# A1 in Northumberland: Morpeth to Ellingham

## Scheme Number: TR010041

## 6.8 Environmental Statement – Appendix 10.3 Drainage Network Water Quality Assessment

## Part B

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 Development Consent Order 20[xx]

## Environmental Statement - Appendix

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|---|---|
| **Regulation Reference:** | APFP Regulation 5(2)(a) |
| **Planning Inspectorate Scheme Reference** | TR010041 |
| **Application Document Reference** | TR010041/APP/6.8 |
| **Author:** | A1 in Northumberland: Morpeth to Ellingham Project Team, Highways England |

| Version | Date | Status of Version |
|---|---|---|
| Rev 0 | June 2020 | Application Issue |

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# EXECUTIVE SUMMARY

The Drainage Network Water Quality Assessment informs **Chapter 10: Road Drainage and the Water Environment**, **Volume 3** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.3**) and supports the Development Consent Order (DCO) application for A1 in Northumberland: Alnwick to Ellingham (Part B). The assessment has been conducted in accordance with the National Policy Statement for National Networks (NPS NN); the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09); as well as consultation with the Environment Agency.

The assessment assesses the potential impacts associated with Part B 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 B 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 (HD 45/09). 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 B 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 impact on the receiving surface water features as a result of the proposed surface water drainage strategy as part of Part B.

# 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 3** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.3**) and supports the Development Consent Order (DCO) application for A1 in Northumberland: Alnwick to Ellingham (Part B).

1.1.2. The assessment has been conducted in accordance with the National Policy Statement for National Networks (NPS NN) (**Ref. 10.1**); Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09) (**Ref. 10.2**); as well as consultation with the Environment Agency.

1.1.3. Part B would increase the impermeable road surface area and alter the current traffic flow regime through 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 B on the effect of sediment and 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 10.4: Drainage Strategy Report** of this ES).

1.1.4. The assessment focusses on the potential risks associated with the operational phase of Part B 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 3** of this ES (**Application Document Reference: TR010041/APP/6.3**).

## 1.2. STUDY AREA

1.2.1. Part B is located within the County of Northumberland and forms part of the Applicant's strategic road network. Part B is located along the A1 between Alnwick and Ellingham and is approximately 8 km in length. Part B comprises online improvements consisting of carriageway widening.

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

# 2. ASSESSMENT METHODOLOGY

## 2.1. APPROACH AND METHODOLOGY

2.1.1. The assessment of risks to water quality during the operation of Part B has been undertaken in accordance with the methods outlined in DMRB (HD 45/09) (**Ref. 10.2**). The assessments use the Highways Agency [now Highways England] Water Risk Assessment Tool (HAWRAT) (**Ref. 10.3**).

2.1.2. The approach includes Method A and Method D of the DMRB (HD 45/09) (**Ref. 10.2**):

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 11.3: Ground Investigation Report** of this ES. All proposed attenuation features would be lined to prevent infiltration.

### METHOD A: POLLUTION IMPACTS FROM ROUTINE RUNOFF TO SURFACE WATERS

2.1.4. DMRB (HD 45/09) (**Ref. 10.2**) 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. 10.2**) 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. 10.4**). 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 spread sheet. These are detailed as follows:

a. Step 1 uses statistical models to determine pollutant concentrations in raw road runoff prior to any treatment or dilution in the receiving watercourse.

b. Step 2 assesses in-river pollutant concentrations after dilution and dispersion in the receiving watercourse, but without active mitigation.
c. 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. 10.2**) 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. 10.2**). 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. 10.2**) 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. 10.2**) 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 change of a serious pollution incident occurring in any one year) is considered by DMRB (HD 45/09) (**Ref. 10.2**) 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. 10.2**) 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. 10.2**) 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 | - WFD Class 'High'.<br>- Site protected/designated under EC or UK habitat legislation (Special Area of Conservation (SAC), Special Protection Area (SPA), Site of Special Scientific Interest (SSSI), Water Protection Zone (WPZ), Ramsar site, salmonid water).<br>- Species protected by EC legislation.<br>- Provides a regionally important water supply resource. |
| High | Attribute has a high quality and rarity on local scale | - WFD Class 'Good'.<br>- Species protected under EC or UK habitat legislation.<br>- Provides a locally important water supply resource. |
| Medium | Attribute has a medium quality and rarity on local scale | - WFD Class 'Moderate'.<br>- Provides water for agricultural or industrial use. |
| Low | Attribute has a low quality and rarity on local scale | - WFD Class 'Poor'.<br>- 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. 10.2**) 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 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).<br>- 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).<br>- 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).<br>- 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).<br>- Risk of pollution from spillages < 0.5% (Method D). |
| Minor Beneficial | Results in some beneficial effect on attribute or a reduced risk of negative effect occurring | - HAWRAT assessment of either soluble or sediment-bound pollutants becomes a Pass from an existing site where the baseline was a Fail condition.<br>- Calculated reduction in existing spillage risk by 50% or more (when existing spillage risk is <1% annually). |

