been located a CCTV survey of existing highway drainage has been undertaken. This did not find any evidence of flow control devices or storage attenuation within the existing system, but identified 14 surface water outfalls from the Scheme at the locations identified in **Table 13-5 and Figure 13.4** of this ES **(Application Document Reference: TR010031/APP/6.2)**.

Table 13-5 - Surface water outfall locations

Outfall	Discharge Location
1	Exact location of this outfall could not be confirmed during CCTV survey and is assumed to be the Highway Authority's Drainage Network
2	Leyburnhold Gill
3	Bowes View
4	Leyburnhold Gill
5	Discharges into the Eighton Lodge Culvert then into the ordinary watercourse in Longacre Dene (Ancient Woodland)
6, 7 and 7A	Ordinary watercourse near to Smithy Lane
8	Ditch leading to the Allerdene Culvert
9 - 13	The River Team

WATER QUALITY

13.7.2. The River Team is located within the Tyne WFD Management Catchment shown on **Figure 13.8** of this ES **(Application Document Reference: TR010031/APP/6.2)**.

13.7.3. The current Northumbria RBMP, as shown by the Environment Agency's Catchment Data Explorer, shows that the River Team is a 'heavily modified waterbody'. The Northumbria RBMP classifies the current Ecological and Chemical Quality of the River Team as Moderate and Fail, respectively. The overall waterbody status is classified as Moderate with an objective for Good by 2027, further details of the quality are provided in Table 1 of the WFD Assessment provided in **Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3).**

13.7.4. The other watercourses within the Study Area, such as the ordinary watercourse in the Longacre Dene and the watercourse that passes under Allerdene Bridge, both of which flow in a southerly direction, have not been separately assessed as part of the Northumbria RBMP. Given that most of the watercourses within the Extent of Works discharge into the River Team, the water quality of the other ordinary watercourses are assigned the category of the River Team i.e. moderate, noting that the area is classed as a Nitrate vulnerable zone and may be susceptible to chemical pollution, especially from agricultural areas.

13.7.5. Given the moderate WFD status of the River Team, the majority of the receiving watercourses described above have been classified as having a **medium** importance with respect to water quality.

13.7.6. The one exception to this is outfall number 5 which discharges surface water into Eighton Lodge Culvert then into the ordinary watercourse in Longacre Dene (designated as Ancient Woodland and the Priority Habitats Inventory). The ultimate discharge of this watercourse would be to the River Team but given the designation of Longacre Dene, this watercourse has been classified as having a **high** importance with respect to water quality.

13.7.7. Groundwater is only expected to be encountered at the additional pier construction at the Kingsway Viaduct at which point it is considered to be in hydraulic connectivity with the River Team and therefore of the same quality as the River Team.

FLOOD RISK

Fluvial Flood Risk

13.7.8. Fluvial flooding relates to the risk of flooding from rivers and ordinary watercourses. The flood zones are shown on **Figure 13.5a** of this ES **(Application Document Reference: TR010031/APP/6.2)**.

13.7.9. The majority of the Study Area is located within Flood Zone 1, which is associated with a low risk of flooding from fluvial and coastal sources (an annual probability of less than 1 in 1000).

13.7.10. The River Team (classified as a Main River and under the jurisdiction of the Environment Agency) is culverted under the highway sections of junction 67 (Coal House), with the main A1 carriageway significantly above on a viaduct. The River Team flows from south to north and joins the River Tyne approximately 4.5km downstream of junction 67 (Coal House). The Scheme crosses at height over the fluvial floodplain of the River Team, land designated as Flood Zone 2 (**Figure 13.5a** of this ES **(Application Document Reference: TR010031/APP/6.2)**). The Lamesley Pastures Nature Reserve is located within the floodplain of the River Team, approximately 1.3km west of the Scheme. The land is currently managed by Durham Wildlife Trust as a winter wetland for wintering birds and other wildlife. It also forms part of the Team Valley flood alleviation and wetland habitat creation scheme facilitated by the Environment Agency and Gateshead Council.

13.7.11. The Environment Agency have advised that their Flood Map for Planning (**Ref 13.8**) has yet to be updated to account for the findings of their latest modelling of the River Team. Therefore, the baseline flood extents from the 2016 River Team Model should be used. This has therefore been included in all figures and assessments instead of the published flood map for planning.

13.7.12. The Environment Agency's revised modelling (**Ref 13.13**) shows the western half of junction 67 (Coal House) and part of the slip roads (to the west of the junction) to be within Flood Zone 2 with respect to fluvial flooding from the River Team. Flood Zone 2 equates to an annual probability of fluvial flooding of between 1 in 1000 and 1 in 100 (0.1-1%).

13.7.13. The fluvial floodplain of the River Team has been classified as of **high** importance with respect to flood risk.

13.7.14. As shown in **Figure 13.5a** of this ES **(Application Document Reference: TR010031/APP/6.2)**, Flood Zone 3 extends up to the south of junction 67 (Coal House), and close to the base of the viaduct carrying the A1 main carriageway across the centre of the junction. Flood Zone 3 equates to an annual probability of fluvial flooding of greater than 1 in 100 (>1%).

13.7.15. The fluvial floodplain of the River Team has been classified as of **high** importance with respect to human safety due to the large number of industrial units within the flood plain, which have previously flooded, as identified by both the Environment Agency and Gateshead Council. This historical flooding is one of the factors in the implementation of the Lamesley Pastures Flood Alleviation Scheme.

13.7.16. The Allerdene Burn, an ordinary watercourse, that passes under the Allerdene Bridge has been classified as of **high** importance with respect to flood risk and human safety due to the close proximity of the residential areas approximately 130 m upstream and the railway which it crosses immediately upstream of the A1.

13.7.17. The Environment Agency have advised that based upon historical information there is a residual risk of flooding from the Lady Park Burn should the trash screen become 100% blocked during extreme events.

Surface Water/Pluvial Flood Risk

13.7.18. Surface water flooding (pluvial flood risk) is a result of overland flow that can follow a rainfall event before the runoff enters a watercourse or sewer. This form of flooding is usually associated with high intensity rainfall events but can also occur with low intensity rainfall or melting snow where the ground is saturated, frozen, developed or otherwise has a low permeability.

13.7.19. The Environment Agency's Risk of Flooding from Surface Water Map (**Ref 13.2**) identifies the following areas within the Extent of Works as being at medium to high risk of pluvial flooding (as shown in **Figure 13.5b** of this ES **(Application Document Reference: TR010031/APP/6.2)**).

a. Pluvial flooding is predicted along the highway at junction 67 (Coal House) in the 1 in 30 year event with depths below 300mm predicted for the southbound slip road, and depths between 300mm and 900mm on the northbound slip road.
b. The western part of the junction 67 (Coal House) roundabout is shown to be at risk of surface water flooding to depths of 300 to 900mm in the 1 in 100 year event.
c. Pluvial flooding is also predicted at depths below 300mm in the 1 in 30 year event on Allerdene Bridge (between junction 67 – Coal House and junction 66 – Eighton Lodge).

13.7.20. An area at high risk of surface water ponding is also predicted on one of the slip roads at junction 65 (Birtley), with depths up to 900mm predicted by the Environment Agency's Risk of Flooding from Surface Water Map.

13.7.21. The pluvial floodplains, in the locations outlined above, has been classified as of **medium** to **high** importance with respect to flood risk and human safety. This category has been adopted as junction 65 (Birtley) the A1 is shown by the Environment Agency's maps to potentially be acting as a floodplain protecting residential properties downstream. Whilst junction 67 (Coal House) the high importance is due to the large number of industrial units within the modelled and historical flood plain as identified by both the Environment Agency and Gateshead Council.

Groundwater Flood Risk and Water Quality

13.7.22. According to the SFRA (**Ref 13.10**), groundwater is not identified as being a significant source of flooding in the area.

