A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.7 Environmental Statement – Appendix 10.3 Drainage Network Water Quality Assessment

Part A

APFP Regulation 5(2)(a)

Planning Act 2008

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

June 2020

Infrastructure Planning

Planning Act 2008

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

The A1 in Northumberland: Morpeth to Ellingham
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Environmental Statement - Appendix

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EXECUTIVE SUMMARY

The Drainage Network Water Quality Assessment informs **Chapter 10: Road Drainage and the Water Environment, Volume 2** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.2**) and supports the Development Consent Order (DCO) application for the A1 Northumberland: Morpeth to Ellingham Scheme (hereafter referred to as the Scheme), Part A: Morpeth to Felton (hereafter referred to as Part A). The assessment has been conducted in accordance with the National Policy Statement for National Networks; Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 (HD 45/09); as well as in consultation with the Environment Agency.

The assessment assesses the potential impacts associated with Part A on the chemical quality of the receiving surface water features and assesses the impact of the proposed mitigation measures within the surface water management strategy. The assessments use Method A (using the Highways Agency [now Highways England] Water Risk Assessment Tool (HAWRAT)) and Method D. Method A is used to assess pollution impacts from routine runoff to surface waters. Method D is used to assess pollution impacts from accidental spillage.

The results of Method A indicate that Part A passes the assessment for acute impacts of soluble pollutants without any mitigation measures. However, the assessment for the chronic impacts of sediment-bound pollutants only passes when taking the proposed mitigation measures into account. The results of the assessment of long term pollution impacts to the receiving water environment indicates that the annual average pollutant concentrations for zinc and copper are below the Environmental Quality Standard thresholds as set out under the Water Framework Directive (WFD) and as summarised within DMRB. When taking the proposed mitigation measures into account the annual average pollutant concentrations were reduced further, showing that the mitigation measures go beyond the minimum standards required in order to pass the HAWRAT Method A assessment.

Method D assesses the pollution impacts from accidental spillage on the receiving watercourse. DMRB (HD 45/09) recommends that an annual probability of a serious pollution incident occurring of less than 1 % would be acceptable. Part A passes Method D without taking the proposed mitigation measures into account. The annual probability of a serious pollution incident occurring is further reduced with the mitigation measures included in the assessment.

The results of both the Method A and Method D assessments demonstrate that there would not be a significant effect on the receiving surface water features as a result of the proposed surface water drainage strategy as part of Part A.

1 INTRODUCTION

1.1 PURPOSE OF THE ASSESSMENT

1.1.1. The Drainage Network Water Quality Assessment informs **Chapter 10: Road Drainage and the Water Environment**, **Volume 2** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.2**) and supports the Development Consent Order (DCO) application for the A1 in Northumberland: Morpeth to Ellingham Scheme (the Scheme), Part A: Morpeth to Felton (Part A).

1.1.2. The assessment has been conducted in accordance with the National Policy Statement for National Networks (NPS NN) (**Ref. 10.3.1**); Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09) (**Ref. 10.3.2**); as well as consultation with the Environment Agency.

1.1.3. Part A would increase the impermeable road surface area and alter the current traffic flow regime through the creation of the offline section and the online widening improvement works. These changes have the potential to impact the volume and quality of surface water runoff to the receiving surface water features. The purpose of the assessment is to assess the potential impacts associated with Part A on the chemical quality of the receiving surface water features and to assess the impact of the proposed mitigation measures within the surface water management strategy (**Appendix 10.5: Drainage Strategy Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

1.1.4. The assessment focusses on the potential risks associated with the operational phase of Part A described above and does not consider any potential risks during the construction phase. The potential impacts to the chemical quality of surface water features during the construction phase are assessed within **Chapter 10: Road Drainage and the Water Environment**, **Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**).

1.2 STUDY AREA

1.2.1. The Scheme is located within the County of Northumberland and forms part of the Applicant's strategic road network. Part A is located between Warreners House Interchange at Morpeth and the dual carriageway at Felton and is approximately 12.6 km in length. Part A comprises a combination of online improvements consisting of carriageway widening and the creation of a new offline section of road. The bypassed existing A1 between Priest's Bridge and Burgham Park (hereafter referred to as the de-trunked section) would be transferred to the ownership and responsibility of Northumberland County Council (NCC).

1.2.2. The spatial scope of this assessment encompasses surface water features that are proposed to receive surface water runoff from the new outfalls as part of the surface water management strategy and surface water features 1 km downstream from the proposed new outfalls.

2 ASSESSMENT METHODOLOGY

2.1 APPROACH AND METHODOLOGY

2.1.1. The assessment of risks to water quality during the operation of Part A has been undertaken in accordance with the methods outlined in DMRB (HD 45/09) (**Ref 10.3.2**). The assessments use the Highways Agency [now Highways England] Water Risk Assessment Tool (HAWRAT) (**Ref. 10.3.3**).

2.1.2. The approach includes Method A and Method D of DMRB (HD 45/09) (**Ref. 10.3.2**):

a. Method A is used to assess pollution impacts from routine runoff to surface waters.
b. Method D is used to assess pollution impacts from accidental spillage.

2.1.3. These methods are described in detail below. Method B has not been used as a detailed assessment was not required based on the results of Method A. Method C has not been used as there is no proposed discharge of runoff to ground due to high groundwater levels, based on the results of the **Ground Investigation Report** in **Appendix 11.2**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**). All proposed attenuation features would be lined to prevent infiltration.

METHOD A: ASSESSMENT OF POLLUTION IMPACTS FROM ROUTINE RUNOFF TO SURFACE WATER

2.1.4. DMRB (HD 45/09) (**Ref. 10.3.2**) specifies procedures for the assessment of potential pollution impacts associated with routine runoff from trunk roads on surface water features, known as Method A. This method is most applicable for roads that have a two-way 24-hour Annual Average Daily Traffic (AADT) flow of 10,000 cars or greater.

2.1.5. The DMRB (HD 45/09) (**Ref. 10.3.2**) Method A assessment comprises two separate elements:

a. **HAWRAT Assessment:** HAWRAT is a Microsoft Excel application designed to assess the short-term risks related to the intermittent nature of road runoff. It assesses the acute and chronic pollution impacts on aquatic ecology associated with soluble and sediment bound pollutants, respectively. For an individual outfall to pass the HAWRAT assessment it must pass both the soluble pollutant and sediment pollutant impacts.
b. **EQS Assessment:** Environmental Quality Standards (EQS) are the maximum permissible annual average concentrations of potentially hazardous chemicals, as defined under the Water Framework Directive (WFD) (**Ref. 10.3.4**). The long-term risks over the period of one year are assessed through comparison of the annual average concentration of pollutants discharged with the published EQS for those pollutants.

2.1.6. HAWRAT is a tiered consequential system which involves up to three assessment stages, outlined as 'steps' within the assessment spreadsheet. These are detailed as follows:

c. Step 1 uses statistical models to determine pollutant concentrations in raw road runoff prior to any treatment or dilution in the receiving watercourse.
d. Step 2 assesses in-river pollutant concentrations after dilution and dispersion in the receiving watercourse, but without active mitigation.
e. Step 3 considers the in-river pollutant concentrations with active mitigation.

Cumulative Assessment

2.1.7. Where more than one individual outfall discharges into the same reach of a watercourse the combined impacts would increase. DMRB (HD 45/09) (**Ref 10.3.2**) promotes the assessment of potential cumulative effects for outfalls within 1 km of each other that drain to the same reach. Where this is the case, each outfall is grouped and assessed cumulatively in HAWRAT. To aggregate the outfalls, the drained areas are added together.

2.1.8. When assessing the combined impact of sediment bound pollutants, outfalls within 100 m of one another are assessed. It is assumed that beyond 100 m the road runoff sediment, if it settles at all, is likely to be sufficiently dispersed and diluted with natural sediments so as not to have an adverse impact.

Environmental Quality Standards Assessment

2.1.9. The EQS assessment considers the long-term chronic impacts associated with soluble pollutants. The in-river annual average concentrations for soluble pollutants are calculated and compared with published EQS to assess whether there is likely to be a long-term impact on ecology.

2.1.10. The EQS provides an assessment of the long-term risks to receiving water ecology from soluble pollutants. The annual average concentrations for dissolved copper and zinc are calculated through HAWRAT and compared with the published EQS. The EQS threshold values for dissolved zinc and dissolved copper are detailed within assessment Method A of DMRB (HD 45/09) (**Ref 10.3.2**). These values are summarised in **Table 2-1** below.

Table 2-1 - Environmental Quality Standards for Dissolved Copper and Zinc

Water Hardness Bands (mg/l CaCO3)	EQS for Dissolved Copper (µg/l)	EQS for Dissolved Zinc (µg/l)
0 - 50	1	7.8
> 50 - 100	6	
> 100 – 250	10	
> 250	28	

METHOD D: SPILLAGE RISK

2.1.11. Method D of DMRB (HD 45/09) (**Ref. 10.3.2**) assesses the risk of pollution from spillages – i.e. if an accident were to occur. The assessment considers likely spillage rates based on the nature of the road (i.e. presence of slip roads, roundabouts, junctions etc. that can increase risk) and the percentage of the AADT that comprises Heavy Goods Vehicles (HGVs).

