M54 to M6 Link Road

TR010054

Volume 6

6.3 Environmental Statement Appendices

Appendix 13.4 Water Framework Directive Assessment

Regulation 5(2)(a)

Planning Act 2008

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

January 2020

Infrastructure Planning

Planning Act 2008

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

M54 to M6 Link Road
Development Consent Order 202[ ]

6.3 Environmental Statement Appendices
Appendix 13.4 Water Framework Directive Assessment

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1 Introduction

1.1 Background

1.1.1 Highways England are developing a link road between the M54 and M6 to provide a link between Junction 1 of the M54, M6 North and the A460 to Cannock. The M54 to M6 Link Road (herein referred to as 'the Scheme') aims to reduce congestion on local / regional routes, particularly the A449 and A460, and deliver improved transport links to encourage the development of the surrounding area. This Appendix has been prepared to report the findings of the Water Framework Directive assessment (WFDa) relating to the potential impacts of the Scheme on the water environment.

1.1.2 The Scheme crosses or may interact (directly or indirectly) with seven watercourses (See Figure 13.1 [TR010054/APP/6.2]) as it passes from south to north (referred to throughout as Watercourses 1-7), which are associated with either the Saredon Brook 'source to River Penk' (GB104028046740) or River Penk 'Source to Saredon Brook' (GB104028046680) waterbodies of the Humber River Basin Management Plan (RBMP). An eighth watercourse, Watercourse 8 on Figure 13.1 [TR010054/APP/6.2], is within 1 km of the Scheme but would not be affected by the Scheme and is not considered any further within this WFDa. Groundwater beneath the Scheme is classified as part of the Staffordshire Trent Valley – Permo Triassic Sandstone Staffordshire Water Framework Directive (WFD) groundwater body (GB40401G300500) and the Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures WFD groundwater body (GB40402G300300).

1.2 The Scheme

1.2.1 The preferred route for the Scheme was announced in September 2018. Since then the Scheme design has been developed through an iterative process in parallel with the environmental assessment. The development of the Scheme design has been informed by knowledge of environmental constraints, the environmental assessment of emerging design proposals and engagement with stakeholders (including the responses received during statutory consultation).

1.2.2 The existing eastbound diverge at M54 Junction 1 would be upgraded from its current single lane drop arrangement to a ghost island (separation of the lip road and mainline using chevrons) lane drop arrangement. The existing westbound merge slip road at the M54 Junction 1 would be upgraded from a single lane gain to a ghost island merge with two diverging lanes. The slip roads at M54 Junction 1 would also be realigned slightly.

1.2.3 The existing A460 Cannock Road (north of Junction 1) would be realigned to connect into the western roundabout of the new M54 Junction 1. A new priority T junction would be provided between the existing A460 and the realigned A460 to maintain access to The Avenue. Two new entry and egress points would be provided for the petrol station and local businesses along the existing A460 affected by the realignment of the road.

1.2.4 The mainline the Scheme would be a dual carriageway road approximately 2.5 km (1.6 miles) in length, with a direct free flow link to the M54 and entry and exit slip roads to the M54 Junction 1. The new road would have a 70 mph speed limit.

1.2.5 The mainline would pass through M54 Junction 1 in a cutting, passing under Featherstone bridge with a headroom clearance of 5.3 m. The mainline would extend northwards from the M54 Junction 1 across greenfield land which is located to the east of Featherstone and Hilton. The mainline of the Scheme would pass to the west of Hilton Hall through part of Lower Pool (a large ornamental pool) and Lower Pool Site of Biological Importance (SBI). The Scheme would be roughly at existing ground level, as it passes to the east of Dark Lane. The distance between the edge of the new carriageway (back of verge) and the closest property (façade) on Dark Lane is approximately 46 m. Dark Lane would be stopped up between the final property along Dark Lane to the west and the junction with Hilton Lane to the east. In order to maintain connectivity for walkers and cyclists a new bridleway connection is proposed between the point at which Dark Lane is stopped up and Hilton Lane.

1.2.6 Continuing north, the Scheme would cross under the existing Hilton Lane at approximately 6.0 m below existing ground level. A section of Hilton Lane would be rebuilt on a new bridge (Hilton Lane overbridge) over the mainline of the Scheme to maintain access across the Scheme. Approximately 500 m of Hilton Lane would be reconstructed to build the new bridge on a similar alignment to the existing road. The carriageway of the road would be raised by approximately 1.7 m in height at the highest point of the bridge.

1.2.7 The route of the Scheme would then continue to the east of Brookfield Farm resulting in the loss of one pond and partial loss of second pond, before continuing north to link into M6 Junction 11. Due to the undulating nature of the existing ground in this location the mainline transitions from cutting at Hilton Lane, to a short section of embankment to the south of Brookfield Farm with a height of approximately 3.5 m then immediately back to cutting to the east of Brookfield Farm with a depth of approximately 5.5 m.

1.2.8 At M6 Junction 11 road improvements would consist of an enlargement of the M6 Junction 11 roundabout to provide additional capacity and accommodate a connection to the new link road.

Highway drainage

1.2.9 As part of the Scheme, a drainage strategy (Appendix 13.2 of the Environmental Statement (ES) [TR010054/APP/6.3]) incorporating the use of Sustainable Drainage Systems (SuDS) would be implemented as part of the Scheme to manage surface water runoff and accidental spillages, where necessary, that may drain to watercourses. SuDS are the preferred solution as they provide a number of functions, including a way to minimise the risk and impact of flooding in addition to potentially providing a degree of treatment for pollutants.

1.2.10 A number of wet ponds filter drains, swales, new highway ditches and vortex flow separators have been incorporated into the overall water management strategy. These have been designed to mimic natural drainage as far as practicable, and to

provide a number of other benefits to ecological habitat creation (see Chapter 8: Biodiversity). Penstocks would also be installed upstream of all wet ponds to allow cut off in the event of a spillage on the highway. The spillage would then be contained within the highways carrier drain system where it could be pumped out.

1.2.11 Attenuation has been incorporated to control any increase in the rate of flow towards the impacted watercourses resulting from increased impermeable road areas. Without attenuation increased flows may result in bank erosion, increased sediment loading, greater flooding and increased pollution to the impacted watercourses. The specific treatment train for each road catchment has been designed to reflect the need for flow attenuation and the pollution risk, as well as to reflect any stakeholder concerns.

1.2.12 The treatment train specifications for each road catchment are summarised in Table 13.6 of Chapter 13: Road Drainage and the Water Environment of the ES [TR010054/APP/6.1].

Proposed watercourse crossing structures

1.2.13 There are seven watercourses within the Scheme boundary which are crossed, or would be crossed by the Scheme. The locations of the watercourses are shown on Figure 13.1 [TR010054/APP/6.2]. The Scheme would include the use of two existing culverts (Watercourse 1 under the M54, and Watercourse 6 under the A460 north of Junction 11), and four new culverts (Watercourse 2 – two No., Watercourse 3 – one No., and Watercourse 4 – one No.) together with the construction of a 10 m wide clear-span bridge at Watercourse 5 (Latherford Brook). The four new culverts would include (please see Annex C for design drawings):

- A 1 m high x 2 m wide box culvert, approximately 182 m in length to allow Watercourse 2 to pass under new arrangement of M54 Junction 1. The invert of the culvert would be a minimum of 150 mm below bed depth to allow for a naturalised bed to form.
- A 1.2 m diameter circular culvert, approximately 58 m in length to allow Watercourse 2 to pass underneath the entry slip road to the M54 Eastbound. Watercourse 2 is also to be diverted approximately 80 m to the north to shorten the lengths of culvert required as it flows through the remodelled M54 Junction 1.
- Watercourse 3 passes through Lower Pool (an ornamental pond). The lower part of the pond and a length of Watercourse 3 would be partially lost by the Scheme. There would be the creation of a new channel and pond overflow/weir configuration downstream of the dissected Lower Pool. The watercourse would be realigned parallel with the southbound carriageway and would pass under the Scheme in a 1.2 m diameter circular culvert, and approximately 60 m in length. The invert of the culvert would be a minimum of 300 mm below bed depth to allow for a naturalised bed to form.
- A 1.2 m diameter circular culvert, approximately 55 m in length to allow Watercourse 4 to cross under the Scheme south-east of Brookfield Farm. The invert of the culvert would be a minimum of 300 mm below bed depth to allow for a naturalised bed to form.

- A 10 m wide clear span bridge, approximately 77 m in length. To allow Latherford Brook (Watercourse 5) to pass under the Scheme to the south of the M6 Junction 11.

1.2.14 Watercourses 1, 6 and 7 do not require new culverts or works to the existing culverts.

1.2.15 It is proposed that the base of each culvert would be sunk at least 300 mm below the current bed level and the invert backfilled with excavated bed material or a suitable grade substrate to make sure that a naturalised bed is provided through each extended culvert structure.

1.2.16 With the exception of Watercourse 5 (Latherford Brook) which would be treated as a 10 m single span bridge to allow sediment movement in the channel and scope for lateral movement, there is limited evidence along the smaller watercourses (watercourses 2, 3 and 4, which would be culverted) of any functional flows and sediment transport processes. However, the provision of a naturalised bed would help maintain channel/process continuum.

1.2.17 Culverts have been sized appropriately to allow for the 300 mm backfill of new material to carry the watercourse without constriction or narrowing to make sure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring.

1.2.18 The hydraulic sizing of the culverts has been determined from the Flood Risk Assessment (Appendix 13.1 [TR010054/APP/6.3]) and hydraulic modelling to ensure no adverse effects of the flow and flood potential of the watercourse up to and including a 1% Annual Exceedance Probability (AEP) Event (1 in 100 year flood event) plus 50% climate change allowance.

Ditch realignment

1.2.19 For Watercourse 2 the realignment and regrading of this minor watercourse would be required as it passes through the remodelled M54 Junction 1. This minor watercourse would be diverted to a new flow route located approximately 80 m north of its current route, required to minimise the length of the new culvert. Realignment and diversion of Watercourse 3 is also required due to the need to connect the overflow from the new impoundment structure (to maintain Lower Pool) with the downstream course via a new culvert beneath the mainline of the Scheme. Minor realignment of Watercourse 4 may also be required to allow the watercourse to pass beneath the mainline of the Scheme in a culvert. The design of the realignment and culverting of these watercourses will be undertaken at the detailed design stage. The design will follow best practice and will be informed by both an ecologist and hydromorphologists to ensure an appropriate design that maximises biodiversity opportunities and reflects a more natural form avoiding engineered cross sections. The design of the new channels will also need to ensure that conveyance of flow and any course sediment transport.

Road outfalls

1.2.20 Drainage from the new road would be to local watercourses but with outfalls from the treatment system being new ditches to the receiving watercourse to avoid the need for new outfalls supported by concrete headwalls, other than land drainage from embankments to Watercourse 5 (Latherford Brook). The intention is that any cut-off land drainage would connect into the outfall from the treatment system upstream of watercourses to avoid the need for any additional and separate land drainage outfalls.

Road cuttings and borrowpit

1.2.21 The design for the Scheme includes the construction of three cuttings with the road level being 5 m to 7 m bgl. These are located to the east of Brookfield Farm, in the centre of the Scheme around the Hilton Lane Overbridge, and to the south of the Scheme through M54 Junction 1 near Featherstone.

1.2.22 The construction of the Scheme would also include the construction of a borrow pit in an agricultural field to the north of Park Road. This would be up to 10 m deep and could be used to obtain up to 545,000 m^3 of suitable engineering material. The borrow pit would be backfilled using material obtained within the construction of the Scheme which is considered unsuitable on engineering parameters. This is estimated to be 50 m from Watercourse 3, the flow in which is likely to be supported by locally high groundwater levels (typically within a few meters of the ground surface).

2 Overview of the Water Framework Directive

2.1 Legislative context

2.1.1 The WFD aims to protect and enhance the quality of the water environment across all European Union (EU) member states. The WFD is transposed into legislation in England by the Water Environment (Water Framework Directive) (England and Wales) Regulations 2003 (as amended 2015 and 2016). 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 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 'RBMPs' are used to summarise baseline conditions and set broad improvement objectives.

2.1.3 In England, the Environment Agency 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 as statutory consultee on planning applications and environmental permitting (under the Environmental Permitting Regulations (England and Wales) 2016, the Environment Agency must consider whether proposals for new developments have the potential to:

- cause a deterioration of a waterbody from its current status or potential; and/ or
- prevent future attainment of good status or potential where not already achieved.

2.1.4 In determining whether a development is compliant or not compliant with the WFD objectives for a waterbody, 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 waterbody status

2.2.1 Under the WFD, surface waterbody status is classified on the basis of chemical and ecological status or potential. Ecological status is assigned to surface water bodies that are natural and considered by the 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 classes are defined in the Humber RBMP (Ref. 15) and replicated in Table 2.1.

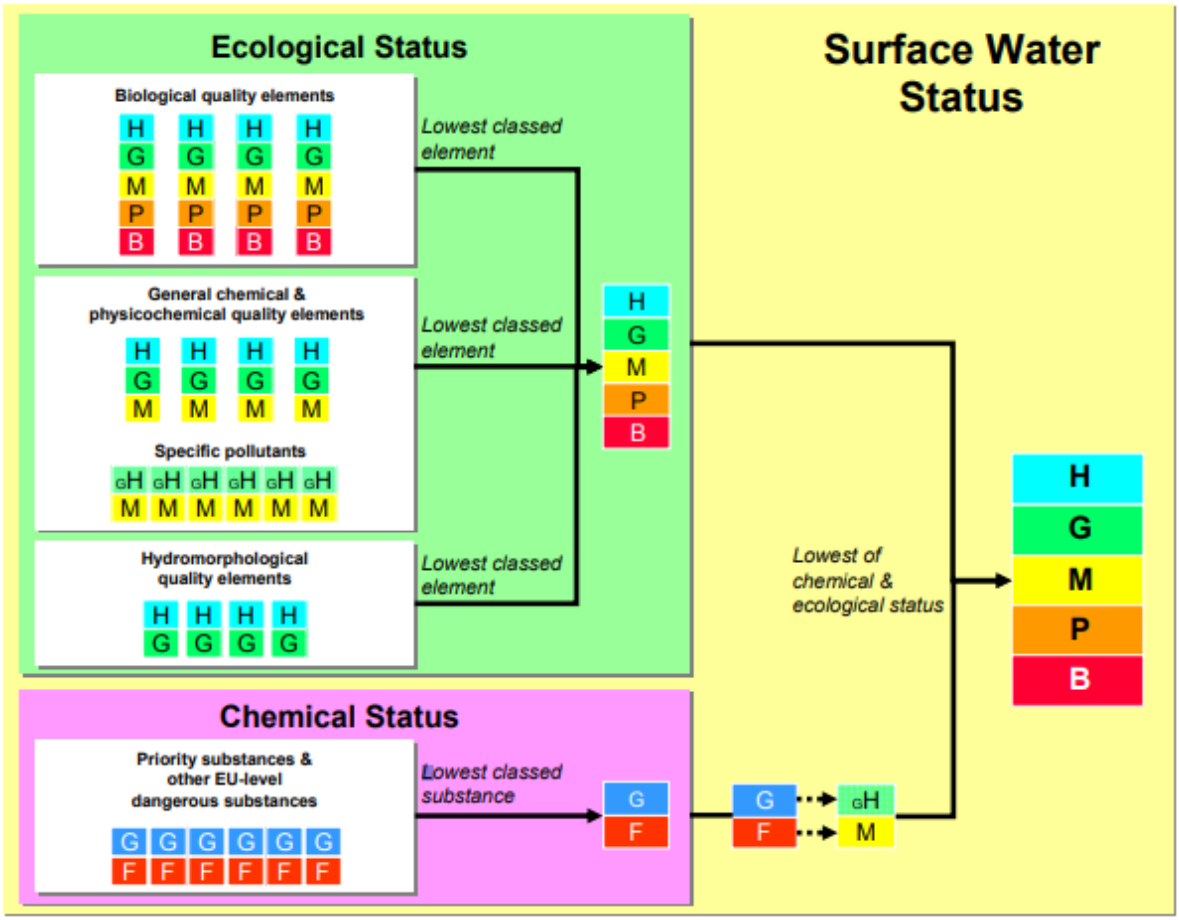
Table 2.1: Definition of status in the Water Framework Directive according to the Environment Agency

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

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 waterbody 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, physicochemical, 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 Diagram 2.1 (Ref 15).