13.7.23. The bedrock underlying the Scheme is classified as Secondary A aquifer.

13.7.24. The majority of superficial deposits underlying the Scheme have been classified as secondary (undifferentiated) aquifer. This classification has been assigned to rocks where it was not possible to attribute either Secondary A or Secondary B to the rock type.

13.7.25. Secondary A Aquifers are permeable strata capable of supporting water supplies at a local rather than strategic scale and in some cases forming an important source of base flow to rivers.

13.7.26. Secondary B Aquifers are predominantly lower permeability strata which may in part have the ability to store and yield limited amounts of groundwater by virtue of localised features such as fissures, thin permeable horizons and weathering.

13.7.27. The Scheme is located within the Tyne Carboniferous Limestone and Coal Measures Groundwater Catchment as shown in **Figure 13.8** of this ES **(Application Document Reference: TR010031/APP/6.2)**. This waterbody is designated as a drinking water protected area and is utilised throughout the catchment for small local, private water supplies. In terms of the WFD categories it is at Poor status due to a combination of point and diffuse coal and metal mine impacts to both ground and surface waters. A number of remediation measures are being developed to mitigate these issues but the groundwater body would remain at Poor status as it is technically unfeasible to clean up polluted groundwater at such a large scale, when this is combined with Environment Agency considering that the cost is disproportionate. Therefore, no change in status is expected and no impact on the status of the waterbody as a result of the Scheme are expected. Additionally, this waterbody is designated as a drinking water protected area and is utilised throughout the catchment for small local, private water supplies (although none are identified in close proximity to the Scheme). Furthermore, any abstractions in close proximity to

the Scheme would be from a perched waterbody given the pumping undertaken by the Coal Authority which leads to a significant depression of groundwater levels. Further information is provided in Table 2 of the WFD Assessment provided in **Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3)**.

13.7.28. Along the A1 there has been the collapse of historical mines, the exact cause has not been determined, although some reports have associated this with groundwater. This risk is considered further in **Chapter 9 Geology and Soils** of this ES **(Application Document Reference: TR010031/APP/6.21** which outlines that any mineshafts will be appropriately treated depending on their risk to the Scheme during the works to stabilise historical mine workings.

13.7.29. The Scoping Opinion states that groundwater flood risk should be scoped into the assessment and that a hydrogeological assessment may be required. With their agreement, the Environment Agency's and Coal Authority's screening toolkit (which was released after the Scoping Opinion) has been used to assess the potential for groundwater flood risk to the Scheme (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**).

13.7.30. The Scoping Opinion identified that due consideration should be given to potential issues associated with possible cessation of large scale, coal mine legacy, dewatering occurring locally. In theory, should the Coal Authority cease, or significantly reduce, their local dewatering operation at Kibblesworth then the whole Study Area would be subject to major groundwater level rebound and an array of associated consequences could manifest including:

a. Impacts on groundwater quantity (levels and flows).
b. Impacts on groundwater quality (mobilisation/inundation of contaminants, inundation of mine audits/shafts/voids and other poor water quality zones).
c. Quantity and quality breakout to the surface water environment.
d. Impacts on drainage/flooding.
e. Impacts on geotechnical properties/stability characteristics (through inundation, reduced pore pressures and possible hydrochemical attack) affecting natural/artificial ground conditions/properties and ground engineered infrastructure.
f. Mobilisation and surface breakout of ground gases.

13.7.31. Although it is incumbent upon the Applicant to give due consideration to realistic changes to the baseline water environment when undertaking an ES, it is not considered that the prospect of cessation, or significant reduction, in local dewatering operations by the Coal Authority is realistic and therefore the need to consider an additional baseline groundwater regime over and above the present baseline has been scoped out. The reasoning for this is set out below.

13.7.32. A meeting was held between WSP and the Coal Authority on 22 March 2018. This identified that the local groundwater regime is heavily influenced by major dewatering at Kibblesworth (~300l/s) and some of the consequences identified in

paragraph 13.7.30 could manifest if this operation were to be terminated. However, the meeting did not identify that this is a realistic prospect.

13.7.33. From the 1980s through to 2005 incremental closure of underground coal mining in the Durham Coalfield occurred along with commensurate cessation of coal mine dewatering operations. In the 1990s great environmental concern was expressed regarding impacts associated with groundwater level rebound and it was decided to abandon mine dewatering operations proximal to the coast and focus continued on mine dewatering inland using both existing facilities (such as Kibblesworth) and newly constructed facilities elsewhere (**Ref 13.14**).

13.7.34. Although pumping rates at Kibblesworth have remained little altered in recent decades (300+ l/s) corresponding pumped groundwater levels have risen from circa -70 to -25m OD over the period 1997 to 2004. This is thought to be due in part to a small reduction in pumping locally at Kibblesworth but also reflects Regional cessation/reduction in dewatering operations proximal to coastal areas (**Ref 13.14**).

13.7.35. Over a corresponding period, groundwater level rises at the Environment Agency Birtley observation borehole (proximal to the Study Area) have risen from circa -33 to -22m AOD.

13.7.36. In 2005 the combined Lamesley (near Birtley) Water Treatment Scheme was commissioned. This entails a joint venture between Northumbrian Water, the Coal Authority and the Environment Agency and involves passive treatment (through a 5.6 hectare wetland) combining treatment of two source waters including secondary treated water from Birtley Waste Water Treatment Works (WWTW) (~100 l/s) and mine water form Kibblesworth (~300 l/s) with onward discharge to the River Team post passive treatment.

13.7.37. Gateshead Council (**Ref 13.10**) recognise the significance of the artificially maintained groundwater level regime in relation to groundwater mediated flood risk in their area. In their assessment no potential groundwater discharge breakouts are identified in the Scheme Study Area should mine dewatering at Kibblesworth be subject to cessation. They make reference to an earlier study by the National Rivers Authority that cessation of dewatering at Kibblesworth could lead to the following surface breakouts:

a. Duston shaft, Dunston (though this breakout would likely be subdued as the mine shaft has been infilled).
b. Norwood shaft, Dunston (though this breakout would likely be subdued as the mine shaft has been infilled).
c. Swalwell Henry shaft, Swalwell (though this breakout would likely be subdued as the mine shaft has been infilled).
d. Swalwell Henry adit, Swalwell (though this breakout would likely be subdued as the mine adit has been infilled).
e. Addison Industrial Estate, Ryton (area identified as being subject to historical mine related flooding).

f. Monkridge Garden, Dunston Hill (area identified as being subject to historical groundwater related flooding).

13.7.38. It is inferred from the above references that the Coal Authority may be prepared to allow very modest levels of further groundwater level recovery in the Kibblesworth Block affecting areas such as Birtley and Gateshead. However, any further significant groundwater level recovery to anything approaching 'natural' regimes can be regarded as unthinkable and unacceptable. The modest levels of additional groundwater level recovery realistically envisaged will not significantly change the present groundwater baseline regime for the project or give rise to added design or environmental considerations for the Scheme. The groundwater has been classified as of **high** importance with respect to flood risk and water quality.