2.1.12. The assessment takes the form of a risk assessment, where the risk is expressed as the annual probability of a serious pollution incident occurring. This risk is the product of two probabilities:

a. The probability that an accident would occur, resulting in a serious spillage of a polluting substance on the carriageway.
b. The probability that, if such a spillage did occur, the polluting substance would reach the receiving watercourse and cause a serious pollution incident.

2.1.13. The annual probability of a spillage occurring on any road component within the drainage catchment is calculated as:

Spillage probability = Road Length x Spillage Rate x AADT for 1 year x % HGV's

2.1.14. The spillage rate is determined from Table D1.1 in DMRB (HD 45/09) (**Ref 10.3.2**) as shown in **Table 2-2** below.

Table 2-2 - Spillage Rate Factors for Serious Spillages (Billion HBV km/Year)

Road Component	Road Type		
	Motorway	Rural Trunk Roads	Urban Trunk Roads
No Junction	0.36	0.29	0.31
Slip Road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Crossroad	-	0.88	1.46
Side Road	-	0.93	1.81

2.1.15. Typically, an annual probability of 1 % (i.e. a 1 in 100 chance of a serious pollution incident occurring in any one year) is considered by DMRB (HD 45/09) (**Ref. 10.3.2**) as an acceptable risk. However, where a road drainage outfall discharges within 1 km of a sensitive receptor (such as a nationally designated site for nature conservation) a higher level of protection is required, such that the risk has no greater annual probability than 0.5 % (i.e. a 1 in 200 chance of occurring in any one year).

2.2 IMPACT ASSESSMENT

2.2.1. The assessment of impacts to water quality is based on the methodology promoted within DMRB (HD 45/09) (**Ref. 10.3.2**) that recommends the following approach:

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

Surface Water Feature Importance

2.2.2. The importance of a surface water feature is highly dependent on its sensitivity. This has been determined based on the guidance presented in Table A4.3 of DMRB (HD 45/09) (**Ref. 10.3.2**) and is summarised as applicable to this assessment in **Table 2-3** below.

Table 2-3 - Criteria used to Estimate the Importance of Receptors

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	– Water Framework Directive Class 'High'. – Site protected/designated under EC or UK habitat legislation (SAC, SPA, SSSI, WPZ, Ramsar site, salmonid water). – Species protected by EC legislation. – Provides a regionally important water supply resource
High	Attribute has a high quality and rarity on local scale	– Water Framework Directive Class 'Good'. – Species protected under EC or UK habitat legislation. – Provides a locally important water supply resource.
Medium	Attribute has a medium quality and rarity on local scale	– Water Framework Directive Class 'Moderate'. – Provides water for agricultural or industrial use.
Low	Attribute has a low quality and rarity on local scale	– Water Framework Directive Class 'Poor'. – Does not provide water supply.

Impact Magnitude

2.2.3. The magnitude of a potential impact to a surface water feature associated with potentially polluting surface water runoff has been determined based on the guidance presented in Table A4.4 of DMRB (HD 45/09) (**Ref. 10.3.2**) and is summarised as applicable to this assessment in **Table 2-4** below.

Table 2-4 - Criteria used to Estimate the Magnitude of an Impact on Receptors

Impact Magnitude	Criteria	Typical Examples
Major Adverse	Results in loss of attribute and / or quality and integrity of the attribute	– Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) and compliance failure with environmental quality standard values (Method B). – Calculated risk of pollution from a spillage > 2 % annually (Method D).
Moderate Adverse	Results in effect on integrity of attribute, or loss of part of attribute	– Failure of both soluble and sediment-bound pollutants in HAWRAT (Method A) but compliance with environmental quality standard values (Method B). – Calculated risk of pollution from spillages > 1 % annually and < 2 % annually (Method D).
Minor Adverse	Results in some measurable change in attribute's quality or vulnerability	– Failure of either soluble or sediment-bound pollutants in HAWRAT (Method A). – Calculated risk of pollution from spillages > 0.5 % annually and < 1 % annually (Method D).
Negligible	Results in effect on attribute, but of insufficient magnitude to affect the use of integrity	– No risk identified by HAWRAT (Pass both soluble and sediment-bound pollutants) (Method A). – Risk of pollution from spillages < 0.5 % (Method D).
Minor Beneficial	Results in some beneficial effect on attribute or a reduced risk	– HAWRAT assessment of either soluble or sediment-bound pollutants becomes a Pass from an existing site

Impact Magnitude	Criteria	Typical Examples
	of negative effect occurring	where the baseline was a Fail condition. – Calculated reduction in existing spillage risk by 50 % or more (when existing spillage risk is < 1 % annually).
Moderate Beneficial	Results in moderate improvement of attribute quality	– HAWRAT assessment of both soluble or sediment-bound pollutants becomes a Pass from an existing site where the baseline was a Fail condition. – Calculated reduction in existing spillage risk by 50 % or more (when existing spillage risk is > 1 % annually).
Major Beneficial	Results in major improvement of attribute quality	– Removal of existing polluting discharge, or removing the likelihood of polluting discharges occurring.

Effect significance

2.2.4. The overall effect significance is determined using the impact matrix outlined in **Table 2-5** below which cross-references the importance of the receptor and the magnitude of the potential impact. The overall effect uses a significance rating score from Neutral to Very Large as per the guidance presented in Table A4.5 of DMRB (HD 45/09) (**Ref. 10.3.2**). A single score would be chosen based on professional judgement where there is a choice of effect score.

Table 2-5 - Criteria used to estimate the significance of potential effects

		Magnitude of potential impact			
		Negligible	**Minor**	**Moderate**	**Major**
Importance of receptor	**Very High**	Neutral	Moderate or Large	Large or Very Large	Very Large
	High	Neutral	Slight or Moderate	Moderate or Large	Large or Very Large
	Medium	Neutral	Slight	Moderate	Large
	Low	Neutral	Neutral	Slight	Slight or Moderate

2.2.5. The magnitude of impact and significance of a potential effect takes into consideration embedded mitigation inherent to the design of Part A, but not additional mitigation that may be proposed following the assessment of potential effects.

3 BASELINE CONDITIONS

3.1.1. Baseline information to inform the desktop study has been obtained from the following sources:

a. Ordnance Survey (OS) mapping.
b. MAGIC online mapping (**Ref. 10.3.5**) (accessed June 2018).
c. Environment Agency's Catchment Data Explorer (**Ref. 10.3.6**) (accessed June 2018).
d. Highways Agency's (now Highways England) Drainage Data Management System (HADDMS) (**Ref. 10.3.7**) (accessed June 2018).
e. **Appendix 10.5: Drainage Strategy Report, Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) (dated June 2019).
f. **Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (dated March 2018).
g. **Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (dated August 2018).
h. Observations made from the site visit (June 2018).

3.1.1. **Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) and the **Water Vole and Otter Survey Report** (**Appendix 9.17**, **Volume 7** of this ES was required for the ecological assessment. During the initial ecological walkover surveys the habitat suitability to potentially support specific species was identified. For more information regarding the ecological surveys refer to **Chapter 9: Biodiversity**, **Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**).

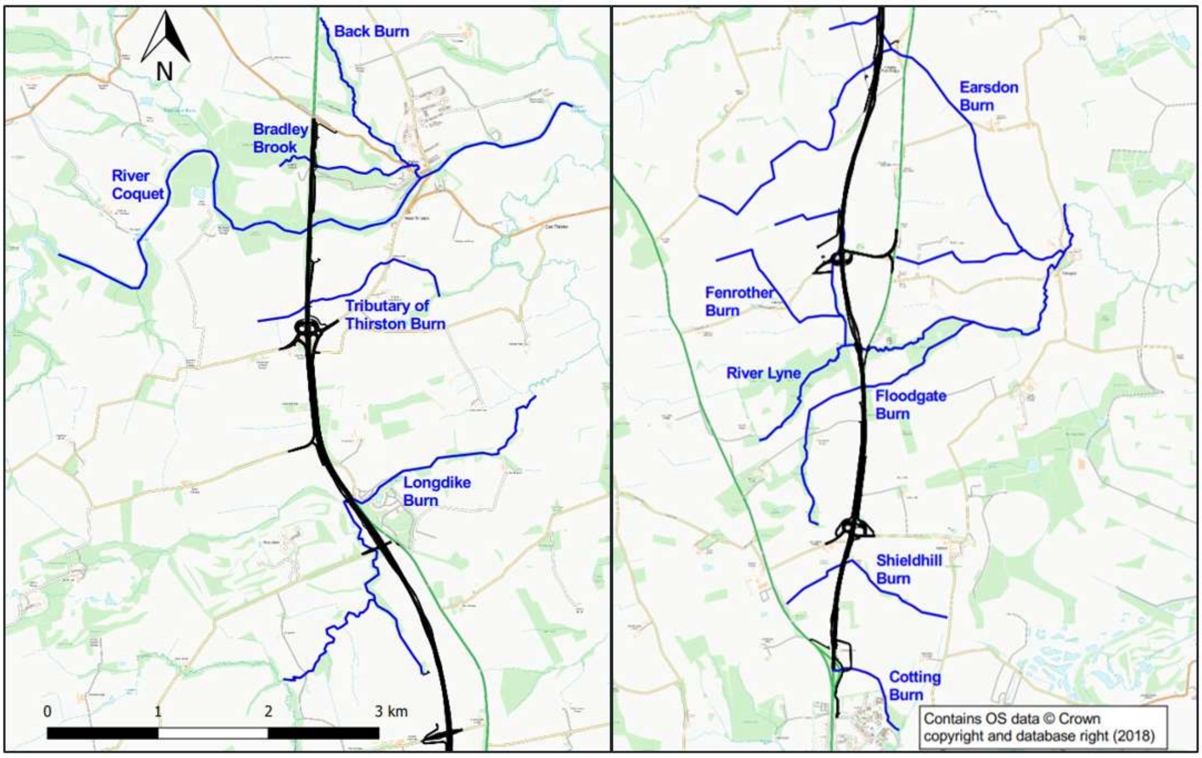
3.1.2. A site walkover was conducted on 7 – 8 June 2018 to inform **Chapter 10: Road Drainage and the Water Environment**, **Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**) and this assessment. The site walkover included the following watercourses (from south to north) and their tributaries:

a. Cotting Burn
b. Shieldhill Burn
c. Floodgate Burn
d. River Lyne
e. Fenrother Burn
f. Earsdon Burn
g. Longdike Burn
h. Unnamed tributary of Thirston Burn
i. River Coquet
j. Bradley Brook

