A38 Derby Junctions

TR010022

Volume 6

6.3 Environmental Statement Appendices

Appendix 13.3B: Little Eaton Water Framework Directive Assessment

Regulation 5(2)(a)

Planning Act 2008

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

April 2019

Infrastructure Planning

Planning Act 2008

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

A38 Derby Junctions Development Consent Order 202[ ]

6.3 Environmental Statement Appendices
Appendix 13.3B: Little Eaton Water Framework Directive Assessment

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A38 Derby Junctions

Little Eaton Junction: Water Framework Directive Assessment Report

Report Number: HE514503-ACM-EWE-Z3_ZZ_ZZ_ZZ-RP-HD-0001 P03 S4
March 2019

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EXECUTIVE SUMMARY

Scheme Details

AECOM has been commissioned by Highways England to provide design services regarding the development of the A38 Derby Junctions Scheme (referred to herein as "the Scheme"). The Scheme concerns the grade separation of three junctions on the A38 in Derby as follows:

- A38/ A5111 Kingsway junction
- A38/ A52 Markeaton junction
- A38/ A61 Little Eaton junction

At Little Eaton junction, the Scheme would involve placing the mainline A38 on an embankment that would, in places, encroach into the floodplain of the River Derwent (although this would be compensated elsewhere for flood risk management purposes), and displace the existing channel of Dam Brook. Dam Brook is considered part of the River Derwent Waterbody under the Water Framework Directive (WFD).

This WFD assessment comprises one of a number of documents supporting the environmental assessment of the Scheme to be reported within an Environmental Statement.

WFD Assessment

The WFD (EC Directive 2000/60/EC) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. This WFD assessment has, therefore, been undertaken to determine whether the Scheme at Little Eaton junction has the potential to:

- Cause deterioration of any waterbodies from their current status or potential, or
- Prevent future attainment of good status or potential where not already achieved.

The main aim of this WFD assessment is to demonstrate that WFD objectives can be met at Little Eaton junction, and that any risks to the water environment can be avoided or mitigated.

Outcome of the WFD Assessment

The focus of this WFD assessment has been to assess whether the Scheme at Little Eaton junction would result in any deterioration from the existing 'moderate' ecological conditions of the River Derwent, prevent or compromise the waterbody from meeting its WFD objectives of 'good' potential by 2027, or prevent connecting waterbodies from meeting their objectives.

This WFD assessment has established that the Scheme at Little Eaton junction would have a negligible impact upon the current ecological status or future objectives of the River Derwent waterbody, whilst the realignment of Dam Brook provides an opportunity to enhance the local water environment and contribute to WFD improvement objectives.

1 INTRODUCTION

1.1 Introduction

1.1.1 AECOM Infrastructure & Environment UK Ltd (AECOM) has been commissioned by Highways England to provide design services regarding the development of the A38 Derby Junctions Scheme (referred to as "the Scheme" herein). This Scheme concerns the grade separation of three junctions on the A38 in Derby as follows:

- A38/ A5111 Kingsway junction.
- A38/ A52 Markeaton junction.
- A38/ A61 Little Eaton junction.

1.1.2 In order to inform the assessment of potential impacts of the Scheme on the water environment, AECOM has carried out a Water Framework Directive (WFD) assessment for the Scheme works at Little Eaton junction. As such, this report focuses upon Scheme works at Little Eaton junction only – a separate WFD assessment has been prepared for Scheme works at Kingsway junction. A WFD assessment was screened out for Markeaton junction as the Scheme would not require any physical changes to watercourses at this junction. Figure 1.1 provides a site location plan for Little Eaton junction.

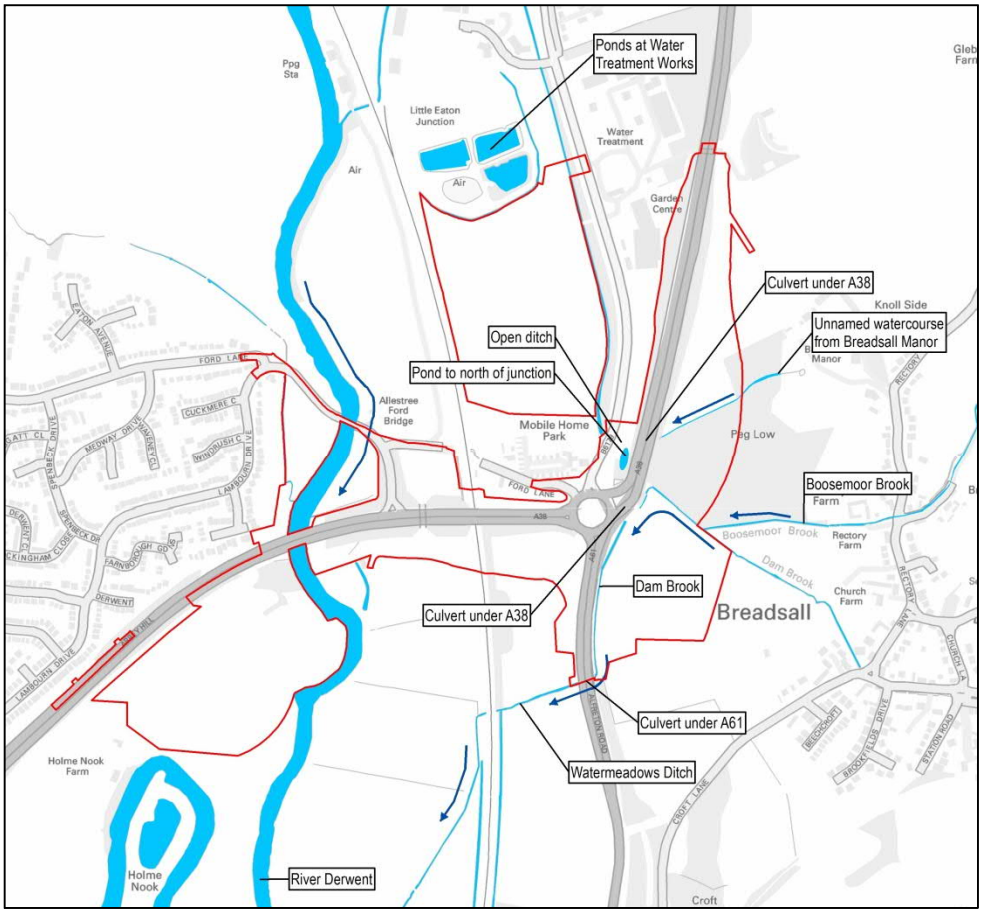

Figure 1.1: Little Eaton junction - site location and water features

1.2 The Scheme

1.2.1 The Little Eaton junction element of the Scheme entails the provision of grade-separation at the junction to enlarge the roundabout at existing ground level with the new A38 mainline passing above on embankment with two bridges over the roundabout. The new mainline A38 would be located to the east and south of the existing roundabout.

1.2.2 Commencing at the southern tie in, the proposed A38 swings slightly to the south of the existing route immediately after crossing the River Derwent bridge (which would not be affected), and passes over a Flood Relief Arch/ Accommodation Bridge which would be extended. Continuing north, the existing railway bridge would be extended to carry the A38 southbound carriageway and southbound merge slip road. The existing northbound carriageway would be retained on the railway bridge and form the northbound diverge slip road.

1.2.3 The A38 would then pass over the two new junction bridges on embankment before continuing to the east of the existing A38 and re-joining the existing A38 alignment immediately south of the Water Treatment Overbridge, which would not be affected.

1.2.4 The Scheme at Little Eaton junction has the potential to impact upon the local watercourses within the River Derwent from Bottle Brook to Trent WFD waterbody catchment (refer to Figure 1.1) as follows:

- **River Derwent:** Whilst the Scheme would not have a direct impact upon the River Derwent, the Scheme would entail enlargement of the A38 footprint into the River Derwent floodplain, including extension of a flood relief bridge including new foundations (piles). Floodplain displacement would be compensated to the west of the River Derwent and thus is not considered further herein[1].
- **Dam Brook:** The proposed improvement of Little Eaton junction would require the realignment of the existing Dam Brook channel (length of approximately 555m, measured from the Boosemoor Brook confluence with Dam Brook to the downstream culvert under to A61) into a new channel of approximately 400m in length (thus a 155m reduction in open channel). The Dam Brook realignment would create a more sinuous channel form within a vegetated corridor, flowing downstream of the Boosemoor Brook confluence to the existing culvert under the A61, bypassing a major weir and existing culvert (approximately 70m in length) located adjacent to the Little Eaton junction roundabout. An approximate 4m wide low level regularly wetted berm and new in-channel features such as inset berms, riffles and point bars would also be provided within the realigned Dam Brook to improve in-channel habitats.
- **Dam Brook tributary:** There is an unnamed Dam Brook tributary emanating from Breadsall Manor. The stream is ephemeral and currently enters an approximate 50m long culvert under the existing A38, discharging into an open ditch on the northern side of the A38 junction. This then enters a second culvert approximately 70m long under the existing A38, before discharging directly into Dam Brook. The Scheme would entail connecting the unnamed watercourse emanating from Breadsall Manor to the realigned Dam Brook via a multi-stage flood alleviation channel (approximately 260m long). In addition, a new approximately 172m long 600mm diameter culvert would also be provided from

[1] Highways England (2019) A38 Derby Junctions – A38 Little Eaton Junction Flood Risk Assessment

the watercourse under the new A38 embankment that would connect into an existing 500mm diameter culvert in order to convey flows from the unnamed watercourse when the flow capacity of the flood alleviation channel is exceeded. This would result in the culverting of approximately 124m of the existing open channel. The culvert would discharge to the existing open ditch located to the north of the A38 junction. The ditch would then flow into an existing culvert which would be extended by approximately 96m under the new junction, which would flow into an open swale (measuring approximately 216m long) which would eventually discharge to the realigned Dam Brook near the existing brook culvert under the A61.

