M42 Junction 6 Improvement
Scheme Number TR010027
Volume 6
6.3 Environmental Statement
Appendix 14.1 Preliminary Water Framework Directive Assessment (pWFD)

Regulation 5(2)(a)

Planning Act 2008

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

January 2019

Infrastructure Planning

Planning Act 2008

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

M42 Junction 6 Improvement

Development Consent Order 202[-]

6.3 Environmental Statement
Appendix 14.1 Preliminary Water Framework Directive Assessment (pWFD)

Regulation Number	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference	TR010027
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Author	M42 Junction 6 Improvement Project Team and Highways England

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1	January 2019	DCO Application

2 Introduction

2.1 Background

2.1.1 AECOM was commissioned by Highways England, the Applicant, to produce a Preliminary Water Framework Directive (pWFD) assessment to support an application for a Development Consent Order (DCO) to the Planning Inspectorate under the Planning Act 2008 (as amended) for the M42 Junction 6 Improvement Scheme (hereafter known as the 'Scheme'), which is a Nationally Significant Infrastructure Project (NSIP). The Scheme would provide connections between the national motorway network, and A45 Coventry Road which provides strategic access to Birmingham to the west, and Coventry to the east. Junction 6 lies on the eastern edge of Birmingham, approximately nine miles from the city centre, with the nearest town being Solihull (please see Figure 1).

1.1 The scheme

2.1.2 The Scheme would be implemented within an area broadly defined by M42 Junction 7 to the north, Birmingham Airport and Catherine-de-Barnes to the west, the A45 and Hampton-in-Arden to the east, and M42 Junction 5 to the south. The Scheme includes the following elements:

M42 Junction 5A

2.1.3 A new junction (M42 Junction 5A) is proposed approximately 1.8km south of M42 Junction 6. This would comprise two roundabouts immediately north of Solihull Road, each positioned either side of the M42 motorway and connected by a new bridge over the M42. The new junction would have south facing slip roads only, enabling M42 northbound traffic to exit the M42 motorway and join a new dual carriageway link road, and traffic travelling from the new main line link road to join the M42 motorway in a southbound direction.

2.1.4 The existing Solihull Road overbridge would be demolished and rebuilt on a slightly modified alignment to accommodate the new slip roads.

Dual carriageway link road and the local road network

2.1.5 A new 2.4km long dual carriageway link road (the new main line link road) would connect M42 Junction 5A with the A45 at Clock Interchange, replacing the existing connection between Catherine-de-Barnes Lane and Clock Interchange. The link would be predominately positioned in cutting to minimise visual and environmental impacts on Bickenhill and the surrounding countryside.

2.1.6 Catherine-de-Barnes Lane would be realigned between Birmingham Dogs Home and Clock Interchange, and the existing connection to Clock Interchange would be closed.

2.1.7 A new roundabout (Barber's Coppice roundabout) to the east of Birmingham Dogs Home would provide access to the northbound carriageway of the link road, nearby properties and the Warwickshire Gaelic Athletic Association (GAA) sports facility (referred to by the users as Páirc na hÉireann). From Barber's Coppice roundabout, the realigned Catherine-de-Barnes Lane would pass over the link road on a new bridge. The existing T-junction with Shadowbrook Lane would be realigned to the north of its current location.

2.1.8 North of Barber's Coppice roundabout; Catherine-de-Barnes Lane, St Peters Lane and Clock Lane would provide local access only, with no direct access onto the A45.

2.1.9 A new roundabout (Bickenhill roundabout) located to the west of Bickenhill village would connect Catherine-de-Barnes Lane to St Peters Lane, and the link road southbound off-slip. From Bickenhill roundabout, Catherine-de-Barnes Lane would connect to Clock Lane via a new overbridge crossing the link road, and to a modified T-junction with St Peters Lane.

A45 Coventry Road and Clock Interchange

2.1.10 The link road would connect to the A45 via a reconfigured Clock Interchange, which would be widened to have three lanes, new traffic signals, and improvements to slip roads joining the interchange. On the approach to the Clock Interchange from the new main line link road, a segregated left turn lane would enable traffic to join the A45 and head westbound. The existing segregated lane from Bickenhill Lane to the A45 eastbound would be closed. Works would also be undertaken to realign and widen Bickenhill Lane, immediately north of Clock Interchange.

2.1.11 Spurring off the northbound carriageway of the link road, prior to the junction at Clock Interchange, a new free flow slip road would allow road users to connect to the existing link leading to Airport Way; allowing direct access to Birmingham Airport and the National Exhibition Centre.

M42 Junction 6 free flow links

2.1.12 A free flow link for A45 eastbound to M42 northbound traffic would be constructed on the north-west quadrant of the junction, with an underpass constructed beneath the existing National Exhibition Centre access. To facilitate construction of this link, a sloped abutment on the existing Eastway overbridge would be replaced with a retaining wall.

2.1.13 A free flow link from the M42 southbound to A45 eastbound would be constructed on the north-eastern quadrant of the junction. The existing connection to Eastway would be modified through the introduction of a new slip road and roundabout to maintain access from the M42 southbound to the National Exhibition Centre.

2.1.14 The Middle Bickenhill loop connecting Eastway with the settlement of Middle Bickenhill would be upgraded to provide two-way access.

2.1.15 The existing M42 northbound to A45 westbound free flow link would be closed to traffic, and the M42 northbound off-slip road would be improved to accommodate four lanes of traffic and provide network resilience.

Modifications to the M42 motorway

2.1.16 Modifications would be undertaken to the M42 between Junctions 5 and 7 to alter the location and spacing of several emergency refuge areas (ERAs), and to accommodate the additional signing, gantries and road markings required by the new road layout.

Modifications to the Warwickshire Gaelic Athletic Association

2.1.17 The new main line link road would sever the existing access to the Warwickshire Gaelic Athletic Association from Catherine-de-Barnes Lane, and would require land currently used for sports pitches. Modifications would be made to reconfigure the access and the layout of the affected pitches using adjacent land to the south of the facility, in order to secure its continued operation and viability.

Drainage Strategy

2.1.18 A drainage strategy has been prepared for the Scheme, with road runoff being discharged to various surrounding drainage ditches and small watercourses. The proposed drainage system includes the use of sustainable drainage systems (SuDS) to enable attenuation of surface water flows due to increases in the impermeable area as a result of the construction of the Scheme. SuDS have also been designed provide treatment of runoff to ensure potential adverse effects on water quality are avoided. The treatment includes the use of filter drains, wetlands, swales and ditches. Full details of the drainage strategy and analysis of its effectivity in terms of treating pollutants are provided in **Appendix 14.1** [**TR010027/APP/6.3**].

1.2 Structure of this report

1.2.1 The remainder of this report is set out as follows:

a. **Section 2** provides a summary of the WFD requirements and screening process.
b. **Section 3** describes the assessment methodology.
c. **Section 4** describes the baseline conditions.
d. **Section 5** describes the results of the assessment and provides details of possible mitigation and monitoring options to alleviate adverse effects.
e. **Section 6** present’s the conclusions and recommendations.

1.2.2 In addition, this assessment is supported by the following figures and technical appendices:

a. **Figure 1** Water Resource Features and their Attributes
b. **Annex A** WFD Water Body Assessments Cycle 2.
c. **Annex B** Water Quality Monitoring Data
d. **Annex C** Review of Routine Road Runoff Impacts.
e. **Annex D** pWFD Assessment Sheets.

2. Overview of the Water Framework Directive

2.1 Legislative context

2.1.1 The Water Framework Directive (WFD) 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.

2.1.2 The WFD is transposed into legislation in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended 2015 & 2016)[1]. 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.

2.1.3 Under the WFD, 'waterbodies' are the basic management units, defined as all or part of a river system or aquifer. Waterbodies form part of a larger 'river basin districts' (RBD), for which 'River Basin Management Plans' (RBMPs) are used to summarise baseline conditions and set broad improvement objectives.

2.1.4 In England, the Environment Agency (EA) is the competent authority for implementing the WFD, although many objectives will be delivered in partnership with other relevant public bodies and private organisations (for example. local planning authorities, water companies, Rivers Trusts, large private landowners and developers). As part of its regulatory role and statutory consultee on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2010 (as amended), the Environment Agency must consider whether proposals for new developments have the potential to:

f. Cause a deterioration of a waterbody from its current status or potential; and / or

g. Prevent future attainment of good status or potential where not already achieved.

2.1.5 In determining whether a development is compliant or not compliant with the WFD objectives for a water body, the Environment Agency must also consider the conservation objectives of any Protected Areas (i.e. Natura 2000 sites or water dependent Sites of Special Scientific Interest) and adjacent WFD water bodies, where relevant.

2.2 Surface water body status

2.2.1 Under the WFD, surface water body status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to

[1] Following the United Kingdom's referendum vote to leave the European Union, the requirements of the WFD remain applicable until such time as new legislation is passed either revoking or amending the current 2003 WFD Regulations.

surface water bodies that are natural and considered by the EA not to have been significantly modified for anthropogenic purposes. The overall objective for natural surface waterbodies is to achieve Good Ecological Status and Good Chemical Status. Good Ecological Status represents only a small degree of departure from pristine conditions, which are otherwise known as High Ecological Status. All five status class definitions are provided in Figure 2.1.

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 2.1: Definition of status in the Water Framework Directive (Environment Agency, 2015))

2.2.2 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). 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. The ecological potential represents the degree to which the quality of the water body approaches the maximum it could achieve and depends on the classification of WFD parameters and the implementation of mitigation measures identified by the Environment Agency.

2.2.3 Ecological status of waterbodies is classified according to relevant biological, physico-chemical, and hydromorphological parameters on a five point scale as either High, Good, Moderate, Poor or Bad Ecological Status. The classification system is based on a worst case system 'one-out all-out' system, meaning that the overall ecological status is based on the lowest individual parameter score. This general system is summarised below in Figure 2.2.

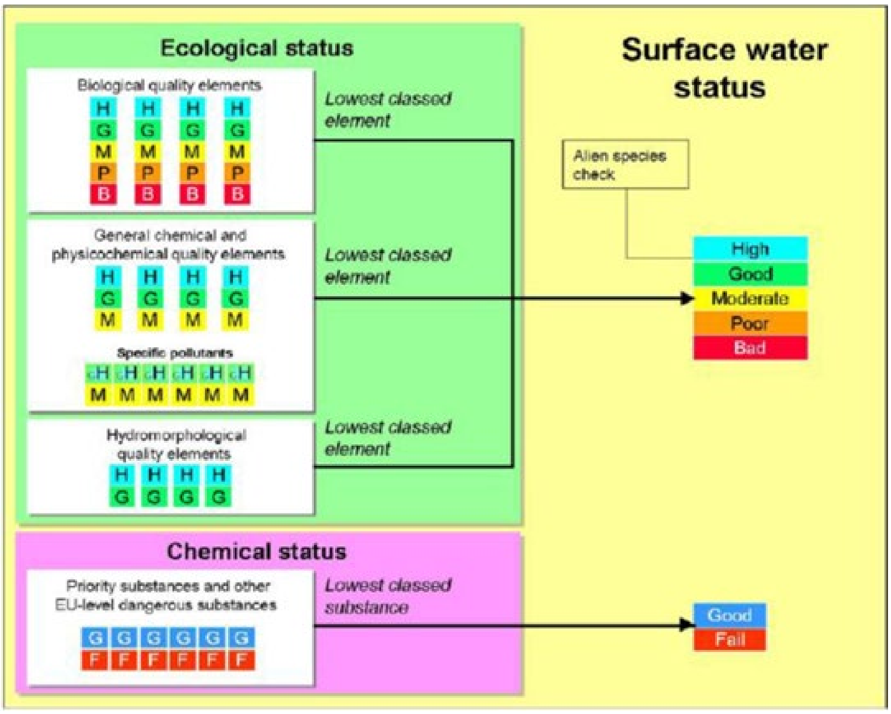


Figure 2.2: WFD classification elements for surface water body status (Environment Agency, 2015)

Chemical Status

2.2.4 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 (2008/105/EC). This is assigned on a scale of good or fail. Surface water bodies are only monitored for priority substances where there are known discharges of these pollutants; otherwise surface water bodies are reported as being at good chemical status.

Ecological Status or Potential

2.2.5 Ecological status or potential is defined by the overall health or condition of the watercourse. This is assigned on a scale of High, Good, Moderate, Poor or Bad, and on the basis of four classification elements or 'tests' (Environment Agency, 2013), as follows:

h. **Biological:** This test is designed to assess the status indicated by a biological quality element such as the abundance of fish, invertebrates or algae and by the presence of invasive species. The biological quality elements can influence an overall water body status from Bad through to High.

i. **Physico-chemical:** This test is designed to assess compliance with environmental standards for supporting physicochemical conditions, such as dissolved oxygen, phosphorus and ammonia. The physicochemical elements can only influence an overall water body status from Moderate through to High.

j. **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 water body status from Moderate through to High.

k. **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 water body 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 water body as less than Good, and hence in determining what mitigation measures may be required to address these failing water bodies.

2.3 Groundwater body status

2.3.1 Under the WFD, groundwater body status is classified on the basis of quantitative and chemical status. Status is assessed primarily using data collected from the EA monitoring network; therefore, the scale of assessment means that groundwater status is mainly influenced by larger scale effects such as significant abstraction or widespread/ diffuse pollution. The worst case classification is assigned as the overall groundwater body status, in a 'one-out all-out' system. This system is summarised in Figure 2.3.

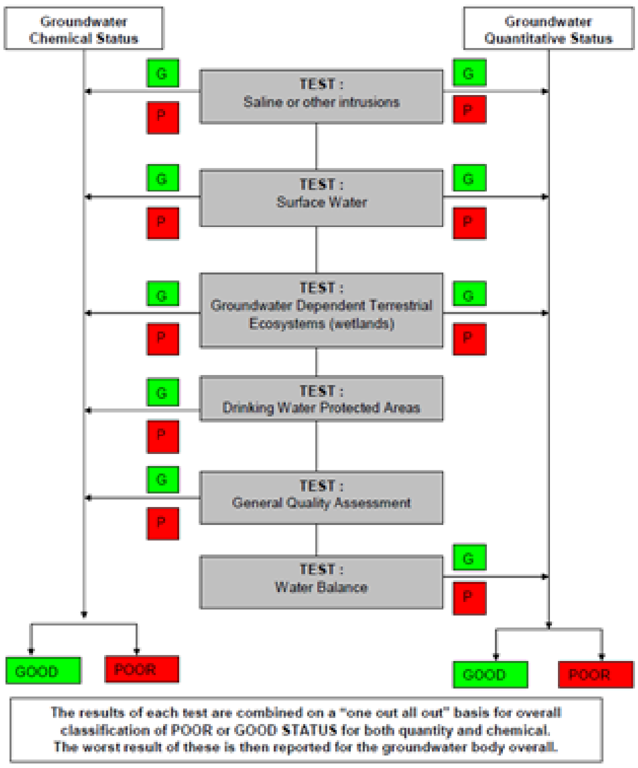


Figure 2.3: WFD Classification Elements for Groundwater Body Status (Environment Agency, 2015)

Quantitative Status

2.3.2 Quantitative status is defined by the quantity of groundwater available as baseflow to watercourses and water-dependent ecosystems, and as 'resource' available for use as drinking water and other consumptive purposes. This is assigned on a scale of Good or Poor, and on the basis of four classification elements or 'tests' as follows:

l. **Saline or other intrusions:** This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction, is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.

m. **Surface water:** This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the ecological status of associated surface water bodies.

n. **Groundwater Dependent Terrestrial Ecosystems (GWDTEs):** This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTEs (with respect to water quantity).

o. **Water balance:** This test is designed to identify groundwater bodies where groundwater abstraction exceeds the 'available groundwater resource', defined as the rate of overall recharge to the groundwater body itself, as well as the rate of flow required to meet the ecological needs of associated surface water bodies and GWDTEs.

Chemical Status

2.3.3 Chemical status is defined by the concentrations of a range of key pollutants, by the quality of groundwater feeding into watercourses and water-dependent ecosystems and by the quality of groundwater available for drinking water purposes. This is assigned on a scale of Good or Poor, and on the basis of five classification elements or 'tests' as follows:

p. **Saline or other intrusions:** This test is designed to identify groundwater bodies where the intrusion of poor quality water, such as saline water or water of different chemical composition, as a result of groundwater abstraction is leading to sustained upward trends in pollutant concentrations or significant impact on one or more groundwater abstractions.

q. **Surface water:** This test is designed to identify groundwater bodies where groundwater abstraction is leading to a significant diminution of the chemical status of associated surface water bodies.

r. **Groundwater Dependent Terrestrial Ecosystems (GWDTEs):** This test is designed to identify groundwater bodies where groundwater abstraction is leading to "significant damage" to associated GWDTE's (with respect to water quality).

s. **Drinking Water Protected Areas (DrWPAs):** This test is designed to identify groundwater bodies failing to meet the DrWPA objectives defined in Article 7 of the WFD or at risk of failing in the future.

t. **General quality assessment:** This test is designed to identify groundwater bodies where widespread deterioration in quality has or will compromise the strategic use of groundwater.

3. Assessment methodology

3.1 Introduction

3.1.1 Proposed developments that have the potential to impact on current or predicted WFD status are required to assess their compliance against the objectives defined for potentially affected water bodies. As part of its role, the Environment Agency must consider whether proposals for new developments have the potential to:

u. Cause a deterioration of a water body from its current status or potential; and/ or

v. Prevent future attainment of Good status (or potential where not already achieved).

3.2 Defining no deterioration

3.2.1 No deterioration was defined by the Environment Agency in its Position Paper (Environment Agency, 2013). Steps are required to prevent deterioration of the ecological status, ecological potential and chemical status of surface water and the qualitative status and quantitative status of groundwater.

3.2.2 Originally deterioration was defined by the Environment Agency as deterioration from one status class to a lower one, however following a ruling by the Court of Justice of the European Union (CJEU) in July 2015 (Case C-461/13 on the 1st July 2016 (Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik Deutschland)), this has been redefined. The CJEU ruling clarified that:

w. 'Deterioration of the status' of the relevant water body includes a fall by one class of any element of the 'quality elements' even if the fall does not result in the a fall of the classification of the water body as a whole;

x. 'Any deterioration' in quality elements in the lowest class constitutes deterioration; and

y. Certainty regarding a project's compliance with the Directive is required at the planning consent stage; hence, where deterioration 'may' be caused, derogations under Article 4.7 of the WFD are required at this stage.

3.2.3 While deterioration within a status class does not contravene the requirements of the WFD, (except for Drinking Water Directive parameters in drinking water protected areas), the WFD requires that action should be taken to limit within-class deterioration as far as practicable. For groundwater quality, measures must also be taken to reverse any environmentally significant deteriorating trend, whether or not it affects status or potential.

3.2.4 The no deterioration requirements are applied independently to each of the elements that come together to form the water body classification as required by Annex V of the Water Framework Directive and Article 4 of the Groundwater Daughter Directive.

z. **Surface water:** To manage the risk of deterioration of the biological elements of surface waters, the no deterioration requirements are applied to the environmental standards for the physico-chemical elements, including those for the Moderate/Poor and Poor/Bad boundaries.

aa. **Groundwater:** The no deterioration requirements are applied to each of the four component tests for quantitative status and the five component tests for chemical status. The no deterioration requirement may not apply to elements at High status and elements at High status may be permitted to deteriorate to Good status, provided that:

- The water body's overall status is not High;
- The RBMP has not set an objective for the water body of High status;
- The objectives and requirements of other domestic or European Community legislation are complied with; and
- Action is taken to limit deterioration within High or Good status or potential classes as far as practicable.

3.2.5 The no deterioration baseline for each water body is the status that is reported in Annex B.

3.3 WFD exemptions and screening the development

3.3.1 Certain activities on or near waterbodies are exempt from WFD assessments, as summarised in Table 3.1 WFD Exemptions List.

Table 3-1 WFD Exemptions 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
	Skimming/ covering/ grit blasting
	Cleaning and/or painting of a structure
Temporary works	Temporary scaffolding to enable bridge re-pointing
	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
	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 road surface on a bridge
Service crossing	Service crossing below the river bed, installed by directional drilling or micro tunnelling if more than 1.5 m below the natural bed line of the river
	Service crossing over a river. This includes those attached to the parapets of a bridge or encapsulated within the bridge's footpath or road
	Replacement, installation or dismantling of service crossing/ high voltage cable over a river
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
	Outfall to a river ≤300 mm diameter

3.3.2 If the project or components of the project meet the criteria above they may be screened out of any further assessment.

3.4 Surface water assessment

3.4.1 Table 3.2 presents the matrix used to assess the effect of the Project on surface water status or potential class. It ranges from a major beneficial effect a positive change in overall WFD status) through no effect, and down to deterioration in overall status class. The colour coding used in Table 3.2 is applied to the spreadsheet assessment in Annex B.

Table 3-2 Surface Water Assessment Matrix

Effect	Description / Criteria	Outcome
Major beneficial	Impacts that taken on their own or in combination with others have the potential to lead to the improvement in the ecological status or potential of a WFD quality element for the entire waterbody	Increase in status of one or more WFD element giving rise to a predicted rise in status class for that waterbody.
Minor / localised beneficial	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary improvement that does not affect the overall WFD status of the waterbody or any quality elements	Localised improvement, no change in status of WFD element
Green (no impact)	No measurable change to any quality elements.	No change
Yellow - Localised/ temporary adverse effect	Impacts when taken on their own or in combination with others have the potential to lead to a minor localised or temporary deterioration that does not affect the overall WFD status of the waterbody or any quality elements or prevent improvement. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Localised deterioration, no change in status of WFD element when balanced against mitigation measures embedded in the scheme.
Orange - Adverse effect on class of WFD element	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the WFD status class of one or more biological quality elements, but not in the overall status of the waterbody. Consideration will be given to mitigation measures such as habitat creation or enhancement measures.	Decrease in status of WFD element when balanced against positive measures embedded in the scheme.
Red – Adverse effect on overall WFD class of waterbody	Impacts when taken on their own or in combination with others have the potential to lead to the deterioration in the ecological status or potential of a WFD quality element, which then lead to a deterioration of status/potential of waterbody.	Decrease in status of overall WFD waterbody status when balanced against positive measures embedded in the scheme.

3.4.2 The assessment has considered all water bodies that may be directly or indirectly affected (adjacent water bodies). It has also considered any Protected Areas as defined by other European Directives such as Special Areas of Conservation (SAC) and Special Protection Areas (SPAs), and water dependent Sites of Special Scientific Interest (SSSI). Where more stringent (than WFD) standards apply (such as conservation objectives) these have also been considered.

3.5 Groundwater assessment

3.5.1 Table 3.3 presents the matrix used to assess the effect of the Project on groundwater status class. It ranges from a beneficial effect, through no effect , and down to deterioration in overall status class. The colour coding used in Table 3.3 is applied to the spreadsheet assessment in Annex B.

Table 3-3 Groundwater assessment matrix

Magnitude of Impact of Scheme Element on WFD Element i.e. in individual cells	Effect on WFD Element within the assessment boundary i.e. at end of row	Effect on Status of WFD element at the Groundwater Body Scale
Impacts lead to beneficial effect	Combined impacts have the potential to have a beneficial effect on the WFD element.	Improvement but no change to status of WFD element
No measurable change to groundwater levels or quality.	No measurable change to WFD elements.	No change and no deterioration in status of WFD element
Impacts when taken on their own have the potential to lead to a minor localised or temporary effect	Combined impacts have the potential to lead to a minor localised or temporary adverse effect on the WFD element.	Combined impacts have the potential to lead to a minor localised or temporary effect on the WFD element. No change to status of WFD element and no significant deterioration at groundwater body scale.
Impacts when taken on their own have the potential to lead to a widespread or prolonged effect.	Combined impacts have the potential to have an adverse effect on the WFD element.	Combined impacts have the potential to have an adverse effect on the WFD element, resulting in significant deterioration but no change in status class at groundwater body scale.
Impacts when taken on their own have the potential to lead to a significant effect.	Combined impacts in combination with others have the potential to have a significant adverse effect on the WFD element.	Combined impacts in combination with others have the potential to have an adverse effect on the WFD element AND change its status at the groundwater body scale

3.6 Future status objectives

3.6.1 RBMPs are used to outline water body pressures and the actions that are required to address them. The future status objective assessment considers the ecological potential of a surface water body and the mitigation measures that defined the ecological potential. Assessments undertaken for the proposed development are based on mitigation measures defined in the 2015 RBMP. Information on WFD measures available from the EA website (accessed October 2018[2]) has also been reviewed. The assessment considers whether the Project has the potential to prevent the implementation or impact the effectiveness of the defined measures.

3.7 General approach and scheme assumption

3.7.1 The following provides a description of the scope of works. The assessment is qualitative and based on readily available data and information, and site

[2]Environment Agency website, access October 2018 at http://environment.data.gov.uk/catchment-planning/

survey. It appraised the potential for non-compliance with the core WFD objectives of no deterioration or failure to improve.

Scope of works

3.7.2 The assessment is based on a desk study and a site walkover survey. These are summarised below, but are described in more detail in **ES Volume 1: Chapter 14** Road Drainage and the Water Environment.

3.7.3 A desk study has been undertaken to:

bb. Review online aerial, historic and Ordnance Survey maps to review historical land uses, channel planform, notable morphological features and any changes to the channel;

cc. Review WFD classifications, Environment Agency investigation reports, and any mitigation measures proposed to meet Good Ecological Potential; and

dd. Review background water quality and biological data from online sources and provided directly by the Environment Agency.

3.7.4 The desk study and site survey has been used as the basis for a qualitative review of the Scheme and to identify Scheme components that require assessment of WFD compliance, or where mitigation or further investigation and assessment will be required.

WFD surveys and assessment

3.7.5 A walkover survey of the Study Area was carried out on 26th October 2017 in fine conditions after a period of dry weather, meaning that the watercourses were at low flow conditions. This survey focused on identifying the water bodies within the Study Area as depicted on Ordnance Survey maps, confirming flow pathways between water bodies and directions of flow, establishing the nature of the existing land use, topography, sources of pollution, identifying other unknown receptors, and identifying attributes of known water bodies.

3.7.6 The Catchment Walkover survey was undertaken with reference to the best practice guidance set out in ‘Catchment Walkovers for River Basin Management Operational Instruction 356_12’ (Environment Agency, 2013) and ‘The Sediment Matters Handbook: A Practical Guide to Sediment’ (Environment Agency, 2011) and included a combination of making observations whilst walking along each watercourse in an upstream direction, as well as spot observations for the more inaccessible areas. Finally, during the Catchment Walkover suitable water quality and flow monitoring sites were identified taking into account factors such as accuracy and reliability of results, access and health and safety.

4. Baseline information

4.1 Consultation

4.1.1 Detailed information about consultation can be found in **ES Volume 1: Chapter 5 EIA Methodology and Consultation.** However, a summary of the most important points is included here.

Environment Agency

4.1.2 The Environment Agency (EA) was consulted as part of the desk study to gather relevant information about the water bodies within the Study Area. In the scoping response to the EIA Scoping Report, the EA also noted the proximity of the Scheme to the River Blythe, a designated Site of Special Scientific Interest (SSSI). It was noted that this waterbody is not meeting “Good” ecological status under the WFD, and it was requested that that the Scheme not lead to any further deterioration in the WFD status of this waterbody the EA was also consulted on the drainage proposals for the Scheme, which EA subsequently confirmed were satisfactory on 3/8/18.