Diagram 2.1: WFD classification elements for surface waterbody status



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:

- **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 waterbody status from 'Bad' through to 'High'.
- **Physico-chemical:** This test is designed to assess compliance with environmental standards for supporting physicochemical conditions, such as

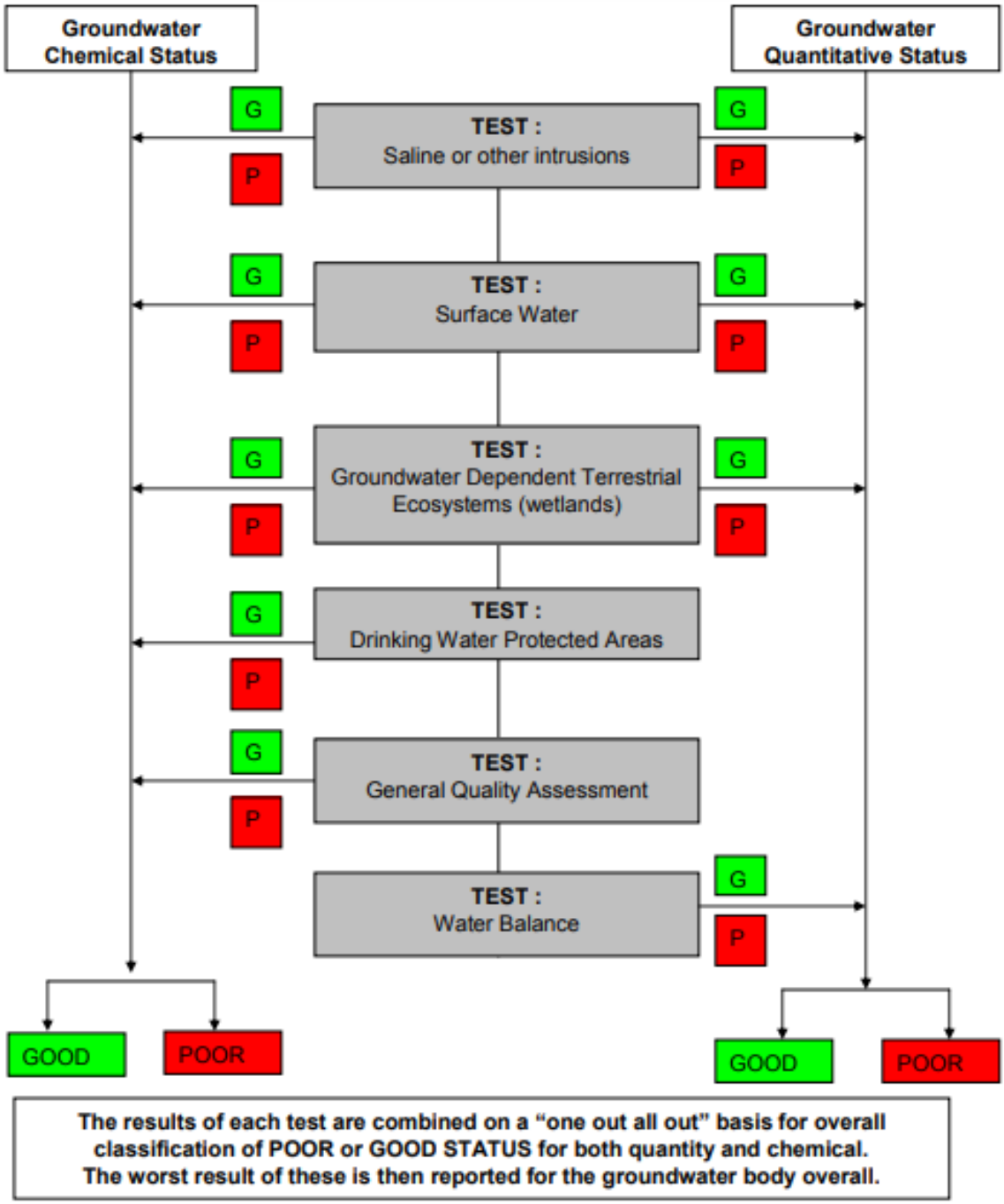
dissolved oxygen, phosphorus and ammonia. The physicochemical elements can only influence an overall waterbody status from 'Moderate' through to 'High'.

- **Specific pollutants**: This test is designed to assess compliance with environmental standards for concentrations of specific pollutants, such as zinc, cypermethrin or arsenic. As with the physicochemical test, the specific pollutant assessment can only influence an overall waterbody status from 'Moderate' through to 'High'.
- **Hydromorphology:** For natural, non-HMWBs, this test is undertaken when the biological and physicochemical tests indicate that a waterbody may be of 'High' status. It specifically assesses elements such as water flow, sediment composition and movement, continuity, and structure of the habitat against reference or 'largely undisturbed' conditions. If the hydromorphological elements do not support High status, then the status of the waterbody is limited to 'Good' overall status. For artificial or HMWBs, hydromorphological elements are assessed initially to determine which of the biological and physicochemical 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 physicochemical elements of a waterbody 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 Diagram 2.2.

Diagram 2.2: WFD Classification Elements for Groundwater waterbody Status



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:

- **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.
- **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.
- **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).
- **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:

- **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.
- **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.
- **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).
- **Drinking Water Protected Areas**: This test is designed to identify groundwater bodies failing to meet the drinking water protected area objectives defined in Article 7 of the WFD or at risk of failing in the future.
- **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 Defining no deterioration

3.1.1 New developments must avoid causing deterioration of the ecological status, ecological potential and chemical status of surface water and the qualitative status and quantitative status of groundwater.

3.1.2 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 in July 2015 (Ref 16), this has been redefined. The Court of Justice of the European Union ruling clarified that:

- 'Deterioration of the status' of the relevant waterbody includes a fall by one class of any element of the 'quality elements' even if the fall does not result in the fall of the classification of the waterbody as a whole;
- 'Any deterioration' in quality elements in the lowest class constitutes deterioration; and
- 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.

3.1.3 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.

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

- **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 physicochemical elements, including those for the Moderate/Poor and Poor/Bad boundaries.
- **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 waterbody's overall status is not High;
  - The RBMP has not set an objective for the waterbody 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.

3.1.5 The no deterioration baseline for each waterbody is the status reported in Annex A.

3.2 Surface water assessment

3.2.1

3.2.2 Table 3.1 presents the matrix used to assess the effect of the Scheme on surface water status or potential class. It ranges from a major beneficial effect (a positive change in overall WFD status) through no effect, to deterioration in overall status class. The colour coding used in

3.2.3 Table 3.1 is applied to the spreadsheet assessment in Annex B.

Table 3.1: 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.

3.2.4 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.

3.3 Groundwater assessment

3.3.1 Table 3.2 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 3.2 is applied to the spreadsheet assessment in Annex B.

Table 3.2: 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

3.4 Future status objective

3.4.1 RBMPs are used to outline waterbody pressures and the actions that are required to address them. The future status objective assessment considers the ecological potential of a surface waterbody and the mitigation measures that defined the ecological potential. Assessments undertaken for the Scheme are based on mitigation measures defined in the 2015 RBMP. Information on WFD measures available on the Environment Agency website (accessed May 2019) has also been reviewed. The assessment considers whether the Scheme has the potential to prevent the implementation or impact the effectiveness of the defined measures.

3.5 Article 4.7 derogations

3.5.1 Article 4.7 of the WFD allows derogation from the Directive but only where new modifications to the physical characteristics of a surface waterbody or alterations to

the level of bodies of groundwater, or for deterioration from high to good status have occurred, and when the following four stringent tests have been met:

- Test (a): All practicable steps are to be taken to mitigate the adverse impacts on the waterbody concerned.
- Test (b): the reasons for modifications or alterations are specifically set out and explained in the RBMP.
- Test (c)(1): There is an overriding public interest in the proposed development and/or Test (c)(2): its benefits outweigh the benefits of the WFD objectives (i.e. that the benefits of the project to human health, human safety or sustainable development outweigh the benefits of achieving the WFD objectives).
- Test (d): The benefits of the project cannot be achieved by a significantly better environmental option (that are technically feasible and do not lead to disproportionate cost).

3.5.2 In addition, the Scheme must not permanently exclude or compromise achievement of the WFD objectives in other bodies of water within the same RBD and must be consistent with the implementation of other EU environmental legislation (Article 4.8). In applying Article 4.7, steps must also be taken to ensure the new provisions guarantee at least the same level of protection as the existing EU legislation (Article 4.9).

3.6 Limitations and assumptions

3.6.1 The assessment has been undertaken using available data and Scheme design details at the time of writing in October 2019.

3.6.2 The Highways England Water Risk Assessment Tool (HEWRAT) assessment uses information from water quality samples obtained from potential receiving watercourses. Refer to Appendix 13.3 [TR010054/APP/6.3].

3.6.3 The assessment has been undertaken with reference to the baseline data, information and records pertaining to the water quality derived from desk study sources. These were subsequently validated and enhanced through field surveys where land access was obtained from landowners.

3.6.4 The assessment is based on the best available water quality data provided by the Environment Agency (for Saredon Brook only), supplemented by monitoring undertaken between February 2019 to November 2019 (see Appendix 13.5 of the ES [TR010054/APP/6.3]). Where access and flow in the channel permitted, samples have been collected on four occasions. The data from these samples represents that at the time of the sampling only and the prevailing conditions at that time. Water quality will vary constantly and over time and thus this data only provides an indication of ‘snap-shot’ of water quality. However, some data was required to inform aspects of the HEWRAT and Metal Bioavailability Assessment Tool (M-BAT) assessments and this number of samples was considered appropriate.

3.6.5 In the absence of background or field monitoring water quality data for Watercourses 1 and 7 (due to the watercourses being dry during monitoring visits), it is assumed that the data from Watercourse 2 is comparable, based on its nearby catchment location and proximity, land use, topography and geological factors. The sampling

point for Watercourse 2 is also upstream of the assessment location for Watercourse 7. All three watercourses share the same underlying superficial and solid geology, with similar mainly rural catchments, with some inputs from the transport network. The baseline data and records obtained are considered to be a snapshot of conditions present at the time of sampling, but it is considered that these would represent an approximation of the conditions that would exist at the point of commencing Scheme construction.

3.6.6 Determination of Q95 low flows (i.e. the flow predicted to be exceeded 95% of the time) has been calculated by a desk-based exercise using catchment data and Wallingford Hydrosolutions Ltd LowFlows software. These are estimates of the Q95 flow and do not take account of the increasing proportional variability between the natural flow and the artificial influences, such as abstractions, discharges and storage changes as the river flow diminishes. However, this is the most robust data available to inform the assessment.

3.6.7 Estimates of channel width used in the assessments have been based on estimations obtained during a combination of site visit undertaken on 25 July 2019, and from online aerial imagery. Channel width, form and gradient have not been surveyed.

3.6.8 The expected treatment performance of different SuDS options are based on advice reported in the DMRB CG 501 (Ref. 1) and HD103/06 (Ref. 2). These are estimates and professional judgement has been used when deciding what percentage treatment a particular option may provide, taking into account the design of the SuDS feature and whether it is considered to be ‘optimum’ or ‘sub-optimum’ due to other constraints.

3.6.9 It is assumed in the assessment that all SuDS and drainage networks will be fully maintained and managed as per standard guidance and practice. Requirements for maintenance and management of vegetated drainage systems are described in HD103/06 (Ref. 2).

3.6.10 The routine runoff and spillage risk water quality risk assessment is based on traffic data modelled for the Scheme. Assumptions would be used in this traffic modelling and these are not repeated in this Appendix.

3.6.11 All of the existing outfalls used within the assessment have been assumed based on the existing data available, topography, and presence of watercourses. It has also been assumed that the outfall from the existing M54 east and west carriageway drainage outfalls to Watercourse 7. This is based on topography and aerial mapping at this stage. A drainage survey has been commissioned to confirm this assumption, but results were not available at the time of writing.

3.6.12 It has been assumed that all construction works would take place in accordance with best practice. This best practice, including implementation of a Construction Environmental Management Plan (CEMP) and Water Management Plan (WMP) and all construction mitigation measures are described in greater detail in the Environmental Statement, Chapter 13: Road Drainage and the Water Environment [TR010054/APP/6.1] and the Outline Environmental Management Plan (OEMP) [TR010054/APP/6.11].

4 Baseline conditions

4.1 Study area

4.1.1 The study area for the WFDa is defined as the area up to and within 1 km of the Scheme boundary to identify water bodies that could reasonably be affected by the Scheme, refer to Figure 13.1 [TR010054/APP/6.2].

4.1.2 Watercourse flow impacts may propagate downstream, where they can impact other waterbody attributes or contribute to changes in flood risk, so where relevant the assessment also considers waterbody attributes within a wider study area of up to 2 km downstream of the Scheme boundary.

4.1.3 The study area includes the following WFD surface water catchments and groundwater bodies:

- Saredon Brook from Source to River Penk (GB104028046740);
- Penk from Source to Saredon Brook (GB104028046680);
- Staffordshire and Worcestershire Canal (GB70410266);
- Staffordshire Trent Valley – Permo Triassic Sandstone Staffordshire WFD groundwater body (GB40401G300500); and
- The northern section of the study area is within the Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures WFD groundwater body (GB40402G300300).

Catchment characteristics

Topography and land use

4.1.4 Topographic data for the study area has been obtained from online Ordnance Survey maps (Ref 3). The study area slopes from 190 m Above Ordnance Datum (AOD) just south of the M54 Junction 1 towards the Latherford Brook to the north, which flows beneath the M6 to the east of Brookfield Farm (SJ 95930 06067). Latherford Brook flows from close to the south-east of the M6 Junction 10a, and after initially flowing north-east beneath the M6 it then returns under the M6 south of Junction 11 and flows towards the north-west. At the point Latherford Brook passes the M6 south of Junction 11, the elevation is between 130 m and 125 m AOD. The land rises to the west of the brook, towards the village of Shareshill (approximately 135 m AOD). To the north of the brook land rises towards Saredon Hill (154 m AOD) and Great Saredon (135 m AOD), and to the east of the brook the land rises towards Holly Bush Farm (158 m AOD). Westwards from M54 Junction 1 to M54 Junction 2 the topography slopes down towards the west from approximately 134 m AOD to 106 m AOD.

4.1.5 The Scheme crosses an area of predominantly agricultural land comprising arable and livestock fields (sheep and equine pasture). There are also some small urban land uses to the west around Featherstone, Hilton and the village of Shareshill. In addition, Millride Country Sports Fishery and equestrian centre located adjacent to the southern extent of the study area, whilst Hilton Hall and Park, is situated adjacent to the east of the study area.

4.1.6 Rainfall data has been collected from an automatic weather station at Penkridge, 8 km north-east of M6 Junction 11 (NGR SJ 923 141) for the period 1981-2010. The weather station recorded an average of 681 mm of rainfall per year, which is relatively low for the UK, with it raining more than 1 mm on around 125 days per year (Diagram 4.1). The average rainfall varies throughout the year, with the wettest period being autumn-winter and driest in late winter and early spring.

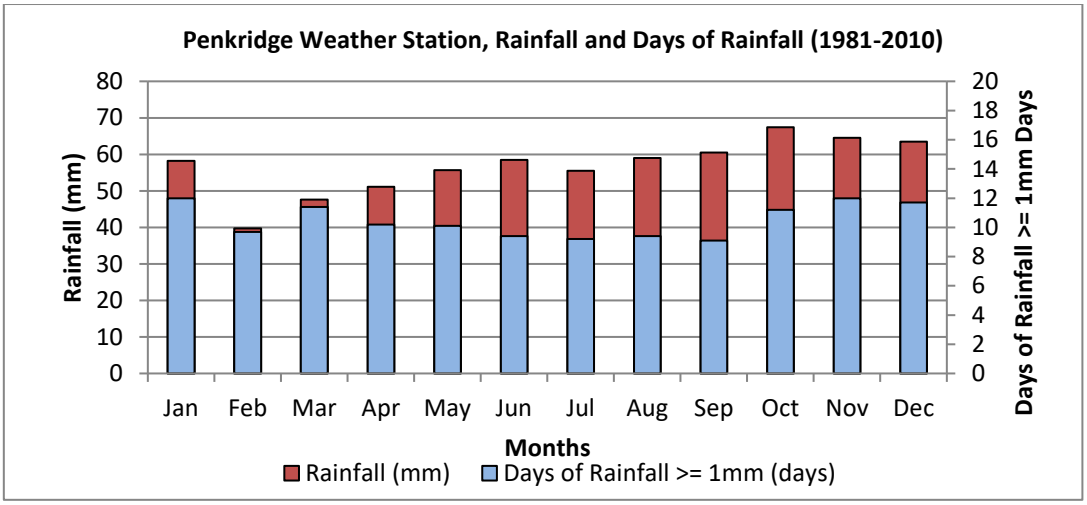


Diagram 4.1: Penkridge Weather Station, Rainfall and Days of Rainfall

4.1.7 The same Met Office (Ref 4) weather station at Penkridge reports that the study area generally gets around 47 days of frost (air) each year distributed evenly across December, January and February, with occasional days of frost in March, April, October and November (Diagram 4.2). 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 December, January and February, although typically de-icant may be applied whenever the temperature is around 4°C or below.

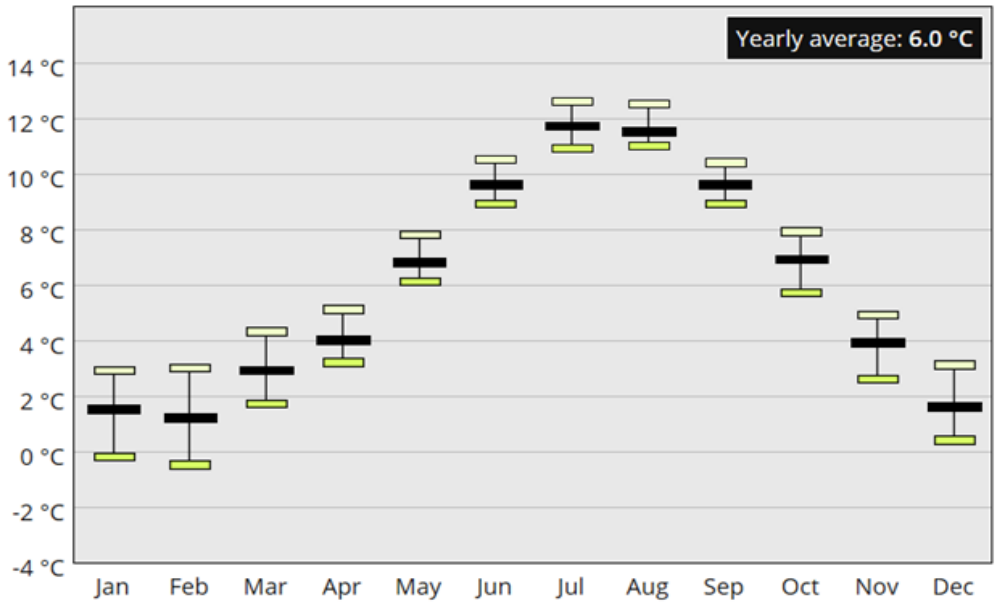


Diagram 4.2: Penkridge Weather Station, Minimum Air Temperature

Published geology

4.1.8 The British Geological Survey (BGS) maps (Ref 18) indicate that the majority of the study area is underlain by Devensian Till – Diamicton described by the BGS as "variable lithology, usually sand, silty clay with pebbles, but can contain gravel rich, or laminated sand layers; varied colour and consistency". A strip of Alluvium associated with the Latherford Brook and Watercourse 4 runs north-east to south-west across the A460 and M6. The Alluvium is described as "normally soft to firm consolidated, compressible silty clay, but can contain layers of silt, sand, peat and basal gravel. A stronger, desiccated surface zone may be present". No superficial deposits are present in areas around the Tower House Farm (North of M54), Rosemary House (on Hilton Lane) and the immediate south of the Alluvium strip.

