A1 in Northumberland: Morpeth to Ellingham

Scheme Number: TR010041

6.8 Environmental Statement – Appendix 10.2 Water Framework Directive 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

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Environmental Statement - Appendix

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EXECUTIVE SUMMARY

The Water Framework Directive (WFD) Assessment informs **Chapter 10: Road Drainage and the Water Environment, Volume 1** of this Environmental Statement (ES) (**Application Document Reference: TR010041/APP/6.1**) and supports the Development Consent Order (DCO) application for the A1 Northumberland: Alnwick to Ellingham (Part B). This report contains an assessment of the potential impacts associated with Part B on the water environment and the ability of surface water features within the Study Area to meet the objectives of the Water Framework Directive (WFD) (2000/06/EC).

Part B is located across three surface water WFD catchments: 'Aln from Edlingham Burn to Tidal Limit', 'Embleton Burn from Source to North Sea', and 'Brunton Burn from Source to North Sea'. The assessment indicates that there would be no detrimental impact or change to the WFD status of these catchments with the appropriate mitigation measures implemented, as detailed within the **Outline Construction Environmental Management Plan** (**Outline CEMP**) (**Application Document Reference: TR010041/APP/7.3**) and through the design of the new culverts and extended culverts, and the new outfalls. As a result, Part B is compliant with WFD objectives and would not prevent the WFD catchments from achieving the status objectives for each catchment.

Part B is located within the Northumberland Carboniferous Limestone and Coal Measures WFD groundwater catchment. The assessment indicates that there would be no detrimental impact or change to the WFD status with the appropriate mitigation measures implemented, as detailed within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and the proposed surface water drainage strategy.

1 INTRODUCTION

1.1 PROJECT OVERVIEW

1.1.1. The Applicant has undertaken a Water Framework Directive (WFD) assessment to support and inform the Environmental Statement (ES) and Development Consent Order (DCO) application for the A1 in Northumberland: Alnwick to Ellingham (Part B). This report provides an assessment of the potential impacts associated with Part B on the water environment and the ability of surface water and groundwater features within the Study Area to meet the objectives of the WFD (2000/06/EC) (**Ref. 10.1**).

1.1.2. The assessment includes the following:

a. A summary of the current baseline conditions.
b. A qualitative assessment of the potential impacts associated with Part B.
c. Identification of possible mitigation measures which could reduce any likely significant impacts that may arise as part of the proposed works.

1.1.3. A detailed assessment of the existing and future flood risk relating to Part B has been undertaken separately to the WFD assessment. This is presented within **Appendix 10.1**: **Flood Risk Assessment (FRA)** of this ES. The FRA has been undertaken in accordance with the National Policy Statement for National Networks (NPS NN) (**Ref. 10.2**), the National Planning Policy Framework (NPPF) (**Ref. 10.3**) and Planning Practice Guidance (PPG) (**Ref. 10.4**). A summary of the key findings is presented within this assessment to assess compliance against the WFD objectives.

1.1.4. The results of the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10 (HD 45/09) (**Ref. 10.5**) Method A and Method D assessments are discussed within this report to assess compliance against the WFD objectives. The full assessment is provided in **Appendix 10.3: Drainage Network Water Quality Assessment** of this ES.

1.2 SCHEME DESCRIPTION

1.2.1. Part B is located within the County of Northumberland and forms part of the 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. A more detailed description of the Scheme is found in **Chapter 2: The Scheme**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). The **General Arrangement Plans** (**Application Document Reference: TR010041/APP/2.4**) show the Scheme layout.

1.2.2. Part B also includes three construction compounds. The **Location Plan** (**Application Document Reference: TR010041/APP/2.1**) shows the location of the Charlton Mires Site Compound close to the Part B Main Scheme Area, the Main Compound to the south-west of Felton and the Lionheart Enterprise Park Compound south of Alnwick.

1.2.3. With specific regard to the water environment, Part B includes the following works from south to north as set out in **Figure 1-1** below (the numbers in brackets at the end relate to the approximate location of the works as this is the number shown in **Figure 1-1**):

a. There are no proposed works to the existing culvert Denwick Burn (Proposed culvert 17.1) at chainage 53470 as the existing culvert is of sufficient length (1).
b. There are no proposed works to the existing culvert Denwick Burn (Proposed culvert 18.1) at chainage 53850 as the existing culvert is of sufficient length (2).
c. The extension of the existing culvert Denwick Burn (Proposed culvert 19.1) at chainage 54080 (3).
d. The extension of the existing culvert Denwick Burn (Proposed culvert 21.1) at chainage 54600 (4).
e. The replacement of the existing culvert at Heckley Fence (Proposed culvert 22.1) at chainage 55300. The small drainage ditch upstream of the culvert would be realigned to discharge into the new culvert (5).
f. The extension of the existing culvert White House Burn (Proposed culvert 23.1) at chainage 56920 (6).
g. The extension of the existing culvert Kittycarter Burn (Proposed culvert 24.2) at chainage 58600 (7).
h. The removal of the existing culvert along the southern tributary of Kittycarter Burn and the construction of a new circular culvert (Proposed culvert 25.1) underneath the B6347 at chainage 58840 (8).
i. The diversion and channel realignment of the southern tributary of Kittycarter Burn to reduce the length of culvert required (9).
j. The extension of the existing Linkhall Culvert (Proposed culvert 26.1) along the western tributary of Kittycarter Burn at chainage 59275 (10).
k. The extension of the existing culvert Shipperton Burn (Proposed culvert 27.1) at chainage 60385 (11).
l. The demolition of the existing culvert along the unnamed tributary of Embleton Burn and the construction of a new circular culvert called Rock Culvert (Proposed culvert 28.1) at chainage 58100 (12).
m. Installation of new drainage infrastructure to accommodate increased runoff rates and volume from the increase in impermeable area and construction of runoff detention basins to manage surface water flow from the drainage network.

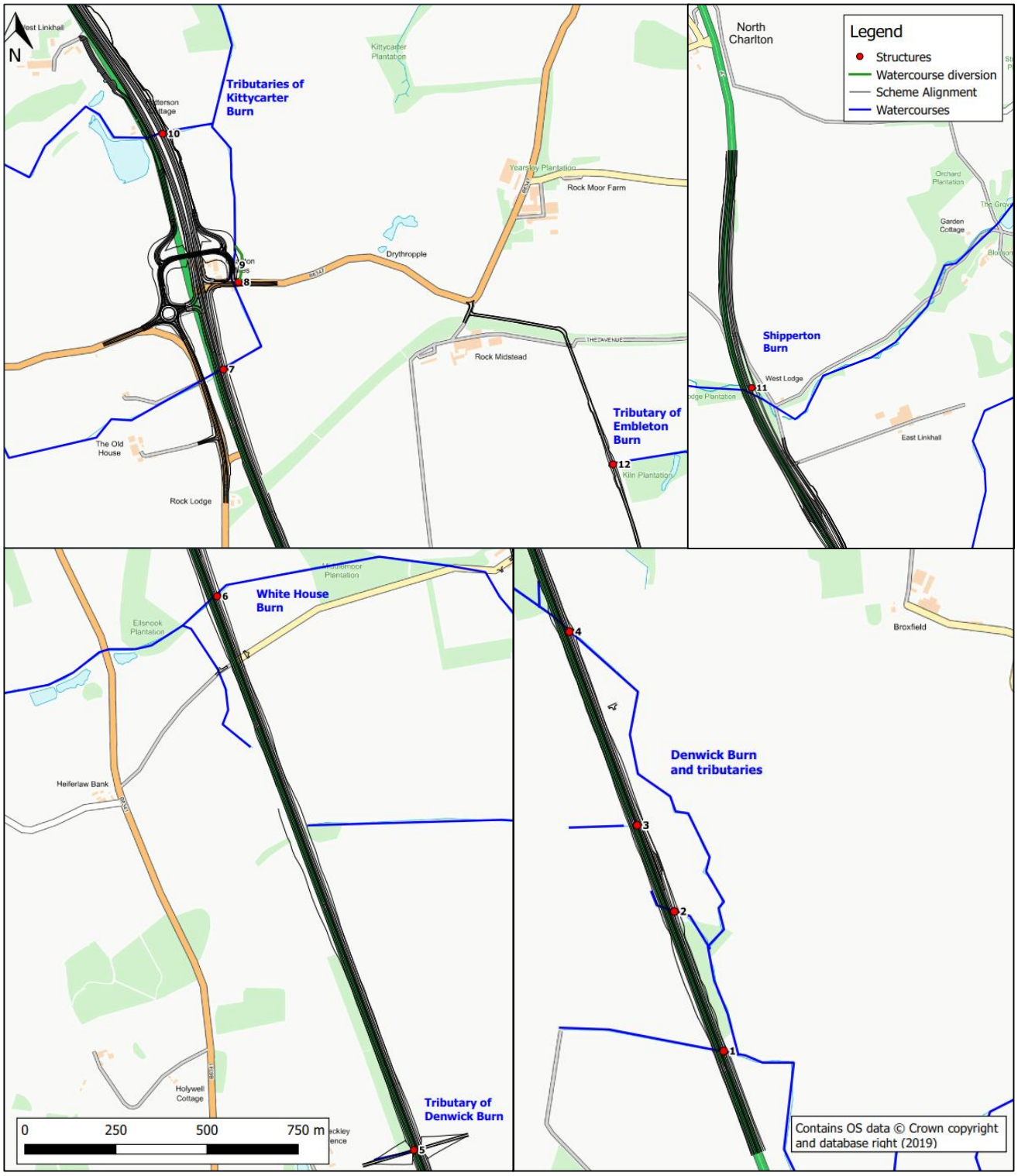

Figure 1-1 - Part B Extent and Proposed Works with regards to the Water Environment

1.3 STUDY AREA

1.3.1. The Study Area encompasses the area within which works have the potential to affect the WFD status or the ability to achieve the WFD objectives of waterbodies. The Study Area encompasses surface water features up to 0.5 km from the Order Limits of Part B. Based on professional judgement using knowledge and experience of similar schemes and current knowledge of the area this distance is considered appropriate for the assessment of direct effects (i.e. associated with overland migration of pollutants directly to surface features, pollutants conveyed in drainage systems, and works within a river channel) due to the relatively flat and vegetated topography, vegetation removing sediment pollutants and upper soil filtration.

1.3.2. Surface water features that have hydraulic connectivity with Part B have also been assessed. This includes watercourses and other water environment receptors that are located downstream of Part B, and that could be affected by pollutants conveyed by watercourses. A 1 km study area is typical for the assessment of water environment features; however, this has been refined based on the sensitivity of downstream receptors and the likelihood of these being affected by the proposed works.

1.3.3. The Study Area encompasses groundwater features and groundwater abstractions up to 1 km from the Order Limits of Part B. This distance is appropriate for the assessment of surface-borne pollutants migrating to groundwater features as there are unlikely to be any significant impacts beyond this distance due to underlying geology and the majority of the underlying soils being slowly permeable, loamy and clayey soils.

1.4 LEGISLATIVE FRAMEWORK AND GUIDANCE

1.4.1. The coordination of policies for the water environment is managed by the UK Government. Many flood risk and water quality requirements are set at European level, which are then transposed into UK law.

EUROPEAN LEGISLATION

Water Framework Directive (2000/60/EC)

1.4.2. The overall objective of the WFD (**Ref. 10.1**) (together with its daughter directive, the Groundwater Directive (2006/118/EC) (**Ref. 10.6**)) is to bring about the effective co-ordination of water environment policy and regulation across Europe. The main aims of the legislation are to ensure that all surface water and groundwater reaches ‘Good’ status (in terms of ecological and chemical quality and water quantity, as appropriate), promote sustainable water use, reduce pollution and contribute to the mitigation of flood and droughts. Specifically, each European country has to ensure the following:

a. Prevent deterioration in the status of aquatic ecosystems, protect them and improve the ecological condition of waters.

b. Aim to achieve at least 'Good' status for all water bodies by 2015. Where this is not possible and subject to the criteria set out in the Directive, aim to achieve 'Good' status by 2021 or 2027.
c. Meet the requirements of WFD Protected Areas.
d. Promote sustainable use of water as a natural resource.
e. Conserve habitats and species that depend directly on water.
f. Progressively reduce or phase out the release of individual pollutants or groups of pollutants that present a significant threat to the aquatic environment. The WFD (**Ref. 10.1**) includes a 'List of Priority Substances'. Various substances are listed as either List I or List II substances, with List I substances considered the most harmful to human health and the aquatic environment. The purpose of the directive is to eliminate pollution from List I substances and reduce pollution from List II substances.
g. Progressively reduce the pollution of groundwater and prevent or limit the entry of pollutants.
h. Contribute to mitigating the effects of floods and droughts.

Determination of 'Good Status'

1.4.3. Under the WFD (**Ref. 10.1**), surface water bodies are classified in accordance with their ecological (quality) status and chemical (quality) status, which are combined to provide an overall status. The chemical status is based on assessment against the defined list of priority substances and EU dangerous substances, and the ecological status is assessed considering the quality of the supporting elements including biological, general chemical, physico-chemical, and hydromorphological elements.

1.4.4. For surface waters, the 'Good' status is determined from the combined ecological and chemical status of surface waters. Ecological status is determined from a number of individual quality elements, as follows:

a. Biological quality elements (e.g. fish, benthic invertebrates, aquatic flora).
b. Supporting hydromorphological quality elements (e.g. flow regime, river continuity and substrate of the river bed).
c. Supporting physical-chemical quality elements (e.g. temperature, oxygenation and nutrient conditions).

1.4.5. The chemical quality refers to environmental quality standards for river basin specific pollutants and the priority substances specified under the WFD (**Ref. 10.1**). These standards specify maximum concentrations for specific water pollutants. The WFD (**Ref. 10.1**) works on a 'one out, all out' basis, so if one such concentration is exceeded, then the water body would not be classed as having a 'Good' status. The chemical status of surface waters is therefore classified as 'Good' or 'Fail'.

1.4.6. The ecological status of surface waters is classified as being 'High', 'Good', 'Moderate', 'Poor' or 'Bad'. Water bodies that have been modified (e.g. canals or which contain significant flood defences) are classed as 'Heavily Modified Water bodies' (HMWB) and have to reach at least 'Good ecological potential' by their objective year. **Figure 1-2** below is extracted from the Classification Method Statement (**Ref. 10.7**) and illustrates the classification approach for surface water features.

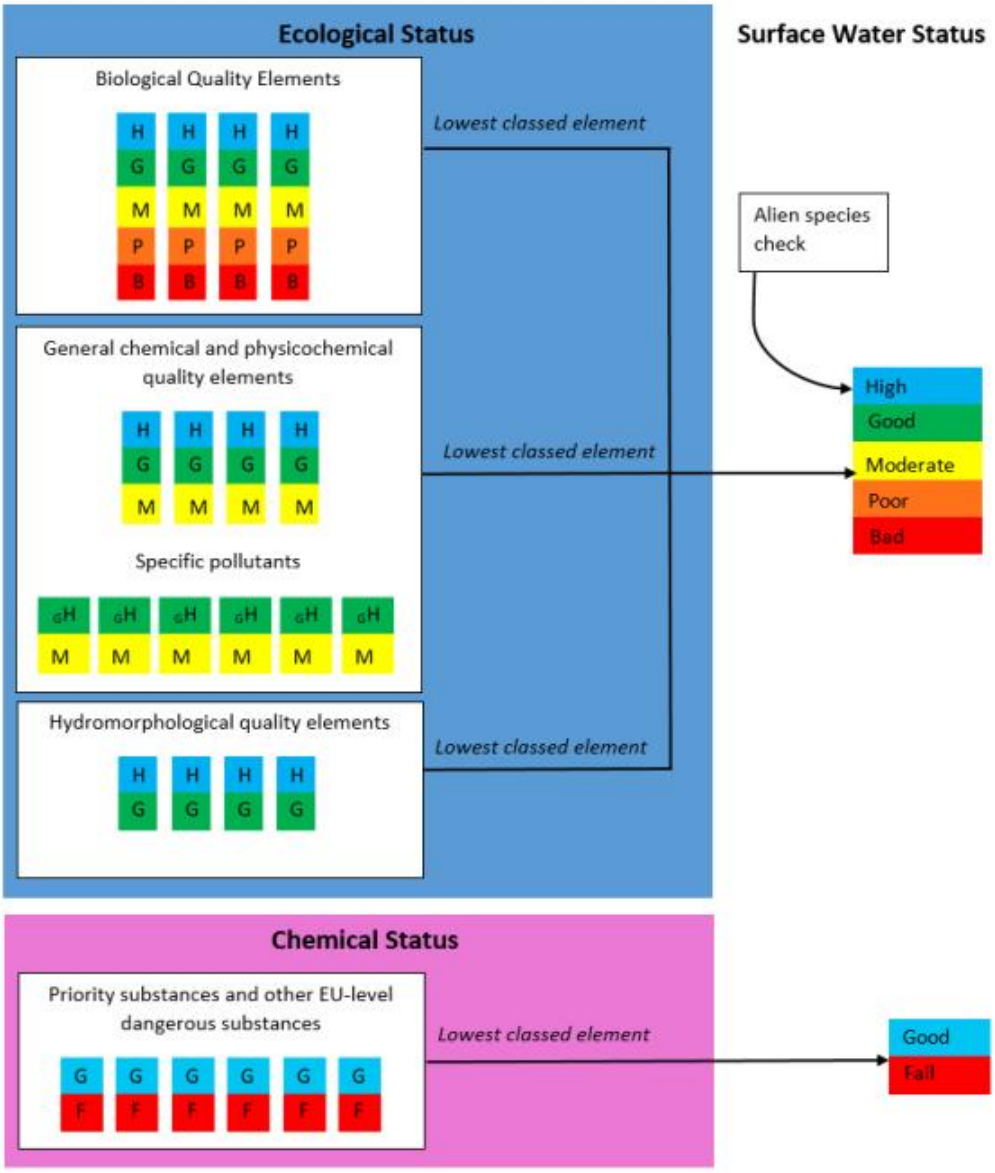

Figure 1-2 - WFD Surface Waterbody Classifications

1.4.7. Under the WFD (**Ref. 10.1**), groundwater bodies are classified in accordance with their quantity (quality) status and chemical (quality) status, which are combined to provide an overall status. The quantity status considers elements such as impacts of saline intrusion, ability to serve ground and surface water abstractions, and ability to support dependent ecosystems. The chemical status is based on assessment against the defined list of priority substances and EU dangerous substances. **Figure 1-3** below is extracted from the Classification Method Statement (**Ref. 10.7**) and illustrates the classification approach for groundwater bodies.