1.2.5 The Scheme works as detailed above would result in a collective loss of existing open channel of approximately 279m. However, provision of the 260m long flood alleviation channel and the new approximately 216m long swale would result in the creation of approximately 476m of new open channel. Therefore, these collective works would result in a net gain in open channel of approximately 197m associated with Dam Brook and its tributaries.

1.2.6 Figure 1.2 provides an illustration of the proposed Dam Brook diversion, together with details of the flood alleviation channel and associated culverting.

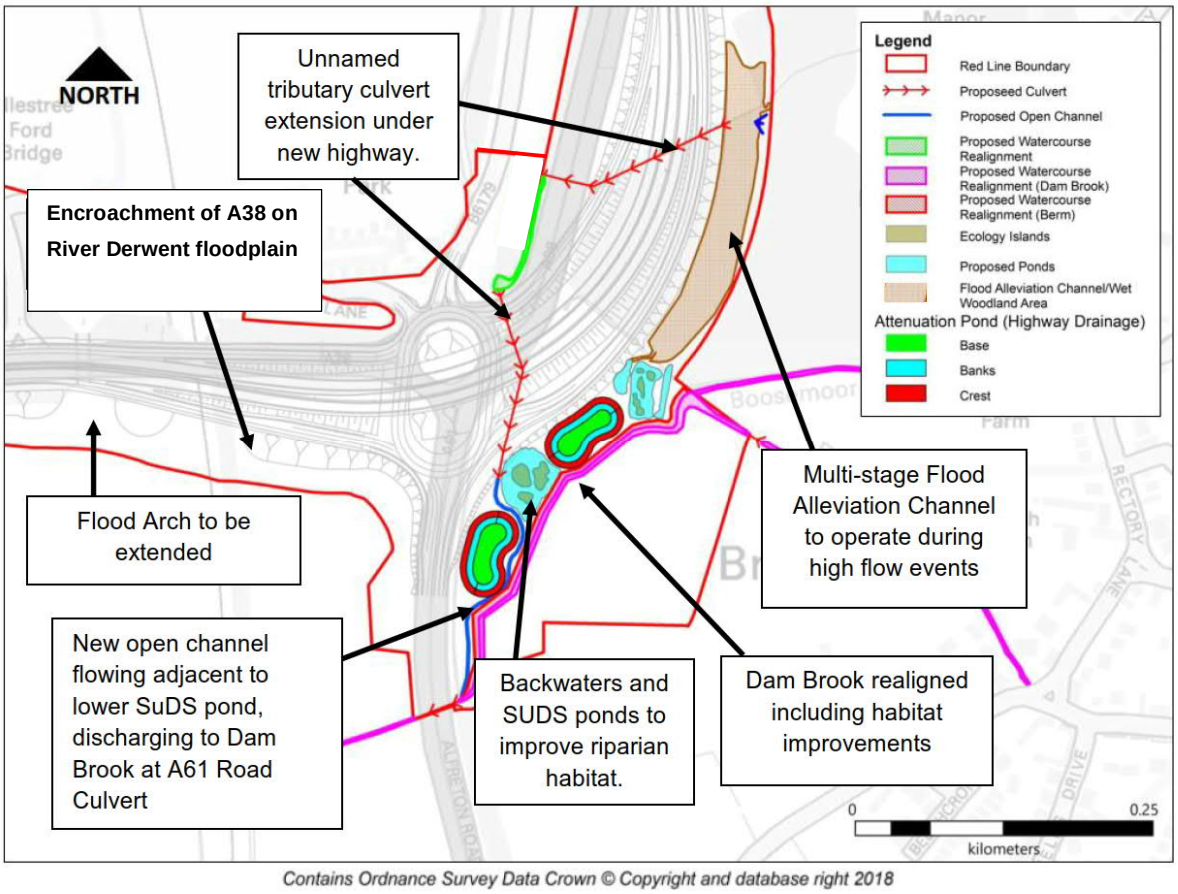

Figure 1.2: Little Eaton junction surface water drainage strategy

1.2.7 It is noted that Scheme at Little Eaton junction would not require any physical alterations to the former Derby Canal, which is located along the western edge of the B6179 Alfreton Road, between Little Eaton junction and Little Eaton village. As such,

the former canal has been scoped out of this WFD assessment. Details regarding Scheme impacts upon the former canal are provided in the Environmental Statement.

1.3 Water Framework Directive (WFD)

1.3.1 The WFD (EC Directive 2000/60/EC) aims to protect and enhance the quality of the water environment across all European Union (EU) member states. It takes a holistic approach to the sustainable management of water by considering the interactions between surface water (including transitional and coastal waters, rivers, streams and lakes), groundwater and water-dependent ecosystems. This includes interactions between sediment and water.

1.3.2 Under the WFD, 'waterbodies' are the basic management units and are defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin district' (RBD), for which River Basin Management Plans (RBMPs) are developed and environmental objectives are set. RBMPs are produced every six years, in accordance with the river basin management planning cycle. Cycle 2 plans were published in February 2016.

1.3.3 The WFD requires all EU member states to classify the current condition (i.e. the 'Status' or 'Potential') of surface and groundwater bodies and to set a series of objectives for maintaining or improving conditions so that waterbodies maintain or reach Good Status or Potential. The Environment Agency is the competent authority for implementing the WFD in England. As part of its role, the Environment Agency must consider whether proposals for new developments have the potential to:

- Cause deterioration of a waterbody from its current status or potential, and
- Prevent future attainment of good status or potential where not already achieved.

1.3.4 As a result, new developments that have the potential to impact on current or predicted WFD status are required to assess their compliance against the WFD objectives of the potentially affected waterbodies.

2 METHODOLOGY

2.1 Background to Surface Water Body Status

2.1.1 Under the WFD, surface water body status is classified on the basis of chemical and ecological status or potential. “Ecological status” is assigned to surface water bodies that are natural and considered by the Environment Agency not to have been significantly modified for anthropogenic purposes. “Ecological potential” is assigned to artificial and man-made water bodies (such as canals), or natural water bodies that have undergone significant modification; these are termed Heavily Modified Water Bodies (HMWBs), and this classification applies to the River Derwent system in the vicinity of Little Eaton junction.

2.1.2 The term ecological potential is used as it may be impossible to achieve good ecological status because of modification for a specific use, such as navigation or flood protection, which needs to be maintained. Ecological potential represents the degree to which the quality of the water body approaches the maximum it could achieve. Overall status or potential is comprised of elements describing waterbody morphology, biology and water quality. The worst case element classification is assigned as the overall surface waterbody status/ potential, in a ‘one-out all-out’ system - this system is summarised in Figure 2.1, whilst Figure 2.2 provides a definition of High, Good, Moderate, Poor and Bad surface water status as related to the WFD.

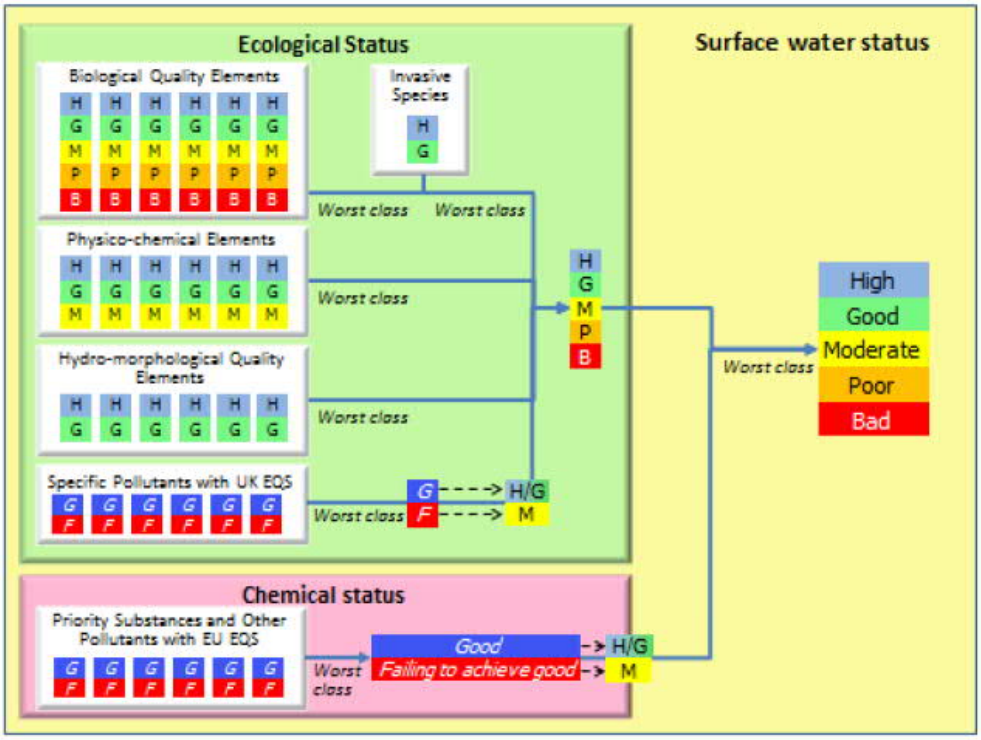

Figure 2.1: WFD classification elements for surface water body status (Environment Agency, 2015[2])

[2] Environment Agency (2015) Rules for Assessing Surface Water Body Status and Potential. Version 2.0 (October 2015).

Status	Definition
High	Near natural conditions. No restriction on the beneficial uses of the water body. No impacts on amenity, wildlife or fisheries.
Good	Slight change from natural conditions as a result of human activity. No restriction on the beneficial uses of the water body. No impact on amenity or fisheries. Protects all but the most sensitive wildlife.
Moderate	Moderate change from natural conditions as a result of human activity. Some restriction on the beneficial uses of the water body. No impact on amenity. Some impact on wildlife and fisheries.
Poor	Major change from natural conditions as a result of human activity. Some restrictions on the beneficial uses of the water body. Some impact on amenity. Moderate impact on wildlife and fisheries.
Bad	Severe change from natural conditions as a result of human activity. Significant restriction on the beneficial uses of the water body. Major impact on amenity. Major impact on wildlife and fisheries with many species not present.