4.1.9 The BGS maps (Ref 19) indicate that the majority of the study area is underlain by the Chester Formation (Sandstone and Conglomerate Interbedded) of the Sherwood Sandstone Group. To the east of the M54 Junction 1 a relatively thin strip of the Chester Formation (Mudstone) crosses the M54 in a north to south orientation, overlying the interbedded Sandstone and Conglomerate. The Chester Formation in the West Midlands area generally comprises conglomerates and reddish brown, cross-bedded, pebbly sandstones with subordinate beds of red-brown mudstone. The BGS website (Ref 18) describes this formation as "pebble conglomerates and reddish-brown sandstones. The sandstones are cross-bedded and pebbly. The conglomerates have a reddish brown sandy matrix and consist mainly of pebbles of brown or purple quartzite, with quartz conglomerate and vein quartz".

4.1.10 Sections of the Scheme alignment (to the south-east of Dark Lane and the south-east of the Brookfield Farm) are underlain by Clent Formation and Enville Formation (Undifferentiated) - Mudstone and Sandstone described by the BGS (Ref 19) as "Breccia, sub-angular, with red-brown mudstone matrix, clasts predominantly volcanic rock and subordinate Lower Palaeozoic rocks. Red pebbly mudstone and

sandstone in Wolverhampton area and Red mudstone and red-brown, fine to coarse grained sandstone, locally pebbly, and lenticular beds of conglomerate. Sandstone mostly sublitharenite; conglomerate clasts mostly Carboniferous limestone and chert".

4.1.11 The small section of the proposed Scheme along the A462 (east of M6) is underlain by the Halesowen Formation (Mudstone, Siltstone and Sandstone).

4.2 Waterbodies

4.2.1 There are eleven watercourses, nine other surface waterbodies (i.e. ponds) and two groundwater bodies within the 2 km study area, illustrated on Figure 13.1 [TR010054/APP/6.2]. This section provides details of the waterbodies located within the study area with a summary provided in Table 4.1.

Watercourses

4.2.2 Watercourse 1 is a minor watercourse approximately 600 m in length that flows in a south-east to north-westerly direction, having risen from its source approximately 0.5 km to the south of M54 Junction 1. It flows beneath the M54 and joins an unnamed watercourse (Watercourse 2) to the south of Featherstone. A review of online Ordnance Survey and historic maps (Ref 3) suggests that the watercourse may have been modified (straightened).

4.2.3 Watercourse 2 has its source to the east of M54 Junction 1 close to Tower House Farm. It has a narrow channel and stream corridor that has been previously re-profiled with evidence of the new channel cutting down into the soft substrate (Photo 1 and 2). The watercourse is culverted beneath the A460 (Photo 2) and flows westward along the southern border of Featherstone. Watercourse 1 joins from the south at the south-west corner of Featherstone. From this confluence, the watercourse continues in a generally easterly direction with Watercourse 7 flowing into it from the south to the east of the Railway Line. Continuing from this confluence, the watercourse crosses beneath the Staffordshire and Worcestershire Canal before joining the Watershed Brook. This then discharges into the River Penk to the south-west of Coven.

Photo 1: Upstream view of Watercourse 2 from the A460

Photo 2: View of the culvert beneath the A460, Watercourse 2

4.2.4 Watercourse 3 flows from the Lower Pool area, alongside Dark Lane in a westerly direction, before being culverted under the A460, and alongside the Kings Pool Fishery. After this is continues westwards towards Featherstone Lane before again flowing north-west towards the direction of the Staffordshire and Worcestershire Canal. It is shown as crossing the canal within a culvert on Ordnance Survey mapping. Watercourse 3 is an ephemeral watercourse. The flow within the channel is ephemeral and as such there is evidence of deposition and ponding (Photos 3 and 4).

Photo 3: View of the channel showing limited flow and fine sediment substrate

Photo 4: View of exposed section of coarse gravel on the stream bed

4.2.5 Watercourse 4 rises to the east of the Hilton Park ponds and flows north and north-east to cross Hilton Lane, before changing direction towards the north-west where it passes through the Fishing Ponds east of Brookfield Farm and then flows in a culvert under the A460. The watercourse continues towards the north-west to meet Watercourse 5 to the north-east of Shareshill and south of Little Saredon. The channel is relatively straight and heavily modified in places due to the presence of several culverts. The bed is composed of gravel deposits with a veneer of fine sediments deposited on top (Photo 5) with some deposits of larger coarser material also present within the channel (Photo 6).

Photo 5 View of a poorly developed pools containing fine sediments

Photo 6 Lateral gravel bars evidence of active sediment transport, with poorly developed intervening pools containing fine sediments

4.2.6 Latherford Brook (Watercourse 5), is a tributary of the Saredon Brook, and is designated under the WFD as 'Saredon Brook from Source to River Penk' (GB104028046740) within the Humber River Basin District. The source is close to the M6 Junction 10a and it flows to the north-east beneath the slip roads at Junction 10a and to the east of the Hilton Park Services. The watercourse then flows to the north-west and crosses beneath the M6 approximately 600 m south of Junction 11. It continues north-west beneath the A460 before passing the village of Shareshill on its northern side. It then discharges into Saredon Brook at grid reference SJ 92830 08220. The channel bed is composed of a primarily coarse material with the largest material forming gravel bars within the channel (Photo 7). There are some deposits of finer material within the channel too (Photo 8). The water appeared slightly opaque with some signs of pollution.

Photo 7 Gravel bars were present within the channel

Photo 8 Deposits of fine sediment were noted at the foot of the river embankment

4.2.7 Watercourse 6 has its source to the east of M6 Junction 11 and Laney Green. It flows in a north-west direction, passing beneath the A460 and the M6 Toll before taking a more northerly direction, crossing Saredon Road. It continues north to

discharge into Saredon Brook north of Wood Lane. The watercourse was ephemeral in nature and deposits of finer sediment within the channel suggested deposition processes operate within this channel. The channel appeared very deep, with steep sided embankments (Photo 9).

Photo 9 Straight channel with steep sides implying the channel has been heavily modified. Evidence of depositional processes operating within the channel.

4.2.8 Watercourse 7, a tributary of the River Penk (from Source to Saredon Brook), rises alongside the railway tracks east of the Wolverhampton Business Park, situated south of the M54 Junction 2. It flows in a northwards direction, crossing beneath the M54 continuing alongside the railway tracks for approximately 510 m before discharging into Watercourse 2.

4.2.9 Watershed Brook (Watercourse 8), rises from the Moseley Fish Pond approximately 1.3 km south-west of the M54 Junction 1. From the Moseley Fish Pond the watercourse flows in a westerly direction towards the residential area of Bushbury where the watercourse eventually becomes culverted and diverted to the Ford Houses Industrial Estate. The watercourse passes under the Staffordshire and Worcestershire Canal and flows in a north-westerly direction before discharging into the River Penk at a point approximately 4 km north-west of the Scheme. As this point is beyond the boundaries of the 2 km study area and the watercourse is not anticipated to be directly or indirectly impacted by the Scheme, Watercourse 8 has therefore not been assessed any further.

4.2.10 The River Penk is a designated watercourse under the WFD as ‘Penk from Source to Saredon Brook’ (GB104028046680) within the Humber River Basin District. At its closest point, the River Penk is 2 km from the Scheme boundary.

4.2.11 Saredon Brook is a designated WFD waterbody classified as ‘Saredon Brook from Source to River Penk’ (GB104028046740). The source of the brook is several

kilometres east outside of the study area. The watercourse enters the study area approximately 2 km south-east of the M6 Junction 11 and flows west across the study area, through several agricultural fields and under several B-roads before crossing beneath the M6 itself, approximately 1.9 km north-west of the northern extent of the Scheme. From this point the watercourse continues to flow east until it discharges into the River Penk outside of the study area.

4.2.12 The Staffordshire and Worcestershire Canal is located 250 m west of the western extent of the Scheme boundary located to the west of M54 Junction 2. It has an approximate north to south alignment and is a designated as the 'Staffordshire and Worcester Canal, summit to Lower Penn' artificial waterbody.

Other surface water bodies

4.2.13 Pond 1 (Tower House Farm Pond) is a pond measuring approximately 5,074 m^2 located 150 m north-east of the current M54 Junction 1, west of Tower House Farm. The Scheme would cross through the pond resulting in the loss of this pond. The pond feeds Watercourse 2, which would be culverted beneath the Scheme, but is not a WFD lake water body and therefore has not been considered any further in this assessment.

4.2.14 Kings Pools Fishery Ponds is a collection of seven fishing ponds approximately 480 m west of the Scheme, adjacent to the A460 Cannock Road. The largest pond measures 11,510 m^2 whilst the smallest pond measures 763 m^2. After discussion with the landowner it was confirmed that the pools are not connected to Lower Pool, a large pond within the grounds of Hilton Hall, approximately 300 m upstream. Although these ponds overflow to Watercourse 3. Kings Pools Fishery ponds, they are not a WFD lake waterbodies body and therefore have not been considered any further in this assessment.

4.2.15 Pond 2 (Lower Pool) is part of the collection of ponds along Watercourse 3 that also includes three further ornamental and fishing ponds to the west of Hilton Hall. Lower Pool is divided into a south-western and north-eastern section with a bridge structure crossing between the two areas. The Scheme would intercept the south-western section of Lower Pool.

4.2.16 Chubb Angling Club Fishing Ponds are a set of fishing ponds located to the south-west of Hilton Hall. Adjacent to these ponds is Hilton Hall Pond, an ornamental pond formed from the old moat. Both sets of ponds are outside of the Scheme boundary and upstream (or gradient, in terms of groundwater) and thus would not be directly or indirectly impacted by the Scheme. These ponds have therefore not been considered any further in this assessment.

4.2.17 Brookfield Fishery and the fishing ponds east of Brookfield Farm are located approximately 615 m and 710 m south of the M6 Junction 11 respectively. Pond 3 is the southern fishery pond. Brookfield Fishery is outside of the Scheme boundary, but the fishing ponds east of Brookfield Farm are located within the footprint of the Scheme and as a result the Scheme would result in the total loss of one of these ponds and the partial loss of a second pond. Two ponds would therefore be lost.

4.2.18 Millride County Sports Fishery is a collection of eight lakes located adjacent to the south of the M54, south-east of Junction 1. These ponds are located outside of the

Scheme boundary and have no connectivity to the Scheme. Therefore, these ponds have been scoped out of any further assessment.

4.2.19 There are some Former sand and gravel pits are located 380 m south-east of M54 Junction 1. These ponds are located outside of the Scheme boundary and are not hydrologically connected to the Scheme. For this reason, the ponds have been scoped out of the assessment.

Groundwater bodies

4.2.20 The Environment Agency Catchment Data Explorer website (Ref 5) indicates that a section of the southern half of the study area lies within the Staffordshire Trent Valley – Permo Triassic Sandstone Staffordshire WFD groundwater body (GB40401G300500).

4.2.21 The northern section of the study area is within the Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures WFD groundwater body (GB40402G300300).

Summary of waterbodies and relevance to this WFD assessment

Table 4.1 provides a summary of all waterbodies identified within the study area, whether they are designated WFD waterbodies or associated with a WFD designated waterbody, and whether they have been considered further in this assessment or not by virtue of direct or indirect WFD designation and applying the source-pathway-receptor model approach.

Table 4.1: Summary of the waterbodies present within a 2 km radius of the Scheme

Waterbody	WFD waterbody / relation to WFD waterbody	Assessed?	Reason for scoping waterbody in/ out of further assessment
Watercourse 1	Tributary of Penk from Source to Saredon Brook (GB104028046680) waterbody.	Yes	Watercourse 1 would cross through the footprint of the Scheme beneath the existing M54 carriageway where works to widen the existing slip road would be undertaken. No direct impact on the waterbody.
Watercourse 2	Tributary of Penk from Source to Saredon Brook (GB104028046680) waterbody.	Yes	Watercourse 2 would be crossed by the Scheme and therefore would be directly impacted.
Watercourse 3	Tributary of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	Watercourse 3 would be crossed by the Scheme and therefore would be directly impacted.
Watercourse 4	Tributary of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	Watercourse 4 would be crossed by the Scheme and therefore would be directly impacted.

Waterbody	WFD waterbody / relation to WFD waterbody	Assessed?	Reason for scoping waterbody in/ out of further assessment
Latherford Brook Watercourse 5	WFD designated as part of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	Watercourse 5 would be crossed by the Scheme and therefore directly impacted.
Watercourse 6	Tributary of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	Watercourse 6 would cross through the footprint of the Scheme north-east of the M6 Junction 11.
Watercourse 7	Tributary of Penk from Source to Saredon Brook (GB104028046680) waterbody.	No	Watercourse 7 is currently culverted beneath the M54 east of the Junction 2. Signage works are proposed within this area but no physical impacts to the channel are anticipated. There is no hydrological connectivity to the upstream works.
Watershed Brook Watercourse 8	Tributary of Penk from Source to Saredon Brook (GB104028046680) waterbody.	No	This watercourse is outside of the Scheme boundary and there is no hydrological connectivity with the Scheme.
River Penk	WFD designated as Penk from Source to Saredon Brook (GB104028046680) waterbody.	Yes	The watercourse is 2 km downstream of the Scheme boundary but is hydrologically connected to the Scheme by several of its tributaries (i.e. indirect impacts only).
Saredon Brook	WFD designated as Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	The watercourse is hydrologically connected to the Scheme by several of its tributaries including Latherford Brook.
Staffordshire and Worcestershire Canal	WFD designated as Staffordshire and Worcestershire Canal, summit to Lower Penn (GB70410266) waterbody.	No	The canal has been scoped out of the assessment as no road drainage from the highway is directed to the canal nor would there be any physical works or additional crossings of the watercourse. The extension of the Scheme boundary to this watercourse is for road signage only.
Pond 1 (West of Tower House Farm)	Within the catchment of Penk from Source to Saredon Brook (GB104028046680) waterbody.	No	Although the pond would be lost as a result of the reconstruction of the M54 Junction 1 it is not associated with a WFD waterbody. The

Waterbody	WFD waterbody / relation to WFD waterbody	Assessed?	Reason for scoping waterbody in/ out of further assessment
			impact of the Scheme on this pond has been considered in the Environmental Statement [TR010054/APP/6.1].
Kings Pools Fishery ponds	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The pond lies outside of the Scheme boundary and would not be directly or indirectly impacted by the works.
Lower Pool (Pond 2)	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	Yes	The Scheme would cross through Lower Pool and although this is not a designated WFD lake waterbody, it is online with Watercourse 3 and therefore has been assessed as part of that watercourse.
Chubb Angling Club Fishing Ponds	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The ponds lie outside of the Scheme boundary and would not be directly or indirectly impacted by the works.
Hilton Hall pond	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The pond lies outside of the Scheme boundary and is upstream of any works.
Brookfield Fishery ponds (Pond 3) (west of Brookfield Farm)	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The four ponds are hydrologically connected Watercourse 4 but are not online. No assessment is proposed in this WFD assessment.
Brookfield Fishery ponds (north of Brookfield Farm)	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The pond is located south of Watercourse 5 and is located offline. The pond is not hydrologically linked to Watercourse 5. No assessment is proposed in this WFD assessment.
Fishing ponds east of Brookfield Farm (four ponds)	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The Scheme would cross through one of these fishing ponds, with the potential for the partial loss of a second pond. No assessment is proposed in this WFD assessment as the four ponds are not hydrologically connected to the water body.

Waterbody	WFD waterbody / relation to WFD waterbody	Assessed?	Reason for scoping waterbody in/ out of further assessment
Millride County Sports Fishery	Within the catchment of Saredon Brook from Source to River Penk (GB104028046740) waterbody.	No	The ponds lie immediately adjacent to the Scheme boundary but are not associated with any WFD waterbody or designated as a lake waterbody.
Former sand and gravel pits south of M54 Junction 1	Within the catchment of Penk from Source to Saredon Brook (GB104028046680) waterbody.	No	The pond lies outside of the Scheme boundary and would not be directly or indirectly impacted by the works.
Former sand and gravel pits south of M54 Junction 1	Within the catchment of Penk from Source to Saredon Brook (GB104028046680) waterbody.	No	The pond lies outside of the Scheme boundary and would not be directly or indirectly impacted by the works.
Groundwater	WFD designated as: Permo Triassic Sandstone – Staffordshire (GB40401G300500); and Mercia Mudstone East & Coal Measures(GB40402G300300)	Yes	These groundwater bodies underlie the Scheme.

4.3 WFD surface water bodies classification

4.3.1 WFD waterbodies within the study area are listed in Table 4.1 and shown on Figure 13.1 [TR010054/APP/6.2]. The 'Penk from Source to Saredon Brook' (GB104028046740) and 'Saredon Brook from Source to River Penk' (GB104028042571) are part of the Humber RBMP[1]. According to the Humber RBMP, the priority basin management issues to tackle within the Staffordshire Trent Valley Catchment include:

- point source discharges from water industry sewage works; and
- physical modification due to urbanisation, water storage, supply and flood protection; and diffuse pollution from agriculture.