Natural England

4.1.3 In its response to the EIA Scoping Report, Natural England stated that the potential for the Scheme to impact designated sites should be assessed. An investigation has been undertaken into the hydrology of the Bickenhill Meadows SSSI, with ongoing consultation with Natural England with regard to the findings taking place at meetings on 16/4/18, 26/4/18 and 18/9/18. Acceptance of the assessment of the SSSI and approach to mitigation of the site, which contains surface watercourses, was obtained on 18/9/18.Further details are given in the **Appendix 14.2: Bickenhill Meadows SSSI Hydrological Investigation** [**TR010027/APP/6.3**],

Birmingham Airport Authority

4.1.4 Birmingham Airport Authority (BAA) was consulted on the drainage strategy for the Scheme at a meeting held on 8th May 2018. This was due to concerns BAA had over safeguarding aircraft if the number of birds in the vicinity of the airport increased as a result of installation of certain sustainable drainage approaches, such as ponds. The drainage proposals were revised in response to the consultation and updated proposals were accepted by BAA on 30th July 2018. Further details on the drainage arrangements are given in **Appendix 14.3 Assessment of Routine Road Runoff and Accidental Spillage Risk (HAWRAT)**. [**TR010027/APP/6.3**]

Canal and Rivers Trust

4.1.5 In their response to the EIA Scoping Report, the Canal and Rivers Trust raised concerns over the Grand Union Canal, which is located to the southwest of the Scheme and is a designated WFD waterbody. the Trust noted that it must be ensured that no contaminants would enter the canal from surface water drainage and connections to the canal must be confirmed by a site visit. A site walkover has since shown that there is no hydrological connectivity between the Scheme and canal based on the topography, and impacts to the canal have therefore been scoped out of the assessment.

4.2 Study area

4.2.1 The M42 Junction 6 Improvement Scheme is broadly defined by M42 Junction 7 to the north, Birmingham Airport and Catherine-de-Barnes to the west, the A45 and Hampton-in-Arden to the east, and M42 Junction 5 to the south.

4.2.2 A Study Area of approximately 1km around the Proposed Development Site has been considered in order to define water bodies that could reasonably be affected. However, watercourse flow impacts may propagate downstream, so where relevant the proposed assessment has also considered a wider Study Area of up to 2km downstream of the Proposed Development site boundary (to ensure all attributes that might be affected are identified and considered). Please refer to Figure 1.

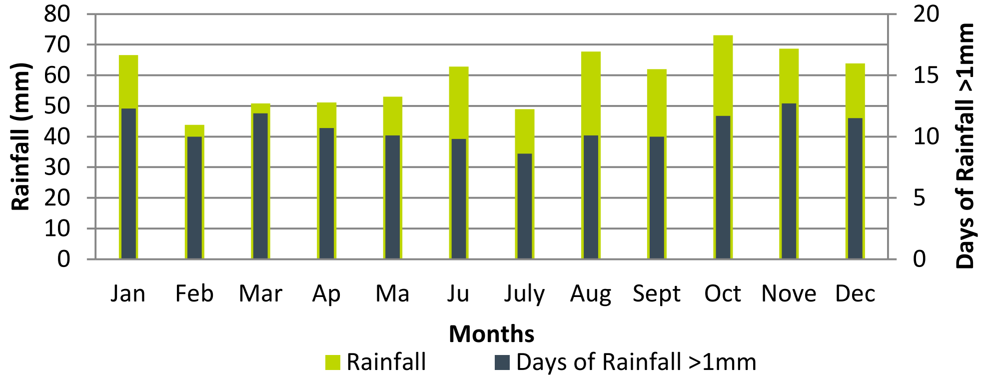
Catchment characteristics

4.2.3 Topographic data for the study area was obtained from Ordnance Survey (OS) mapping. The study area is only very gently undulating with all elevations being between 90m and 120m above ordnance datum (AOD). There are valleys with low gradients around the various watercourses. To the north of the study area the elevation is 100 m AOD at Park Farm to the north of Middle Bickenhill. The land gently slopes down to Hollywell Brook (approximately 85 m AOD) which is orientated west-east, roughly parallel with the A45. The land rises from the watercourse towards Diddington Hall (100m AOD) to the south of the A45. The elevation then declines south towards Shadow Brook at around 95m AOD, which also flows roughly west to east. The land rises to 98m AOD to the east at Siden Hill Wood southeast of Hampton-in-Arden. To the west the land rises to 120m AOD at Hampton Lane Farm, east of Catherine-de-Barnes. To the south of the study area the land rises to 120m AOD at Eastcote.

4.2.4 The Scheme crosses an area of predominantly arable agriculture to the east of Solihull. The northern extent of the Scheme borders the National Exhibition Centre (NEC) site and Birmingham Airport, including associated facilities such as hotels, car parks, fuel stations and landscape features such as the ornamental Pendigo Lake. A railway line crosses the A45 south of Birmingham International Railway Station to the west of the M42 Junction 6. The new main line link road would pass to the west of the village of Bickenhill, with the village of Catherine-de-Barnes being within 1 kilometre of the Scheme to the southwest. The Grand Union Canal is located to the southeast of the study area.

4.2.5 Rainfall data has been obtained from an automatic weather station at Coleshill, available on the Met Office website, which is the nearest available station to the study area. The area receives an average of 700 mm rainfall per year, with it raining more than 1 mm on an average of 129 days per year (Graph 3.1). The wettest period of the year is generally August to January, with February and July being the driest months on average. Rainfall is expected to be generally between 60 millimetre and 70 millimetre per month between August and January, while the minimum is in February with <45 millimetre.

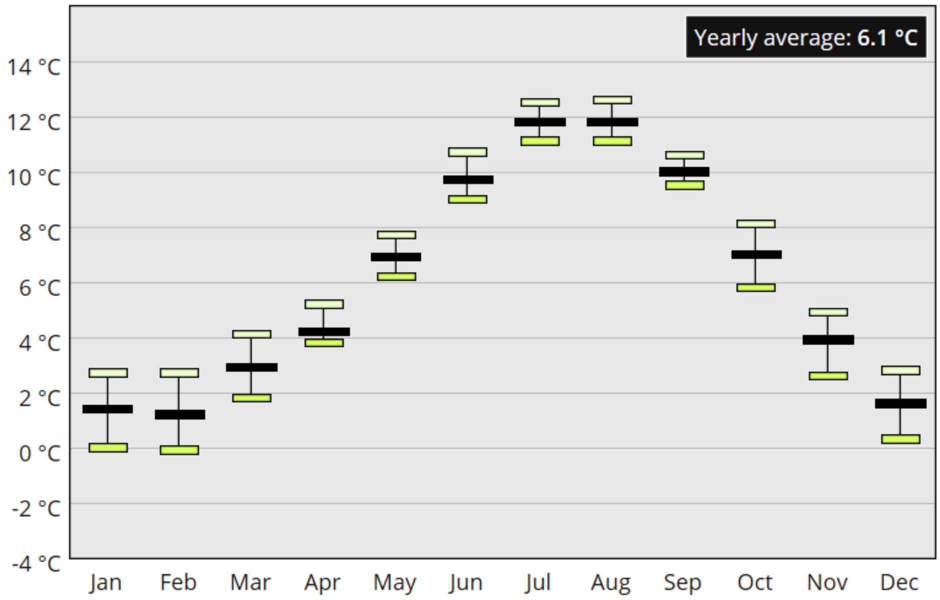
Graph 3.1 Coleshill Weather Station, Rainfall and Days of Rainfall >1mm



4.2.6 On the National River Flow Archive website[3], the nearest catchment with rainfall statistics is the River Cole at Coleshill (http://nrfa.ceh.ac.uk/data/station/info/28066). Standard Annual Average Rainfall (SAAR) for the period 1961-1990 suggests a slightly greater annual average rainfall than the Met Office, with 723mm per year.

4.2.7 The same Met Office weather station at Coleshill reports that the study area generally gets around 50 days of frost (air) each year distributed evenly across December, January and February, with occasional days of frost in March, April, October and November. Using minimum air temperature as a general indicator of air temperatures, it is clear that the potential for de-icant use on roads would be most likely during November, December, January, February and March as indicated by Graph 3.2.

Graph 3.2: Coleshill Weather Station Minimum Air Temperature



[3] National River Flow Archive website, access July 2018 http://nrfa.ceh.ac.uk/data/station/info/28050

4.3 Water features in the study area

4.3.1 Within this study area the following waterbodies and receptors are present:

ee. River Blythe – a Main River, WFD designated waterbody and a SSSI. There are three WFD designated stretches of the River Blythe within 1.3 km of the Scheme, namely: the *Blythe from Patrick Bridge to River Tame* (GB104028042572) located 1.3 km to the east of the Scheme and which flows north roughly parallel to the A452; the *Blythe from Source to Cuttle Brook* (GB104028042400), which crosses the M42 at the south of the Scheme boundary; and the *Blythe from Temple Balsall Brook to Patrick Bridge* (GB104028042571), which includes a tributary with its source 230 m east of the M42 at the southern extent of the Scheme.

ff. Hollywell Brook – a Main River and tributary of the WFD designated River Blythe. The watercourse flows east out of Pendigo Lake at the NEC, is culverted under the M42 parallel to the A45, and has two standing water bodies connected to the brook downstream of the motorway. It then meets the River Blythe approximately 2.2 km downstream at SP 21390 83923.

gg. Shadow Brook – a Main River and a tributary of the WFD designated River Blythe. The watercourse forms from coalescence of a series of agricultural drains to the northwest of the M42 crossing of Solihull Lane. It then flows in a north-easterly direction to meet the River Blythe at Stonebridge Golf Club at SP 21612 82541. A tributary of Shadow Brook has its source northwest of the source of Shadow Brook and flows northwest through the Bickenhill Meadows SSSI (southeastern unit) before meeting Shadow Brook to the south of Diddington Hill (SP 18961 81746);

hh. Low Brook – a Main River and tributary of the WFD designated Hatchford-Kingshurst Brook (GB104028042490). Low Brook rises to the east of Damson Parkway at SP 16721 81124, approximately 1.4 km west of the Scheme. It flows in a generally northeast direction towards Birmingham Airport, where it is culverted beneath the runway. It emerges north of the airport and flows through Marston Green before meeting Hatchford-Kingshurst Brook at SP 17155 86349. A tributary of Low Brook flows north through the Bickenhill Meadows SSSI (northwest unit) to meet Low Brook to the north of the A45.

ii. Numerous highway and agricultural drainage ditches are located within the study area and are tributaries of the aforementioned watercourses;

jj. Grand Union Canal, Solihull to Birmingham WFD waterbody (GB70410204) – has an approximate west to east alignment and is located around 420m south of the Scheme site;

kk. Pendigo Lake – ornamental lake within the grounds of the NEC, which is within 400m of the Scheme, and from which Hollywell Brook flows;

ll. Coleshill and Bannerley Pools – three large pools at the northeastern extent of the study area. These are located between the M42 and Packington Lane. They cover a combined area of 37.6 ha and are designated as a SSSI, together with the intervening area known as the Bogs;

mm. Several small ponds across the study area, notably seven small ponds surrounding Woodhouse Farm and a relatively large pond at Diddington Hall, located to the southeast of junction 6;

nn. Tame Anker Mease – Secondary Combined WFD Groundwater Body (GB40402G990800) – underlays the entire study area.

4.3.2 The Grand Union Canal is located upslope of the Scheme, with a further raised topographic mound located between the southwest extent of the Scheme works and the canal, which would prevent flow between the two. As the canal would not receive surface water or groundwater flows from the Scheme, or highway discharges, it would not be impacted in terms of its WFD status / potential. It is therefore not considered further within this assessment. Similarly, the Coleshill and Bannerley Pools are located 1.6 km north of physical works related to the Scheme and do not have hydrological connectivity. As such, they are not considered by the assessment.

4.3.3 Observations of the surface watercourses made during the site visit on 26th October 2017 and subsequent visits are described below:

Hollywell Brook

4.3.4 As it flows out of Pendigo Lake the channel is very straight and appears to have a two-stage channel cut, with steep embankments either side of the channel and a wooded riparian zone that is only likely to become wet in extreme floods (depending on the impact of the upstream lake). This is likely to have been linked to the straightening of the channel during NEC development works. The channel of Holywell Brook itself is approximately 3m wide (Photo 1a), and the banks are reinforced with bricks in places. Fine sediment covers the bed with some fine gravel on the top of small riffles. These small riffles have developed where the channel narrows slightly compared to the general widths elsewhere. Exposed gravels across these riffle features are around 10-20mm in diameter. Some larger gravels are present and are stable but are not spatially extensive. Gravel / sediment supply to these features is limited as a result of the upstream lake influence. The culvert beneath the M42 is circular and approximately 3m in diameter. At the time of the site visit, the culvert did not appear to be having excessive influence on the flow regime, although it may be contributing to the deposition of fine sediment in the channel observed upstream.

4.3.5 An outfall was observed approximately 40m upstream of the culvert during the initial site walkover. This is thought to drain the surrounding NEC car parks and a surface scum beneath the outfall was indicative of the presence of pollutants. There is also a protected left-hand bank adjacent to the outfall along the main channel. Downstream of the culvert beneath the M42 (Photo 1b) the channel narrows to approximately 1.5m wide across a fallow field with overhanging riparian vegetation. The narrowing of the channel has created a localised area of elevated velocities that has reduced the tendency for fine sediment deposition and exposed some short improved gravel and riffle sections. The river is culverted through two pipes of approximately 1m width at Middle Bickenhill Lane, after flowing through a wide ponded area of around 30m width containing emergent reed vegetation. This area is generally of low energy where fine sediment deposition dominates the channel bed. There are outfalls to Hollywell Brook both upstream and downstream of the culvert beneath the M42. These are likely to include road drainage and runoff from the NEC roads and car parks. As a result there are likely to be contaminants within this reach of the channel downstream of the culvert.


Photo 1a (left) Hollywell Brook just upstream of the M42 culvert; Photo 1b (right) Holywell Brook downstream of the M42 culvert.

Shadow Brook and its tributary

4.3.6 Upstream of the M42 Shadow Brook is a series of agricultural drains along field boundaries that were completely dry and overgrown at the time of the site visit (Photo 2a). There was little evidence of any gravel features, with significant fine sediment accumulation and growth indicating infrequent and low energy flows. The width of the ditches is approximately 1m. Shadow Brook was also observed further downstream where it crosses Shadowbrook Lane (Photo 2b) through an approximately 1m wide concrete pipe culvert. The channel width is approximately 1.5m wide and the bed had a significant amount of gravel upstream of the culvert. This gravel is being largely impounded by the structure as downstream of the culvert the bed has a fine sediment bed.


Photo 2a (left) Shadow Brook towards its source upstream of the M42; Photo 2b (right) Shadow Brook shortly downstream of its crossing of Shadowbrook Lane.

4.3.7 A tributary of Shadow Brook, which is an ordinary watercourse, flows from SP 18497 81469, to the east of Shadowbrook Lane, in a north-easterly direction to meet Shadow Brook at SP 20640 82243. The source is mapped by OS as being immediately north of Shadowbrook Lane at the south of the southwestern unit of the Shadowbrook Meadows Nature Reserve. Here lateral drainage ditches from the road coalesce and flow north beneath the caravan park site and emerge at the southern border of the Nature Reserve. There is a pond on the opposite (south) side of Shadowbrook Lane to the mapped source of the stream, which collects water from adjacent road and agricultural drainage. The topography of the adjacent fields gently slope towards this point, creating a natural focal point for drainage to collect. The connectivity of this pond to the stream on the opposite side of the road was not clear on the site visit, but mapping suggests a culvert beneath the road which was not visible amongst thick vegetation. Significant amounts of standing water were observed in the ditches adjacent to the culvert after heavy rainfall, indicative of impeded flow through the culvert, presumably due to siltation. There may also be drainage to this watercourse from the small caravan park site under which the brook flows prior to emerging in the nature reserve. The watercourse then flows in a northeasterly direction through Shadow Brook Meadows unit (the southeastern unit) of the Bickenhill Meadows SSSI.

4.3.8 On the initial site visit the watercourse was dry, but on subsequent visits to the SSSI (for example 18 January 2018, 28 February 2018, 2 May 2018) it was flowing freely. The watercourse is very straight and would have originally been an agricultural drainage ditch. It was around 0.5 metres wide and 3-4 centimetres deep at the time of the January site visit (Photo 3a). The bed was generally covered by accumulations of fine sediment (and thick with leaf litter in the autumn), as well as small patches of gravel of 4-5 millimetres in diameter.

Photo 3a (left) Tributary of Shadow Brook within the Bickenhill Meadows SSSI, and Photo 3b (right) confluence of the tributary of Shadow Brook and the drainage ditch within the SSSI's alder woodland.

4.3.9 As the watercourse flows into the SSSI boundary it is culverted under a grassed land bridge through a pipe of around 400 millimetre diameter. Upstream the culvert is partially buried and may cause impoundment of flow under very high discharge conditions, with occasional out of bank flows onto the surrounding grasslands. However, the stream is not considered significant enough in size to cause widespread out of bank events across the grasslands and woodland, and when consulted, Natural England and Warwickshire Wildlife Trust were not aware of any widespread flooding at the site resulting from out of bank stream flows.

4.3.10 An ephemeral agricultural drainage ditch of between 1m and 1.5m width flows along the northwestern boundary of the SW Bickenhill Meadows SSSI Unit, off Shadowbrook Lane. It flows into the larger tributary of Shadow Brook at the northern extent of the SSSI unit (Photo 3b) at SP 18950 81743. This ditch is straight and generally dry except following particularly heavy rainfall. The ditch is overgrown with hedgerow vegetation.

Low Brook and its tributary

4.3.11 Low Brook could not be visited during the initial site visit as it is fenced off in the grounds of Birmingham Airport. At its closest location to the Scheme, Low Brook is approximately 640 metres from the Scheme's Order Limits at Clock Lane, and would only potentially be impacted through receipt of any polluted flows from its tributary.

4.3.12 The tributary of Low Brook was visited in the Bickenhill Meadows northwest SSSI unit on 28 February 2018 following several days of light snow showers. The tributary of Low Brook has its source 340 metres west of Catherine de Barnes Lane at SP 18212 82011, which is the southern boundary of the northwest (NW) unit of the Bickenhill Meadows SSSI. The watercourse appeared to emanate from numerous ephemeral drainage ditches which coalesce at the south of the site (Photo 4a) to then flow north through the SSSI (Photo 4b). As the watercourse flows north it widens out into a marshland area of 4-5m width temporarily, with little discernable surface water flow, before reverting to a well-defined stream of up to 2.5m width containing emergent macrophytic vegetation in places. The watercourse is not considered of sufficient size to cause significant flooding of the adjacent fields.

4.3.13 The watercourse bed was mainly covered by accumulations of fine sediment, but with some fine gravel (3-4 mm diameter) visible in small patches. There was a mixture of submerged and emergent macrophytic vegetation in the watercourse. Red staining was observed on an adjacent embankment at the head of the stream, with the embankment marking the northern extent of a former landfill site. The staining was potentially indicative of iron seepage into the watercourse. There is a bridge across the channel at the northern end of the NW SSSI unit. As the watercourse leaves the SSSI and flows north through the arable field, the stream takes on more of a ditch course character. It has heavily incised banks of up to 1.5m deep and is perfectly straight (Photo 4c). Several other agricultural drains join with this tributary at the north of the field as it approaches the A45, at which point the watercourse was fenced off with barbed wire, thereby preventing access to the confluence with Low Brook. The tributary of Low Brook was dry when later visited in the summer months and so is ephemeral in nature.

Photo 4a (left) Tributary of Low Brook within the NW Bickenhill Meadows SSSI unit, Photo 4b (centre) tributary of Low Brook observed from the bridge within the SSSI and Photo 4c (right) tributary of Low Brook in the field to the north of the SSSI

River Blythe

4.3.14 The River Blythe was visited close to its confluence with its tributary that rises close to the Barston Lane STW on 8th June 2018, following a prolonged dry spell of several days. At this location the Blythe is approximately 9 m wide and flows adjacent to a large fishery pond at Windmill Farm. Its banks rise 1.5-2.0 m from the channel bed and so connectivity to the surrounding floodplain is poor at this location. The river was extremely turbid at the time of the visit, preventing assessment of the bed character. Emergent vegetation was abundant in sections of the river. The tributary was observed from a footbridge adjacent to the fishery pond. Here the channel was approximately 5.0 m wide and 0.2 m deep at the time of the site visit in low flow conditions. The bed was dominated by fine sediment, including significant accumulations at the channel margins. There were some fine gravels (3-4 mm) and larger cobbles (5-6 mm), but these were not abundant. The channel was heavily shaded by deciduous vegetation at the margins, but had limited vegetation within the channel. Photo 5a shows the River Blythe and Photo 5b shows its tributary.


Photo 5a (left) River Blythe observed adjacent to Windmill Farm, and Photo 5b (right) the tributary of the River Blythe that rises close to Barston STW.

Small unnamed watercourse flowing beneath the A45 to Pendigo Lake

4.3.15 A small stream/ditch rises immediately southwest of the M42 Junction 6 roundabout, and flows north through a culvert beneath the A45 (which is to be extended) at SP 19541 83039, and ultimately discharges to Pendigo Lake. This was observed at the northern side of the A45 as it leaves the culvert and flows between two NEC car parks. This is a very straight and heavily engineered channel with a width of around 1m and only 4-5cm water depth (during the site visit). A large amount of fine sediment has built up downstream of the culvert, which is approximately 600mm in diameter. Flow was extremely slow and barely perceptible during the October 2017 site visit. Further downstream this watercourse is culverted below ground before discharging into Pendigo Lake. Fine sediment deposition on the channel bed generally dominates with few areas of exposed gravel observed.

Pendigo Lake

4.3.16 Pendigo Lake is an ornamental lake within the grounds of the NEC (Photo 6a and 6b), which is within 400m of the Scheme, and from which Hollywell Brook flows. The lake itself is around 3m deep, around 65,000 m^2 in area, and is used for angling with the rights leased by the NEC Angling Club. During the site visit the lake was very turbid with the lake bed unable to be seen further than 1m from the lake edge. A large wildfowl population was observed together with areas of deciduous vegetation on the central lake island and around the northeastern arm of the lake. These sources, together with any ditches and drains flowing into the lake are likely to be contributing to the perceived poor water quality.

Photo 6a (left) Pendigo Lake with overhanging deciduous vegetation, and Photo 6b, location of Pendigo Lake adjacent to a leisure complex (Resorts World) at the NEC.

Other waterbodies

4.3.17 There are a number of field drains within the study area, the most significant of which include:

4.3.18 An unnamed drain north of Park Farm which flows east from the existing M42 (SP 199 844) towards an unnamed waterbody near Church Farm Barn, which then flows southeast to the River Blythe. This watercourse passes through disused workings (Packington Landfill Site) to the north of Little Packington;

- Four unnamed drains to the north of Bickenhill at Clock Interchange;
- Four field drains to the east of Woodhouse Farm; and
- Several artificial drains associated with Barston Sewage Treatment Works (STW) at SP 192 799;
- Several field drains and ditches less than 300 metres west of Bickenhill which coalesce with the tributary of Low Brook and ultimately meet Low Brook to the south of Birmingham Airport; and
- A ditch flowing northwest through the arable agricultural field at Four Winds (east of Catherine de Barnes Lane) which conveys water towards the tributary of Shadow Brook at Bickenhill Meadows SSSI SW unit.

4.3.19 There are a number of small ponds scattered across the study area (see Volume 2, Figure 14.1), notably seven small ponds surrounding Woodhouse Farm and a relatively large pond at Diddington Hall, located to the southeast of Junction 6. The majority of ponds in the area are not online with watercourses as far as can be ascertained from OS mapping, with the exception being those previously mentioned along Hollywell Brook, and an online pond on Low Brook east of Elmdon to the south of A45 Coventry Road. The risk to the ponds in terms of water quality and morphology is therefore reduced and restricted to works that may take place close by. Several ponds have been identified as containing Great Crested Newts (GCN) during surveys in 2017 and 2018 (please see Appendix 9.9: Great Crested Newt Report). Within 500 metres of the Scheme boundary these are ponds 6, 7, 11, 12, 13 and 36 (Figure 14.1) [**TR010027/APP/6.2**], although none of these are within the Scheme's DCO limits. Pond 19 is assumed to have GCN as survey was not possible.

WFD Surface Water Bodies Classification

4.3.20 WFD waterbodies within the study area are shown in Table 4-1.

Table 4-1: WFD water bodies located within the study area

Type	WFD Classification	Waterbody Name / ID	Location
Surface WFD Waterbodies	River	Blythe from Patrick Bridge to River Tame (GB104028042572)	It passes the M42 Junction 6 approximately 1.3 km from the east of the motorway and is hydrologically connected to the Scheme.
	River	Blythe from Source to Cuttle Brook (GB104028042400)	Crosses the M42 within the Scheme boundary at its southern extent.
	River	Blythe from Temple Balsall Brook to Patrick Bridge (GB104028042571)	The designation includes a tributary which has its source less than 230m to the east of the M42 at the southern extent of the Scheme, close to the Barston STW.
	River	Hatchford-Kingshurst Brook from source to River Cole (GB104028042490)	Located 5km downstream of the Scheme boundary to the northwest of the study area, but is the nearest designated WFD watercourse to Low Brook.
	Canal	Grand Union Canal, Solihull to Birmingham WFD waterbody (GB70410204)	Located in the southwest of the study area, but is scoped out of the assessment on the basis of topography and lack of hydrological connectivity to the Scheme.
Groundwater WFD Waterbodies	Groundwater	Tame Anker Mease – Secondary Combined WFD Groundwater Body (GB40402G990800)	Underlies the Scheme.

4.3.21 The 'Blythe from source to Cuttle Brook' (GB104028042400), the 'Blythe from Temple Balsall Brook to Patrick Bridge' (GB104028042571), the 'Blythe from Patrick Bridge to River Tame' (GB104028042572) and Hatchford-Kingshurst Brook (GB104028042490) are all included in the Humber RBMP[4]. According to this Plan, the priority river basin management issues to tackle in the Tame Anker and Mease Operational Catchment are *"diffuse pollution from urban and rural areas, habitat modification and improving stakeholder engagement".*

Blythe from source to Cuttle Brook

4.3.22 The EA Catchment Data Explorer website gives details of WFD classifications. This waterbody is designated from Wood End, which is located to the northeast of Redditch, and flows generally in a northeasterly direction tracking the M42 until just south of Catherine-de-Barnes, where it crosses the M42 before continuing in a southeasterly direction to meet Cuttle

[4] Environment Agency (2015). "Part 1: Humber River Basin District River Basin Management Plan. Department for Environment Food and Rural Affairs, Ref: LIT 10312, 107 pages.

Brook at Temple Balsall. It is not designated as artificial or heavily modified. It is 22.9 km in length and has a catchment area of 62.2 km^2. It was classified as being at 'Poor Ecological Status' under the 2016 Cycle 2 classification due to it being 'Poor' in terms of phosphate, macrophytes and phytobenthos. Fish were classified 'High' and invertebrates were classified as 'Good'. It is currently classified as being at 'Good Chemical Status'. The watercourse is protected under the Nitrates Directive.

4.3.23 Reasons for not achieving good status affecting the Blythe from source to Cuttle Brook are:

oo. Diffuse pollution pressures from livestock and urbanisation (impacting the phosphate classification and macrophytes and phytobenthos classifications);

pp. Point source pollution from private sewage treatment (impacting the phosphate classification and macrophytes and phytobenthos classifications);

qq. Point source pollution from continuous sewage discharge relating to the water industry (impacting the phosphate classification).