Figure 2.2: Definition of status or potential in the WFD (Environment Agency, 2015)

2.2 Ecological Status or Potential

2.2.1 Ecological status or potential is defined by the overall health or condition of the watercourse. The waterbody affected by the Scheme at Little Eaton junction is designated as a HMWB, therefore, its condition and objectives are referred to in terms of Potential rather than Status. Potential is assigned on a scale of High, Good, Moderate, Poor or Bad (see Figure 2.2), and on the basis of four classification elements or 'tests' (Environment Agency, 2013), as follows:

- **Biological**: This test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates, macrophytes or algae (phytobenthos) and by the presence of invasive species. The biological quality elements can influence an overall waterbody status from Bad through to High.
- **Physico-chemical**: This test is designed to assess compliance with environmental standards for supporting physico-chemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physico-chemical elements can only influence an overall waterbody status from Moderate through to High.
- **Specific pollutants**: This test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physico-chemical test, the specific pollutant assessment can only influence an overall waterbody status from Moderate through to High.
- **Hydromorphology**: For natural, non-HMWBs, this test is undertaken when the biological and physico-chemical tests indicate that a water body may be of High status. It specifically assesses elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological elements do not support High status, then the status of the waterbody is limited to Good overall status. For artificial or HMWBs, hydromorphological elements are

assessed initially to determine which of the biological and physico-chemical elements should be used in the classification of ecological potential. In all cases, assessment of baseline hydromorphological conditions are an important factor in determining possible reasons for classifying biological and physico-chemical elements of a waterbody as less than Good, and hence in determining what mitigation measures may be required to address these failing waterbodies.

2.3 Chemical Status

2.3.1 Chemical status is defined by compliance with environmental standards for chemicals that are priority substances and/ or priority hazardous substances, in accordance with the Environmental Quality Standards Directive (EQSD) (2008/105/EC). This is assigned on a scale of good or fail. Surface waterbodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface waterbodies are reported as being at good chemical status.

2.4 Changes between Cycle 1 (2009 RBMP) and Cycle 2 (2015 RBMP) New Building Blocks

2.4.1 Cycle 1 (inaugural release of 2009 RBMP) comprised a set of building blocks for water environmental improvements (highlighted above), in order to establish:

- Waterbody and monitoring networks.
- The designation of artificial and heavily modified waterbodies.
- The standards and boundaries used in assessment.
- The tools used to derive classification results for individual elements from monitoring data.

2.4.2 The second cycle of River Basin Management Planning commenced in early 2016. A number of significant changes to these building blocks have been introduced for the second cycle of River Basin Management Planning[3] - these are:

- Updated standards are being used to determine good status for nutrients and some chemical substances. These new standards were developed as part of a UK-wide collaboration and were widely consulted upon.
- New chemical standards have been introduced as a result of the 2013 EQSD amendments.
- A second generation of biological classification tools to ensure biological classifications are better at reflecting local conditions.
- The size and shape of some waterbodies have changed so that they become more logical management units.
- The process to designate heavily modified waterbodies has been improved.

2.4.3 The new building blocks set the baseline for the updated RBMPs released in early 2016, and help to inform future investigations and help determine appropriate measures and objectives.

[3] Available at: https://www.gov.uk/government/collections/river-basin-management-plans-2015 Last retrieved November 2018

2.5 Assessment Methodology

2.5.1 The assessment of WFD compliance for new activities and schemes that may affect the water environment consists of a 4-step process (summarised in Figure 2.3). This document is designed to support key steps 1- 3 of the assessment process including data collection (Step 1.1), screening for risk of WFD deterioration and risk to waterbody potential (Step 1.3), determining whether the activity would prevent achievement of good potential at the waterbody scale (Step 2.5) and details of proposed mitigation measures to ensure there is no local deterioration, opportunities for enhancement are maximised, and that the proposed development is compliant with WFD legislation.

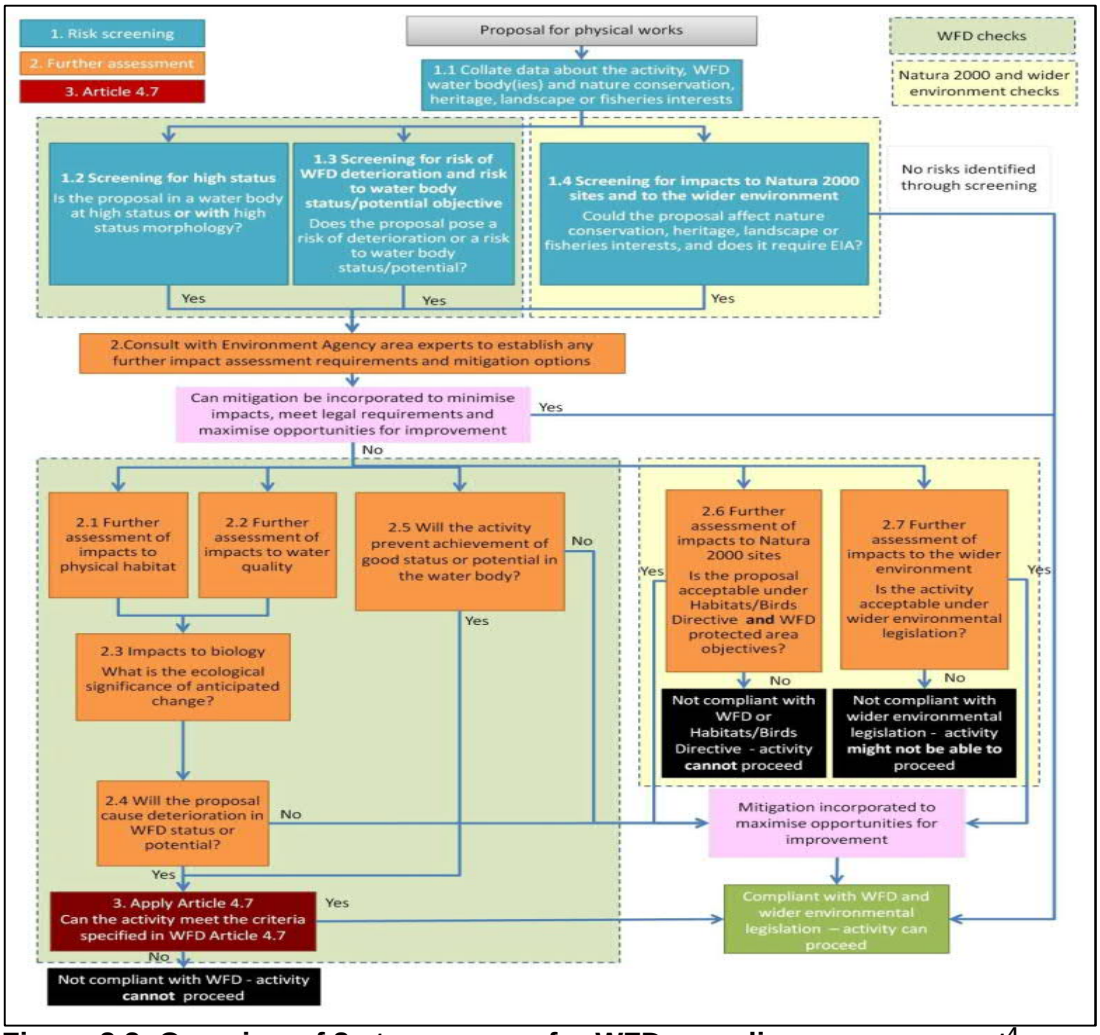

Figure 2.3: Overview of 8-step process for WFD compliance assessment[4]

[4] Environment Agency (2016) Protecting and improving the water environment Water Framework Directive compliance of physical works in rivers position 488_10 (Public Facing Document)

3 BASELINE DATA

3.1 Relevant Waterbodies

3.1.1 The Scheme at Little Eaton junction is in the vicinity of waterbody GB104028053240 "River Derwent from Bottle Brook to River Trent" which is classified in the Humber RBMP[5], and hereafter referred to as the River Derwent for simplicity.

3.1.2 The Scheme would require the diversion of the Dam Brook; a small tributary of the River Derwent. Dam Brook does not have an independent waterbody classification and in WFD terms is, therefore, considered as part of the River Derwent. Whilst the Dam Brook realignment would reduce the length of existing channel by approximately 155m, the realigned Dam Brook channel would be designed to create a more sinuous channel form within a vegetated corridor, flowing downstream of the Boosemoor Brook confluence to the existing brook culvert under the A61, bypassing a major weir and existing culvert located adjacent to the existing A38 Little Eaton junction roundabout, thus improving habitat connectivity upstream to Breadsall.

3.1.3 A small surface water drain emanates from near Breadsall Manor and is a tributary of the Dam Brook. This currently runs into a culvert, north-west of Dam Brook under the A38, before it crosses the A38 again in culvert, discharging to Dam Brook to the south-east of the A38 junction. This waterbody does not have an independent waterbody classification and in WFD terms is considered as part of the River Derwent. The Scheme would entail connecting the unnamed watercourse emanating from Breadsall Manor to the realigned Dam Brook via a multi-stage flood alleviation channel. In addition, a new approximate 172m long 600mm diameter culvert would also be provided from the watercourse under the new A38 embankment that would connect into an existing 500mm diameter culvert in order to convey flows from the unnamed watercourse when the flow capacity of the flood alleviation channel is exceeded. This existing culvert connects into an open ditch on the northern side of the A38 junction. The open ditch would then flow into an existing culvert which would be extended under the new junction, which would then flow into an open swale which would eventually discharge into the realigned Dam Brook near the existing culvert under the A61.