| Impact Magnitude | Criteria | Typical Examples |
|---|---|---|
| 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.<br>- 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. 10.2**). 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 and significance of a potential effect takes into consideration mitigation inherent to the design of Part B, 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. 10.5**) (accessed January 2019).
c. Environment Agency's Catchment Data Explorer (**Ref. 10.6**) (accessed January 2019).
d. Highways Agency's (now Highways England) Drainage Data Management System (HADDMS) (**Ref. 10.7**) (accessed January 2019).
e. **Drainage Strategy Report** (2019) in **Appendix 10.4** of this ES.
f. **Aquatic Ecology Assessment Report** (2019) in **Appendix 9.10** of this ES.
g. **Otter and Water Vole Report** (2019) in **Appendix 9.3** of this ES.
h. Observations made from the site visit (February 2019).

3.1.2. A site walkover was conducted on the 13 and 14 February 2019 to inform **Chapter 10: Road Drainage and the Water Environment**, **Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**) and this assessment. The site walkover included the following watercourses (from south to north) and their tributaries:

a. Denwick Burn and its tributaries
b. White House Burn
c. Tributary of Embleton Burn
d. Tributaries of Kittycarter Burn
e. Shipperton Burn

## 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.

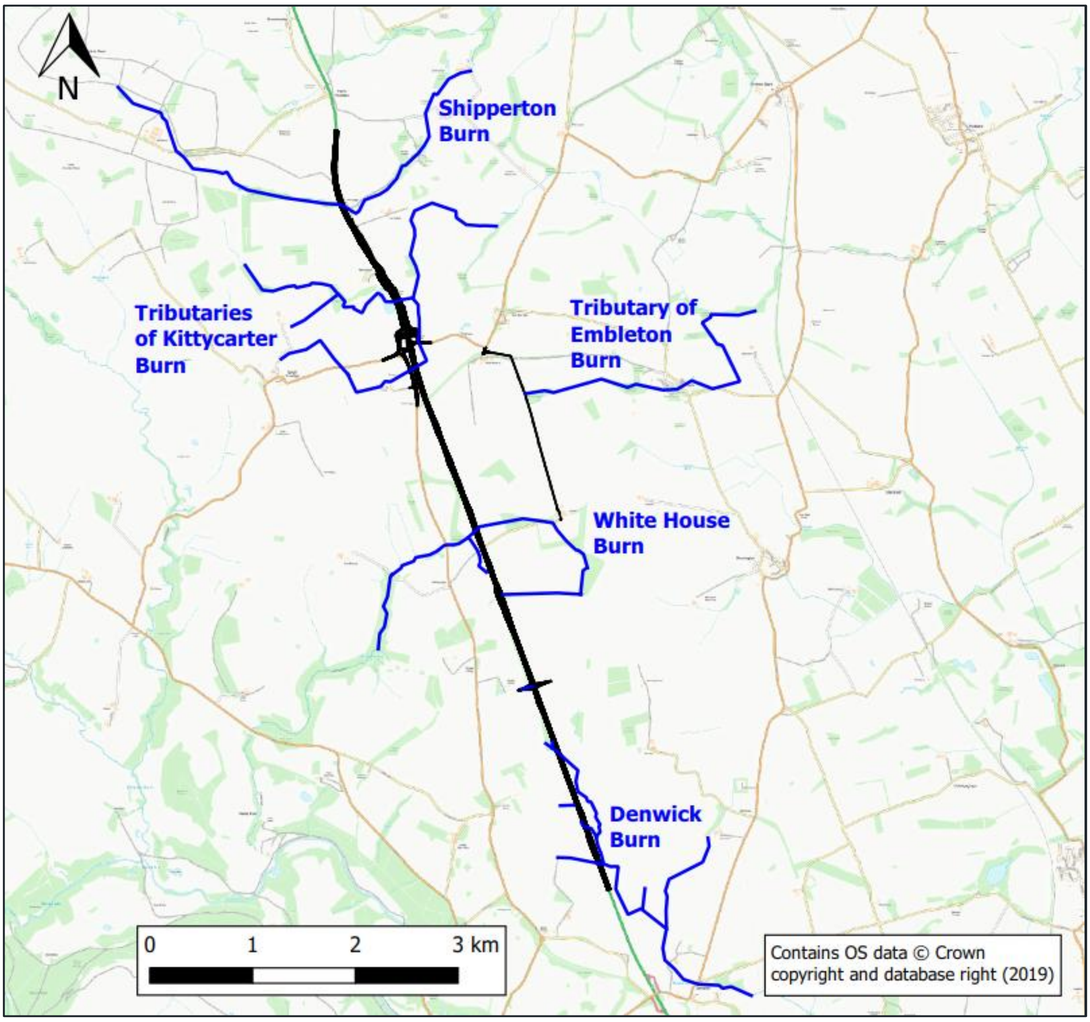


**Figure 3-1 - Location of Main Surface Water Features**

### DENWICK BURN AND TRIBUTARIES

3.2.2. Denwick Burn and its tributaries flow in a north to south-east direction beneath the existing A1 alignment at four locations to the north of the village of Denwick. The source of Denwick Burn is just to the west of the existing A1 alignment to the south of Heckley Fence. The catchment of the watercourse is gently sloping towards the watercourse from both the east and west. Denwick Burn discharges into the River Aln approximately 4.4 km downstream from Part B.