SENSITIVE RECEPTORS

13.7.39. The importance of potential receptors has been assessed based on the criteria and typical examples as outlined in Table A4.3 of HD 45/09 (**Ref 13.1**) and are summarised in **Table 13-6.**

Table 13-6 - Importance of the baseline receptors

	Receptor	Criteria/Attribute	Importance
Water Quality	River Team	Heavily modified waterbody WFD Moderate for ecological quality and Fail for chemical quality with overall waterbody status as Moderate (objective Good by 2027).	Medium
	Ordinary watercourse in the Longacre Dene	Watercourse drains through the designated Longacre Dene Ancient Woodland, which falls under the Ancient Woodland Inventory and the Priority Habitats Inventory.	High
	Allerdene Burn	Heavily modified watercourse Hydraulically linked to the River Team WFD Moderate (overall waterbody status of the River Team) Currently receive highway drainage and potentially urban drainage.	Medium
	Leyburnhold Gill	Heavily modified watercourse (culverted underneath the A1 and potentially through the urban areas of Birtley) Hydraulically linked to the River Team WFD Moderate (overall waterbody status of the River Team) Currently receive highway drainage and potentially urban drainage.	Medium
	Ordinary watercourse	Heavily modified watercourse	Medium

	Receptor	Criteria/Attribute	Importance
	adjacent to Bowes View	Hydraulically linked to the River Team WFD Moderate (overall waterbody status of the River Team) Currently receive highway drainage and potentially urban drainage.	
	Ordinary watercourse adjacent to Smithy Lane	Heavily modified watercourse Hydraulically linked to the River Team WFD Moderate (overall waterbody status of the River Team) Currently receive highway drainage and potentially urban drainage.	Medium
	Groundwater (Tyne Carboniferous Limestone and Coal Measures groundwater body)	WFD Poor (with no known objectives to improve current status) Designated drinking water protected area (albeit none in close proximity to the Scheme Footprint) Abstractions for small local, private water supplies Major dewatering operations at Kibblesworth give rise to a highly modified (artificial) groundwater level regime.	High
Flood Risk	River Team – fluvial floodplain	The Scheme crosses over the fluvial floodplain (Flood Zone 2) of the River Team The western half of junction 67 (Coal House) as well as a small proportion of the industrial area immediately north of the Scheme is located	High

	Receptor	Criteria/Attribute	Importance
		within Flood Zone 2 of the River Team.	
	River Team – human safety	Potential impact to the safety of the construction workers with respect to flooding from the River Team.	High
	Allerdene Burn	Flood risk to the residential areas approximately 130m upstream of the Scheme.	High
	Allerdene Burn– Human Safety	Potential impact to the safety of the construction workers with respect to flooding from the Allerdene Burn.	High
	Pluvial floodplain	Sections of the Scheme are identified to be at medium to high risk of pluvial flooding but this is restricted to surface water runoff along the A1 with low probability of flooding of residential and industrial properties.	Medium to High
	Pluvial flood risk – Human Safety	Potential impact to the safety of the construction workers with respect to pluvial flooding.	Medium to High
	Surface water runoff – Human safety	Potential impact to the safety of the construction workers due to increased surface water runoff and/or changes to the overland flow routes.	Medium to High
	Groundwater	The risk of groundwater flooding is considered to be low based on information provided in the SFRA. The possible risks associated with potential groundwater level rebound, should the Coal Authority cease (or significantly reduce) major dewatering operations at	Low

	Receptor	Criteria/Attribute	Importance
		Kibblesworth, have been assessed and scoped out as extremely unlikely (See **paragraphs 13.7.22 to 13.7.38**.	

13.8. POTENTIAL IMPACTS

CONSTRUCTION

Surface Water Quality

a. The receiving water bodies could be impacted as a result of mobilised suspended solids (e.g. top soil and sub-soil storage, runoff from construction sites/roads and vegetation clearance) or spillage of fuels, lubricants, hydraulics fluids and cements from construction.
b. Potential spillage of grout and/or conveyance of grout into watercourse, should the stabilisation of the mine workings require grouting.
c. The nature of the works that will be undertaken in the flood plain, especially to Allerdene Burn, may require stockpiles and vehicles to be utilised and stored in the flood plain which increase the potential for oil spills and sediment movement. Where possible these will be outside of the functional floodplain and measures to prevent/restrict sediment movement should a flood event occur would be included within the CEMP.
d. Potential for impacts on the Allerdene Burn and the River Team (as the downstream receptor) due to the removal of the culvert beneath the A1, which may require over pumping and/or direct transfer of sediment into the watercourse as the culvert is broken out (entirely for the Allerdene viaduct option or partially for the Allerdene embankment option).
e. The widening of Kingsway Viaduct would include temporary culverting and use of heavy plant in and near the river which could lead to potential water quality impacts e.g. spillages entering the River Team, hydraulic hose bursts, concrete spillages and runoff.

Flood Risk

Fluvial

a. The Scheme could affect the existing fluvial flood risk as a result of construction works in proximity to the River Team.
b. Impacts to the River Team from the widening of Kingsway Viaduct including temporary culverting and use of heavy plant in and near the river potential including impacts to flow regime/the river channel, e.g. spillages entering the River

Team, hydraulic hose bursts, concrete spillages, runoff of mobilised sediment due to vegetation clearance etc.

c. Impacts to human health from the works that will be undertaken in the flood plain, especially under the Kingsway Viaduct which will require workers to be adjacent to the river channel.

Pluvial

a. Interception of overland flood flow routes, which could cause localised flooding of low lying road segments.

Surface Water Runoff

a. Increased runoff into surface water drainage systems, with potential impacts on flood risk.

Groundwater

a. Possible impacts on the groundwater as a result of the dewatering / piling activities or stabilisation of mineshafts.
b. Alteration in the regional groundwater quality due to contaminants in site surface water discharge or accidental spillages of materials during construction.

OPERATION

Surface Water Quality

13.8.1. The release of contaminants from both routine runoff and accidental spillages has the potential to impact upon the water quality of the River Team that the Scheme ultimately discharges to, with the subsequent loss of aquatic habitats and possible reduction of local aquatic populations, in particular:

a. Pollution to surface water (mainly the Longacre Dene and River Team) due to contaminants and suspended solids contained within routine road runoff.
b. Pollution to surface water (mainly the Longacre Dene and River Team) due to accidental spillages and subsequent discharges of contaminants and suspended solids through road drainage systems.
c. Improvements to the hydromorphological quality of the Allerdene Burn due to the daylighting of part of all of the existing culvert (Allerdene embankment option and Allerdene viaduct option respectively).

Flood Risk

Fluvial

a. Potential increased risk of fluvial flooding from the River Team due to widening of the Kingsway Viaduct.
b. Alterations to the hydromorphological regime, such as changes to flow velocities, erosion, deposition and channel migration process along the River Team due to widening of the Kingsway Viaduct.

c. Potential increased risk of fluvial flooding from Allerdene Burn due to the railway bridge replacement and associated channel modifications of the ordinary watercourse.
d. There is a potential increase in risk of fluvial flooding in the short term, if the flood plain compensation at the Kingsway Viaduct and/or the replacement channel at Allerdene Burn are not in place prior to the works in the flood plain (e.g. pier extension) and deculverting respectively.
e. Alterations to the hydromorphological regime, such as changes to flow velocities, erosion, deposition and channel migration process along Allerdene Burn due to the railway bridge replacement and associated channel modifications of the ordinary watercourse.

Pluvial

a. Potential risk to the safety of motorists associated with discrete areas at high risk of pluvial flooding at junction 67 (Coal House), between Allerdene Bridge and Smithy Lane and at junction 65 (Birtley).

Surface Water Runoff

a. Increase in surface water runoff from the Scheme Extents as a result of an overall increase in impermeable area.

Groundwater

a. Potential impacts on groundwater flow paths as a result of mineshaft stabilisation.

13.9. DESIGN, MITIGATION AND ENHANCEMENT MEASURES

13.9.1. The following section outlines the design considerations of the Scheme and presents mitigation and enhancement measures proposed to minimise impacts related to water quality and flood risk during construction and operation.