3.2 SURFACE WATER FEATURES

3.2.1. The main surface water features within the Study Area that would receive discharge from the surface water drainage system are identified in **Figure 3-1** below. The map on the left shows the northern extent of Part A and the map on the right shows the southern extent of Part A.

Figure 3-1 - Location of Main Surface Water Features



COTTING BURN AND SHIELDHILL BURN

3.2.2. Cotting Burn flows underneath the existing A1 alignment at the junction with the A697, flowing in a west to east direction through five existing culverts. Shieldhill Burn flows in a west to east direction and flows underneath the existing A1 alignment through a culvert approximately 1 km to the north of the A697 junction. The Shieldhill Burn discharges into Cotting Burn approximately 2.5 km downstream from the existing A1 crossing.

3.2.3. No fish surveys have been undertaken along either Cotting Burn or Shieldhill Burn as it was determined that the watercourses were unsuitable as habitats (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). This is due to the long culverted section along Shieldhill Burn with small river flow and the presence of a septic tank along Cotting Burn. No evidence of otters were identified during the mammal surveys (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

3.2.4. Cotting Burn and Shieldhill Burn are located within the 'Wansbeck from Font to Bothal Burn' WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref 10.3.6**) indicates an overall quality of 'Moderate' with the ecological quality assessed as 'Moderate' and the chemical quality assessed as 'Good'.

FLOODGATE BURN, RIVER LYNE AND FENROTHER BURN

3.2.5. The River Lyne flows underneath the existing A1 alignment through a culvert at Priest's Bridge, flowing in a west to east direction. The River Lyne has a number of significant tributaries including Floodgate Burn and Fenrother Burn.

3.2.6. Floodgate Burn flows in a south-west to north-east direction underneath the existing A1 alignment through an arch culvert. Approximately 1.3 km downstream of the watercourse crossing, the Floodgate Burn discharges into the River Lyne.

3.2.7. Fenrother Burn flows underneath Fenrother Lane just to the west of the A1 through a culvert in a predominantly north to south direction. Fenrother Burn then discharges into the River Lyne approximately 1 km downstream from the Fenrother Lane watercourse crossing.

3.2.8. The fish survey identified the presence of Three-spined stickleback which are a common species within Floodgate Burn and the River Lyne and bullhead within the River Lyne (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Bullhead is considered to be an important species but is not a designated species under UK legislation. Fenrother Burn was not surveyed as it was determined that the watercourse was unsuitable as a habitat for aquatic species due to heavily shaded areas and the small volume of water within the watercourse. No evidence of otters were identified during the mammal surveys (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

3.2.9. Floodgate Burn, Fenrother Burn and the River Lyne are all located within the 'Lyne from Source to Tidal Limit' WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

EARSDON BURN

3.2.10. Earsdon Burn and its tributaries flow in a predominantly west to east direction flowing through two existing culverts; one underneath the existing A1 alignment at Causey Park Bridge and the other underneath the local side road to the west. Earsdon Burn eventually discharges into the River Lyne approximately 4.2 km downstream of the existing watercourse crossings.

3.2.11. No fish surveys have been undertaken along Earsdon Burn as it was determined that the watercourse was unsuitable as a habitat for aquatic species (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). This is due to the relatively shallow water depth in the watercourse. The mammal survey identified the presence of otters along the Earsdon Burn (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Otters are a European protected species and are listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) (**Ref. 10.3.8**) and are considered to be of principal importance.

3.2.12. Earsdon Burn is located within the ‘Lyne from Source to Tidal Limit’ WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency’s Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of ‘Poor’ with the ecological quality assessed as ‘Poor’ and the chemical quality assessed as ’Good’.

LONGDIKE BURN

3.2.13. Longdike Burn flows in a predominantly south-west to north-east direction, flowing underneath the existing A1 alignment just downstream of where the Bywell Letch discharges into Longdike Burn. Longdike Burn also flows through another culvert approximately 0.5 km upstream of the existing A1 watercourse crossing. Approximately 2.7 km downstream of the existing A1 watercourse crossing Longdike Burn discharges into Thirston Burn.

3.2.14. The fish surveys undertaken identified a number of aquatic species along Longdike Burn (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Brown trout and lamprey were identified during the survey and are both protected species listed under Section 41 of the NERC Act (2006) (**Ref. 10.3.8**) and are considered to be of principal importance. Other freshwater species identified along Longdike Burn were loach, stickleback and minnow. The mammal survey identified the presence of otters along Longdike Burn (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Otters are a European protected species and are listed under Section 41 of the NERC Act (2006) (**Ref. 10.3.8**).

3.2.15. Longdike Burn is located within the ‘Longdike Burn (Trib of Coquet)’ WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency’s Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of ‘Poor’ with the ecological quality assessed as ‘Poor’ and the chemical quality assessed as ‘Good’.

TRIBUTARY OF THIRSTON BURN

3.2.16. The unnamed tributary of Thirston Burn flows in a west to east direction and underneath the existing A1 alignment just to the south the of the River Coquet bridge. Approximately 2.1 km downstream of the A1 watercourse crossing the unnamed tributary discharges into the Thirston Burn.

3.2.17. No fish surveys have been undertaken along Thirston Burn as it was determined that the watercourse was unsuitable as a habitat for aquatic species due to an abundance of terrestrial grasses and low water levels (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). No evidence of otters were identified during the mammal surveys (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

3.2.18. Thirston Burn is located within the 'Longdike Burn (Trib of Coquet)' WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

RIVER COQUET

3.2.19. The River Coquet flows under the existing A1 bridge and flows in a predominantly south-west to north-east direction. It eventually discharges into the North Sea approximately 17 km downstream of the bridge by the town of Amble.

3.2.20. The River Coquet is designated as part of the River Coquet and Coquet Valley Woodlands Site of Special Scientific Interest (SSSI). The SSSI was last surveyed in August 2010 and was found to be in an 'unfavourable – recovering' condition.

3.2.21. No fish surveys have been undertaken along the River Coquet as river flows were too high to be able to survey fish during the survey period (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Due to the assumed presence of migratory species able to reach the spawning grounds in the tributaries and the large size of the River Coquet, it was deemed unnecessary to assess fish populations as part of the assessment. Data obtained from the Environment Agency during consultation returned the following records of fish:

a. Atlantic salmon
b. Brown/sea trout
c. European eel
d. Stone loach
e. Minnow
f. Three-spined stickleback

3.2.22. Atlantic salmon, brown/sea trout and European eel are all protected species listed under Section 41 of the NERC Act (2006) (**Ref. 10.3.8**) and are of principal importance. Brown trout and European eel are also listed in the Northumberland Local Biodiversity Action Plan (LBAP) (**Ref. 10.3.9**).

3.2.23. The mammal survey identified the presence of otters along the River Coquet (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). Otters are a European protected species and are listed under Section 41 of the NERC Act (2006) (**Ref. 10.3.8**) and are considered to be of principal importance.

3.2.24. The River Coquet is located within the 'Coquet from Forest Burn to Tidal Limit' WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of 'Good' with the ecological quality assessed as 'Good' and the chemical quality assessed as 'Good'.

BRADLEY BROOK AND BACK BURN

3.2.25. Bradley Brook flows in a west to east direction and flows underneath the existing A1 alignment through a culvert within Park Wood. Bradley Brook discharges into Back Burn approximately 0.9 km downstream of the existing culvert.

3.2.26. The fish surveys undertaken did not identify any freshwater species (**Appendix 9.3: Aquatic Ecology Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)). No evidence of otters were identified during the mammal surveys (**Appendix 9.17: Water Vole and Otter Survey Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**)).

3.2.27. Bradley Brook and Back Burn are located within the 'Coquet from Forest Burn to Tidal Limit' WFD catchment which is monitored against the objectives of the WFD. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.3.6**) indicates an overall quality of 'Good' with the ecological quality assessed as 'Good' and the chemical quality assessed as 'Good'.