4.3.2 The following sub-sections describe the current WFD classification for each designated waterbody. Please also refer to Annex A for further information on waterbody classification.

Penk from Source to Saredon Brook

4.3.3 The Environment Agency Catchment Data Explorer website provides details of WFD classifications, these are provided in Annex A (for the latest 2016 classification). Penk from Source to Saredon Brook is designated from its source at Wrottesley Lodge Farm, which is located north-west of Wolverhampton. The river flows in a north-easterly direction for 14.1 km covering a catchment area of approximately 6400 ha. The waterbody is located outside the Scheme boundary, but is

[1] 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.

hydrologically connected to Saredon Brook which is crossed by the M6, north of Junction 11. The waterbody is not designated as artificial or heavily modified and is at Poor Status overall (due to Ecological Status; Chemical Status is Good).

4.3.4 The Poor Ecological Status is due to the catchment having been designated as having 'Poor' biological elements, specifically in terms of fish, macrophytes and phytobenthos (combined). The physicochemical parameters phosphates and dissolved oxygen were also designated as 'Poor'. Invertebrates were also classified as Moderate Status.

4.3.5 Reasons for not achieving Good Status are reported to be:

- urban development providing physical barriers to ecology within the river (for example affecting fish movements) and urbanisation facilitating greater amounts of transport journeys (impacting the phosphate classification, invertebrates, macrophytes and phytobenthos combined classification and fish classification);
- continuous and intermittent sewage discharges (potentially affecting dissolved oxygen, macrophhytes and phytobenthos, and phosphate classification); and
- livestock proving a source of diffuse pollution (affecting macrophytes and phytobenthos, dissolved oxygen and phosphate classification).

4.3.6 Of these reasons for not achieving Good Status, those related to urban development are relevant to the Scheme, while those relating to sewage discharge and livestock are scoped out of further consideration.

4.3.7 Relevant Protected Areas include the Nitrate Vulnerable Zones; 308 (ID NVZ12SW013080), 594 (ID NVZ12SW015940) and 601 (ID NVZ12SW016010) and the area covered by River Sow and River Penk Urban Waste Water Treatment Directive (ID UKENRI153). A basic measure under the WFD are minimum standards for the provision of sewerage systems and sewage treatment. The Urban Waste Water Treatment Directive (91/271/EEC) aims to protect the environment from the adverse effects of urban waste water discharges and waste water discharges from certain industrial sectors. Waterbodies at risk of nutrient enrichment are identified under it. Similarly, waterbodies at risk from nitrate pollution (which also leads to unnatural eutrophication and poor raw water quality for abstraction) are designated under the Nitrates Directive (912/676/EEC) as Nitrate Vulnerable Zones.

4.3.8 Full details on the ecology baseline and potential impacts and effects are presented in Chapter 8: Biodiversity of the ES [TR010054/APP/6.1]. Aquatic surveys have been undertaken of six watercourses located within the vicinity of the Scheme, including fish and macroinvertebrate surveys along Watercourse 2 that ultimately flows into the River Penk. See Appendix 8.14 Aquatic Invertebrates, Fish and Macrophytes for detail of surveys [TR010054/APP/6.3].

4.3.9 The majority of fish captured during these surveys were common freshwater fish in the UK with no protected status. Bullhead were of interest and captured at Watercourse 2. This species is listed on Annex II of the EC Habitats Directive.

4.3.10 Although no species of conservation interest were recorded, Watercourse 2 supports a diverse macroinvertebrate community. In addition, Watercourse 2

supports macroinvertebrate communities adapted to relatively fast flowing conditions and are likely to be sensitive to pollution and sedimentation, as indicated by the high average score per taxa (ASPT) (5.1 to 5.3) and the proportion of sediment-sensitive invertebrates scores (indicative of 'Slightly sedimented' to 'Moderately sedimented' conditions).

4.3.11 No information was provided by the Environment Agency for proposed mitigation measures for improvement for this waterbody.

Saredon Brook from Source to Penk

4.3.12 Saredon Brook is a designated waterbody that rises at Wood Common, south-east of Fishley Lane and flows to the River Penk, north of the village of Coven. It is approximately 25 km in length with a catchment area of around 7050 ha. The brook is crossed by the M6 2.5 km north of the M6 Junction 11. It is a heavily modified watercourse and is classified as being at Moderate Potential (due to Moderate Ecological Potential; Chemical Status is Good).

4.3.13 The reason for not being at Good Ecological Potential are, invertebrates and not all mitigation measures being implemented. The Fish biological element is Good and the chemical priority / priority hazardous substances zinc, triclosan and copper are all at High status.

4.3.14 Fish survey data for the most recent survey undertaken in November 2018 was provided through consultation with the Environment Agency. The survey covered a length of 110 m from an upstream location (NGR SJ 96014 09010) to a downstream location (NGR SJ 95939 08990) west of Wedges Mill, approximately 1.6 km north of the northern extent of the Scheme boundary at the M6 Toll Junction T8. This catch recorded two brown trout (*Salmo trutta*), one chub (*Squalius cephalus*), two dace (*Leuciscus leuciscus*), 10 roach (*Rutilus rutilus*), five perch (*Perca fluviatilis*), one three-spined stickleback (*Gasterosteus aculeatus*), 20 bullhead (*Cottus gobio*), 20 minnow (*Phoxinus phoxinus*) and two stone loach (*Barbatula barbatula*). Bullhead is an Annex II species under the Conservation of Habitats and Species Regulations 2017.

4.3.15 Macroinvertebrate data was provided by the Environment Agency for sampling which took place on Saredon Brook (NGR SJ 96705 08838) (18th March 2015 and 8th September 2015). The samples were collected using the three minute pond net sampling method and had ASPT scores of 3.92 and 5.50 and Biological Monitoring Working Party (BMWP) scores of 51 and 99, respectively. March's sample scores suggest that Saredon Brook is moderately impacted by pollution whilst September's sample scores suggest that Saredon Brook is only slightly impacted by pollution. It is not known why there is such a wide variance between these two sampling dates and whether this reflects positive intervention and improvement in habitat conditions. The sampling location was approximately 1.3 km north-east of the Scheme at M6 Toll Junction T8.

4.3.16 Macrophyte survey data was also provided by the Environment Agency. The most recent survey was completed on 18 July 2016 at Wood Lane (SJ 96028 08996), approximately 1.4 km north of the M6 Toll Junction T8. Six functional groups were identified within the sample and a Mean Trophic Rank (MTR) score of 38.6 was

given, indicating that the waterbody at this location is likely to be eutrophic or at risk of becoming eutrophic (i.e. nutrient enriched). The River Macrophyte Nutrient Index (RMNI) score was 6.56, which is also indicative of nutrient enriched conditions.

4.3.17 Full details on the ecology baseline and potential impacts is presented in Chapter 8: Biodiversity [TR010054/APP/6.1]. This section provides a summary of information related to the baseline surveys which have been undertaken. See Appendix 8.14 Aquatic Invertebrates, Fish and Macrophytes for detail of surveys [TR010054/APP/6.3].

4.3.18 Aquatic surveys have been undertaken by the project for six watercourses located within the vicinity of the Scheme, including fish surveys along Watercourses 3 to 6 that are tributaries of Saredon Brook, and macroinvertebrate surveys on Watercourse 5 Latherford Brook. The results are summarised below.

4.3.19 The majority of fish captured at the running waterbodies were common freshwater fish in the UK with no protected status. Bullhead were of interest and captured at Watercourse 3 and 5 downstream of the Scheme boundary. These species are listed on Annex II of the EC Habitats Directive.

4.3.20 Brown trout, a BAP species, are known to be present within Watercourse 5. Fish are mobile species and their presence should be considered when developing mitigation options as they have the ability to move in to the Scheme boundary.

4.3.21 Watercourse 2 supports a diverse macroinvertebrate community. However, no macroinvertebrate species of conservation interest were recorded.

4.3.22 Watercourse 5 supports a moderate taxonomic diversity. However, no macroinvertebrate species of conservation interest were recorded.

4.3.23 Watercourse 2 and Watercourse 5 support macroinvertebrate communities adapted to relatively fast flowing conditions and likely to be sensitive to pollution and sedimentation, as indicated by the high ASPT (5.1 to 5.3) and the proportion of sediment-sensitive invertebrates scores (indicative of 'Slightly sedimented' to 'Moderately sedimented' conditions).

4.3.24 The reasons for not achieving Good Potential include:

- Point source pollution from intermittent and continuous sewage discharges associated with the water industry (affecting invertebrates, ammonia, phosphate, and dissolved oxygen classification).
- Diffuse pollution sources associated with livestock farming, urbanisation, transport drainage and industry (affecting invertebrates, dissolved oxygen, phosphate, and ammonia classification).
- Physical modification deriving from urban development (affecting invertebrate classification).

4.3.25 Of these reasons for not achieving Good Status, that relating to urban development are relevant to the Scheme, while those relating to sewage discharge and livestock are scoped out of further consideration.

4.3.26 Relevant Protected Areas include the Nitrate Vulnerable Zone 308 (ID NVZ12SW013080).

4.3.27 The Environment Agency has provided information on the planned improvement and mitigation measures they are considering to improve the status of this waterbody. These measures include:

- retain marginal aquatic and riparian habitats (channel alteration);
- preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone;
- preserve and, where possible, restore historic aquatic habitats;
- increase in-channel morphological diversity;
- operational and structural changes to locks, sluices, weirs, beach control etc;
- structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works; and
- educate landowners on sensitive management practices.

4.3.28 The operational and structural changes to locks, sluices, weirs and beach controls are specific measures at particular locations in the waterbody and are not relevant to this assessment, and so have been scoped out of further consideration. Similarly, educating landowners is not relevant to the assessment and is also scoped out.

4.4 WFD groundwater bodies classification

4.4.1 The Environment Agency Catchment Data Explorer website (Ref 5) indicates that a section of the southern half of the study area lies within the Staffordshire Trent Valley – Permo Triassic Sandstone Staffordshire WFD groundwater body (GB40401G300500). Under the 2016 Cycle 2 classification this has an overall Waterbody Status of 'Poor'. The quantitative and chemical classifications are both also Poor. According to the Environment Agency's Catchment Data Explorer website (Ref 5) the reasons for not meeting Good Status include: Surface and groundwater abstraction; poor nutrient management; and a point source from an abandoned mine (it is not known if this is within the study area or elsewhere given the large size of this groundwater body).

4.4.2 The northern section of the study area is within the Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures WFD groundwater body (GB40402G300300). This has an overall waterbody classification for 2016 of 'Good', including 'Good' quantitative and chemical status.

Hydrogeology

4.4.3 The BGS online maps (Ref. 18) indicate that the majority of the study area is underlain by the Chester Formation (Sandstone and Conglomerate Interbedded) of the Sherwood Sandstone Group. The Environment Agency describes Principal aquifer as 'layers of rock or drift deposits that have high intergranular and/or fracture permeability - meaning they usually provide a high level of water storage. They may support water supply and/or river base flow on a strategic scale. In most cases, principal aquifers are aquifers previously designated as major aquifer'. The eastern part is underlain by the Clent and Enville Formation which comprises interbedded layers of mudstones and sandstones. These are designated as Secondary A aquifer which are described by the Environment Agency as 'permeable layers capable of supporting water supplies at a local rather than strategic scale, and in some cases

forming an important source of base flow to rivers. These are generally aquifers formerly classified as minor aquifers'.

4.4.4 The overlying superficial deposits across the study area comprises Alluvial deposits (designated Secondary A aquifer) and these are present in the vicinity and along the course of Latherford Brook. The remainder of the study area is a mix of Secondary (undifferentiated) aquifer (Devensian Till) and unproductive strata. The Environment Agency assign Secondary (undifferentiated) aquifers in cases where it has not been possible to attribute either category A or B to a strata type. In most cases, this means that the layer has previously been designated as both minor and non-aquifer in different locations due to the variable characteristics of the strata type. Unproductive strata are defined as rock layers or drift deposits with low permeability that has negligible significance for water supply or river base flow.

4.4.5 There are no groundwater Drinking Water Safeguard Zone or Protected Areas in the 1 km study area, or within a 2 km study area.

4.4.6 There are seven groundwater abstractions within the 2 km of the study area (Figure 13.1 [TR010054/APP/6.2]), four for spray irrigation (A3, A4, A5, A6), one for industrial process water (A3) and two private water supplies (A8, A9). These are also shown on Figure 13.1 [TR010054/APP/6.2].

4.4.7 The two private water abstractions are a well (A8) at Latherford Farm, Shareshill located 1.7 km north-west of the A460, and a spring (A9) at Saredon Hall Farm located over 1.4 km north of the A460.

4.4.8 There are two further groundwater abstractions beyond the 2 km study area which have been included here for information. These are for public and general water supply abstractions (A1 and A2), and are approximately 3.4 km and 2.7 km from the study area.

4.4.9 The study area is not within a groundwater source protection zone (SPZ) for a public water supply source, but land to the west of Featherstone (approximately 1 km to the west of the Scheme) is designated as a SPZ3 (i.e. total catchment - defined as the area around a source within which all groundwater recharge is presumed to be discharging at the source). This abstraction is for a public water supply borehole at Slade Heath, approximately 3.3 km north-west of M54 Junction1.

Table 4.2: Summary of WFD waterbodies located within the study area.

Type	WFD Classification	Waterbody Name / ID	Location
Surface WFD Waterbodies	River	Latherford Brook 'Saredon Brook from Source to River Penk' (GB104028046740)	The brook is currently crossed by the A460 Cannock Road near the M6 Junction 11. The Scheme would cross the river in this location to the east of the A460.
	River	River Penk Staffordshire and Worcestershire Canal 'Penk from Source to Saredon Brook' (GB104028046680)	The River Penk is located 1.7 km west of the eastern extent of the Scheme boundary at the M54 Junction 2. The river is hydrologically connected to the

Type	WFD Classification	Waterbody Name / ID	Location
			Scheme by Watercourse 2 which discharges into the River Penk.
	River	Saredon Brook	The brook is located 2.5 km north of the M6 Junction 11 where it is crossed by the M6.
	Canal	Staffordshire and Worcester Canal, summit to Lower Penn (GB70410266)	The canal crosses beneath the M54, 370 m west of the Scheme boundary at the M54 Junction 2.
Groundwater WFD Waterbodies	Groundwater	Staffordshire Trent Valley – Permo Triassic Sandstone Staffordshire (GB40401G300500)	A section of the southern half of the Scheme is underlain by this groundwater body (see Figure 13.1 [TR010054/APP/6.2])
	Groundwater	Staffordshire Trent Valley – Mercia Mudstone East & Coal Measures (GB40402G300300)	Northern section of the Scheme (see Figure 1)

4.5 Water quality and resources

Background water quality data

Surface water quality data were requested from the Environment Agency for all watercourses and ponds within the 2 km study area, with a response received on 11 December 2018. None of the watercourses within the Scheme boundary are currently monitored by the Environment Agency. Data was available for Saredon Brook and the River Penk. This data is provided in Table 4.3.

Table 4.3: Summary of water quality data for Saredon Brook (period 2017 – 2018)

Water Quality Parameter	Unit	EQS for Good Status)	Statistic	Saredon Brook (Saredon Brook from Source to River Penk (NGR: SJ9186602953
pH	pH Units	Good (5thP >6 to 95thP <9)	Mean average	7.21
			10% percentile	7.15
			90th percentile	7.27
Conduct-ivity @ 25C	uS/cm	N/A	Mean average	838.33
			10% percentile	780.20
			90th percentile	903.40
Water Temperature	°C	28 (98thP)	Mean average	11.6
			10% percentile	10.96
			90th percentile	12.16
Ammonia	mg/l	0.3 (90thP)	Mean average	<0.03
			10% percentile	<0.03
			90th percentile	<0.03
Nitrate	mg/l	N/A	Mean average	9.11
			10% percentile	8.96

Water Quality Parameter	Unit	EQS for Good Status)	Statistic	Saredon Brook (Saredon Brook from Source to River Penk (NGR: SJ9186602953
			90th percentile	9.23
Nitrite	mg/l	N/A	Mean average	0.008
			10% percentile	0.004
			90th percentile	0.013
Alkalinity to pH 4.5	mg/l	N/A	Mean average	246.67
			10% percentile	229.8
			90th percentile	267.4
Orthophosphate (reactive as P)	mg/l	0.0157 (based on 90 m altitude and 143 mg/l alkalinity)	Mean average	0.052
			10% percentile	0.021
			90th percentile	0.088
Dissolved oxygen	%	75% (10thP)	Mean average	86.7
			10% percentile	74.4
			90th percentile	102.8
Dissolved oxygen	mg/l	N/A	Mean average	9.83
			10% percentile	8.26
			90th percentile	11.34
Orthophosphate (reactive as P)	mg/l	0.0157 (based on 90 m altitude and 143 mg/l alkalinity)	Mean average	0.052
			10% percentile	0.021
			90th percentile	0.088
Dissolved oxygen	%	75% (10thP)	Mean average	86.7
			10% percentile	74.4
			90th percentile	102.8
Dissolved oxygen	mg/l	N/A	Mean average	9.83
			10% percentile	8.26
			90th percentile	11.34

4.5.1 Due to the different characteristics (including morphology, size and flow etc.) this data may not be wholly representative of all the waterbodies within the study area.