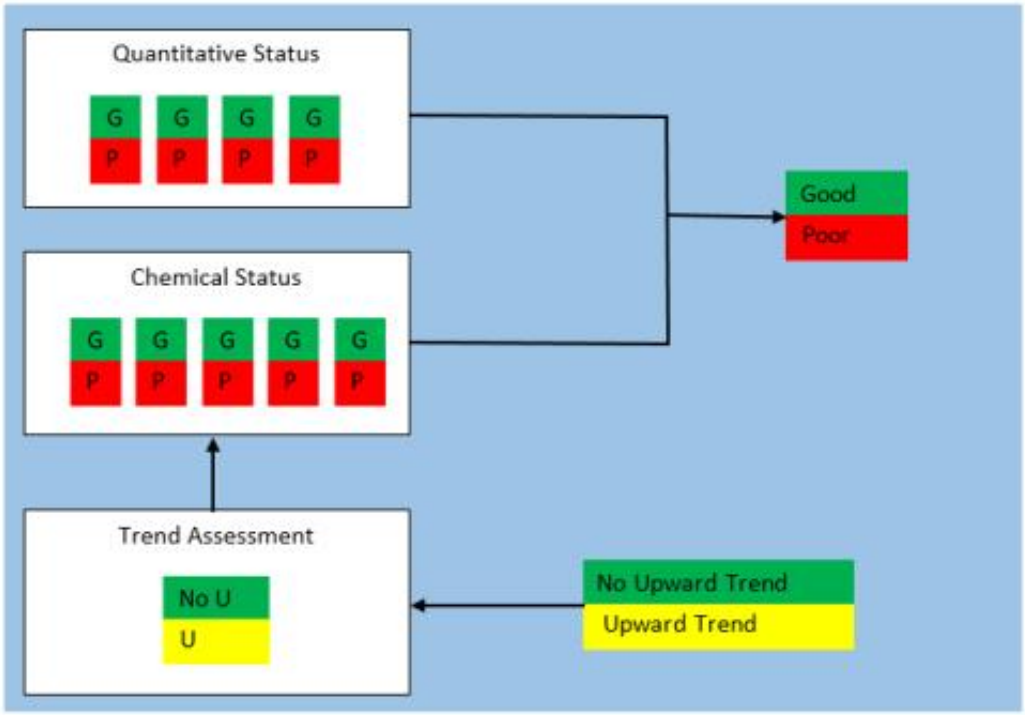

Figure 1-3 - WFD Groundwater Classification

1.4.8. The WFD (**Ref. 10.1**) also contains provisions for controlling discharges of dangerous substances to surface waters and groundwater and includes a 'List of Priority Substances'. Various substances are listed as either List I or List II substances, with List I substances considered the most harmful to human health and the aquatic environment. The purpose of the Directive is to eliminate pollution from List I substances and reduce pollution from List II substances.

1.4.9. The WFD (**Ref. 10.1**) is transposed into law in England and Wales by The Water Environment (Water Framework Directive) (England and Wales) Regulations 2017 (the 2017 Regulations) (**Ref. 10.8**). The 2017 Regulations (**Ref. 10.8**) revoke and replace The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (subject to transitional provisions in article 38 of the 2017 Regulations).

Article 4.7

1.4.10. Article 4.7 of the WFD (**Ref. 10.1**) sets out reasons why physical modifications or activities may be allowed to cause deterioration in quality status or prevent 'Good' status being achieved (for example, where activities are in the overriding public interest). If a project or activity is predicted to cause deterioration in water body status or prevent the water body from meeting any of its objectives, then assessment is required against the conditions listed in WFD Article 4.7, all of which must be met for Part B to proceed without contravening the

WFD (**Ref. 10.1**). The impact of Part B or activity on other water bodies within the River Basin District (RBD) must also be considered (Article 4.8) and protection given by existing Community Legislation to any Protected Areas must also be maintained (Article 4.9).

Water Framework Directive Assessments

1.4.11. WFD Assessments are undertaken to demonstrate that proposed works (at strategy level, detailed design or implementation stage) may be undertaken without impacting the status of water bodies or preventing future works to enable the water bodies to achieve 'Good' status or potential.

1.4.12. Determination of WFD compliance comprises a series of steps intended to establish the potential impacts of the proposed works, at an appropriate level of detail, and then to examine whether the identified impacts contravene the conditions of the WFD (**Ref. 10.1**).

1.4.13. The following assessment objectives (derived from the Environmental Objectives of the Directive) are used to determine whether the planned development, in and around the water environment, which is affected by the planned development, comply with the overarching objectives of the WFD (**Ref. 10.1**):

a. **Objective 1:** To prevent deterioration in the ecological status of the water body.
b. **Objective 2:** To prevent the introduction of impediments to the attainment of 'Good' WFD status for the water body.
c. **Objective 3:** To ensure that the attainment of the WFD objectives for the water body are not compromised.
d. **Objective 4:** To ensure the achievement of the WFD objectives in other water bodies within the same catchment are not permanently excluded or compromised.

1.4.14. The assessment process is as follows:

a. Screening of the preferred option against the ecological, chemical and quantitative status objectives and elements to determine if the project has any impact on the criteria identified for any water bodies.
b. Detailed assessment for those criteria where a potential adverse effect has been identified to determine the effects on quality elements.
c. Identified impacts are then considered in relation to the ecological and supporting chemical and hydromorphological status objectives.
d. For HMWBs, the preferred option is then also assessed against their relevant mitigation measures.
e. Article 4.7 test: if the preferred option is predicted to cause deterioration in water body status or prevent the water body from meeting any of its objectives, then assessment is required against the conditions listed in WFD Article 4.7, all of which must be met for the preferred option to proceed without contravening the WFD (**Ref. 10.1**). The impact of the preferred option on other water bodies within the RBD must also be considered (Article 4.8) and protection given by existing Community legislation to any Protected Areas must also be maintained (Article 4.9).

Groundwater Directive (2006/118/EC)

1.4.15. This Groundwater Directive (**Ref. 10.6**) aims to set groundwater quality standards and introduce measures to prevent or limit pollution of groundwater, including those listed with the 'List of Priority Substances'. The Directive has been developed in response to the requirements of Article 17 of the WFD (**Ref. 10.1**), specifically the assessment of chemical status of groundwater and objectives to achieve 'Good' status.

LOCAL POLICY

Northumbria River Basin Management Plan

1.4.16. The WFD (**Ref. 10.1**) introduced RBDs to better manage water bodies without administrative and political boundaries. Each river basin is managed to achieve the objectives of the WFD through the development River Basin Management Plans (RBMPs), which provide a clear indication of the way the objectives set for the river basin are to be reached within the required timescale and set out a programme of measures. All watercourses along Part B are located within the Northumbria RBD (**Ref. 10.9**).

THE PLANNING INSPECTORATE ADVICE NOTE

Advice Note Eighteen: The Water Framework Directive

1.4.17. The Planning Inspectorate published Advice Note Eighteen: The Water Framework Directive (**Ref. 10.10**) in 2017. The note outlines the different roles of applicants, statutory authorities and the Secretary of State in meeting the requirements of the WFD specifically related to nationally significant projects. The note also sets out the WFD overview matrices that have been prepared by the Planning Inspectorate.

2 ASSESSMENT METHODOLOGY

2.1 OVERVIEW

2.1.1. In brief, the methodology used for this WFD assessment comprises:

a. Site visits completed for the Part B Main Scheme Area on 13 and 14 February 2019.
b. Review of available relevant baseline information and consultation with the Environment Agency to confirm status of the surface water features and groundwater resources within the Study Area and agree principles for the mitigation measures.
c. Review of the proposed works and the potential impacts to the identified surface and groundwater features, i.e. impacts that could reduce the WFD status of the feature and affect the ability of the waterbodies to meet the objectives of the WFD (**Ref. 10.1**) (discussed in greater detail below).

2.2 WATER FRAMEWORK DIRECTIVE ASSESSMENT METHODOLOGY

2.2.1. Determination of WFD compliance for Part B comprises a series of steps intended to establish the potential impacts of the proposed works at an appropriate level of detail using available information, and then to examine whether the identified impacts contravene the objectives of the WFD (**Ref. 10.1**).

2.2.2. The general assessment process is as follows:

a. Identify WFD water bodies in the Study Area with potential to be affected by Part B.
b. Obtain information to identify the current status and objectives for the water bodies, important features such as linked protected areas and relevant habitats, and improvement measures set out in the RBMP.
c. Identify the aspects of Part B with potential to affect WFD water bodies, mitigation included in Part B proposals and consideration of further mitigation where necessary.
d. For those criteria where a potential adverse effect has been identified, assessment of Part B (including relevant mitigation) against the individual quality elements to determine if these effects are sufficient to cause a deterioration in the quality status of each element.
e. Assessment of Part B (including relevant mitigation) to determine if Part B would impact upon the proposed mitigation measures and objectives for the water bodies and objectives for individual quality elements.
f. Assessment of Part B against the wider catchment objectives and aims of the WFD (**Ref. 10.1**).
g. Where applicable, application of the Article 4.7 test.

2.2.3. This assessment is a qualitative assessment of potential impacts of Part B against WFD quality elements and measures.

2.3 DATA SOURCES

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

a. Environment Agency's groundwater data available on MAGIC online mapping (accessed January 2019) (**Ref. 10.11**).
b. Environment Agency's Catchment Data Explorer (accessed July 2018) (**Ref. 10.12**).
c. Northumbria River Basin Management Plan (dated December 2015) (**Ref. 10.9**).
d. Observations made from site walkover (February 2019).
e. **Ground Investigation Report** (2019) (**Appendix 11.3** of this ES).
f. **Aquatic Ecology Assessment Report** (2019) (**Appendix 9.10** of this ES).
g. **Otter and Water Vole Report** (2019) (**Appendix 9.3** of this ES).
h. British Geological Survey (BGS) Geology of Britain viewer (accessed January 2019) (**Ref. 10.13**).
i. BGS Geoindex online dataset (accessed January 2019) (**Ref. 10.14**).
j. Cranfield University's Soilscapes (accessed January 2019) (**Ref. 10.15**).
k. Historical maps (accessed January 2019) (**Ref. 10.16**).
l. Aerial imagery (Google Earth) (accessed January 2019).
m. Ordnance Survey (OS) mapping.
n. MAGIC online mapping (accessed January 2019) (**Ref. 10.11**).

2.3.2. The **Aquatic Ecology Assessment Report** (**Appendix 9.10** of this ES) and the **Otter and Water Vole Report** (**Appendix 9.3** of this ES) were 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 3** of this ES (**Application Document Reference: TR010041/APP/6.3**).

2.4 CONSULTATION

2.4.1. Consultation has been undertaken with the following authorities:

a. Meeting held with the Environment Agency in November 2018 to discuss stakeholder requirements and review the available WFD information and agree (in principle) the methodology, appropriate mitigation and management options during the construction and operation stages.
b. Two teleconferences held with Northumberland County Council (NCC) as the Lead Local Flood Authority (LLFA) in May 2019 to discuss the results of the hydraulic modelling undertaken for the tributaries of the Kittycarter Burn and to review Part B proposals and proposed mitigation.

2.4.2. The meeting minutes have been included in **Appendix 4.2: Environmental Consultation**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**).

2.5 POTENTIAL IMPACTS

2.5.1. A review of the proposed works and the potential impacts to the identified surface and groundwater bodies has been undertaken by identifying the impacts that could reduce the WFD status or affect the ability of the water bodies to meet the objectives of the WFD (**Ref. 10.1**).

2.5.2. The following factors have been considered when determining whether the potential adverse effects of Part B are likely to lead to a deterioration in status or prevent objectives being met:

a. Whether the impact is temporary (such as short-term construction impacts) or permanent and long term.
b. The characteristics and sensitivity of the specific water features affected by Part B (which may be different to the designated WFD water body).
c. The scale and importance of the specific water features affected by Part B to the designated WFD water body.
d. The nature, scale and extent of potential impact in the context of the existing pressures and proposed measures for the water body.

3 ASSESSMENT OVERVIEW

3.1 SITE DESCRIPTION

3.1.1. Land surrounding Part B generally consists of woodland and agricultural land. The most notable urban areas surrounding Part B are the town of Alnwick to the south-west, the village of Denwick to the south and the village of North Charlton to the north.

3.1.2. There are three compounds. The Charlton Mires Site Compound is close to the Part B Main Scheme Area. The Main Compound is located approximately 16.4 km to the south of the Part B Main Scheme Area and is to the south of Felton. The Lionheart Enterprise Park Compound is located approximately 4 km to the south of the Part B Main Scheme Area, just to the south of Alnwick.

3.1.3. A detailed description of the surrounding areas to each watercourse is provided in more detail below within **Sections 4 to 8** of this report.

3.2 EXISTING SURFACE WATER FEATURES

3.2.1. The Part B alignment crosses nine watercourses or tributaries which are listed below from south to north:

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

3.2.2. The watercourses listed above are located across three WFD catchments as listed below:

a. Aln from Edlingham Burn to Tidal Limit
b. Embleton Burn from Source to North Sea
c. Brunton Burn from Source to North Sea

3.2.3. The location of these catchments in relation to Part B is shown in **Figure 3-1** below.

3.2.4. The summary of baseline information and Part B design is organised as a separate section of this report for each watercourse. This is due to the extent of Part B and the number of watercourses and associated tributaries that are crossed by Part B.