IMPORTANCE OF SURFACE WATER FEATURES

3.2.28. **Table 3-1** below summarises the importance of the identified surface water features based on DMRB (HD 45/09) (**Ref. 10.3.2**) criteria used to estimate the importance of receptors, as previously summarised in **Table 2-3**. Although water voles were identified in the baseline ecological surveys, they are not considered to be a constraint to Part A due to the absence of definitive field signs suggesting a resident population and the presence of American mink. For more information regarding water voles refer to **Chapter 9: Biodiversity**, **Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.2**).

Table 3-1 - Summary of the Importance of Surface Water Features

Receptor	Description	Importance
Cotting Burn	No fish/mammal species identified. Located within a ‘Moderate’ WFD catchment.	Medium
Shieldhill Burn	No fish/mammal species identified. Located within a ‘Moderate’ WFD catchment.	Medium
Floodgate Burn	Stickleback identified. No mammal species identified. Located within a ‘Poor’ WFD catchment.	Medium
River Lyne	Stickleback and bullhead identified. Located within a ‘Poor’ WFD catchment.	Medium
Fenrother Burn	No fish species identified. Located within a ‘Poor’ WFD catchment.	Low
Earsdon Burn	No fish species identified. Otters identified. Located within a ‘Poor’ WFD catchment.	High
Longdike Burn	Trout and lamprey identified. Otters identified. Located within a ‘Poor’ WFD catchment.	High
Tributary of Thirston Burn	No fish/mammal species identified. Located within a ‘Moderate’ WFD catchment.	Medium
River Coquet	Designated as a SSSI. Otters identified. Located within a ‘Good’ WFD catchment.	Very High
Bradley Brook and Back Burn	No fish/mammal species identified. Located within a ‘Good’ WFD catchment.	High

3.3 EXISTING HIGHWAY DRAINAGE

3.3.1. Information regarding the existing highway drainage infrastructure that currently serves the A1 has been collated from the HADDMS online database (**Ref. 10.3.7**). A summary of the existing highway drainage infrastructure is provided below.

3.3.2. Surface water runoff from the existing A1 is currently collected by a system of gullies and combined kerb drainage transported to a number of outfalls to various watercourses along Part A through an underground piped system. The location and condition of the existing outfalls is currently uncertain at the time of this assessment, however review of the features on the HADDMS online database (**Ref. 10.3.7**) indicates that there are no existing flow controls or pollution prevention measures in place. There are indications that the existing A1 highway drainage infrastructure has a number of defects classified as Internal Condition Grade (ICG) categories four and five based on a high-level review of the HADDMS online database (**Ref. 10.3.7**). The ICG categories are defined in the Sewer Rehabilitation Manual (4th Edition) (**Ref. 10.3.10**) as follows:

a. Category five: Collapsed or collapse imminent.
b. Category four: Collapse likely in foreseeable future.
c. Category three: Collapse unlikely in near future but further deterioration likely.
d. Category two: Minimal collapse likelihood in short term but potential for further deterioration.
e. Category one: Acceptable structural condition.

3.3.3. Surveys of any existing outfalls located along the de-trunked section of Part A would be undertaken at the detailed design stage of Part A, to identify their condition and any need for repairs.

3.4 PROPOSED SURFACE WATER DRAINAGE STRATEGY

3.4.1. It is proposed to install a new surface water drainage system to ensure that Part A does not increase flood risk to Part A and to people and places elsewhere and provides appropriate treatment. For a detailed description of the proposed surface water drainage strategy refer to the standalone **Appendix 10.5: Drainage Strategy Report**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**).

3.4.2. **Table 3-2** below provides an overview of the proposed attenuation and treatment features at each outfall proposed as part of Part A. Consideration for a filter drain to be installed within detention basin 17 would be explored during the detailed design phase and has been assumed to not be part of the current design and assessment of mitigation measures.

Table 3-2 - Overview of Proposed Surface Water Drainage System

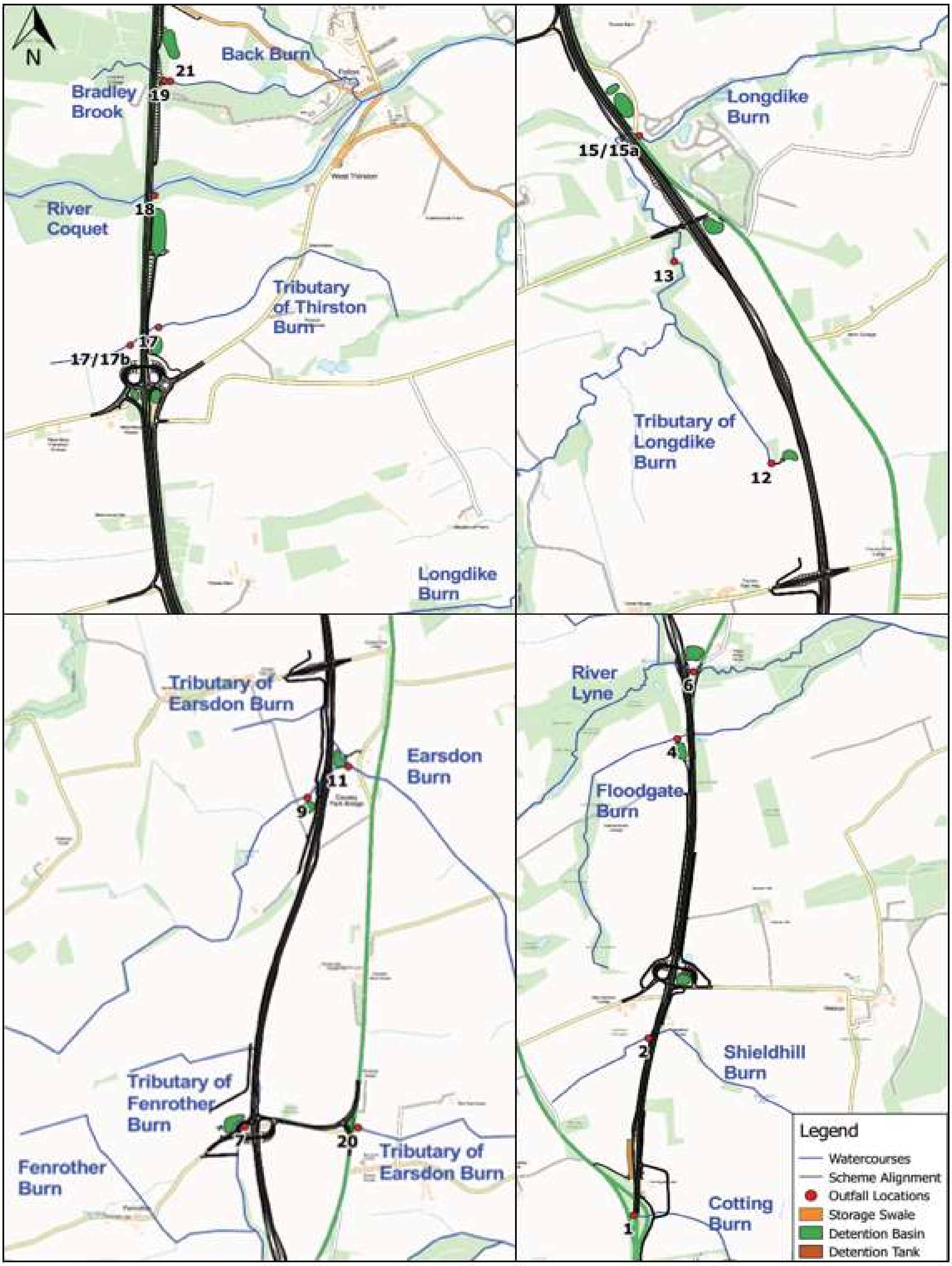
Outfall	Receiving Watercourse	Proposed Attenuation and Treatment		Percentage of Surface Water Runoff Received
1	Cotting Burn	Stage 1	Filter drain located within the verge of the carriageway.	50 %
			Kerb and gully drainage.	30 %
			Combined kerb drainage.	20 %
		Stage 2	Grassed storage swale which would have a permanent wet area.	100 %
2	Shieldhill Burn	Stage 1	Filter drain located in the northbound verge.	50 %
			Kerb and gully drainage.	25 %
			Combined kerb drainage.	25 %
		Stage 2	Grassed detention basin which would have a permanent wet area.	100 %
4	Floodgate Burn	Stage 1	Filter drain located in the northbound verge.	50 %
			Combined kerb drainage.	35 %
			1.5 m drainage channel in the central reservation.	15 %
		Stage 2	Grassed detention basin that would have a permanent wet area .	100 %
6	River Lyne	Stage 1	Filter drains located in the verges.	90 %
			Kerb and gully drainage.	10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.	100 %
7	Tributary to Fenrother Burn	Stage 1	Filter drains located in the verges.	90 %
			Kerb and gully drainage.	10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.	100 %
9	Earsdon Burn	Stage 1	Filter drains located in the verges.	90 %
			Kerb and gully drainage.	10 %