Blythe from Temple Balsall Brook to Patrick Bridge

4.3.24 This watercourse is designated from Cuttle Brook at Temple Balsall to Patrick Bridge to the northeast of Hampton-in-Arden. The designation also includes a tributary which has its source less 230m to the east of the M42 at the southern extent of the Scheme, close to the Barston STW. This tributary flows directly east to meet the Blythe at Windmill farm. The watercourse is not designated artificial or heavily modified. It is 10.2km in length and has a catchment area of 35.7km^2. The watercourse is at 'Moderate Ecological Status' under the 2016 Cycle 2 classification. It is not achieving 'Good' status due to 'Moderate' macrophytes and phytobenthos combined. It is also 'Poor' for phosphate. It is at 'Good Chemical Status'. The watercourse is protected under the Nitrates Directive and Urban Waste Water Treatment Directive.

4.3.25 Reasons for not achieving good status affecting the Blythe from Temple Balsall Brook to Patrick Bridge are:

rr. Diffuse pollution pressures from livestock (impacting the phosphate classification and macrophytes and phytobenthos classifications);

ss. Diffuse pollution pressures from septic tanks (impacting the phosphate classification and macrophytes and phytobenthos classifications);

tt. Point source pollution from continuous sewage discharge relating to the water industry (impacting the phosphate and macrophytes and phytobenthos classifications).

Blythe from Patrick Bridge to River Tame

4.3.26 This waterbody flows north from Patrick Bridge at the east of Hampton-in-Arden to its confluence with the River Tame at Coleshill. It also includes a tributary that flows west from Meriden to meet the Blythe just south of Molands Bridge. It passes the M42 Junction 6 approximately 1.3km away to the east of the motorway. The watercourse receives flows from Hollywell Brook at SP 21390 83923 and Shadow Brook at SD 21612 82541, both of which are directly impacted by the Scheme. The waterbody is not designated artificial or heavily modified and is 20.5km in length and has a catchment area of 63.04km^2. It was classified as being at 'Poor Ecological Status' under the 2016 Cycle 2 classification due to it being 'Poor' in terms of phosphate, macrophytes and phytobenthos. On the other hand, fish and invertebrates were classified as 'Good'. It is also at 'Good Chemical Status'. The watercourse is protected under the Drinking Water Directive, Nitrates Directive and Urban Waste Water Treatment Directive.

4.3.27 Reasons for not achieving good status affecting the Blythe from Patrick Bridge to River Tame are:

uu. Diffuse pollution pressures from livestock and poor nutrient management (impacting the phosphate classification and macrophytes and phytobenthos classifications);

vv. Diffuse pollution pressures from septic tanks (impacting the phosphate);

ww. Point source pollution pressures from continuous sewage discharge relating to the water industry (impacting the phosphate and macrophytes and phytobenthos classifications);

xx. Surface water abstraction pressures (impacting the hydrological regime).

Hatchford-Kingshurst Brook from source to River Cole

4.3.28 The Hatchford-Kingshurst Brook from Source to River Cole (GB104028042490) waterbody is designated from north of Marston Green railway station, and flows northeast to meet the River Cole north of Chelmsley Wood. It is 2.3 km in length with a catchment area of 44.98 km^2. It is 5km downstream of the Scheme boundary but is the closest designated WFD waterbody that has hydrologic connectivity to the tributary of Low Brook. It is a heavily modified waterbody and is at 'Moderate Ecological Potential' and 'Good Chemical Status'. Biological quality elements are failing to meet 'Good Ecological Potential' on the basis of invertebrates which are classified as 'Moderate'. The dissolved oxygen classification is 'Poor', while ammonia and phosphate are 'Moderate'. The watercourse is protected under the Nitrates Directive.

4.3.29 Reasons for not achieving good status affecting the Blythe from Patrick Bridge to River Tame are:

yy. Diffuse pollution pressures from urbanisation (impacting the invertebrates and dissolved oxygen classifications);

zz. Diffuse pollution pressures from livestock (impacting the phosphate classification);

aaa. Physical modification pressures from urbanisation (impacting the invertebrate classification);

bbb. Point source pollution pressures from intermittent sewage discharge relating to the water industry (impacting the dissolved oxygen classification);

ccc. Physical modification pressures (impacting mitigation measures assessment).

4.3.30 The latest available WFD classification data for the Blythe from source to Cuttle Brook', the 'Blythe from Temple Balsall Brook to Patrick Bridge', the 'Blythe from Patrick Bridge to River Tame' and Hatchford-Kingshurst Brook are provided in Annex A Tables A1-A4.

Aquatic ecology

4.3.31 Aquatic ecology data has been obtained for the River Blythe and Hatchford-Kingshurst Brook from the UK Government data website. Further data was requested from the Environment Agency for those watercourses located within the study area, but none was available.

Blythe from source to Cuttle Brook

4.3.32 Biological Quality Elements are at Poor Status overall, due to a Poor classification for Macrophytes and Phytobenthos combined. Fish are at High status for the watercourse under Cycle 2 (2016). Fish survey data for rivers in England available online includes a single catch sample collected in July 2012 from Sandalls Bridge (SP1637478957) on this waterbody. This catch recorded 137 roach (*Rutilus rutilus*), 51 chub (*Leuciscus cephalus*), 43 gudgeon (*Gobio gobio*), 35 dace (*Leuciscus leuciscus*), 8 common bream (*Abramis brama*), 6 perch (*Perca fluviatilis*) and 1 brown trout (*Salmo trutta*).

4.3.33 Macroinvertebrates had a classification of Good under the 2016 Cycle 2 classification. Freshwater and marine biological surveys for macroinvertebrate in England are available on the UK Government website. The latest samples taken on the Blythe from source to Cuttle Brook waterbody were taken at Sandalls Bridge (SP1635478952) in September 2014 and Cheswick Green (SP1270075300) in September 2014. The invertebrate data available online includes Average Score Per Taxa (ASPT) and Biological Monitoring Working Party (BMWP) scores, which together can be used to evaluate sensitivity of macroinvertebrate communities to pollution (mainly organic pollution and nutrient enrichment). The BMWP scores reflect the sensitivity of macroinvertebrates to oxygen depletion, with scores below 10 suggesting that the watercourse is heavily polluted, and BMWP scores above 100 indicating water that is unpolluted. The Sandalls Bridge sample had an ASPT of 5.4 (which range from 0 to 10) and BMWP of 135, and the Cheswick Green sample had an ASPT of 5.48 and BMWP of 148. In both cases the high BMWP suggests that the watercourse does not suffer from heavy pollution.

4.3.34 Freshwater biological surveys for macrophytes in England are available on the UK Government website. The latest sample contained in the dataset for the Blythe from source to Cuttle Brook waterbody was taken at Elvers Green Lane near Barston (SP2001877422) in July 2014. The sample had a Mean Trophic Rank score of 33.9 and River Macrophyte Nutrient Index (RMNI) score of 7.88. Both scores point to waters that are relatively nutrient-enriched.

4.3.35 There are records of otter presence on the River Blythe. Otters typically have home ranges in the order of 11km to 18km of a main river and its associated tributaries. Given these typical territory sizes, it is considered that the study area for the Scheme would be very unlikely to sustain more than one or two breeding pairs of otter.

Blythe from Temple Balsall Brook to Patrick Bridge

4.3.36 Biological Quality Elements are at Moderate Status overall, due to a Moderate classification for Macrophytes and Phytobenthos combined. Fish and invertebrates were at Good status. The Environment Agency has provided reports from investigations into biological elements for this watercourse. A Tier 2 investigation into reasons for invertebrate failure from 2012 indicate that the watercourse was suffering organic pollution pressure from elevated ammonia related to point source pollution sewage discharges. Under the 2016 Cycle 2 classification, however, both ammonia and invertebrates are now at Good status. A Fish Deterioration Report from August 2014 was also provided, highlighting that there had been a decline in the fish classification due to changes in the sites/statistics used for fish classification, deterioration in survey efficiency and real fish deterioration due to deterioration in downstream waterbodies. The 2016 Cycle 2 classification is now at Good for fish.

4.3.37 The UK Government data website (Ref 8) indicates that a fish sample was collected downstream of Eastcote Brook (SP 21436 80245) in 2006 which included14 species. From most abundant to least abundant the sample consisted of 64 chub (*Leuciscus cephalus*), 58 roach (*Rutilis rutilus*), 51 dace (*Leuciscus leuciscus*), 30 gudgeon (*Gobio gobio*), 14 perch (Perca fluviatilis), 6 brown trout (*Salmo trutta*), 4 pike (*Esox lucius*), 1 tench (*Tinca tinca*), 1 mirror carp (*Cyprinus carpio*), 1 crucian carp (*Carassius carassius*), plus observations of bullhead (*Cottus gobio*), stone loach (*Barbatula barbatual*), minnow (*Phoxinus phoxinus*), and 3 spined stickleback (*Gasterosteus aculeatus*). Of the recorded species, bullhead (*Cottus gobio*) is an Annex II species protected under the Habitats Directive.

4.3.38 Macroinvertebrate data is available on the UK Government data website for this waterbody. The latest data collected at Temple Balsall (SP 20800 76300) in March 2005 had an ASPT score of 5.38 and BMWP of 140. This suggests that the watercourse was relatively unpolluted.

4.3.39 Diatom data was also obtained from the UK Government website. The latest available data for this watercourse was from Temple Balsall (SP 20402 75999) in September 2014. The assemblage had a Trophic Diatom Index (TDI) score of 70.94. The TDI scale runs from 0 representing very low nutrients, to 100 representing very high nutrients. Therefore, the score of 70.94 points to relatively eutrophic conditions (excess nutrients leading to oxygen depletion).

4.3.40 The most recent macrophyte survey summarised on the UK Government data website for this watercourse was undertaken at Temple Balsall (SP 20601 76092) in June 2014. Four functional groups were identified and a Mean Trophic Rank (MTR) score of 26.4 was given, indicating that the site is eutrophic or in danger of becoming so. The River Macrophyte Nutrient Index (RMNI) score was 7.7, also indicative of nutrient enriched conditions.

4.3.41 There are records of otter presence on the River Blythe (see **ES Chapter 8: Biodiversity**).

Blythe from Patrick Bridge to River Tame

4.3.42 Biological Quality Elements are at Poor Status overall, due to a Poor classification for Macrophytes and Phytobenthos combined. Fish and invertebrates were at Good status.

4.3.43 Fish survey data was available on the UK Government website for the River Blythe at Molands Bridge (SP21998 82050), which is northeast of Hampton-in-Arden. This location was most recently surveyed in June 2013 using a single catch sample. This survey identified 10 species, specifically 91 Gudgeon (*Gobio gobio*), 30 minnow (*Phoxinus phoxinus*), 15 roach (*Rutilus rutilus*), 14 chub (*Leuciscus cephalus*), 10 perch (*Perca fluviatilis*), 8 dace (*Leuciscus leuciscus*), 6 bullhead (*Cottus gobio*), 5 stone loach (*Barbatula barbatula*), 3 pike (*Esox luvius*) and 1 tench (*Tinca tinca*). Of the recorded species, bullhead (*Cottus gobio*) is an Annex II species protected under the Habitats Directive.

4.3.44 Macroinvertebrate data is available on the UK Government website for the River Blythe at Patrick Bridge (SP21514 81308), which was last surveyed in 2014. In April and November 2014, ASPT scores were 5.26 and 5.61, respectively, and BMWP scores 121 and 129 respectively. The BMWP scores suggest the river was relatively unpolluted at this point in time. In addition, **Chapter 8: Biodiversity of the ES** reports on macroinvertebrate surveys that have been undertaken as part of the HS2 project in 2013 (HS2, 2013) on two tributaries of this WFD waterbody. These tributaries are Holywell Brook and Shadow Brook, both of which would be crossed by the Scheme. These surveys recorded the following:

ddd. Shadow Brook: A high invertebrate diversity comprising mostly common species with the exception of locally common leech and caddisfly. Based on the biological and environmental data collected, Shadow Brook was of moderate overall quality;

eee. Holywell Brook: A moderate invertebrate diversity of common and widespread species. Based on the biological and environmental data collected, Holywell Brook was of moderate overall quality.

4.3.45 Diatom data was obtained from the UK Government website. The latest available data for this watercourse was last collected at Patrick Bridge (SP21514 81308) in November 2014. The assemblage had a Trophic Diatom Index (TDI) score of 73.9, thereby indicating eutrophic conditions.

4.3.46 The most recent macrophyte survey summarised on the UK Government data website for this watercourse was undertaken at Patrick Bridge (SP21514 81308) in July 2014. Nine functional groups were identified and a Mean Trophic Rank (MTR) score of 29.2 was given, indicating that the site is eutrophic or in danger of becoming so. The River Macrophyte Nutrient Index (RMNI) score was 8.09, also indicative of nutrient enriched conditions.

4.3.47 There are records of otter presence on Holywell Brook tributary and the River Blythe (see **ES Chapter 9: Biodiversity**).

Hatchford-Kingshurst Brook

4.3.48 Biological quality elements are at Moderate status overall, due to moderate invertebrates. Survey data for Hatchford-Kingshurst Brook is available on the UK Government data website, although there are no fish surveys included for this waterbody. Hatchford-Kingshurst Brook was last surveyed for macroinvertebrates close to the confluence with the Cole (SP17896 87440) in September 2014. The ASPT score was 4.39 and BMWP score was 79, indicating that there are substantial pollution pressures at this location.

4.3.49 The most recent macrophyte survey was undertaken at the Cole confluence (SP17896 87440) in June 2014 and had 7 functional groups, a MTR of 24.3 (indicative of eutrophication and/or organic pollution) and a RMNI of 8.46, also indicative of enriched conditions.

4.3.50 Hatchford-Kingshurst Brook was sampled for diatoms upstream at the Cole confluence (SP1789687440) in September 2014 and had a TDI of 75.24. This suggests eutrophic conditions.

Other waterbodies

4.3.51 Numerous ponds in the study area are known to contain Great Crested Newt (GCN), which are a protected species. Full details are provided in **Chapter 9: Biodiversity**.

4.3.52 Pendigo Lake is used for angling with the rights leased by the NEC Angling Club. It is known to contain roach (*Rutilus rutilus*), perch (*Perca fluviatilis*), mirror carp (*Cyprinus carpio carpio*), gudgeon (*Gobio gobio*), ghost carp (*Cyprinus carpio*), eel (*Anguilla anguilla*), crucian carp (*Carassius carassius*), common carp (*Cyprinus carpio*), tench (*Tinca tinca*), rudd (*Scardinius erythrophthalmus*), chub (*Leuciscus cephalus*), catfish, bream (*Abramis brama*) and barbel (*Barbus barbus*).

Water Quality

4.3.53 The Environment Agency's Water Quality Archive website (Ref 9) includes water quality data for the River Blythe. Data for 2016-2017 is summarised in Table 4-2.

4.3.54 The data indicates that the River Blythe is slightly alkaline, with moderate to high alkalinity. It has elevated levels of nutrients including nitrate and orthophosphate, which is indicative of diffuse agricultural pollution. Dissolved oxygen is meeting the WFD requirement for Good status at the River Blythe monitoring locations. The River Blythe – Ryton End monitoring point has elevated ammonia concentrations.

4.3.55 The Blythe at Stonebridge has dissolved zinc levels in excess of environmental quality standards (EQS), and is located adjacent to the A452, which is a likely source of dissolved metals through road runoff from road outfalls.

4.3.56 To understand the baseline water quality of tributaries of the River Blythe that are directly impacted by the Scheme, a programme of water quality monitoring has been undertaken. Sampling points were established on Hollywell Brook (SP 20099 83795) and Shadow Brook (SP 19884 81289) and samples were collected in November 2017, February 2018 and May 2018. Two further sampling points were established on the tributary of Shadow Brook (SP 18957 81746) and tributary of Low Brook (SP 18242 82418), and samples were collected in February 2018 and May 2018. Locations are shown in Figure 1, and full results tabulated in Annex B. Hollywell Brook, Shadow Brook and its tributary fall under the Blythe from Patrick Bridge to River Tame WFD waterbody classification. The tributary of

Low Brook falls within the Hatchford-Kingshurst Brook WFD waterbody classification.

Table 4-2: Summary Water Quality Data for the River Blythe for 2016-2017 (obtained from the EA Water Quality Archive)

Water Quality Parameter	Unit	EQS for Good Status)	Statistic	Blythe – Patrick Bridge (Long Lat 421499, 281330)	Blythe – Ryton End (Lat Long 421631 278398)	Blythe – Stonebridge (Long Lat 421400, 283190)
WFD waterbody				Blythe from Patrick Bridge to River Tame	Blythe from Temple Balsall Brook to Patrick Bridge	Blythe from Patrick Bridge to River Tame
pH	pH Units	Good (5thP >6 to 95thP <9)	Mean average	7.93	7.99	-
			10% percentile	7.71	7.84	-
			90th percentile	8.11	8.07	-
Conductivity @ 20C	uS/cm	N/A	Mean average	546	597	-
			10% percentile	404	446	-
			90th percentile	750	761	-
Water Temperature	°C	28 (98thP)	Mean average	11.4	10.96	-
			10% percentile	6.08	7.06	-
			90th percentile	16.14	14.8	-
Ammonia	mg/l	0.3 (90thP)	Mean average	0.25	0.10	-
			10% percentile	0.03	0.03	-
			90th percentile	0.69	0.27	-
Nitrate	mg/l	N/A	Mean average	8.85	4.85	-
			10% percentile	4.84	2.87	-

			90th percentile	14.9	7.12	-
Nitrite	mg/l	N/A	Mean average	0.073	0.040	-
			10% percentile	0.028	0.013	-
			90th percentile	0.162	0.082	-
Alkalinity to pH 4.5	mg/l	N/A	Mean average	132	155	-
			10% percentile	98	117	-
			90th percentile	163	187	-
Orthophosphate (reactive as P)	mg/l	0.0157 (based on 90 m altitude and 143 mg/l alkalinity)	Mean average	0.219	0.188	-
			10% percentile	0.181	0.129	-
			90th percentile	0.264	0.249	-
Dissolved oxygen	%	75% (10thP)	Mean average	89.38	86.43	-
			10% percentile	81.2	75.3	-
			90th percentile	97.48	91.64	-
Dissolved oxygen	mg/l	N/A	Mean average	9.83	9.62	-
			10% percentile	8.26	7.84	-
			90th percentile	11.34	11.04	-
Dissolved Copper	ug/l	10	Mean average	-	-	3.58
			10% percentile	-	-	2.34
			90th percentile	-	-	4.94
Dissolved	ug/l	7.8	Mean	-	-	9.77

Zinc			average			
			10% percentile	-	-	4.90
			90th percentile	-	-	14.58

4.3.57 All of the four monitored watercourses were generally neutral to slightly alkaline, with the exception of the tributary of Shadow Brook which had a slightly acidic pH. Hollywell Brook was also weakly acidic in spring 2018 having recorded neutral values in the preceding winter and autumn. Conductivity was generally moderate but was more than doubled at Hollywell Brook at the time of the winter sampling (1708 µs/cm February 2018) in comparison to autumn (714 µs/cm in November 2017). Total suspended solids (TSS) were highest at Shadow Brook and Hollywell Brook (maximum of 40 mg/l at Hollywell Brook in November 2017) and below the limits of detection at the tributary of Shadow Brook and tributary of Low Brook. Although there are no standard EQS for TSS, usually concentrations below 25mg/l are considered to be required to maintain healthy aquatic ecosystems.

4.3.58 Common indicators of sanitary pollutants include ammonia, nitrate, BOD and chemical oxygen demand (COD). Ammonia was generally low but was noticeably elevated at Hollywell Brook during the winter sampling (0.35 mg/l) in comparison to the remainder of the sites and sampling periods. Nitrate was very high across all four streams, particularly in the winter sampling period, with the highest values recorded in the tributary of Shadow Brook (38.7 mg/l) and tributary of Low Brook (23.1 mg/l), adjacent to the Bickenhill Meadows SSSI units. These streams may be impacted by agricultural fertiliser application to the surrounding fields. BOD was generally low, but with periodically elevated values recorded in Hollywell Brook (4 mg/l) and Shadow Brook (5 mg/l). The highest COD values were also recorded in Shadow Brook (53 mg/l) and Hollywell Brook (41 mg/l) during the autumn sampling period.

4.3.59 As well as elevated nitrates indicating agricultural pressures across all monitored watercourses, orthophosphate was also elevated at Hollywell Brook (0.12 mg/l) and Shadow Brook (0.08 mg/l) in the autumn sampling period and the tributary of Low Brook in the spring sampling period (0.09 mg/l), further indicating periodic inputs from agricultural practises. Total phosphorus was between 59 and 195 ug/l across the four sites.

4.3.60 Metals were generally below EQS for all four sites. However, copper and zinc, which are typical of pollution from road runoff, were elevated at Shadow Brook, Hollywell Brook and the tributary of Shadow Brook. These watercourses all receive road outfalls. These metals were not elevated at the tributary of Low Brook, which is not known to receive any road outfalls.

4.3.61 All measured polycyclic aromatic hydrocarbons (PAHs), total petroleum hydrocarbons (TPHs) and organic compounds were below the limits of detection for all watercourses, with the exception of the autumn 2017 sample for Hollywell Brook. At this site, fluoranthene was above the WFD EQS. This is a pollutant found in many combustion properties and given the proximity to the M42 it is expected that this pollutant was transported to the watercourse through the road drainage system having been derived from automobiles. Subsequent samples from Hollywell Brook were within the EQS and the limits of detection for the laboratory.

Geology and Soils

4.3.62 According to the British Geological Society website, the bedrock underlying the site consists predominantly of Sidmouth Formation Mudstone, comprising Mercia Mudstone Formation, Branscombe Mudstone Formation and Arden Sandstone Formation. Areas of Branscombe Mudstone Formation (Mudstone) are mainly to the northeast of the site and around Catherine de Barnes. Arden Sandstone Formation (Sandstone, Siltstone, Mudstone) is found in small patches including at the NEC, the immediate east of Bickenhill and south of Catherine-de-Barnes. Superficial deposits are generally sparse in the area, but there are scattered patches of glaciofluvial deposits (sands and gravels), and this is more widespread around Catherine-de-Barnes. Alluvium is found in the immediate vicinity of the larger watercourses.

4.3.63 The 107 exploratory holes advanced as part of the 2018 Ground Investigation for the Scheme encountered a variable thickness of topsoil and/ or Made Ground overlying natural superficial deposits of Alluvium and Glaciofluvial Deposits, overlying the Mercia Mudstone Group. The succession encountered in the exploratory holes confirmed the anticipated geology, however, the Glaciofluvial Deposits encountered across the Scheme were more widespread than expected. No river terrace deposits were encountered. Refer to **ES Chapter 10: Geology and Soils** for further details.

4.3.64 According to Defra's multi-agency geographical information for the countryside (MAGIC) map website the bedrock aquifer designation is Secondary B. These are predominantly lower permeability layers which may store and yield limited amounts of groundwater due to localised features such as fissures, thin permeable horizons and weathering. These are generally the water-bearing parts of the former non-aquifers. The superficial aquifer designation is a mixture of non-classified and Secondary A aquifer. The designated areas are mainly around the NEC, Catherine-de-Barnes and Hampton in Arden, with other small patches scattered over the site. Secondary A aquifer are permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases forming an important source of baseflow to rivers.

4.3.65 Groundwater was encountered in approximately 60% of the exploratory holes advanced during the 2018 ground investigation. A further 17% of the boreholes that were dry during exploration were subsequently installed and have been observed to contain water post fieldwork.

4.3.66 Groundwater was only encountered within the Glacio-fluvial deposits and Mercia Mudstone Group. Groundwater was encountered within both the cohesive and granular Glaciofluvial Deposits at depths ranging from 0.3m to 2.5m. The strikes, where described, were noted most frequently as 'seepage' and occasionally 'slow' or 'medium inflow', reflecting the presence of perched water in the Glacial Deposits. Groundwater strikes in the Mercia Mudstone Group ranged from 0.3 metres to 22.5 metres below ground level and were noted in a variety of material types. Where the strikes were described they were generally recorded as ‘seepage’ or ‘slow inflow’ and to a lesser degree ‘medium inflow’, with only two strikes recorded as ‘fast inflow’. Refer to **ES Chapter 10: Geology and Soils** for further details.

4.3.67 According to the Cranfield University’s Soilscapes website the site is underlain by slowly permeable seasonally wet slightly acid but base-rich loamy and clayey soils.

WFD Groundwater Bodies Classification

4.3.68 The underlying groundwater WFD waterbody is the Tame Anker Mease – Secondary Combined (GB40402G990800). Information on the status of this water body is available on the Environment Agency Catchment Data Explorer website and is summarised as follows:

fff. The 2016 Cycle 2 Overall water body status is Good;

ggg. The 2016 Cycle 2 Quantitative Status is Good;

hhh. The 2016 Cycle 2 Chemical Status is Good; and

iii. The overall objective of the groundwater body is Good by 2015 (i.e. the objective is to ensure no deterioration from the current Good Status).

4.3.69 A summary of the 2016 Cycle 2 assessment is reproduced in Table 4-3.

Table 4-3: Groundwater body assessment in 2016, Cycle

Parameter		Tame Anker Mease – Secondary Combined
Water Body ID		GB40402G990800
Water Body Type		Groundwater Body
Groundwater area		114,057.047 ha
Surface area		1140.57 km^2
Overall Status		Good
Quantitative Status		Good
Chemical Status		Good
Quantitative Elements	Saline Intrusion	Good
	Water Balance	Good
	Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good
	Surface Water Body Status	Good
Chemical Elements	Chemical Drinking Water Protected Area	Good
	Dependent Surface Water Body Status	Good
	GWDTEs	Good
	Drinking Water Protected Areas (FrWPAs)	Good
	General Chemical Test	Good

Water Resources and Known Pollution Incidents

4.3.70 Data provided by the Environment Agency indicate that there are eight discharge consents near the Scheme, and these are listed in Table 4-4 and shown on **Figure 1**. These are primarily discharges related to treated sewage effluent.

Table 4-4: Active Discharge Consents

ES Vol 2 Fig 14.1 Ref	Licence	NGR	Location	Discharge Type	Discharge Rate (max daily)	Nearest watercourse
D1	3/28/11/1621	SP18900 81400	Heath Farm	Not detailed	0.7 m^3/d	Shadow Brook
D2	EPRCB3792WM	SP20586 83052	Arden Landfill	Surface water runoff with settlement	240 m^3/d	Drain to Hollywell Brook
D3	NPSWQD007749	SP19273 82708	STW to private residence	Secondary treated effluent containing no trade effluent	0.45 m^3/d	Hollywell Brook
D4	T/11/35564/S	SP19081 81351	Cottage, SE of Bickenhill	Secondary treated sewage effluent	0.8 m^3/d	Shadow Brook
D5	T/11/35994/R	SP19400 80280	Barston STW	Tertiary treated sewage effluent	Not given	Tributary of the Blythe
D6	T/12/14382/SG	SP18900 83100	Arden Hotel	Treated sewage effluent	22 m^3/d	Pond at Trinity Park
D7	T/12/35929/S	SP20670 83060	Arden Brickworks	Secondary treated sewage effluent	0.9 m^3/d	Tributary of Hollywell Brook
D8	T/14/20604/S	SP18850 83200	Trinity Park Sewage Pumping Staton	Sewage in an emergency	Not given	Pond at Trinity Park

4.3.71 The PCF Stage 2 EAR (May 2017) for the Scheme indicates that there is a medium sized surface water abstraction point north-east of the Scheme, east of Little Packington on the River Blythe, which is used for agriculture or private purposes (see **Figure 1**). Further details on current abstractions were requested from the Environment Agency but no further surface water abstractions were reported.