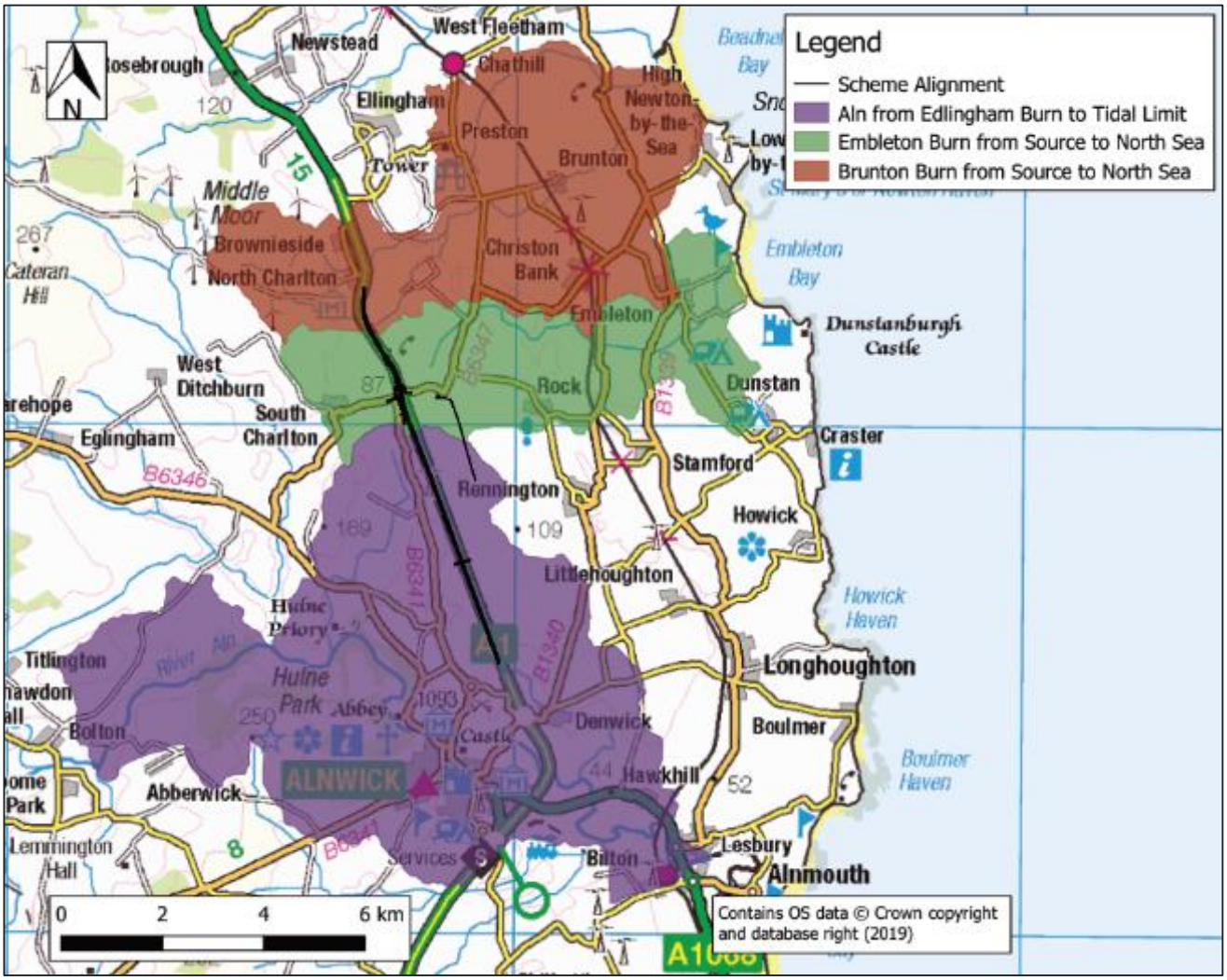

Figure 3-1 - WFD Catchments

3.2.5. Potential impacts associated with both the construction and operation stages of Part B for all watercourses are discussed in **Section 10** of this report. A combined assessment for all the watercourses has been undertaken due to the similar nature of these watercourses.

4 DENWICK BURN

4.1 BASELINE CONDITIONS

CATCHMENT OVERVIEW

4.1.1. 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. It has an approximate catchment area of 3.8 km² and consists primarily of agricultural land. Denwick Burn and its tributaries flow in a north to south-east direction underneath the existing A1 alignment at four locations to the north of the village of Denwick. Denwick Burn discharges into the River Aln approximately 4.4 km downstream from Part B. The watercourse is classified as an ordinary watercourse under the jurisdiction of NCC as LLFA.

4.1.2. The estimated Q95 for Denwick Burn at the location of Part B proposals range from 0.00266 to 0.00349 m³/s. Q95 is defined as the flow equalled or exceeded for 95% of the flow record and is a low flow parameter. The estimated Qmed for Denwick Burn at the location of Part B proposals is 2.08 m³/s. Qmed is defined as the median annual flow rate for the 1 in 2 year flood event.

Historical Channel Changes

4.1.3. Analysis of historical maps (**Ref. 10.16**) dating back to the 1860s indicates that the alignment of Denwick Burn has not altered to the present day. The watercourse appears to have been realigned along field boundaries pre-dating the historical mapping.

Contemporary Channel Characteristics

4.1.4. During the site walkover it was noted that the river bed comprised silt and gravel materials. Denwick Burn and its tributaries flow through a number of crossings underneath the A1, farm access tracks and a Public Right of Way (PRoW), as labelled in **Figure 4-1** below. During the site walkover it was noted that downstream of the watercourse crossing there were erosion protection measures in place.

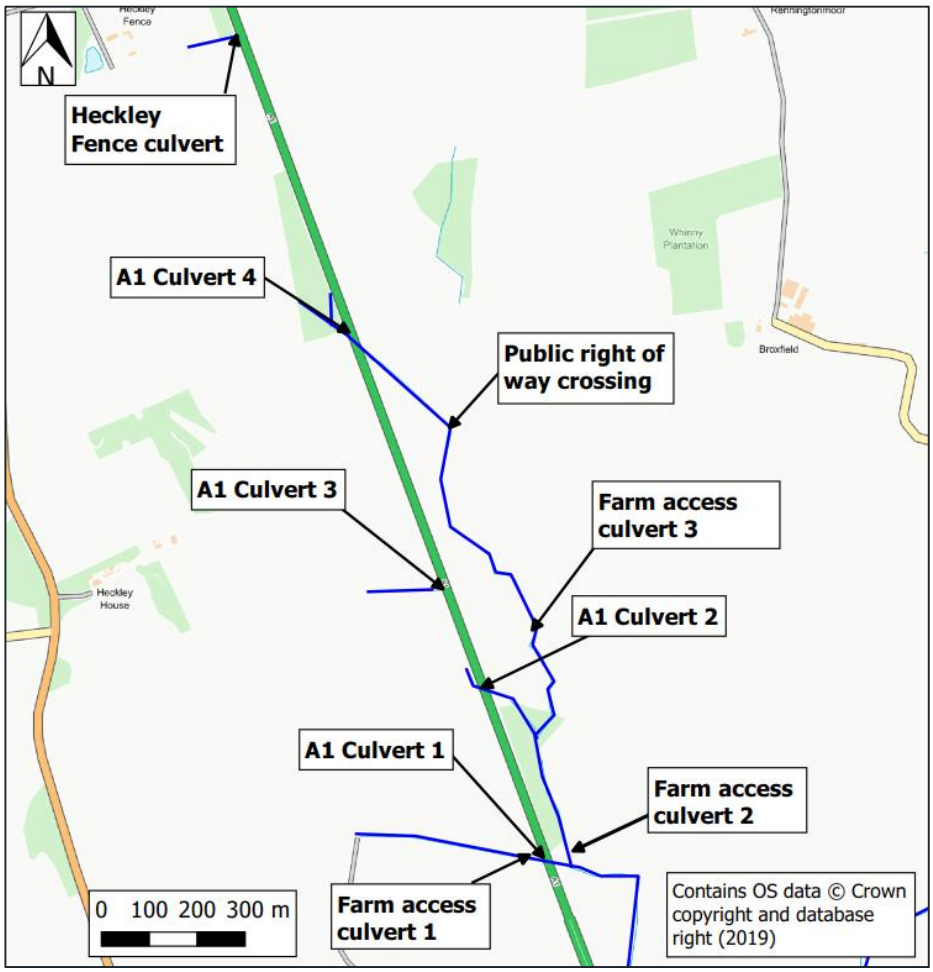

Figure 4-1 - Location of Denwick Burn and Tributaries Culverts

4.1.5. A detailed description of these crossings (from north to south) is provided below.

4.1.6. A small field ditch at Heckley Fence flows adjacent to the A1 and flows into a 36 m long circular culvert with a diameter of 300 mm as shown in **Figure 4-2** below. The culvert then discharges into another culvert which runs parallel to the A1 for approximately 580 m to the south and discharges into the Denwick Burn.

4.1.7. During the site walkover a small inlet on the eastern side of the A1 was observed in line with the Heckley Fence culvert. It is assumed that this collects surface water runoff from fields to the east of the A1 and connects into the Heckley Fence culvert as no separate ditch or watercourse was observed during the walkover.

Figure 4-2 - Heckley Fence Culvert Inlet

4.1.8. Denwick Burn flows underneath the A1 through culvert four as labelled in **Figure 4-1**. **Figures 4-3** and **4-4** show the inlet and outlet of the structure. The circular culvert has a diameter of approximately 1.2 m and is approximately 72.3 m in length.

Figure 4-3 - Denwick Burn A1 Culvert Four Inlet

Figure 4-4 - Denwick Burn A1 Culvert Four Outlet

4.1.9. Approximately 230 m downstream of culvert four, Denwick Burn flows beneath a PRoW through a bridge as shown in **Figure 4-5** below. The watercourse crossing is approximately 700 mm in width and approximately 895 mm in height. The bridge is approximately 4.5 m in length. During the site walkover it was noted that downstream of the crossing the channel banks were concrete walls for approximately 20 m.

Figure 4-5 - Public Right of Way Denwick Burn Crossing

4.1.10. Approximately 500 m downstream of the PRoW bridge Denwick Burn flows beneath a farm access track, labelled as farm access culvert three in **Figure 4-1**. **Figure 4- 6** below shows the inlet of the concrete circular pipe concrete which is approximately 600 mm in diameter and 10 m in length.

Figure 4-6 - Farm Access Denwick Burn Crossing Three

4.1.11. Another tributary of Denwick Burn flows beneath the A1 through a concrete circular pipe labelled as A1 culvert three in **Figure 4-1**. The culvert has an approximate diameter of 600

mm and is approximately 21.25 m in length and is shown in **Figure 4-7** below. At the outlet of the culvert there is approximately 2 m of open channel before the watercourse enters another culvert. It is assumed that the watercourse discharges into Denwick Burn to the south-east of the A1, however during the site walkover the outlet of the downstream culvert was not identified.

Figure 4-7 - Denwick Burn A1 Culvert Three Inlet

4.1.12. A tributary of Denwick Burn flows beneath the A1 labelled as culvert two in **Figure 4-1**. The culvert, shown in **Figure 4-8** below, is circular with a diameter of approximately 300 mm and is approximately 86.9 m in length. The tributary discharges into Denwick Burn approximately 100 m downstream from the watercourse crossing.

Figure 4-8 - Denwick Burn A1 Culvert Two Inlet

4.1.13. Denwick Burn flows beneath a farm access track, labelled farm access culvert two in **Figure 4-1** and as shown in **Figures 4-9** and **4-10** below. **Figure 4-9** shows the inlet of the culvert which is located underneath a footbridge and **Figure 4-10** shows the outlet of the culvert. The circular concrete culvert is approximately 61.17 m on length and has a diameter of approximately 600 mm.

Figure 4-9 – Farm Access Culvert Two Inlet

Figure 4-10 – Farm Access Culvert Two Outlet

4.1.14. The most southern tributary of Denwick Burn within the Study Area flows beneath the A1 through a circular culvert labelled as culvert one in **Figure 4-1**. The inlet of the culvert is shown in **Figure 4-11** below. The culvert has a diameter of approximately 500 mm and is

approximately 49.59 m in length. Immediately upstream of the A1 culvert the tributary flows beneath a farm access track as shown in **Figure 4-12** below. The crossing consists of twin 150 mm pipes and is approximately 20 m in length. The outlet of culvert one discharges into the Denwick Burn at the same location as the farm access culvert two.

Figure 4-11 – Denwick Burn A1 culvert One inlet

Figure 4-12 – Farm Access Culvert One Inlet

4.1.15. No fish surveys have been undertaken along Denwick Burn and its tributaries as the aquatic walkover survey undertaken by Part B ecologists did not identify the watercourses to have the potential to support any legally protected or notable aquatic species (**Appendix 9.10: Aquatic Ecology Assessment Report** of this ES). No evidence of otters was identified during the mammal surveys (refer to **Appendix 9.3: Otter and Water Vole Report** of this ES).

4.1.16. Denwick Burn and its tributaries are not monitored directly against the objectives of the WFD (**Ref. 10.1**) but are located within the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'. The catchment has been assessed as having a hydromorphological designation of 'not designated artificial or heavily modified'. **Tables 4-1** and **4-2** below present the ecological and chemical classifications ranging from 2013 to 2016 for the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment, as classified by the Environment Agency.

Table 4-1 – Ecological Classifications for Aln from Edlingham Burn to Tidal Limit

	2013	2014	2015	2016
Overall	Good	Poor	Poor	Poor
Ecological	Good	Poor	Poor	Poor
Biological quality elements	Good	Poor	Poor	Poor
Hydromorphological supporting elements	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical quality elements	Good	Good	Good	High
Specific pollutants	High	High	-	-

Table 4-2 – Chemical Classifications for Aln from Edlingham Burn to Tidal Limit

	2013	2014	2015	2016
Overall	Good	Poor	Poor	Poor
Chemical	Good	Good	Good	Good
Priority substances	Good	Good	-	-
Other pollutants	-	-	-	-
Priority hazardous substances	Good	Good	-	-

4.1.17. The Environment Agency's Catchment Data Explorer (**Ref. 10.12**) for the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment identifies the reason for not achieving 'Good' overall status as sewage discharge, poor nutrient management and riparian and in-river activities (including bankside erosion).

4.1.18. **Table 4-3** below shows the current status for each element and the status objectives for the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment.

Table 4-3 – Status Objectives for Aln from Edlingham Burn to Tidal Limit

Element	Current Status	Status Objective
Ecological		
Biological	Poor	Good by 2027
Hydromorphology	Supports Good	Supports Good
Physico-chemical / specific pollutants	High	Good
Chemical		
Priority substances	Good	Good

4.2 SCHEME DESIGN

4.2.1. No new culverts are proposed along Denwick Burn and its tributaries and all proposed works relate to the extension of existing culverts. The following section describes the proposed extended culverts to be provided as part of Part B. The numbers in the brackets below refer to the proposed culvert references (refer to the **General Arrangement Plans** (**Application Document Reference: TR010041/APP/2.4**)). **Figures 4-13** and **4-14** below shows the alignment of Part B and proposed culvert extensions along Denwick Burn and its tributaries. Existing A1 culverts one (proposed culvert 17.1) and two (proposed culvert 18.1) underneath the A1 alignment would be retained as part of Part B with no amendments made due to the sufficient length of the existing culverts. The existing three farm access culverts and the PRoW crossing would all be retained as part of Part B with no amendments made.

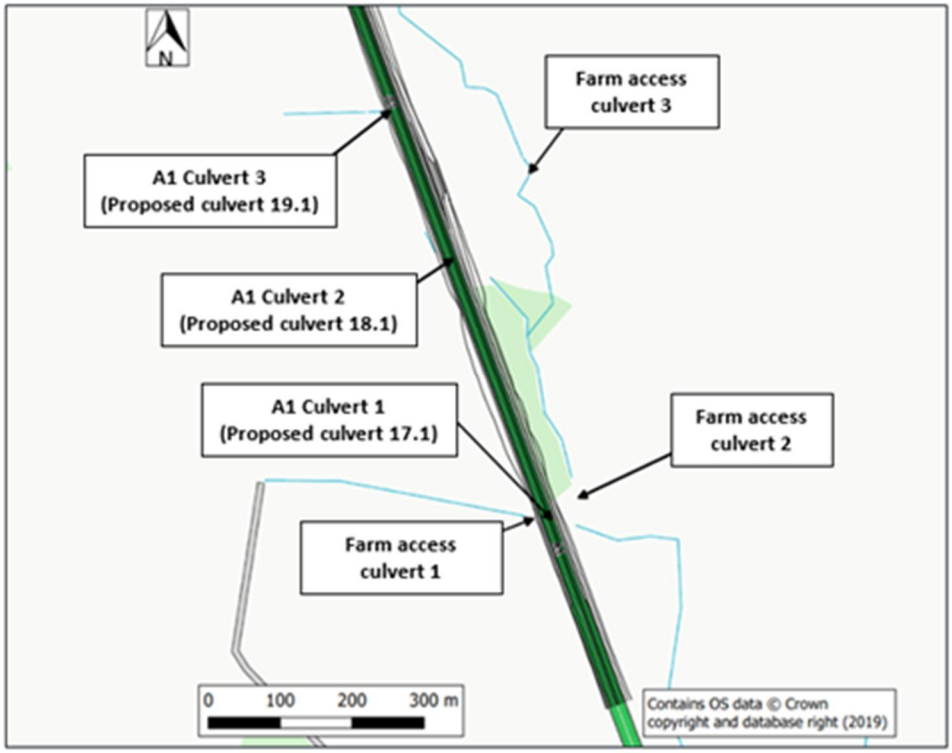

Figure 4-13 – Proposed Denwick Burn (South) Culverts

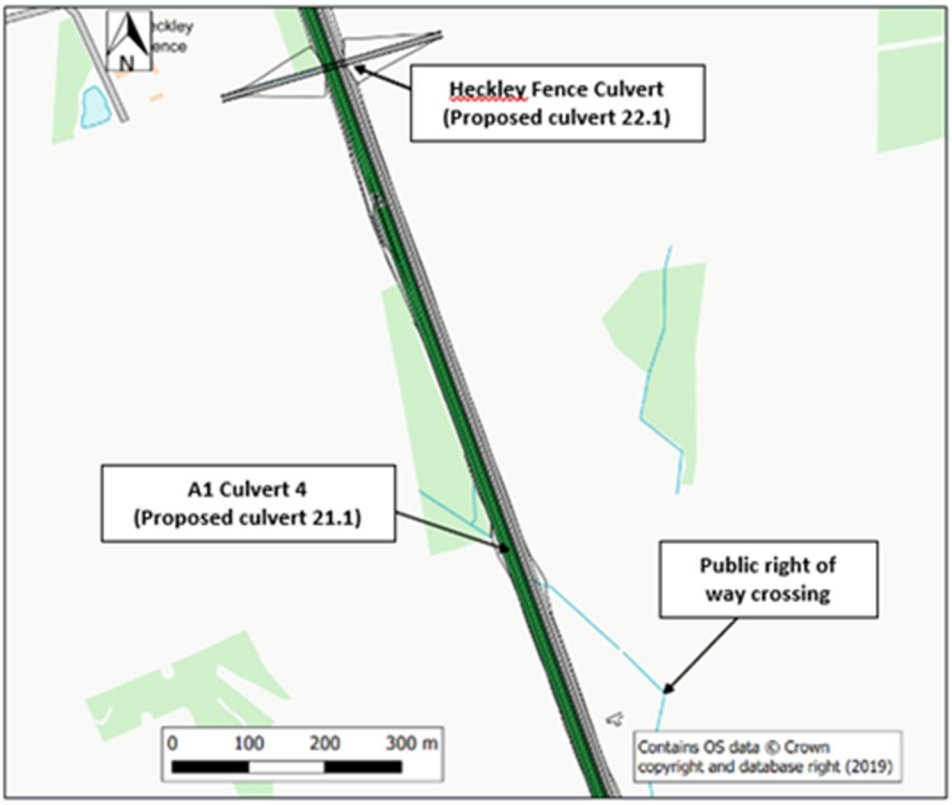

Figure 4-14 – Proposed Denwick Burn (North) Culverts

A1 Culvert 3 (Proposed Culvert 19.1)

4.2.2. The existing culvert (A1 culvert 3) located at chainage 54080 underneath the A1 alignment would be extended by 21.25 m with the total length of extended culvert 37.75 m. The extension would be a new 600 mm circular pipe, with a manhole located downstream to tie into the existing culvert. The culvert extension would be on the same alignment of the watercourse.