3.2.3. No fish surveys have been undertaken along Denwick Burn and its tributaries as during the aquatic walkover survey undertaken by the Scheme ecologists did not identify the watercourses to have the potential to support any legally protected or notable aquatic species. No evidence of otters or water voles were identified during the mammal surveys.

3.2.4. Denwick Burn and its tributaries are located within the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment which is monitored against the objectives of the WFD (**Ref. 10.4**). A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

**WHITE HOUSE BURN**

3.2.5. White House Burn flows in an east to south-west direction beneath the existing A1 alignment to the west of Rock South Farm. The source of White House Burn is located approximately 1.3 km upstream of the A1 crossing within the Wisplaw Whin plantation. The catchment of the watercourse is relatively flat with an approximate upstream catchment area of 1.22 $km^2$. Approximately 4.3 km downstream from Part B, White House Burn discharges into the River Aln adjacent to the remains of Hulne Priory, located to the south-west of Part B.

3.2.6. No fish surveys have been undertaken along White House Burn as during the aquatic walkover survey undertaken by the Scheme ecologists did not identify the watercourse to have the potential to support any legally protected or notable aquatic species. No evidence of otters or water voles were identified during the mammal surveys.

3.2.7. White House Burn is located within the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment which is monitored against the objectives of the WFD (**Ref. 10.4**). A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

**TRIBUTARIES OF KITTYCARTER BURN**

3.2.8. Two tributaries of Kittycarter Burn flow beneath the existing A1 alignment. The southern tributary flows in a south-west to north-east direction beneath the A1 and two adjacent side roads, and the western tributary flows in a west to east direction beneath the A1. The source of the unnamed southern tributary of Kittycarter Burn is just upstream of Part B within the South Charlton Bog. The source of the unnamed western tributary of Kittycarter Burn is approximately 1.7 km to the north-west of Part B, adjacent to Victory Wood. The catchment for where the two tributaries meet is relatively flat with an approximate upstream catchment area of 3.98 $km^2$. Approximately 2 km downstream from Part B, the unnamed tributaries of Kittycarter Burn discharge into the Kittycarter Burn by the Kittycarter Plantation.

3.2.9. No fish surveys have been undertaken along the tributaries of Kittycarter Burn as during the aquatic walkover survey undertaken by the Scheme ecologists did not identify the watercourses to have the potential to support any legally protected or notable aquatic species. No evidence of otters or water voles were identified during the mammal surveys.

3.2.10. The tributaries of Kittycarter Burn are located within the 'Embleton Burn from Source to North Sea' WFD catchment which is monitored against the objectives of the WFD (**Ref. 10.4**). A review of the Environment Agency's Catchment Data Explorer (2016 results)

(**Ref. 10.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

**TRIBUTARY OF EMBLETON BURN**

3.2.11. The unnamed tributary of Embleton Burn flows in a west to east direction beneath an access track approximately 0.95 km to the east of the A1 through a kiln plantation. The source of the unnamed tributary of Embleton Burn is just upstream of the access track watercourse crossing. The catchment of the watercourse is relatively flat with an approximate upstream catchment area of 0.58 $km^2$. Approximately 4.1 km downstream of the access track crossing the unnamed tributary of Embleton Burn discharges into the Embleton Burn by Prickley Bridge.

3.2.12. No fish surveys have been undertaken along the tributary of Embleton Burn as during the aquatic walkover survey undertaken by the Scheme ecologists did not identify the watercourse to have the potential to support any legally protected or notable aquatic species. No evidence of otters or water voles were identified during the mammal surveys.

3.2.13. The unnamed tributary of Embleton Burn is located within the 'Embleton Burn from Source to North Sea' WFD catchment which is monitored against the objectives of the WFD (**Ref. 10.4**). A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.6**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'.

**SHIPPERTON BURN**

3.2.14. Shipperton Burn flows in a west to east direction and flows beneath the existing A1alignment through the Lodge Plantation, and then under Shipperton Bridge approximately 100 m downstream that serves as a local private road. The source of Shipperton Burn is approximately 2.7 km to the north-west of the A1 crossing, to the north of Middlemoor Wind Farm. The catchment of the watercourse is gently sloping from the north-west to the south-east with an approximate upstream catchment area of 3.09 $km^2$. Shipperton Burn eventually discharges into Doxford Lake and becomes Mill Burn approximately 2.7 km downstream of the existing A1 crossing, to the north-east of Part B.