4.3.72 The whole of the study area is located within a Nitrate Vulnerable Zone (NVZs) for surface water, as designated in 2017.

4.3.73 The eastern half of the study area to the east of Catherine de Barnes Lane and Clock Interchange are in a surface water Drinking Water Protected Area. Drinking Water Protected Areas are, within the WFD, where raw water is abstracted from rivers and reservoirs. Raw water needs to be protected to ensure that it is not polluted, which could lead to additional purification treatment. To do this water companies and the Environment Agency identify raw water sources that are 'at risk' of deterioration which would result in the need for additional treatment. These zones are areas where the land use is causing pollution of the raw water. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided.

4.3.74 The eastern half of the study area to the east of Catherine de Barnes Lane and Clock Interchange is also in a Drinking Water Safeguard Zone (for Surface Water). These are catchment areas that influence the water quality of their respective Drinking Water Protected Area, where at risk of failing the drinking water protection objectives. These non-statutory Safeguard Zones are where action to address water contamination will be targeted, so that extra treatment by water companies can be avoided.

4.3.75 Nine groundwater abstractions within 500m of the Scheme boundary have been determined from an Envirocheck Report, and are shown in Table 4-5 and **Figure 1**.

Table 4-5: Groundwater abstractions within 500m of the Scheme boundary as listed in the Envirocheck Report for the Scheme

ES Vol 2 Fig 14.1 Ref	Licence Holder	NGR	Location	Licence Number	Type of Use
A1	Birmingham Corporation (Warren Farm)	SP 19900 83900	Approximately 200 m north of the M42 Junction 6 southbound off-slip road.	03/28/11/0079	General Farming And Domestic
A2	[redacted]	SP 19900 84600	115 m east of the Scheme and approximately 350m west of Chester Road	03/28/11/0020	General Farming And Domestic
A3	Melbick Nurseries Limited	SP 20000 85100	196 m east of Scheme, off Chester Road (A452)	03/28/11/0081	Horticulture And Nurseries: General Use (Medium Loss) - DEEP WELL
A4	Melbick Nurseries Limited -	SP 20000 84900	204 m east of Scheme, off Chester Road A452 (northbound)	03/28/11/0081	Horticulture And Nurseries: General Use (Medium Loss) - SHALLOW WELL
A4	[redacted]	SP 20000 84900	204 m east of Scheme, off Chester Road A452 (northbound)	03/28/11/0020	General Farming And Domestic
A5	Whale Tankers ltd	SP 17590 79000	442 m west of southern extent of the Scheme where the M42 crosses Henwood Lane	03/28/11/0131	Other Industrial/Commercial/Public Services: Process Water
A6	[redacted]	SP 20100	286 m east of Scheme, off	03/28/11/0065	General Farming And Domestic

		85300	A446 westbound approach to A446/A452 interchange		
A7	Wyevale Garden Centres G&L Limited	SP 20107 84932	310 m east of Scheme off Chester Road A452 (southbound)	Md/028/0011/006	Horticulture And Nurseries: Spray Irrigation – Direct
North of map area	[redacted]	SP 19400 86300	461 m north west of the northern extent of the Scheme. Approximately 200 m west of the M42 Junction 7 off-slip road.	03/28/12/0014	General Farming And Domestic

4.3.76 Most of the groundwater abstractions provide water for farms and nurseries to the northeast of the Scheme boundary. There is one industrial/commercial abstraction to the south of the Scheme to the northeast of the M6 Junction 5. One abstraction falls within the Scheme boundary to the north of Hollywell Brook, and this is for general farming and domestic purposes (licence 03/28/11/0079).

4.3.77 There are 5 private water supplies within the study area that are located within Solihull Metropolitan Borough Council's jurisdiction. However, exact coordinates were not provided by SMBC due to data protection restrictions. The northwest of the study area falls within the jurisdiction of North Warwickshire Borough Council, who have confirmed that there are no Private Water Supplies (PWS) within this section of the study area.

4.3.78 There are no groundwater source protection zones or drinking water safeguard zones for groundwater in the Study Area.

4.3.79 Details of pollution incidents as recorded on the National Incident Reporting System (NIRS) were provided by the Environment Agency for the period 2012-2017. Only three incidents of note occurred in terms of the water environment:

jjj. Barber's Coppice (SP18790 79900), April 2014 – around 200 litres of diesel entered a surface water drain (labelled P1 on Figure 1). Based on known outfall locations this may have been discharged to the River Blythe ('Source to Cuttle Brook' WFD waterbody);

kkk. Small pond north of Pendigo Lake (SP19501 83699), January 2015 – report of blue-green algae in the water (labelled P2 on Figure 1); and

lll. Arden Landfill, Diddington Hill (SP20533 82770), January 2015 – report of water pollution incident at the landfill site (labelled P3 on Figure 1), but no further details are available.

Protected Areas

4.3.80 Nature conservation designations with hydrological connectivity to the Scheme have been reviewed using the Multi-Agency Geographical Information for the Countryside (MAGIC) website. This has shown that the River Blythe is a designated Site of Special Scientific Interest (SSSI). The

Bickenhill Meadows SSSI is also located within the Scheme boundary, and the Coleshill and Bannerly Pools are located immediately adjacent to the Scheme at its north eastern extent.

River Blythe SSSI

4.3.81 A 39 km reach of the River Blythe was designated as a SSSI in 1989 and currently has a status of 'Unfavourable – Recovering'. It stretches from its crossing with the Stratford-upon-Avon to Birmingham railway line to its confluence with the River Tame (i.e. all WFD designated reaches of the Blythe described above). The Natural England citation for the site states that the Blythe has a wide range of natural structural features such as riffles, pools, small cliffs and meanders. These features are combined with a high diversity of substrate types ranging from fine silt and clay in the lower reaches to sands and gravels in the upper and middle reaches and in the riffles. The structure of this river is very variable and its importance is increased because of the rarity of such examples in lowland Britain. The diverse physical features of the Blythe are mirrored by its diverse plant communities. The mean number of plant species found in any 1 km stretch is above average for a lowland river, as is the number of species recorded for the whole length of the river. Botanically, the Blythe is one of the richest rivers in lowland England with the most species-rich sections containing as many species as the very richest chalk streams. The river supports a diverse invertebrate community with a wide range of molluscs, oligochaetes and caddisflies.

4.3.82 The Management Principles for the site state that the maintenance of good water and sediment quality are essential to maintaining a healthy river system. Management should minimise pollution of the river from point and diffuse sources, including discharges of domestic and industrial effluent, run-off from agriculture, forestry and urban land, and accidental pollution from industry and agriculture. Siltation of the river bed can smother and infill coarse gravels, which can affect fish spawning success and the establishment of submerged plants such as water crowfoot, as well as having an impact on the invertebrates living in and on the riverbed.

Bickenhill Meadows SSSI

4.3.83 The Bickenhill Meadows SSSI was notified in 1991. The site is split into two separate units covering a total area of 7.7 ha (see **Figure 1**). The two units are situated each side of Catherine-de-Barnes Lane and both feature natural lowland grasslands that require wet soil conditions, particularly in winter and spring. The SSSI has a status of 'Unfavourable – Recovering'. Hydrological investigation into the site indicates that both sites are most probably rainwater fed, with lateral groundwater flows being potentially important at the SE SSSI unit. The tributary of Shadow Brook flows through the middle of the SE SSSI unit and the tributary of Low Brook flows through the middle of the NW SSSI unit. However, these small ephemeral streams are considered to have a very limited role in maintenance of wet conditions required for the grasslands within the SSSI (see Appendix 14.2 [**TR010027/APP/6.3**]). The SE unit of the Bickenhill Meadows SSSI falls within the larger Shadowbrook Meadows Local Nature Reserve, which is managed by Warwickshire Wildlife Trust.

4.3.84 The Natural England designation note states that the SSSI comprises one of the richest grassland floras in the county with good examples of meadow foxtail (*Alopecurus pratensis*) and great burnet (*Sanguisorba officinalis*) flood meadow, and common knapweed (*Centaurea nigra*) and crested dog's-tail (*Cynosurus cristatus*) meadow and pasture. Both grassland types have declined very severely nationally in the 20th century due to agricultural improvement. There is a complex pattern of vegetation resulting from local variations in topography and drainage, such as the ridge and furrow pattern, evident in some fields. Further interest is provided by the wetter areas characterised by rushes (*Juncus* spp.) sedges (*Carex* spp.) and tall herbs such as meadowsweet (*Filipendula ulmaria*) and great burnet. Further description of the site is provided in the **Appendix 14.2** [**TR010027/APP/6.3**]**.**

4.3.85 Natural England's Management Principles for the site includes the following information with regard to the water environment, "For both the damper pastures and meadows, regular and careful maintenance of surface drainage including ditches and drains can be essential to prevent adverse changes in the plant composition of the sward. Deepening of surface drainage should be avoided."

Coleshill and Bannerly Pools SSSI

4.3.86 Coleshill and Bannerly Pools SSSI incorporates two pools and an intervening bog area (known as The Bogs) covering 37.6ha. This is the only valley mire system in Warwickshire. It has a status of 'Unfavourable – Recovering'.

4.3.87 The Natural England citation describes the site as follows, "Coleshill Pool lies at the head of the valley system. Here, a bog has developed over deep peat which has built up in part of the pool. The water then flows through the Bogs with its narrow streamside mire and acid, valley alder woodland (a nationally restricted habitat) thence to Bannerly Pool with its swamp and sump alderwood – another nationally restricted habitat".

4.3.88 Natural England's Management Principles for the site indicate that groundwater quality and quantity should be maintained, though the quantity is not likely to be naturally constant throughout the seasons or between wet and dry years. The groundwater is often susceptible to contamination by agricultural fertilisers, or by leachate from landfill sites. Drainage schemes should not intercept the sources of ground and surface water to the valley mire. It is important for the watercourses that flow to the valley mire not to receive runoff from fertilised land or surface water from farmyards.

4.3.89 OS mapping indicates that there is no hydrological connectivity between the SSSI and the Scheme, and although the pools are within the study area, they are located over 1.5km north of any physical improvement works to the M42 Junction 6 slip roads, and so will not be considered by the pWFD assessment.

4.4 Future good status

Construction (2020-2024)

4.4.1 The future baseline has been determined qualitatively by considering the possibility of changes in the attributes that are considered when deciding the importance of water bodies in the Study Area.

4.4.2 It is assumed that no other development within the Study Area will commence between now and the commencement of the Scheme. It is not expected that the baseline conditions will be significantly different by the time the development commences in 2020 or when it is completed in 2024.

4.4.3 Generally, there is an improving trend in water quality and the environmental health of waterways in the UK since the commencement of significant investment in sewage treatment in the 1990’s, the adoption of the WFD from 2003, and the application of increasingly stringent planning policies. In terms of water quality effects, the future baseline assumes that all WFD water bodies achieve their final target status.

4.4.4 It is likely that through the action of new legislative requirements, planning policy and regulation that the health of the water environment will continue to improve post-2027, although there are significant challenges such as adapting to a changing climate and pressures of population growth. However, it is difficult to forecast these changes with any certainty, and in any case the way the importance of the water environment is determined takes into account a wide range of attributes, some of which are unlikely to change.

4.4.5 Under the WFD, the Blythe from source to Cuttle Brook has an objective of achieving Moderate Ecological Status by 2027, the Blythe from Temple Balsall Brook to Patrick Bridge has an objective of achieving Moderate Ecological Status by 2015 (ithere must not be any deterioration from existing classifications), and the Blythe from Patrick Bridge has an objective of achieving Moderate Ecological Status by 2027. Hatchford-Kingshurt Brook has an objective of achieving Moderate Ecological Potential by 2015 (there must not be any deterioration from existing classifications), and the Tame Anker Mease – Secondary Combined groudwater body has an objective of achieving Good by 2015 (there must not be any deterioration from existing classifications). It is assumed that these objectives are achieved following the development of the Scheme. This includes reduced pollutant loadings from road outfalls as existing road outfalls without SuDS treatment are replaced by drainage networks that do contain such attenuation features.

Operation (2024)

4.4.6 The same baseline conditions expected during construction will be maintained during operation, provided all the pollution control measures are put in place. It is also assumed that all necessary maintenance practices outlined for the Scheme are fully implemented, such as clearing of sediment from storage tanks and clearing litter and debris from filter drains.

Proposed Environment Agency Mitigation Measures

4.4.7 Information on proposed Environment Agency mitigation measures to improve the status of these water bodies was requested but none was provided. The assessment of the failure to improve objective has therefore been based on the known pressures as described on the Catchment Data Explorer website.

5. Preliminary assessment of likely compliance / non-compliance

5.1 WFD screening assessment

5.1.1 The first stage of the preliminary assessment is to screen development components against the list of exemptions detailed in Section 3.3. With reference to the exemptions listed in Table 3.1, the Proposed Development requires the extension to existing culverts (e.g. Hollywell Brook), some realignment or loss of minor ditches that connect into WFD designated water bodies, new outfalls and changes to the volume and quality of highway runoff, although it is possible that some outfalls may be smaller than 300 mm diameter. There may also be temporary adverse impacts from construction works as well as impacts to groundwater flow pathways that may be important for water dependent ecological sites (e.g. Bickenhill SSSI). As a result of these scheme components further assessment is required.

5.2 No deterioration assessment

5.2.1 The second stage of the preliminary assessment is to consider the likely impact on WFD parameters and whether the proposed development may prevent Environment Agency mitigation measures from being implemented. The appraisal of these two WFD objectives is considered under the following sub-sections. Assessment for all WFD classifications for each watercourse is provided in Annex D pWFD assessment worksheets; however, the results are summarised below.

Potential construction impacts

River Blythe from Source to Cuttle Brook

5.2.2 No direct or indirect impacts are predicted to ecological, physicochemical or hydromorphological WFD parameters of this watercourse as the nearest physical works are approximately 600m northeast of the existing M42 crossing of this watercourse. Furthermore, any construction drainage would be directed to surface waterbodies further north, which are not tributaries of the Blythe from source to Cuttle Brook. The Scheme boundary only extends to the existing watercourse crossing of the M42 to cover installation of signage for the Scheme.

River Blythe from Temple Balsall Brook to Patrick Bridge

Construction site runoff - suspended fine sediments

5.2.3 Ecological and physicochemical WFD parameters may be adversely affected by excessive levels of fine sediment contained within construction site runoff, dewaters or from works directly affecting water bodies. The Scheme requires earthworks, construction of cuttings, other localised excavations, ground levelling, upgrades to existing structures, and the installation of drains and services. The risk to the water environment from these activities is greatest where they occur close to and within water bodies, such as construction works close to Eastcote Brook in this instance, which is a tributary of the Blythe from Temple Balsall Brook to Patrick Bridge and rises approximately

200m east of the Scheme boundary. The Scheme also includes modification of a road outfall to a ditch upstream of Eastcote Brook. This ditch is small, has low socio-economic value and does not contain a diverse aquatic ecosystem.

5.2.4 Given the size of the ditch that will undergo direct works for the drainage outfall, the typical rates of conveyance, and likely deposition of sediment in intervening vegetated agricultural ditches, it is unlikely that flow contaminated with high concentrations of suspended sediments would propagate to Eastcote Brook (which is over 200m downstream from the outfall through agricultural ditches). Eastcote Brook also develops into a watercourse of significant size that offers dispersal and dilution potential for contaminants prior to discharging to the River Blythe from source to Temple Balsall Brook.

5.2.5 Mitigation measures have been identified to avoid, minimise and reduce the potential adverse impacts from high concentrations of suspended sediments in construction site runoff on receiving watercourses. These measures are described in detail in Chapter 14 of the Environmental Statement Volume 1 (Road Drainage and the Water Environment) and include the implementation of a temporary drainage system, use of construction SuDS, filtration barriers (such as fabric silt fences) etc. These measures are also defined in the CEMP and Outline Water Management Plan (OWMP). With the implementation of these measures, no significant adverse impact is predicted or non-compliance with any WFD objectives.

Construction site runoff - chemical spillages

5.2.6 During construction, potentially polluting substances would be stored and / or used on site. Leaks and spillages of these substances could pollute surface watercourses if their use were not carefully controlled and spillages were to enter existing flow pathways, causing acute impacts to water quality and potentially aquatic organisms. Like excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within water bodies.

5.2.7 Mitigation measures have been proposed to avoid, minimise and reduce the potential adverse impacts from chemical spillages on receiving watercourses during construction works. These measures are described in detail in Chapter 14 of the Environmental Statement Volume 1 (Road Drainage and the Water Environment) and include the implementation of a temporary drainage system, bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of a Pollution Control Plan. These measures are further defined in the OWMP. Given the implementation of these measures, no significant adverse impact is predicted or non-compliance with any WFD objectives.

River Blythe from Patrick Bridge to River Tame

Construction site runoff - suspended fine sediments

5.2.8 As stated for the Blythe from Temple Balsall Brook to Patrick Bridge, suspended sediments from construction site runoff have the potential to affect ecological and chemical WFD elements of watercourses draining the Scheme boundary, including Shadow Brook and its tributary, Hollywell Brook and numerous minor unnamed ditches. All tributaries are further than 1.5km from the WFD designated watercourse, and so there is limited potential for sediment to reach the Blythe due to deposition in the low gradient intervening reaches of the waterbodies. There are also online ponds along Hollywell Brook which are likely to attenuate sediment impacts from this tributary, where impacts might be expected to be greater due to a required culvert extension. The tributary of Shadow Brook flows through the Bickenhill Meadows SSSI which is partially surface water dependent, but with the mitigation measures in place as described for the Blythe from Temple Balsall Brook to Patrick Bridge above, any impacts resulting from suspended sediments to this and the other watercourses draining the Scheme would be small, temporary and localised. As such, no significant adverse impacts or non-compliance with WFD objectives are predicted for this or any other of the tributaries.

Construction site runoff - chemical spillages

5.2.9 As stated for the Blythe from Temple Balsall Brook to Patrick Bridge, chemical spillages from construction works have the potential to affect ecological and chemical WFD elements of watercourses draining the Scheme. Given that the designated waterbody is over 1.5km downstream of the Scheme boundary for all tributaries, it is unlikely that these impacts could propagate as far as the River Blythe. The tributaries are also low gradient and are generally well vegetated close to the scheme boundary, offering some treatment potential. The online ponds on the larger Hollywell Brook also offer dilution and dispersal of pollutants. Furthermore, with the mitigation measures as described for the Blythe from Temple Balsall Brook to Patrick Bridge above, no significant adverse impacts or non-compliance with WFD objectives are predicted for any waterbody. This includes the tributary of the Shadow Brook which flows through the Bickenhill Meadows SSSI.

Hatchford-Kingshurst Brook

Construction site runoff - suspended fine sediments

5.2.10 The potential impacts of construction site runoff containing suspended fine sediments are described above. The tributary of Low Brook flows through the Bickenhill Meadows SSSI, which is partially surface water dependent, but with the mitigation measures in place as described above and in more detail in the CEMP and OWMP, any impacts resulting from suspended sediments to watercourses draining the Scheme would be small, temporary and localised. The WFD designated watercourse is 5 km downstream from the Scheme boundary, and so would not be impacted. As such, no significant adverse impacts or non-compliance with WFD objectives are predicted.

Construction site runoff - chemical spillages

5.2.11 The potential impacts of chemical spillages from construction works have been described above. Given that the designated waterbody is over 5km downstream of the Scheme boundary, it is unlikely that these impacts could propagate as far as Hatchford-Kingshurt Brook. The tributaries are also low gradient, and are generally well vegetated close to the scheme boundary, thereby offering some treatment potential. No significant adverse impacts or non-compliance with WFD objectives are predicted, including for the tributary of Low Brook which flows through the Bickenhill Meadows SSSI.

Tame Anker Mease - Secondary Combined Groundwater Body

5.2.12 During construction works there is the potential for groundwater to be contaminated from spillages associated with vehicles, construction materials and storage of fuels, oils and other chemicals. There is also the potential for the generation of contaminated runoff during dewatering activities which may not be suitable for discharge without treatment. Finally, foundation methods and construction activities may open and/or modify potential pollutant linkages, including the disturbance of sediments and drilling of piling foundations. However, with the implementation of the mitigation measures discussed earlier and described in the CEMP, OWMP and Chapter 9 of the Environmental Statement, no impacts on water quality or quantity are predicted that would be significant at the waterbody scale.

Potential permanent impacts

River Blythe from Source to Cuttle Brook

5.2.13 No direct or indirect impacts are predicted as the Drainage Strategy for the Scheme indicates that there will be no road drainage to this watercourse or its tributaries, nor any physical works or additional crossings of the watercourse. The extension of the Scheme boundary to this watercourse is for road signage only.

River Blythe from Temple Balsall Brook to Patrick Bridge

Road runoff including spillages

5.2.14 The potential impacts that are generally associated with routine road runoff and spillages are outlined in Annex C. For the Scheme as assessed here, the Drainage Strategy Report indicates that there would be one road outfall from the M42 within the catchment of this watercourse, to a ditch upstream of Eastcote Brook. In the absence of mitigation, this could cause water quality deterioration through release of dissolved metals, hydrocarbons and contaminated sediments, with subsequent impacts on ecological and physicochemical parameters in Eastcote Brook. There is also a risk that a significant chemical spillage or pollution incident could occur on the road and be transmitted to the receiving waterbody through the road drainage network. If untreated these releases of contaminants would have the potential to propagate to the downstream Eastcote Brook. However, impacts to the Blythe SSSI over 2.5km downstream are likely to be reduced by dispersal and dilution in Eastcote Brook.

5.2.15 The Drainage Strategy includes a range of treatments for routine road runoff and accidental spillages (as outlined in the ES Chapter 14. The suitability of the Drainage Strategy treatment has been determined for this outfall in line with guidance in DMRB HD45/09 (HAWRAT assessment), including assessments of routine road runoff and chemical spillages, and is shown to be compliant with the necessary standards. Water quality impacts that could affect ecological and physicochemical WFD parameters are therefore considered to be negligible. However, for the treatment train to operate properly and efficiently in the long term it will be important that the proprietary and SuDS components are well maintained. Assuming this to be the case, then there would be an improvement over the existing situation where there is no treatment for road runoff from the M42.

5.2.16 There would be sporadic release of de-icant salts in winter with potential for impacts on ecological and physicochemical parameters. Generally, it is considered that because de-icing salts are used only infrequently and in the colder months, over short periods and with frequent higher flows in between in which to dilute and disperse ‘salty’ water, and when flora tends to have died back and fauna less active and dormant, that significant long term adverse impacts would be unlikely to occur. SuDS systems may also provide some dilution of salt, although they are not generally considered to reduce salinity and there is a risk that the ‘salty’ water could re-mobilise metals deposited in the sediments. Impacts would be greatest in the small ditchcourse that would receive the road drainage, but which is of limited biodiversity and socio-economic value. There is existing de-icing pressure on the watercourse, but there would be an increase in de-icant applied to treat the larger impermeable road area drained by this network for the Scheme. However, should the de-icant salts reach Eastcote Brook there would be potential for dispersal and dilution upstream of the River Blythe. As such, any impacts from this outfall would not be significant at the waterbody scale.

Morphological impacts to water bodies

5.2.17 The drainage design would ensure that peak discharge rates from the Scheme to the road outfalls were controlled and SuDS that discharged to a watercourse would accommodate the 1 in 100 year return period +20% for climate change, and so no impact to the flow regime is predicted.

5.2.18 There is the potential for adverse morphological impact relating to road outfalls through damage or loss of riparian, bankside and bed habitats and accumulation of sediment. To mitigate any such impacts, pre-fabricated headwalls would be used where possible. Outfalls would be micro-sited to ensure best locations which minimise bankside and bed damage and would be orientated to prevent sediment accumulation and hydromorphological impacts. The attenuation for road runoff has also been assessed in accordance with DMRB HD45/09 (HAWRAT assessment) to ensure that chronic sediment impact is accounted for. Any remaining impacts would be affecting an artificial ditch and there would be little potential for adverse impacts on the downstream Eastcote Brook and River Blythe (including the SSSI). The works would therefore be insignificant at the scale of the whole waterbody.

River Blythe from Patrick Bridge to River Tame

Road runoff including spillages

5.2.19 The Drainage Strategy Report indicates that most of road outfalls for the Scheme would drain into the catchment of this waterbody. This includes outfalls to Hollywell Brook, Shadow Brook and its tributary and several minor drainage ditches. The majority of these are existing outfalls, but there would also be new outfalls to drain the new main line link road, as described in the ES Chapter 14 Road Drainage and the Water Environment. The outfall to the tributary of Shadow Brook could release contaminants into the watercourse that flows through the SE unit of the Bickenhill Meadows SSSI.

5.2.20 To mitigate any adverse impacts on receiving waterbodies, the Drainage Strategy includes a range of treatment trains for these outfalls including SuDS (for example. filter drains, wetlands, swales) and conventional drainage systems (for example. sediment tanks). Full details are described in Chapter 14 Road Drainage and the Water Environment and Appendix 14.1 [**TR010027/APP/6.3**]. Penstocks and pump cut-off options have also been included to isolate chemical spillages should they occur, and to prevent them propagating into SuDS wetlands and further downstream. The suitability of the Drainage Strategy treatment has been assessed in line with guidance in DMRB HD45/09 (HAWRAT). Mitigation has been added where required to ensure that all outfalls pass the assessment of routine road runoff and accidental spillages. Water quality impacts that could affect ecological and physicochemical WFD parameters would therefore be negligible. However, it is important that the proprietary and SuDS components are well maintained for adequate functioning of the drainage system. An improvement in water quality is predicted for existing outfalls where there is no current treatment for road runoff provided.

5.2.21 As with the Blythe from Temple Balsall Brook to Patrick Bridge, there would be sporadic release of de-icant salts in winter with potential for impacts on ecological and physicochemical parameters. Impacts would be greatest in the small ditchcourses that are to receive the road drainage, but which are of limited biodiversity and socio-economic value. The outfalls to Shadow Brook and its tributary are of greater significance, but de-icant impact would be attenuated to some extent through the proposed treatment trains, and remaining discharges would be intermittent and would have little impact on long-term waterbody status. However, the application of de-icing salts should be regularly reviewed in terms of the frequency, rate and product used to minimise any local impacts. De-icant salts discharging to Hollywell Brook are thought to be the least impactful, due to the greater dilution and dispersal potential available in this watercourse. Overall, any impacts from de-icant salts would be temporary and localised, and so are not considered significant at the WFD waterbody scale, with the designated reach being over 1.5km downstream from any road outfall.

Morphological impacts to watercourses

5.2.22 There would be modification of existing outfalls and construction of new outfalls to waterbodies in order to implement the Drainage Strategy for the Scheme. 12 of the 15 proposed outfalls are located within the catchment of this WFD watercourse, with outfalls to Hollywell Brook, Shadow Brook and its tributary, and numerous minor drainage ditches (see Appendix 14.1) [**TR010027/APP/6.3**]. As was the case for the Blythe from Temple Balsall Brook to Patrick Bridge, there would be the potential for adverse morphological impact through damage or loss of riparian, bankside and bed habitats and accumulation of sediment. Again, these impacts would be minimised by pre-fabricating new outfall headwalls and micro-siting their locations to ensure minimal bankside and bed damage. A HD45/09 HAWRAT assessment has determined the suitability of the Drainage Strategy for treating sediment impacts, and further mitigation has been incorporated where necessary. The outfalls would generally discharge to vegetated headwater streams or artificial ditches. The exception is Hollywell

Brook which is a larger watercourse, but which has online ponds downstream of the outfalls offering considerable dilution and dispersal potential. Based on the above, any adverse impacts would be localised and no significant impacts are predicted at the waterbody scale that would cause non-compliance with WFD objectives.