A1 Culvert 4 (Proposed Culvert 21.1)

4.2.3. The existing culvert (A1 culvert 4) located at chainage 54600 underneath the A1 alignment would be extended by 38 m with a new precast concrete 1.2 m pipe, and the construction of a new headwall and wing wall at the culvert outlet. The length of the extended culvert would be 110.3 m. The culvert extension would be on the same alignment of the watercourse.

Heckley Fence Culvert (Proposed Culvert 22.1)

4.2.4. The new overbridge at Heckley Fence would replace the existing culvert arrangement with a realigned watercourse channel immediately to the north of the proposed earthworks for the overbridge. The new alignment would tie into the extended culvert. Pipe sizes and inlets would match the existing culvert and is assumed to be a 300 mm circular pipe that would be approximately 43.75 m in length.

Culvert Summary

4.2.5. **Table 4-4** below provides a summary of the existing and proposed culvert dimensions along Denwick Burn and its tributaries.

Table 4-4 - Existing and proposed Denwick Burn culvert dimensions

Structure	Length (m)	Shape	Width (m)	Height (m)
Existing A1 culvert 1 (Proposed culvert 17.1)	49.95	Circular	0.5	-
Existing A1 culvert 2 (Proposed culvert 18.1)	89	Circular	0.3	-
Existing A1 culvert 3	21.25	Circular	0.6	-
Proposed A1 culvert 3 (Proposed culvert 19.1)	37.75	Circular	0.6	-
Existing A1 culvert 4	72.3	Circular	1.2	-
Proposed A1 culvert 4 (Proposed culvert 21.1)	110.3	Circular	1.2	-

Existing Heckley Fence culvert	36	Circular	0.3	-
Proposed Heckley Fence (Proposed culvert 22.1)	43.75	Circular	0.3	-

Surface Water Drainage

4.2.6. A detailed description of the surface water drainage strategy is provided in **Appendix 10.4: Drainage Strategy Report** of this ES. There are two new outfalls proposed to discharge into Denwick Burn (outfalls 22 and 23). **Table 4-5** below shows the different stages of treatment provided and the percentage of surface water runoff that would pass through each stage for each new outfall proposed.

Table 4-5 – Denwick Burn Proposed Surface Water Drainage System

Outfall Number	Stage	Proposed Attenuation and Treatment	Percentage of Surface Water Runoff Received
22	1	Filter drain located within the verge of the carriageway	98%
		Kerb and gully drainage	2%
	2	Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area.	100%
23	1	Filter drains located within the verge of the carriageway.	98%
		Kerb and gully drainage.	2%
	2	Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area.	100%

5 WHITE HOUSE BURN

5.1 BASELINE CONDITIONS

CATCHMENT OVERVIEW

5.1.1. 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 km². White House Burn flows in an east to south-west direction beneath the existing A1 alignment to the west of Rock South Farm. 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. White House Burn is classified as an ordinary watercourse under the jurisdiction of NCC as LLFA for this area.

5.1.2. The estimated Q95 for White House Burn at the location of Part B proposals is 0.00242 m³/s. Q95 is defined as the flow equalled or exceeded for 95 % of the flow record and is a low flow parameter. The estimated Qmed for White House Burn at the location of Part B proposals is 1.73 m³/s. Qmed is defined as the median annual flow rate for the 1 in 2 year flood event.

Historical Channel Changes

5.1.3. Analysis of historical maps (**Ref. 10.16**) dating back to the 1860s indicates that the alignment of White House Burn has not altered to the present day. The watercourse appears to have been realigned along field boundaries pre-dating the historical mapping.

Contemporary Channel Characteristics

5.1.4. During the site walkover it was noted the bed material consisted of silt and gravels. **Figure 5-1** below shows the location of the existing structures and watercourse crossings along White House Burn.

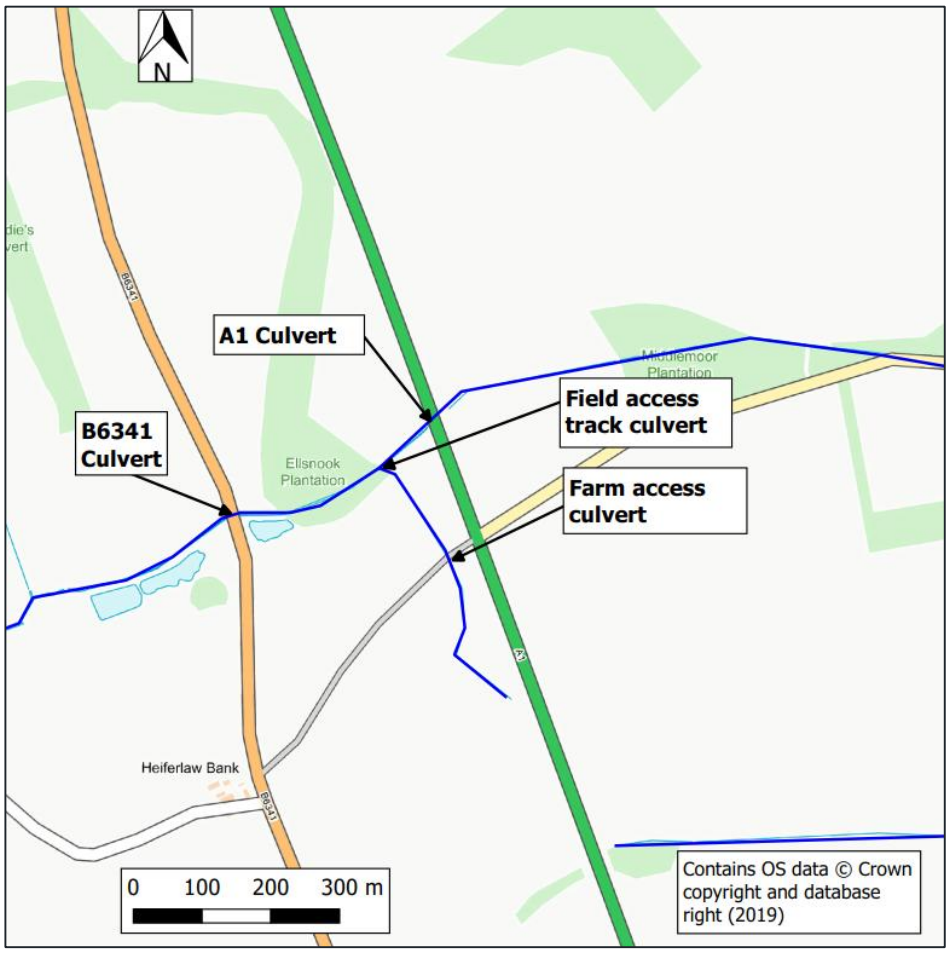

Figure 5-1 – White House Burn Existing Structures

5.1.1. **Figure 5-2** below shows White House Burn flowing beneath the A1 through an oversized concrete box culvert which is thought to also be used as a passage underneath the road for animals between fields. To prevent animals from entering the watercourse there is a fence running through the culvert as evident in the photograph. The culvert is approximately 3.25 m wide, 3.45 m high and approximately 21.9 m long.

5.1.2. White House Burn then flows through a concrete circular culvert underneath a field access track approximately 80 m downstream from the A1 watercourse crossing. **Figure 5-3** below shows the culvert underneath the field access track. The culvert has a diameter of approximately 1.5 m and is approximately 5.3 m in length.

Figure 5-2 – White House Burn A1 Culvert (Outlet)

Figure 5-3 – White House Burn Field Access Culvert (Outlet)

5.1.3. A small unnamed tributary of White House Burn flows in a south to north direction adjacent to the A1 and discharges into White House Burn immediately downstream of the field access culvert. Approximately 160 m upstream of where the tributary discharges into White House Burn the tributary flows underneath a farm access track through a culvert. A circular pipe discharges into a masonry box culvert as shown in **Figure 5-4** below. There are also a number of outfalls discharging into the culvert as can be seen in the photograph.

Figure 5-4 – Farm Access Track Culvert along Tributary of White House Burn (Outlet)

5.1.4. Approximately 315 m downstream from the A1 culvert, White House Burn flows underneath the B6341 through a concrete box culvert, as shown in **Figure 5-5** below.

Figure 5-5 – Culvert Underneath the B6341 (Inlet)

5.1.5. No fish surveys have been undertaken along White House Burn as the aquatic walkover survey undertaken by Part B ecologists did not identify the watercourses to have the potential to support any legally protected or notable aquatic species (refer to **Appendix 9.10: Aquatic Ecology Assessment Report** of this ES). No evidence of otters was identified during the mammal surveys (**Appendix 9.3: Otter and Water Vole Report** of this ES).

5.1.6. White House Burn is not monitored directly against the objectives of the WFD (**Ref. 10.1**) but is located within the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'. The catchment has been assessed as having a hydromorphological designation of 'not designated artificial or heavily modified'. **Tables 4-1** and **4-2** in **Section 4** of this report present the ecological and chemical classifications ranging from 2013 to 2016 for the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment, as classified by the Environment Agency. The Environment Agency's Catchment Data Explorer (**Ref. 10.12**) for the 'Aln from Edlingham Burn to Tidal Limit' WFD catchment identifies the reason for not achieving 'Good' overall status as sewage discharge, poor nutrient management and riparian and in-river activities (including bankside erosion).

5.2 SCHEME DESIGN

5.2.1. No new culverts are proposed along White House Burn and all proposed works relate to the extension of the existing culvert. The following section describes the proposed culvert extension to be provided as part of Part B. The number in the brackets below refer to the proposed culvert reference. Refer to the **General Arrangement Plans** (**Application**

Document Reference: TR010041/APP/2.4) as part of this ES. **Figure 5-6** below shows the location of the existing culvert to be extended underneath the A1 alignment. The existing farm access culverts and culvert beneath the B6341 would all be retained as part of Part B with no amendments made.

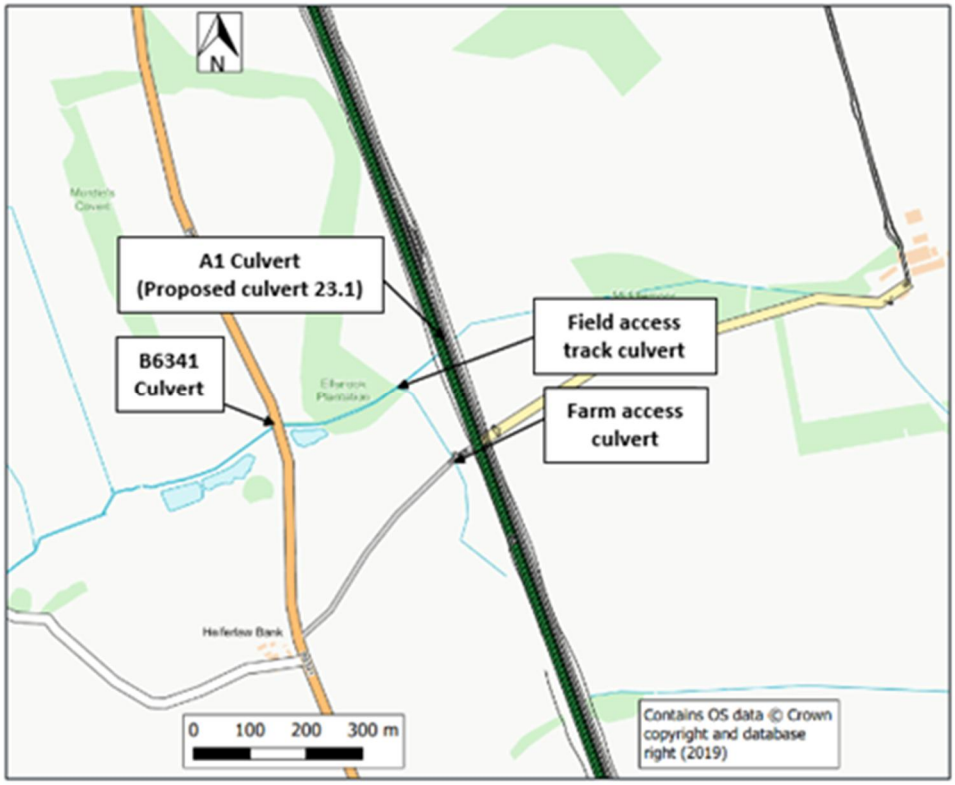

Figure 5-6 - Proposed White House Burn Culvert

A1 Culvert (Proposed Culvert 23.1)

5.2.2. The existing 21.7 m long culvert underneath the A1 alignment at chainage 56920 would be extended by approximately 15.6 m on the upstream face of the culvert to accommodate the proposed increased width of the Part B alignment. The approximate total length of the structure would be approximately 37.3 m. The proposed extension would be a precast reinforced concrete box culvert with 3.23 m width and 3.44 m height to match the existing culvert dimensions. Precast wing walls would be provided at the upstream face of the culvert. The culvert extension would be on the same alignment of the watercourse.

Culvert Summary

5.2.3. **Table 5-1** below provides a summary of the existing and proposed culvert dimensions.

Table 5-1 – Existing and Proposed White House Burn Culvert Dimensions

Structure	Length (m)	Shape	Width (m)	Height (m)
Existing A1 culvert	21.7	Box	3.23	3.44
Proposed A1 culvert (Proposed culvert 23.1)	37.3	Box	3.23	3.44

Surface Water Drainage

5.2.4. A detailed description of the surface water drainage strategy is provided in **Appendix 10.4: Drainage Strategy Report** of this ES. There is one new outfall proposed to discharge into White House Burn (outfall 24). **Table 5-2** below shows the different stages of treatment provided and the percentage of surface water runoff that would pass through each stage.

Table 5-2 – White House Burn Proposed Surface Water Drainage System

Stage	Proposed Attenuation and Treatment	Percentage of Surface Water Runoff Received
1	Filter drain located within the verge of the carriageway	98%
	Kerb and gully drainage	2%
2	Grassed detention basin with a sediment forebay located at the inlet of the basin and would have a permanent wet area.	100%

6 TRIBUTARIES OF KITTYCARTER BURN

6.1 BASELINE CONDITIONS

CATCHMENT OVERVIEW

6.1.1. 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. 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. Approximately 2 km downstream from Part B, the unnamed tributaries of Kittycarter Burn discharge into the Kittycarter Burn by the Kittycarter Plantation. Kittycarter Burn and its tributaries are classified as ordinary watercourses under the jurisdiction of NCC as LLFA.

6.1.2. The combined estimated Q95 for the tributaries of Kittycarter Burn downstream of Part B proposals where the two tributaries meet is 0.00322 m^3/s. Q95 is defined as the flow equalled or exceeded for 95% of the flow record and is a low flow parameter. The combined estimated Qmed for Kittycarter Burn downstream of Part B proposals where the two tributaries meet is 1.35 m^3/s. Qmed is defined as the median annual flow rate for the 1 in 2 year flood event.

Historical Channel Changes

6.1.3. Analysis of historical maps (**Ref. 10.16**) dating back to the 1860s indicates that the alignment of Kittycarter Burn has not altered to the present day. The watercourse appears to have been realigned along field boundaries pre-dating the historical mapping.