Water quality monitoring

Quarterly water quality monitoring has been undertaken for those watercourses (and some ponds) identified as being directly impacted by the Scheme or that would potentially receive highway runoff. To date, three water quality monitoring surveys

have been undertaken for five watercourses (4 March 2019, 4 June 2019 and 5 September 2019). The methodology for sampling is described in Section 3: Methodology. Table 4.4 provide a summary of the results collected to date whilst providing a qualitative comment of how this relates to the monitoring of Saredon Brook and WFD classification standards as described in The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015 (Ref 6).

Table 4.4: Summary of quarterly water quality monitoring (March - September 2019)

Water Quality Parameter	Unit	EQS for Good Status)	Statistic	Watercourse				
				2	3	4[2]	5	6
pH	pH Units	Good (5thP >6 to 95thP <9)	Mean average	8	7.67	7.93	7.87	7.65
Conductivity @ 25C	uS/cm	N/A	Mean average	762.7	617.7	910	910	2104
Water Temperature	°C	28 (98thP)	Mean average	16.8	14.2	12.3	14.2	14.2
Ammonia	mg/l	0.3 (90thP)	Mean average	0.03	0.36	0.04	0.06	0.18
Nitrate	mg/l	N/A	Mean average	44.97	19.9	21.1	22.5	28.4
Nitrite	mg/l	N/A	Mean average	0.03	0.027	0.02	0.09	28.4
Alkalinity to pH 4.5	mg/l	N/A	Mean average	199.33	233.7	218.5	20	0.36
Orthophos-phate (reactive as P)	mg/l	0.0157 (based on 90 m altitude and 143 mg/l alkalinity)	Mean average	0.04	0.03	0.004	0.05	<0.03
Dissolved oxygen	%	75% (10thP)	Mean average	77	47	N/A	77	88
Dissolved oxygen	mg/l	N/A	Mean average	7.5	5.1	N/A	8.3	9.3
Dissolved Copper	ug/l	10	Mean average	<3	4	<3	<3	4

[2] Note: Aaccess to Watercourse 4 was not available in September 2019

Water Quality Parameter	Unit	EQS for Good Status)	Statistic	Watercourse				
				2	3	4[2]	5	6
Dissolved Zinc	ug/l	7.8	Mean average	1.7	6.5	6.05	7.27	9.3

4.5.2 All monitored watercourses were generally neutral to slightly alkaline, with pH values falling in the range of 7.35 and 8.14. The three monitored ponds were also neutral, with pH values falling between 7.21 and 7.62.

4.5.3 Total water hardness (as calcium carbonate, $CaCO_3$) varied from a minimum of 178 mg/l at Watercourse 3 and Watercourse 4 in June 2019 to 329 mg/l in Watercourse 2 in September 2019. Total water hardness (as $CaCO_3$) values for the three ponds showed a smaller range with values ranging between 168 mg/l and 202 mg/l.

4.5.4 Data for Watercourse 2, Watercourse 5, Watercourse 6 and Pond 1 show these waterbodies to be well oxygenated with dissolved oxygen values ranging from 77% to 88%. Watercourse 3, which is downstream of Lower Pool, is not well oxygenated with the data showing saturation values of 47%.

4.5.5 Common indicators of sanitary pollutants include ammonia, nitrate, biochemical oxygen demand and chemical oxygen demand. Ammonia was generally low for each pond and watercourse, falling below the value used to indicate good WFD class or better (<0.6 mg/l). Watercourse 3 was the only exception, with markedly higher values of 0.37 mg/l (4 June 2019) and 0.67 mg/l (5 September 2019) of Ammonia recorded in June and September compared with other watercourses. This is reflected in the ammonia within the sampling of Pond 2: Lower Pool, which was 0.93 mg/l on 4 June 2019.

4.5.6 Pond 1, east of: Tower House Farm had ammonia concentrations of <0.03 mg/l (4 June 2019) and 0.05 mg/l (5 September 2019), and Pond 3 had an ammonia concentration of 0.03 mg/l on 4 June 2019 (with no access possible for the September monitoring).

4.5.7 Nitrate values varied across each watercourse with Watercourse 2 consistently recording the highest values with values ranging from 40.1 mg/l to 45.1 mg/l. With the exception of Watercourse 2, nitrate values were lower in September in comparison with March and June, possibly reflecting agricultural practices in the area. Nitrate values within the three ponds sampled were all at the limit of detection reflecting a disconnection between ponds and the surrounding farmland.

4.5.8 All monitored watercourses have instances of total cyanide above the WFD environmental quality standards (EQS), and this is usually related to industrial activities such as metal treatment. It can also be derived from de-icing agents, although the occurrence of cyanide was not limited to the winter months in these watercourses.

4.5.9 Total zinc levels recorded in Watercourse 3, Watercourse 4, Watercourse 5 and Watercourse 6 regularly exceeding the maximum allowable EQS values for zinc. Of the 11 samples taken on these watercourses, nine samples showed values that surpassed the EQS values. Values ranged from 665.3 ug/l to 10.8 ug/l across these

four watercourses. Total zinc levels in Watercourse 2 in contrast did not exceed the EQS values on any occasion to date.

4.5.10 The levels of numerous metals at Watercourse 3 were regularly reported as exceeding the maximum allowable EQS vales. Dissolved iron, dissolved manganese, dissolved zinc, total chromium, total copper, total iron, total lead, total manganese, total mercury, total nickel and total zinc all surpassed the EQS values at least once. Notably, total manganese and total iron levels surpassed the EQS vales in each sample taken to date.

4.5.11 Numerous metals were reported at levels greater than the annual average or maximum allowable EQS at Watercourse 6. Dissolved manganese, dissolved nickel, total chromium, total manganese and total zinc all surpassed EQS values once. Total copper and total iron surpassed the EQS values twice whilst total zinc has surpassed the EQS values in each of the three samples taken. June samples recorded considerably higher metal content than any other of the two samples taken.

Past pollution incidents

4.5.12 Details of pollution incidents as recorded on the National Incident Reporting Systems were provided by the Environment Agency for the period 2013 to 2019. Only five incidents were of note with regards to the water environment, all of which were category three minor incidents. These are:

- Pool Farm, Mill Ride Fishing Ponds area, incidents of ‘sewage’ reported on 28 June 2018, and 9 August 2018. These took place over 1 km from the Scheme boundary. For the August incident, there were no fish kills, and it was listed as minor incident which was reported anonymously. For the June incident, the fisheries manager was not aware of any issues.
- On Dark Lane, 27 July 2016, an incident was reported. This was attributed to ‘industry’ as the source.
- On 4 September 2017 in the area of the sand and gravel pits to the south of M54 Junction 1, there was an incident ‘likely related to sewage in the ponds’.
- On 10 September 2017, there was an accident on M54 Junction 1 which released a diesel spillage.

Water activity permits

4.5.13 Data provided by the Environment Agency indicate that there are seven discharge consents in the vicinity of the Scheme, refer to Figure 13.1 [TR010054/APP/6.2]. They relate to discharges from mineral extraction works into Watercourse 5 (D1 and D2); sewage treatment into Watercourse 5 (D3); intermittent discharges from the public sewer network into Watercourse 2 (D5 and D6); ‘undefined or other (east of the M6 Junction 11, unknown watercourse, D4) and waste management activities (D7) discharging approximately 2 km south of the centre of Junction 1 of the M54).

Existing highway outfalls

4.5.14 The Highways Agency HADDMS GIS Mapping website (Ref.10) indicates the location of existing road outfalls on the motorway network. Outfalls are categorised in order of their priority in terms of the pollution risk they present to the surface water

environment. There are numerous existing outfalls to Latherford Brook (Watercourse 5). Specifically, there are nine low priority outfalls mapped from the M54 slips roads as they meet the M6 Junction 10a. Adjacent to this are two moderate priority outfalls from the M6 to Latherford Brook. There is a further moderate priority outfall to this watercourse east of the Hilton Park Services and a further seven moderate priority outfalls between the service area and Junction 11 of the M6. There are two moderate priority outfalls and one low priority outfall to Watercourse 6 adjacent to the M6 Junction 11. There are also two moderate priority outfalls to Watercourse 1 to the west of M54 Junction 1.

Other protected areas

4.5.15 There is one statutory designated site within the study area, Stowe Pool and Walk Mill Clay Pit Site of Special Scientific Interest (SSSI), which is located 1.5 km east of the northern extent of the Scheme boundary. The site covers 3.12 ha and mostly consists of standing open water, which provides a habitat for white-clawed crayfish. The Stowe Pool and Walk Mill Clay Pit SSSI site is unlikely to be impacted as there is no hydrological connectivity between the watercourses within the Scheme boundary and the Clay Pit. Should groundwater provide a source of water for this SSSI, it is unlikely to be affected by the Scheme, due to its distance from the Scheme and its much lower ground elevation in comparison to the location of the Scheme. It is also anticipated that the Scheme is not likely to affect groundwater flows (as discussed in Section 6 of this appendix). Furthermore, there are physical barriers between the SSSI and the Scheme in the form of the M6 and M6 Toll.

4.5.16 The Lower Pool SBI has been taken into consideration in the assessment of impacts on the water body in terms of surface water pollution and morphological change. However, an investigation of pond sediments has been carried out (reported in Appendix 13.6 Sediment Sampling of Lower Pool [TR010054/APP/6.3]) and this showed that the pond is founded on clay-rich substrate restricting any connectivity with groundwater.

4.5.17 Brookfield Farm SBI is an area of wet woodland close to Watercourse 5 (Latherford Brook), and just east of the alignment of the Scheme. It is understood that the site has been drying out for unknown reasons. The SBI does inundate during flood conditions but during the highest frequency events (e.g. 1 in 2 year event), the change is almost imperceptible (see FRA presented in Appendix 13.1 [TR010054/APP/6.3]). The difference is slightly greater for the 1 in 20 year event, but this is not thought to be significant in habitat terms. Finally, during the 100 year plus 50 % climate change events the extent of flooding is significantly greater, but this frequency of event is unlikely to be a driver for the habitat types present.

4.5.18 From observations of groundwater monitoring within boreholes BH20, 21 and BH24 the gradient of the water table, and therefore, groundwater flow can be estimated. The groundwater gradient to the north of Latherford brook is from north to south and to the south of Latherford Brook is south to north. The hydraulic gradient in the area of Brookfields Farm SBI, which is south of Latherford Brook, will be towards the north and Latherford Brook. On this basis, no further assessment of the Brookfields Farm SBI is included in this assessment, as groundwater reaching the site will be from the south where no construction activities are taking place. Additionally, the Scheme will

be constructed on embankment through this area, and therefore there will be no impact to groundwater levels in this area. On this basis, no further assessment of the Brookfields Farm SBI is included in this assessment.

4.6 Future good status

Construction (2021-2024)

4.6.1 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 and with reference to WFD targets.

4.6.2 It is assumed that no other development within the study area would commence construction between now and the start of Scheme construction that has the potential to and approval to cause deterioration or prevent current WFD targets from being met. 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.

4.6.3 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.

4.6.4 Under the WFD, the Penk from Source to Saredon Brook has an objective of achieving 'Poor' (2015) whilst the Saredon Brook from Source to River Penk has an objective of achieving 'Moderate' (2015). Under these objectives, neither waterbody must suffer deterioration below these classifications.

4.6.5 In addition to these overall objectives, there are biological and chemical sub-element targets that exceed the existing overall objectives, which the Scheme will need to not prevent improving. Notably, the Penk from Source to Saredon Brook has a target to achieve 'Good' for macrophytes and phytobenthos (Combined), invertebrates, physicochemical quality and dissolved oxygen status by 2027, and a target of 'Good' Phosphate status by 2021. Saredon Brook from Source to River Penk similarly has an objective of achieving 'Good' biological quality elements, invertebrates, physicochemical quality and dissolved oxygen status by 2027.

4.6.6 In addition, the WFD groundwater bodies PT Sandstone Staffordshire and Merica Mudstone East and Coal Measures have objectives of 'Poor' (2015) and 'Good' (2015), respectively. Some chemical sub-elements of the groundwater body PT Sandstone have been targeted towards achieving 'Good' status by 2027. Quantitative dependent surface water waterbody status, chemical status, chemical drinking water protected area and chemical dependent surface water waterbody status have all been given a target of achieving 'Good' by 2027.

5 Potential Impacts

5.1.1 The introduction and/or modification of road infrastructure associated with the Scheme would potentially result in different types and durations of impact on waterbodies, during construction and operation of the Scheme. The following section describes the potential impacts in general before providing information on the scope for mitigation.

5.2 Construction

5.2.1 During the construction phase construction works may result in a reduction in water quality, both surface and groundwater, due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals, or through mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site run-off. Deterioration in water quality can also lead to adverse impacts on aquatic organisms and habitats.

5.2.2 Construction activities such as earth works, excavations, site preparation, levelling and grading operations result in the disturbance of soils. Exposed soil is more vulnerable to erosion during rainfall events due to loosening and removal of vegetation to bind it, compaction and increased runoff rates. Surface runoff from such areas can contain excessive quantities of fine sediment, which may eventually be transported to watercourses where it can result in adverse impacts on water quality, flora and fauna. Construction works within, along the banks and across watercourses can also be a direct source of fine sediment mobilisation.

5.2.3 Fine sediment fractions are of most concern in terms of water pollution as runoff laden with suspended particles may be readily created on construction sites, transported in site runoff, and eventually discharged either in a controlled or uncontrolled manner to watercourses and other water bodies, where adverse environmental effects may occur. Fine sediments in runoff may also be associated with chemical pollutants (for example, polycyclic aromatic hydrocarbons tend to have a strong affiliation to sediment particles or may leach metals into the runoff). Therefore, filtering and settling out fine sediment from construction site runoff prior to it being discharged to a water body will also contribute to the removal of other chemical pollutants that might be present.

5.2.4 Contamination of surface waters, groundwater and soil could result from leakage and spills of fuels, oils, chemicals and concrete during construction affecting watercourses indirectly via site runoff or directly where works are close to and within a water body. Groundwater may be at risk during piling, excavations or leaching through the soil. Contamination may reduce water quality (and potentially affect any water users) and impact aquatic fauna and flora.

5.2.5 Groundwater level and flow may also be impacted where excavations and cutting extend below the existing groundwater level. This has the potential to impact on baseflow to nearby watercourses.

5.2.6 Although only short term, temporary and intermittent deterioration of water quality would be expected during construction works, there is the potential for adverse impacts on aquatic organisms and habitats. Potential adverse effects may be acute

(i.e. very high concentrations persisting for a short time measured in hours) or chronic (lower concentrations but still above background and persisting over longer periods of time such as days, weeks and even months etc.) and typically include:

- direct physiological and behaviour effects on fish and other aquatic fauna;
- sedimentation of bed of watercourses, including macroinvertebrates and potentially macrophytes; and
- water quality impacts that may impact fauna and flora, commercial and recreational uses.

5.2.7 The presence of high levels of fine sediment in watercourses can have direct physiological and behavioural effects on fish and other fauna such as:

- direct mortality (although relationships are complex);
- reduced reproduction and growth through the degradation of spawning habitat/redds and smothering of eggs and yolk-sac fry;
- gill irritation / trauma;
- altered blood physiology;
- impeded fish movement; and
- altered foraging behaviour and reduced territory.

5.2.8 Sedimentation on the bed of watercourses or lakes may smother macrophytes, invertebrates and substrate important for fish and invertebrates (particularly fish spawning gravels). Fine sediment pollution can also have trophic effects on fish through changes in invertebrate communities in response to high and persistent sediment loads and effects on food sources.

5.2.9 Suspended solids reduce water clarity and increase turbidity, exerting a negative effect upon primary production. Suspended solids may also depress oxygen levels in the water by reducing the potential for plants to photosynthesise and exerting a Sediment Oxygen Demand.

5.3 Operation

5.3.1 Operational impacts of the Scheme are likely to include the following:

- impacts on the surface or groundwater quality from highway run-off (including the use of de-icants) or as a result of accidental spillages;
- changes in the natural form of the landscape, which may have a subsequent effect on surface water and groundwater drainage patterns, including adverse effects on local ecologically sensitive sites (including groundwater dependent terrestrial ecosystems);
- impacts and the loss of aquatic and riparian habitat along watercourses that are crossed by the Scheme; and
- impacts on hydraulic processes and sediment dynamics in watercourses and their floodplains potentially resulting in changes in hydromorphology.

5.3.2 Runoff pollution, in terms of runoff quality and quantity, can be increased by impermeable road surfaces and vehicle use. Highway runoff can include a range of

substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately, although generally where roads carry around 10,000 vehicles or more per day there is a risk that the water environment would be degraded. Common roadway pollutants include sediment, heavy metals, hydrocarbons, pesticides, de-icing salt and grit. Runoff rates and chemistry should be mitigated with SuDs, with a preference for surface attenuation and bioremediation.

5.3.3 The construction of new structures to cross watercourses or to discharge highway runoff can have a number of impacts on the hydromorphology of water bodies and aquatic ecosystems depending on the type of structure and their design. These include the following:

- **Scour**: can result from structural flow constrictions, which can affect site or nearby assets, maintenance requirements, and habitat continuity.
- **Direct loss or fragmentation of habitats:** can cause direct loss of riparian, bank and bed habitats, and indirect loss due to shading effects. Structures that cross watercourses can also sever longitudinal connectivity between upstream and downstream reaches and continuity of the channel with the riparian, floodplain, hyporheic and groundwater zones, and alter flow dynamics and sediment transport. Where possible and practical to do so clear-span structures should be recommended. If not, culverts should be sympathetically designed to minimise the adverse impact on the environment taking into account the scale, importance and sensitivity of the watercourse being culverted.
- **Excessive shading**: can affect fish habitat because it does not allow the growth of macrophytes, which are important parts of fluvial ecosystems and provide a source of cover for fish species, in addition to diversifying the channels flow characteristics (i.e. Pool riffle run), and also provide a food source for invertebrates that live among them. Furthermore, macrophytes provide suitable spawning habitat for coarse species. A reduction in light penetration due to excessive shading may also reduce the growth of macrophytes and therefore limits photosynthesis and the subsequent production of dissolved oxygen. Although fish may prefer shaded areas to excessive light penetration, which they use as a refuge, continuous excessive shading or structures that result a harsh contrast between light and dark areas are detrimental to habitat quality for fish. Resident and migratory fish species have also shown avoidance behaviour when negotiating dark tunnels possibly because they deem them unsafe to access because of the distinct light/dark interface, or they may be unaware there is habitat beyond the structure while the lack of cover within the culvert may cause avoidance in small fish species (Kemp et al. 2005) (Ref 7). 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. Light levels in box culverts are also typically greater than pipe culverts of a similar length because of the larger entrances.