5.2.23 The Scheme designs include realignment and regrading of four minor drainage ditches within the catchment of the Blythe from Patrick Bridge to the River Tame. These are artificial, ephemeral, vegetated drainage ditches with minimal socio-economic or biodiversity value, and are not considered functional watercourses for much of the year. However, the diversions would unavoidably mean temporary loss of the existing sections of channel including riparian, bank and bed habitats. Given the low value of these ditches, the adverse impact is considered insignificant at the waterbody scale in terms of WFD parameters and so is compliant with waterbody objectives. None of these realignments would impact the Bickenhill Meadows SSSI.

5.2.24 General impacts to watercourses related to watercourse and floodplain crossings are described in Annex C. For the Scheme as assessed here, there would be extensions of two culverts, one to Hollywell Brook and one to the small ditch that flows north beneath the A45 and into Pendigo Lake. Construction works over and within the channel would unavoidably cause direct loss of riparian, bank and bed habitats either side of the existing culverts, and cause indirect losses through shading effects. However, given that these would be extensions rather than whole new culverts, the construction impacts are considered to be only slight adverse and of local scale, and a naturalised bed would be included in the culvert to help minimise the impact.

5.2.25 Culverting also has the potential to cause impedance of flow upstream of the structure leading to sediment accumulation, and/or increased flow through the structure causing scour of the bed downstream and formation of a pool. The design of these culverts minimises changes in river alignment and length as much as possible and are designed to ensure no impact on fluvial flood risk as described in the ES Chapter 14 Road Drainage and the Water Environment. As such, culvert extensions would give only a localised, minor and insignificant impact to Hollywell Brook and a negligible impact to the watercourse beneath the A45. At the scale of the Blythe from Patrick Bridge to River Tame WFD waterbody, these changes would be insignificant and do not compromise WFD objectives.

5.2.26 Construction of the new road would cause loss of approximately 20m of the source area of Shadow Brook. At this point, the watercourse is an ephemeral and artificial agricultural drainage ditch that is of limited biodiversity and socio-economic value. In terms of the full waterbody length, the loss amounts to around 0.5%, and all surface water cut-off from the catchment due to construction of the new main line link road would be picked up in earthworks drainage ditches and returned to the channel downstream, hence reducing any impact on the hydrological regime of Shadow Brook. The impact on morphology is therefore considered insignificant at the WFD waterbody scale and would not cause non-compliance with WFD objectives.

5.2.27 Construction of the new road would cause loss of approximately one fifth of the surface water catchment draining to the tributary of Shadow Brook within the southeast unit of Bickenhill Meadows SSSI. Loss of the catchment area could adversely impact the flow regime of this watercourse, and potentially take away a source of water required for maintaining the sensitive grassland communities within the SSSI. To mitigate for this, all surface water flows cut off from the tributary of Shadow Brook by the new main line link road would be gathered by a collection drain and pumped back to a ditch at the Bickenhill Meadows SSSI, which connects to the tributary of Shadow Brook. This would ensure that the hydrological regime of this watercourse was maintained, and the objectives of the SSSI would not be compromised. Furthermore, there would be no change to the hydrological regime of the Blythe from Patrick Bridge to River Tame WFD waterbody.

Hatchford-Kingshurst Brook

Road runoff including spillages

5.2.28 The Drainage Strategy Report indicates that two road outfalls for the Scheme drain to two ditches within the catchment of this waterbody. As above, the Drainage Strategy has been assessed in accordance with DMRB HD45/09 (HAWRAT), with further mitigation being provided to ensure all outfalls pass the assessment for routine road runoff and chemical spillages. Assuming appropriate maintenance of the drainage networks, there would be negligible impacts to these low value ditches and given that the WFD designated waterbody is 5km downstream, the road drainage would not impact on WFD waterbody objectives.

5.2.29 There would be sporadic release of de-icant salts in winter to the receiving waterbodies with potential for impacts on ecological and physicochemical parameters. As with application of de-icant salts in the Blythe catchments, any impacts from de-icant salts would be temporary and localised, and so are not considered significant at the WFD waterbody scale and would not compromise its objectives.

Physical modification of water bodies

5.2.30 The drainage network leading to a new road outfall to a ditch close to Four Winds, and that connecting to the existing road outfall to the ditch upstream of the tributary of Low Brook, adjacent to Clock Lane, has been designed to moderate flows and mitigate against changes in the flow regime as described above. There would be the potential for adverse morphological impact through damage or loss of riparian, bankside and bed habitats and accumulation of sediment, and adverse biological or physicochemical impacts through runoff of sediment laden water or spillages as described above. Pre-fabricated headwalls would again be used where possible and outfalls would be micro-sited to minimise impacts. The attenuation for road runoff has also been assessed in accordance with DMRB HD45/09 to ensure that chronic sediment impact is accounted for. Furthermore, impacts would only affect artificial ditches with low biodiversity and socio-economic value. There would be little potential for adverse impacts to propagate to the downstream Low Brook and Hatchford-Kingshurst Brook. The works would be insignificant at the scale of the whole waterbody, and would not cause non-compliance with WFD objectives.

Tame Anker Mease - Secondary Combined Groundwater Body

5.2.31 All routine road runoff and chemical spillages for the Scheme are directed to surface watercourses. However, due to the small and ephemeral nature of many of the drainage ditches which would receive flows, there would be potential for contaminants to soak away to ground from these watercourses if untreated. Mitigation has been built into the Drainage Strategy to provide treatment for road drainage as described above and assessed through a HAWRAT analysis as described in DMRB HD45/09. Whilst designed with surface watercourses in mind, DMRB HD33/16 indicates that the use of grassed swales and constructed surface wetlands are equally compatible with soakaway scenarios as with surface watercourses. As such, the underlying waterbody would be protected from contaminants related to drainage and no significant adverse impacts to the WFD groundwater body are predicted.

5.2.32 The Scheme includes a new main line link road which is in cutting of up to 10m deep adjacent to Catherine-de-Barnes Lane. The adjacent Bickenhill Meadows SSSI is divided into two units which have previously been assumed to be partially dependent on groundwater flows. If the new main line link road disrupted flows to the SSSI, the Scheme would then potentially prevent the SSSI from obtaining a future 'favourable' status, which would depend on maintenance of wet soil conditions that sustain the sensitive grassland communities. To determine whether this would be a significant impact, an investigation has been undertaken into the hydrology of the SSSI sites, taking into account the surrounding geology and obtaining primary data through additional ground investigation and soil saturation monitoring (Appendix 14.2) [**TR010027/APP/6.3**]. This investigation has led to the production of conceptual models describing the hydrological behaviour of each SSSI unit and has indicated that neither site would be significantly impacted by disruption of groundwater flows from construction of the new main line link road. This is due to the cutting being constructed over areas of shallow Mercia Mudstone which has restricted permeability. Interception of surface water flows by the new main line link road are considered a more significant impact for the southeast SSSI unit and would require mitigation, and this is dealt with under the Blythe - Patrick Bridge to River Tame waterbody assessment above.

5.3 No prevention of improvement assessment

5.3.1 To fulfil the WFD objective of meeting Good Ecological Status or Good Ecological Potential (for modified water bodies) for water bodies not already meeting that target status, the Environment Agency will identify the mitigation (or really enhancement) measures needed to be implemented. Information about water body specific mitigation measures was requested from the Environment Agency but no details were provided. Instead, consideration has been given to the potential impact of the Proposed Development and the pressures and reasons for not achieving Good Status that can be viewed on the Environment Agency's Catchment Data Explorer Website (See Table 5.1). Note that there are no pressures and reasons for not achieving good status for the Tame Anker and Mease Secondary

Combined groundwater body, as all criteria are already at Good status, and so this waterbody is not assessed in this section

Table 5-1: Reasons for not achieving Good Status and Deterioration

Water Body	Classification element affected	Pressure Type	Activity	Appraisal
Blythe – Source to Cuttle Brook	Phosphate	Point source	Private sewage treatment (domestic general public); sewage discharge – continuous (water industry).	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There wold be no foul sewage discharged during operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); urbanisation (urban and transport).	No road runoff would be discharged to this watercourse.
	Macrophytes and Phytobenthos Combined	Point source	Private sewage treatment (domestic general public); sewage discharge – continuous (water industry)	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. No foul sewage would be discharged during operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); urbanisation (urban and transport).	No road runoff would be discharged to this watercourse.

Water Body	Classification element affected	Pressure Type	Activity	Appraisal
Blythe – Temple Balsall Brook to Patrick Bridge	Phosphate	Point source	Sewage discharge – continuous (water industry).	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There would be no foul sewage discharged from operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); septic tanks (domestic – general public)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.
	Macrophytes and Phytobenthos Combined	Point source	Sewage discharge – continuous (water industry)	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There would be no foul sewage discharged from operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); urbanisation (urban and transport).	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.

Water Body	Classification element affected	Pressure Type	Activity	Appraisal
Blythe –Patrick Bridge to River Tame	Phosphate	Point source	Sewage discharge – continuous (water industry).	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There would be no foul sewage discharged from operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); septic tanks (domestic – general public)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.
	Macrophytes and Phytobenthos Combined	Point source	Sewage discharge – continuous (water industry)	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There would be no foul sewage to be discharged from operation of the Scheme.
		Diffuse source	Livestock (agricultural and rural land management); poor nutrient management (agriculture and rural land management).	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.
	Hydrological Regime	Surface Water Abstraction	Water Industry	The headwaters of Shadow Brook (tributary of the Blythe) would be lost beneath the scheme footprint (0.5% of total waterbody), but it is an ephemeral drainage ditch at this point. Any surface water cut-off would be collected by earthworks drainage ditches and returned to the waterbody downstream. This would be insignificant to the hydrological regime on the WFD catchment scale. The tributary of Shadow Brook as it flows through Bickenhill Meadows SSSI would lose one fifth of the surface water catchment which would be cut-off by the new main line link road. All surface water cut-off would be collected and pumped back to the SSSI. This would be insignificant to the hydrological regime on the WFD catchment scale.

Water Body	Classification element affected	Pressure Type	Activity	Appraisal
Blythe –Patrick Bridge to River Tame	Phosphate	Diffuse source	Livestock (agricultural and rural land management); septic tanks (domestic – general public)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.
	Invertebrates	Physical Modification	Urbanisation (urban and transport)	There would be no physical modifications to the watercourse as a result of the Scheme with the exception of two road outfalls to be installed/modified on two minor upstream ditches. This is insignificant on the waterbody scale with the WFD designated watercourse being 5km downstream.
		Diffuse source	Urbanisation (urban and transport)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.
	Dissolved oxygen	Point source	Sewage discharge (intermittent)	Foul sewage from construction compounds would be collected and disposed of off-site as per the CEMP and OWMP. There would be no foul sewage discharged from operation of the Scheme.
		Diffuse source	Urbanisation (urban development)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy with no residual impacts on the receiving waterbodies.

5.3.2 With the available information about the pressures and reasons for not being at Good Ecological Status or Good Ecological Potential no potential noncompliance with the WFD objective 'failure to prevent improvement' is predicted.

5.4 Mitigation

Fine sediment runoff and chemical spillages

5.4.1 In order to avoid, minimise and reduce adverse effects where possible on the local surface water and groundwater receiving environment, both direct (for example. spillage straight into a watercourse) and indirect (for example. receiving pollution from an upstream tributary), a Construction Environmental Management Plan (CEMP) and Water Management Plan would be implemented by the contractor appointed. The OEMP and OWMP are included in [**TR010027/APP/6.11**]. The OEMP would be standard procedure for the Scheme and would be reviewed, revised and updated as the project progressed towards construction. This would ensure all potential impacts and effects would be managed as far as reasonably practicable, in keeping with best practice at that point in time. Please refer to Chapter 14 Road Drainage and the Water Environment for further details.

Control of routine road runoff and spillage risk

5.4.2 The Drainage Strategy Report describes the drainage designs for the Scheme. The strategy has been designed in accordance with HD33/16, ensuring no surcharge for a 1 in 1 year return period and no flooding in a 1 in 5 year return period. The network has been designed to include a 20% increase in rainfall intensity to account for the effects of climate change. Peak discharge rates would be controlled and SuDS that discharge to a watercourse would accommodate the 1 in 100 year return period +20%. Without this attenuation increased flows could result in bank erosion, increased sediment loading, greater flooding and increased pollution to the impacted watercourses. Specific treatment approaches have been incorporated for each road catchment to reflect the extent of flow attenuation and pollutant treatment required, as well as to reflect stakeholder concerns. For example, there is a need to avoid attracting birds that could pose a bird strike risk to aircraft close to Birmingham International Airport, and so ponds have been ruled out. Flow attenuation and water quality treatment measures are included variously in the form of filter drains, wetland/reedbed areas, proprietary sediment tank systems, vortex grit separators and swales. The treatment train specifications for each road catchment are summarised within the Drainage Strategy Report and Appendix 14.3 [Assessment of Routine Road Runoff and Accidental Spillage Risk (HAWRAT)] [**TR010027/APP/6.3**]. Mechanisms for isolating chemical spillages are also incorporated. Where a pump is used to convey road drainage to a SuDS system, there would be an option to stop the pump in the event of a pollution incident. For drainage networks that do not require a pump, penstocks are incorporated.

Culverts

5.4.3 The extension of the two culverts required by the Scheme has been designed in such a way as to minimise the potential adverse hydromorphological, water quality and biological impacts of the structure, while being large enough to convey flood flows. It is proposed that the base of each culvert would be sunk below the current bed level and backfilled with a suitable grade/type of substrate to ensure a naturalised bed is provided through the culvert structure. This would help to maintain channel / process continuum. Culverts have been sized appropriately to carry the watercourse without constriction or narrowing, and would be no smaller than the size of existing culverts to ensure that they do not accumulate sediment upstream due to afflux caused by too narrow a culvert.

Minor Ditch Realignment and Regrading

5.4.4 The minor drainage ditches that would be regraded or realigned are not considered functioning watercourses as they are largely dry with a low biodiversity value. However, any realignment would ensure conveyance of flow was unimpeded and would be sensitive to the aquatic ecology.

Bickenhill Meadows SSI SE Unit – Pumping Solution

5.4.5 A pumped mitigation solution has been incorporated into the design of the Scheme to mitigate for the loss of surface water catchment at the SE SSSI unit. The design consists of a collection drain on the western slope of the new main line link road cutting to intercept all surface water flows that would otherwise have drained towards the SSSI. The collection drain would discharge to a sealed collection sump, from where water would be pumped to an existing ditch adjacent to Shadowbrook Lane (SP 18544 81608), which would then flow along the northwest boundary of the SE SSSI unit. Water would either drain through to the upper sand, gravel and clay deposits in the upper layers of the substrata within the SSSI from this ditch, or be conveyed to its confluence with the tributary of Shadow Brook. This would ensure that all surface water lost to the new main line link road cutting was rerouted to the SSSI so that there would be no overall loss of water supplied to the site.

5.4.6 Please refer to Chapter 14 Road Drainage and the Water Environment of the Environmental Statement for further details.

5.5 Environmental enhancement opportunities

5.5.1 The outline Drainage Strategy Report proposes to use a combination of SuDS and conventional drainage systems to manage and treat surface water runoff. This includes the creation of three new wetland/reedbed areas and grassed swales at six of the outfalls. The wetland features would all provide biodiversity value in terms of the water environment, with opportunity for development of macrophyte, phytobenthos and invertebrate communities, while providing protection for downstream receiving waterbodies.

5.5.2 For the waterbodies that receive road drainage from the existing M42 and local road network and which would be used by the Scheme, the Drainage Strategy provides improvement over existing conditions by providing treatment for routine road runoff and accidental spillages where there is currently none. This would help reduce pressures on biological and physicochemical WFD parameters in the receiving waterbodies.

6. Conclusion and recommendations

6.1.1 The Preliminary WFD assessment indicates that, based on the current understanding of the Scheme, no significant adverse impacts to WFD relevant water bodies would occur. Therefore the Scheme is compliant with the WFD objectives for the Blythe – source to Cuttle Brook, Blythe – Temple Balsall Brook to Patrick Bridge, Blythe – Patrick Bridge to River Tame, Hatchford-Kingshurst Brook and the Tame Anker and Mease Secondary Combined (groundwater) water bodies, taking into account the mitigation measures identified. These include measures to be adopted during construction to manage all pollution risks, and which would be implemented by the Contractor using a Water Management Plan prepared as part of a Construction and Environmental Management Plan, and measures to treat surface water runoff and manage the risk of future routine road runoff and risk of accidental spillages as described in the Drainage Strategy Report for the Scheme. Finally, a number of permissions will be required from the Environment Agency prior to construction related to discharges of any ‘unclean’ runoff during construction, and for any activity within 8m of the bank of a main river (including Hollywell Brook and Shadow Brook downstream of the M42) or culvert on a main river.

Abbreviations

ASPT	Average Score Per Taxa
BGS	British Geological Society
BOD (ATU)	Biochemical oxygen demand (Allyl thiourea)
BMWP	Biological Monitoring Working Party
CEMP	Construction Environmental Management Plan
CIRIA	Construction Industry Research and Information Association
CIWEM	Chartered Institute of Water and Environmental Management
DEIDB	Doncaster East Internal Drainage Board
DSA	Doncaster Sheffield Airport
EQS	Environmental Quality Statement
EU	European Union
HAWRAT	Highways Agency's Water Risk Assessment Took
GEP	Good Ecological Potential
GES	Good Ecological Status
GPP	Guidance on Pollution Prevention
LLFA	Lead Local Flood Authority
IDB	Internal Drainage Board
PPG	Pollution Prevention Guidelines
PWS	Private Water Supplies
Qmax	Maximum discharge
NGR	National Grid Reference
NIRS	National Incident Reporting System
NNR	National Nature Reserves
NPPG	National Planning Policy Guidance
NPPF	National Planning Policy Framework

RMHI	River Hydraulic Index Score
RMNI	River Macrophyte Nutrient Index
SAC	Special Areas of Conservation
SBR	Sequencing Batch Reactor
SPA	Special Protection Areas
SSSI	Sites of Special Scientific Interest
SuDS	Sustainable Urban Drainage Systems
TDI	River Trophic Diatom Index
TSS	Total suspended solids
UK	United Kingdom
WFD	Water Framework Directive
WMP	Water Management Plan
WwTW	Wastewater Treatment Works
YWL	Yorkshire Water Limited

Annex A WFD Water Body Assessments Cycle 2 2016

Table A1 Surface Water Body Classification Details – Blythe – source to Cuttle Brook

RBMP Parameter	Blythe: Source to Cuttle Brook Cycle 2 2016 Classification
RBMP	Humber RBMP
Waterbody Name and ID	Blythe from source to Cuttle Brook (GB104028042400)
Water Body Type	Not designated artificial or heavily modified
Size (Area, Length)	Area 62.2 km^2, Length 22.9 km
Overall Ecological Status	**Poor**
Chemical Status	**Good**
Downstream Waterbody	Blythe from Temple Balsall Brook to Patrick Bridge
Biological Quality Elements	***Poor***
Fish	High
Macrophytes and Phytobenthos Combined	Poor
Invertebrates	Good
Physico-Chemical Parameters	***Moderate***
Acid Neutralising Capacity	High
Ammonia (phys-chem)	High
Dissolved Oxygen	Good
pH	High
Phosphate	Poor
Temperature	High
Hydromorphological Supporting Elements	***Supports Good***
Hydrological regime	Supports Good
Morphology	Supports Good
Priority Hazardous Substances	***Does not require assessment***

RBMP Parameter	Blythe: Source to Cuttle Brook Cycle 2 2016 Classification
Priority Substances	***Does not require assessment***

Table A2 Surface Water Body Classification Details – Blythe from Temple Balsall Brook to Patrick Bridge

RBMP Parameter	Blythe from Temple Balsall Brook to Patrick Bridge Cycle 2 2016 Classification
RBMP	Humber RBMP
Waterbody Name and ID	Blythe from Temple Balsall Brook to Patrick Bridge (GB104028042571)
Water Body Type	Not designated artificial or heavily modified
Size (Area, Length)	Area 3570.74 ha, Length 10.171 km
Overall Ecological Status	**Moderate**
Chemical Status	**Good**
Downstream Waterbody	Blythe from Patrick Bridge to River Tame
Biological Quality Elements	***Moderate***
Macrophytes and Phytobenthos Combined	Moderate
Fish	Good
Invertebrates	Good
Physico-Chemical Parameters	***Moderate***
Acid Neutralising Capacity	High
Ammonia (phys-chem)	Good
Biochemical Oxygen Demand	High
Dissolved Oxygen	Good
pH	High
Phosphate	Poor
Temperature	High
Hydromorphological Supporting Elements	***Supports Good***

RBMP Parameter	Blythe from Temple Balsall Brook to Patrick Bridge Cycle 2 2016 Classification
Hydrological regime	Supports Good
Morphology	Supports Good
Specific Pollutants	***High***
Triclosan	High
Manganese	High
Copper	High
Iron	High
Zinc	High
Priority Substances	***Good***
Lead and its compounds	Good
Nickel and its compounds	Good
Priority Hazardous Substances	***Good***
Benzo (b) and (k) fluoranthene	Good
Benzo (ghi) perelyene and indeno(123-cd) pyrene	Good
Benzo(a)pyrene	Good
Cadmium and Its Compounds	Good
Di(2-ethylhexyl)phthalate	Good
Mercury and Its Compounds	Good
Nonylphenol	Good

Table A3 Surface Water Body Classification Details – Blythe from Patrick Bridge to River Tame

RBMP Parameter	Blythe from Patrick Bridge to River Tame Cycle 2 2016 Classification
RBMP	Humber RBMP
Waterbody Name and ID	Blythe from Patrick Bridge to River Tame (GB104028042571)
Water Body Type	Not designated artificial or heavily modified
Size (Area, Length)	Area 3563.04 km^2, Length 20.5 km
Overall Ecological Status	**Poor**
Chemical Status	**Good**
Downstream Waterbody	River Tame
Biological Quality Elements	***Poor***
Macrophytes and Phytobenthos Combined	Poor
Invertebrates	Good
Fish	Good
Physico-Chemical Parameters	***Moderate***
Ammonia (phys-chem)	High
Dissolved Oxygen	High
pH	High
Phosphate	Poor
Temperature	High
Hydromorphological Supporting Elements	***Supports Good***
Hydrological regime	Does not support Good
Morphology	Supports Good
Specific Pollutants	***High***
Copper	High
Zinc	High
Priority Hazardous Substances	***Good***

RBMP Parameter	Blythe from Patrick Bridge to River Tame Cycle 2 2016 Classification
Nonylphenol	Good
Priority Substances	***Does not require assessment***

Table A4 Surface Water Body Classification Details – Hatchford-Kingshurt Brook from source to River Cole

RBMP Parameter	Hatchford-Kingshurst Brook from source to River Cole Cycle 2 2016 Classification
RBMP	Humber RBMP
Waterbody Name and ID	Hatchford-Kingshurst Brook from source to River Cole Cycle 2 2016 Classification (GB104028042490)
Water Body Type	heavily modified
Size (Area, Length)	Area 4497.7 ha, Length 2.3 km
Overall Ecological Status	**Moderate**
Chemical Status	**Good**
Downstream Waterbody	Cole from Hatchford-Kingshurt Brook to R Blythe
Biological Quality Elements	***Moderate***
Invertebrates	Moderate
Physico-Chemical Parameters	***Moderate***
Ammonia (phys-chem)	Moderate
Dissolved Oxygen	Poor
pH	High
Phosphate	Moderate
Temperature	High
Hydromorphological Supporting Elements	***Supports Good***
Hydrological regime	Support Good
Specific Pollutants	***High***
Triclosan	High

RBMP Parameter	Hatchford-Kingshurst Brook from source to River Cole Cycle 2 2016 Classification
Priority Hazardous Substances	***Good***
Nonylphenol	Good
Priority Substances	***Does not require assessment***