Contemporary Channel Characteristics

6.1.4. During the site walkover, it was noted that the river bed comprised silt with gravels also present. Two tributaries of Kittycarter Burn flow beneath the existing A1 alignment. **Figure 6-1** below identifies the two tributaries (southern and western) and locations of existing structures.

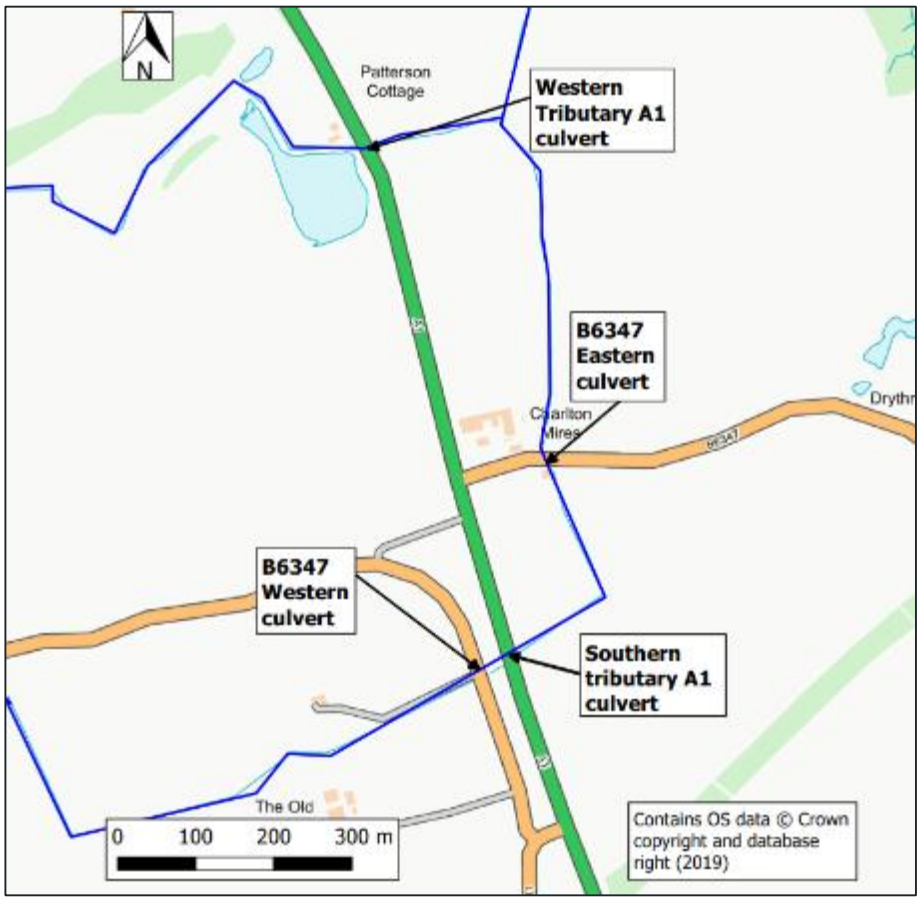

Figure 6-1 – Tributaries of Kittycarter Burn Existing Structures

6.1.5. The unnamed southern tributary of Kittycarter Burn flows beneath the western section of the B6347 through a circular concrete culvert, as shown in **Figure 6-2** below. The culvert is approximately 21.2 m in length with a diameter of 0.45 m. Approximately 25 m downstream of this culvert the unnamed southern tributary flows beneath the A1 through another circular concrete culvert. **Figure 6-3** below shows the inlet of the culvert which has an approximate diameter of 0.6 m and is approximately 25.5 m in length. During the topographic survey it was noted that there was approximately 0.15 m deep silt deposit at the base of the culvert.

6.1.6. Approximately 315 m downstream of the A1 watercourse crossing the unnamed southern tributary of Kittycarter Burn flows beneath a small farm access track as shown in **Figure 6-4** below. The crossing is a circular concrete pipe with a diameter of approximately 0.6 m and approximately 3 m in length. Approximately 10 m downstream of the farm access track the unnamed southern tributary of Kittycarter Burn flows beneath the eastern section of the B6347 through a circular culvert. As shown in **Figure 6-5** below there is a brick headwall at the inlet. The culvert has an approximate diameter of 0.6 m and is approximately 15 m in length.

Figure 6-2 – B6347 Western Culvert (Inlet)

Figure 6-3 – Southern Tributary A1 Culvert (Inlet)

Figure 6-4 – Small Access Track Culvert (Outlet)

Figure 6-5 – B6347 Eastern Culvert (Inlet)

6.1.7. The unnamed western tributary of Kittycarter Burn flows beneath the A1 through a box culvert as shown in **Figure 6-6** below. There are wooden debris fences just upstream and downstream of the culvert as shown in **Figure 6-7** below and a fence running through the centre of the culvert as shown in **Figure 6-6**. It is considered likely that the fence is to

facilitate animal passage between fields when required. The culvert has an approximate width of 21.4 m and height of 22.5 m and is approximately 20 m in length. In the adjacent field to the south-west of the culvert there is a pond as shown on the OS mapping. Consultation with the LLFA identified that the pond is ephemeral and floods when the water level exceeds the banks of the watercourse.

Figure 6-6 – Western Tributary of Kittycarter Burn Culvert Underneath A1 (Inlet)

Figure 6-7 – Debris Fence along Unnamed Western Tributary of Kittycarter Burn

6.1.8. No fish surveys have been undertaken along the tributaries of Kittycarter Burn as the aquatic walkover survey undertaken by Part B ecologists did not identify the watercourses to have the potential to support any legally protected or notable aquatic species (refer to **Appendix 9.10: Aquatic Ecology Assessment Report** of this ES). No evidence of otters was identified during the mammal surveys (refer to **Appendix 9.3: Otter and Water Vole Report** of this ES).

6.1.9. The tributaries of Kittycarter Burn are monitored against the objectives of the WFD (**Ref. 10.1**) and is located within the 'Embleton Burn from Source to North Sea' WFD catchment. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'. The catchment has been assessed as having a hydromorphological designation of 'not designated artificial or heavily modified'. **Tables 6-1** and **6-2** below present the ecological and chemical classifications ranging from 2013 to 2016 for the 'Embleton Burn from Source to North Sea' WFD catchment, as classified by the Environment Agency.

Table 6-1 – Ecological classifications for Embleton Burn from Source to North Sea

	2013	2014	2015	2016
Overall	Good	Moderate	Moderate	Poor
Ecological	Good	Moderate	Moderate	Poor
Biological quality elements	-	Good	Good	Poor
Hydromorphological supporting elements	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical quality elements	-	Moderate	Moderate	Moderate
Specific pollutants	High	High	-	-

Table 6-2 – Chemical classifications for Embleton Burn from Source to North Sea

	2013	2014	2015	2016
Overall	Good	Moderate	Moderate	Poor
Chemical	Good	Good	Good	Good
Priority substances	Good	Good	-	-
Other pollutants	-	-	-	-
Priority hazardous substances	Fail	Fail	Good	Good

6.1.10. The Environment Agency's Catchment Data Explorer (**Ref. 10.12**) for the 'Embleton Burn from Source to North Sea' WFD catchment identifies the reason for not achieving 'Good' overall status as private sewage treatment, poor nutrient management and continuous sewage discharge.

6.1.11. **Table 6-3** below shows the current status for each element and the status objectives for the 'Embleton Burn from Source to North Sea' WFD catchment.

Table 6-3 – Status objectives for Embleton Burn from Source to North Sea

Element	Current Status	Status Objective
Ecological		
Biological	Poor	Good by 2027
Hydromorphology	Supports Good	Supports Good
Physico-chemical / specific pollutants	Moderate	Good by 2027
Chemical		
Priority substances	Good	Good

6.2 SCHEME DESIGN

6.2.1. No new culverts are proposed along Kittycarter Burn and its tributaries, all proposed works relate to the extension or replacement of existing culverts. The following section describes the proposed replacement and extension to culverts, and realignment of the southern tributary of Kittycarter Burn to be provided as part of Part B. The numbers in the brackets below refer to the proposed culvert references. Refer to the **General Arrangement Plans** (**Application Document Reference: TR010041/APP/2.4**) as part of this ES. **Figure 6-8** below shows the location of the replacement and extension to culverts. The existing B6347 western culvert would be retained as part of Part B with no amendments made.

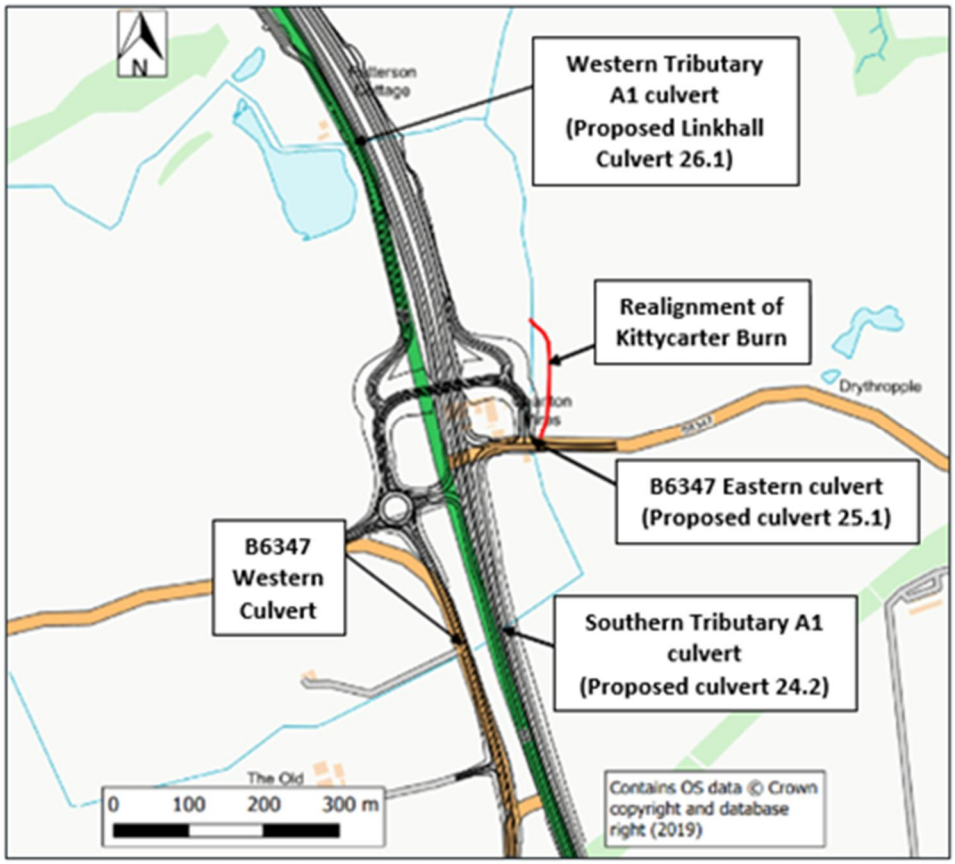

Figure 6-8 - Proposed Tributaries of Kittycarter Burn Culverts

Southern Tributary A1 Culvert (Proposed Culvert 24.2)

6.2.2. The existing culvert located along the southern tributary of Kittycarter Burn at approximately chainage 58600 underneath the A1 alignment would be extended by 26.5 m. The extension would be a new precast concrete circular 600 mm pipe, and the construction of a new headwall and wing wall at the culvert outlet. The length of the extended culvert would be 50 m. The culvert extension would be on the same alignment of the watercourse.

B6347 Eastern Culvert (Proposed Culvert 25.1)

6.2.3. The existing culvert underneath the B6347 would be demolished and replaced with the same dimensions as the existing culvert but would move slightly to the east to tie into the realigned tributary of Kittycarter Burn. The new culvert would be located at chainage 58850, with a circular 600 mm culvert and would be 17 m in length. The new culvert would be set below bed level to allow a natural bed to form over time.

Western Tributary A1 Culvert (Proposed Linkhall Culvert 26.1)

6.2.4. The existing western tributary A1 culvert is located at approximately chainage 59275. The culvert would need to be lengthened to accommodate the wider layout of Part B, including an access road to the west of the main carriageway and a slip road on the opposite side, to the east of the carriageway. The proposed new extension to the culvert would comprise a number of precast reinforced concrete box units, which would have an internal width of 1.88 m and height of 2.25 m. The extension of the culvert would have an approximate length of 50.8 m. The total length of the culvert including the length of the retained existing culvert would be 70.9 m. The culvert extension would be on the same alignment of the watercourse.

6.2.5. The existing culvert, as previously described, currently provides animal passage underneath the A1. The extension of the culvert would include an extension to the animal passage through the culvert. This would not reduce the normal channel or where water would flow during low flow conditions within the watercourse.

Kittycarter Burn Realignment

6.2.6. The southern tributary of Kittycarter Burn would be realigned around Charlton Mires Junction to reduce the total length of the new culverts required. The alignment of the watercourse is shown in **Figure 6-9** below and would be approximately 165 m in length. The design of the new channel would maintain a similar channel profile and dimensions to the existing watercourse to mimic existing conditions. As shown in **Figure 6-10** below, boulders would be placed within the new channel to provide varied substrate features and flow dynamics within the watercourse channel. The design would be further developed during the detailed design stage alongside further consultation with the Environment Agency and NCC as LLFA.

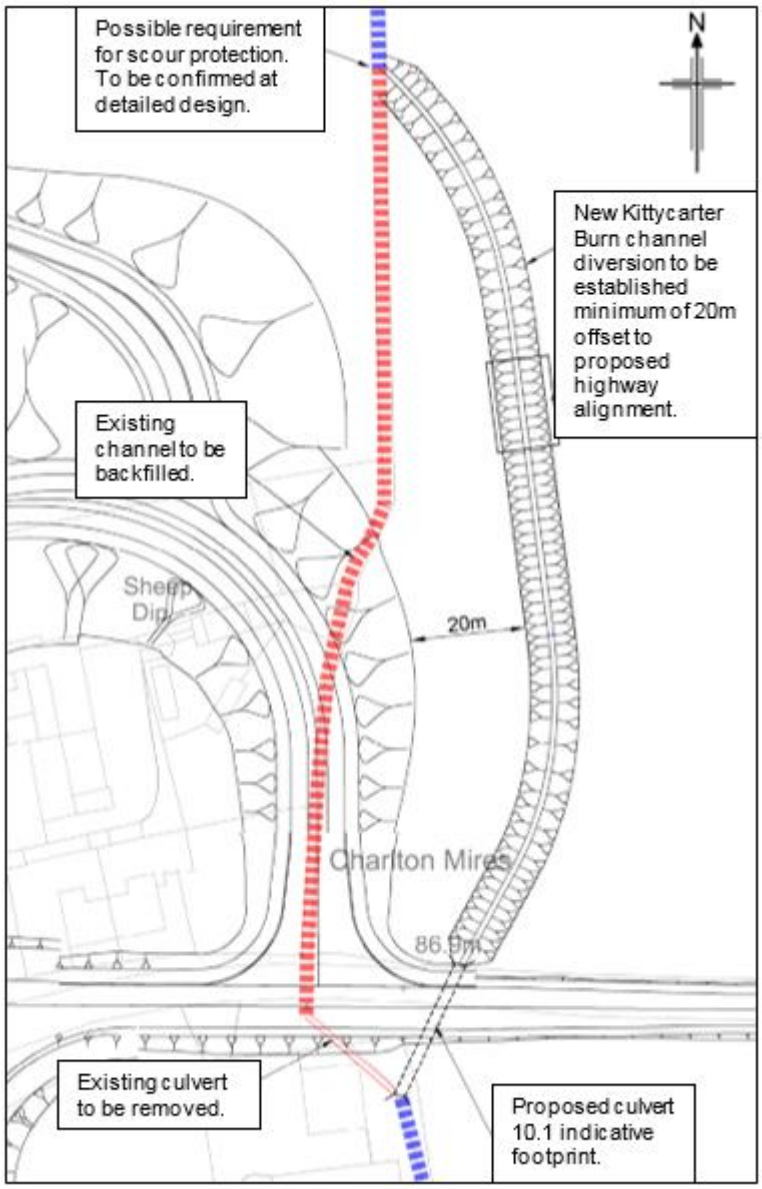

Figure 6-9 - Tributary of Kittycarter Burn Realignment

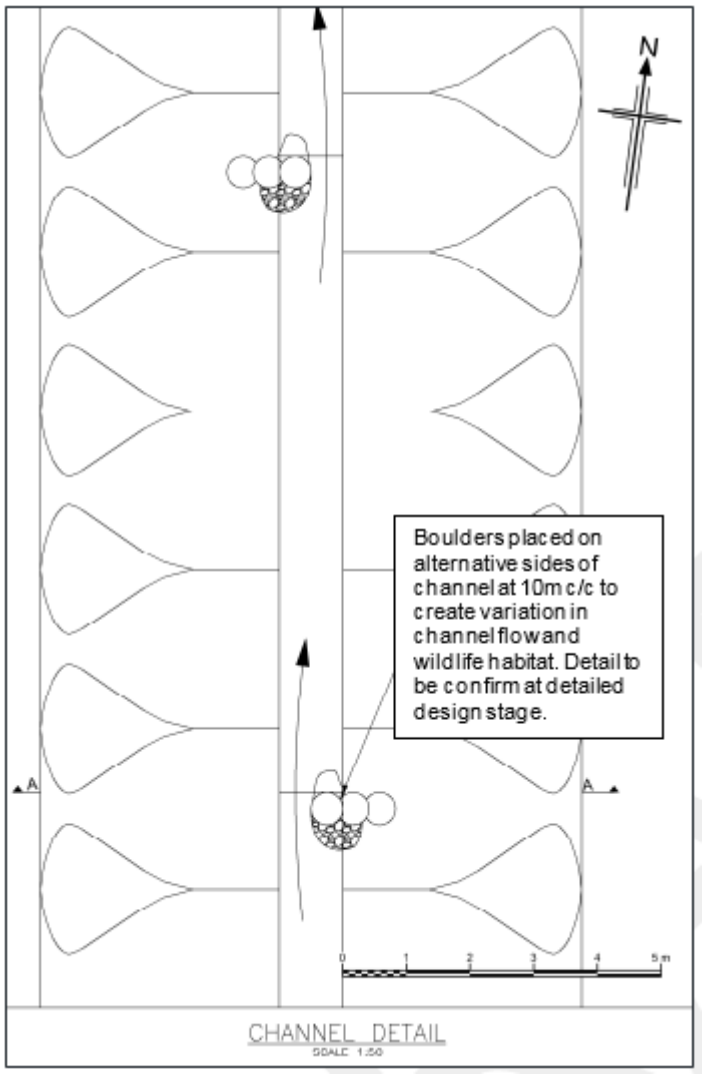

Figure 6-10 – Design of Realigned Tributary of Kittycarter Burn

Culvert Summary

6.2.7. **Table 6-4** below provides a summary of the existing and proposed culvert dimensions.