DESIGN

13.9.2. The committed design elements in terms of the water environment are:

a. An operational surface water drainage strategy. The proposed surface water drainage strategy for the Scheme will be an improvement to the existing through the use of SuDs, attenuation measures, oil interceptors and filter drains with an additional measure of silt control vortex separators at Longacre Dene to reduce the rate of runoff and to improve the water quality of road drainage.
b. The additional piers at Kingsway Viaduct would have piled foundations (into bedrock) to ensure that the effects of scour would not undermine the foundations.
c. Flood plain compensation on a level for level, volume for volume basis within the highway roundabout at the River Team/Kingsway Viaduct pier extension, to offset the loss associated with the additional piers is shown in **Figure 13.7** of this ES **(Application Document Reference: TR010031/APP/6.2)**.
d. Two options have proposed with respect to the Allerdene Bridge replacement and the modifications to the Allerdene Culvert:

i. Allerdene embankment option, whereby the Allerdene Culvert will be lengthened downstream to accommodate the bridge replacement and the upstream section will be daylighted to reduce the length of the resulting culvert. Furthermore, an approximate 300m of the open section of the watercourse downstream will be realigned parallel to the new bridge.
ii. Allerdene viaduct option: whereby the Allerdene Culvert will be replaced by an engineered open channel and the existing watercourse downstream will be realigned to accommodate the new viaduct. The proposed channel (new section and realignment) will be approximately 620m in length and will run under one of the bridge spans of the new structure.

13.9.3. Specific recommendations and areas where mitigation measures would be required are detailed in the relevant construction or operational phase sections below.

MITIGATION

Construction Phase

13.9.4. A CEMP would be prepared for the works that would include method statements for the proposed works, details of materials to be used, and an emergency response plan. The CEMP would contain measures to protect both surface and groundwater quality, and other water resource aspects. An Outline CEMP **(Application Document Reference: TR010031/APP/7.4)**., which incorporates these measures in as much detail as is available at this time, has been prepared in support of this Application.

13.9.5. The CEMP would be produced in accordance with the following applicable guidance (this list is not exhaustive):

a. GPPs which are currently being developed and published individually to provide environmental good practice guidance for the whole UK and replace the Environment Agency's PPGs, which have been withdrawn but in the instances where they have yet to be updated still provide good practice advice, these include:

i. PPG1: General guide to the prevention of pollution
ii. GPP2: Above ground oil storage tanks
iii. PPG6: Working at construction and demolition sites

b. GPP21: Pollution incident response planning.
c. Construction Industry Research and Information Association (CIRIA) Control of Water Pollution from Construction Sites.
d. CIRIA Environmental Good Practice on Site (C741).

13.9.6. The CEMP will include a requirement to obtain the following consents prior to the commencement of construction works to prevent an increase in flood risk or deterioration on water quality:

a. Flood Risk Activities Environmental Permit (formerly known as a Flood Defence Consent), this is required from the Environment Agency for any works within 8m of the top of the River Team bank.

b. Ordinary Watercourse Consent, this required from the Lead Local Flood Authority for any works within the channel of any watercourses (that is not the River Team) that has the potential to impede flows.
c. Environmental Permits, these could be required for any dewatering or discharge of waters during construction, the need for which will be subject to the final construction methodology.

13.9.7. The CEMP will include a requirement for any baseline surveys, as built drawings or post construction surveys to be provided to Highways England to enable HADDMS to be updated.

Water Quality

13.9.8. The construction phase has the potential to impact upon the water environment through mobilisation of sediments due to earthworks and vehicular movements and/or as a result of potentially polluting substances such as fuel, oil, chemicals or wastewater e.g. concrete washout. The following mitigation measures would be included within the CEMP and implemented during the construction phase:

a. Appropriate construction methodology such as the use of coffer dams to exclude the work area from the main waterbody (such as the Allerdene Burn), thus reducing the risk of increased sediment loads or hazardous substances being directly released into the waterbody.
b. A temporary drainage strategy will be in place to ensure that the works do not lead to an increase in pollution from the highway or as a result of construction works **(paragraphs 5.4.10 to 5.4.12** of **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**.
c. Environmental permit and ordinary watercourse consents would be sought and a method statement would be produced prior to starting work around the River Team and Allerdene Burn respectively.
d. Fuels and potentially hazardous construction materials would be stored at least 10 m away from the River Team and other surrounding watercourses and in bunds that have areas with external cut-off drainage; fuel would be stored in double skinned tanks with 110% capacity.
e. Areas with a greater risk of spillage (e.g. vehicle maintenance and storage areas for hazardous materials) would be carefully sited (e.g. away from drains or areas where surface waters may pond).
f. All drains within the Scheme Footprint would be identified and labelled and measures implemented to prevent polluting substances from entering them.
g. The use of silt fences, silt traps, filter bunds, settlement ponds and/or proprietary units such as a ‘siltbuster’ to treat sediment laden water.
h. Fuelling and lubrication of construction vehicles and plant would generally be on hardstandings, where reasonably practical, with appropriate cut-off drainage and located away from watercourses. In the event of plant breakdown, drip trays would be used during any emergency maintenance and spill kits would be available on site.

i. Construction plant would be checked regularly for oil and fuel leaks, particularly when construction works are undertaken in or near the existing site waterbodies.
j. Waste fuels and other fluid contaminants would be collected in leak-proof containers prior to removal from construction site to an approved recycling processing facility.
k. Oil absorbent booms would be installed, as appropriate, on the surface watercourses immediately downstream of the works area, and would be regularly inspected and maintained.
l. Temporary cut-off drains would be used uphill and downhill of the working areas to prevent clean runoff entering and dirty water leaving the working area without appropriate treatment.
m. Control and treatment measures would be regularly inspected to ensure they are working effectively.
n. Emergency response plans would be developed and spill kits made available on site.
o. Concrete wash out would only take place at designated concrete washout areas.
p. Surface water run-off and excavation dewatering would be captured and settled out prior to disposal to sewer as appropriate. Any contaminants would be removed prior to disposal.
q. Stockpiles/excavated materials would be stored in such a way to minimise silt laden runoff and/or windblown particles (e.g. by covering or seeding).
r. All loose materials would be covered so as not to give rise to a significant increase in sediment load to the drainage network.
s. Sewage generated from site welfare facilities would be disposed of appropriately. This may be by discharge to the foul sewer or by collection in septic tank for disposal off site.

Groundwater

a. Piling and modulus columns associated with construction of bridges could potentially create preferential pathways for contaminants to migrate down into the underlying groundwater and associated aquifer bodies. However, mobile contaminants have not been identified along the Scheme Footprint at concentrations considered to pose a risk to controlled water receptors in areas likely to be piled/improved. Further detail is provided in **Chapter 9 Geology and Soils** of this ES (**Application Document Reference: TR010031/APP/6.1)**.

13.9.9. The grouting methodology will be developed to ensures there are no detrimental impacts on the groundwater regime.

Flood Risk

13.9.10. During construction there is a risk of localised flooding within the Scheme Footprint during and following heavy rainfall events, in areas identified as at high risk of surface water flooding. The following measures would be implemented to minimise risks to the water environment. These measures would be included in the temporary

surface water drainage strategy **(paragraphs 5.4.10 to 5.4.12** of **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**:

a. The temporary surface water drainage strategy will detail measures to ensure that the surface water drainage and the area within the Scheme Footprint would be maintained in order to prevent significant ponding of surface water and to ensure the risk of localised flooding is not increased.
b. Where there is a risk of localised flooding, measures would be put in place to prevent pollution e.g. by ensuring no fuel, oil or chemicals are stored in these locations, and moving plant and machinery from these areas when not attended.
c. Monitoring of local weather would take place in order to be able to predict localised flooding within the Scheme Footprint during construction so that measures could be implemented.
d. The River Team would be temporarily culverted to allow safe access over the river during the construction works to the Kingsway Viaduct. The temporary culvert units and channel would be appropriately sized to manage the design flows in order to minimise the impacts on the natural flow characteristics of the watercourse. These are not anticipated to be any larger than the current channel dimensions as the hydraulic model demonstrates that the 1% AEP flows do not lead to flooding at junction 67 (Coal House) **(paragraph 4.2.8** of **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**.
e. The contractor would be required to sign up to the Environment Agency's flood warning service and have an appropriate flood management plan in place to ensure the safety of the workers in and around the River Team channel and flood plain.
f. The potential for disruption to offsite field drainage will be assessed prior to the commencement of works by the contractor, in the locations where this will occur, diversions/alternative drainage routes will be constructed prior to the works.
g. The CEMP will detail the timing of the works for the construction of the flood plain compensation and the relocation of the Allerdene Burn and Culvert. This is to ensure that the mitigation measures are in place prior to the commencement of the works that they are required to off-set.