Annex B Water Quality Monitoring Results

Shadow Brook

			Watercourse	Shadow Brook					
			Site	Site M1		Site M1		Site M1	
			Type	Stream		Stream		Stream	
			Date	13/11/2017		28/02/2018		22/05/2018	
			Time	11:16:00		11:01:00		10:00:00	
			Report ID	17-18708		18-3098		18-7831	
			Conditions	Dry, overcast, not rained for over 24 hours		Overcast, light snow showers, following several days of freezing conditions		Following a week of fair weather and no rain.	
Analyte	**Units**	**Limits of Detection**	**Screening Value**						
Dissolved Oxygen	%				82		84		69
Dissolved Oxygen	mg/L				10		11.4		7.4
Temperature	°C				7.2		2.9		12.1
Conductivity at 20C	uS/cm	2			867		859		851
pH	pH Units	0.01			7.96		7.64		7.02
BOD	mg/l	1			4	<	1	<	1
COD	mg/l	7			53		8	<	7
Carbon, Organic, Dissolved as C :- {DOC}	mg/l	2			5	<	2		4
Carbon, Organic, Total (TOC)	mg/l	2			6		3	<	2
Alkalinity to pH 4.5 (as CaCO3)	mg/l	1			406		362		374
Total Hardness Dissolved (as CaCO3)	mg/l	1			442		404		450
Solids, Suspended at 105 C	mg/l	10			40	<	10		14
Ammoniacal Nitrogen as N	mg/l	0.03	0.6		0.05	<	0.03		0.05
Nitrite as N	mg/l	0.02	0.5	<	0.02	<	0.02	<	0.02
Nitrogen : Total Inorganic	mg/l	0.05			3.47		3.92		1.96
Nitrate as N	mg/l	0.2	50		15.1		17.4		8.5
Orthophosphate, reactive as P	mg/l	0.03	0.066		0.08	<	0.03		0.04
Total Phosphorus	mg/l	0.0007			0.1533		0.079		0.1191
Chromium III, Total Dissolved	mg/l	0.002		<	0.002	<	0.002	<	0.002
Total Cyanide	mg/l	0.01	0.001	<	0.01	<	0.01		0.04
Silica	mg/l	0.01			16		22		29
Free Residual Chlorine	mg/l	0.02		<	0.02	<	0.03		0.1
Arsenic Dissolved	ug/l	0.9	10		2.2		7.9		10.2
Arsenic	ug/l	0.9	10		6.4		-		5.6
Lead, Dissolved	ug/l	<0.4	1.2	<	0.4	<	0.4	<	0.4
Lead	ug/l	<0.4	1.2	<	0.4	<	0.4	<	0.4
Aluminium, Dissolved	ug/l	1.5	200	<	1.5	<	1.5	<	1.5
Barium, Dissiolved	ug/l	1.8			229.5		241.7		254.7
Boron, Dissolved	ug/l	12			65		39		61
Cadmium, Dissolved	ug/l	0.03	0.25	<	0.03	<	0.03	<	0.03
Calcium, Dissolved	mg/l	0.2			72.3		62.9		67.3
Chromium, Dissolved	ug/l	0.5	3.4	<	0.7		0.9		1.4
Copper, Dissolved	ug/l	3	1	<	3	<	3	<	3
Magnesium, Dissolved	mg/l	0.1			62.3		58.7		67.1
Nickel, Dissolved	ug/l	0.2	4		0.8	<	0.2	<	0.2
Potassium, Dissolved	mg/l	0.1			2.2		2.3		1.4
Selenium, Dissolved	ug/l	1.2		<	1.2	<	1.2	<	1.2
Sodium, Dissolved	mg/l	0.1			27.8		24.7		22.1
Vanadium, Dissolved	ug/l	0.6			3.7		5.1		5.6
Zinc, Dissolved	ug/l	1.5	10.9	<	1.5		1.8		2.6
Aluminium	ug/l	10			654.1		227.2		579.4
Barium	ug/l	1.8			229.7		244.4		271.6
Boron	ug/l	12			67		33		64
Cadmium	ug/l	0.03	0.25	<	0.03	<	0.03	<	0.03
Chromium	ug/l	0.2	3.4		2.2		2.1		1.5
Copper	ug/l	3	1 (bioavailable)		4	<	3	<	3
Nickel	ug/l	0.2	4		1.9		0.5		180.3
Zinc	ug/l	1.5	10.9		7.5		3.4		8.2
Iron, Dissolved	ug/l	4.7	1000		11.2		11.3		13.6
Manganese, Dissolved	ug/l	1.5	123		12.6		4		21.9
Iron	ug/l	4.7	1000		709.1		175.6		550.5
Manganese	ug/l	1.5	123 (bioavailable)		45.5		5.8		35.8
Selenium	ug/l	1.2		<	1.2	<	1.2	<	1.2
Vanadium	ug/l	0.6			5.3		6.4		6.8
Sulphate as SO4	mg/l	0.5	250		60.3		43.8		46.2
Mercury, Dissolved	ug/l	0.5	0.07	<	0.5	<	0.5	<	0.5
Mercury	ug/l	0.5	0.07	<	0.5	<	0.5	<	0.5
Aliphatics >C5-C6	mg/l	0.2		<	10	<	10	<	10
>C6-C8	ug/l	10		<	10	<	10	<	10
>C8-C10	ug/l	10		<	10	<	10	<	10
>C10-C12	ug/l	5		<	5	<	5	<	5
>C12-C16	ug/l	10		<	10	<	10	<	10
>C16-C21	ug/l	10		<	10	<	10	<	10
>C21-C35	ug/l	10		<	10	<	10	<	10
Total Aliphatics C5-C35	ug/l	10		<	10	<	10	<	10
Aromatics >C5-EC7	ug/l	10		<	10	<	10	<	10
>EC7-EC8	ug/l	10		<	10	<	10	<	10
>EC8-EC10	ug/l	10		<	10	<	10	<	10
>EC10-EC12	ug/l	5		<	5	<	5	<	5
>EC12-EC16	ug/l	10		<	10	<	10	<	10
>EC16-EC21	ug/l	10		<	10	<	10	<	10
>EC21-EC35	ug/l	10		<	10	<	10	<	10
Total aromatics C5-35	ug/l	10		<	10	<	10	<	10
Total aliphatics and aromatics(C5-35)	ug/l	10		<	10	<	10	<	10
Naphthalene	ug/l	0.1	2	<	0.1	<	0.1	<	0.1
Acenaphthylene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Phenanthrene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Anthracene	ug/l	0.01	0.1	<	0.01	<	0.01	<	0.01
Fluoranthene	ug/l	0.01	0.0063	<	0.01	<	0.01	<	0.01
Pyrene	ug/l	0.01	4	<	0.01	<	0.01	<	0.01
Benzo(a)anthracene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Chrysene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Benzo(bk)fluoranthene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Benzo(a)pyrene	ug/l	0.01	0.00017	<	0.01	<	0.01	<	0.01
Indeno(123cd)pyrene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Dibenzo(ah)anthracene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Benzo(ghi)perylene	ug/l	0.01		<	0.01	<	0.01	<	0.01
PAH 16 Total	ug/l	0.1		<	0.1	<	0.1	<	0.1
Benzo(b)fluoranthene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Benzo(k)fluoranthene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Acenapthene	ug/l	0.01		<	0.01	<	0.01	<	0.01
Fluorene	ug/l	0.01		<	0.01	<	0.01	<	0.01
MTBE :- {Methyl tert-butyl ether}	ug/l	5	5100	<	5	<	5	<	5
Benzene	ug/l	5		<	5	<	5	<	5
Toluene	ug/l	5		<	5	<	5	<	5
Ethybenzene	ug/l	5		<	5	<	5	<	5
m/p-Xylene	ug/l	5		<	5	<	5	<	5
o-Xylene	ug/l	5		<	5	<	5	<	5
Resorcinol	mg/l	0.01		<	0.01	<	0.01	<	0.01
Catechol	mg/l	0.01		<	0.01	<	0.01	<	0.01
Phenol	mg/l	0.01		<	0.01	<	0.01	<	0.01
m/p-cresol	mg/l	0.02		<	0.02	<	0.02	<	0.02
o-cresol	mg/l	0.01		<	0.01	<	0.01	<	0.01
Total cresols	mg/l	0.03		<	0.03	<	0.03	<	0.03
Xylenols	mg/l	0.06		<	0.06	<	0.06	<	0.06
1-naphthol	mg/l	0.01		<	0.01	<	0.01	<	0.01
2,3,5-trimethyl phenol	mg/l	0.01		<	0.01	<	0.01	<	0.01
2-isopropylphenol	mg/l	0.01		<	0.01	<	0.01	<	0.01
Total Speciated Phenols HPLC	mg/l	0.1		<	0.1	<	0.1	<	0.1
Chromium Hexavalent	mg/l	0.002	3.4	<	0.002	<	0.002	<	0.002

Hollywell Brook

			Watercourse	Hollywell Brook				
			Site	Site M2		Site M2		Site M2
			Type	Stream		Stream		Stream
			Date	13/11/2017		28/02/2018		22/05/2018
			Time	12:40:00		15:14:00		13:37:00
			Report ID	17-18708		18-3098		18-7831
			Conditions	Dry, overcast, not rained for over 24 hours		Overcast, light snow showers, following several days of freezing conditions		Following a week of fair weather and no rain.
Analyte	**Units**	**Limits of Detection**	**Screening Value**					
Dissolved Oxygen	%			69		-		63
Dissolved Oxygen	mg/L			8.4		-		6.2
Temperature	°C			7		3.3		16
Conductivity at 20C	uS/cm	2		714		1708		1131
pH	pH Units	0.01		7.41		7.29		6.52
BOD	mg/l	1		2		5		1
COD	mg/l	7		41		35		13
Carbon, Organic, Dissolved as C :- {DOC}	mg/l	2		6		6		8
Carbon, Organic, Total (TOC)	mg/l	2		6		6		7
Alkalinity to pH 4.5 (as CaCO3)	mg/l	1		160		176		166
Total Hardness Dissolved (as CaCO3)	mg/l	1		245		330		321
Solids, Suspended at 105 C	mg/l	10		22		25	<	10
Ammoniacal Nitrogen as N	mg/l	0.03	0.6	0.12		0.35		0.14
Nitrite as N	mg/l	0.02	0.5	0.08		0.08		0.03
Nitrogen : Total Inorganic	mg/l	0.05		1.44		3.76		4.63
Nitrate as N	mg/l	0.2	50	5.7		15		19.8
Orthophosphate, reactive as P	mg/l	0.03	0.066	0.12	<	0.03		0.06
Total Phosphorus	mg/l	0.0007		0.1956		0.1065		0.1354
Chromium III, Total Dissolved	mg/l	0.002		0.002	<	0.002	<	0.002
Total Cyanide	mg/l	0.01	0.001	0.01	<	0.01		0.02
Silica	mg/l	0.01		8.1		9.5		8.8
Free Residual Chlorine	mg/l	0.02		0.04	<	0.02		0.1
Arsenic Dissolved	ug/l	0.9	10	1.2		5.5		5.3
Arsenic	ug/l	0.9	10	2.6		-		1
Lead, Dissolved	ug/l	<0.4	1.2	0.4	<	0.4	<	0.4
Lead	ug/l	<0.4	1.2	0.4	<	0.4	<	0.4
Aluminium, Dissolved	ug/l	1.5	200	2.5	<	1.5		10.7
Barium, Dissiolved	ug/l	1.8		76.7		111.2		92.5
Boron, Dissolved	ug/l	12		67		55		81
Cadmium, Dissolved	ug/l	0.03	0.25	0.03	<	0.03	<	0.03
Calcium, Dissolved	mg/l	0.2		57.8		78.2		75
Chromium, Dissolved	ug/l	0.5	3.4	0.9	<	0.2	<	0.2
Copper, Dissolved	ug/l	3	1	3	<	3	<	3
Magnesium, Dissolved	mg/l	0.1		24		32.1		31.8
Nickel, Dissolved	ug/l	0.2	4	1.5		1.5		1
Potassium, Dissolved	mg/l	0.1		2.6		3.5		4.2
Selenium, Dissolved	ug/l	1.2		1.2	<	1.2	<	1.2
Sodium, Dissolved	mg/l	0.1		49.5		202.9		122
Vanadium, Dissolved	ug/l	0.6		3.9		2.3		3.7
Zinc, Dissolved	ug/l	1.5	10.9	8.7		10.9		7.1
Aluminium	ug/l	10		289.5		486.6		193.6
Barium	ug/l	1.8		79.6		116.4		97.2
Boron	ug/l	12		67		48		77
Cadmium	ug/l	0.03	0.25	0.03	<	0.03	<	0.03
Chromium	ug/l	0.2	3.4	1.4		1.5		1.3
Copper	ug/l	3	1 (bioavailable)	3		5		3
Nickel	ug/l	0.2	4	1.2		1.5		1
Zinc	ug/l	1.5	10.9	16.9		29.8		15.9
Iron, Dissolved	ug/l	4.7	1000	13.3		13.8		16.2
Manganese, Dissolved	ug/l	1.5	123	13.6		23.1		42
Iron	ug/l	4.7	1000	305.5		600		233.7
Manganese	ug/l	1.5	123 (bioavailable)	23.4		43.8		54.3
Selenium	ug/l	1.2		1.2	<	1.2	<	1.2
Vanadium	ug/l	0.6		3.9		3.5		3.2
Sulphate as SO4	mg/l	0.5	250	88.4		113.5		96.6
Mercury, Dissolved	ug/l	0.5	0.07	0.5	<	0.5	<	0.5
Mercury	ug/l	0.5	0.07	0.5	<	0.5	<	0.5
Aliphatics >C5-C6	mg/l	0.2		10	<	10	<	10
>C6-C8	ug/l	10		10	<	10	<	10
>C8-C10	ug/l	10		10	<	10	<	10
>C10-C12	ug/l	5		5	<	5	<	5
>C12-C16	ug/l	10		10	<	10	<	10
>C16-C21	ug/l	10		10	<	10	<	10
>C21-C35	ug/l	10		10	<	10	<	10
Total Aliphatics C5-C35	ug/l	10		10	<	10	<	10
Aromatics >C5-EC7	ug/l	10		10	<	10	<	10
>EC7-EC8	ug/l	10		10	<	10	<	10
>EC8-EC10	ug/l	10		10	<	10	<	10
>EC10-EC12	ug/l	5		5	<	5	<	5
>EC12-EC16	ug/l	10		10	<	10	<	10
>EC16-EC21	ug/l	10		10	<	10	<	10
>EC21-EC35	ug/l	10		10	<	10	<	10
Total aromatics C5-35	ug/l	10		10	<	10	<	10
Total aliphatics and aromatics(C5-35)	ug/l	10		10	<	10	<	10
Naphthalene	ug/l	0.1	2	0.1	<	0.1	<	0.1
Acenaphthylene	ug/l	0.01		0.01	<	0.01	<	0.01
Phenanthrene	ug/l	0.01		0.01	<	0.01	<	0.01
Anthracene	ug/l	0.01	0.1	0.01	<	0.01	<	0.01
Fluoranthene	ug/l	0.01	0.0063	0.02	<	0.01	<	0.01
Pyrene	ug/l	0.01	4	0.02	<	0.01	<	0.01
Benzo(a)anthracene	ug/l	0.01		0.01	<	0.01	<	0.01
Chrysene	ug/l	0.01		0.01	<	0.01	<	0.01
Benzo(bk)fluoranthene	ug/l	0.01		0.03	<	0.01	<	0.01
Benzo(a)pyrene	ug/l	0.01	0.00017	0.01	<	0.01	<	0.01
Indeno(123cd)pyrene	ug/l	0.01		0.01	<	0.01	<	0.01
Dibenzo(ah)anthracene	ug/l	0.01		0.01	<	0.01	<	0.01
Benzo(ghi)perylene	ug/l	0.01		0.01	<	0.01	<	0.01
PAH 16 Total	ug/l	0.1		0.1	<	0.1	<	0.1
Benzo(b)fluoranthene	ug/l	0.01		0.02	<	0.01	<	0.01
Benzo(k)fluoranthene	ug/l	0.01		0.01	<	0.01	<	0.01
Acenapthene	ug/l	0.01		0.01	<	0.01	<	0.01
Fluorene	ug/l	0.01		0.01	<	0.01	<	0.01
MTBE :- {Methyl tert-butyl ether}	ug/l	5	5100	5	<	5	<	5
Benzene	ug/l	5		5	<	5	<	5
Toluene	ug/l	5		5	<	5	<	5
Ethybenzene	ug/l	5		5	<	5	<	5
m/p-Xylene	ug/l	5		5	<	5	<	5
o-Xylene	ug/l	5		5	<	5	<	5
Resorcinol	mg/l	0.01		0.01	<	0.01	<	0.01
Catechol	mg/l	0.01		0.01	<	0.01	<	0.01
Phenol	mg/l	0.01		0.01	<	0.01	<	0.01
m/p-cresol	mg/l	0.02		0.02	<	0.02	<	0.02
o-cresol	mg/l	0.01		0.01	<	0.01	<	0.01
Total cresols	mg/l	0.03		0.03	<	0.03	<	0.03
Xylenols	mg/l	0.06		0.06	<	0.06	<	0.06
1-naphthol	mg/l	0.01		0.01	<	0.01	<	0.01
2,3,5-trimethyl phenol	mg/l	0.01		0.01	<	0.01	<	0.01
2-isopropylphenol	mg/l	0.01		0.01	<	0.01	<	0.01
Total Speciated Phenols HPLC	mg/l	0.1		0.1	<	0.1	<	0.1
Chromium Hexavalent	mg/l	0.002	3.4	0.002	<	0.002	<	0.002

Tributary of Shadow Brook

			Watercourse	Tributary of Shadow Brook			
			Site		Site M3		Site M3
			Type		Stream		Stream
			Date		28/02/2018		22/05/2018
			Time		12:07:00		09:30:00
			Report ID		18-3098		18-7831
			Conditions		Overcast, light snow showers, following several days of freezing conditions		Following a week of fair weather and no rain.
Analyte	***Units***	***Limits of Detection***	***Screening Value***				
Dissolved Oxygen	%				-		DRY
Dissolved Oxygen	mg/L				-		DRY
Temperature	°C				0.7		DRY
Conductivity at 20C	uS/cm	2			574		DRY
pH	pH Units	0.01			6.67		DRY
BOD	mg/l	1			2		DRY
COD	mg/l	7			36		DRY
Carbon, Organic, Dissolved as C :- {DOC}	mg/l	2			11		DRY
Carbon, Organic, Total (TOC)	mg/l	2			11		DRY
Alkalinity to pH 4.5 (as CaCO3)	mg/l	1			110		DRY
Total Hardness Dissolved (as CaCO3)	mg/l	1			193		DRY
Solids, Suspended at 105 C	mg/l	10		<	10		DRY
Ammoniacal Nitrogen as N	mg/l	0.03	0.6		0.04		DRY
Nitrite as N	mg/l	0.02	0.5	<	0.02		DRY
Nitrogen : Total Inorganic	mg/l	0.05			8.77		DRY
Nitrate as N	mg/l	0.2	50		38.7		DRY
Orthophosphate, reactive as P	mg/l	0.03	0.066	<	0.03		DRY
Total Phosphorus	mg/l	0.0007			0.0584		DRY
Chromium III, Total Dissolved	mg/l	0.002			0.002		DRY
Total Cyanide	mg/l	0.01	0.001	<	0.01		DRY
Silica	mg/l	0.01			8		DRY
Free Residual Chlorine	mg/l	0.02		<	0.04		DRY
Arsenic Dissolved	ug/l	0.9	10		1.8		DRY
Arsenic	ug/l	0.9	10				DRY
Lead, Dissolved	ug/l	<0.4	1.2	<	0.4		DRY
Lead	ug/l	<0.4	1.2	<	0.4		DRY
Aluminium, Dissolved	ug/l	1.5	200	<	16.7		DRY
Barium, Dissiolved	ug/l	1.8			40.5		DRY
Boron, Dissolved	ug/l	12			27		DRY
Cadmium, Dissolved	ug/l	0.03	0.25	<	0.03		DRY
Calcium, Dissolved	mg/l	0.2			53.9		DRY
Chromium, Dissolved	ug/l	0.5	3.4	<	0.4		DRY
Copper, Dissolved	ug/l	3	1		4		DRY
Magnesium, Dissolved	mg/l	0.1			13.9		DRY
Nickel, Dissolved	ug/l	0.2	4		1.9		DRY
Potassium, Dissolved	mg/l	0.1			3.2		DRY
Selenium, Dissolved	ug/l	1.2		<	1.2		DRY
Sodium, Dissolved	mg/l	0.1			31.2		DRY
Vanadium, Dissolved	ug/l	0.6			<0.6		DRY
Zinc, Dissolved	ug/l	1.5	10.9		10.7		DRY
Aluminium	ug/l	10			323.4		DRY
Barium	ug/l	1.8			41.2		DRY
Boron	ug/l	12			22		DRY
Cadmium	ug/l	0.03	0.25	<	0.03		DRY
Chromium	ug/l	0.2	3.4		1		DRY
Copper	ug/l	3	1 (bioavailable)		4		DRY
Nickel	ug/l	0.2	4		2.9		DRY
Zinc	ug/l	1.5	10.9		13.3		DRY
Iron, Dissolved	ug/l	4.7	1000		47.5		DRY
Manganese, Dissolved	ug/l	1.5	123		5.7		DRY
Iron	ug/l	4.7	1000		346.5		DRY
Manganese	ug/l	1.5	123 (bioavailable)		17.9		DRY
Selenium	ug/l	1.2		<	1.2		DRY
Vanadium	ug/l	0.6			<0.6		DRY
Sulphate as SO4	mg/l	0.5	250		50.8		DRY
Mercury, Dissolved	ug/l	0.5	0.07	<	0.5		DRY
Mercury	ug/l	0.5	0.07	<	0.5		DRY
Aliphatics >C5-C6	mg/l	0.2		<	10		DRY
>C6-C8	ug/l	10		<	10		DRY
>C8-C10	ug/l	10		<	10		DRY
>C10-C12	ug/l	5		<	5		DRY
>C12-C16	ug/l	10		<	10		DRY
>C16-C21	ug/l	10		<	10		DRY
>C21-C35	ug/l	10		<	10		DRY
Total Aliphatics C5-C35	ug/l	10		<	10		DRY
Aromatics >C5-EC7	ug/l	10		<	10		DRY
>EC7-EC8	ug/l	10		<	10		DRY
>EC8-EC10	ug/l	10		<	10		DRY
>EC10-EC12	ug/l	5		<	5		DRY
>EC12-EC16	ug/l	10		<	10		DRY
>EC16-EC21	ug/l	10		<	10		DRY
>EC21-EC35	ug/l	10		<	10		DRY
Total aromatics C5-35	ug/l	10		<	10		DRY
Total aliphatics and aromatics(C5-35)	ug/l	10		<	10		DRY
Naphthalene	ug/l	0.1	2	<	0.1		DRY
Acenaphthylene	ug/l	0.01		<	0.01		DRY
Phenanthrene	ug/l	0.01		<	0.01		DRY
Anthracene	ug/l	0.01	0.1	<	0.01		DRY
Fluoranthene	ug/l	0.01	0.0063	<	0.01		DRY
Pyrene	ug/l	0.01	4	<	0.01		DRY
Benzo(a)anthracene	ug/l	0.01		<	0.01		DRY
Chrysene	ug/l	0.01		<	0.01		DRY
Benzo(bk)fluoranthene	ug/l	0.01		<	0.01		DRY
Benzo(a)pyrene	ug/l	0.01	0.00017	<	0.01		DRY
Indeno(123cd)pyrene	ug/l	0.01		<	0.01		DRY
Dibenzo(ah)anthracene	ug/l	0.01		<	0.01		DRY
Benzo(ghi)perylene	ug/l	0.01		<	0.01		DRY
PAH 16 Total	ug/l	0.1		<	0.1		DRY
Benzo(b)fluoranthene	ug/l	0.01		<	0.01		DRY
Benzo(k)fluoranthene	ug/l	0.01		<	0.01		DRY
Acenapthene	ug/l	0.01		<	0.01		DRY
Fluorene	ug/l	0.01		<	0.01		DRY
MTBE :- {Methyl tert-butyl ether}	ug/l	5	5100	<	5		DRY
Benzene	ug/l	5		<	5		DRY
Toluene	ug/l	5		<	5		DRY
Ethybenzene	ug/l	5		<	5		DRY
m/p-Xylene	ug/l	5		<	5		DRY
o-Xylene	ug/l	5		<	5		DRY
Resorcinol	mg/l	0.01		<	0.01		DRY
Catechol	mg/l	0.01		<	0.01		DRY
Phenol	mg/l	0.01		<	0.01		DRY
m/p-cresol	mg/l	0.02		<	0.02		DRY
o-cresol	mg/l	0.01		<	0.01		DRY
Total cresols	mg/l	0.03		<	0.03		DRY
Xylenols	mg/l	0.06		<	0.06		DRY
1-naphthol	mg/l	0.01		<	0.01		DRY
2,3,5-trimethyl phenol	mg/l	0.01		<	0.01		DRY
2-isopropylphenol	mg/l	0.01		<	0.01		DRY
Total Speciated Phenols HPLC	mg/l	0.1		<	0.1		DRY
Chromium Hexavalent	mg/l	0.002	3.4	<	0.002		DRY

Tributary of Low Brook

			Watercourse	Tributary of Low Brook				
			Site	Site M4		Site M4		
			Type	Stream		Stream		
			Date	28/02/2018		22/05/2018		
			Time	13:40:00		12:15:00		
			Report ID	18-3098		18-7831		
			Conditions	Overcast, light snow showers, following several days of freezing conditions		Following a week of fair weather and no rain.		
Analyte	**Units**	**Limits of Detection**	**Screening Value**					**Screening Source**
Dissolved Oxygen	%				-		88	
Dissolved Oxygen	mg/L				-		9.3	
Temperature	°C				1.1		12.7	
Conductivity at 20C	uS/cm	2			716		792	
pH	pH Units	0.01			8.12		7.47	
BOD	mg/l	1		<	1	<	1	
COD	mg/l	7			12	<	7	
Carbon, Organic, Dissolved as C :- {DOC}	mg/l	2			5		4	
Carbon, Organic, Total (TOC)	mg/l	2			5		3	
Alkalinity to pH 4.5 (as CaCO3)	mg/l	1			382		372	
Total Hardness Dissolved (as CaCO3)	mg/l	1			381		436	
Solids, Suspended at 105 C	mg/l	10		<	10		10	
Ammoniacal Nitrogen as N	mg/l	0.03	0.6		0.05		0.06	WFD Eng/Wales 2015
Nitrite as N	mg/l	0.02	0.5		0.03		0.09	
Nitrogen : Total Inorganic	mg/l	0.05			5.28		4.7	
Nitrate as N	mg/l	0.2	50		23.1		20.4	
Orthophosphate, reactive as P	mg/l	0.03	0.066	<	0.03		0.09	
Total Phosphorus	mg/l	0.0007			0.0939		0.1514	
Chromium III, Total Dissolved	mg/l	0.002		<	0.002	<	0.002	
Total Cyanide	mg/l	0.01	0.001	<	0.01		0.02	WFD Eng/Wales 2015
Silica	mg/l	0.01			17.9		23.7	
Free Residual Chlorine	mg/l	0.02		<	0.03	<	0.02	
Arsenic Dissolved	ug/l	0.9	10		3.4		3.6	WFD Eng/Wales 2015
Arsenic	ug/l	0.9	10		-		3.4	WFD Eng/Wales 2015
Lead, Dissolved	ug/l	<0.4	1.2	<	0.4	<	0.4	WFD Eng/Wales 2015
Lead	ug/l	<0.4	1.2	<	0.4	<	0.4	WFD Eng/Wales 2015
Aluminium, Dissolved	ug/l	1.5	200	<	1.5	<	1.5	WFD Eng/Wales 2015
Barium, Dissiolved	ug/l	1.8			118.9		124.6	
Boron, Dissolved	ug/l	12			119		179	
Cadmium, Dissolved	ug/l	0.03	0.25	<	0.03	<	0.03	
Calcium, Dissolved	mg/l	0.2			73.1		83.5	
Chromium, Dissolved	ug/l	0.5	3.4	<	0.4	<	0.2	
Copper, Dissolved	ug/l	3	1	<	3	<	3	WFD Eng/Wales 2015
Magnesium, Dissolved	mg/l	0.1			47.1		54	
Nickel, Dissolved	ug/l	0.2	4	<	0.2	<	0.2	WFD Eng/Wales 2015
Potassium, Dissolved	mg/l	0.1			2.3		2.6	
Selenium, Dissolved	ug/l	1.2		<	1.2	<	1.2	
Sodium, Dissolved	mg/l	0.1			13.6		15.6	
Vanadium, Dissolved	ug/l	0.6		<	0.6		2	
Zinc, Dissolved	ug/l	1.5	10.9	<	1.5		1.8	WFD Eng/Wales 2015
Aluminium	ug/l	10			231.2		230.7	
Barium	ug/l	1.8			117.3		125.5	
Boron	ug/l	12			117		172	
Cadmium	ug/l	0.03	0.25	<	0.03	<	0.03	
Chromium	ug/l	0.2	3.4		0.4		0.9	
Copper	ug/l	3	1 (bioavailable)	<	3	<	3	WFD Eng/Wales 2015
Nickel	ug/l	0.2	4	<	0.2	<	0.2	WFD Eng/Wales 2015
Zinc	ug/l	1.5	10.9		2.3		4.4	WFD Eng/Wales 2015
Iron, Dissolved	ug/l	4.7	1000		9.6		5.4	WS Regs 2016 (Eng/Wal)
Manganese, Dissolved	ug/l	1.5	123		10.2		17.4	WS Regs 2016 (Eng/Wal)
Iron	ug/l	4.7	1000		115.9		229.5	WS Regs 2016 (Eng/Wal)
Manganese	ug/l	1.5	123 (bioavailable)		12.1		22.9	WS Regs 2016 (Eng/Wal)
Selenium	ug/l	1.2		<	1.2	<	1.2	
Vanadium	ug/l	0.6		<	0.6		1.5	
Sulphate as SO4	mg/l	0.5	250		56.9		64.3	WFD Eng/Wales 2015
Mercury, Dissolved	ug/l	0.5	0.07	<	0.5	<	0.5	WFD Eng/Wales 2015
Mercury	ug/l	0.5	0.07	<	0.5	<	0.5	WFD Eng/Wales 2015
Aliphatics >C5-C6	mg/l	0.2		<	10	<	10	
>C6-C8	ug/l	10		<	10	<	10	
>C8-C10	ug/l	10		<	10	<	10	
>C10-C12	ug/l	5		<	5	<	5	
>C12-C16	ug/l	10		<	10	<	10	
>C16-C21	ug/l	10		<	10	<	10	
>C21-C35	ug/l	10		<	10	<	10	
Total Aliphatics C5-C35	ug/l	10		<	10	<	10	
Aromatics >C5-EC7	ug/l	10		<	10	<	10	
>EC7-EC8	ug/l	10		<	10	<	10	
>EC8-EC10	ug/l	10		<	10	<	10	
>EC10-EC12	ug/l	5		<	5	<	5	
>EC12-EC16	ug/l	10		<	10	<	10	
>EC16-EC21	ug/l	10		<	10	<	10	
>EC21-EC35	ug/l	10		<	10	<	10	
Total aromatics C5-35	ug/l	10		<	10	<	10	
Total aliphatics and aromatics(C5-35)	ug/l	10		<	10	<	10	
Naphthalene	ug/l	0.1	2	<	0.1	<	0.1	WFD Eng/Wales 2015
Acenaphthylene	ug/l	0.01		<	0.01	<	0.01	
Phenanthrene	ug/l	0.01		<	0.01	<	0.01	
Anthracene	ug/l	0.01	0.1	<	0.01	<	0.01	WFD Eng/Wales 2015
Fluoranthene	ug/l	0.01	0.0063	<	0.01	<	0.01	WFD Eng/Wales 2015
Pyrene	ug/l	0.01	4	<	0.01	<	0.01	
Benzo(a)anthracene	ug/l	0.01		<	0.01	<	0.01	
Chrysene	ug/l	0.01		<	0.01	<	0.01	
Benzo(bk)fluoranthene	ug/l	0.01		<	0.01	<	0.01	
Benzo(a)pyrene	ug/l	0.01	0.00017	<	0.01	<	0.01	WFD Eng/Wales 2015
Indeno(123cd)pyrene	ug/l	0.01		<	0.01	<	0.01	
Dibenzo(ah)anthracene	ug/l	0.01		<	0.01	<	0.01	
Benzo(ghi)perylene	ug/l	0.01		<	0.01	<	0.01	
PAH 16 Total	ug/l	0.1		<	0.1	<	0.1	
Benzo(b)fluoranthene	ug/l	0.01		<	0.01	<	0.01	
Benzo(k)fluoranthene	ug/l	0.01		<	0.01	<	0.01	
Acenapthene	ug/l	0.01		<	0.01	<	0.01	
Fluorene	ug/l	0.01		<	0.01	<	0.01	
MTBE :- {Methyl tert-butyl ether}	ug/l	5	5100	<	5	<	5	PNEC (EU REACH) - Freshwater
Benzene	ug/l	5		<	5	<	5	
Toluene	ug/l	5		<	5	<	5	
Ethybenzene	ug/l	5		<	5	<	5	
m/p-Xylene	ug/l	5		<	5	<	5	
o-Xylene	ug/l	5		<	5	<	5	
Resorcinol	mg/l	0.01		<	0.01	<	0.01	
Catechol	mg/l	0.01		<	0.01	<	0.01	
Phenol	mg/l	0.01		<	0.01	<	0.01	
m/p-cresol	mg/l	0.02		<	0.02	<	0.02	
o-cresol	mg/l	0.01		<	0.01	<	0.01	
Total cresols	mg/l	0.03		<	0.03	<	0.03	
Xylenols	mg/l	0.06		<	0.06	<	0.06	
1-naphthol	mg/l	0.01		<	0.01	<	0.01	
2,3,5-trimethyl phenol	mg/l	0.01		<	0.01	<	0.01	
2-isopropylphenol	mg/l	0.01		<	0.01	<	0.01	
Total Speciated Phenols HPLC	mg/l	0.1		<	0.1	<	0.1	
Chromium Hexavalent	mg/l	0.002	3.4	<	0.002	<	0.002	WFD Eng/Wales 2015