3.1.4 The potential for the Scheme at Little Eaton junction to affect other local and connecting waterbodies has also been assessed. The following waterbodies, which in principle could be considered to be within the zone of influence of the Scheme, have been screened out of the WFD assessment for the reasons below:

- River Derwent from the River Amber to Bottle Brook (GB104028052310) is screened out because it is over 2.5km upstream from the A38 crossing of the River Derwent and thus would not be affected by the Scheme.
- Bottle Brook catchment (tributary of River Derwent) (GB104028052300) is screened out because it is over 790m upstream from the A38 crossing of the River Derwent and would not be affected by the Scheme.

[5] Environment Agency (2015) Part 1: Humber River Basin District - River Basin Management Plan. Updated: December 2015

- Markeaton Brook from Mackworth Brook to River Derwent (GB104028052830) is screened out because it is over 3.5km upstream of the A38 crossing of the River Derwent and thus would not be affected by the Scheme.
- Boosemoor Brook is located to the north-east of Little Eaton junction (refer to Figure 1.1). The brook flows in a south-westerly direction crossing Rectory Lane to the north of Breadsall, flowing through the field network before its confluence with Dam Brook. As Boosemoor Brook is upstream from the junction (located just outside of the Scheme boundary), and not within an area of the proposed Scheme works, this brook it would not be affected by the Scheme.
- The underlying Derwent-Secondary Combined Ground waterbody (GB40402G990400) is not considered at risk from the Scheme (refer to the Environmental Statement which indicate that impacts upon groundwater at Little Eaton junction would be negligible – refer to Chapter 13; Road Drainage and the Water Environment), and thus is not screened into the WFD assessment.

3.2 Ecological Baseline, Potential and Objectives

3.2.1 Baseline WFD data for the River Derwent is summarised in Table 3.1 using data from the Environment Agency's Catchment Data Explorer, the Humber RBMP, the Little Eaton Junction Flood Risk Assessment (Highways England, 2019[6]) and data presented within the Environmental Statement.

3.2.2 The River Derwent (from Bottle Brook to the River Trent) is a HMWB that according to the 2015 Humber RBMP has an overall Moderate ecological potential. Further details of its WFD status are presented in Table 3.1. Other available details for the different WFD elements are provided in Tables 3.2 and 3.3.

3.2.3 Dam Brook is considered to be part of the River Derwent waterbody and, therefore, has the same Moderate ecological potential.

Table 3.1: Surface waterbody classification details

RBMP Parameter	Classification
Waterbody Name, ID, and Category	GB104028053240 River Derwent from Bottle Brook to River Trent
Size (Area, Length)	Length 31.8km. Area 84.9km^2
Current Overall Ecological Quality	Moderate
Current Hydromorphological Condition	HMWB
Reasons for Designation	Drinking Water, Flood Protection, Urbanisation, Water Regulation (impoundment release), Water Regulation (strategic transfer)
Biological Status	Macrophytes and Phytobenthos Moderate, other elements Good or High
Current Chemical Status	Good

[6] Highways England (2019) A38 Derby Junctions – A38 Little Eaton Junction Flood Risk Assessment

RBMP Parameter	Classification
Supporting Elements	Phosphate and Zinc classification is Moderate. Other classified elements are High status
Future Overall Ecological Potential	Moderate by 2015
Protected Area Designation	Drinking Water Protected Area, Nitrates Directive, Urban Waste Water Treatment Directive

3.2.4 The chemical and physico-chemical conditions described in the 2015 Humber RBMP are reproduced in Table 3.2.

Table 3.2: Physico-chemical supporting elements assessed for the 2015 Humber RBMP below good

Element	Current status (and certainty of less than good)	Predicted status by 2021
Phosphate	Moderate (Very Certain)	Moderate
Zinc	Moderate	Moderate

3.2.5 The biological conditions described in the 2015 Humber RBMP are reproduced in Table 3.3.

Table 3.3: Biological elements assessed for the 2015 Humber RBMP below good

Element	Current status (and certainty of less than good)	Predicted status by 2021
Fish	Moderate (Quite Certain)	Good
Macrophytes	Moderate (Quite Certain)	Moderate
Phytobenthos	Moderate (Quite Certain)	Moderate

3.2.6 Hydromorphology elements are not specified within the 2015 RBMP.

3.3 Protected Habitats

3.3.1 Reference to online natural environment mapping available at MAGIC[7] shows that there are Priority Habitats (protected floodplain grazing marsh and woodland) close to the Scheme at Little Eaton junction. Floodplain grazing marsh could be directly dependent on the hydromorphology of the local River Derwent, and this is assessed below. Further details of protected habitats are available within the Environmental Statement – also refer to para. 6.4.10.

3.4 River Basin Management Plan Mitigation Measures

3.4.1 The 2009 Humber RBMP includes general mitigation measures that would serve to improve the ecological status of the River Derwent. However, mitigation measures are not available for the 2015 RBMP.

[7] Available at: http://www.magic.gov.uk/. Last accessed November 2018

4 SCREENING ASSESSMENT

4.1 Risk

4.1.1 According to Environment Agency Guidance (Environment Agency 2016[8]) the following works listed in Table 4.1 would be considered low risk and would not require detailed assessment.

Table 4.1: WFD low risk activities list

Activity	Type of modification
Low impact maintenance activities (encourage removal of obstructions to fish/ eel passage)	Re-pointing (block work structures)
	Void filling ('solid' structures)
	Re-positioning (rock or rubble or block work structures)
	Replacing elements (not whole structure)
	Re-facing
	Maintenance, repair or replacement of minor structures
	Cleaning and/ or painting of a structure
	Maintenance of pumps at pumping station (including pumps that operate outside of 'normal' parameters)
	Blockage/ obstruction removal at a structure (or within 10m upstream or downstream of a structure)
	Removal of young trees, shrubs and grass that may affect the structural stability/ integrity of the structure (including the use of herbicides where permission has been obtained). Only applicable to very localised vegetation growing directly on or immediately adjacent (for example 10m) to a structure that risks impacting structural integrity.
	Vermin control
Temporary works	Temporary scaffolding to enable bridge re-pointing
	Temporary flood defences
	Temporary clear span bridge with abutments set-back from bank top
	Temporary coffer dam (if eel/ fish passage not impeded)
	Temporary flow diversion (if fish/ eel passage not impeded) such as flumes and porta-dams
	Repair works to bridge or culvert which do not extend the structure, reduce the cross-section of the river or affect the banks or bed of the river, or reduce conveyance
	Temporary excavation of trial pits of boreholes in byelaw margin
	Structural investigation works of a bridge/ culvert/ flood defence such as intrusive tests, non-intrusive surveys
Bridges	Permanent clear span bridge, with abutments set-back from bank top
	Bridge deck/ parapet replacement/ repair works
	Replacing surfacing on a bridge
Service crossing	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road

[8] Environment Agency (2016) Protecting and improving the water environment Water Framework Directive compliance of physical works in rivers Position 488_10 (Public Facing)

Activity	Type of modification
	Replacement or dismantling of any pipes, cables or service crossings over a water course. This does not include crossings that require the installation of in-channel supports building a new in-channel structure to support the crossing or any new bed or bank reinforcement.
Other structures	Fishing platforms
	Fish/ eel pass on existing structure (where <2% water body length is impacted)
	Cattle drinks
	Mink rafts
	Fencing (if open panel/ chicken wire) in byelaw margin
	Removal of urban trash from channel and banks. This does not include the removal of gravel or woody debris.

4.1.2 The Scheme at Little Eaton junction involves non-temporary encroachment onto the floodplain of the River Derwent and the realignment of Dam Brook – such works according to Environment Agency guidance, are not listed on the low risk activity register and are thus considered to be high risk activities from a WFD compliance perspective (Environment Agency, 2016[9]). The Scheme, therefore, has the potential to affect waterbody status and objectives, and thus is screened in for WFD assessment.

[9] Environment Agency (2016) Protecting and improving the water environment Water Framework Directive compliance of physical works in rivers Position 488_10 (Public Facing)

5 PRELIMINARY ASSESSMENT

5.1.1 For high WFD risk proposals, a WFD Preliminary Assessment is used to rationalise Further Assessments, by screening out waterbody elements and development elements that would not be impacted by the proposals.

5.2 Possible Impacts on Ecological Potential and Objectives

5.2.1 The outcomes of the Preliminary Assessment are presented as an assessment matrix in Appendix A. This includes temporary and non-temporary effects associated with the construction phase and operational phases of the Scheme (at Little Eaton junction). The assessment matrix in Appendix A is colour coded to help visualise potentially positive, neutral and negative impacts associated with the Scheme at Little Eaton junction, as shown in Table 5.1.

5.2.2 For the Preliminary Assessment, the main focus is identifying those Scheme/ WFD elements that are not applicable i.e. particular WFD elements that would not be impacted by particular Scheme elements. For ease of presentation, elements that do have the potential to be impacted, and therefore require Further Assessment, are also summarised in Appendix A.

5.2.3 The scale of the Scheme works associated with the Scheme at Little Eaton junction means that there are a number of potential waterbody impacts that cannot be ruled out at this stage, and that these require Further Assessment.

Table 5.1: WFD impact colour coding used in Appendix A

Not applicable
Major beneficial effect that could result in improved overall status of the waterbody
Minor beneficial effect that would have local benefits but would not contribute to status change at waterbody scale
Neutral effect, i.e. no effect or an overall balance of minor beneficial and adverse effects
Localised and/or temporary adverse effect that needs to be acknowledged but would not have an impact on WFD objectives
Major adverse effect on one WFD element at waterbody scale
Major adverse effect that could result in deteriorated overall status of waterbody

6 FURTHER ASSESSMENT

6.1 Methodology Overview

6.1.1 WFD Further Assessment involves all at-risk biological, chemical, hydrological and physico-chemical elements, and consideration of whether they could potentially cause deterioration in WFD status/ potential or prevent a waterbody from meeting its ecological objectives. Further Assessment provides more in-depth analysis of Scheme elements that have been screened in through the Preliminary Assessment matrix.