Outfall	Receiving Watercourse	Proposed Attenuation and Treatment			Percentage of Surface Water Runoff Received
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.		100 %
11	Tributary of Earsdon Burn	Stage 1	Filter drains located in the verges.		90 %
			Kerb and gully drainage.		10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.		100 %
12	Tributary of Longdike Burn	Stage 1	Filter drains located in the verges.		90 %
			Kerb and gully drainage.		10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.		100 %
13	Longdike Burn	Stage 1	Filter drains located in the verges.		90 %
			Kerb and gully drainage.		10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.		100 %
15/15a	Longdike Burn	Stage 1	Detention basin 15	Filter drain located in the verge.	75 %
				1.5 m drainage channel in the central reservation.	25 %
			Detention basin 15a	Kerb and gully drainage.	100 %
		Stage 2	Grassed detention basins 15 and 15a would operate as a dry basin when not attenuating rainfall. There would be no standing water within the basins due to the proximity of the airfield. The grassed detention basins would also have a granular trench running through the centre to ensure that standing water is not an issue and would also provide additional treatment.		100 %
17a/17b	Tributary of Thirston Burn	Stage 1	Two grassed detention basins that would have a permanent wet area with sediment forebays located at the inlets of the basins.		100 %
17	Tributary of Thirston Burn	Stage 1	Filter drains located in the verges.		25 %
			Kerb and gully drainage.		75 %

Outfall	Receiving Watercourse	Proposed Attenuation and Treatment		Percentage of Surface Water Runoff Received
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.	100 %
18	River Coquet	Stage 1	Filter drains located in the verges.	90 %
			Kerb and gully drainage.	10 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.	100 %
19	Bradley Brook	Stage 1	Filter drains located in the verges.	65 %
			Surface water channel.	35 %
		Stage 2	Grassed detention basin that would have a permanent wet area with a sediment forebay located at the inlet of the basin.	100 %
20	Tributary of Earsdon Burn	Stage 1	Kerb and gully drainage.	100 %
		Stage 2	Grassed detention basin that would have a permanent wet area.	100 %
21	Bradley Brook	Stage 1	Filter drains located in the verges.	100 %
		Stage 2	Detention tank	100 %

3.4.3. **Figure 3-2** below provides an overview of the proposed surface water drainage strategy, showing the location of the storage swale, grassed detention basins and outfalls.

Figure 3-2 - Overview of Proposed Surface Water Drainage Strategy



3.4.4. The existing highway drainage infrastructure that currently serves the A1 is thought to have a number of defects across the system. It is not considered feasible to re-use the existing drainage infrastructure as part of Part A, however there are some small sections where the carriageway is already dualled, and at the existing River Coquet bridge where re-using the existing drainage infrastructure is feasible. For the assessment, it has been assumed that the existing highway drainage infrastructure would be replaced. The existing River Coquet bridge drainage infrastructure is assumed to be retained as part of Part A.

3.4.5. The existing surface water drainage infrastructure located along the de-trunked section would also be surveyed to ensure that the existing infrastructure is of a suitable standard. The surveys that are proposed would determine the condition of the existing infrastructure and identify any repairs required.

4 IMPACT ASSESSMENT

4.1 METHOD A – ASSESSMENT OF POLLUTION IMPACTS FROM ROUTINE RUNOFF TO SURFACE WATER

BASELINE DATA

4.1.1. The HAWRAT Method A assessment has been informed by a range of baseline data as summarised below:

a. Location of proposed outfalls and proposed pollution control measures: Obtained from information provided by the Scheme drainage design team for Part A.
b. River flow and Base Flow Index: Q95 flows and BFI obtained from Catchments UK software and Low Flows 2 software.
c. River water hardness: This information was not available therefore a worst-case scenario was assumed that used low $CaCO_3$/l levels.
d. River width: Obtained from measurements taken from the topographic and channel survey.
e. Location of designated sites for nature conservation: Obtained from review of MAGIC website (**Ref. 10.3.5**).
f. Traffic flow AADT data for the new A1 main carriageway: Obtained from traffic flow analysis provided by the Scheme transport team for Part A.
g. Traffic flow AADT data for the de-trunked section of Part A: Obtained from traffic flow analysis provided by the Scheme transport team for Part A.
h. Traffic flow AADT data for the existing A1 alignment: Obtained from traffic flow analysis provided by the Scheme transport team for Part A.
i. Permeable areas draining to the new outfalls: Obtained from information provided by the Scheme drainage design team for Part A.
j. Impermeable areas draining to the new outfalls: Obtained from information provided by the Scheme drainage team for Part A.

4.1.2. The baseline data that was used in the assessment of routine runoff using DMRB (HD 45/09) Method A is provided in **Appendix A: Method A Data**.

MITIGATION MEASURES DATA

4.1.3. Step 3 of Method A assesses the pollutant concentrations after dilution and dispersion in the receiving watercourses whilst taking into account the proposed mitigation measures embedded within the surface water drainage strategy. The embedded mitigation measures for Part A are summarised in **Table 3-2** and include filter drains, grassed detention basins and, where feasible, sediment forebays. **Table 4-1** shows the estimated pollutant removal for filter drains and detention basins as taken from Construction Industry Research and Information Association (CIRIA) guidance (**Ref. 10.3.11**). These parameters were used as a guide to the HAWRAT assessment. The level of pollutant removal used in the HAWRAT assessment considered the percentage of surface water runoff that would receive this treatment. For example, if only 50 % of surface water runoff was to pass through a filter drain, the pollutant removal potential was reduced by 50 % within the assessment.

Table 4-1 - Estimated Pollutant Removal Capability for Assessment of SUDS Features

SuDS technique	Pollutant Removal Potential - Total Suspended Solids (%)	Pollutant Removal Potential - Heavy Metals (%)
Filter drains	50 – 85	50 – 80
Extended detention basin	65 – 90	40 – 90

4.1.4. Treatment trains with multiple stages (e.g. a filter drain followed by a detention basin) applied a mitigation index equation to take both stages into account that assumed the pollutant removal from subsequent stages would be half as effective at removing residual pollutants as set out in the SUDS Manual (**Ref. 10.3.12**). The equation is summarised below and uses the mitigation index for each stage, which has been calculated based on the guidance detailed in **Table 4-1**.

Total SuDS mitigation index = mitigation index +0.5 (mitigation index)

4.1.5. The mitigation measures data that was used in the assessment of routine runoff using DMRB (HD 45/09) (**Ref. 10.3.2**) Method A is provided in **Appendix A: Method A Data**.

ENVIRONMENTAL QUALITY STANDARDS

4.1.6. The assessment of long term pollution impacts to the receiving water environment considers the annual average pollutant concentrations associated with Part A against the EQS threshold values set out under the WFD (**Ref. 10.3.4**) and as summarised within DMRB (HD 45/09) (**Ref. 10.3.2**). **Table 4-2** shows the EQS threshold values for dissolved copper and dissolved zinc for the 'worst case' water hardness scenario, taken from Table A1.1 in DMRB (HD 45/09) (**Ref. 10.3.2**).

Table 4-2 - Environmental Quality Standards for Dissolved Copper and Zinc

Water Hardness Bands (mg/l $CaCO_3$)	EQS for Dissolved Copper (µg/l)	EQS for dissolved Zinc (µg/l)
0 - 50	1	7.8

CUMULATIVE ASSESSMENT

4.1.7. In accordance with DMRB (HD 45/09) (**Ref 10.3.2**) methodology, the HAWRAT assessment should include a cumulative assessment that considers other outfalls located within 1 km of the selected outfall and that drain to the same watercourse catchment. Within this assessment this applies to outfalls 9 and 11, outfalls 13 and 15/15a, outfalls 17a/17b and 17 and outfalls 19 and 21. The results of the cumulative assessment are presented in **Table 4-5** below.

4.1.8. Consideration has also been given to the existing outfalls that discharge to the receiving watercourses that would remain operational and serve the de-trunked section of Part A. The de-trunked section would be transferred to the ownership and responsibility of NCC, however the location and condition of the existing outfalls is currently unknown at the time of this assessment. It is therefore not possible to undertake a HAWRAT assessment of this scenario, but a qualitative assessment of potential cumulative effects associated with Part A and the de-trunked section has been completed.

4.1.9. Limited information regarding the existing highway drainage infrastructure that currently serves the A1 has been collated from the HADDMS online database (**Ref. 10.3.7**) and through consultation with the Scheme's drainage team for Part A. This review indicates that there are no existing flow controls or pollution prevention measures in place.

4.1.10. **Table 4-3** below shows the AADT for the baseline scenario for the existing A1 and the post-development AADT for Part A and the de-trunked section. The modelled AADT values show that the majority of traffic would use the new section of Part A, as opposed to the de-trunked section. As a result, the vast majority of future discharge into the receiving watercourses would pass through the new drainage system that incorporates flow attenuation and treatment systems instead of the existing unmitigated outfalls. Whilst a quantitative cumulative assessment cannot be undertaken, it is considered unlikely that the cumulative assessment would present a greater risk to the quality of the receiving water environment when compared to the current scenario.

Table 4-3 - Summary of AADT Values for Part A and De-trunked Section

Scenario	Northbound	Southbound	Two Way
Base year 2015 (Existing)	9768	10521	20288
Do Something 2038 (Part A)	19702	19565	39267
Do Something 2038 (De-trunked section)	1247	1777	3024

RESULTS

4.1.11. The results of the Method A assessments are summarised in **Table 4-4** (single assessments) and **Table 4-5** (cumulative assessments) below for steps one, two and three of the HAWRAT assessment. For outfalls located between 100 m and 1 km apart, in accordance with DMRB (HD 45/09) (**Ref. 10.3.2**) methodology only the soluble impacts have been assessed (i.e. a cumulative assessment of sediment impacts has not been assessed). Outfalls 19 and 21 are located less than 100 m apart, and in accordance with DMRB (HD 45/09) (**Ref. 10.3.2**) methodology, both the soluble and sediment impacts have been assessed within the cumulative assessment.