Table 6-4 – Existing and Proposed Kittycarter Burn Culvert Dimensions

Structure	Length (m)	Shape	Width (m)	Height (m)
Existing southern tributary A1 culvert	25.5	Circular	0.6	-
Proposed southern tributary A1 culvert (Proposed culvert 24.2)	50	Circular	0.6	-
Existing B6347 Eastern culvert	17	Circular	0.6	-

Structure	Length (m)	Shape	Width (m)	Height (m)
Proposed B6347 Eastern culvert (Proposed culvert 25.1)	17	Circular	0.6	-
Existing western tributary A1 culvert	20.1	Box	1.88	2.25
Proposed western tributary A1 culvert (Proposed Linkhall culvert 26.1)	70.9	Box	1.88	2.25

Surface Water Drainage

6.2.8. A detailed description of the surface water drainage strategy is provided in **Appendix 10.4: Drainage Strategy Report** of this ES. There are two new outfalls proposed to discharge into the tributaries of Kittycarter Burn (outfalls 25/26 and 27). **Table 6-5** below shows the different stages of treatment provided and the percentage of surface water runoff that would pass through each stage for each new outfall proposed.

Table 6-5 – Tributaries of Kittycarter Burn Proposed Surface Water Drainage System

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

7 TRIBUTARY OF EMBLETON BURN

7.1 BASELINE CONDITIONS

CATCHMENT OVERVIEW

7.1.1. 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 km². 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 as shown in **Figure 7-1** below. Approximately 4.1 km downstream of the access track crossing, the unnamed tributary of Embleton Burn discharges into the Embleton Burn by Prickley Bridge. Embleton Burn and its tributaries are classified as ordinary watercourses under the jurisdiction of NCC as LLFA.

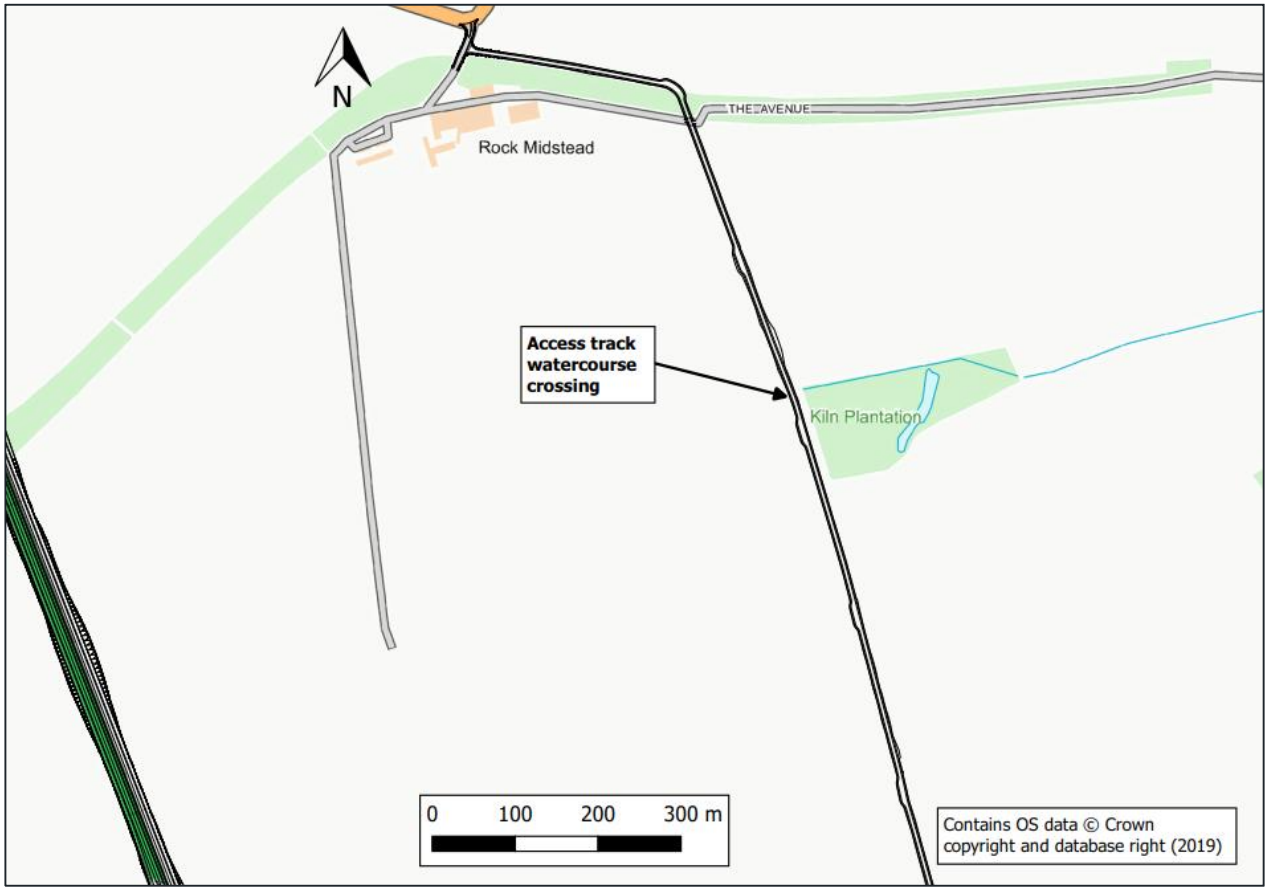

Figure 7-1 – Tributary of Embleton Burn and Existing Structure

7.1.2. The estimated Qmed for the tributary of Embleton Burn at the location of Part B proposals is 0.44 m³/s. Qmed is defined as the median annual flow rate for the 1 in 2 year flood event.

Historical Channel Changes

7.1.3. Analysis of historical maps (**Ref. 10.16**) dating back to the 1860s indicates that the alignment of the tributary of Embleton Burn has not altered to the present day. The watercourse appears to have been realigned along field boundaries pre-dating the historical mapping.

Contemporary Channel Characteristics

7.1.4. **Figure 7-2** below shows the watercourse crossing that conveys the watercourse beneath an access track with a width of approximately 450 mm, height of approximately 310 mm and length of approximately 5.7 m. During the site walkover it was observed the culvert was submerged. Upstream of the watercourse crossing the channel was heavily vegetated.

Figure 7-2 – Tributary of Embleton Burn Culvert (Outlet)

7.1.5. No fish surveys have been undertaken along the tributary of Embleton Burn as the aquatic walkover survey undertaken by Part B ecologists did not identify the watercourse to have the potential to support any legally protected or notable aquatic species (refer to **Appendix 9.10: Aquatic Ecology Assessment Report** of this ES). No evidence of otters was identified during the mammal surveys (refer to **Appendix 9.3: Otter and Water Vole Report** of this ES).

7.1.6. The tributary of Embleton Burn is not monitored against the objectives of the WFD (**Ref. 10.1**) but is located within the 'Embleton Burn from Source to North Sea' WFD catchment. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Poor' with the ecological quality assessed as 'Poor' and the chemical quality assessed as 'Good'. The catchment has been assessed as having a hydromorphological designation of 'not designated artificial or heavily modified'.

7.1.7. **Tables 6-1**, **6-2** and **6-3** in **Section 6** of this report present the ecological and chemical classifications ranging from 2013 to 2016 and the status objectives for the 'Embleton Burn from Source to North Sea' WFD catchment, as classified by the Environment Agency.

7.2 SCHEME DESIGN

7.2.1. The following section describes the proposed new culvert to be provided as part of Part B. Refer to the **General Arrangement Plans** (**Application Document Reference: TR010041/APP/2.4**). **Figure 7-1** above shows the location of the new culvert. The existing access track watercourse crossing along the tributary of Embleton Burn would be retained as part of Part B with no amendments made.

Rock Culvert (Proposed Culvert 28.1)

7.2.2. The new culvert would be constructed on the existing watercourse alignment just upstream of the existing watercourse crossing. The new culvert would be a circular 1.2 m structure and would be 17 m in length. The new culvert would be on the same alignment of the watercourse.

Culvert Summary

7.2.3. **Table 7-1** below provides a summary of the existing and proposed culvert dimensions.

Table 7-1 – Existing and Proposed Tributary of Embleton Burn Culvert Dimensions

Structure	Length (m)	Shape	Width (m)	Height (m)
Existing access track watercourse crossing	5.7	Box	0.45	0.31
Proposed Rock Culvert (Proposed culvert 28.1)	17	Circular	1.2	-

8 SHIPPERTON BURN

8.1 BASELINE CONDITIONS

CATCHMENT OVERVIEW

8.1.1. 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 km². Shipperton Burn flows in a west to east direction and flows beneath the existing A1 alignment through the Lodge Plantation, and then under Shipperton Bridge just downstream underneath a local private road as shown in **Figure 8-1** below. 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. Shipperton Burn is classified as an ordinary watercourse under the jurisdiction of NCC as LLFA.

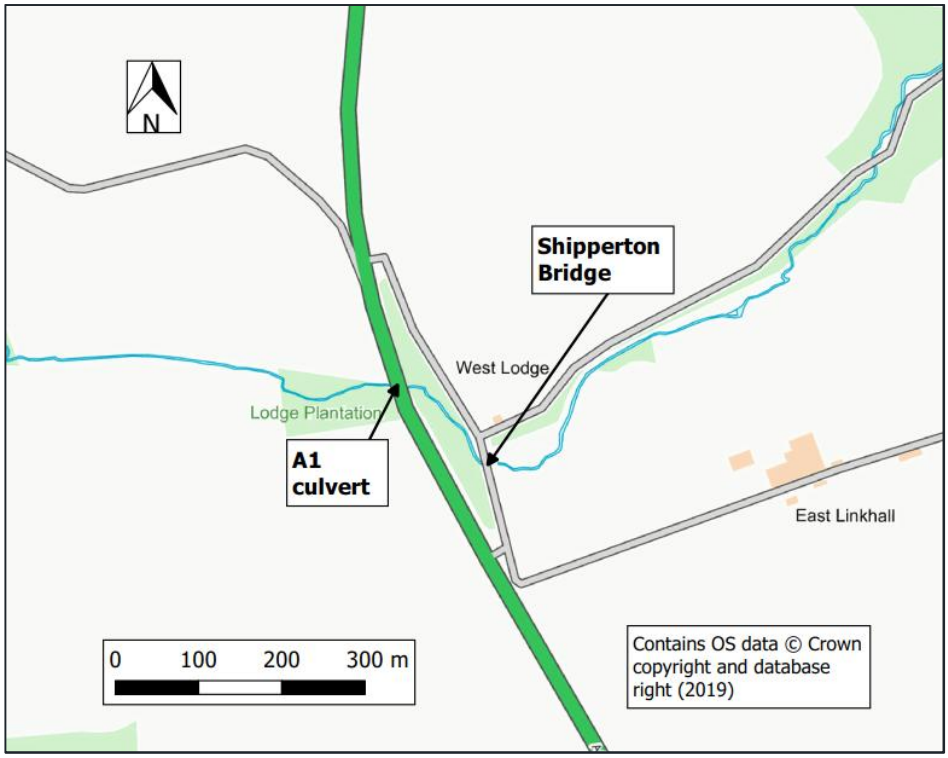

Figure 8-1 – Shipperton Burn and existing structures

8.1.2. The estimated Qmed for Shipperton Burn at the location of Part B proposals is 1.54 m³/s. Qmed is defined as the median annual flow rate for the 1 in 2 year flood event.

Historical Channel Changes

8.1.3. Analysis of historical maps (**Ref. 10.16**) dating back to the 1860s indicates that the alignment of Shipperton Burn has not altered to the present day. The watercourse appears to have been realigned along field boundaries pre-dating the historical mapping.

Contemporary Channel Characteristics

8.1.4. Shipperton Burn flows beneath the A1 through a rectangular culvert (approximately 2.1 m wide and 1.2 m high) which is 18.3 m in length with the inlet and outlet shown in **Figures 8- 2** and **8-3** below. Approximately 100 m downstream of this culvert the watercourse flows under Shipperton Bridge that serves as a local private road, as shown in **Figures 8-4** and **8-5** below. The bridge has a width of approximately 1.9 m, a height of approximately 1.1 m and length of approximately 21 m.

8.1.5. During the site walkover immediately upstream of the existing A1 watercourse crossing, a metal gate was observed in the watercourse that was collecting debris. This is shown in **Figure 8-2**.

Figure 8**-2** – Shipperton Burn A1 Culvert (Inlet)

Figure 8**-3** – Shipperton Burn A1 Culvert (Outlet)

Figure 8-4 – **Shipperton** Bridge (**I**nlet)

Figure 8-5 – Shipperton Bridge (Outlet)

8.1.6. The electric fish surveys undertaken identified brown trout along Shipperton Burn (refer to **Appendix 9.10: Aquatic Ecology Assessment Report** of this ES). Brown trout are a protected species listed under Section 41 of the Natural Environment and Rural Communities (NERC) Act (2006) (**Ref. 10.17**) and are considered to be of principal importance. No evidence of otters or water voles were identified during the mammal surveys (refer to **Appendix 9.3: Water Vole and Otter Report** of this ES).

8.1.7. Shipperton Burn is not monitored against the objectives of the WFD (**Ref. 10.1**) but is located within the 'Brunton Burn from Source to North Sea' WFD catchment. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Good', with the ecological quality assessed as 'Good' and the chemical quality assessed as 'Good'. The catchment has been assessed as having a hydromorphological designation of 'not designated artificial or heavily modified'.

8.1.8. **Tables 8-1** and **8-2** below present the ecological and chemical classifications ranging from 2013 to 2016 for the 'Brunton Burn from Source to North Sea' WFD catchment, as classified by the Environment Agency.

Table 8-1 – Ecological Classifications for Brunton Burn from Source to North Sea

	2013	2014	2015	2016
Overall	Good	Good	Good	Good
Ecological	Good	Good	Good	Good
Biological quality elements	-	Good	Good	Good
Hydromorphological supporting elements	Supports Good	Supports Good	Supports Good	Supports Good
Physico-chemical quality elements	-	High	Good	Good
Specific pollutants	High	High	-	-

Table 8-2 – Chemical Classifications for Brunton Burn from Source to North Sea

	2013	2014	2015	2016
Overall	Good	Good	Good	Good
Chemical	Good	Good	Good	Good
Priority substances	Good	Good	-	-
Other pollutants	-	-	-	-
Priority hazardous substances	Good	Good	-	-

8.1.9. **Table 8-3** below shows the current status for each element and the status objectives for the 'Brunton Burn from Source to North Sea' WFD catchment.