6.2 Hydromorphological Impacts

6.2.1 A number of field surveys have been undertaken to assist with the assessment of Scheme impacts upon watercourses within the vicinity of the Scheme at Little Eaton junction. This includes a topographic survey, including 13 channel cross-section surveys within the River Derwent, as well as a number of ecological surveys along the River Derwent and Dam Brook (includes a River Habitat Survey (RHS) (Highways England 2018[10])). Desk studies and the RHS survey data are summarised below which have informed the WFD assessment.

River Derwent Desk-based Hydromorphology Assessment

6.2.2 The River Derwent is a single-thread meandering channel with limited surface water diversity and bed forms, set in a well-connected floodplain. An assessment of historic maps suggests that the channel planform has been stable for approximately 100 years, implying that it has a contemporary fixed geometry in contrast to an actively meandering natural typology. Aerial imagery suggests minimal bed forms (pools, bars, riffles) as would be expected for a heavily modified channel.

6.2.3 The total area of the River Derwent catchment is approximately 84.9km^2. It is estimated that the Scheme at Little Eaton junction would impact <0.15% of the total River Derwent catchment area. This suggests that there would be no significant impacts upon the River Derwent at a waterbody scale. Localised impacts are examined below.

6.2.4 The Scheme would not significantly impact River Derwent in-channel flows or formations relative to existing conditions. In addition, the Scheme would not have any permanent direct impacts upon the River Derwent, with the River Derwent A38 Bridge being unaffected. The Ford Lane bridge over the River Derwent may require strengthening works during the Scheme construction phase, but such works would not have any impacts upon the River Derwent. Given that there is unlikely to be significant channel migration, Scheme impacts on hydromorphology would be minimal.

[10] Highways England (2018) A38 Derby Junctions - River Habitat Survey Report

6.2.5 The Scheme at Little Eaton junction has the potential to impact the River Derwent by encroachment onto the floodplain. Hydraulic modelling undertaken for the FRA[11] indicates that the Scheme could cause some localised flow deepening during peak events, but there would be no significant change to overall flow dynamics at the reach scale.

6.2.6 Part of the Scheme flood risk design includes a floodplain compensation area to the west of the River Derwent (south of the A38) to compensate for the loss of floodplain displaced by the Scheme at Little Eaton junction. Thus the existing amount of floodplain connectivity would effectively be retained. Overall, the Scheme is assessed as not causing waterbody deterioration or inhibit any future improvements.

Dam Brook Hydromorphology Assessment

6.2.7 The Scheme at Little Eaton junction would directly impact Dam Brook due to a need to realign the channel to make way for the mainline A38 embankment. Dam Brook, a tributary of the River Derwent, is a heavily constrained single thread channel with a natural plane-riffle typology that would naturally be sinuous within the larger River Derwent floodplain, and may have occupied different parts of the lowland alluvial plane historically due to low rates of lateral migration.

6.2.8 Historic maps from 1901 suggest the Dam Brook channel upstream of Little Eaton junction flowed in its current planform and was realigned and re-sectioned with the channel discharging directly to the Derby Canal up until canal closure[12]. Following this period, the present day channel downstream of the Little Eaton junction was realigned against the existing A38 embankment within a straight planform, resulting in loss of sinuosity and in-channel features.

6.2.9 The RHS survey of Dam Brook in the vicinity of Little Eaton junction found the brook to be featureless, with only a single riffle, and no pools or point bars present. The watercourse was also noted as being impounded by two weirs including a major weir and an intermediate weir. The major weir is located near the junction roundabout, with associated upstream channel reinforcement for scour protection. The intermediate weir is located further upstream in the form of a debris dam, with flow clearly impounded behind it.

6.2.10 Channel banks are predominantly composed of earth in a homogenous trapezoidal form; however, the banks are impacted with concrete reinforcement in the form of a culvert and minor outfalls associated with highways drainage. Each outfall has an outfall pipe and wing-wall apron as scour protection, with scour protection also present on the opposite bank in places. The banks are also periodically impacted by cattle downstream of the A61 culvert, which introduces fine sediments to the bed of the watercourse.

[11] Highways England (2019) A38 Derby Junctions – A38 Little Eaton Junction Flood Risk Assessment
[12] National Library of Scotland (2018) (Online) - https://maps.nls.uk/geo/explore/#zoom=15&lat=52.9584&lon=-1.4626&layers=171&b=1 Accessed December 2018

6.2.11 Channel substrate is dominated by silt with only gravel/ pebble and artificial substrate recorded downstream of the A38 roundabout culvert and near the A61 culvert and weir, likely due to the faster flushing flows in this section. Flows slacken downstream of the A61 culvert and weir and silt was observed to be particularly dominant in this area, providing optimal habitat for European brook lamprey (*Lampetra planeri*) which have been found during fish surveys of the brook (see Section 6.4).

6.2.12 Channel vegetation is dominated by fringing emergent reeds and grasses, with emergent broad-leaved, amphibious, submerged broad-leaved and submerged linear-leaved plants, and filamentous algae also present.

6.2.13 The east bank is extensively embanked to provide flood protection, and a setback embankment is present for much of the west bank in the form of the A38 carriageway.

Unnamed Drain (Tributary of Dam Brook) Hydromorphology Assessment

6.2.14 This watercourse is a small tributary of the Dam Brook issuing from a pond near Breadsall Manor. The channel is tree lined with shallow banks and no appreciable flow; however, areas of standing water within the channel are noted as being present. The channel is also noted as being periodically dry during walkovers in both the summer and winter. The FRA[13] undertaken for the Scheme also suggests that the channel will only flow during periods of heavy rain. The bed gradient is shallow and dominated by silt. In-channel macrophytes are lacking in diversity and are composed mainly of watercress (*Rorippa nasturtium*) and fools watercress (*Apium nodiflorum*).

Groundwater Impacts

6.2.15 With regards to surface water – groundwater connectivity, Environment Agency mapping shows that the underlying bedrock is classified as 'Secondary A' Aquifer, which is defined 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. These are generally aquifers formerly classified as minor aquifers*".

6.2.16 At Little Eaton junction, no major below ground construction works are proposed and thus the Scheme would have a negligible impact on groundwater levels and flows.

6.2.17 During routine operation of the Scheme, highway run-off would be directed into the proposed highway drainage system which would discharge to receiving surface watercourses (with no discharges going to groundwater). Given the provision of an appropriate highway drainage system, operation of the Scheme at Little Eaton junction would have a negligible impact upon groundwater, and thus effects would not be significant.

Impact Summary

6.2.18 Overall, given the relative scale of the Scheme and the waterbody, significant detrimental temporary or non-temporary impacts on waterbody hydromorphological potential are not anticipated. Channel realignment proposals on the Dam Brook could

[13] Highways England (2019) A38 Derby Junctions – A38 Little Eaton Junction Flood Risk Assessment

contribute to waterbody improvement objectives. Appropriate naturalisation design would significantly offset any localised impacts of the Dam Brook realignment and the culvert extensions on the unnamed tributary (see Section 6.4) and could result in overall improvement to the local waterbody.

6.3 Chemical and Physico-Chemical Impacts

6.3.1 The Scheme at Little Eaton junction could have temporary impacts on the physico-chemical status of local waterbodies due to the effects of residual contaminants, sediment mobilisation and the introduction of new contaminants through construction activities. It could also have non-temporary impacts in terms of the potential to create new chemical pathways from road runoff, including automobile-related contaminants.

6.3.2 No priority substances have been identified in the existing waterbody, although it is noted from the RBMP that some polycyclic hydrocarbons (PAHs) and tributyltin compounds have a 'moderate' ecological status, suggesting that there is reason for these priority substances to be of particular concern.

6.3.3 At Little Eaton junction, no major below ground construction works are proposed and thus the Scheme would have a negligible impact on groundwater levels and flows.

6.3.4 Temporary (construction) and non-temporary impacts associated with increased local traffic and associated road runoff could result in the introduction of priority substances such as automobile related contaminants including polycyclic hydrocarbons (PAHs) or heavy metals. However, construction works would be temporary and any potential effects would be mitigated through the adoption of standard environmental construction best practices – such management practices would be specified within a Construction Environmental Management Plan (CEMP) which would be prepared and implemented by the construction contractor.

6.3.5 A former landfill site is located approximately 200m to the north of the junction which would be used as construction compound for the Scheme. A separate investigation and remediation design will be undertaken for the site in order to ensure that there would be no impacts upon local water resources.

6.3.6 The Scheme would direct highway runoff into a highway drainage system that includes two highway runoff attenuation ponds at Little Eaton junction as well as oversized pipes, narrow filter drains, combined kerb drainage units, trapped gully pots/ road-side linear drains, petrol interceptors at outfalls and connections to existing public sewers, and by-pass separators. The highway drainage system would thus appropriately manage both water runoff and quality and avoid adverse effects upon Dam Brook and the River Derwent.

Impact Summary

6.3.7 In summary, it is considered that the Scheme at Little Eaton junction would have negligible impacts on the physico-chemical potential of the River Derwent, given that appropriate construction and operational mitigation measures would be put in place. Details of such mitigation measures are further discussed within the Environmental Statement.

6.4 Biological Assessment and Impacts

6.4.1 Detailed biological/ ecological surveys were not undertaken at Little Eaton junction as part of the RBMP. However, in order to assist with the design of the Scheme, several ecological surveys have been undertaken at select locations on the River Derwent and Dam Brook in the vicinity of Little Eaton junction. This has included the following:

- Aquatic macro-invertebrate surveys in spring (April 2015), summer (August 2015) and autumn (October 2015) (Highways England, 2015[14]).
- Updated macro-invertebrate surveys in Spring (May 2018) and autumn (September 2018) (Highways England, 2018[15].
- A fish survey of the Dam Brook and Watermeadows Ditch (August 2018) (Highways England, 2018[16]).
- White-clawed crayfish surveys undertaken in July 2015 (Highways England, 2015[17]), July 2017[18] (Highways England, 2017) and July 2018 (Highways England, 2018[19]) in the vicinity of Little Eaton junction.