Table 4-4 - Summary of HAWRAT Assessment of Pollution Risks (Single Assessments)

Outfall	Step	Acute Impact Assessment of Copper	Acute Impact Assessment of Zinc	Chronic Impact Assessment of Sediment	Annual Average Concentration of Copper (µg/l) due to Road Runoff		Annual Average Concentration of Zinc (µg/l) due to Road Runoff	
1	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.82	PASS	3.20	PASS
	Step 3	PASS	PASS	PASS	0.45	PASS	1.76	PASS
2	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.57	PASS	2.25	PASS
	Step 3	PASS	PASS	PASS	0.26	PASS	1.01	PASS
4	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.62	PASS	2.41	PASS
	Step 3	PASS	PASS	PASS	0.34	PASS	1.33	PASS
6	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.26	PASS	1.01	PASS
	Step 3	PASS	PASS	PASS	0.06	PASS	0.25	PASS
7	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.83	PASS	3.23	PASS
	Step 3	PASS	PASS	PASS	0.29	PASS	1.13	PASS
9	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.22	PASS	0.87	PASS
	Step 3	PASS	PASS	PASS	0.05	PASS	0.22	PASS
11	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.30	PASS	1.19	PASS
	Step 3	PASS	PASS	PASS	0.08	PASS	0.30	PASS

Outfall	Step	Acute Impact Assessment of Copper	Acute Impact Assessment of Zinc	Chronic Impact Assessment of Sediment	Annual Average Concentration of Copper (µg/l) due to Road Runoff		Annual Average Concentration of Zinc (µg/l) due to Road Runoff	
12	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.51	PASS	2.00	PASS
	Step 3	PASS	PASS	PASS	0.13	PASS	0.50	PASS
13	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	PASS	0.09	PASS	0.37	PASS
	Step 3	PASS	PASS	PASS	0.02	PASS	0.09	PASS
15/15a	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.12	PASS	0.47	PASS
	Step 3	PASS	PASS	PASS	0.06	PASS	0.24	PASS
17a/17b	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.55	PASS	2.17	PASS
	Step 3	PASS	PASS	PASS	0.22	PASS	0.87	PASS
17	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.55	PASS	2.17	PASS
	Step 3	PASS	PASS	PASS	0.28	PASS	1.08	PASS
18	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	PASS	0.00	PASS	0.01	PASS
	Step 3	PASS	PASS	PASS	0.00	PASS	0.00	PASS
19	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.42	PASS	1.67	PASS
	Step 3	PASS	PASS	PASS	0.17	PASS	0.67	PASS
20	Step 1	FAIL	FAIL	FAIL	-		-	

Outfall	Step	Acute Impact Assessment of Copper	Acute Impact Assessment of Zinc	Chronic Impact Assessment of Sediment	Annual Average Concentration of Copper (µg/l) due to Road Runoff		Annual Average Concentration of Zinc (µg/l) due to Road Runoff	
	Step 2	PASS	PASS	PASS	0.23	PASS	0.90	PASS
	Step 3	PASS	PASS	PASS	0.14	PASS	0.54	PASS
21	Step 1	FAIL	FAIL	FAIL	-		-	
21	Step 2	PASS	PASS	PASS	0.16	PASS	0.62	PASS
21	Step 3	PASS	PASS	PASS	0.08	PASS	0.31	PASS

Table 4-5 - Summary of HAWRAT Assessment of Pollution Risks (Cumulative Assessments)

Outfalls	Step	Acute Impact Assessment of Copper	Acute Impact Assessment of Zinc	Chronic Impact Assessment of Sediment	Annual Average Concentration of Copper (µg/l) due to Road Runoff		Annual Average Concentration of Zinc (µg/l) due to Road Runoff	
9 and 11	Step 1	FAIL	FAIL	N/A	-		-	
9 and 11	Step 2	PASS	PASS	N/A	0.45	PASS	1.76	PASS
9 and 11	Step 3	PASS	PASS	N/A	0.11	PASS	0.44	PASS
13 and 15/15a	Step 1	FAIL	FAIL	N/A	-		-	
13 and 15/15a	Step 2	PASS	PASS	N/A	0.19	PASS	0.76	PASS
13 and 15/15a	Step 3	PASS	PASS	N/A	0.10	PASS	0.40	PASS
17a/17b and 17	Step 1	FAIL	FAIL	N/A	-		-	
17a/17b and 17	Step 2	PASS	PASS	N/A	0.84	PASS	3.27	PASS
17a/17b and 17	Step 3	PASS	PASS	N/A	0.42	PASS	1.64	PASS

Outfalls	Step	Acute Impact Assessment of Copper	Acute Impact Assessment of Zinc	Chronic Impact Assessment of Sediment	Annual Average Concentration of Copper (µg/l) due to Road Runoff		Annual Average Concentration of Zinc (µg/l) due to Road Runoff	
19 and 21	Step 1	FAIL	FAIL	FAIL	-		-	
	Step 2	PASS	PASS	FAIL	0.50	PASS	1.94	PASS
	Step 3	PASS	PASS	PASS	0.25	PASS	0.97	PASS

SUMMARY

4.1.12. Step one assesses the quality of the direct highway runoff against the toxicity thresholds whilst assuming no in-river dilution and no treatment or attenuation. All the single and cumulative assessments fail step one for both acute impacts of soluble pollutants and the chronic impacts of sediment-bound pollutants. As a result, a step two assessment was undertaken for each outfall.

4.1.13. Step two assesses the acute impacts of soluble pollutants (zinc and copper) and takes into account the diluting capacity of the receiving watercourse. Step two also assesses the chronic impacts of sediment-bound pollutants taking into account the likelihood and extent of sediment deposition. All of the single and cumulative assessments pass step two for the acute impacts of soluble pollutants, but a number fail for the chronic impacts of sediment-bound pollutants. As a result, step three assessments were undertaken to consider the proposed mitigation measures. As mitigation measures are proposed for all of the outfalls, Step three was undertaken for all outfalls.

4.1.14. Step three assesses the acute impacts of soluble pollutants and chronic impacts of sediment-bound pollutants whilst considering the proposed mitigation measures and the treatment and attenuation they would provide. All the single and cumulative assessments pass step three for both the acute impacts of soluble pollutants and the chronic impacts of sediment-bound pollutants.

4.1.15. The assessment of long term pollution impacts to the receiving water environment considers the annual average pollutant concentrations associated with Part A against the EQS threshold values set out under the WFD (**Ref. 10.3.4**). All the annual average pollutant concentrations, for both zinc and copper, are below the EQS threshold values for step two. The values range from 0.00 µg/l to 0.84 µg/l for copper and from 0.01 µg/l to 3.27 µg/l for zinc. The annual average pollutant concentrations for step three take into account the proposed mitigation measures and as a result, the annual average pollutant concentrations have been reduced so that they are well below the thresholds. For step three the values range from 0.00 µg/l to 0.45 µg/l for copper and from 0.00 µg/l to 1.76 µg/l for zinc. This shows that the proposed mitigation measures go beyond the minimum standards required to pass the HAWRAT Method A assessment.

4.1.16. With reference to **Table 2-4**, the magnitude of impact to each of the receiving watercourses associated with the proposed surface water drainage strategy for Part A is therefore considered to be **Negligible.** Considering the importance of the receptors as set out in **Table 3-1** and the magnitude of impact, the overall effect significance is **Neutral** (**not significant**).

4.2 METHOD D – SPILLAGE RISK

BASELINE DATA

4.2.1. The Method D spillage risk assessment has been informed by a range of data and parameters as summarised below:

a. Length of road draining to outfall: Obtained from information provided by the Scheme drainage design team for Part A.
b. Road type: Obtained from the Scheme information for Part A.
c. Junction type: Obtained from the Scheme information for Part A.
d. Location: Obtained from Table D1.2 in DMRB (HD 45/09) (**Ref. 10.3.2**).
e. Traffic flow: AADT data obtained from traffic flow analysis provided by the Scheme transport team for Part A.
f. Percentage of HGV: Obtained from traffic flow analysis provided by the Scheme transport team for Part A.
g. Spillage factor: Obtained from Table D1.1 in DMRB (HD 45/09) (**Ref. 10.3.2**).
h. Existing measures factor: Obtained from Table 8.1 in DMRB (HD 45/09) (**Ref. 10.3.2**). A default value of 1 was used for all the assessments as there are no existing measures.
i. Proposed measures factor: Obtained from Table 8.1 in DMRB (HD 45/09) (**Ref. 10.3.2**).

4.2.2. The baseline data that was used in the spillage assessment using DMRB (HD 45/09) (**Ref. 10.3.2**) Method D is provided in **Appendix B: Method D Data**.

MITIGATION MEASURES DATA

4.2.3. Method D assesses the risk of a spillage causing a pollution impact on the receiving watercourse. The assessment takes into consideration any proposed mitigation measures embedded within the surface water drainage strategy. The embedded mitigation measures for Part A as previously discussed include filter drains, grassed detention basins and sediment forebays. Table 8.1 in DMRB (HD 45/09) (**Ref. 10.3.2**) shows the guidance used to determine the pollution risk reduction factors of the proposed mitigation measures used in the assessment. The assessment has considered the different percentages of surface water runoff that would receive the proposed treatments. For example, if only 50 % of surface water runoff was to pass through a filter drain, the spillage risk would not be reduced as much so a higher factor (lower percentage treatment removal) was used in the assessment.