5.3.4 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. The cost of waterbody crossing is often dependent on length, so the least expensive option is usually perpendicular to the waterbody crossing. This may require extensive realignments and training upstream and downstream. This could mean lengthening or shortening the waterbody and changing channel gradients, with direct changes to physical habitat areas, and consequent changes to hydraulic/substrate habitats in terms of changes to flow velocities and substrate erosion transport or deposition.

5.3.5 Finally, the construction of new cuttings has the potential to create new pollutant pathways to groundwater or affect groundwater availability and support for watercourse baseflow or GWDTEs through localised draw down of the water table.

5.4 Mitigation Measures

Construction

5.4.1 The Outline Environmental Management Plan (OEMP) [TR010054/APP/6.11] details the measures that would be undertaken prior to, and during construction of, the Scheme to mitigate effects on the water environment.

5.4.2 The OEMP includes an Outline Water Management Plan (OWMP) that provide details of the mitigation proposed for the following key areas of concern:

- managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations);
- measures to control the storage, handling and disposal of substances during construction;
- emergency procedure for how to respond to a serious pollution incident;
- the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes;
- the scope of any pre-, during, and post-construction water quality or other relevant environmental monitoring;
- measures to minimise impact on groundwater levels and flows across the study area; and
- details of what permits and consents are required for works to water bodies.

5.4.3 The Contractor will be responsible for preparing a full Water Management Plan and then to implement this during all works as required.

5.4.4 Chapter 8: Biodiversity of the Environmental Statement [TR010054/APP/6.1], and the OEMP [TR010054/APP/6.11] describe the ecological mitigation for the Scheme in detail. If there is a need to over-pump or flume Latherford Brook, Watercourses 2 and 3 (where bullhead have been identified) during the construction of the bridge or new culverts, a fish rescue and removal would need to be completed. In addition, areas of the Latherford Brook channel beyond the primary channel would need to be sectioned off with stop nets and fish captured within this area during the draw-down of water. Any water pumps used would need to be fitted with a fine mesh to

stop fish being pulled though the pump in addition to a fisheries consultant monitoring the area of the pump abstraction to reduce the risk of fish entrainment. Captured fish should be kept in aerated holding facilities on the river bank until all fish have been captured. The fish should then be moved upstream of the construction works (approx. 100 m) where they would not be impacted and then released safely in to the watercourse. The construction work should only go ahead when the fisheries team/Ecological Clerk of Works have approved that all fish have been removed and with the appropriate consents from SCC and the Environment Agency. If over-pumping/fluming is required, water would be returned to the channel in the shortest possible distance downstream to minimise the depleted reach.

Dewatering and Baseflow to Watercourses.

5.4.5 In order to minimise the impact of the dewatering on groundwater and surface water resources, a scheme of groundwater control would be implemented to ensure water levels in adjacent water bodies are maintained and any discharge is of a suitable quality. This would involve a programme of water monitoring and controlled discharges. It is proposed that four monitoring boreholes are drilled on the north-western and south-western boundaries of the borrow pit and another on the opposite side of the A460 between the upper pond of Kings Pool Fishery and the A460 and that gauge boards are installed in each of the fishery ponds and on Watercourse 3 adjacent to the borrow pit at least six months before any excavation starts at the borrow pit. Water level monitoring should be carried out in all of the boreholes and of the gauge boards to establish the natural fluctuations in groundwater, stream and pond levels. Dataloggers to facilitate continuous monitoring should be installed in the boreholes and in the upper fishery pond.

5.4.6 Once dewatering starts in the borrow pit, the water should be discharged following settlement to remove suspended solids, to Watercourse 3 adjacent to the south-western corner of the borrow pit to maintain the flow in the stream downstream of the site. In addition, it is likely that dewatering and discharge of water from the borrow pit may require an Abstraction Licence and a Water Activity Permit from the Environment Agency. Applications for these would be made following the DCO application.

5.4.7 It is also expected that temporary storage basins would be required on the site of the borrow pit in the event that there is a pump failure or discharge to Watercourse 3 is not possible. The storage basins would allow for the settlement of suspended fine sediment, and in combination with other measures (e.g. straw bales) the filtration of dewaters. The bed of the temporary storage basins should be above the maximum recorded groundwater levels. Multiple storage basins may also be required to maintain storage as they would silt up over time and a basin would need to be unused in order for this silt to be dried and removed. Other measures that could be used in combination with temporary storage may include lamella clarifiers and chemical dosing using flocculants.

Operation

5.4.8 Operation phase mitigation is embedded in the Scheme design as described in Section 1.2. The key elements that may result in adverse impacts on the water environment include runoff and spillage risk from the carriageway, and the

construction of new structures that may impact the form of waterbodies of the hydrological and sediment transport process that occur.

Highway Drainage

5.4.9 The proposed Drainage Strategy has been presented in Appendix 13.2 of the ES [TR010054/APP/6.3]. A combination of measures has been proposed to intercept surface water runoff from the carriageway including carrying runoff from the carriageway via a combination of road edge channels, gullies and combined kerb drainage units. The use of carrier pipes ensures spillages would be contained within the drainage system and would not infiltrate to ground close to source. Storage would be provided to include the 1 in 100 year flood event + 40% climate change through the provision of oversized pipes and attenuation ponds. The provision of wet attenuation ponds, swales, drainage ditches, filter drains and hydrodynamic vortex separator (HVS) would also provide treatment of the runoff. These treatment trains have been informed by a HEWRAT assessment, which is presented in Appendix 13.3 of the ES [TR010054/APP/6.3]. Where runoff from the highway is to discharge to a new outfall to a watercourse it is proposed to convey this runoff from the treatment train using a new ditch course, thus avoiding the need for new concrete headwalls. Land drainage would also be discharged into these ditches upstream of the outfall to the receiving watercourse, other than two outfalls to Latherford Brook where new engineered structures will be required.

5.4.10 Management of the proposed highway drainage system, including sustainable and proprietary measures, would be undertaken by Highways England and their management partners according to standard methods and operating protocols. Water quality monitoring is not considered necessary as the treatment train has been developed in accordance with a risk assessment following best practice guidance, for which the Environment Agency was involved in the development (i.e. HEWRAT and M-BAT). Water quality monitoring of highway outfalls is not something that is done routinely across the UK. However, the Environment Agency's own network of monitoring stations could potentially be used to detect if there are any changes once the Scheme has been constructed and opened to traffic.

Watercourse Crossings

5.4.11 A new 10 m clear-span bridge is proposed for the crossing of Latherford Brook, reflecting the need to minimise any impact on channel flow and sediment processes, as well as riparian habitat, of this more significant and naturally functioning watercourse. The justification for the size of the bridge span is discussed in more detailed in Section 6 of this report.

5.4.12 Other than Watercourse 5 (Latherford Brook), new culverts are proposed on some of the smaller and more minor watercourses in the study area. The length of watercourses are described in the bullets in paragraph 1.2.13. Two culverts are proposed on Watercourse 2 at approximately 182 m and 58 m in length. A new culvert would be provided on Watercourse 3 at approximately 60 m in length. Finally, a new culvert would be provided on Watercourse 4 at approximately 55 m in length. To minimise the impact of these, the invert of the culvert would be sunken beneath the existing bed level so that a naturalised bed can form through the structure and so that there are no gradient step changes that can impact flows (especially under

low flow conditions) or interrupt the transport of any coarse sediment or encourage erosion of the bed. Where possible existing structures have also been used.

5.4.13 It would be necessary to divert Watercourse 2 to ensure that the new culvert beneath the M54 Junction 1 is kept to a minimum length. The design of this diversion would be undertaken during the detailed design stage, but would be informed by hydromorphological and ecology surveys to ensure that where enhancement on the existing channel is possible this is provided.

5.4.14 Within the constraints of the Scheme, mitigation for the loss of aquatic habitats includes provision of 12 new ecological mitigation ponds and a total of 408 m of watercourse habitat (exceeding the 355 m of watercourses that would be culverted). This includes 32 m of new ditchcourse to Watercourse 2, 280 m to Watercourse 3, and 96 m to Watercourse 4. The Scheme is also proposing incorporation of five new attenuation ponds, which although not proposed with ecological benefit as a primary function, would provide some ecological benefit as a secondary function. Where these ponds discharge to the local stream network they would be connected by new ditches rather than pipes. This avoids the need for engineered outfalls, extends existing green corridors, and provides greater connectivity with the proposed treatment and attenuation ponds. These ditches would be carefully designed following best practice, and in consultation with project ecologists and geomorphologists so that the final form avoids a uniform cross section and maximises biodiversity opportunities. This may potentially be achieved by having a low flow channel alternating between berms on either bank. These ditches would be maintained by Highways England as part of the drainage system. A commitment for the design of these drainage ditches is included within the OEMP [TR010054/APP/6.11].

5.4.15 Although we recognise that mitigation for mammals is important, mammals are not a WFD biological quality element and therefore this is not directly relevant to the outcome of the WFD Assessment. An assessment of impacts on mammals is presented in Chapter 8: Biodiversity of the Environmental Statement [TR010054/APP/6.1] and associated appendices [TR010054/APP/6.3].

5.5 Environmental enhancement opportunities

5.5.1 The Drainage Strategy (Appendix 13.2 of the ES [TR010054/APP/6.3]). proposes to use a combination of SuDS and conventional drainage systems to manage and treat surface water runoff. In some cases, this includes providing new treatment measures to existing road catchments. New HVS would be fitted on road catchments 1 and 2 that discharge to Watercourse 7. A new ditch course would be provided on road catchment 14, which drains to Watercourse 6, and combinations of new filter drains and swales or ditches would be provided on the remodelled M6 Junction 11 and altered slip roads. In addition, traffic flows along the A460 would be lower in the future with the Scheme, which would reduce the water quality pollution risk from those road catchments (with this traffic moved to the new link road which would be treated by wet ponds and other measures).

6 Assessment of likely compliance/non-compliance

6.1 No deterioration assessment

6.1.1 The WFDa considers the likely impact on WFD parameters and whether the Scheme may prevent Environment Agency improvement/mitigation measures from being implemented. Assessment for all WFD classifications for each watercourse is provided in Annex B where WFDa worksheets are presented. The results of this assessment are summarised below.

Construction impacts

Penk from Source to Saredon Brook

Construction Site Runoff – Suspended Sediments

6.1.2 Pollution from mobilised suspended solids is a primary concern, but spillage of fuels, lubricants, hydraulic fluids and cement from construction plant may lead to incidents, especially where there are inadequate pollution mitigation measures. Suspended sediments have the potential to adversely impact the biological and physiochemical parameters of WFD elements of Watercourse 2, and possibly Watercourse 1 (although no works are proposed in this area or to the existing culvert beneath the M54), by impairing biological functions, physically altering habitat, and transporting sediment bound and soluble pollutants.

6.1.3 The redesign of the M54 Junction 1 would involve working within the channel of Watercourse 2 to connect the channel to an attenuation pond and culvert the watercourse beneath the new junction arrangement. Works would also be undertaken adjacent to the watercourse. Such activities present a high risk of excessive levels of sediment entering the watercourse, although impacts are anticipated to be localised due to limited conveyance in the small watercourse, and the dilution of the runoff. Any contaminated flow is unlikely to propagate downstream to the designated WFD waterbody of the River Penk, which is located 4 km north-west of the Scheme works and is deemed too far away from the Scheme to be adversely impacted.

6.1.4 Best practice measures would be put in place as detailed in the OEMP [TR010054/APP/6.11] to ensure all impacts are small, localised and temporary, and no non-compliance with WFD objectives is predicted. 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 WMP. Water quality monitoring would also be undertaken throughout the construction phase, which would enable any impacts on physicochemical status of Watercourse 2 to be identified and mitigation implemented.

Construction Site Runoff - Chemical Spills

6.1.5 Potentially polluting substances would be stored and used on site during construction. Leaks and spillages of these substances could pollute surface watercourses if their use is not carefully controlled and spillages were to enter existing flow pathways, causing acute impacts to water quality and potentially

aquatic organisms. As with the impact from excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within water bodies.

6.1.6 Mitigation measures have been proposed to avoid, minimise and reduce the potential adverse impacts from chemical spillages on receiving watercourses during construction works and are detailed in the OEMP [TR010054/APP/6.11]. These measures include the implementation of a temporary drainage system, bunded fuel tanks, spill kits, plant nappies on static plant, and the implementation of a WMP. Given the implementation of these measures, no significant adverse impact is predicted or non-compliance with any WFD objectives.

Construction Runoff – Abstraction

6.1.7 Abstracting water from watercourses can reduce the available flow and this can impact fish and other biological quality elements in a number of ways. Reducing the volume of water within a channel would reduce the availability of habitat for fish and can also reduce longitudinal connectivity by increasing the likelihood of barriers to fish migration. Reduced flow would also increase the impact of water quality problems, especially during low flow periods or when the weather is very warm (as water will hold less dissolved oxygen).

6.1.8 It is not known at this stage whether any water would need to be abstracted from watercourses during construction. If more than $20m^3$ of water was to be abstracted, or for longer than 28 consecutive days, it would need to be approved by the Environment Agency under an Abstraction Licence. Determination of this application will take account of the volume, rate and duration of the abstraction, as well as the potential environmental impacts of it. Mitigation measures would be required such as avoiding key seasonal spawning and nursery timings of those fish present in the running water bodies would reduce the impact on fish by reducing the likelihood of eggs being left in dry margins, and reduce the impact of barriers allowing fish to migrate to suitable spawning grounds (typically March to June). Overall, providing these measures are implemented no significant adverse impacts are predicted and no non-compliance with WFD objectives.

<u>Saredon Brook from Source to Penk</u>

Construction Site Runoff – Suspended Sediments

6.1.9 Due to works close to the channel and embankments of the WFD designated Watercourse 5 (Latherford Brook) to install a new bridge, the risk of excessive levels of fine sediment being transported within site runoff to this waterbody is high, although less so than if a culvert was to be constructed, which would also require over-pumping or similar to create a dry working area. Construction of the Scheme would also require excavations and storage of excavated material within proximity to the embankments and installation of culverts within the channel of minor tributaries of Saredon Brook including Watercourse 2, 3 and 4 (with temporary diversion of the flow) and the construction of new drainage measures such as drains and attenuation ponds. There would be high levels of sediment generated as a result of these construction activities, which if mobilised in runoff could adversely impact the biological, physicochemical and hydromorphological parameters of this WFD waterbody. Impacts may also propagate downstream to the main channel of

Saredon Brook under higher flow condition (approximately 1.9 km downstream of the Scheme where it crosses Watercourse 5, but further from other watercourses), although at this distance any suspended sediments would be increasingly diluted and dispersed. However, with the proposed mitigation measures only local and not significant adverse impact on Saredon Brook are predicted.

6.1.10 There are also online ponds (at King's Pool Fishery on Watercourse 3 and Brookfield Farm Fishery on Watercourse 4) downstream of the construction works, which may attenuate excessive flows of sediment associated with upstream activities. However, these online ponds would also need to be protected from siltation by the application of appropriate mitigation measures.

6.1.11 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 defined within the OEMP [TR010054/APP/6.11] and to manage formation of excessive sediment in runoff and provide treatment prior to discharge. With the implementation of these measures, no significant adverse impact is predicted or non-compliance with any WFD objectives.

Construction Site Runoff - Chemical Spills

6.1.12 During construction, potentially polluting substances would be stored and 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. As with the impact from excessive fine sediment in construction site runoff, the risk is greatest where works occur close to and within water bodies.

6.1.13 Mitigation measures are outlined in the OEMP [TR010054/APP/6.11] to avoid, minimise and reduce the potential adverse impacts from chemical spillages on receiving watercourses during construction works. These measures 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. Given the implementation of these measures, no significant adverse impact is predicted or non-compliance with any WFD objectives.

Construction Runoff – Piling

6.1.14 Terrestrial piling would result in vibrations reaching the online ponds located near the Scheme within the Saredon Brook catchment (i.e. Kings Pool and Brookfield Farm fisheries). Excessive vibration from piling can cause shock and stress to fish, that occurring at critical life stages could lead to unsuccessful spawning). The degree of damage to fish is not related directly to the distance of the fish from the pile, but to the received level and duration of the sound exposure. It is evident that sound affects different species to a differing degree.

6.1.15 The method of piling should be considered to reduce and manage the risk of piling to fish health. Continuous flight auger piles are deemed to fit best practise over other methods as it produces significantly lower levels of noise and vibration compared to conventional piling.

Construction Runoff – Abstraction

6.1.16 Abstracting water from watercourses can reduce the available flow and this can impact fish and other biological quality elements in a number of ways. Reducing the volume of water within a channel would reduce the availability of habitat for fish and can also reduce longitudinal connectivity by increasing the likelihood of barriers to fish migration. Reduced flow would also increase the impact of water quality problems, especially during low flow periods or when the weather is very warm (as water will hold less dissolved oxygen).