Aquatic Macro-Invertebrates

6.4.2 The diversity of the macroinvertebrate community indicates the River Derwent is of "Very Good" biological quality within the surveyed reach and supports communities likely to be highly sensitive to pollution and changes in water quality.

6.4.3 Dam Brook was found to be of moderate (autumn) to good (spring/ summer) biological quality within the area surveyed, and supports communities that are likely to be sensitive to changes in water quality.

Fish

6.4.4 The fish surveys undertaken in August 2018 were conducted on Dam Brook and Watermeadows Ditch. The Dam Brook survey took place within the weir pool and channel between the junction roundabout and the A61 road culvert, whilst the Watermeadows Ditch survey took place adjacent to the turf production site. Three notable species of fish were recorded within Dam Brook, namely brook lamprey, brown trout *Salmo trutta* and bullhead *Cotus gobbio*.

6.4.5 The fish community structure at Dam Brook differed amongst each site. The main site, located downstream of the Little Eaton roundabout and weir held a good number of brown trout, perch *Perca fluviatilis*, brook lamprey (ammocoetes – juvenile lamprey) and bullhead. Whereas the survey section upstream of the weir contained small numbers of trout, three-spined stickleback *Gasterosteus aculeatus* and stone loach *Barbatula barbatula*. The Dam Brook weir pool only contained one trout and one perch.

[14] Highways England (2015) A38 Derby Junctions. Aquatic Macroinvertebrate Survey Report
[15] Highways England (2018) A38 Derby Junctions Aquatic Macroinvertebrate Survey Report
[16] Highways England (2018) A38 Derby Junctions Dam Brook and Watermeadows Ditch Fish Survey Report
[17] Highways England (2015) A38 Derby Junctions. White-clawed Crayfish Survey Report
[18] Highways England (2017) A38 Derby Junctions. White-clawed Crayfish Survey Report
[19] Highways England (2018) A38 Derby Junctions. White-clawed Crayfish Survey Report

6.4.6 The diminishing number of species and fish abundance upstream of the original survey site at Dam Brook is believed to be caused by the culvert and weir impacting fish movements. Further, it is believed that the weir is a barrier to all fish movements upstream, notably due to the absence of brook lamprey upstream of the weir.

6.4.7 Watermeadows Ditch only contained four fish species: brook lamprey (ammocoetes), three-spined stickleback, nine-spined stickleback *Pungitius pungitius* and Stoneloach. Brook lamprey were the most prominent, with the minor species only being recorded in small numbers.

6.4.8 The difference in fish community structure between the two watercourses is believed to be the result of a reduction in water quality and heavy siltation in Watermeadows Ditch. It is believed that this is being caused by two factors: i) increased eutrophication as a result of nutrient input from the adjacent land; and ii) the installation of a handmade barrier dam in the watercourse resulting in an increased water depth and sedimentation, and a reduction in flow. Both of these factors are reducing the habitat suitability in Watermeadows Ditch for more sensitive fish species (e.g. trout and bullhead).

White-clawed Crayfish

6.4.9 The white-clawed crayfish survey recorded one white-clawed crayfish within the Dam Brook in 2015; however, subsequent surveys in 2017 and 2018 recorded only signal crayfish. White-clawed crayfish are now considered to be absent from this watercourse due to the potential presence of crayfish plague, *Aphanomyces astaci,* and competition from signal crayfish.

Designated and Non-designated Sites

6.4.10 There are several sensitive habitats, designated and non-designated ecological sites within proximity to Little Eaton junction as follows:

- Site of Special Scientific Interest (SSSI):
  - Breadsall Railway Cutting SSSI located approximately 1.7km from the Scheme
- Local Nature Reserve (LNRs):
  - Allestree Park LNR
  - Darley and Nutwood LNR
  - Breadsall Railway Cutting LNR
  - Chaddesden Woods and Lime Lane Wood LNR

  The LNRs are all designated for the types of habitats present and are located greater than 500m from the junction.
- Local Wildlife Site (LWS):
  - There are two non-statutory designated LWSs located within or directly adjacent to the Scheme at Little Eaton junction (Alfreton Road Rough Grassland LWS (the site is designated for its floodplain grassland which is semi-improved) and River Derwent LWS (the site is designated for its flowing water, river and associated streams)).

- Watermeadows Ditch LWS located within approximately 600m, and to the south of Little Eaton junction. The site is designated for its standing open water and has hydrological links to the site through connecting watercourses.
- Nooney's Pond LWS located approximately 750m south of Little Eaton junction. The site is designated for its standing open water and has hydrological links to the site through connecting watercourses.
- Other LWS sites are not considered to be relevant due to their distance from the Scheme (>500m), with intervening housing developments or roads, and the absence of hydrological or habitat links to the Scheme.

6.4.11 The Scheme would avoid significant effects upon the sites as detailed above, although approximately 25% of the Alfreton Road Grassland LWS would be permanently lost due to the Scheme. Scheme effects upon these designated and non-designated ecological sites are detailed within the Environmental Statement, together with appropriate mitigation measures.

River Derwent – Impacts

6.4.12 The Scheme would have no direct impacts to WFD biological quality elements on the River Derwent. The risks to the River Derwent would be highest during the construction phase due to potential indirect impacts such as silt laden run-off, oil/ diesel spills, vibration and noise which could have adverse effects on fish and invertebrate species. Such indirect impacts would be mitigated using the measures as detailed in Section 6.5.

Dam Brook - Impacts

6.4.13 Dam Brook would be permanently impacted by the Scheme due to the realignment of the channel, resulting in the initial loss of existing established channel features, including marginal and emergent vegetation and bed and bank substrates, which notably provides a habitat for brook lamprey.

6.4.14 The Dam Brook channel from source to confluence with the River Derwent (including the lengths of the Ferriby Brook, located upstream of Breadsall and the A608, and the Watermeadows Ditch located downstream of the A61 road culvert to its confluence with the River Derwent) is approximately 6km in length. The proposed realignment works would impact an approximate 555m length of open channel (i.e. approximately 9.25% of the total channel length) (refer to Figure 1.2). Considering the proposed scale of in-channel works within Dam Brook, the brook's existing biodiversity characteristics and the proposed channel realignment designed to bypass the roundabout culvert and major weir, and improve in-channel habitats (including a low level regularly wetted berm, inset berms, riffle and point bar creation), significant effects are not anticipated and would have only a local, temporary impact on WFD quality elements at the waterbody scale. This local impact would be appropriately mitigated as discussed in Section 6.5.

Unnamed Dam Brook Tributary Impacts

6.4.15 The unnamed Dam Brook tributary currently runs in open channel for approximately 280m upstream of the A38 roundabout from source to a culvert headwall (passing into an approximate 50m long culvert under the existing A38) (refer to Figure 1.2).

Approximately 124m of this existing open channel length would be permanently impacted by the extension of the road culvert to the east of the A38 due to the Scheme. A flood alleviation channel measuring 260m in length would be created by the Scheme upstream of the A38 culvert to carry surface water flows into the realigned Dam Brook, within a proposed two stage channel and wet woodland.

6.4.16 The proposed culverting of a section of the unnamed tributary upstream of the junction would result in a loss of open channel habitat which would have adverse impacts on in-channel macrophytes and invertebrates. Considering the channel has little to no flow during normal flow conditions and periodically runs dry, this loss of open channel would have a negligible effect on the River Derwent waterbody at the catchment scale; however, the shading effect of the culvert would have a local detrimental effect and this would be mitigated as discussed in Section 6.5.

6.4.17 The unnamed tributary currently passes back under the A38 via a second approximately 70m long culvert and discharges to the open Dam Brook channel at an existing headwall. The Scheme proposals include an extension of this culvert by approximately 96m with the discharge point outfalling to an open swale channel, approximately 216m in length running adjacent to the Dam Brook and associated new ponds before discharging to the realigned Dam Brook at the downstream A61 road culvert. Given the existing length of channel is already in culvert and that the vast majority of flows would discharge down the new flood alleviation channel (as described above), there would be a negligible effect on the River Derwent waterbody and a negligible local effect as a result of the culvert extension.

Impact Summary

6.4.18 Overall, it is considered that the Scheme at Little Eaton junction would have negligible impact on the River Derwent biological potential at the waterbody scale. Some temporary local deterioration is possible due to land take and temporary habitat loss due to the additional culverts on the Dam Brook tributary and the realignment of the Dam Brook channel; however, these impacts can be mitigated, whilst the waterbody biology could potentially be enhanced as part of the Scheme (see Section 6.5).

6.5 Mitigations Measures

6.5.1 The impacts of the Scheme on the water environment and WFD objectives have been identified as being negligible at the WFD waterbody scale. This has been achieved through the incorporation of appropriate mitigation measures into the Scheme design as detailed in the sections below. In defining such measures, opportunities to improve the local water environment have been taken where feasible.

Construction Management

6.5.2 During the Scheme construction phase, best practices would be applied in accordance with a CEMP to be prepared and implemented by the selected construction contractor. Such measures would ensure that significant effects upon local waterbodies in the vicinity of the Scheme at Little Eaton junction would be avoided.

Operational Highway Runoff

6.5.3 The Scheme would direct highway runoff into a highway drainage system that includes two highway runoff attenuation ponds at Little Eaton junction (refer to Figure 1.2) as well as oversized pipes, narrow filter drains, combined kerb drainage units, trapped gully pots/ road-side linear drains, petrol interceptors at outfalls and connections to existing public sewers, and by-pass separators. The highway drainage system would thus appropriately manage both water runoff and quality and avoid adverse effects upon Dam Brook and the River Derwent.