3.2.15. The electric fish surveys undertaken identified brown trout along Shipperton Burn. Brown trout are a protected species listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) (**Ref. 10.8**) and are considered to be of principal importance. No evidence of otters or water voles were identified during the mammal surveys.

3.2.16. Shipperton Burn is located within the 'Brunton Burn from Source to North Sea' WFD catchment which is monitored against the objectives of the WFD (**Ref. 10.4**). A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.6**) 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

3.2.17. **Table 3-1** below summarises the importance of the identified surface water features based on the DMRB (HD 45/09) (**Ref. 10.2**) criteria used to estimate the importance of receptors as previously summarised in **Table 2-3**.

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

| Receptor | Description | Importance |
|---|---|---|
| Denwick Burn | No fish or mammal species identified. Located within a 'Poor' WFD catchment. | Low |
| White House Burn | No fish or mammal species identified. Located within a 'Poor' WFD catchment. | Low |
| Tributary of Embleton Burn | No fish or mammal species identified. Located within a 'Poor' WFD catchment. | Low |
| Tributaries of Kittycarter Burn | No fish or mammal species identified. Located within a 'Poor' WFD catchment. | Low |
| Shipperton Burn | Brown trout 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. 10.7**). 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 B through an underground piped system. For more information regarding the existing highway drainage infrastructure refer to **Appendix 10.4: Drainage Strategy Report** of this ES. **Table 3-2** below details the information collated from the HADDMS online database (**Ref. 10.7**) regarding the existing outfalls.

**Table 3-2 - Information on Existing Highway Drainage**

| Outfall | HADDMS Reference | Receiving Watercourse |
|---|---|---|
| 1 | NU1915_6357b | Denwick Burn |
| 2 | NU1916_3914a | Tributary of Denwick Burn |
| 3 | NU1916_2162a | Denwick Burn |

| Outfall | HADDMS Reference | Receiving Watercourse |
|---|---|---|
| 4 | NU1916_1668c | Denwick Burn |
| 5 | NU1818_3778c | White House Burn |
| 6 | NU1721_5701b | Tributary of Kittycarter Burn |
| 7 | NU1720_8163a | Tributary of Kittycarter Burn |
| 8 | NU1721_0697a | Shipperton Burn |

3.3.3. **Figure 3-2** below shows the location of the existing outfalls along Part B. The 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. 10.7**) indicates that there are no existing flow controls or pollution prevention measures in place.