Temporary Surface Water Drainage Strategy

13.9.11. Where works would lead to temporary changes in the surface water runoff regime, a temporary surface water drainage strategy would be developed to ensure that there would be no increase in runoff or pollutant load during the construction phase. This would be undertaken in consultation with Gateshead Council as LLFA. Approval of the temporary surface water drainage strategy would be sought from the LLFA. As the drainage strategy is based upon enhancing the current features and providing attenuation to greenfield rates for the new impermeable areas, the construction works would not lead to increased runoff, assuming appropriate management practises are in place to avoid premature damage to the existing features.

Operation phase

Water Quality

13.9.12. The proposed surface water drainage strategy for the Scheme has included the provision of treatment of highway runoff to improve the water quality of surrounding watercourses. The following pollution control measures have been considered in the drainage strategy (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**) and the requirements for prevention measures are assessed in **Section 13.10**:

a. All attenuation storage would be designed with overflow and isolation systems to retain contaminated road drainage, allowing the contaminated water to be treated before discharge. The storage facilities would also allow sediment and pollutants to settle thus reduce the contaminant concentration in the water.
b. Oil interceptors would be installed at all the outfalls to improve the water quality of the road discharge.
c. In addition, silt control vortex separators would be incorporated into the outfalls to Longacre Dene to minimise sediment issues. The potential to include further silt control measures on all other outfalls would be investigated at detailed design to minimise sediment issues.
d. Catchpits have been specified instead of manholes to aid sediment retention within the drainage system.
e. The potential to modify outlet structures at existing outfalls within the Scheme Footprint would be investigated at detailed design stage to identify if they can be set back from the watercourse in order to enhance the channel and flow characteristics in accordance with the WFD.

13.9.13. Cut-off drains are to be constructed at the base of the new embankments along the road to prevent any contaminated runoff that exceeds the drainage capacity from entering third party land.

13.9.14. Pollution Control Devices (Penstocks) will be installed where the larger volumes of liquid can be retained in the case of a pollution incident. These would be at the following locations:

a. Allerdene pond - Outfall 8
b. Coal House underground storage tank (north-east quadrant) – Outfall 11
c. Coal House underground storage tank (south-east quadrant) - Outfall 13
d. Birtley Bowes Incline underground storage tank – Outfall 1

13.9.15. A surface water drainage strategy will be developed for the relocated NGN site (adjacent to the relocated section of the Allerdene Burn) during detailed design and approved by the Sectretary of State (SoS) in consultation with the local authority. The strategy will utilise SuDS based attenuation/principles where feasible to ensure that there is no impact on water quality.

Flood Risk

13.9.16. Flood plain compensation will be provided via a top soil scrape for the loss of the River Team plain due to the extended piers, this will be provided within the junction 67 (Coal House) roundabout.

13.9.17. Scour protection would be incorporated into the design of the Kingsway Viaduct extension to mitigate against erosion around the bridge pier abutments at the River Team crossing. As the piers would be founded on pile foundations, this would remove the risk of scour to the structure itself. Scour protection would be considered at detailed design and implemented in such a way so as not to impact the morphology of the river.

13.9.18. The existing Allerdene Culvert would be replaced by either a new culvert and realignment of the drainage channel (Allerdene embankment option) or daylighting of the Allerdene Culvert and replacement and realignment of the drainage channel to accommodate a new viaduct over the adjacent railway line (Allerdene viaduct option). Both options for Allerdene Culvert would be designed to mimic the flow conditions of the existing watercourse in order to minimise impacts to the channel morphology and to ensure flood risk is not increased within and outside of the Scheme Footprint. Mitigation measures to be implemented include:

a. For Allerdene embankment option, reinforced concrete headwalls, wingwalls and aprons would be provided at the inlet and outlet of the new culvert with appropriate scour prevention measures to minimise the risk of erosion.
b. For Allerdene viaduct option, in addition to the alterations provided for Allerdene embankment option, the existing culvert would be removed and replaced with an open channel.
c. For both Allerdene embankment option and Allerdene viaduct option potential opportunities have been identified to improve the channel design and to provide enhancement to the river environment and morphology (this may, for example, include pools and riffles, or similar features to increase biodiversity, dependent upon the findings of a geomorphological assessment to support the design, as required) constructing a two-stage channel, adopting bioengineering techniques, such as planted rock rolls and mattresses, to maintain the channel profile and by re-vegetating the banks of the proposed channel realignment. These potential enhancements would be considered in the detailed design stage of the Scheme.
d. The proposed channels, for both Allerdene embankment option and Allerdene viaduct option, have a slightly larger capacity than the existing (1,001m^3, 1,293m^3 and 865m^3 respectively) as detailed in **Table 8** of the FRA (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**), therefore the use of flow control culverts has been considered to maximise the channel storage and subsequently utilise the storage in the floodplain to minimise the change in flow contribution to the River Team. The effects of the flow control culverts have been modelled and they are shown to be effective such that the post-development flood peaks/levels for both options will remain unchanged from the existing for all

modelled events up to and including the 1 in 1000 year event. The requirements for flow control culverts would be incorporated into the detailed design stage of the proposed channel.

13.9.19. The realigned channel includes features to restrict the flows to ensure that the flood peak is attenuated and to maximise the storage within the channel realignment. For Allerdene embankment option, the modelling indicates that two 1200mm culverts are required to be incorporated along the channel realignment to minimise the change in flood peak from the existing for both the 1% Annual Exceedance Probability (AEP) plus 50% climate change and the 0.1% AEP events. Similarly, for the Allerdene viaduct option, the modelling indicates that 1500mm and 1350mm culverts are required in the realigned channel to attenuate flows and minimise the change compared to the existing for the 1% AEP plus 50% climate change and the 0.1% AEP events.

13.9.20. Measures would be incorporated into the operational management protocols to ensure the risks to users from fluvial flood risk are appropriately managed, as these are largely constrained to the entry/exit slips on junction 67 (Coal House).

13.9.21. The pluvial flood risks are for events significantly greater than the 1 in 5 year which is the standard for managing the surface water on the highway, in accordance with HD33/16 (**Ref 13.7**) requires the surface water drainage network to be functioning, beyond this flooding of the highway is allowed. As the surface water risks are for greater events, flooding would technically be acceptable. However, if at detailed design additional mitigation is required, consideration of the timing of the surface water runoff peaks from the highway and the wider catchment could be considered to determine whether further mitigation is required. This could include active management through CCTV observation linked to water level sensors, this would enable operatives to implement slip road closures to reduce the risk to users during/following the more extreme heavy rainfall events.

13.9.22. The NGN site is located outside of the 1 in 100 year plus 50% climate change floodplain for the Allerdene viaduct option. Whereas for the Allerdene embankment option there is a small area of ponding within the centre of the site which has maximum flood depths of 50mm, this would be addressed through detailed design of the platform with appropriate slab levels, cut of drain and optimisation of the design of the relocated section of the Allerdene Burn.

13.9.23. The approach for ensuring adequate inspection and maintenance of the Lady Park Burn trash screen and water level monitoring would be agreed between the Environment Agency and Highways England during detailed design.