The River Derwent

6.5.4 The River Derwent would not be directly impacted by the Scheme at Little Eaton junction. Implementation of the mitigation measures as detailed in the CEMP would ensure that significant temporary effects would be avoided during the Scheme construction phase. Similarly the highway drainage design would ensure no local deterioration of this WFD waterbody during Scheme operation.

Dam Brook Mitigation Measures

6.5.5 The proposed Dam Brook realigned channel design would create a more sinuous channel form within a vegetated corridor, flowing downstream of the Boosemoor Brook confluence to the existing culvert under the A61, bypassing the major weir and existing culvert located adjacent to the Little Eaton junction roundabout. This would improve river connectivity and the installation of in-channel features, such as the regularly wetted berm, inset berms and point bars, would improve bed and bank structure. Where the bed of the watercourse is raised, this would encourage a more natural bed formation. The reinstatement of a natural watercourse gradient would also improve floodplain connectivity and create new wetland habitat. Further to this, backwaters are proposed which would improve the habitat for both coarse and salmonid fish and brook lamprey. Given the historic modifications to Dam Brook and the existing lack of diverse channel morphology, these modifications are anticipated to lead to an improvement at a local scale to the Biological WFD quality elements and more than offset the reduction in Dam Brook channel length and any initial temporary habitat loss.

6.5.6 During the realignment of the Dam Brook, given the presence of brook lamprey, there would be a need for fish rescue and translocation to suitable sites within the Watermeadows Ditch and the River Derwent. The mitigation approach is detailed within the Environmental Statement.

6.5.7 Following Dam Brook diversion, implementation of the mitigation measures as detailed in the CEMP would ensure that significant temporary effects on the realigned brook would be avoided during the remaining parts of the Scheme construction phase. Similarly, the highway drainage system would ensure no local deterioration of this WFD waterbody during Scheme operation.

Unnamed Dam Brook Tributary Mitigation Measures

6.5.8 This unnamed watercourse is a ditch with no perceivable flow during normal conditions. The Scheme would create a flood alleviation channel which would divert flows through a wet woodland between the watercourse and the realigned Dam

Brook. Due to channel capacity and Scheme design, some flow during extreme flood events would be discharged to the extended culvert under the A38, eventually discharging back under the A38 junction via a second extended culvert into an open swale channel running adjacent to Dam Brook and associated new ponds before discharging to the realigned Dam Brook near the downstream A61 road culvert.

6.5.9 The multi-stage channel within the flood alleviation channel would provide a regularly wetted berm to encourage a more diverse macrophyte community. Given the existing lack of flow within the unnamed watercourse, and the creation of a new overflow channel within wet woodland, the Scheme modifications are anticipated to lead to betterment at the local scale to this watercourse.

7 CONCLUSION

7.1.1 The Scheme at Little Eaton junction would require encroachment into the floodplain of the River Derwent (with floodplain compensation being provided to the west of the River Derwent), the realignment of the Dam Brook channel, creation of a flood alleviation channel connecting an unnamed watercourse from Breadsall Manor to the realigned Dam Brook channel, plus the extension of two culverts under the A38 to carry some flows from an unnamed watercourse which would discharge into a new open swale channel running adjacent to Dam Brook and associated new ponds before discharging to the realigned Dam Brook near the downstream A61 road culvert.

7.1.2 The Scheme works would result in a collective loss of existing open channel of approximately 279m (loss of approximately 155m of Dam Brook and approximately 124m loss of the unnamed watercourse). However, provision of the 260m long flood alleviation channel and the new approximately 216m long swale would result in the creation of approximately 476m of new open channel. Therefore, these collective works would result in a net gain in open channel of approximately 197m associated with Dam Brook and its tributaries.

7.1.3 This WFD assessment has been undertaken to identify the potential impacts of the Scheme at Little Eaton junction and its compliance with EC Directive 2000/60/EC, the Water Framework Directive (WFD), which aims to protect and enhance the quality of the water environment. This report has been produced to help inform the development of the Scheme design in terms of WFD objectives.

7.1.4 The impacts of the Scheme at Little Eaton junction on the water environment and WFD objectives have been identified as being negligible at the waterbody scale. Mitigation measures have been incorporated into the Scheme design to minimise potential adverse impacts, and improve the local water environment in line with WFD objectives.

7.1.5 Mitigation measures include:

- Construction works would be undertaken in accordance with a CEMP which would be prepared and implemented by the selected construction contractor.
- The Scheme would be provided with an appropriate highway drainage design that would control the quantity and quality of runoff from the new road network.
- The Dam Brook realigned channel design would create a more sinuous channel form within a vegetated corridor.
- The watercourse emanating from Breadsall Manor would be connected to a flood alleviation channel which would divert flows through a wet woodland to the realigned Dam Brook (approximately 260m long).
- Provision of an open swale measuring approximately 216m long which would connect flows from a culvert under the junction to the realigned Dam Brook near the existing brook culvert under the A61.

7.1.6 In terms of WFD objectives, it is considered that the Scheme at Little Eaton junction, with the defined package of mitigation, would support WFD objectives by:

- Not causing deterioration in the ecological potential of any waterbodies.

- Not preventing the local waterbody from meeting its objective of good ecological potential.
- Not preventing or compromising WFD objectives being met in other waterbodies.
- Not causing failure to meet good groundwater status, or result in a deterioration of groundwater status.
- Not preventing the implementation of mitigation measures which define the hydromorphological designation of heavily modified waterbodies.