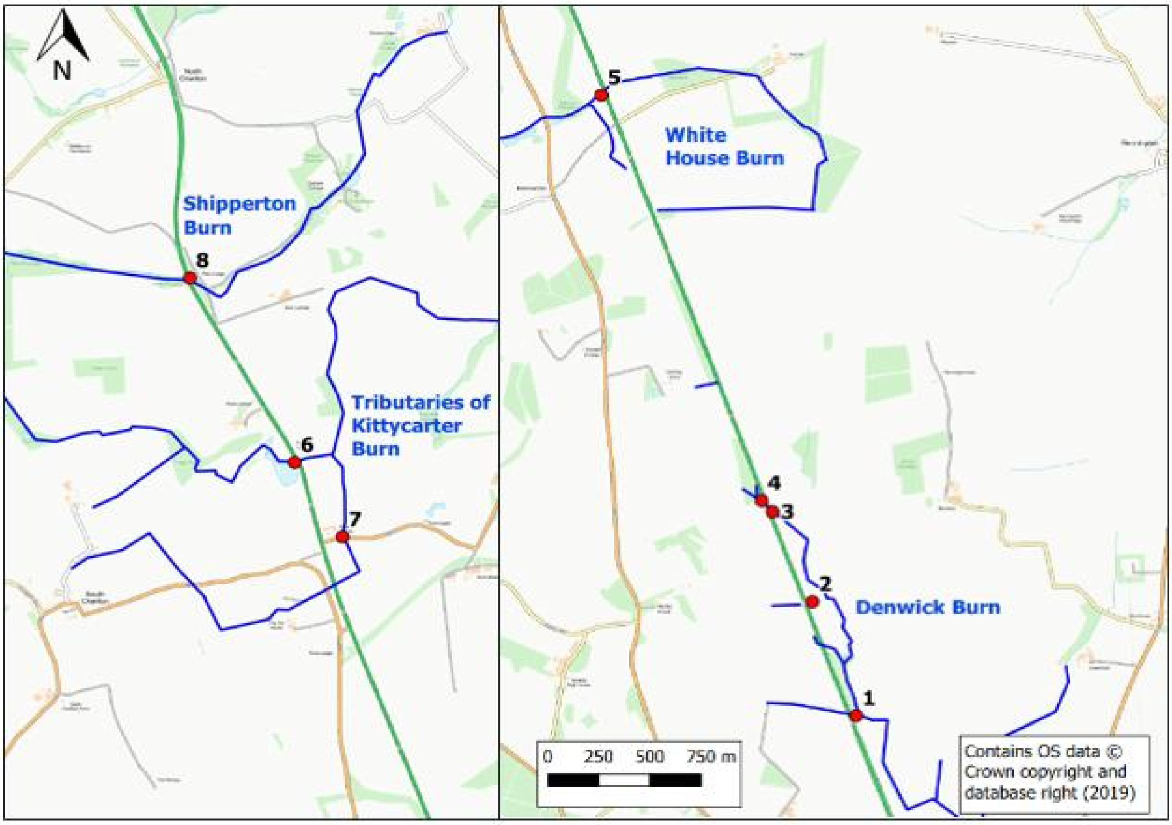


**Figure 3-2 - Location of Existing Outfalls**

## 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 B does not increase flood risk to Part B and to people and places elsewhere and provides appropriate treatment. The existing highway drainage infrastructure would not be retained as part of Part B. For a detailed description of the proposed surface water drainage strategy refer to the standalone **Drainage Strategy Report** (**Appendix 10.4** of this ES).

3.4.2. **Table 3-3** below provides an overview of the proposed attenuation and different stages of treatment features at each outfall proposed as part of Part B. The watercourses that receive surface water runoff from the existing outfalls are broadly similar to the proposed outfall locations.

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

| Outfall | Receiving Watercourse | Proposed Attenuation and Treatment | | Percentage of Surface Water Runoff Received (%) |
|---|---|---|---|---|
| 22 | Denwick Burn | Stage 1 | Filter drains located within the verge of the carriageway. | 98 |
| | | | Kerb and gully drainage. | 2 |
| | | Stage 2 | Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area. | 100 |
| 23 | Denwick Burn | Stage 1 | Filter drains located within the verge of the carriageway. | 98 |
| | | | Kerb and gully drainage. | 2 |
| | | Stage 2 | Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area. | 100 |
| 24 | White House Burn | Stage 1 | Filter drains located within the verge of the carriageway. | 98 |
| | | | Kerb and gully drainage. | 2 |
| | | Stage 2 | Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area. | 100 |

| Outfall | Receiving Watercourse | Proposed Attenuation and Treatment | | Percentage of Surface Water Runoff Received (%) |
|---|---|---|---|---|
| 25 / 26 | Tributary of Kittycarter Burn | Stage 1 | Filter drains located within the verge of the carriageway. | 98 |
| | | | Kerb and gully drainage. | 2 |
| | | Stage 2 | Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area. | 100 |
| 27 | Tributary of Kittycarter Burn | Stage 1 | Filter drains located within the verge of the carriageway. | 98 |
| | | | Kerb and gully drainage. | 2 |
| | | Stage 2 | Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area. | 100 |