Surface Water Runoff

13.9.24. Existing outfalls along the A1 would be utilised but the surface water drainage strategy includes storage measures and associated flow control structures, such as oversized pipes, geo-cellular storage and balancing/attenuation ponds, that would be installed at each outfall to reduce the rate of surface water runoff. It has been agreed

with the Highways England Safety, Engineering & Standards team and the Environment Agency that attenuation storage will be designed to accommodate the 1 in 100 year plus 20% climate change event for all areas with the discharge restricted to off-set the increases in impermeable area to the greenfield runoff rates.

13.9.25. The surface water strategy for the NGN site will ensure that discharge rates do not exceed the greenfield rates and will require new outfalls to the relocated Allerdene Burn.

ENHANCEMENT

13.9.26. The Scheme would provide opportunities for enhancement over and above the existing scenario, as follows:

a. Allerdene Burn – the Scheme would provide opportunities to daylight the existing culvert (more substantially in the Allerdene viaduct option) and create a two stage channel which would provide ecological benefits during the summer (again more extensive for the Allerdene viaduct option).
b. Surface Water Drainage – this strategy provides water quality benefits through the inclusion of the oil interceptors and reductions in surface water runoff for the future design scenarios.

13.10. ASSESSMENT OF LIKELY SIGNIFICANT EFFECTS

CONSTRUCTION PHASE

Water Quality

13.10.1. Measures have been set out in **Section 13.9.8** and would prevent impacts on the water quality of receiving waterbodies from mobilised suspended solids or spillage of fuels, lubricants, hydraulics fluids and cements from construction.

13.10.2. The River Team has been classified as of **medium** importance, given that the overall WFD status of the river is Moderate. The Allerdene Burn has also been classified as of **medium** importance, given it discharges into the River Team and is assigned the WFD status of the river i.e. Moderate.

13.10.3. With the inclusion of the proposed mitigation measures (see **paragraphs 13.9.4 - 13.9.56**), the magnitude of impact on the water quality of the above watercourses is judged to be **minor adverse**. This would result in **slight adverse** effect (not significant).

13.10.4. The other ordinary watercourses within the Study Area, including Leyburnhold Gill and the watercourses adjacent to Bowes View and Smithy Lane, are classified as of **medium** importance. Minor construction works are proposed along the road adjacent to these watercourses, hence with the inclusion of the proposed mitigation measures (see **paragraphs 13.9.4** and **13.9.25**), the magnitude of impact on the water quality of these watercourses would be **negligible**. This would result in **neutral** effect (not significant).

13.10.5. The ordinary watercourse in the Longacre Dene is classified as **high** importance, given that this area falls under the Ancient Woodland and the Priority Habitats Inventory. Limited works are proposed at junction 66 (Eighton Lodge), however lane widening to the nearby carriageway could lead to contaminants and/or mobilised suspended solids entering the sensitive watercourse.

13.10.6. With the inclusion of the proposed mitigation measures (see **paragraphs 13.9.4** and **13.9.25)**, the magnitude of impact on the water quality of the watercourse in the Longacre Dene would be negligible. This would result in neutral effect (not significant).

Flood Risk

Fluvial Floodplain

13.10.7. Given the importance of the A1 for conveying traffic and the industrial areas to the north of junction 67 (Coal House), the River Team floodplain has been classified as of **high** importance.

13.10.8. With the 1 in 100 year flood flows being within the River Team channel beneath the Kingsway Viaduct and the mitigation measures incorporated into the construction phase, the magnitude of impact arising during the construction phase is considered to be **minor**, and there would be a potential for a **slight adverse** effect on the fluvial floodplain during the construction phase (not significant).

13.10.9. Given the surrounding industrial areas, gas works and residential areas immediately upstream of the Scheme, the floodplain of the Allerdene Burn has been classified as of **high** importance.

13.10.10. With the mitigation measures detailed in **paragraphs 13.9.4 to 13.9.26** implemented the magnitude of impact arising during the construction phase is considered to be **negligible**, and there would be a potential for a **neutral** effect (not significant) on the fluvial floodplain during the construction phase.

Pluvial Floodplain

13.10.11. The surface water floodplain along the A1 has been classified as of **low** importance.

13.10.12. With the mitigation measures incorporated into the construction phase (see **paragraphs 13.9.4 to 13.9.25)**, the magnitude of impact arising during the construction phase is considered to be **negligible**, and there would be a potential for a **neutral** effect (not significant) on surface water runoff and flow paths during the construction phase.

Human Safety

13.10.13. Human safety associated with the construction workers with respect to flooding from the River Team has been classified as of **high** importance.

13.10.14. With the mitigation measures implemented (see **paragraphs 13.9.4 to 13.9.25)**, the magnitude of impact arising during the construction phase is considered to be

negligible, and there would be a potential for a **neutral** effect (not significant) on flood risk with respect to human health during the construction phase.

Groundwater

13.10.15. Groundwater has been classified as of **high** importance due to the water abstractions, although it is at 'Poor' quality due to the impacts of past mining and quarrying. Additionally, as detailed in **paragraphs 13.4.10 to 13.4.18** the groundwater levels are considered to be substantially lower than the bed of the watercourse given the magnitude of the pumping the coal authority undertake at Kibblesworth. Any dewatering is likely to be associated with localised perched water tables and would therefore be unlikely to have a significant impact on flow rates in the watercourse. Additionally, no discharges are proposed to groundwater.

13.10.16. With the mitigation measures implemented (including the selection of the piling method that minimises risks to groundwater and the preparation of the piling method statement), the magnitude of impact arising during the construction phase is considered to be **negligible**, and there would be a potential for a **neutral** effect (not significant) on groundwater during the construction phase. This does not account for the on-going dewatering and treatment of the associated water at Kibblesworth by the Coal Authority due to its poor quality.

OPERATION PHASE

Water Quality – River Team

13.10.17. With the design and mitigation measures in place as outlined in the previous section, there would be no short term impacts on the water quality of the River Team with respect to soluble pollutants. This means that the in-river annual average concentrations for dissolved copper and zinc would not exceed the Environment Agency's Runoff Specific Thresholds (**Table 13-7),** the values for which were updated in line with the current thresholds. There would also be no long-term effects on the River Team in association with routine road discharge from the Scheme (**Table 13-8**). This means that the estimated annual average concentrations of dissolved copper and zinc would remain within the published proposed standards identified by Defra (2014). The River Team also passes the HAWRAT with respect to sediment bound pollutants and the potential for chronic pollution to occur. An alert has been flagged for the potential of a downstream structure, the potential impacts of which has been qualitatively assessed through a site visit. This identified that:

a. Both the existing and proposed outfalls are within the centre of the roundabout below the Kingsway Viaduct.
b. The River Team flows through the centre of this roundabout, within a largely man-made channel, it is then culverted under the northern section of the roundabout reappearing within an open culvert, which is located within the central verge of Kingsway South.

13.10.18. It is considered that these features will facilitate flows and sediment transport rather than leading to sediment build up, which a more significant feature such as a weir, could. In light of this it is considered that no further assessment is required.

13.10.19. These findings, in combination with the measures outlined within the surface water drainage strategy as detailed in **paragraph 13.9.24**, provide environmental betterment when compared to the existing situation, and are in accordance with the Environment Agency's request that *"the use of sustainable drainage systems combined with oil interceptors would be a recognised way to improve the water quality from the highway draining into the watercourses."*

Table 13-7 - Routine runoff, HAWRAT method A results – short term impact

RECEIVING WATERCOURSE	HAWRAT RESULTS			COMPLIANCE WITH ENVIRONMENT AGENCY'S PROPOSED STANDARDS	ACTION
	Soluble: acute impacts - Copper	Soluble: acute impacts - Zinc	Sediments: chronic impacts		
River Team	Pass	Pass	Pass	Pass	No further action
River Team – both scenarios plus downstream structure	Pass	Pass	Alert – d/s structure	Pass	Need for further site-specific consideration at junction 67- Coal House (detailed results in HAWRAT are the same, but 'Alert' indicates further assessment needed). As detailed above the structure is a man-made channel which will convey sediments

Table 13-8 - Routine runoff, HAWRAT method A results – long term impact

	COPPER	ZINC	LONG TERM ASSESSMENT
Predicted Annual Average Concentrations (ug/l)	0.06	0.39	**Pass**
Proposed standards (maximum concentrations for EQS compliance)	1	10.9	

13.10.20. Sensitivity testing has been undertaken to assess the influence of including the permeable areas within the Scheme, as this would provide additional dilution capacity. The results remain unchanged from those reported in **Table 13-7** and **Table 13-8**.