Table 8-3 – Status Objectives for Brunton Burn from Source to North Sea

Element	Current Status	Status Objective
Ecological		
Biological	Good	Good
Hydromorphology	Supports Good	Supports Good

Element	Current Status	Status Objective
Physico-chemical / specific pollutants	Good	Good
Chemical		
Priority substances	Good	Good

8.2 SCHEME DESIGN

8.2.1. No new culverts are proposed along Shipperton Burn and all proposed works relate to the extension of the existing culvert. The following section describes the proposed culvert extension to be provided as part of Part B. The number is the brackets below refer to the proposed culvert reference (refer to the **General Arrangement Plans** (**Application Document Reference: TR010041/APP/2.4**). **Figure 8-3** below shows the location of the existing culv14ert to be extended underneath the A1 alignment. The existing Shipperton Bridge would be retained as part of Part B with no amendments made.

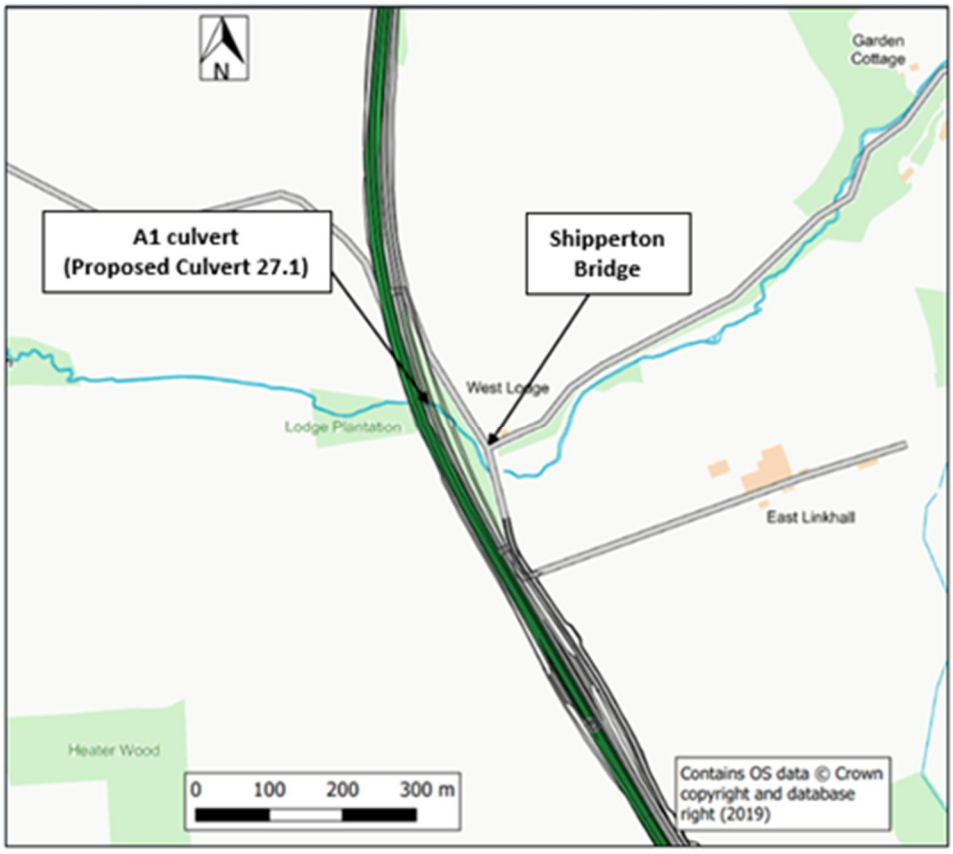

Figure 8-6 – Shipperton Burn Part B Proposal

A1 Culvert (Proposed Culvert 27.1)

8.2.2. The existing Shipperton Burn Culvert is located at approximately chainage 60385 and would be extended on the outlet side, to the east of the proposed carriageway. The proposed new extension would be a precast reinforced concrete box with internal 2 m width and 1.25 m height. The culvert would be extended by 27.65 m. The extension of the culvert would have an approximate length of 27.6 m. The total length of the culvert would be 47.6 m. The culvert extension would be on the same alignment of the watercourse.

Culvert Summary

8.2.3. **Table 8-4** below provides a summary of the existing and proposed culvert dimensions.

Table 8-4 – Existing and Proposed Shipperton Burn Culvert Dimensions

Structure	Length (m)	Shape	Width (m)	Height (m)
Existing A1 Culvert	19.1	Box	2.05	1.28
Proposed A1 Culvert (Proposed culvert 27.1)	46.75	Box	2	1.25

9 GROUND CONDITIONS

9.1 BASELINE CONDITIONS

9.1.1. Review of the British Geological Survey (BGS) 1:625,000 data (**Ref. 10.13**) indicates that the majority of the land located to the east of the Part B alignment (excluding construction compounds discussed below) is underlain by bedrock geology of the Yoredale Group comprising limestone and argillaceous rocks. Land located to the west of the Part B alignment is underlain by bedrock geology of the Yoredale Group and the Border Group consisting of limestone, sandstone and argillaceous rocks.

9.1.2. Review of the Environment Agency Groundwater data available on MAGIC online mapping (**Ref. 10.11**) indicates that the bedrock geology is classified as a Secondary A Aquifer. This is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

9.1.3. Review of BGS 1:625,000 data (**Ref. 10.13**) indicates that superficial deposits within the Study Area are mostly glacial till with areas of glacial sands and gravels located to the north of South Charlton and to the south-west of Denwick. There is also a small peat deposit located to the south of South Charlton.

9.1.4. Review of the Environment Agency Groundwater data available on MAGIC online mapping (**Ref. 10.11**) indicates that the majority of the superficial deposits are classified as a Secondary (Undifferentiated) Aquifer. The areas of glacial sands and gravels identified in **paragraph 10.1.3** above are classified as a Secondary A Aquifer. This is described as permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of base flow to rivers.

9.1.5. A review of the Cranfield University Soilscapes mapping (**Ref. 10.15**) indicates that the majority of the soils within the Study Area are slowly permeable loamy and clayey soils. Freely draining slightly acid and loamy soils are located in the areas of glacial sands and gravels identified in **paragraph 10.1.3** above.

9.1.6. Review of the Environment Agency Groundwater data available on MAGIC online mapping (**Ref. 10.11**) indicates that there are no Source Protection Zones (SPZ) located within the Study Area.

9.1.7. Groundwater quality has been assessed against the objectives of the WFD (**Ref. 10.1**). Part B is located within the Northumberland Carboniferous Limestone and Coal Measures groundwater catchment area. A review of the Environment Agency's Catchment Data Explorer (2016 results) (**Ref. 10.12**) indicates an overall quality of 'Poor', with the quantitative quality assessed as 'Poor' and the chemical quality assessed as 'Poor'. **Table 9-1** below presents the quantitative quality and chemical quality classifications ranging from 2013 to 2016 for the Northumberland Carboniferous Limestone and Coal Measures groundwater catchment area, as classified by the Environment Agency. The

Environment Agency identifies the reason for not achieving 'Good' overall status as point source pollution from an abandoned mine.

Table 9-1 – WFD Classifications for Northumberland Carboniferous Limestone and Coal Measures Operational Catchment

Year	Overall	Quantitative	Chemical	Chemical Drinking Water Protected Area	General chemical test	Chemical GWDTEs test	Chemical dependant surface water body status	Chemical Saline Intrusion
2013	Poor	Good	Poor	Good	Good	Good	Poor	Good
2014	Poor	Good	Poor	Good	Good	Good	Poor	Good
2015	Poor	Good	Poor	Good	Good	Good	Poor	Good
2016	Poor	Good	Poor	Good	Good	Good	Poor	Good

9.1.8. The ground investigation work undertaken in 2019 (**Appendix 11.3: Ground Investigation Report** of this ES) was completed to enhance understanding of baseline conditions. Groundwater was encountered in 21 trial pits and six boreholes during their construction typically between depths of 1 m below ground level (bgl) and 3.5 m bgl. The groundwater is considered to be relatively shallow along the Part B alignment due to the presence of low permeability glacial materials overlying bedrock.

9.1.9. Sections of Part B to the north and south are located within the Coal Authority's (CA) reporting area. The online CA's screening tool (**Ref. 10.18**) indicates that Part B is not located within a constraint area with regards to groundwater.

9.2 SCHEME DESIGN

9.2.1. There are no deep excavations or retaining structures proposed as part of the construction of Part B. There are no proposed outfalls that would discharge directly to ground in the surface water drainage system. All of the detention basins would be lined in order to prevent infiltration and to also prevent any groundwater ingress into the attenuation features.

10 IMPACT ASSESSMENT

10.1 CONSTRUCTION STAGE

10.1.1. This section details the construction impacts associated with surface water bodies. The impacts associated with groundwater are discussed later in **Section 10.3** of this report.

INCREASED SEDIMENTATION

10.1.2. Site runoff during the construction stage containing elevated suspended particles may result from land clearance, excavation, dewatering of excavations, stockpiles, wheel washings and movement of materials to and from the site. Runoff with high sediment loads may have direct adverse effects on adjacent water bodies through increasing turbidity (thus reducing light penetration and reducing plant growth), and by smothering vegetation and bed substrates (thus impacting on invertebrate and fish communities through the destruction of feeding areas, refuges and breeding and/or spawning areas). Organic sediments can also have indirect effects on physico-chemical properties such as dissolved oxygen demand and pH. The impacts would be direct and temporary. Water quality within the affected water body would improve over time as sediments settle or are trapped by vegetation, and vegetation adapts to the new bed conditions.

10.1.3. The magnitude of the impact is likely to be greatest when working in areas adjacent to the identified surface water features, and in periods of heavy rainfall. Notwithstanding the in-channel works, the greatest risk to increased sedimentation is most likely to be associated with runoff from earth stockpiles or occur during the construction of the online improvements, drainage detention basins and outfalls that are located within approximately 10 m of any watercourses.

10.1.4. There would be a number of topsoil stores located along the Part B alignment, dependant on adjacent ground levels and local surface water flow paths.

10.1.5. Increased sedimentation may also be caused by sediment (particularly from construction plant) that may migrate to the site drainage systems that outfall directly to the adjacent watercourses.

POLLUTION RISKS

10.1.6. The release of hydrocarbons into on-site drainage systems, or from direct runoff and spillages into watercourses, is the second most common form of pollution after increased sediment loading. Hydrocarbons form a film on the surface of the water body, deplete oxygen levels and may be toxic to fish. Even at very low concentrations, the film may negatively affect the visual appearance of the water body. The impact would be direct and temporary. Water quality within the affected water body would improve over time as pollutants disperse and are treated by natural processes. The risk is likely to increase during the construction period due to a larger number of vehicles accessing the site, refuelling of vehicles and plant, leakage from oil and fuel storage tanks, and accidental spillages.

10.1.7. The use of hazardous products on site may present a pollution risk because of the potential for accidental spillages and the uncontrolled release of washdown water and runoff. If materials and activities are not stored and carried out in designated areas, runoff and washdown may enter a water body, adversely affect the aquatic environment or contaminate surface and groundwater water abstractions. The most common source of pollution is from concrete and cement products. These products are highly alkaline and corrosive. Fish may be physically damaged, and their gills blocked, and both vegetation and the bed of the receiving water body may be smothered. For the most part, it is only when large quantities of hazardous substances are spilled, or the spillage is directly into the water body, that a significant risk of acute toxicity would arise in the receiving water. The magnitude of any impact would depend on the scale and nature of any potential incident and, is therefore, difficult to predict. Generally, impacts would be direct and temporary to long term. Water quality within the affected water body would improve over time as pollutants are dispersed and diluted. However, a significant direct spillage of a toxic substance could cause long-term damage to the receiving water body.

WORKS WITHIN WATERCOURSES

10.1.8. Works that are proposed within or immediately adjacent to the river channels have the potential to impact the chemical, ecological and hydromorphological quality of the watercourses associated with increased sedimentation, pollution spillages, removal of existing bankside habitat, damage to existing substrate, and changes to the hydraulic profile of the watercourse.

CONSTRUCTION STAGE MITIGATION AND ASSESSMENT SUMMARY

All Watercourses

10.1.9. The culvert construction methodology is included in **Appendix 2.3: Culvert Construction Methodology**, **Volume 1** of this ES (**Application Document Reference: TR010041/APP/6.1**). The demolition of existing culverts, extensions to existing culverts, and the construction of new culverts would all be undertaken within a dry construction area.

10.1.10. The dry construction area would be created by diverting flows through an adjacent culvert, pipe or drainage channel. If this is deemed infeasible by the main contractor, then a temporary sump is proposed. The sump would be excavated on the upstream side of the existing structure, and a pump would be used to divert flows through a pipe suspended above the base of the culvert.

10.1.11. Works along Shipperton Burn should be avoided between September and March due to the brown trout spawning season. A fish translocation would be required along Shipperton Burn prior to the creation of the dry working area. Further information regarding fish translocation and the permit required can be found in **Appendix 9.10: Aquatic Ecology Assessment Report** of this ES.

10.1.12. The new sections of culvert would be made from precast concrete or pipes to reduce the potential for polluting the watercourses.

10.1.13. Measures are detailed in the **Outline CEMP (Application Document Reference: TR010041/APP/7.3)** and includes the following:

a. Measures to deal with the first flush once flows are diverted through the new culverts.
b. An exclusion zone of 8 m from the watercourses should be maintained as far as practicable.
c. Avoid the positioning of stockpiles near to watercourses, ensure they are located outside of the flood zone. Stockpiles should be located a minimum of 8 m from the top of bank.
d. Cover stockpiles when not in use.
e. Contain the stockpiles with bunds or sediment fences.
f. Do not wash vehicles near to the watercourses.
g. Avoid undertaking works adjacent to the watercourses, where practicable. When working adjacent to a watercourse is required, maintain the maximum distance possible from the watercourse along with appropriate mitigation outlined above for fine sediment management.
h. Avoid works during high flow events and intense rainfall to reduce the risk of fine sediment release.
i. Limit the clearance of vegetation on the channel banks and riparian zone. Where practicable, maintain a vegetated buffer strip between the construction zone and the watercourse. Ideally, a minimum buffer strip of 8 m should be retained where possible.
j. Use seeded biodegradable fibre matting to encourage re-vegetation after works on, or near, the banks.
k. Maintaining, where possible, vegetation cover on the banks close to the rivers and prompt reinstatement of vegetation to minimise the impact of reduced roughness, thus potentially reducing stream power, flow velocity and sediment transport capability through the construction zone.
l. Avoid critical periods for fish migration and spawning. This is important for the watercourses where notable or protected species of fish have been identified.
m. Mitigation for the potential impacts outlined should be included within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and should be adhered to. The **Outline CEMP** should include measures to control runoff during construction. This may include creating temporary drainage systems to both alleviate flood risk and help to prevent sediment laden runoff entering the watercourse.
n. The appointed contractor shall be required to comply with the relevant sections of British Standard (BS) 6031:2009 Code of Practice for Earthworks (**Ref. 10.19**) with respect to protection of water quality and control of site drainage including washings, dewatering, abstractions and surface water.
o. Best practice measures associated with storage of oils and fuels shall be followed and included within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**).
p. Concrete mixing and washing areas shall be located more than 10 m from any watercourse; have settlement and re-circulation systems for water reuse; have a contained area for washing out of concrete batching plant or ready-mix lorries; collect wash-waters and, where necessary, contain wash-water for authorised off-site disposal. Wash-water from concrete shall not be discharged into a watercourse.

10.1.14. **Table 10-1** below provides an assessment of the potential for Part B to cause deterioration in the current ecological and chemical WFD potential of all the watercourses along Part B and construction compounds during construction. The assessment considers appropriate and best practice mitigation that would be implemented to minimise any adverse impacts. Longer term impacts associated with permanent changes to the hydraulic profile of the watercourses are discussed as operational impacts.

10.1.15. A detailed assessment of the potential impacts to aquatic ecology and riparian habitat associated with Part B is presented in **Chapter 9: Biodiversity**, **Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**).