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

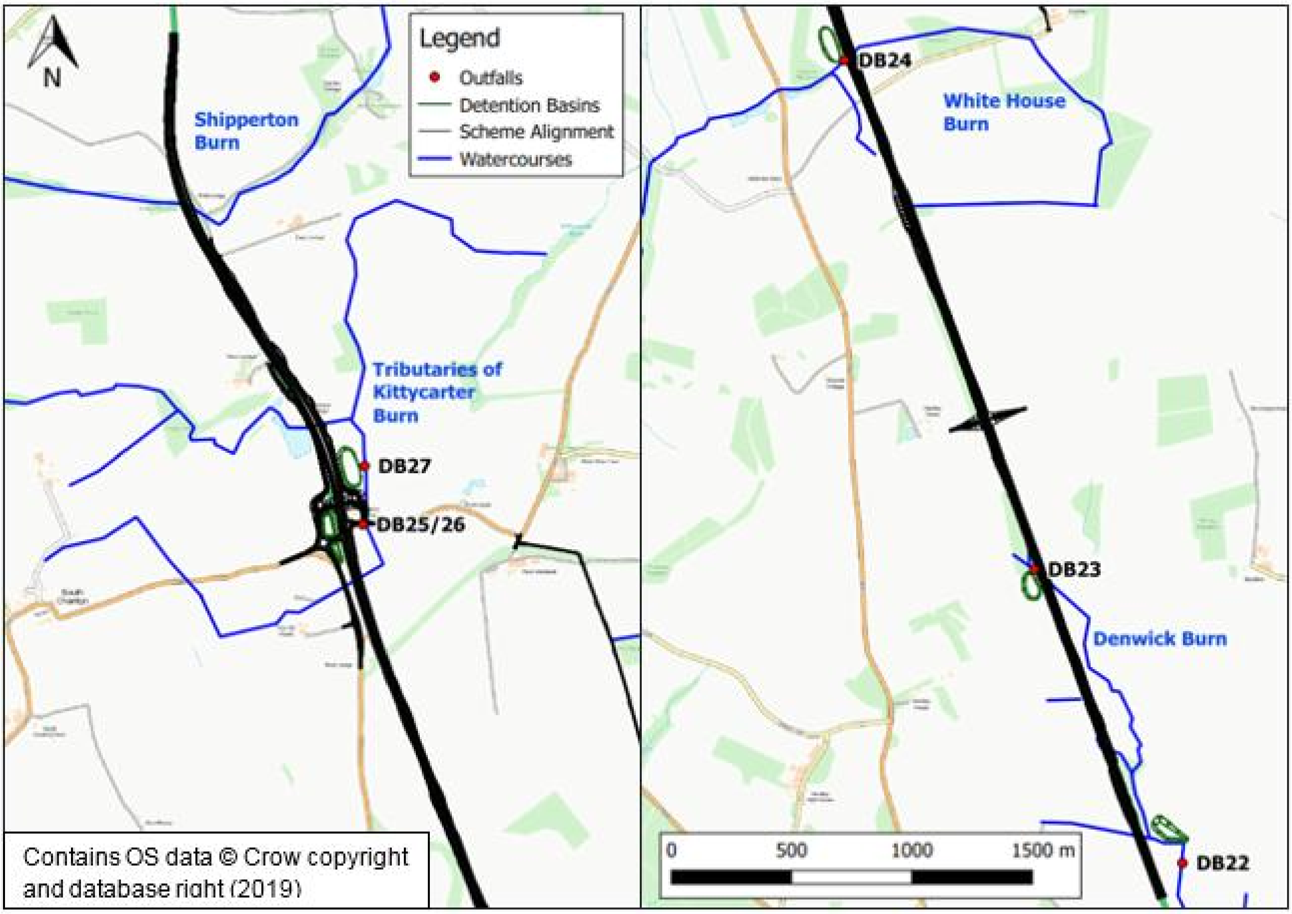


**Figure 3-3 - Overview of Proposed Surface Water Drainage Strategy**

# 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 was 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 engineers.
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: Obtained from review of MAGIC website (**Ref. 10.5**).
f. Traffic flow AADT data for the new A1 main carriageway: Obtained from traffic flow analysis provided by the Scheme transport team.
g. Permeable areas draining to the new outfalls: Obtained from information provided by the Scheme drainage design engineers.
h. Impermeable areas draining to the new outfalls: Obtained from information provided by the Scheme drainage design engineers.

4.1.2. The baseline data that was used in the assessment of routine runoff using DMRB (HD 45/09) (**Ref. 10.2**) 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 within the surface water drainage strategy. The mitigation measures for Part B are summarised in **Table 3-3** 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. 10.9**). These parameters were used as a guide to the HAWRAT assessment. The level of pollutant removal used in the HAWRAT assessment took into account 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. 10.10**). 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. 10.2**) 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 B against the EQS threshold values set out under the WFD (**Ref. 10.4**) and as summarised within the DMRB (HD 45/09) (**Ref. 10.2**). **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 the DMRB (HD 45/09) (**Ref. 10.2**).

**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 |

### RESULTS: SINGLE OUTFALL ASSESSMENT

4.1.7. The results of the Method A single outfall assessments are summarised in **Table 4-3** below for steps one, two and three of the HAWRAT assessment.

**Table 4-3 - 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 | |
|---|---|---|---|---|---|---|---|---|
| 22 | Step 1 | FAIL | FAIL | FAIL | - | | - | |
| | Step 2 | PASS | PASS | PASS | 0.26 | PASS | 1.04 | PASS |
| | Step 3 | PASS | PASS | PASS | 0.008 | PASS | 0.31 | PASS |
| 23 | Step 1 | FAIL | FAIL | FAIL | - | | - | |
| | Step 2 | PASS | PASS | FAIL | 0.34 | PASS | 1.34 | PASS |
| | Step 3 | PASS | PASS | PASS | 0.10 | PASS | 0.40 | PASS |
| 24 | Step 1 | FAIL | FAIL | FAIL | - | | - | |
| | Step 2 | PASS | PASS | FAIL | 0.50 | PASS | 1.96 | PASS |
| | Step 3 | PASS | PASS | PASS | 0.15 | PASS | 0.59 | PASS |
| 25 / 26 | Step 1 | FAIL | FAIL | FAIL | - | | - | |
| | Step 2 | PASS | PASS | FAIL | 0.31 | PASS | 1.26 | PASS |
| | Step 3 | PASS | PASS | PASS | 0.09 | PASS | 0.38 | PASS |
| 27 | Step 1 | FAIL | FAIL | FAIL | - | | - | |
| | Step 2 | PASS | PASS | FAIL | 0.44 | PASS | 1.74 | PASS |
| | Step 3 | PASS | PASS | PASS | 0.13 | PASS | 0.52 | PASS |

**RESULTS: CUMULATIVE ASSESSMENT**

4.1.8. In accordance with DMRB (HD 45/09) (**Ref. 10.2**) 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 25 / 26 and 27. The results of the cumulative assessment are presented in **Table 4-4** below. Outfalls 25 / 26 and 27 are located between 100 m and 1 km apart and in accordance with DMRB (HD 45/09) (**Ref. 10.2**) methodology only the soluble impacts have been assessed (i.e. a cumulative assessment of sediment impacts has not been assessed).