13.10.21. For the spillage risk assessment (Method D of HD45/09), the annual probability of a serious pollution incident arising from a spillage incident has been calculated individually for each outfall as well as cumulatively. In individual outfall terms, the risk to each receptor is within acceptable limits (has an annual probability of less than 1%).

13.10.22. The cumulative assessment also finds the annual probability of a serious pollution incident is 1 in 274, less than 1% probability in any given year, which is within acceptable limits and consequently no specific mitigation measures are required.

13.10.23. The WFD Assessment concludes that the Scheme, taking into account the proposed mitigation, would not impact on the WFD status or objectives of the waterbodies within the 1km Study Area (**Appendix 13.2** of this ES **(Application Document Reference: TR010031/APP/6.3)**). Furthermore, the Scheme would not prevent the achievement of the wider WFD objectives in the Northumbria River Basin District.

13.10.24. The assessment demonstrates that the Scheme passes with respect to short term acute pollution and long term annual average concentrations of copper and zinc. With respect to chronic pollution (sediment bound pollutants) the Scheme also passes the HAWRAT assessment.

13.10.25. The River Team has been classified as of **medium** importance, given its overall WFD status as moderate. Based on the results of the HAWRAT assessment, the magnitude of impact on the water quality of the River Team would be **negligible**, resulting in a **neutral** (not significant) effect.

13.10.26. With the implementation of mitigation measures identified in **Section 13.9**, the likelihood of polluting road discharges occurring in the River Team would be reduced. Hence the magnitude of impact arising during the operation phase would be **minor beneficial**. This would result in a **slight beneficial** (not significant) effect.

Water Quality – Ordinary Watercourses

13.10.27. The Allerdene Burn has not been assessed as part of the Northumbria RBMP. However, given it discharges into the River Team, the water quality of this Burn is assumed to be similar to the River Team, i.e. Moderate. As such it has been classified as of **medium** importance with respect to water quality. The magnitude of impact on the water quality of the watercourse would be **negligible**, resulting in a **neutral** (not significant) effect.

13.10.28. With the implementation of mitigation measures identified in **Section 13.9** water quality of the burn may be improved. Hence the magnitude of potential impact arising during the operation phase could be **minor beneficial**. This would result in a **slight beneficial** (not significant) effect.

13.10.29. The ordinary watercourse in Longacre Dene has been classified as of **high** importance, given that it falls under the Ancient Woodland and Priority Habitats Inventory. An existing outfall (Outfall 5) has been identified to discharge runoff into the watercourse.

13.10.30. With the inclusion of the proposed mitigation measures, the magnitude of impact on the water quality of the watercourse in the Longacre Dene is judged to be **negligible** as no risk has been identified within the HAWRAT assessment. This would result in **neutral** (not significant) effect.

13.10.31. The other ordinary watercourses within the Study Area, including Leyburnhold Gill and the watercourses adjacent to Bowes View and Smithy Lane, are classified as of **medium** importance. Existing outfalls have been identified to discharge runoff into these watercourses.

13.10.32. With the inclusion of the proposed mitigation measures, the water quality of these watercourses could be improved. Hence the magnitude of impact arising during the operation phase could be **minor beneficial**. This would result in a **slight beneficial** (not significant) effect.

Fluvial Flooding – River Team

13.10.33. Hydraulic modelling of the River Team at junction 67 (Coal House) has been carried out to assess the impact of the proposed extension of the Kingsway Viaduct. This modelling utilises the existing Environment Agency River Team ICM model.

13.10.34. The modelling shows that the proposed widening of the Kingsway Viaduct has negligible impact on flood risk. The model does not predict flooding from the River Team at junction 67 (Coal House) for the 1% Annual Exceedance Probability (AEP) event under both baseline and post-development conditions. However, for events greater than the 1% AEP the model demonstrates that flooding will occur. The model shows that flood waters inundate the west side of junction 67 (Coal House) including the A1 northbound (entry) and southbound (exit) slip roads for both the baseline and post-development scenarios.

13.10.35. Under operational conditions, the flood level could increase by up to 10mm around the Kingsway Viaduct piers for the 1% AEP plus 25% climate change event and 20mm around the pillars for the 1% AEP plus 50% climate change event. This has been based upon the preliminary design parameters of the addition pillar width that would be required.

13.10.36. Given the importance of the A1 for conveying traffic and the industrial areas to the north of the junction, the River Team floodplain has been classified as of **medium** importance.

13.10.37. The implementation of the mitigation measures identified in **Section 13.9** would ensure no change in the likelihood of fluvial flooding to the Scheme or elsewhere. Therefore, with the inclusion of the mitigation measures, the magnitude of impact resulting from the Scheme is estimated to be **negligible**. The effect on flood risk during the operation phase would be **neutral** (not significant).

Fluvial Flooding – Allerdene Burn

13.10.38. Hydraulic modelling of the Allerdene Burn has been carried out to assess the impact of the A1 realignment. This model has incorporated both Allerdene embankment option and Allerdene viaduct option to ensure that the impacts upon this Burn are assessed.

13.10.39. Findings from the hydraulic modelling show that there will be negligible change in flood peaks/levels between the existing and the operational conditions for events up to and including the 1% AEP plus 25% climate change event.

13.10.40. With the implementation of the mitigation measures identified in **Section 13.9** (including the above), the magnitude of impact resulting from the Scheme for both options is considered to be **negligible**. The effect on flood risk during the operation phase would be **neutral** (not significant).

Pluvial Flooding

13.10.41. Based on the Environment Agency's Risk of Flooding from Surface Water Map (**Ref 13.2**), the Scheme is identified as being at medium to high risk of pluvial flooding at the locations identified in **paragraph 13.7.19**.

13.10.42. However, it is believed that due to the national strategic scale of the modelling, the current surface water flood map does not give an accurate representation of the pluvial flood risk at junction 66 (Eighton Lodge). This is because it is considered highly likely that the existing drainage channel at Low Eighton, upstream of the junction, and the Eighton Lodge Culvert were not represented in the modelling. Due to this lack of confidence in the mapping, The FRA has undertaken site specific hydraulic modelling to refine the understanding of surface water flood risk at this junction (as detailed within **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**). This approach has been discussed with the LLFA and the Environment Agency. The Environment Agency are currently reviewing the model. With the inclusion of the drainage channel and the Eighton Lodge Culvert,

which connects the watercourse to the existing outfall (Outfall 5) at Longacre Dene, the model results show that the 1% AEP flood level at junction 66 (Eighton Lodge) roundabout reduces by between 0.1 and 0.5m as surface water flows from the drainage channel upstream is no longer routed to the roundabout but conveyed through the Eighton Lodge culvert to Outfall 5.

13.10.43. Surface water flood risks to the Scheme have been investigated in the FRA provided in **Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)** and deemed to be appropriate when considered in perspective with the Highways England standards for surface water design and the point at which the road surface can become flooded. The 1 in 5 year event is the standard for managing the surface water on the highway, in accordance with HD33/16 (**Ref 13.7**) which requires the surface water drainage network to be functioning, for events greater than this event flooding of the highway is allowed.