RESULTS

4.2.4. DMRB (HD 45/09) (**Ref. 10.3.2**) recommends that an annual probability of a serious pollution incident occurring of less than 1 % would be acceptable. Outfall 18, which discharges into the River Coquet, is located within 1 km of a sensitive receptor (the River Coquet and Coquet Valley Woodlands SSSI). As a result, DMRB (HD 45/09) (**Ref. 10.3.2**) recommends that an annual probability of a serious pollution incident occurring of less than 0.5 % would be acceptable for sensitive receptors.

4.2.5. The assessment has been undertaken for each of the proposed outfalls along the length of Part A. The results of the Method D spillage assessment for both the without and with the proposed embedded mitigation scenarios are summarised in **Table 4-6** below.

Table 4-6 - Summary of HAWRAT Method D Spillage Assessment

Outfall	Receiving Watercourse	Type of Road	Annual Probability of Serious Pollution Incident (Without Mitigation)	Annual Probability of Serious Pollution Incident (With Mitigation)	Action
1	Cotting Burn	Carriageway	0.026 %	0.019 %	No further action required
2	Shieldhill Burn	Carriageway and slip road	0.04 %	0.03 %	No further action required
4	Floodgate Burn	Carriageway	0.022 %	0.016 %	No further action required
6	River Lyne	Carriageway	0.03 %	0.02 %	No further action required
7	Tributary of Fenrother Burn	Carriageway and slip road	0.06 %	0.04 %	No further action required
9	Earsdon Burn	Carriageway	0.015 %	0.009 %	No further action required
11	Earsdon Burn	Carriageway and slip road	0.03 %	0.02 %	No further action required
12	Tributary of Longdike Burn	Carriageway	0.015 %	0.009 %	No further action required

Outfall	Receiving Watercourse	Type of Road	Annual Probability of Serious Pollution Incident (Without Mitigation)	Annual Probability of Serious Pollution Incident (With Mitigation)	Action
13	Longdike Burn	Carriageway	0.023 %	0.015 %	No further action required
15 and 15a	Longdike Burn	Carriageway and slip road	0.05 %	0.03 %	No further action required
17a and 17b	Tributary of Thirston Burn	Carriageway and slip road	0.05 %	0.03 %	No further action required
17	Tributary of Thirston Burn	Carriageway and slip road	0.08 %	0.06 %	No further action required
18	River Coquet	Carriageway	0.02 %	0.01 %	No further action required
19	Bradley Brook	Carriageway	0.024 %	0.015 %	No further action required
20	Tributary of Earsdon Burn	Side road	0.027 %	0.016 %	No further action required
21	Bradley Brook	Carriageway	0.009 %	0.005 %	No further action required

SUMMARY

4.2.6. The results of the Method D assessments for outfalls 1 to 17 and for outfall 19 indicate an annual probability of between 0.019 % and 0.005 %, taking the proposed embedded mitigation measures into account, which is significantly below the recommended threshold of 1 %. The Method D assessment for outfall 18 indicates an annual probability of 0.01 %, taking into account the proposed embedded mitigation measures, which is significantly below the recommended threshold of 0.5 % due to the SSSI.

4.2.7. With reference to **Table 2-4**, the magnitude of impact to all surface water features associated with the risk of spillage for Part A is considered to be **Negligible.** Taking into account the importance of the receptors as set out in **Table 3-1** and the magnitude of impact, the overall effect significance is **Neutral** (**not significant**).

5 CONCLUSION

5.1.1. The results of both the HAWRAT Method A and Method D assessments demonstrate that there would not be a significant effect on the receiving surface water features as a result of the proposed surface water drainage strategy as part of Part A. All the proposed mitigation measures that would be included as part of the design of Part A have been taken into consideration within the assessments. As a result, the proposed embedded mitigation measures are deemed to be appropriate and would provide an appropriate level of treatment to the surface water runoff discharged into the watercourses.

5.1.2. The HAWRAT Method A and Method D assessments and results would also provide evidence and support the standalone WFD assessment in **Appendix 10.2: Water Framework Directive Assessment**, **Volume 7** of this ES (**Application Document Reference: TR010041/APP/6.7**) and **Chapter 10: Road Drainage and Water Environment**, **Volume 2** of this ES (**Application Document Reference: TR010041/APP/6.1**) for Part A.

6 REFERENCES

Ref 10.3.1: Department for Transport (2014) *National Policy Statement for National Networks*. London: Her Majesty's Stationary Office (HMSO).
Ref 10.3.2: Highways Agency (2009) *Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09)*.
Ref 10.3.3: Highways Agency (2009) *Highways Agency Water Risk Assessment Tool*. [Available online] https://infrastructure.planninginspectorate.gov.uk/wp-content/ipc/uploads/projects/TR050002/TR050002-000650-5.2%20ES%20Appendix%208.4%20140409_HAWRAT_Outputs-Catchment%20E%20%28M1%20Junction%29.pdf [Accessed July 2018].
Ref 10.3.4: European Parliament (2000) *Water Framework Directive (2000/60/EC)*. European Parliament, Brussels.
Ref 10.3.5: Multi-Agency Geographic Information for the Countryside (MAGIC) (2019) Multi-Agency Geographic Information for the Countryside. [Available online] https://magic.defra.gov.uk/MagicMap.aspx [Accessed July 2018].
Ref 10.3.6: Environment Agency (2019) *Catchment Data Explorer*. [Available online] https://environment.data.gov.uk/catchment-planning/ [Accessed July 2018].
Ref 10.3.7: Highways Agency Drainage Data Management System http://www.hagdms.co.uk/ [Accessed July 2018].
Ref 10.3.8: HMSO (2006) Natural Environment and Rural Communities Act. HMSO, London.
Ref 10.3.9: Northumberland Wildlife Trust (2008) *Northumberland Biodiversity Action Plan*. [Available online] http://www.nwt.org.uk/northumberland-BAP [Accessed September 2018].
Ref 10.3.10: Water Research Centre (2001) Sewerage rehabilitation manual. 4th edition. Volume I - rehabilitation planning. Water Research Centre, Swindon.
Ref 10.3.11: Ciria (2004) Sustainable drainage systems: Hydraulic, structural and water quality advice. Ciria, London.
Ref 10.3.12: Ciria (2015) *The SUDS Manual*. Ciria, London.

Appendix A

METHOD A DATA

DMRB METHOD A HAWRAT ASSESSMENT OF POLLUTION IMPACTS FROM ROUTINE RUNOFF TO SURFACE WATERS

Outfall Reference	Easting	Northing	Receiving Watercourse	AADT DS 2038	Climatic Region	Rainfall Site	Base Flow Index (BFI)	Hardness (mg CaCO3/l)	Q95 Flow (m^3/s)	Impermeable Area Drained to the Outfall (ha)	Permeable Area Drained to the Outfall (ha)	River Width (m)	Downstream Structure within 100m of Outfall?	Discharge in or within 1km U/S of a Designated Site?
1	418203	588425	Cotting Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.001	3.796	0.247	3.34	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
2	418302	589472	Shieldhill Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.001	2.073	0.077	0.76	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
4	418448	591242	Floodgate Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.00113	2.622	0.054	3.37	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
6	418539	591633	River Lyne	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.00608	4.182	0.422	2.75	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
7	418277	592563	Tributary to Fenrother Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.001	3.848	0.258	1.5	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
9	418589	594462	Earsdon Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.00335	1.904	0.266	3.92	N	N
11	418774	594718	Tributary of Earsdon Burn	39267	Colder Dry	Newcastle upon tyne	0.312	High >200	0.00335	2.951	0.386	3.09	N	N
12	418468	595759	Tributary of Longdike Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.001	1.747	0.144	1.41	N	N
13	418061	596694	Longdike Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.014	2.966	0.489	10.29	N	N
15/15a	417867	597336	Longdike Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.0143	3.916	0.063	6.12	N	N
17a/17b	417409	598825	Tributary of Thirston Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.00159	3.1145	0.0475	1.6	Y Culvert downstream but not perched above bed level so assumed to not reduce velocity.	N
17	417494	599141	Tributary of Thirston Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.00159	3.1145	0.0475	1.6	N	N
18	417472	599796	River Coquet	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.903	2.339	1.687	30	N	Y (River Coquet and Coquet Valley Woodlands SSSI)
19	417548	600359	Back Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.0014	1.98	1.57	2.49	N	N
21	417539	600359	Back Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.0014	0.55	0.75	2.49	N	N
20	418865	592566	Tributary of Earsdon Burn	39267	Colder Dry	Newcastle upon tyne	0.313	High >200	0.001	0.593	0.058	2	N	N