6.1.17 It is not known at this stage whether any water would need to be abstracted from watercourses during construction. If more than 20 m^3 of water was to be abstracted, or for longer than 28 consecutive days, it would need to be approved by the Environment Agency under an Abstraction Licence. Determination of this application will take account of the volume, rate and duration of the abstraction, as well as the potential environmental impacts of it. Mitigation measures would be required such as avoiding key seasonal spawning and nursery timings of those fish present in the running water bodies would reduce the impact on fish by reducing the likelihood of eggs being left in dry margins, and reduce the impact of barriers allowing fish to migrate to suitable spawning grounds (typically March to June). Overall, providing these measures are implemented no significant adverse impacts are predicted and no non-compliance with WFD objectives.

Permo Triassic Sandstone Staffordshire Groundwater Waterbody and Mercia Mudstone East and Coal Measures Groundwater Waterbody

6.1.18 During construction works there is the potential for these groundwater bodies 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. Foundation methods and construction activities may also open and/or modify potential pollutant linkages, including the disturbance of sediments and drilling of piling foundations. Dewatering and groundwater management is required for deep excavations (including a potential borrow pit) and in areas of cutting, as there is the potential to temporarily intercept the groundwater flow and resource resulting in impacts on baseflow of nearby watercourses (i.e. Watercourse 3). The risk of impacts to groundwater levels and flows from proposed cuttings and the borrow pit have been assessed in detail in Appendix 13.8 Groundwater Technical Note [TR010054/APP/6.3]. However, with the implementation of the mitigation measures described in the OEMP [TR010054/APP/6.11] no impacts on water quality or quantity are predicted that would be significant at the waterbody scale.

Permanent impacts

Penk from Source to Saredon Brook

Road runoff including spillages

6.1.19 There is a broad range of potential pollutants associated with routine runoff from the Scheme once it is operational. There is also a risk that a significant chemical spillage or pollution incident could occur on the Scheme and be transmitted to the receiving

waterbody. The impacts of this could cause water quality deterioration through release of dissolved metals, hydrocarbons and contaminated sediments, with subsequent impacts on ecological and physicochemical parameters in Watercourse 1 and 2. This deterioration is unlikely to propagate downstream to the River Penk (WFD designated), given the distance between the two watercourses and the dilution effect associated with Watercourse 1 discharging into Watercourse 2 downstream of the point of introduction of the polluting substance. The effects of any pollution incident are anticipated to be local.

6.1.20 The drainage strategy (Appendix 13.2 of the ES [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70 m to 80 m of open ditch. This has been assessed according to the methods described in the DMRB (Appendix 13.3 of the ES [TR010054/APP/6.3]). In order for the treatment train to remain effective at all times, it would require maintenance through the lifecycle of the Scheme. Assuming this is the case, there are no significant impacts anticipated.

6.1.21 There would be sporadic release of de-icant salts in winter with potential for impacts on ecological and physicochemical parameters of Watercourse 1 and Watercourse 2. There is existing de-icing pressure on the Watercourse 1 and 2, but there would be an increase in de-icant applied to treat the larger impermeable road area drained associated with the re-design of the junction. Generally, it is considered that because de-icing salts are used infrequently, in the colder months, over relatively short time periods, and at a time when higher flows are generally more frequent in between in which to dilute and disperse 'salty' water, significant long term adverse impacts would be unlikely to occur. SuDS systems, such as the attenuation pond in place, 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 stored in pond sediments.

Morphological impacts to water bodies - watercourse crossing structures

6.1.22 Two culverts would be constructed to convey Watercourse 2 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this report. Each culvert would result in the loss of a proportion of the channel and associated habitats. However, through the application of mitigation measures the adverse impact of these culverts can be mitigated and compensated for.

6.1.23 It is proposed that the base of the culverts would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. There is limited evidence along Watercourse 2 of any natural functional flows and sediment transport processes that can support the creation of geomorphic bedforms and channel features, as these watercourses are first order headwater streams that have already been significantly modified by past land use and construction of the M54. However, the provision of a naturalised bed would help maintain channel/process continuum.

6.1.24 The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities.

6.1.25 For Watercourse 2, to minimise the length of the culvert it is proposed to realignment and regrade this minor watercourse over approximately 80 m. Realignment and culverting of this watercourse would be done in such a way as to ensure conveyance of flow, and any coarse sediment transport processes. The form of the diversions will be determined during the detailed design stage and informed by appropriate hydromorphological and ecological surveys, and would replicate, as far as reasonably practically, the natural form of the channel. The OEMP [TR010054/APP/6.11] includes a commitment to this.

Morphological impacts to water bodies - outfalls

6.1.26 No new surface water concrete/pipe outfalls will be constructed for highway runoff. All highway and land drainage to Watercourse 1 and 2 would be via new ditchcourses or outfalls associated with the existing road runoff network. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls.

Saredon Brook from Source to Penk

Road runoff from spillages

6.1.27 Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 3, 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 [TR010054/APP/6.3]. According to the results of this assessment adequate treatment is provided without exceeding the long-term annual average WFD EQS. For existing roads, some outfalls would still fail against the non-WFD short term EQS, but the number of exceedances would reduce with the Scheme (i.e. the Scheme reduces the risk but has not eliminated it). Overall, the Scheme provides adequate treatment on new road outfalls, and has sought to reduce the risk from existing road outfalls as much as possible. Therefore, no significant impacts or non-compliance with the WFD objectives are predicted.

6.1.28 There is 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. However, this risk has also been assessed according to the method presented in DMRB LA 113 (Ref 17) and the spillage risk was lower than EQS. The Drainage Strategy (Appendix 13.2 of the ES [TR010054/APP/6.3] incorporates a range of treatments for routine road runoff and accidental spillages to mitigate any adverse effects. Water quality impacts that could affect ecological and physicochemical WFD parameters are therefore considered to be negligible.

Maintenance of the drainage system would be required to ensure the treatment train continues to operate properly and efficiently.

6.1.29 During the colder months, there would be sporadic release of de-icant salts which may potentially impact ecological and physiochemical parameters of Watercourses 4-7. There is existing de-icing pressure on these watercourses from existing treated roads, but there would be an increase in de-icant applied to treat the larger impermeable road area drained associated with the re-design of the junction. Generally, it is considered that because de-icing salts are used infrequently, in the colder months, over relatively short time periods, and at a time when higher flows are generally more frequent in which to dilute and disperse 'salty' water, significant long term adverse impacts would be unlikely to occur. The presence of ponds online within Watercourses 3 and 4 may also provide a positive benefit, allowing for the salt to become diluted, there is however potential for metals deposited to become remobilised. The greatest impacts would be localised within each watercourse, with higher flows within Watercourse 3 and Watercourse 5 (Latherford Brook) unlikely to transmit downstream to Saredon Brook due to dilution effect over this distance.

Morphological impacts to water bodies - Watercourse Crossing Structures

6.1.30 Watercourse 5 (Latherford Brook) has been historically straightened, however, there is evidence that the watercourse is returning to its natural form. At the location of the proposed crossing the watercourse is showing signs of lateral movement, most likely as a result of localised change in gradient, and secondary channels active during high flow events.

6.1.31 Culverting or straightening of the watercourse would result in further modification of the Latherford Brook at the crossing location, therefore representing a risk to the current WFD ecological and overall status. Therefore, it is recommended that the new link road crosses Watercourse 5 (Latherford Brook) supported on a 10 m clear-span bridge structure. This solution allows the naturally returning morphology of the waterbody to be retained as far as possible.

6.1.32 A topographical channel survey shows that the wetted river corridor at the crossing location (split section) to be approximately 18 m total width – this includes two channels, a primary channel and secondary channel (utilised during higher flows), and the bank section between the two channels. The wetted river corridor of the existing primary channel at the crossing location is approximately 14 m wide.

6.1.33 Ideally, a structure at this location would be at least wide enough to encompass both the primary and secondary channels in their existing alignments (18 m). This would allow the channel to continue to function and evolve naturally, therefore having minimal impact on the hydromorphology of the channel. However, the watercourse is a low energy stream with relatively cohesive banks and therefore the channel planform does not naturally actively change. What is occurring at the crossing location is considered to be adjustment, triggered by historic anthropogenic modification (e.g. straightening), as the watercourse attempts to re-establish equilibrium. Taking this into account it is considered that an acceptable compromise for the width of the structure at this location would be a minimum width of 10 m. This would allow the primary channel to be accommodated with minimal modification to channel geometry. It is considered that there is limited residual risk that the

modifications required to build the structure would result in sufficient acceleration of the secondary currents to cause significant morphological adjustments to the channel. The minimum 10 m width allows for a 0.5 m buffer either side of the new channel cross-section to provide a residual floodplain. This buffer would allow for some lateral re-working of gravels as the channel adjusts to a new equilibrium post-construction.

6.1.34 A culvert would be constructed to convey Watercourse 3 and Watercourse 4 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this report. The construction of a new culvert would result in the loss of a proportion of the channel and associated habitats, although the realignment of the channel presents an opportunity to provide enhancement over the current form.

6.1.35 It is proposed that the base of each culvert would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. There is limited evidence along Watercourse 3 and Watercourse 4 within the Scheme Boundary of any natural functional flows and sediment transport processes that can support the creation of geomorphic bedforms and channel features, as these watercourses are first order headwater streams that has already been significantly modified by past land use. However, the provision of a naturalised bed would help maintain channel/process continuum. The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities.

Morphological impacts to water bodies - Outfalls

6.1.36 No new surface water concrete/pipe outfalls will be constructed for highway runoff. All highway drainage to Watercourse 3-7 from the Scheme would be via new ditchcourses or existing outfalls associated with the existing road runoff network. However, two new outfalls supported by concrete headwalls will be required for drainage Catchments 11 and 12, which is embankment drainage only. This is because the topography in the area prohibits the inclusion of new ditchcourses. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls. New outfalls would cause the loss of a small amount of riparian habitat, and if not well designed can result in bank and bed erosion, especially where watercourses have easily erodible substrates (for example, by locating them with a downstream angle and not protruding into the channel). It will also be important that the rate of any discharge is attenuated to reduce the risk of scour. However, the effects from installing new outfalls would tend to be localised and not significant at the waterbody level. The size of any supporting headwall should also be kept to a minimum and where possible pre-fabricated structures used to avoid having to pour concrete close to a watercourse. Given the small number of outfalls required, ability

to ensure that the design is sympathetic to the environmental circumstances, and the localised nature of the impacts, no significant adverse impacts are predicted.

Permo Triassic Sandstone Staffordshire Groundwater Waterbody and Mercia Mudstone East and Coal Measures Groundwater Waterbody

6.1.37 All routine road runoff and chemical spillages for the Scheme are directed to attenuation ponds and watercourses, and not directly to ground via soakaways. Due to the small nature of some of these watercourses, it is possible that there will be some infiltration of highway runoff. However, treatment measures have been embedded in the drainage design and any infiltration would be diluted with stream flow. The proposed use of carrier pipes means that any significant chemical spillage would be contained within the drainage system and would not infiltrate into the ground.

6.1.38 No impact on groundwater levels and flows are predicted in the long term. With reference to the groundwater technical note presented in Appendix 13.8 [TR010054/APP/6.3], only small quantities of permanent dewatering would occur from the central cutting near the Hilton Lane Overbridge. The other two cuttings would not be of sufficient depth to interact with groundwater.

6.2 No prevention of improvement assessment

6.2.1 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 measures needed to be implemented. Information about waterbody specific mitigation measures was requested from the Environment Agency and provided for Saredon Brook and are summarised in Annex B. No mitigation measures have been provided by the Environment Agency for the Penk from Source to Saredon Brook, PT Sandstone Staffordshire or the Mercia Mudstone East and Coal Measures WFD waterbodies. For these water bodies the assessment refers to the known risks and pressures acting on them as taken from the Environment Agency's Catchment Data Explorer website.

Saredon Brook from Source to Penk

6.2.2 Saredon Brook is currently at Moderate Ecological Potential, its target status due to an unfavourable balance of costs and benefits, disproportionate burdens and long ecology recovery time to implement all mitigation measures to meet Good Ecological Potential. Regardless, the Environment Agency have identified some mitigation measures that will support improvement in a number of WFD parameters, notably phosphates to Good by 2021, and macroinvertebrates and dissolved oxygen to Good by 2027. The mitigation measures identified by the Environment Agency include:

- retain marginal aquatic and riparian habitats (channel alteration);
- preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone;
- preserve and, where possible, restore historic aquatic habitats; and
- increase in-channel morphological diversity.

6.2.3 With regards to the Saredon Brook mitigation measures, the installation of a new culvert across Watercourse 3 and Watercourse 4, two new outfalls to Watercourse 5 (Latherford Brook), and to a lesser extent the construction of a new 10 m clear-span bridge across Watercourse 5 (Latherford Brook) has the potential to have localised adverse impacts on their delivery and effectiveness of these mitigation measures.

6.2.4 The culverting of Watercourse 3 and Watercourse 4 would unavoidably impact riparian, bankside and in-channel habitats, cause a localised severance of lateral connectivity with the floodplain, potentially create a physical barrier to longitudinal migration of fish to reach a variety of habitats and spawning grounds, and could impact hydrological and sediment regimes if not sensitively designed. However, and as described in the 'No Deterioration' assessment above, the culvert design includes provision for a naturalised bed. The Scheme also proposes new ditchcourses rather than pipe outfalls supported by concrete headwalls. The design of these would be informed by an ecologist and a geomorphologist and would include as much as possible 'natural' features such as a sinuous low flow channel (albeit along a straight corridor) incorporating shallow berms and occasional sections where the channel is narrowed to improve flow. The loss of a section of the channel of Watercourse 3 and Watercourse 4 would be offset by the creation of new highway drainage ditches as part of the drainage networks.

6.2.5 It is acknowledged that the culverts proposed for Watercourse 3 and Watercourse 4, and the outfalls to Watercourse 5 (Latherford Brook) are potentially inconsistent with the above mitigation measures proposed by the Environment Agency to improve the status of some WFD parameters of this waterbody. However, the physical impact of these structures would be very localised in nature and affecting the first order and minor channels of headwater tributaries, rather than the main stem of the waterbody. The impact would also be compensated by the creation of new ditchcourses as part of the highway drainage system, but designed to best practice and linking existing green corridors with proposed treatment and attenuation ponds along the Scheme.

6.2.6 Overall, such impacts would be unlikely to have significant ecological or morphological impacts at the waterbody scale (this waterbody is already heavily modified and is 25 km in length so any culvert is likely to be significantly less than 1% of the length of the main stem channel. This proportion would be even smaller if all tributaries were taken into account, although a proportion of the existing channels would already be modified. As such, there is not anticipated to be any prevention of future improvement in the waterbody, providing that any culvert is appropriately designed as described above. Furthermore, although acting on other WFD quality elements, the Scheme has the potential to provide a degree of improvement to the water quality of Latherford Brook by the provision of treatment for road drainage where there is currently none. Opportunities can also be explored for localised improvements around the culvert and outfall works at the detailed design stage, for instance providing a variety of morphological bed features, de-silting and improvements to flow conveyance, and enhancement of riparian habitat structure.

Other water bodies

6.2.7 As no mitigation measures are available for the Penk 'from source to Saredon Brook' and Permo-triassic Sandstone Staffordshire WFD waterbodies, consideration of the potential impacts of the Scheme against the pressures and reasons for not achieving Good Status have been considered. There are no reasons for not achieving good status for the Mercia Mudstone East and Coal Measures WFD waterbody as it is already at Good status.

6.2.8 In the baseline (Section 4) certain pressures were scoped out for not being relevant (e.g. pressure from livestock and sewage discharges) and so they are not considered within Table 6.1. With the available information about the pressures and reasons for not being at Good Ecological Status or Good Ecological Potential no potential non-compliance with the WFD objective 'failure to prevent improvement' is predicted for these waterbodies.

6.2.9 Based on the assessment presented in Table 6.1, the Scheme or the mitigation has been incorporated into the design (e.g. SuDS to treat highway runoff) should not worsen the existing pressures on WFD waterbodies.

Table 6.1: Reasons for not achieving Good Status and deterioration

Waterbody	Classification element affected	Pressure Type	Activity	Appraisal
Penk from Source to Saredon Brook	Fish	Physical Modification	Flood protection – sediment management (agriculture and rural land management) and barriers – ecological discontinuity(other)	Physical modifications to upstream tributaries of this waterbody will be designed to maintain ecological continuity as far as reasonably practical. No physical modification would occur in the reportable reach. The drainage strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) has been designed to prevent aggravation of an existing flood and a full Flood Risk Assessment has been produced for the Scheme, Appendix 13.1 of the Environmental Statement [TR010054/APP/6.3]. This concludes there will be no adverse effect on Flood Risk potential within the area as a result of the Scheme.
	Phosphate (target Good by 2021)	Diffuse Source	Urbanisation (urban and transport)	No road runoff would be discharged to this watercourse directly. For the upstream tributaries, a Drainage Strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) has been produced to manage surface water runoff using SuDS (e.g. source control, swales, and wet ponds, road drainage ditches and hydrodynamic vortex separators). A water quality assessment has been undertaken and is reported in Chapter 13: Road Drainage and the Water Environment of the Environmental Statement [TR010054/APP/6.1] has been undertaken to ensure that the necessary treatment of routine runoff and spillage containment is provided. Although roads are not principal sources of nutrients such as phosphorus, research has also shown that SuDS can be effective in removing nutrients, which is a particular concern in the Penk catchment.