Annex C: Review of potential impacts from road runoff and watercourse and floodplain crossings

Review of Potential Impacts to Watercourses from Routine Road Runoff and Accidental Spillages:

C.1 Highway runoff is a major contributor to diffuse pollution to the aquatic environment because roads collect a wide range of pollutants which accumulate on the carriageway (SEPA, 1999). These contaminants can be transported to watercourses surrounding the roads through routine road runoff. Loadings of contaminants can be particularly high in the 'first flush' of runoff following periods of dry weather (EA, 2002), although due to the large number of factors and length of road catchments it may not always be possible to detect the first flush in monitoring data. They can also become stored in neighbouring buffer zones (vegetated verges and banks) and even in the channel of receiving watercourses, and be later mobilised under suitable conditions (Taylor et al., 2014).

C.2 Road-derived pollutants include heavy metals (for example vanadium, chromium, manganese, copper, zinc, nickel, cobalt, cadmium and lead), organic molecules (particularly Polycyclic Aromatic Hydrocarbons (PAHs)), inert particulates, de-icing salts used during cold weather (which can encourage further release of 'stored metals' in sediments or enhanced corrosion of vehicles), and even litter (Beasley and Kneale, 2002).

C.3 Speed limits and traffic signals have also been shown to influence runoff metal concentrations on highways because braking and acceleration activities lead to increased abrasion of tyres, higher use of brake linings, and increased automotive exhaust gas emissions (Muschack, 1990; Langbein et al., 2006).

C.4 Further factors influencing metal concentrations in roadside soils include meteorological conditions, soil parameters (for example asphalt or concrete surfaces), traffic density, vehicle type (diesel or petrol), construction and maintenance works, car accidents, firefighting foams and leakages (Viard et al., 2004, Sezgin et al., 2003m Turer and Maynard, 2003, Garcia and Milan, 1998, Othman et al., 1997). Topsoil contaminants may find their way to receiving watercourses due to leaching into various catchment flow pathways (for example sub-surface throughflow).

Bioaccumulation and Toxicity to Aquatic Organisms

C.5 The structure and functioning of biological communities can be significantly affected by increased concentrations of road-related contaminants, particularly metals and hydrocarbons (Maltby et al., 1995). Runoff of sediments into watercourses can also have direct physical effects by smothering and damaging aquatic habitats, and has been associated with a decrease in fish populations, especially of salmon and trout (Maltby et al., 1995).

C.6 Dissolved pollutants are perhaps the most difficult to treat in modern road drainage systems often requiring a biological component in the treatment train, although this is most effective during the growing season. Conversely, dissolved pollutants are more likely to be attenuated by dilution and dispersion, and conveyed downstream in the receiving watercourse, even in small channels, unlike sediment-bound pollutants that can accumulate over time.

C.7 Pollutants can accumulate in receiving waters and lead to chronic (slow accumulation) or acute (severe and transient) impacts. For example, copper is particularly toxic for fish and can have an acute impact in terms of fatalities. Chronic effects are associated with PAHs, zinc, chromium, nickel and lead which might accumulate through time in animal tissue. Alternatively, toxins may leach from sediments over time and can directly impact sediment dwelling organisms (Maltby et al., 1995). Studies have shown that the application of road salts can impact succession of aquatic vegetation (Wilcox, 1986)) and PAHs bound to sediments have been proven to have toxic effects in amphipods. Accumulation of pollutants in sediment can be particularly problematic for benthic aquatic organisms as they are often the most exposed.

Review of Impacts Relating to Watercourse and Floodplain Crossings:

C.8 General water and environmental design guidance for water body crossings (including flood risks) gives a strong preference for clear-span structures. However, as the Scheme is making use of existing culverts for watercourse crossings, there is potential for the following adverse effects:

- Flood risks can be affected upstream and downstream of a water body crossing due to afflux and attenuation. Structures should be designed in accordance with channels and floodplains so that there is no impact on flood levels away from the crossing location. It can sometimes be necessary to extend highways site boundaries in order to provide sufficient space for hydraulic mitigation;

- Scour can result from structural flow constrictions, which can affect site or nearby assets, maintenance requirements, and habitat continuity;

- Culverting can cause direct loss of riparian, bank and bed habitats, and indirect loss due to shading effects. Culverts can also sever the continuity of the channel with the riparian, floodplain, hyporheic and groundwater zones, and alter flow dynamics and sediment transport;

- Structures can often impede the movement of migratory and other species, and interrupt the continuity of the natural hydraulic and sediment regimes;

- Excessive shading can reduce light intensity, photosynthesis, metabolic activity and biochemical cycling, such as nitrification. It can also affect temperature, thereby limiting habitat colonisation by some species, and cause a reduction in dissolved oxygen concentration (which is directly dependent on temperature). Shading is also thought to affect fish habitat and migration. Structure dimensions and habitat sensitivity determine whether shading is 'excessive'. It can be mitigated with multi-span structures, light chimneys, and sometimes with artificial lighting; and

- Other modifications to watercourses such as diversions can result in direct loss of habitats, and/or disruption to natural flow and sediment regimes, which can cause loss of substrate and hydraulic habitats.

Annex C Sources:

Beasley G, Kneale P, 2002. Reviewing the impact of metals and PAHs on macroinvertebrates in urban watercourses. Progress in Physical Geography 26,236-270. doi: 10.1191/0309133302pp334ra;

Environmental Agency (2002) Long term monitoring of pollution from highway runoff: final report.

Garcia R, Millan E, 1998. Assessment of Cd, Pb and Zn contamination in roadside soils and grasses from Gipuzkoa (Spain). Chemosphere 37(8), 1615-1625.

Langbein S, Steiner M, Boller M, 2006. Schadstoffe im Straßenabwasser einer stark befahrenen Straße und deren Retention mit neuartigen Filterpaketen aus geotextil und Adsorbermaterial. Schlussbericht des Forschungsprojekts, pp. 1-77.

Maltby L, Boxall ABA, Farrow DM, Calow P, Betton CI, Indu B, Choudhri GN, 1995. The effects of motorway runoff on freshwater ecosystems. 2. Identifying major toxicants. Environmental Toxicology and Chemistry 14:1, O93-1101.

Muschack W, 1990. Pollution of street run-off by traffic and local conditions. Sci. Total Environ. 93, 419-431.

Othman I, Al Oudat M, Al Masri MS, 1997. Lead levels in roadside soils and vegetation of Damascus city. Sci Total Environ 207, 43-48.

SEPA (1999) Improving Scotland's Water Environment. SEPA State of the Environment Report. Scottish Environment Protection Agency, Stirling.

Sezgin N, Ozcan HK, Demir G, Nemlioglu S, Bayat C, 2003. Determination of heavy metal concentrations in street dusts in Istanbul E-5 highway. Environ Int 29, 979-985.

Taylor A, Blake WH, Comber S, Goddard R, Fisher A, Smith HG, Gaspar L, Darmovzalova J, 2014. Investigation of road runoff inputs from the A42 into the River Mease, UK: winter 2013/14. Catchment and river science with Plymouth University.

Turer DG, Maynard BJ, 2003. Heavy metal contamination in highway soils. Comparison of Corpus Christi, Texas and Cincinnati. Clean Technol Environ Policy 4(4), 235-245.

Wilcox DA, 1986. The effects of deicing salts on vegetation in Pinhook Bog, Indiana. Canadian Journal of Botany 64, 865-874.

1.1.1 Annex D pWFD Assessment Sheets.

Surface Water Body (name/ID/RBMP):	Hatchford-Kingshurst Brook from Source to River Cole (GB104028042490)	**Current status or potential:**	Moderate Ecological Potential
Water body length:	2.264 km	**Target status or potential (2027):**	Moderate (2015)
water body catchment area:	4497.73 ha	**Protected Areas:**	NVZ12SW013080 (Nitrates Directive)
Heavily modified?	Yes		
Summary of scheme components:	An ephemeral tributary of Low Brook flows through the Bickenhill Meadows NW SSSI Unit within the proposed scheme boundary. This combines with numerous small agricultural drainage ditches to form Low Brook south of Birmingham International Airport, before flowing into Hatchford-Kingshurst Brook approximately 5km downstream from the proposed development boundary. A ditch which is also a tributary of Low Brook has a road outfall and will receive road runoff under the proposed Drainage Strategy.		

WFD Parameter	**Current Status/Potential**	**Target Status/ Potential**	**Description of other Protected Areas objectives**	**Brief description of impact**		**Brief description of mitigation measures**		**Residual impacts and WFD compliance**	**Adjacent waterbodies**
				Construction	**Operation**	**Construction**	**Operation**		
Biological status	**Moderate**	**Moderate (2027)**							
Invertebrates	Moderate	Moderate (2027)	Bickenhill Meadows SSSI - 'unfavourable - recovering'. Target 'favourable'	Reduction in water quality could impact invertebrate communities in tributaries of Low Brook (in and adjacent to proposed scheme boundary at Bickenhill Meadows SSSI) and could also propagate downstream. Reduced water quality could be due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals, or through uncontrolled site run-off. Accumulations of sediment could smother invertebrate habitats. No impacts predicted to Hatchford-Kingshurt Brook itself due to distance form the proposed scheme boundary (>5km) with sufficient dilution and sediment settlement in upstream sediments to prevent impact to the WFD watercourse.	The Drainage Strategy indicates that there will be road outfalls to two ditches that are tributaries of Low Brook. In the absence of mitigation this could cause water quality deterioration through release of dissolved metals, hydrocarbons, sediments, with subsequent impacts on invertebrates and their habitat. There would also be intermittent discharge of de-icant products within road runoff. Water quality impacts could also propagate downstream if not controlled at source.	Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge to be implemented, under permit to Controlled Waters to be described in a CEMP, Water Management Plan (WMP) and Pollution Control Plan. Please refer to the CEMP, WMP and Chapter 14 Road Drainage and the Water Environment of the Environmental Statement for further details.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages. The outfalls to the tributaries of Low Brook are treated with filter drains (and one with a sediment tank) and discharge to ditches which provide further treatment of runoff. The Drainage Strategy has been assessed using a DMRB HD45/09 (HAWRAT) analysis. Any identified failures have been provided with appropriate mitigation. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. See Appendix 14.1 for further details. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature, and only increase in significance against existing release where greater impermeable road areas are drained.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is Cole from Hatchford-Kingshurst Brook to River Blythe. Assessment of this waterbody is not required as there are no upstream residual effects.
General physicochemical status	**Moderate**	**Moderate (2027)**							
Ammonia	Moderate	Good (2027)	The waterbody is in a Nitrate Vulnerable Zone (NVZ12SW013080) where restrictions apply for use of nitrogen fertiliser and storage of organic manure. Bickenhill Meadows SSSI - 'unfavourable - recovering'. Target 'favourable'	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, affecting physicochemical status of the small tributaries of Low Brook. However, the WFD designated reach of Hatchford-Kingshurst Brook is considered too far away (>5km) to be at significant risk of adverse impacts.	The Drainage Strategy indicates that there will be road outfalls to two ditches that are tributaries of Low Brook. In the absence of mitigation, this could impact physicochemical status in the tributaries of Low Brook through release and deposition of excessive levels of fine sediment. There would also be intermittent discharge of de-icant products within road runoff. Water quality impacts could also propagate downstream if not controlled at source. However, Hatchford-Kingshurst Brook is considered too far away (>5km) to be at significant risk of adverse impacts.	Following best construction practice should mean any impacts are small, temporary and localised. This would include implementation of temporary site drainage system, management of excessive fine sediment in runoff, planning works with respect to weather forecasts and flood warnings, and implementation of an appropriate Pollution Control Plan (as described in CEMP and WMP). Water quality monitoring will also be undertaken throughout the construction phase, which will enable any impacts on physicochemical status to be identified and mitigation implemented.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages. The outfalls to the tributaries of Low Brook are treated with filter drains (and one with a sediment tank) and discharge to ditches which provide further treatment of runoff. The outfalls passes the risk assessment of routine road runoff and accidental spillage with mitigation included. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. For the existing outfall from the M42 there is betterment over the existing situation where there is no treatment of runoff. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature with limited impact on physicochemical status.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is Cole from Hatchford-Kingshurst Brook to River Blythe. Assessment of this waterbody is not required as there are no upstream residual effects.
Dissolved oxygen	Poor	Poor (2015)							
pH	High	Good (2015)							
Phosphate	Moderate	Moderate (2015)							
Temperature	High	Good (2015)							
Specific pollutants	**High**	**High (2015)**							
Triclosan	High	High (2015)	None identified	Triclosan may be found in certain construction products and could be released to the tributaries of Low Brook if there are accidental spillages, or through uncontrolled site run-off. However, it is not expected to be present or stored in large quantities on site. No impacts predicted to Hatchford-Kingshurst Brook itself due to distance form the proposed scheme boundary (>5km) with sufficient dilution upstream to prevent impact to the WFD watercourse.	The Drainage Strategy indicates that there will be road outfalls to two ditches that are tributaries of Low Brook. Triclosan can be derived from numerous sources (e.g. soaps, construction products) and could be deposited on the road in small quantities. There is some limited potential for any spillages of tricolsan to the road to be runoff to the tributaries of Low Brook through the road outfalls. However, Hatchford-Kingshurst Brook is considered too far away (>5km) to be at significant risk of adverse impacts from the small quantities of triclosan that may be present.	Following best construction practice will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised particularly given the minor quantitites of triclosan expected to be on site. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan (as described in CEMP and WMP). Any spillage that is observed would be contained and water removed for disposal off site.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages as described above and would thereby provide some treatment for triclosan. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. As triclosan is not expected to be deposited on the road in any great quantity any remaining tricolsan that enters watercourses would be diluted prior to reaching Hatchford-Kingshurt Brook (>5km from the proposed scheme boundary).	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is Cole from Hatchford-Kingshurst Brook to River Blythe. Assessment of this waterbody is not required as there are no upstream residual effects.
Chemical status-priority substances	**Does Not Require Assessment**	**Does Not Require Assessment (2015)**							
Chemical status-priority hazardous substances	**Good**	**Does Not Require Assessment (2015)**							
Nonylphenols	Good	Does Not Require Assessment (2015)	None identified	Nonylphenols may be found in certain construction products (e.g. road paint) and could be released to the tributaries of Low Brook if there are accidental spillages, or through uncontrolled site run-off. However, it is not expected to be present or stored in large quantities on site, and any paint applied to the road would dry quickly. No impacts predicted to Hatchford-Kingshurt Brook itself due to distance form the proposed scheme boundary (>5km) with sufficient dilution upstream to prevent impact to the WFD watercourse.	The Drainage Strategy indicates that there will be road outfalls to two ditches that are tributaries of Low Brook. Nonylphenols can be derived from numerous sources and could be deposited on the road. There is potential for any spillages of nonylphenol products to the road to be runoff to the tributaries of Low Brook through the road outfalls. However, Hatchford-Kingshurst Brook is considered too far away (>5km) to be at significant risk of adverse impacts given upstream dilution.	Following best construction practice will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised particularly given the minor quantitites of nonylphenol expected to be on site. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan (as described in CEMP and WMP). Any spillage that is observed would be contained and water removed for disposal off site.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages as described above and would provide some treatment for nonylphenols. As nonlyphenols are not expected to be deposited on the road in any great quantity any remaining tricolsan that enters watercourses would be diluted prior to reaching Hatchford-Kingshurt Brook (>5km from the proposed scheme boundary).	No significant residual effects are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is Cole from Hatchford-Kingshurst Brook to River Blythe. Assessment of this waterbody is not required as there are no upstream residual effects.
Hydromorphological Status	**Supports Good**	**Supports Good (2015)**							
Hydrological Regime	Supports Good	Supports Good (2015)	None identified	Construction of the road outfall to the tributary of Low Brook will require some works close to and potentially within the receiving watercourses. There is the potential for accumulation of fine sediment during any works to these outfalls to result in direct impacts to the receiving watercourses.	There is potential for accumulation of sediments from road runoff at the outfalls to the tributaries of Low Brook if mitigation was not provided.	Pre-fabricated headwalls are to be used where possible. Outfalls would be micro-sited to ensure best location and orientation in order to prevent sediment accumulation and hydromorphological impacts. Furthermore, bank impacts would be insignificant at the scale of the whole waterbody.	The Drainage Strategy ensures that peak discharge rates from the scheme are to be controlled and SuDS that discharge to a watercourse will accommodate the 1 in 100 year return period +20% for climate change, thereby preventing impacts on the hydrological regime. The strategy incorporates treatment to prevent chronic sediment impact from routine road runoff, including filter drains, a sediment tank, wetland and grassed swale. The outfall passes the risk of assessment of routine road runoff and accidental spillage with mitigation included. As such there is predicted to be negligible impact from routine road runoff, and there is also an improvement over the existing situation where there is no treatment.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is Cole from Hatchford-Kingshurst Brook to River Blythe. Assessment of this waterbody is not required as there are no upstream residual effects.
Mitigation measures assessment	**Moderate or less**	**Moderate or less (2015)**							

Surface Water Body (name/ID/RBMP):	Blythe from source to Cuttle Brook (GB104028042400)	**Current status or potential:**	Poor Ecological Status
Water body length:	22.9 km	**Target status or potential (2027):**	Moderate (2027)
water body catchment area:	62.2 km^2	**Protected Areas:**	NVZ12SW013080, NVZ12SW015900 (Nitrates Directive); River Blythe SSSI
Heavily modified?	No		
Summary of scheme components:	The watercourse is crossed by the southern extent of the proposed scheme boundary to the south of Catherine de Barnes. There are no physical works to be undertaken on this watercourse or its tributaries, with the nearest physicals works to the M42 approximately 600m northeast of the existing crossing.		

WFD Parameter	Current Status/Potential	Target Status/ Potential	Description of other Protected Areas objectives	Brief description of impact		Brief description of mitigation measures		Residual impacts and WFD compliance	Adjacent waterbodies
				Construction	Operation	Construction	Operation		
Biological status	**Poor**	**Moderate (2027)**							
Fish	High	Good (2015)	River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'.	No direct or indirect impacts are predicted as there are no planned works to this watercourse or to the existing crossing of this watercourse, and no planned outfalls to this watercourse which would require works in or close to the river, thereby impacting biological communities. The nearest physical works are approximately 600m northeast of the existing M42 crossing of this watercourse. The proposed scheme boundary only extends to the existing watercourse crossing to cover installation of signage on the M42 related to the scheme.	No direct or indirect impacts are predicted as the Drainage Strategy indicates that there will be no road drainage from the proposed scheme to this watercourse or its tributaries, and no physical works to the watercourse.	No specific mitigation is required for this waterbody as it will not be impacted directly or indirectly. However, all construction works for the proposed scheme will include measures to manage construction runoff and to contain any spillages prior to discharge under permit to Controlled Waters to be described in a CEMP, Water Management Plan (WMP) and Pollution Control Plan.	No specific mitigation is required as no impacts are predicted.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Temple Balsall Brook to Patrick Bridge. No impacts will propagate downstream to this waterbody.
Macrophytes and Phytobenthos	Poor	Moderate (2027)							
Invertebrates	Good	Good (2015)							
General physicochemical status	**Moderate**	**Good (2021)**							
Acid-Neutralising Capacity	High	Good (2015)	The waterbody is in a Nitrate Vulnerable Zone (NVZ12SW013080, NVZ12SW015900) where restrictions apply for use of nitrogen fertiliser and storage of organic manure. River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'.	No direct or indirect impacts are predicted as there are no planned works to this watercourse or to the existing crossing of this watercourse, and no planned outfalls to this watercourse which would require works in or close to the river, thereby impacting physicochemical status. The nearest physical works are approximately 600m northeast of the existing M42 crossing of this watercourse. The proposed scheme boundary only extends to the existing watercourse crossing to cover installation of signage on the M42 related to the scheme.	No direct or indirect impacts are predicted as the Drainage Strategy indicates that there will be no road drainage from the proposed scheme to this watercourse or its tributaries, and no physical works to the watercourse.	No specific mitigation is required for this waterbody as it will not be impacted directly or indirectly. However, all construction works for the proposed scheme will include measures to manage construction runoff and to contain any spillages prior to discharge under permit to Controlled Waters to be described in a CEMP, Water Management Plan (WMP) and Pollution Control Plan.	No specific mitigation is required as no impacts are predicted.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Temple Balsall Brook to Patrick Bridge. No impacts will propagate downstream to this waterbody.
Ammonia	High	Good (2015)							
Dissolved oxygen	Good	Good (2015)							
pH	High	Good (2015)							
Phosphate	Poor	Good (2021)							
Temperature	High	Good (2015)							
Specific pollutants	**Does not require assessment (2015)**	**Does not require assessment (2015)**							
Chemical status-priority substances	**Does not require assessment (2015)**	**Does not require assessment (2015)**							
Chemical status-priority hazardous substances	**Does not require assessment (2015)**	**Does not require assessment (2015)**							
Hydromorphological Status	**Supports Good**	**Supports Good (2015)**							
Morphology	Supports Good	Supports Good (2015)	River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'.	No direct or indirect impacts are predicted as there are no planned works to this watercourse or to the existing crossing of this watercourse, and no planned outfalls to this watercourse which would require works in or close to the river, thereby impacting hydromorphological status. The nearest physical works are approximately 600m northeast of the existing M42 crossing of this watercourse. The proposed scheme boundary only extends to the existing watercourse crossing to cover installation of signage on the M42 related to the scheme.	No direct or indirect impacts are predicted as the Drainage Strategy indicates that there will be no road drainage from the proposed scheme to this watercourse or its tributaries, and no physical works to the watercourse.	No specific mitigation is required for this waterbody as it will not be impacted directly or indirectly.	No specific mitigation is required as no impacts are predicted.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Temple Balsall Brook to Patrick Bridge. No impacts will propagate downstream to this waterbody.
Hydrological Regime	Supports Good	Supports Good (2015)							

Surface Water Body (name/ID/RBMP):	Blythe from Temple Balsall Brook to Patrick Bridge (GB104028042571)	**Current status or potential:**	Moderate Ecological Status
Water body length:	10.17 km	**Target status or potential (2027):**	Moderate (2015)
water body catchment area:	3570.74 ha	**Protected Areas:**	NVZ12SW013080, NVZ12SW015900 (Nitrates Directive) UKENR18 (Urban Waste Water Treatment Directive)
Heavily modified?	No		
Summary of scheme components:	The watercourse is located to the east of the proposed scheme boundary. A tributary known as Eastcote Brook (part of the WFD designation) rises east of the M42, immediately north of the Barston Sewage Treatment Works. A minor ditch upstream of Eastcote Brook will receive drainage from the M42 (network 8 under the Drainage Strategy). There are no physical works to be undertaken on this watercourse or its tributaries with the exception of this one outfall.		