**Table 4-4 - 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 | |
|---|---|---|---|---|---|---|---|---|
| 25 / 26 and 27 | Step 1 | FAIL | FAIL | N/A | - | | - | |
| | Step 2 | PASS | PASS | | 0.59 | PASS | 2.36 | PASS |
| | Step 3 | PASS | PASS | | 0.18 | PASS | 0.71 | PASS |

**SUMMARY**

4.1.9. 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.

4.1.10. Step two assesses the acute impacts of soluble pollutants (zinc and copper) and takes into account the diluting capacity of the receiving watercourse. Step 2 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, and all but one 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.

4.1.11. 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.

4.1.12. The assessment of long term pollution impacts to the receiving water environment considers the annual average pollutant concentrations associated with Part B against the EQS threshold values set out under the WFD (**Ref. 10.4**). All the annual average pollutant concentrations, for both zinc and copper, are below the EQS threshold values for step two. The values range from 0.26 µg/l to 0.5 µg/l for copper and from 1.04 µg/l to 1.96 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 0.008 µg/l to 0.15 µg/l for copper and from 0.31 µg/l to 0.59 µg/l for zinc. This shows that the proposed mitigation measures go beyond the minimum standards required to pass the HAWRAT Method A assessment.

4.1.13. 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 B is therefore 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**.

## 4.2. METHOD D – SPILLAGE ASSESSMENT

### BASELINE DATA

4.2.1. The Method D spillage assessment was 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 engineers.
b. Road type: Obtained from the Scheme information.
c. Junction type: Obtained from the Scheme information.
d. Location: Obtained from Table D1.2 in the DMRB (HD 45/09) (**Ref. 10.2**).
e. Traffic flow: AADT data obtained from traffic flow analysis provided by the Scheme transport team.
f. Percentage of HGV: Obtained from traffic flow analysis provided by the Scheme transport team.
g. Spillage factor: Obtained from Table D1.1 in the DMRB (HD 45/09) (**Ref. 10.2**).
h. Existing measures factor: Obtained from Table 8.1 in the DMRB (HD 45/09) (**Ref. 10.2**). 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 the DMRB (HD 45/09) (**Ref. 10.2**).

4.2.2. The baseline data that was used in the spillage assessment using DMRB (HD 45/09) (**Ref. 10.2**) Method D is provided in **Appendix B: Method D Data** of this report.

### 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 within the surface water drainage strategy. The mitigation measures for Part B as previously discussed include filter drains, grassed detention basins and sediment forebays. Table 8.1 in DMRB (HD 45/09) (**Ref. 10.2**) shows the guidance used to determine the pollution risk reduction factors of the proposed mitigation measures used in the assessment. The assessment took into account 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. The DMRB (HD 45/09) (**Ref. 10.2**) recommends that an annual probability of a serious pollution incident occurring of less than 1% would be acceptable. None of the outfalls located along Part B are located within 1 km of a sensitive receptor.

4.2.5. The assessment was undertaken for each of the proposed outfalls along the length of Part B. The results of the Method D spillage assessment for both the without and with the proposed mitigation scenarios are summarised in **Table 4-5** below.

**Table 4-5 - 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 |
|---|---|---|---|---|---|
| 22 | Denwick Burn | Carriageway | 0.005% | 0.004% | No further action required |
| 23 | Denwick Burn | Carriageway | 0.006% | 0.004% | No further action required |
| 24 | White House Burn | Carriageway | 0.009% | 0.006% | No further action required |
| 25 / 26 | Tributary of Kittycarter Burn | Carriageway and slip roads | 0.01% | 0.01% | No further action required |
| 27 | Tributary of Kittycarter Burn | Carriageway | 0.008% | 0.005% | No further action required |

**SUMMARY**

4.2.6. The results of the Method D assessments for outfalls 22 to 27 indicate an annual probability of between 0.006% and 0.01%, taking the proposed mitigation measures into account, which is significantly below the recommended threshold of 1%.

4.2.7. With reference to **Table 2-4** above, the magnitude of impact to all surface water features associated with the risk of spillage for Part B is predicted 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**.

# 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 B. All the proposed mitigation measures that would be included as part of the design of Part B have been taken into consideration within the assessments. As a result, the proposed 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** of this ES and **Chapter 10: Road Drainage and Water Environment**, **Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**).

# REFERENCES

**Ref. 10.1** Department for Transport (2014) National Policy Statement for National Networks. London: Her Majesty's Stationary Office (HMSO).

**Ref. 10.2** Highways Agency (2009) Design Manual for Roads and Bridges Volume 11, Section 3, Part 10 (HD 45/09).

**Ref. 10.3** Highways Agency (2009) Highways Agency Water Risk Assessment Tool. Available at: 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 January 2019).