APPENDIX

WFD Assessment Matrix

A. Risk screening of potential to cause deterioration of current WFD Ecological status

Waterbody and Scheme Details				Scheme Elements	Expanded road network	River Derwent - Extension of A38 Little Eaton junction into River Derwent floodplain				Unnamed tributary of Dam Brook culverting - Extension of Little Eaton junction				Dam Brook realignment - Extension of Little Eaton junction		OVERALL effect on element	Additional proposed mitigation measures		RESIDUAL effect on element (following any additional mitigation measures)
	Surface Water body	Current status	Status objective														Construction	Operation	
	GB104028053240	Moderate	Good ecological status by 2027	Description of Scheme element impact	Expanded road network and increased impervious surface area drainage (Little Eaton junction).	Expansion of A38 carriageway embankment and the extension of an arched flood relief bridge with foundations in the River Derwent floodplain.				Extension of two culverts of unnamed tributary underneath the Scheme.				Length of Dam Brook to be diverted due to Scheme.					
	River Derwent			Identified biological impacts	Drainage	Noise and vibration	Land take (embankments)	Scheme drainage/ release of contaminants/ accidental spillage	Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	Noise and vibration	Shading	Scheme drainage release of contaminants/ accidental spillage	Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	Changes to water body hydromorphology leading to changes in river processes and habitats upstream and downstream	Creation of new habitats				
	Biological Potential																		
WFD classification elements	1.Macrophytes and phytobenthos - diatoms			Predicted change to status elements (green = none, amber = possibly, red = likely)	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
	2. Macrophytes and phytobenthos - macrophytes	-	-		Expansion of the existing road network has the potential to increase polluted sediment mobilisation. Proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	No channel impact. No effect anticipated.	Floodplain impact only, with no impacts on channel habitats. Floodplain storage displacement would be compensated as part of Scheme flood risk management. The scale of impact relative to the waterbody scale would be negligible, but water environment improvements should be designed into the Scheme design as applicable.	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	Floodplain impact only with no significant impacts on channel habitats. Floodplain storage displacement would be compensated as part of Scheme flood risk management. The scale of impact relative to waterbody scale would be negligible, but water environment improvements should be integrated into the Scheme as applicable.	No channel impact. No effect anticipated.	Shading would deplete available habitat.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	Potential flow pattern and channel morphology homogenisation, and increased velocities and could deplete habitats.	Potential for some temporary impacts, although long term impacts would be minimal. Brook realignment design would create new habitats.	Channel realignment offers the opportunity to incorporate habitats specifically designed for macrophytes.	Scheme elements identified as having potential for temporary and/ or localised minor adverse effects (brook realignment, culverting, embankment), but would be mitigated through adherence to construction best practices. Overall effect considered to be minor, with no potential of compromising the achievement of this element status objectives for this waterbody.	Implement best construction practices to provide sediment controls, limiting sediment from entering the watercourse.	Restoration and naturalisation design, based on reconstruction of pre-modified ecology. Dam Brook diversion appropriately designed to include a range of channel habitats, including low level berm pools,, riffles and runs in order to allow for colonisation by the range of taxa that currently (and historically) characterise the reach. Multi-stage flood alleviation channel would be created adjacent to the unnamed tributary which would be enhanced for biodiversity benefit. The unnamed downstream of the junction would run in open swale channel for 216m and would be planted with native wetland species benefiting macro-invertebrate species.	Minor localised and temporary effects during construction, possible non-temporary benefits given appropriate Scheme design.
	3. Macroinvertebrates	Moderate	-		Expansion of the existing road network has the potential to increase polluted sediment mobilisation. Proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	No channel impact. No effect anticipated.	Floodplain impact only, with no impacts on channel habitats. Floodplain storage displacement would be compensated as part of Scheme flood risk management. The scale of impact relative to waterbody scale would be negligible, but water environment improvements should be designed into the Scheme design as applicable.	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	Floodplain impact only with no significant impacts on channel habitats. Floodplain storage displacement would be compensated as part of Scheme flood risk management. The scale of impact relative to waterbody scale would be negligible, but water environment improvements should be integrated into the Scheme as applicable.	Ditch channel has minimal water and runs dry at periods throughout the year. The watercourse is not likely to support a diverse assemblage of invertebrates, however, noise and vibration could impact local biodiversity.	Ditch channel has minimal water and runs dry at periods throughout the year. The watercourse is not likely to support a diverse assemblage of invertebrates. Localised shading would deplete available habitat for invertebrates.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	Ditch channel has minimal water and runs dry at periods throughout the year. The watercourse is not likely to support a diverse assemblage of invertebrates. Shading and potential flow pattern and channel morphology homogenisation, and increased velocities could deplete habitats.	Invertebrates assessment indicate that Dam Brook is of moderate (autumn) to good (spring/ summer) biological quality within the area surveyed, and supports communities that are likely to be sensitive to changes to construction activities. Potential for some temporary impacts, although long term impacts would be minimal. The realignment design improves the morphology of the channel and improves in-channel habitats.	Channel realignment incorporates habitats to improve invertebrate habitat.				
	4. Fish	=	-		Expansion of the existing road network has the potential to increase polluted sediment mobilisation. Proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	River Derwent channel would not be impacted and, therefore, there would be negligible effects from noise and vibration.	No channel impacts.	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	Floodplain impact only, with no significant impacts on channel habitats.	Can cause fish mortality or injury at high levels and behavioural responses at low levels. Unlikely to be an impact as the channel runs dry and would not be suitable for fish. This would, therefore, have a negligible impact.	Likely to lead to the permanent loss of habitat, however, the channel has very low water levels and runs dry periodically which would not provide suitable existing habitat for fish. This impact would, therefore, be negligible.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	Potential flow pattern and channel morphology homogenisation, and increased velocities could deplete habitats. The majority of flows would discharge into an flood alleviation channel created upstream of the junction which would connect to Dam Brook further upstream than the existing culverted discharge point.	Channel realignment would have an initial impact on fish including brook lamprey found on site. However, the lamprey and other fish species would be moved to a suitable donor site downstream of the proposed works within the Watermeadows Ditch or the River Derwent to mitigate initial construction impacts. In the long term the realigned channel would bypass a major weir and would have an improved morphology including backwaters which would benefit fish species, such that long term impacts are likely to be minimal if not beneficial. Diversion design takes the opportunity to create new habitats.	Channel realignment offers the opportunity to incorporate habitats specifically designed for fish.				
	Physico-Chemical Potential																		
WFD classification elements	5. Dissolved Oxygen	Good	-	Predicted change to status elements (green = none, amber = possibly, red = likely)	Expansion of an existing road network has the potential to increase polluted sediment mobilisation, which can lead to decreased dissolved oxygen levels. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	N/A	N/A	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	N/A	No significant impact anticipated.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.	Impacts from Scheme construction and operation would be negligible with appropriate construction management plans and Scheme design - potential water quality benefits with the provision of a new drainage design, although gains are likely to be small at waterbody scale.	Implement best construction practices to prevent sediment and pollutants entering the watercourse.	Sustainable drainage systems to reduce sediment and sediment-related contaminants from entering the watercourse.	Minor localised and temporary effects during construction, possible non-temporary benefits given appropriate Scheme design.
	6. pH	High	-		Expansion of an existing road network has the potential to increase road polluted sediment mobilisation. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	N/A	N/A	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	N/A	No significant impact anticipated.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.				
	7. Phosphate	Good	-		Expansion of an existing road network has the potential to increase road polluted sediment mobilisation. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	N/A	N/A	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	N/A	No significant impact anticipated.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.				
	8. Ammonia	High	-		Expansion of an existing road network has the potential to increase road polluted sediment mobilisation. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	N/A	N/A	Floodplain impact only, with no significant impacts on channel habitats. The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are integrated into the Scheme design.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	N/A	No significant impact anticipated.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.				
	9. Temperature	-	-		Expansion of an existing road network has the potential to increase road polluted sediment mobilisation. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality with a beneficial impact on biodiversity.	N/A	N/A	Floodplain impact only, with no significant impacts on channel habitats.	Floodplain impact only with no significant impacts on channel habitats.	N/A	Possible temperature reduction associated with increased shading, although this is assessed to be negligible or non-measurable.	The scale of impact relative to waterbody scale would be negligible, given that appropriate drainage management and sustainable drainage systems are incorporated into the Scheme design	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.				
	10. Specific Pollutants (Annex VIII)	-	-		Expansion of an existing road network has the potential to increase road polluted sediment mobilisation. However, proposed sustainable drainage systems should effectively manage any effects and could improve runoff quantity and quality.	N/A	N/A	None recorded, although historic landfill to the north of the Scheme (excavations into this area are not proposed).	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	N/A	No significant impact anticipated.	None recorded, although historic landfill to the north of the Scheme (excavations into this area are not proposed)	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	No significant impacts anticipated on fine sediment or sediment-associated pollutants.	An appropriately designed channel, including sustainable drainage systems for water quality control and morphology for sediment-associated pollutant control, could benefit water quality.				
	Hydromorphological Potential																		
WFD classification elements	11. Quantity and dynamics of river flow	-	-	Predicted change to status elements (green = none, amber = possibly, red = likely)		N/A	N/A	N/A	Floodplain impact only with no significant impacts on channel habitats. Floodplain storage displacement would be compensated as part of flood risk management. Flood risk modelling suggests potential local increases in flood depth around the extended embankments, but the scale of impact relative to waterbody scale would be negligible.	N/A	N/A	N/A	The tributary is approximately 1m wide with shallow banks. There is limited flow and the channel runs dry periodically throughout the year. The culvert extension would prevent out of bank flows and culvert boundaries would be smooth compared to natural banks and vegetated riparian zones, which may result in homogenised flow patterns and increased flow velocities. The majority of high flows would discharge into an adjacent multi-staged flood alleviation channel through a proposed area of woodland therefore impacts are likely to be minor.	Dam Brook is approximately 2m wide and could be hydromorphologically diverse, but appears to have been historically modified. Realignment of the historically straightened watercourse would be a morphological and habitat development opportunity. In morphological terms, significant benefits are not anticipated, although local habitat creation may be viewed as a positive impact. Overall, considered that significant impacts on flow dynamics are unlikely.	Channel realignment offers the opportunity to naturalise and restore flow dynamics.	Given the current modified and deteriorated hydromorphological status of the River Derwent and Dam Brook, impacts from Scheme are assessed to be minor, especially when considered at waterbody scale. Realignment of Dam Brook provides the opportunity to mitigate local impacts, and to improve hydromorphology.	Implement best construction practices to prevent sediment entering watercourses.	Implement recommendations of the hydromorphological surveys/ fluvial audits (RHS Survey) to aid detailed design development. Incorporate hydromorphological mitigation measures into detailed design where practicable. Mitigation measures include: bank reprofiling (rehabilitation); create low level regularly wetted berm; introduce riparian vegetation/ green corridors where space allows; recreate a sinuous river channel where space allows; recreation of gravel bars and riffles using permanent and/ or temporary bed structures (increase morphological diversity); retain marginal vegetation; use of engineering techniques to assist natural recovery; use soft engineering techniques.	Minor localised and temporary effects during construction, possible non-temporary benefits given appropriate Scheme design.
	12. Connection to groundwater	-	-			N/A	N/A	N/A	Likely to be no significant relationship with groundwater.	N/A	N/A	N/A	Likely to be no significant relationship with groundwater.	Likely to be no significant relationship with groundwater.	Likely to be no significant relationship with groundwater.				
	13. River continuity	-	-			N/A	N/A	N/A	Floodplain impact only with no significant impacts on channel habitats or downstream continuity. Floodplain connectivity would not be impacted because floodplain storage displacement would be compensated as part of flood risk management.	N/A	N/A	N/A	The culvert would disconnect floodplains and out-of-bank flows, bank habitats and effectively sever existing flow and habitat continuity within and adjacent to both sides of the channel. Due to the ephemeral nature of in channel flows and the provision of the overflow channel, impacts are assessed to be minor.	Realignment of the historically straightened watercourse is, in principle, a morphological and habitat development opportunity. In morphological terms, significant benefits are not anticipated, although local habitat creation may be viewed as a positive impact.	Channel realignment offers the opportunity to naturalise and restore river continuity, especially with riparian and floodplain habitats.				
	14. River depth and width variation bed	-	-			N/A	N/A	N/A	Floodplain impact only with no significant impacts on channel habitats. Floodplain storage displacement would be compensated as part of flood risk management. Flood risk modelling suggests potential local increases in flood depth around the extended embankments, but the scale of impact relative to waterbody scale would be negligible.	N/A	N/A	N/A	Flow geometry is likely to be homogenised, but the culvert extension would be small scale, so impacts are assessed to be minor.	Realignment of the historically straightened watercourse is, in principle, a morphological and habitat development opportunity. In morphological terms, significant benefits are not anticipated, although local habitat creation may be viewed as a positive impact.	Channel realignment offers the opportunity to naturalise and restore channel shape diversity.				
	15. Structure and substrate of river bed	-	-			N/A	N/A	N/A	No planned works within the river channel, therefore no significant impacts anticipated for in-channel flows, limiting any risk of changes to structure and substrate of the bed.	N/A	N/A	N/A	Culverts can interrupt downstream substrate transport, and can affect local scour and deposition of bed forms, as channel flows are minimal with limited potential for sediment transport except during high flow conditions. The culvert extensions would be accompanied by an adjacent flood alleviation channel which would operate during high flow events facilitating natural sediment transport and deposition, impacts are therefore assessed to be minor. If the culvert base is set below the channel bed, the impacts on the bed could be minimised further.	Realignment of the historically straightened watercourse is, in principle, a morphological and habitat development opportunity. In morphological terms, significant benefits are not anticipated, although local habitat creation may be viewed as a positive impact.	Channel realignment offers the opportunity to naturalise and restore bed diversity.				
	16. Structure of riparian zone	-	-			N/A	N/A	N/A	Floodplain impact only with no significant impacts on riparian habitats.	N/A	N/A	N/A	The culvert would result in loss of riparian habitat, but the culvert extension would be accompanied by a flood alleviation channel, which would operate during high flow replicating the existing situation and providing riparian habitat. Impacts are therefore assessed to be minor.	Realignment of the historically straightened watercourse is, in principle, a morphological and habitat development opportunity. In morphological terms, significant benefits are not anticipated, although local habitat creation may be viewed as a positive impact.	Channel realignment offers the opportunity to naturalise and restore riparian zones.				