Table 10-1 - Potential for Part B to Cause Deterioration in the Current Ecological and Chemical Potential of Identified Watercourses during Construction

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Ecological					
Biological	Fish Invertebrates Macrophytes	Impacts and changes to the watercourses during construction of Part B as a result of increased diffuse pollution and sedimentation.	Prior to construction, a CEMP would be produced by the main contractor to manage environmental impacts during construction. The CEMP would set out how construction activities would be undertaken in accordance with appropriate good practice guidance, such as CIRIA's control of water pollution from construction sites (C532) (**Ref. 10.20**). Although withdrawn, the Pollution Prevention Guidelines (PPG) (**Ref. 10.21**) published by the Environment Agency still provide good practice guidance, particularly PPG 1 - General guide to the prevention of water pollution, PPG 5 - Works in, near or liable to affect watercourses and PPG 6 - Working at construction and demolition sites. Measures outlined in the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) for managing risks to the water environment include the following: - Locating topsoil stores and construction compounds away from the banks of watercourses. - Covering and or seeding topsoil stores to further prevent sediment entering the watercourses during periods of heavy rainfall. - All loose materials would be covered so as not to increase sediment load to the drainage network. - Dewatering watercourses to maintain a dry construction area and passing any water generated by the dewatering process through silt busters or sediment tanks prior to returning this water to the watercourses. The **Outline CEMP** contains an ecological mitigation strategy to identify measures to mitigate the impact on ecological assets and a strategy of pollution prevention, which would include details of fuel storage, spillage management, disposal of contaminated drainage and measures for highlighting pollution prevention awareness within the workforce.	Some increase in sedimentation is likely to occur due to the proximity of the works to the river channels and works required within the river channels. Given the low sensitivity of the majority of watercourses to increased sedimentation and specific fish mitigation measures along the Shipperton Burn, the impact is not likely to pose a risk of failing current WFD catchment status or preventing watercourses from meeting future WFD catchment objectives. A number of watercourses along Part B have small catchments where flows are minimal so changes would not be significant enough to impact WFD catchment status. Given the low flow of the watercourse's effects are likely to be localised and no effects to downstream watercourses are predicted. The duration of the works within the watercourses would be limited to the time required to install the culverts.	Yes

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
			The gravel bed of the new and extended culvert would improve connectivity for fish passage and mammal passage along the tributaries of Kittycarter Burn, Shipperton Burn and White House Burn. Where notable or protected aquatic species have been identified in the baseline conditions, it is proposed to carry out fish rescues prior to commencing any construction. Further information regarding this can be found in **Chapter 9: Biodiversity**, **Volume 3** of this ES (**Application Document Reference: TR010041/APP/6.3**).		
Hydromorphology	Hydrological regime Morphology	Temporary diversions of watercourses to create dry working areas, changing upstream and downstream flow dynamics. Mobilisation of sediment during construction stage. Temporary loss of riparian habitat. Loss of connectivity for aquatic species.	The **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) details the construction methodology for the replacement or extension of the culverts. The flows would be diverted to create a dry working area. Where possible, a temporary channel would be created adjacent to the existing / permanent one to maintain connectivity during the construction stage. Where a temporary channel is not possible a temporary sump would be used to create a dry construction area. Some change to flow dynamics during construction would be inevitable but a review of the affected watercourses indicates that this would not pose risk of changing current WFD catchment status or failure of WFD catchment objectives due to the low flows and low energy of the watercourses. The change in flow dynamics may alter sediment processes upstream and downstream of the works, but this is not considered likely to have a notable impact on upstream or downstream morphological conditions that would pose risk to not meeting the objectives of the WFD catchment. Riparian habitats temporarily lost are expected to re-establish within two years once construction has been completed. The removal of riparian habitats would be minimised as much as possible. The permanent losses of watercourses caused by the culvert extensions are discussed as part of the operational effects.	Some impact to the hydromorphology of the watercourses is likely to occur due to the works required within the river channels. Given the low sensitivity and low energy of the majority of watercourses, the impact is not considered to pose a risk of failing current WFD catchment status or preventing watercourses from meeting future WFD catchment objectives. A number of watercourses along Part B have small catchments where flows are minimal so changes would not be significant enough to impact WFD catchment status. Given the low flow of the watercourse's effects are likely to be localised and no effects to downstream watercourses are predicted.	Yes

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Physico-chemical / specific pollutants	Acid neutralising capacity Ammonia BOD Dissolved oxygen pH Phosphate Temperature Copper Zinc	Increase in concentration of elements due to accidental spillage of materials during construction or contaminants in site surface water discharge during construction. Increase in sediment-laden runoff with the potential to increase BOD, reduce dissolved oxygen, change pH and elevate phosphates.	All site works and ground works would be undertaken in accordance with the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) to ensure the risk of contamination during construction is mitigated. Measures included in the **Outline CEMP** for managing risks to the water environment include the following: - Management of surface water runoff to intercept and, where necessary, treat runoff to prevent the migration of pollutants to receiving water features. - Management of polluting substances that are being brought on site and used as part of the construction process. - Where practicable, all works would remain at least 8 m from the watercourse and from the top of the valley sides. - Similar mitigation to that discussed above for the control of increased sedimentation to ensure that flow would be maintained along the watercourses as discussed above which would assist in the dispersion of pollution.	Some increase in pollution is likely to occur due to the proximity of the works to the river channels and works required within the river channels. Given the low sensitivity of the majority of watercourses to pollution and the fact that a lot of the watercourses receive runoff from adjacent agricultural land that is likely to introduce sediment laden runoff with high organic loading, the impact is unlikely to pose a risk of failing current WFD catchment status or preventing watercourses from meeting future WFD catchment objectives.	Yes
Chemical					

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Priority substances / Other pollutants / Priority hazardous substances	Lead Nickel Cadmium	Increase in concentration of elements due to accidental spillage of materials during construction or contaminants in site surface water discharge during construction.	All site works and ground works would be undertaken in accordance with the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) to ensure the risk of contamination during construction is mitigated. Measures included in the **Outline CEMP** for managing risks to the water environment include the following: - Management of surface water runoff to intercept and, where necessary, treat runoff to prevent the migration of pollutants to receiving water features. - Management of polluting substances that are being brought on site and used as part of the construction process. - Where practicable, all works would remain at least 8 m from the watercourse and from the top of the valley sides. - The Main Compound would be approximately 50,000 m² located adjacent to the Thirston Burn. The Lionheart Enterprise Park Compound would be approximately 40,000 m² to the south of Alnwick. A construction compound would be approximately 8,000 m² at Charlton Mires adjacent to the southern tributary of Kittycarter Burn. No cement or machinal plant would be stored within the construction compound to reduce pollution due to the close proximity to the southern tributary of Kittycarter Burn.	None predicted	Yes

10.2 OPERATION STAGE

10.2.1. This section details the operation impacts associated with surface water bodies. The impacts associated with groundwater are discussed later in **Section 10.3** of this report.

CULVERTS

10.2.2. The replacement or extension of culverts has the potential to significantly impact the hydromorphological quality of the watercourses along Part B. This could be because of increasing or reducing flow velocity, changing flow depth, removing natural bed and bank habitat. Culverts may pose a barrier to the movement of aquatic species along the river. If the hydromorphological characteristics of the existing watercourses are not retained or improved, this could consequently affect the ecological quality of the river.

10.2.3. The design of the culvert along the southern tributary of Kittycarter Burn (proposed culvert 10.1) has taken hydromorphological considerations into account where feasible and appropriate. The culvert would tie into the existing channel and a gravel bed, with a low flow channel if appropriate would be created throughout the length of the new culvert. Further analysis of flow dynamics would be undertaken during the detailed design stage to inform the selection of the most appropriate material size and grading. A brief summary of the additional mitigation measures for each watercourse regarding mammal passage through the culverts and baffles to facilitate the movement of aquatic species is provided in **Table 10-2** below.

Table 10-2 – Summary of additional mitigation measures

Culvert	Natural Gravel Bed
A1 culvert 1 (Proposed culvert 17.1)	No
A1 culvert 2 (Proposed culvert 18.1)	No
A1 culvert 3 (Proposed culvert 19.1)	No
A1 culvert 4 (Proposed culvert 21.1)	No
Heckley Fence culvert (Proposed culvert 22.1)	No

Culvert	Natural Gravel Bed
A1 culvert (Proposed culvert 23.1)	No
Southern tributary A1 culvert (Proposed culvert 24.2)	No
B6347 eastern culvert (Proposed culvert 25.1)	Yes
Western tributary A1 culvert (Proposed Linkhall culvert 26.1)	No
Rock Culvert (Proposed culvert 28.1)	No
A1 culvert (Proposed culvert 27.1)	No

10.2.4. The replacement of culverts would offer opportunity to improve the performance of certain culverts, for example, where no natural bed is currently provided. This is relevant to the southern tributary of Kittycarter Burn. Baffles would be used to retain the natural bed along the base of the culverts and to create a natural low flow channel.

10.2.5. The realigned sections of the tributary of Kittycarter Burn would be diverted adjacent to the A1 to reduce the total length of the new culverts required. The design of the new channel would maintain a similar channel profile and dimensions to the existing watercourse to mimic existing conditions. Boulders would be placed within the new channel to provide varied substrate features and flow dynamics within the watercourse channel.

10.2.6. The removal of riparian habitat would be inevitable as many of the existing culverts would need to be extended to facilitate Part B, however the removal would be kept to a minimum, as previously discussed. The temporary loss of riparian habitats is expected to re-establish naturally within two years once construction has been completed.

SURFACE WATER DRAINAGE

10.2.7. Surface water runoff has the potential to contain silts and hydrocarbons that are washed off hard paved areas and vehicular areas. These may increase water turbidity, deplete oxygen levels and be toxic to the aquatic environment. The current surface water drainage system is assumed to provide no treatment.

10.2.8. The DMRB Volume 11, Section 3, Part 10 (HD 45/09) (**Ref. 10.5**) and the Highways Agency (now Highways England) Water Risk Assessment Tool (HAWRAT) has been used to assess the risks to water quality during the operation of Part B. Method A assessed the

pollution impacts from routine runoff to surface waters and Method D assessed the pollution impacts from accidental spillage. For more information regarding the methodology refer to **Appendix 10.3: Drainage Network Water Quality Assessment** of this ES.

Method A

10.2.9. All the single and cumulative assessments pass the HAWRAT assessment for acute and chronic impacts when proposed attenuation and treatment measures are taken into account.

10.2.10. The assessment of long term pollution impacts to the receiving water environment considers the annual average pollutant concentrations associated with Part B against the Environmental Quality Standards (EQS) threshold values set out under the WFD (**Ref. 10.1**). All the annual average pollutant concentrations, for both zinc and copper, are below the EQS threshold values. 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, taking into account proposed attenuation and treatment measures. This shows that the proposed mitigation measures go beyond the minimum standards required to pass the HAWRAT Method A assessment.

Method D

10.2.11. The results of the Method D assessments for all outfalls indicate an annual probability of a significant pollution risk occurring in the event of spillage of between 0.006% and 0.003%, taking the proposed mitigation measures into account, which is well below the recommended threshold of 1%.

10.2.12. **Table 10-3** below provides an assessment of the potential for Part B to cause deterioration in the current ecological and chemical potential of the watercourses during operation. The assessment considers appropriate and best practice mitigation that would be implemented in order to minimise any adverse impacts.

Table 10-3 - Potential for Part B to Cause Deterioration in the Current Ecological and Chemical Potential of Watercourses During Operation

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Ecological					
Biological	Fish Invertebrates Macrophytes	Changes to the hydromorphological quality of a watercourse could result in a barrier to the movement of aquatic species. Increased discharge of sediment laden runoff from the operational highway drainage system that could increase turbidity, smother bed substrates and cause a loss of macrophytes and natural bed substrate.	No new culverts are proposed as all works are to replace existing culverts on a like for like basis or extend culverts mimicking the existing culverts. A natural bed would be provided within the culvert along the southern tributary of Kittycarter Burn (Proposed culvert 25.1) to assist potential fish passage. Baffles would be used to retain the natural bed material and create a natural low flow channel through the culvert. The proposed culverts would tie into the existing channel. Vegetation at the upstream and downstream face of the culverts would be reinstated as soon as practicable post-construction. Once vegetation is established, fine sediment inputs would reduce to baseline conditions, or near to baseline conditions. The surface water drainage system passes Method A and Method D HAWRAT assessments for all watercourses when taking the mitigation and treatment measures into consideration.	None predicted as no new culverts are proposed and existing conditions would be retained.	Yes

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Hydromorphology	Hydrological regime Morphology	Increase in surface water runoff as a result of increased impermeable area. Changes to the hydromorphological quality of watercourses due to new culverts, culvert extensions and realigned watercourse channel.	No new culverts are proposed as all works are to replace existing culverts on a like for like basis or extend culverts mimicking the existing culverts. All of the watercourses within the Study Area are low energy and therefore any impacts would be localised. The design of the culverts has taken hydromorphological considerations into account where appropriate. All the culverts would tie into the existing channel and a gravel bed would be created throughout the length of the culverts where appropriate. **Table 10-2** summarises the additional mitigation measures for each watercourse regarding mammal passage and baffles to assist the movement of aquatic species. The realigned sections of the tributary of Kittycarter Burn would be diverted adjacent to the A1 to reduce the total length of the new culverts required. The design of the new channel would maintain a similar channel profile and length of the existing watercourse to mimic existing conditions. The new channel is 1 m shorter in length. Boulders would be placed within the new channel to provide varied substrate features and flow dynamics within the watercourse channel. The watercourse also low energy so it is unlikely that flows would scour the new realigned channel. The removal of habitat would be kept to a minimum, as discussed as part of the construction impact summary. Riparian habitat would be reinstated naturally within two years once construction has been completed.	None predicted as no new culverts are proposed and existing conditions would be retained.	Yes

Element	Indicator	Potential Impact of Part B on Receptor	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD Status	Compliant with WFD Objectives
Physico-chemical / specific pollutants	Acid neutralising capacity Ammonia BOD Dissolved oxygen pH Phosphate Temperature Copper Zinc	Increase in diffuse pollution and discharge of contaminants into receiving watercourses due to highway contributing area.	HAWRAT has been used to assess the potential pollution impacts of routine runoff from Part B on the water quality. The results indicate that there would be no short term or long-term impacts on the water quality. As mentioned above, the proposed drainage strategy has incorporated the use of a management train to improve the water quality of the road discharge.	None predicted	Yes
Chemical					
Priority substances / Other pollutants / Priority hazardous substances	Lead Nickel Cadmium	Increase in diffuse pollution and discharge of contaminants into receiving watercourses as a result of the increase in highway contributing area.	The proposed drainage strategy has incorporated the use of SuDS to improve the water quality of the road discharge. As discussed above, HAWRAT has been used to assess the potential pollution impacts of routine runoff from Part B on the water quality. The results indicate that there would be no short term or long-term impacts on the water quality.	None predicted	Yes

10.3 GROUNDWATER

POLLUTION RISKS

10.3.1. The dispersion and impact of hydrocarbons and hazardous products that enter groundwater resources is dependent on geology, depth to groundwater table and characteristics of the aquifer. Groundwater contamination is difficult to treat and may have an adverse indirect effect on the quality of watercourses that receive groundwater baseflow and or are in hydraulic connectivity to groundwater. The relatively low permeability of geology within most of the Study Area would limit the ability of pollutants to affect groundwater resources. Excavations and boreholes may pose greatest risk to groundwater resources. However, general good site practice would reduce this risk and it is considered unlikely that pollution of groundwater resources would occur.

10.3.2. **Table 10-4** below provides an assessment of the potential for Part B to result in deterioration in the current quantitative and chemical potential of the Northumberland Carboniferous Limestone and Coal Measures Groundwater Operational WFD Catchment, with appropriate mitigation measures that would be implemented to minimise any adverse impacts.

Table 10-4 – Assessment of the Potential for Part B to Result in Deterioration in the Current Quantitative and Chemical Potential of the Northumberland Carboniferous Limestone and Coal Measures Groundwater Operational Catchment

Element	Receptor	Potential Impact of Part B	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD status	Compliant with WFD Objectives
Quantitative					
Quantitative elements	Impact on dependent surface water bodies. Water balance	Part B would not involve any significant changes in land use when considered in the context of the wider catchment area and, therefore, would not impact on groundwater	None	None predicted	Yes

Element	Receptor	Potential Impact of Part B	Part B Proposal (including mitigation)	Detrimental Impact or Change to WFD status	Compliant with WFD Objectives
		recharge or water balance and the overall quantitative elements. No cuttings ore below ground structures are proposed that would impede or change groundwater movement.			
Chemical					
Chemical elements	Drinking water protected area. General chemical test. Impact on surface waters.	Due to the relatively localised scale of the proposed works, no alteration in the regional groundwater quality due to contaminants in site surface water discharge or accidental spillages of materials during construction is expected.	All site works and ground works would be undertaken in accordance with the Outline CEMP to ensure the risk of contamination during construction is mitigated. The surface water drainage strategy does not include discharging to ground and the grassed detention basins would be lined.	None predicted	Yes

11 CONCLUSION

11.1.1. Part B is located across three surface water WFD catchments: 'Aln from Edlingham Burn to Tidal Limit', 'Embleton Burn from Source to North Sea', and 'Brunton Burn from Source to North Sea'. The assessment indicates that there would be no detrimental impact or change to the WFD status of these catchments with the appropriate mitigation measures implemented, as detailed within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and through the design of the new culverts and extended culverts, and the new outfalls. As a result, Part B is compliant with WFD objectives and would not prevent the WFD catchments from achieving the status objectives for each catchment.

11.1.2. Part B is located within the Northumberland Carboniferous Limestone and Coal Measures WFD groundwater catchment. The assessment indicates that there would be no detrimental impact or change to the WFD status with the appropriate mitigation measures implemented, as detailed within the **Outline CEMP** (**Application Document Reference: TR010041/APP/7.3**) and the proposed surface water drainage strategy. Part B would therefore not prevent the WFD groundwater catchment from achieving the status objectives set for it.

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