				Step One			Step Two							Step Three						
Existing Measures	Treatment for solubles (%)	Discharge rate (l/s)	Settlement of Sediments (%)	Acute impact assessment of Copper	Acute impact assessment of Zinc	Chronic impact assessment of Sediment	Acute impact assessment of Copper	Annual average concentration of copper (µg/l) due to road runoff		Acute impact assessment of Zinc	Annual average concentration of zinc (µg/l) due to road runoff		Chronic impact assessment of Sediment	Acute impact assessment of Copper	Annual average concentration of copper (µg/l) due to road runoff		Acute impact assessment of Zinc	Annual average concentration of zinc (µg/l) due to road runoff		Chronic impact assessment of Sediment
N/A	45	37.6	80	Fail	Fail	Fail	Pass	0.82	Pass	Pass	3.20	Pass	Fail	Pass	0.45	Pass	Pass	1.76	Pass	Pass
N/A	55	20	82.5	Fail	Fail	Fail	Pass	0.57	Pass	Pass	2.25	Pass	Fail	Pass	0.26	Pass	Pass	1.01	Pass	Pass
N/A	45	24.9	80	Fail	Fail	Fail	Pass	0.62	Pass	Pass	2.41	Pass	Fail	Pass	0.34	Pass	Pass	1.33	Pass	Pass
N/A	75	42.8	87.5	Fail	Fail	Fail	Pass	0.26	Pass	Pass	1.01	Pass	Fail	Pass	0.06	Pass	Pass	0.25	Pass	Pass
N/A	65	38	82.5	Fail	Fail	Fail	Pass	0.83	Pass	Pass	3.23	Pass	Fail	Pass	0.29	Pass	Pass	1.13	Pass	Pass
N/A	75	18.9	87.5	Fail	Fail	Fail	Pass	0.22	Pass	Pass	0.87	Pass	Fail	Pass	0.05	Pass	Pass	0.22	Pass	Pass
N/A	75	20.2	87.5	Fail	Fail	Fail	Pass	0.30	Pass	Pass	1.19	Pass	Fail	Pass	0.08	Pass	Pass	0.30	Pass	Pass
N/A	75	17.6	87.5	Fail	Fail	Fail	Pass	0.51	Pass	Pass	2.00	Pass	Fail	Pass	0.13	Pass	Pass	0.50	Pass	Pass
N/A	75	32.1	87.5	Fail	Fail	Fail	Pass	0.09	Pass	Pass	0.37	Pass	Pass	Pass	0.02	Pass	Pass	0.09	Pass	Pass
N/A	47.5	37	60	Fail	Fail	Fail	Pass	0.12	Pass	Pass	0.47	Pass	Fail	Pass	0.06	Pass	Pass	0.24	Pass	Pass
N/A	60	19.5	75	Fail	Fail	Fail	Pass	0.55	Pass	Pass	2.17	Pass	Fail	Pass	0.22	Pass	Pass	0.87	Pass	Pass
N/A	50	39.9	77.5	Fail	Fail	Fail	Pass	0.55	Pass	Pass	2.17	Pass	Fail	Pass	0.28	Pass	Pass	1.08	Pass	Pass
N/A	75	37.4	87.5	Fail	Fail	Fail	Pass	0.00	Pass	Pass	0.01	Pass	Pass	Pass	0.00	Pass	Pass	0.00	Pass	Pass
N/A	60	32.9	72.5	Fail	Fail	Fail	Pass	0.42	Pass	Pass	1.67	Pass	Pass	Pass	0.17	Pass	Pass	0.67	Pass	Pass
N/A	50	12	50	Fail	Fail	Fail	Pass	0.16	Pass	Pass	0.62	Pass	Pass	Pass	0.08	Pass	Pass	0.31	Pass	Pass
N/A	40	6	65	Fail	Fail	Fail	Pass	0.23	Pass	Pass	0.90	Pass	Pass	Pass	0.14	Pass	Pass	0.54	Pass	Pass

											Step One		Step Two							Step Three						
Cumulative Assessment Required?	**Outfalls for Cumulative Assessment**	**Q95 Cumulative Flow (m3/s)**	**BFI Cumulative**	**Impermeable Area Drained to the Outfalls for Cumulative Assessment (ha)**	**Permeable Area Drained to the Outfalls for Cumulative Assessment (ha)**	**Downstream River Width (m)**	**Existing Measures**	**Treatment for solubles (%)**	**Settlement of Sediments (%)**	**Discharge rate (l/s)**	**Acute impact assessment of Copper**	**Acute impact assessment of Zinc**	**Acute impact assessment of Copper**	**Annual average concentration of copper (µg/l) due to road runoff**		**Acute impact assessment of Zinc**	**Annual average concentration of zinc (µg/l) due to road runoff**		**Chronic impact assessment of Sediment**	**Acute impact assessment of Copper**	**Annual average concentration of copper (µg/l) due to road runoff**		**Acute impact assessment of Zinc**	**Annual average concentration of zinc (µg/l) due to road runoff**		**Chronic impact assessment of Sediment**
N																										
N																										
N																										
N																										
N																										
Y	Outfall 9 and Outfall 11 are located approximately 300m apart.	0.00335	0.312	4.855	0.652	3.09	N/A	75.00	N/A	39.1	Fail	Fail	Pass	0.45	Pass	Pass	1.76	Pass	N/A	Pass	0.11	Pass	Pass	0.44	Pass	N/A
N																										
Y	Outfall 13 and Outfall 15/15a are located approximately 910m apart.	0.0143	0.313	6.882	0.552	6.12	N/A	47.5	N/A	69.1	Fail	Fail	Pass	0.19	Pass	Pass	0.76	Pass	N/A	Pass	0.10	Pass	Pass	0.40	Pass	N/A
Y	Outfall 17a/17b and Outfal 17 are located approximately 170m apart.	0.00159	0.313	6.229	0.095	1.6	N/A	50	N/A	59.4	Fail	Fail	Pass	0.84	Pass	Pass	3.27	Pass	N/A	Pass	0.42	Pass	Pass	1.64	Pass	N/A
N																										
Y Y	Outfall 19 and 21 are located approximately 10m apart	0.0014	0.313	2.53	2.32	2.49	N/A	50	55	44.9	Fail	Fail	Pass	0.5	Pass	Pass	1.94	Pass	Fail	Pass	0.25	Pass	Pass	0.97	Pass	Pass
N																										

Appendix B

METHOD D DATA

DMRB METHOD D HAWRAT ASSESSMENT OF RISK FROM ACCIDENTAL SPILLAGE

Outfall Reference	Easting	Northing	Receiving Watercourse	AADT DS 2038	% Heavy Goods Vehicles	Junction Type	Length of highway drained (m)	Spillage Factor (no/10^{32}HGVkm /year))	Junction Type	Length of highway drained (m)	Spillage Factor (no/10^{32}HGVkm/ year))	Junction Type	Length of highway drained (m)	Spillage Factor (no/10^{32}HGVkm /year))	Existing Measures factor	Proposed Measures Factor	Annual probability of serious pollution incident (without mitigation)	Is risk greater than 1%?	Annual probability of serious pollution incident (with mitigation)	Is risk greater than 0.5%?
1	418203	588425	Cotting Burn	39267	9	Carriageway	1180	0.29							1	0.7	0.026%	N	0.019%	
2	418302	589472	Shieldhill Burn	39267	9	Carriageway	370	0.29	Carriageway by slip road	100	0.83	Slip road	450	0.83	1	0.7	0.04%	N	0.03%	
4	418448	591242	Floodgate Burn	39267	9	Carriageway	1000	0.29							1	0.7	0.022%	N	0.016%	
6	418539	591633	River Lyne	39267	9	Carriageway	1350	0.29							1	0.65	0.03%	N	0.02%	
7	418277	592563	Tributary to Fenrother Burn	39267	9	Carriageway	1050	0.29	Carriageway by slip road	100	0.83	Slip road	400	0.83	1	0.65	0.06%	N	0.04%	
9	418589	594462	Earsdon Burn	39267	9	Carriageway	650	0.29							1	0.65	0.015%	N	0.009%	
11	418774	594718	Tributary of Earsdon Burn	39267	9	Carriageway	830	0.29	Carriageway by slip road	100	0.83	Slip road	100	0.83	1	0.65	0.03%	N	0.02%	
12	418468	595759	Tributary of Longdike Burn	39267	9	Carriageway	650	0.29							1	0.65	0.015%	N	0.009%	
13	418061	596694	Longdike Burn	39267	9	Carriageway	1020	0.29							1	0.65	0.023%	N	0.015%	
15/15a	417867	597336	Longdike Burn	39267	9	Carriageway	1530	0.29	Carriageway by slip road	100	0.83	Slip road	100	0.83	1	0.7	0.05%	N	0.03%	
17a/17b	417409	598825	Tributary of Thirston Burn	39267	9	Carriageway	1310	0.29	Carriageway by slip road	100	0.83	Slip road	150	0.83	1	0.6	0.05%	N	0.03%	
17	417494	599141	Tributary of Thirston Burn	39267	9	Carriageway	500	0.29	Carriageway by slip road	100	0.83	Slip road	1000	0.83	1	0.75	0.08%	N	0.06%	
18	417472	599796	River Coquet	39267	9	Carriageway	700	0.29							1	0.65	0.02%		0.01%	N
19	417548	600359	Back Burn	39267	9	Carriageway	1084	0.29							1	0.65	0.023%	N	0.015%	
20	418865	592566	Tributary of Earsdon Burn	39267	9	Side Road	370	0.93							1	0.6	0.03%	N	0.02%	
21	417539	600359	Back Burn	39267	9	Carriageway	402	0.29							1	0.6	0.01%	N	0.01%	

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