**Ref. 10.4** European Parliament (2000) Water Framework Directive (2000/60/EC). European Parliament, Brussels.

**Ref. 10.5** Multi-Agency Geographic Information for the Countryside (MAGIC) (2019) Multi-Agency Geographic Information for the Countryside. Available at: https://magic.defra.gov.uk/MagicMap.aspx (Accessed January 2019).

**Ref. 10.6** Environment Agency (2019) Catchment Data Explorer. Available at: https://environment.data.gov.uk/catchment-planning/ (Accessed January 2019).

**Ref. 10.7** Highways England (2019) Highways Agency Drainage Data Management System. Available at: http://www.hagdms.co.uk/ (Accessed January 2019).

**Ref. 10.8** HMSO (2006) Natural Environment and Rural Communities Act. London: HMSO.

**Ref. 10.9** Construction Industry Research and Information Association (CIRIA) (2004) Sustainable drainage systems: Hydraulic, structural and water quality advice. CIRIA, London.

**Ref. 10.10** 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? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 419779 | 615467 | Denwick Burn | 20616 | Colder Dry | Newcastle upon tyne | 0.316 | High >200 | 0.00349 | 2.54 | 1.35 | 8.53 | N | N |
| 23 | 419159 | 616682 | Denwick Burn | 20616 | Colder Dry | Newcastle upon tyne | 0.317 | High >200 | 0.00266 | 2.690 | 1.250 | 4.6 | Y<br>Culvert downstream but not perched above bed level so assumed to not reduce velocity. | N |
| 24 | 418363 | 618788 | White House Burn | 20616 | Colder Dry | Newcastle upon tyne | 0.324 | High >200 | 0.00242 | 4.280 | 2.230 | 4.01 | N | N |
| 25 / 26 | 417814 | 620618 | Tributary of Kittycarter Burn | 20616 | Colder Dry | Newcastle upon tyne | 0.515 | High >200 | 0.00322 | 2.640 | 1.080 | 3.35 | Y<br>Culvert downstream but not perched above bed level so assumed to not reduce velocity. | N |
| 27 | 417821 | 620865 | Tributary of Kittycarter Burn | 20616 | Colder Dry | Newcastle upon tyne | 0.515 | High >200 | 0.00352 | 4.460 | 1.240 | 4.56 | 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 | 70 | 36.2 | 82.5 | Fail | Fail | Fail | Pass | 0.26 | Pass | Pass | 1.04 | Pass | Pass | Pass | 0.01 | Pass | Pass | 0.31 | Pass | Pass |
| N/A | 70 | 36.6 | 82.5 | Fail | Fail | Fail | Pass | 0.34 | Pass | Pass | 1.34 | Pass | Fail | Pass | 0.10 | Pass | Pass | 0.4 | Pass | Pass |
| N/A | 70 | 60.4 | 82.5 | Fail | Fail | Fail | Pass | 0.5 | Pass | Pass | 1.96 | Pass | Fail | Pass | 0.15 | Pass | Pass | 0.59 | Pass | Pass |
| N/A | 70 | 34.6 | 82.5 | Fail | Fail | Fail | Pass | 0.31 | Pass | Pass | 1.26 | Pass | Fail | Pass | 0.09 | Pass | Pass | 0.38 | Pass | Pass |
| N/A | 70 | 53 | 82.5 | Fail | Fail | Fail | Pass | 0.44 | Pass | Pass | 1.74 | Pass | Fail | Pass | 0.13 | Pass | Pass | 0.52 | 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 | | | | | | | | | | | | | | | | | | | | | | | | | | |
| Y | 25 / 26 and 27 | 0.00352 | 0.515 | 7.1 | 2.32 | 4.56 | N/A | 70 | 82.5 | 87.6 | Pass | Pass | Pass | 0.59 | Pass | Pass | 2.36 | Pass | N/A | Pass | 0.18 | Pass | Pass | 0.71 | Pass | N/A |

# 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%? |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 22 | 419779 | 615467 | Denwick Burn | 20616 | 3 | Carriageway | 1376 | 0.29 | | | | | | | 1 | 0.65 | 0.005% | N | 0.004% | |
| 23 | 419159 | 616682 | Denwick Burn | 20616 | 3 | Carriageway | 1412 | 0.29 | | | | | | | 1 | 0.65 | 0.006% | N | 0.004% | |
| 24 | 418363 | 618788 | White House Burn | 20616 | 3 | Carriageway | 2204 | 0.29 | | | | | | | 1 | 0.65 | 0.009% | N | 0.006% | |
| 25 / 26 | 417814 | 620618 | Tributary of Kittycarter Burn | 20616 | 3 | Carriageway | 140 | 0.29 | Carriageway by slip road | 400 | 0.83 | Slip road | 395 | 0.83 | 1 | 0.65 | 0.01% | N | 0.01% | |
| 27 | 417821 | 620865 | Tributary of Kittycarter Burn | 20616 | 3 | Carriageway | 1985 | 0.29 | | | | | | | 1 | 0.65 | 0.008% | N | 0.005% | |

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