WFD Parameter	Current Status/Potential	Target Status/ Potential	Description of other Protected Areas objectives	Brief description of impact		Brief description of mitigation measures		Residual impacts and WFD compliance	Adjacent waterbodies
				Construction	Operation	Construction	Operation		
Biological status	**Moderate**	**Moderate (2015)**							
Fish	Good	Good (2015)	River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'.	Eastcote Brook is in close proximity to proposed construction works (approximately 200m), and works will be undertaken to modify the drainage road outfall on a drainage ditch upstream of Eastcote Brook (network 8 which drains the M42). Disturbance to water quality due to potential spillages and excess fine sediments during construction works can affect biological communities, smothering habitat and physically impacting organisms.	The Drainage Strategy indicates that the proposed scheme will use an existing road outfall (draining the M42) to a ditch that is a tributary of Eastcote Brook. In the absence of mitigation, this could cause water quality deterioration through release of dissolved metals, hydrocarbons and sediments, with subsequent impacts on biological communities in Eastcote Brook. This is an existing outfall with no treatment and so is a source of pollution under current conditions There would also be intermittent discharge of de-icant products within road runoff in winter which could have impacts on biological parameters in the receiving ditch and potentially to Eastcote Brook. This would be a worsening of existing impacts as the outfall will drain a larger impermeable road area than the existing. Water quality impacts are unlikely to propagate as far as the Blythe SSSI (approximately 2.5km downstream), due to dispersal and dilution in Eastcote Brook.	Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge to be implemented, under permit to Controlled Waters to be described in a CEMP and Water Management Plan (WMP). Measures to reduce the risk of chemical spillages are outlined in the CEMP and include bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of an Pollution Control Plan. Concrete headwalls will be pre-fabricated where possible to reduce need for works in the ditchcourse. Please refer to the CEMP, WMP and Chapter 14 Road Drainage and the Water Environment of the Environmental Statement for further details.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages. The outfall to the tributary of Eastcote Brook is treated with a filter drain, sediment tank, wetland and grassed swale. It also discharges to a ditch which provides further treatment of runoff. The Drainage Strategy has been assessed using a DMRB HD45/09 (HAWRAT) analysis. Any identified failures have been provided with appropriate mitigation. The ability to isolate spillages has also been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. Water quality impacts that could affect biological communities will therefore be negligible. There is also predicted to be an improvement over the existing situation where there is no treatment for M42 drainage. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Macrophytes and Phytobenthos	Moderate	Moderate (2015)							
Invertebrates	Good	Good (2027)							
General physicochemical status	**Moderate**	**Good (2021)**							
Acid-Neutralising Capacity	High	na	The waterbody is in a Nitrate Vulnerable Zone (NVZ12SW013080, NVZ12SW015900) where restrictions apply for use of nitrogen fertiliser and storage of organic manure. It is also in an Urban Wastewater Treatment Directive Zone (UKENR18). River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'.	Construction works adjacent to, or within, surface watercourses can lead to excessive levels of fine sediment in runoff to watercourses and spillages of chemicals. There could therefore be a risk to physicochemical status of the ditch upstream of Eastcote Brook during works to the drainage outfall, and there is a risk of construction runoff reaching Eastcote Brook due to its proximity to the proposed scheme, if appropriate mitigation was not implemented.	The Drainage Strategy indicates that the proposed scheme will use an existing road outfall to a ditch that is a tributary of Eastcote Brook. In the absence of mitigation, this could cause water quality deterioration through release of dissolved metals, hydrocarbons and sediments, with subsequent impacts on physicochemical parameters in Eastcote Brook. There is potential for BOD to rise in sediment tanks if sediment is allowed to build up substantially. There would also be intermittent discharge of de-icant products within road runoff in winter which could have impacts on physicochemical parameters in the receiving ditch and potentially to Eastcote Brook. Water quality impacts are unlikely to propagate as far as the Blythe SSSI (approximately 2.5km downstream), due to dispersal and dilution in Eastcote Brook.	Following best construction practice should mean any impacts are small, temporary and localised. This would include implementation of a temporary site drainage system, management of excessive fine sediment in runoff, planning works with respect to weather forecasts and flood warnings, and implementation of an appropriate Pollution Control Plan (as described in CEMP and WMP). Water quality monitoring will also be undertaken throughout the construction phase, which will enable any impacts on physicochemical status to be identified and mitigation implemented.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages. The outfall to the tributary of Eastcote Brook is treated with a filter drain, sediment tank, wetland and grassed swale. It also discharges to a ditch which provides further treatment of runoff. The Drainage Strategy has been assessed using a DMRB HD45/09 (HAWRAT) analysis. Any identified failures have been provided with appropriate mitigation. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. Water quality impacts that could affect physicochemical status will therefore be negligible. There is also predicted to be an improvement over the existing situation where there is no treatment for M42 drainage. Build up of BOD in sediment tanks would be reduced by regular mainenance of the tanks to remove sediment. Furthermore, all tanks drain to further treatment components (e.g. wetlands or swales) where aeration would lessen the BOD, leading to a negligible impact. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Ammonia	Good	Good (2015)							
Biochemical Oxygen Demand (BOD)	High	na							
Dissolved oxygen	Good	Good (2015)							
pH	High	Good (2015)							
Phosphate	Poor	Good (2021)							
Temperature	High	Good (2015)							
Specific pollutants	**High**	**High (2021)**							
Triclosan	High	High (2021)	River Blythe SSSI; Urban Wastewater Treatment Directive Zone (UKENR18).	These specific pollutants may be found in certain construction products, chemicals, fuels, oils etc and could be released to Eastcote Brook and ditches upstream of Eastcote Brook if there are accidental spillages, or through uncontrolled site run-off. A serious pollution incident may also propagate downstream to the River Blythe SSSI.	The Drainage Strategy indicates that the proposed scheme will use an existing road outfall to a ditch that is a tributary of Eastcote Brook. Specific pollutants, particularly copper and zinc, could be deposited on the road and then transferred to watercourses in road runoff or through accidental spillages.	Following best construction practice as outlined in the CEMP and WMP will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan.	The outfall to the tributary of Eastcote Brook is treated with filter drains, a sediment tank, a wetland and a grassed swale and discharges to a ditch which provides further treatment of runoff. The Drainage Strategy has been assessed using a DMRB HD45/09 (HAWRAT) analysis. Any identified failures have been provided with appropriate mitigation. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. As such there is predicted to be negligible impact from routine road runoff, and there is also an improvement over the existing situation where there is no treatment for M42 drainage.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Manganese	High	na							
Copper	High	High (2015)							
Iron	High	High (2015)							
Zinc	High	High (2015)							
Chemical status-priority substances	**Good**	**Good (2015)**							
Nickel and its compounds	Good	Good (2015)	River Blythe SSSI; Urban Wastewater Treatment Directive Zone (UKENR18).	These priority substances may be found in certain construction products, chemicals, fuels, oils etc and could be released to Eastcote Brook and ditches upstream of Eastcote Brook if there are accidental spillages, or through uncontrolled site run-off. A serious pollution incident may also propagate downstream to the River Blythe SSSI.	The Drainage Strategy indicates that the proposed scheme will use an existing road outfall to a ditch that is a tributary of Eastcote Brook. These priority substances could be deposited on the road and then transferred to watercourses in road runoff or through accidental spillages.	Following best construction practice as outlined in the CEMP and SWP will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan. Any known spillage of priority substances would be contained and water removed for disposal off site.	The outfall to the tributary of Eastcote Brook is treated with filter drains, a sediment tank, a wetland and a grassed swale and discharges to a ditch which provides further treatment of runoff. The Drainage Strategy has been assessed using a DMRB HD45/09 (HAWRAT) analysis. Any identified failures have been provided with appropriate mitigation. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. As such there is predicted to be negligible impact from routine road runoff, and there is also an improvement over the existing situation where there is no treatment for M42 drainage.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Lead and its compounds	Good	Good (2015)							
Chemical status-priority hazardous substances	**Good**	**Good (2015)**							
Benzo (b) and (k) fluoranthene	Good	Good (2015)	River Blythe SSSI; Urban Wastewater Treatment Directive Zone (UKENR18).	These priority hazardous substances may be found in certain construction products, chemicals, fuels, oils etc and could be released to Eastcote Brook and ditches upstream of Eastcote Brook if there are accidental spillages, or through uncontrolled site run-off. A serious pollution incident may also propagate downstream to the River Blythe SSSI.	The Drainage Strategy indicates that the proposed scheme will use an existing road outfall to a ditch that is a tributary of Eastcote Brook. These priority hazardous substances could be deposited on the road and then transferred to watercourses in road runoff or through accidental spillages.	Following best construction practice as outlined in the CEMP and SWP will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan. Any known spillage of hazardous substances would be contained and water removed for disposal off site.	The outfall to the tributary of Eastcote Brook is treated with filter drains, a sediment tank, a wetland and a grassed swale and discharges to a ditch which provides further treatment of runoff. The ability to isolate spillages has also been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. As such there is predicted to be negligible impact from routine road runoff, and there is also an improvement over the existing situation where there is no treatment.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Benzo (ghi) perelyene and indeno (123-cd) pyrene	Good	Good (2015)							
Benzo(a)pyrene	Good	Good (2015)							
Di(2-ethylhexyl)phthalate (Priority hazardous)	Good	Good (2015)							
Cadmium and Its Compounds	Good	Good (2015)							
Mercury and Its Compounds	Good	Good (2015)							
Hydromorphological Status	**Supports Good**								
Morphology	Supports Good	Supports Good (2015)	River Blythe SSSI	Construction / modification of the road outfall to the ditch upstream of Eastcote Brook will require some works close to and potentially within the receiving watercourse. There is the potential for morphological impact and accumulation of fine sediment during any works to these outfalls in the ditch.	There is potential for accumulation of sediments from road runoff at the outfall to the ditch upstream of Eastcote Brook if mitigation was not provided. Excessive flow from routine road runoff could cause scour if not controlled.	Pre-fabricated headwalls are to be used where possible. Outfalls would be micro-sited to ensure best location and orientation in order to prevent sediment accumulation and hydromorphological impacts. Furthermore, bank impacts would be impacting an artificial ditch and would have no impact on the downstream Eastcote Brook and River Blythe. The works would be insignificant at the scale of the whole waterbody.	The Drainage Strategy ensures that peak discharge rates from the scheme are to be controlled and SuDS that discharge to a watercourse will accommodate the 1 in 100 year return period +20% for climate change, thereby preventing impacts on the hydrological regime. The strategy incorporates treatment to prevent chronic sediment impact from routine road runoff, including filter drains, a sediment tank, wetland and grassed swale. The outfall passes the risk of assessment of routine road runoff and accidental spillage with mitigation included. As such there is predicted to be negligible impact from routine road runoff, and there is also an improvement over the existing situation where there is no treatment.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Blythe from Patrick Bridge to the River Tame. No impacts will propagate to this downstream watercourse.
Hydrological Regime	Supports Good	Supports Good (2015)							

Surface Water Body (name/ID/RBMP):	Blythe from Patrick Bridge to River Tame (GB104028042571)	**Current status or potential:**	Poor Ecological Status
Water body length:	20.523 km	**Target status or potential (2027):**	Moderate (2027)
water body catchment area:	6303.51 ha	**Protected Areas:**	NVZ12SW013080, NVZ12SW015900 (Nitrates Directive) UKENR18 (Urban Waste Water Treatment Directive); UKGB104028042572 (Drinking Water Protected Area); (SWSGZ2204) Safeguard Zone
Heavily modified?	No		
Summary of scheme components:	Numerous tributaries of this watercourse intersect the proposed scheme boundary, namely Hollywell Brook, Shadow Brook and a tributary of Shadow Brook. The latter also flows through the Bickenhill Meadows SSSI within the proposed scheme boundary. The Drainage Strategy indicates that all outfalls from the proposed scheme will discharge to watercourses that drain to the Blythe (from Patrick Bridge to River Tame) watercourse with the exception of three (Network 1A, 4 and 8). Extensions to existing culverts are planned to Hollywell Brook and a small ditch under the A45 which is online with Pendigo Lake, which then flows to Hollywell Brook. There will be loss of a small portion (~20m) of the ephemeral headwater of Shadow Brook within the footprint of the proposed scheme. There will be diversions of 4 minor ditchcourses that are ephemeral but would connect to tributaries of the Blythe (from Patrick Bridge to River Tame) watercourse if they were flowing.		

WFD Parameter	Current Status/Potential	Target Status/ Potential	Description of other Protected Areas objectives	Brief description of impact		Brief description of mitigation measures		Residual impacts and WFD compliance	Adjacent waterbodies
				Construction	Operation	Construction	Operation		
Biological status	**Poor**	Moderate (2027)							
Fish	Good	Good (2015)	River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'. Bickenhill Meadows SSSI - 'unfavourable - recovering'. Target 'favourable'	Disturbance to water quality due to potential spillages and excess fine sediments during all construction works can affect biological communities, smothering habitat and physically impacting organisms. There will also be modifications to existing outfalls and construction of new outfalls to upstream ditches and tributaries of this WFD watercourse, involving construction in or adjacent to the watercourse.	The Drainage Strategy indicates that there will be new or modified road outfalls to Hollywell Brook, Shadow Brook, the tributary of Shadow Brook (which flows through Bickenhill Meadows SSSI) and numerous ditches that ultimately drain to these watercourses. In the absence of mitigation, routine runoff and accidental spillages could cause water quality deterioration through release of dissolved metals, hydrocarbons, sediments and other pollutants, with subsequent impacts on biological communities and their habitat. The risk is greatest for the modified M42 and proposed link road drainage, whereas risk from side roads is much reduced. There would also be intermittent discharge of de-icant products within road runoff. Potential minor and temporary impacts due to the loss of habitat during realigning of minor drainage ditches, extensions to existing culverts on Hollywell Brook and a ditch beneath the A45, and loss of headwater area of Shadow Brook (~20m).	Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge to be implemented, under permit to Controlled Waters to be described in a CEMP and Water Management Plan (WMP). Measures to reduce the risk of chemical spillages are outlined in the CEMP and include bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of an Pollution Control Plan Please refer to the CEMP, WMP and Chapter 14 Road Drainage and the Water Environment of the Environmental Statement for further details.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages that covers all outfalls. This includes filter drains, wetlands, sediment tanks, grassed swales and vortex grit separators. All outfalls have been subject to a risk assessment of routine road runoff and accidental spillage, and all pass the assessment with mitigation included. For the existing drainage networks, there will be an improvement in water quality due to inclusion of attenuation where there is currently none, which may lessen pressures on biological communities to some extent. The ability to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature, and only increase the impact over existing where outfalls drain larger impermeable road areas than at present. Culvert extensions will be naturalised to encourage ecological continuum, and would only result in a very localised effect. Realigned channels only impact ditches that do not carry functional flows. However, realigned ditches will aim to improve conveyance of flow and be sensitive to the aquatic ecology. The headwater area of Shadow Brook that is lost is agricultural ditch that is of limited value in terms of biodiversity, and is ephemeral. It is also insignificant in terms of total watercourse lost (approximately 0.5%)	Localised deterioration due to extension of the culverts and realigned ditches causing loss of habitat. This is localised and temporary and does not change the status of the WFD element.	The downstream waterbody is the Tame from River Blythe to River Anker. As there is no residual effect there are no impacts to the downstream waterbody.
Macrophytes and Phytobenthos	Poor	Moderate (2027)							
Invertebrates	Good	Good (2015)							
General physicochemical status	**Moderate**	**Good (2021)**							
Ammonia	High	Good (2015)	The waterbody is in a Nitrate Vulnerable Zone NVZ12SW013080, NVZ12SW015900 (Nitrates Directive), where restrictions apply for use of nitrogen fertiliser and storage of organic manure. It is also designated under the Urban Waste Water Treatment Directive (UKENR18); is a Drinking Water Protected Area (UKGB104028042572) and Drinking Water Safeguard Zone (SWSGZ2204). Drinking Water Protected Areas are where raw water is abstracted from rivers and reservoirs, and where water sources that are 'at risk' of deterioration which would result in the need for additional treatment. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided; River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'. Bickenhill Meadows SSSI - 'unfavourable - recovering'. Target 'favourable'	Construction works adjacent to, or within, surface watercourses can lead to excessive levels of fine sediment in runoff to watercourses and spillages of chemicals. There could therefore be a risk to physicochemical status of the upstream ditches and tributaries of the Blythe as some of them will undergo direct works (for culverts and road outfalls), while others are in immediate proximity to the scheme and could receive construction runoff.	The Drainage Strategy indicates that there will be new or modified road outfalls to Hollywell Brook, Shadow Brook, the tributary of Shadow Brook and numerous ditches that ultimately drain to these watercourses. In the absence of mitigation, routine runoff and accidental spillages could cause water quality deterioration through release of dissolved metals, hydrocarbons, sediments and other pollutants, with subsequent impacts on physicochemical parameters. The risk is greatest for the modified M42 and proposed link road drainage, whereas risk from side roads is much reduced. There is potential for BOD to rise in sediment tanks if sediment is allowed to build up substantially. There would also be intermittent discharge of de-icant products within road runoff which could impact physicochemical status.	Following best construction practice should mean any impacts are small, temporary and localised. This would include implementation of temporary site drainage system, management of excessive fine sediment in runoff, planning works with respect to weather forecasts and flood warnings, and implementation of an appropriate Pollution Control Plan (as described in CEMP and WMP). Water quality monitoring will also be undertaken throughout the construction phase, which will enable any impacts on physicochemical status to be identified and further mitigation implemented if necessary.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages that covers all outfalls. This includes filter drains, wetlands, sediment tanks, grassed swales and vortex grit separators. All outfalls have been subject to a risk assessment of routine road runoff and accidental spillage, and all pass the assessment with mitigation included. For the existing drainage networks, there will be an improvement in water quality due to inclusion of attenuation where there is currently none. The abiltiy to isolate spillages has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping. Build up of BOD in sediment tanks would be reduced by regular mainenance of the tanks to remove sediment. Furthermore, all tanks drain to further treatment components (e.g. wetlands or swales) where aeration would lessen the BOD, leading to a negligible impact. There will be sporadic release of de-icant salts in winter, but these will be intermittent and temporary in nature with limited impact on physicochemical status. Furthermore, the impact is only greater than the existing where outfalls drain larger impermeable road areas than at present.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Tame from River Blythe to River Anker. As there is no residual effect there are no impacts to the downstream waterbody.
Biochemical Oxygen Demand (BOD)	High	na							
Dissolved oxygen	High	Good (2015)							
pH	High	Good (2015)							
Phosphate	Poor	Good (2021)							
Temperature	High	Good (2015)							
Specific pollutants	**Does not require assessment**	**High (2015)**							
Chemical status-priority substances	**Does not require assessment**	**Does not require assessment (2015)**							
Chemical status-priority hazardous substances	**Good (2015)**	**Does not require assessment (2015)**							
Nonylphenol	Good	Good (2015)	Designated under the Urban Waste Water Treatment Directive (UKENR18); is a Drinking Water Protected Area (UKGB104028042572) and Drinking Water Safeguard Zone (SWSGZ2204). Drinking Water Protected Areas are where raw water is abstracted from rivers and reservoirs, and where water sources that are 'at risk' of deterioration which would result in the need for additional treatment. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided.	Nonylphenols may be found in certain construction products (e.g. road paint) and could be released to the ditches and tributaries of the River Blythe if there are accidental spillages, or through uncontrolled site run-off. However, it is not expected to be present or stored in large quantities on site, and any paint applied to the road would dry quickly.	The Drainage Strategy indicates that there will be new or modified road outfalls to Hollywell Brook, Shadow Brook, the tributary of Shadow Brook and numerous ditches that ultimately drain to these watercourses Nonylphenols can be derived from numerous sources and could be deposited on the road in small quantities. There is potential for any spillages of nonylphenol products to the road to be runoff to the receiving watercourses through the road outfalls.	Following best construction practice will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised particularly given the minor quantitites of nonylphenol expected to be on site. A temporary site drainage system would be implemented along with an appropriate Pollution Control Plan (as described in CEMP and WMP). Any known spillage of priority substances would be contained and water removed for disposal off site.	The Drainage Strategy incorporates a range of treatments for routine road runoff and accidental spillages that covers all outfalls. This includes filter drains, wetlands, sediment tanks, grassed swales and vortex grit separators. All outfalls have been assessed using the approach in DMRB HD45/09 (HAWRAT), and further mitigation included where necessary. The drainage designs will improve current treatment of priority hazardous substances where there currently is none. Furthermore, nonlyphenols are only expected be present in very low quantity and any that enter watercourses would be diluted in the larger tributaries prior to reaching the River Blythe SSSI. Furthermore, the ability to isolate spillages of hazardous substances has been designed into the scheme, including the use of penstocks and mechanisms to stop water pumping.	No significant impacts are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	The downstream waterbody is the Tame from River Blythe to River Anker. As there is no residual effect there are no impacts to the downstream waterbody.
Hydromorphological Status	**Supports Good**	**Supports Good (2015)**							
Morphology	Supports Good	Supports Good (2015)	River Blythe SSSI currently 'Unfavourable Recovering'. Target is 'Favourable'. Bickenhill Meadows SSSI - 'unfavourable - recovering'. Target 'favourable'	Construction / modification of road outfalls will require some works close to and potentially within the receiving watercourses. There is the potential for fine sediment accumulation and associated hydromorphological impacts.	There is potential for accumulation of sediments from road runoff at the various road outfalls if mitigation not provided. Approximately one fifth of the surface water catchment for the tributary of Shadow Brook at the Bickenhill Meadows SSSI is to be cut-off by the proposed link road. This may impact hydrological regime. Impacts to hydromorphology due to realigning of minor drainage ditches, extensions to existing culverts on Hollywell Brook and a ditch beneath the A45, and loss of headwater area of Shadow Brook (~20m).	Pre-fabricated headwalls are to be used where possible. Outfalls would be micro-sited to ensure best location and orientation in order to prevent sediment accumulation and hydromorphological impacts. Furthermore, bank impacts would be insignificant at the scale of the whole waterbody.	The Drainage Strategy ensures that peak discharge rates from the scheme are to be controlled and SuDS that discharge to a watercourse will accommodate the 1 in 100 year return period +20% for climate change, thereby preventing impacts on the hydrological regime. The strategy incorporates treatment to prevent chronic sediment impact from routine road runoff, including filter drains, sediment tanks, wetland and grassed swales. All outfalls pass the risk of assessment of routine road runoff and accidental spillage with mitigation included. As such there is predicted to be negligible impact from routine road runoff on morphology, and there is also an improvement for existing outfalls which currently receive no treatment. Ditches to be diverted are to artificial, ephemeral ditches of low socio-economic value. However, diversions will aim to improve flow conveyance. The impact will be slight adverse but insignificant for these ditches. The headwater of Shadow Brook that is to be lost is insignificant at the waterbody scale (approximately 0.5%), and pre-earthworks drainage will collect and return surface flows from the catchment that is cut off by the proposed link road. At this point the watercourse is also artificial and ephemeral and of low socio-economic value. Culvert extensions will be designed to minimise changes in river alignment and length as much as possible, and will give only a very localised and minor, insignificant impact to Hollywell Brook and the watercourse beneath the A45, as they are already culverted. All surface water flows cut off from the tributary of Shadow Brook by the proposed link road are to be gathered by a collection drain and pumped back to a ditch at the Bickenhill Meadows SSSI that connects to the tributary of Shadow Brook. This will ensure no impact to the hydrological regime of this watercourse.	Localised deterioration due to extension of the culverts, this is localised and temporary and does not change the status of the WFD element.	The downstream waterbody is the Tame from River Blythe to River Anker. As there is no residual effect there are no impacts to the downstream waterbody.
Hydrological Regime	Doe not support good	Supports Good (2015)							

Groundwater Body (name/ID/RBMP): Tame Anker Mease - Secondary Combined, GB40402G990800		**Current status or potential:**	Good
Groundwater area: 1140.57 ha		**Target status or potential (2027):**	Good (2015)
Summary of scheme components: The groundwater body underlies the entire scheme area.		**Protected Areas:** NVZ12GW010360, NVZ12GW010340, NVZ12GW010330 (Nitrates Directive), UKGB40402G990800 (Drinking Water Protected Area)	

WFD Parameter	Current Status/Potential	Target Status/ Potential	Description of other Protected Areas objectives	Brief description of impact		Brief description of mitigation measures		Residual impacts and WFD compliance	Consideration of impact to adjacent waterbodies
				Construction	Operation	Construction	Operation		
Quantitative Status Element	**Good**	**Good (2015)**							
Saline or other intrusions	Good	Good (2015)		No direct or indirect impacts are predicted.	No direct or indirect impacts are predicted.	No comment	No comment		
Dependent Surface Water Body Status	Good	Good (2015)		No direct or indirect impacts are predicted.	No direct or indirect impacts are predicted.	No comment	No comment		
Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good	Good (2015)	Overlaps with Drinking Water Protected Area (UKGB40402G990800). Drinking Water Protected Areas are where raw water is abstracted from rivers and reservoirs or the ground, and where water sources that are 'at risk' of deterioration which would result in the need for additional treatment. Action is targeted in these zones to address pollution so that extra treatment of raw water can be avoided. The area also overlaps with Nitrate Vulnerable Zones (NVZ12GW010360, NVZ12GW010340, NVZ12GW010330) where restrictions apply for use of nitrogen fertiliser and storage of organic manure. Bickenhill Meadows SSSI has moisture dependent grassland communities that are partly dependent on groundwater.	Excavation of cuttings may liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted.	The cutting for the proposed link road could intercept groundwater that contributes to maintaining the grassland communities in the Bickenhill Meadows SSSI units. Loss of groundwater could lead to its deterioration over time.	It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the CEMP, WMP and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Also see ES Chapter 10 Geology and Soils.	Investigation into the geology and ground conditions adjacent to the Bickenhill Meadows SSSI has shown that groundwater flows to the GWTDE will not be significantly impacted, and that mitigation for intercepted groundwater flows are not required during operation (see Appendix 14.2 Hydrological Investigation into the Bickenhill Meadows SSSI for further detail). Interception of surface water flows are considered more significant, and this is dealt with under the Blythe - Patrick Bridge to River Tame waterbody assessment.	No impacts to groundwater quantities are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	No applicable
Water Balance	Good	Good (2015)		No direct or indirect impacts are predicted as the Proposed Development will not affect Water Balance.	No direct or indirect impacts are predicted as the Proposed Development will not affect Water Balance.	No comment	No comment		
Chemical Status Element	**Good**	**Good (2015)**							
Saline or other intrusions	Good	Good (2015)							
Dependent Surface Water Body Status	Good	Good (2015)							
GWDTEs	Good	Good (2015)	Same as above	Contamination arising from spillages associated with storage and use of construction chemicals. Generation of impacted groundwater/ surface water during dewatering activities which may not be suitable for discharge without treatment. Construction activities that may open and/ or modify potential pollutant linkages, including the disturbance of sediments and drilling of piling foundations.	Risk from routine road runoff that may soakaway through ephemeral drainage ditches (including chemical spillages). Runoff may contain pollutants associated with vehicle traffic (that include metals such as copper and zinc and hydrocarbons). Leaks, spills and contamination from storage of chemicals, fuels and wastes on site affecting site users and groundwater.	Measures to manage formation of excessive sediment in runoff and to provide treatment prior to discharge under permit to Controlled Waters to be described in a Water Management Plan. Measures to reduce the risk of chemical spillages such as bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of a Pollution Control Plan. Please refer to Chapter 14 Road Drainage and the Water Environment of the Environmental Statement for further details. Foundations and services will be designed and constructed to prevent the creation of pathways for the migration of contaminants, following an appropriate risk assessment. Water generated from dewatering activities must be appropriately stored and treated on site to allow it to be discharged directly to ground or surface water. Alternatively, it should be removed from site to an appropriate waste transfer system for off-site disposal	A Surface Water Drainage Strategy to manage surface water runoff using a combination of SuDS (wetlands, swales) and conventional drainage systems (e.g. storage tanks and oil interceptors) is proposed. The appropriateness of the strategy has been assessed through a HAWRAT analysis as described in DMRB HD45/09, and is compliant.	No significant residual impacts are predicted at the water body level. Therefore, the proposed development would be compliant with all WFD objectives.	Not applicable
Drinking Water Protected Areas (FrWPAs)	Good	Good (2015)							
General Chemical Test	Good	Good (2015)							