13.10.44. The surface water floodplain has been classified as of **low** importance. The implementation of the mitigation measures identified in **Section 13.9** could reduce the likelihood of surface water flooding occurring within the Scheme Footprint. The surface water drainage strategy limits runoff to controlled rates through the capture and discharge of the water at designated outfalls along the highway. Therefore, the magnitude of impact resulting from the Scheme is estimated to be **negligible**. The effect on surface water flood risk during the operation phase would be of **neutral** (not significant).

13.10.45. The importance to human safety is considered to be of **high**. With the implementation of the mitigation measures identified in **Section 13.9**, the magnitude of impact resulting from the Scheme is estimated to be **negligible**. The effect on surface water flood risk with respect to human safety during the operation phase would be **neutral** (not significant).

Surface Water Runoff

13.10.46. The Scheme would lead to an increase in the impermeable area resulting in a proportionate increase in surface water runoff from the Study Area. The increase in impermeable area may result in an increase in localised flooding in addition to a potential threat of pollution if pollution control devices are bypassed during high intensity rainfall events.

13.10.47. These risks have been considered in the FRA (**Appendix 13.1** of this ES **(Application Document Reference: TR010031/APP/6.3)**) and associated surface water drainage strategy developed for the Scheme. The proposed drainage strategy will be an improvement to the existing through the use of SuDS, oversized pipes and geo-cellular tanks to reduce the rate of runoff and to improve the water quality of road drainage.

13.10.48. The importance to human safety with respect to surface water runoff is considered to be **high**. With the implementation of the mitigation measures identified in **Section 13.9**, the magnitude of impact is estimated to be **negligible**. The effect on human

safety with respect to surface water runoff during the operation phase would be of **neutral** (not significant).

Groundwater

13.10.49. No impacts resulting from the Scheme on groundwater with respect to flooding and water quality, have been identified. Groundwater has been classified as of **high** importance due to the water abstractions, although it is at 'Poor' quality due to the impacts of past mining and quarrying. Additionally, as detailed in **paragraphs 13.4.10-13.4.10** the groundwater levels are considered to be substantially lower than the bed of the watercourse given the magnitude of the pumping the coal authority undertake at Kibblesworth. Any remaining groundwater is likely to be associated with localised perched water tables and would therefore be unlikely to have a significant impact on flow rates in the watercourse or flood risk to the Scheme.

13.10.50. The magnitude of impact arising during the operational phase is considered to be **negligible**, and there would be a potential for a **neutral** (not significant) effect on groundwater during the operational phase.

SUMMARY OF EFFECTS

13.10.51. **Table 13-9** provides a summary of the likely significant effects, taking into account the provision of the design and mitigation measures identified in **Section 13.9** for the construction and operational phases, respectively.

Table 13-9 - Summary of potential impacts and likely significant effects

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
Construction	Decrease in water quality	River Team	Water Quality	Medium	Medium	Measures outlined in the CEMP/Construction Drainage Strategy	Minor	Slight Adverse, not significant
	Decrease in water quality	Ordinary watercourse in the Longacre Dene	Water Quality	High	High	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Decrease in water quality	Allerdene Burn	Water Quality	Medium	Medium	Measures outlined in the CEMP/Construction Drainage Strategy	Minor	Slight Adverse, not significant
	Decrease in water quality	Leyburnhold Gill	Water Quality	Medium	Medium	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Decrease in water quality	Ordinary watercourse	Water Quality	Medium	Medium	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
		adjacent to Bowes View						
	Decrease in water quality	Ordinary watercourse adjacent to Smithy Lane	Water Quality	Medium	Medium	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Increased fluvial flood risk	River Team	Fluvial floodplain	High	High	Measures outlined in the CEMP	Minor	Slight Adverse, not significant
	Increased fluvial flood risk	River Team	Human safety	High	High	Measures outlined in the CEMP	Negligible	Neutral, not significant
	Increased fluvial flood risk	Allerdene Burn	Fluvial floodplain	High	High	Measures outlined in the CEMP	Negligible	Neutral, not significant
	Increased fluvial flood risk	Allerdene Burn	Human Safety	High	High	Measures outlined in the CEMP	Negligible	Neutral, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
	Increased surface water flood risk	Pluvial flooding	Pluvial floodplain	Key locations at Medium to High	Medium to High	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Increased surface water flood risk	Pluvial flooding	Human Safety	Key locations at Medium to High	Medium to High	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Increased surface water runoff	Surface water runoff	Human safety	Key locations at Medium to High	Medium to High	Measures outlined in the CEMP/Construction Drainage Strategy	Negligible	Neutral, not significant
	Increased groundwater flood risk	Groundwater	Flooding	Low	High	Measures outlined in the CEMP	Negligible	Neutral, not significant
	Decrease in groundwater flood quality	Groundwater	Water Quality	Low	High	Measures outlined in the CEMP/piling methodology	Negligible	Neutral, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
Operation	Decrease in water quality	River Team	Water quality	Medium	Medium	Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Minor	Slight Beneficial, not significant
	Decrease in water quality	Ordinary watercourse in the Longacre Dene	Water quality	High	High	Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Negligible	Neutral, not significant
	Decrease in water quality	Allerdene Burn	Water quality	Medium	Medium	Enhancement measures in the design of the proposed channel realignment Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Minor	Slight Beneficial, not significant
	Decrease in water quality	Leyburnhold Gill	Water quality	Medium	Medium	Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Minor	Slight Beneficial, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
	Decrease in water quality	Ordinary watercourse adjacent to Bowes View	Water quality	Medium	Medium	Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Minor	Slight Beneficial, not significant
	Decrease in water quality	Ordinary watercourse adjacent to Smithy Lane	Water quality	Medium	Medium	Surface water drainage strategy (with SuDs and pollution control devices to improve water quality)	Minor	Slight Beneficial, not significant
	Increased fluvial flood risk and changes to WFD status	River Team	Fluvial floodplain	High	High	Detailed design of the Scheme will take into consideration the findings and recommendations from the FRA, hydraulic modelling and the WFD assessment Scour protection measures	Negligible	Neutral, not significant
	Increased fluvial flood risk and changes to WFD status	Allerdene Burn	Fluvial floodplain	High	High	Detailed design of the Scheme will take into consideration the findings and recommendations from the FRA, hydraulic	Negligible	Neutral, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
						modelling and the WFD assessment Design of the new culvert and channel realignment will incorporate mitigation measures to minimise the impacts on the channel morphology and the long term flow characteristic of the watercourse		
	Increased surface water flood risk	Pluvial flooding	Pluvial floodplain	Medium to High	Medium to High	Surface water drainage strategy with storage attenuation	Negligible	Neutral, not significant
	Increased surface water flood risk	Pluvial flooding	Human Safety	Medium to High	Medium to High	Surface water drainage strategy with storage attenuation	Negligible	Neutral, not significant
	Increased surface water runoff	Surface water runoff	Human safety	Medium to High	Medium to High	Surface water drainage strategy with storage attenuation	Negligible	Neutral, not significant

Stage	Potential Impact	Feature	Attribute	Quality	Importance	Design/Mitigation Measure	Magnitude of impact (post-mitigation)	Likely Significant Effect
	Increased groundwater flood risk	Groundwater	Flooding	Low	High		Negligible	Neutral, not significant
	Decrease in groundwater flood quality	Groundwater	Water Quality	Low	High		Negligible	Neutral, not significant

13.11. MONITORING

13.11.1. Monitoring of the Scheme will be required during construction to ensure that the surface water discharges are within acceptable limits in terms of flows and water quality. These points will be agreed within the CEMP and any Environmental Permits that are required.

13.11.2. No monitoring for the road drainage and the water environment is proposed following completion of the Scheme.

REFERENCES

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