Waterbody	Classification element affected	Pressure Type	Activity	Appraisal
	Macrophytes and Phytobenthos (target Good by 2027)	Diffuse Source	Urbanisation (urban and transport)	No road runoff would be discharged to this watercourse directly. For the upstream tributaries, a Drainage Strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) has been produced to manage surface water runoff using a combination of SuDS (e.g. source control, swales, dry and wet ponds) and conventional drainage systems (e.g. underground storage, oil interceptors and penstocks). A water quality has been undertaken and is reported in Chapter 13: Road Drainage and the Water Environment of the Environmental Statement [TR010054/APP/6.1] has been undertaken to ensure that the necessary treatment of routine runoff and spillage containment is provided.
PT Sandstone Staffordshire	Chemical Dependent Surface Water Body Status	Flow	Surface water abstraction (water industry); groundwater abstraction (industry, water industry, agriculture and rural land management) and abandoned mine (mining and quarrying)	Any surface water or groundwater abstractions would be temporary and be undertaken in line within the requirements of the permit.
	Quantitative Water Balance	Flow	Groundwater abstraction (industry, agriculture and rural land management and water industry)	
	Quantitative Dependent Surface Water Waterbody Status	Flow	Groundwater abstraction (other)	

Waterbody	Classification element affected	Pressure Type	Activity	Appraisal
	Trend Assessment	Diffuse source	Agriculture and rural land management	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy, Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3], with no residual impacts expected on the receiving waterbodies.
	Chemical Drinking Water Protected Area	Diffuse Source	Poor nutrient management (agriculture and land management)	Routine road runoff and chemical spillages would be treated in accordance with the Drainage Strategy, Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3], with no residual impacts on the receiving waterbodies.

7 Conclusion

7.1.1 This WFD assessment provides a description of the relevant water bodies with the study area and how they could be impacted by the Scheme. The assessment is based on a combination of existing data, site survey and the Scheme description provided in Section 1.2.

7.1.2 The WFD assessment indicates that, based on the current understanding of the Scheme, only minor and localised temporary and permanent impacts to WFD relevant bodies are expected providing the mitigation measures embedded in the design are implemented with regards to the design of drainage systems, new watercourse crossings, and outfalls, and construction phase mitigation measures are implemented. In particular, a 10 m clear-span bridge has been proposed across the most functional watercourse crossed by the Scheme, and culverts elsewhere would include mitigation measures to minimise adverse impacts. In addition, a drainage strategy has been proposed with multiple treatment train components that would adequately treat the runoff from new roads, and reduce the impact from existing roads.

7.1.3 The future design of the clear-span bridge across Watercourse 5 (Latherford Brook) and any minor watercourse diversions to new culverts will be informed by appropriate hydromorphological and ecological surveys. Where possible, the diversion of minor watercourses would deliver enhancement on the existing channel form. Overall, the Scheme will provide a greater length of new ditchcourses than the length of headwater channels lost to culverts. These new ditchcourses would extend existing green corridors and provide a link with the proposed new treatment and attenuation ponds. They will be designed with geomorphic features (e.g. berms) to provide a degree of diversity and to maximise biodiversity. Using ditches to convey treated highway runoff to watercourses also avoids the need for new engineered outfalls.

7.1.4 Mitigation measures including those to be adopted during construction to manage all pollution risks are outlined in the OEMP [TR010054/APP/6.11]. Within the Scheme design there would be embedded mitigation measures to treat surface water runoff and manage the risk of future routine road runoff and risk of accidental spillages, and the design of any structures would ensure minimal impact to designated water bodies.

8 References

Ref 1. Highways England (2019) Design Manual for Roads and Bridges Volume 4 Geotechnics and Drainage, Section 2 Drainage, Part 3, CG 501 Design of Highway Drainage Systems

Ref 2. Highways Agency (2006) Design Manual for Roads and Bridges Volume 4 Geotechnics and Drainage, Section 2 Drainage, Part 1, HA 103/06 Vegetated Treatment Systems for Highway Runoff

Ref 3 Ordnance Survey, Available online at https://www.ordnancesurvey.co.uk/

Ref 4 Met Office, Available online at https://www.metoffice.gov.uk/

Ref 5 Environment Agency Catchment Data Explorer, Available online at https://environment.data.gov.uk/catchment-planning/

Ref 6 The Water Framework Directive (Standards and Classification) Directions (England and Wales) 2015, Available online at http://www.legislation.gov.uk/uksi/2015/1623/pdfs/uksiod_20151623_en_003.pdf

Ref 7 Kemp. P.S. et al (2005). Procedures for Evaluating and Prioritising the removal of Fish Passage Barriers: a synthesis. Fisheries Management and Ecology 17 (4) pages: 297-322.

Ref 8 Highways England (2019) M54-M6/ M6 Toll Link Road: PCF Stage 3 EIA Scoping Report.

Ref 9 Highways England (2015) M54 to M6/ M6 Toll Link Road Scheme. PCF Stage 2 Environmental Assessment Report

Ref 10 Highways Agency, Drainage Data Management System (HADDMS) website, available at http://www.haddms.com/ [Accessed January 2019]

Ref 11 Cranfield soils and agrifood institute soilscapes, Available online at: http://www.landis.org.uk/soilscapes/

Ref 12 Environment Agency, Flood Map for Planning website, available online at https://flood-map-for-planning.service.gov.uk/, [Accessed January 2019]

Ref 13 Environment Agency, updated Flood Map for Surface water. Available online at: https://flood-warning-information.service.gov.uk/long-term-flood-risk/map

Ref 14 Environment Agency, Areas Susceptible to Groundwater Flooding map

Ref 15 Environment Agency (2015), Humber River Basin Management Plan Cycle 2

Ref 16 Case C-461/13 on the 1st July 2016 (Bund für Umwelt und Naturschutz Deutschland eV v Bundesrepublik Deutschland)

Ref 17 Highways England (2019) Design Manual for Roads and Bridges, Volume 11, Section 3, Part 10. LA 113 Road Drainage and the Water Environment

Ref 18 British Geological Society GeoIndex Available online at: https://www.bgs.ac.uk/geoindex/

Annex A - A WFD Waterbody Assessments Cycle 2

Table A1. Surface water body classifications

RBMP Parameter	Saredon Brook from Source to River Penk	Penk from Source to Saredon Brook	Staffordshire and Worcestershire Canal
RBMP	Humber RBMP	Humber RBMP	Humber RBMP
Waterbody Name and ID	Saredon Brook from Source to River Penk (GB104028046740)	Penk from Source to Saredon Brook (GB104028046680)	Staffordshire and Worcester Canal, summit to Lower Penn (GB70410266)
Waterbody Type	Heavily modified	Not designated artificial or heavily modified	Artificial
Size (Catchment Area, Length)	7041.941 ha, 25.163 km	6386.87 ha, 14.015 km	16.608 km
Overall Ecological Status	Moderate	Poor	Moderate
Chemical Status	Good	Good	Good
Downstream waterbody	Penk-Saredon Brook to Wiston Brook	Penk-Saredon Brook to Wiston Brook	n/a
Biological Quality Elements	Moderate	Poor	n/a
Fish	Good	Poor	n/a
Macrophytes and Phytobenthos combined	n/a	Poor	n/a
Invertebrates	Moderate	Moderate	n/a
Physico-Chemical Parameters	Moderate	Moderate	Moderate
Acid Neutralising Capacity	High	n/a	n/a
Ammonia	Moderate	High	High
Biochemical Oxygen Demand (BOD)	n/a	n/a	High
Dissolved Oxygen	Moderate	Moderate	Good
pH	High	High	High
Phosphate	Moderate	Poor	Moderate
Temperature	High	High	High
Hydromorphological Supporting Elements	Supports Good	Supports Good	n/a
Hydrological regime	Supports Good	Supports Good	n/a
Morphology	n/a	Supports Good	n/a
Specific Pollutants	High	High	Moderate
Triclosan	High	High	n/a

RBMP Parameter	Saredon Brook from Source to River Penk	Penk from Source to Saredon Brook	Staffordshire and Worcestershire Canal
Manganese	High	High	n/a
Copper	High	High	High
Iron	High	High	High
Zinc	High	High	n/a
Phenol	n/a	n/a	Moderate
Chemical	Good	Good	Good
Priority Substances	Good	Good	Good
Lead and its compounds	Good	Good	Good
Nickel and its compounds	Good	Good	Good
Other Pollutants	Does not require assessment	Does not require assessment	Does not require assessment
Priority Hazardous Substances	Good	Good	Good
Benzo (b) and (k) flouranthene	Good	n/a	n/a
Benzo (ghi) perylene and indeno (123-cd) pyrene	Good	n/a	n/a
Benzo (a)pyrene	Good	n/a	n/a
Cadmium and its compounds	Good	Good	Good
Di(2-ethylhexyl) phthalate (Priority hazardous)	Good	Good	n/a
Mercury and its compounds	Good	n/a	n/a
Nonylphenol	Good	Good	n/a

Table A2. Groundwater body classifications

Parameter		Staffordshire Trent Valley – PT Sandstone Staffordshire	Staffordshire Trent Valley – Mercia Mudstone East and Coal Measures
Waterbody ID		GB 40401G300500	GB40402G300300
Waterbody Type		Groundwater Waterbody	Groundwater Waterbody
Catchment area		311.268 km^2	418.478 km^2
Overall Status		Poor	Good
Quantitative Status		Poor	Good
Chemical Status		Poor	Good
Quantitative Elements	Saline Intrusion	Good	Good
	Water Balance	Poor	Good
	Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good	Good
	Surface Water Waterbody Status	Poor	Good
Chemical Elements	Chemical Drinking Water Protected Area	Poor	Good
	Dependent Surface Waterbody Status	Poor	Good
	GWDTEs	Good	Good
	General Chemical Test	Good	Good
	Chemical Saline Intrusion	Good	Good

Annex B – WFDa Sheets

water body catchment area:	7041.941 ha	**Protected Areas:**	Nitrates Directives 308 (ID: NVZ12SW013080)
Heavily modified?	Not designated artificially or heavily modified		
Summary of scheme components:	Saredon Brook is a designated WFD waterbody classified as 'Saredon Brook from Source to River Penk' (GB104028046740). The source of the brook is several kilometres east outside of the study area. The watercourse enters the study area approximately 2 km north-east of the M6 Junction 11a and flows west across the study area, through several agricultural fields and under several B Roads before crossing beneath the M6 itself, approximately 1.9 km north-west of the northern extent of the Scheme. From this point the watercourse continues to flow east until it discharges into the River Penk outside of the study area's boundary. No direct impacts will occur to the main channel due to its distances from the Scheme. However, Watercourses 3-6 are tributaries of the Saredon Brook and can convey water quality impacts from the construction or operation of the Scheme. New or modified structures to cross watercourses or outfalls to discharge highway or embankment runoff will be provided and will have direct physical impacts to tributaries of Saredon Brook.		

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**	**Poor (2015)**							
Invertebrates	Moderate	Good (2027)	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	During the construction phase construction works may result in a reduction in water quality, both surface and groundwater, due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals, or through mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site run-off. Any reduction in water quality could impact invertebrate and fish communities through toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smoother macrophytes and diatoms and reduce the potential for photosynthesis. Impacts to the Saredon Brook would be indirect via construction site discharges of runoff to Latherford brook and Watercourse 6.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and Hydrodynamic Vortex Separator (HVS). These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 of the ES [TR010054/APP/6.3]. According to the results of this assessment adequate treatment is provided and no significant impacts are predicted. Spillage risk has been assessed according to the method presented in DMRB LA113 (Ref 17) and the spillage risk was lower than Environmental Quality Standards (EQS). The Drainage Strategy (Appendix 13.2 of the Environment Statement incorporates a range of treatments for routine road runoff and accidental spillages to mitigate any adverse effects. Water quality impacts that could affect ecological and physicochemical WFD parameters are therefore considered to be negligible. Maintenance of the drainage system would be required to ensure the treatment train continues to operate properly and efficiently. During the colder months, there would be sporadic release of de-icant salts which may potentially impact ecological and physiochemical parameters of Watercourses 4-7. However, since the application of de-icants salts would be infrequently applied and frequent higher flows to dilute the salt would be experienced in between applications, significant long term adverse impacts are not expected. The presence of ponds online within Watercourses 3 and 4 may also provide a positive benefit, allowing for the salt to become diluted, there is however potential for metals deposited to become remobilised. The greatest impacts would be localised within each watercourse, with higher flows within Watercourse 3 and Watercourse 5 (Latherford Brook) unlikely to transmit downstream to Saredon Brook due to dilution effect over distance. Watercourse 5 (Latherford Brook) has been historically straightened, however, there is evidence that the watercourse is returning to its natural form. At the location of the proposed crossing the watercourse is showing signs of lateral movement, most likely as a result of localised change in gradient, and secondary channels active during high flow events. Culverting or straightening of the watercourse would result in further modification of the Latherford Brook at the crossing location, therefore representing a risk to the current WFD ecological and overall status. Therefore, it is recommended that the new link road crosses Watercourse 5 (Latherford Brook) supported on a 10 m clear-span bridge structure. This solution allows the naturally returning morphology of the waterbody to be retained as far as possible. A topographical channel survey shows that the wetted river corridor at the crossing location (split section) to be approximately 18 m total width – this includes two channels, a primary channel and secondary channel (utilised during higher flows), and the bank section between the two channels. The wetted river corridor of the existing primary channel at the crossing location is approximately 14 m wide. Ideally, a structure at this location would be at least wide enough to encompass both the primary and secondary channels in their existing alignments (18 m). This would allow the channel to continue to function and evolve naturally, therefore having minimal impact on the hydromorphology of the channel. However, the watercourse is a low energy stream with relatively cohesive banks and therefore the channel planform does not naturally actively change. What is occurring at the crossing location is considered to be adjustment, triggered by historic anthropogenic modification (e.g. straightening), as the watercourse attempts to re-establish equilibrium. Taking this into account it is considered that an acceptable compromise for the width of the structure at this location would be a minimum width of 10 m. This would allow the primary channel to be accommodated with minimal modification to channel geometry. It is considered that there is limited residual risk that the modifications required to build the structure would result in sufficient acceleration of the secondary currents to cause significant morphological adjustments to the channel. The minimum 10 m width allows for a 0.5 m buffer either side of the new channel cross-section to provide a residual floodplain. This buffer would allow for some lateral re-working of gravels as the channel adjusts to a new equilibrium post-construction. A culvert would be constructed to convey Watercourse 3 and Watercourse 4 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this WFDa report. The construction of a new culvert would result in the loss of a proportion of the channel and associated habitats, although the realignment of the channel presents an opportunity to provide enhancement over the current form. No new surface water concrete / pipe outfalls will be constructed for highway runoff. All highway drainage to Watercourse 3-7 from the Scheme would be via new ditchcourses or existing outfalls associated with the existing road runoff network. However, two new outfalls supported by concrete headwalls will be required for drainage catchments 11 and 12, which is embankment drainage only. This is because the topography in the area prohibits the inclusion of new ditchcourses. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls. New outfalls would cause the loss of a small amount of riparian habitat, and if not well designed can result in bank and bed erosion, especially where watercourses have easily erodible substrates (for example, by locating them with a downstream angle and not protruding into the channel). It will also be important that the rate of any discharge is attenuated to reduce the risk of scour. However, the effects from installing new outfalls would tend to be localised and not significant at the waterbody level. The size of any supporting headwall should also be kept to a minimum and where possible pre-fabricated structures used to avoid having to pour concrete close to a watercourse. Given the small number of outfalls required, ability to ensure that the design is sympathetic to the environmental circumstances, and the localised nature of the impacts, no significant adverse impacts are predicted.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. Maintenance of the drainage system would be required to ensure the treatment train continues to operate properly and efficiently. Watercourse 5 (Latherford Brook)will be crossed by a clear-span bridge with a minimum width of 10 m. This would allow the primary channel to be accommodated with minimal modification to channel geometry. It is considered that there is limited residual risk that the modifications required to build the structure would result in sufficient acceleration of the secondary currents to cause significant morphological adjustments to the channel. The minimum 10 m width allows for a 0.5 m buffer either side of the new channel cross-section to provide a residual floodplain. This buffer would allow for some lateral re-working of gravels as the channel adjusts to a new equilibrium post-construction. A culvert would also be constructed to convey Watercourses 3 and 4 beneath the Scheme. The dimensions and lengths of these culverts are described earlier in this report. The base of each culvert would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. With the exception of Watercourse 5 (Latherford Brook), there is limited evidence along the other small watercourses in the study area of any functional flows and sediment transport processes. However, the provision of a naturalised bed would help maintain channel/process continuum. The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities. New outfalls would cause the loss of a small amount of riparian habitat, and if not well designed can result in bank and bed erosion, especially where watercourses have easily erodible substrates (for example, by locating them with a downstream angle and not protruding into the channel). It will also be important that the rate of any discharge is attenuated to reduce the risk of scour. However, the effects from installing new outfalls would tend to be localised and not significant at the waterbody level. The size of any supporting headwall should also be kept to a minimum and where possible pre-fabricated structures used to avoid having to pour concrete close to a watercourse. Given the small number of outfalls required, ability to ensure that the design is sympathetic to the environmental circumstances, and the localised nature of the impacts, no significant adverse impacts are predicted.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges and appropriate design of the Latherford Brook crossing. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Fish	Good	Good (2015)							
General physicochemical status	**Moderate**	**Good (2027)**							
Ammonia	Moderate	Good (2015)	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, affecting physicochemical status of Latherford Brook and Watercourse 6. However, the WFD designated reach of Saredon Brook is considered too far away (1.9km) to be at significant risk of adverse impacts.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the Saredon Brook would be indirect via Latherford Brook and Watercourse 6. At its closest point, Saredon Brook is 1.9 km downstream of Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the Saredon Brook. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	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.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 of the ES. According to the results of this assessment adequate treatment is provided and no significant impacts are predicted. Spillage risk has been assessed according to the method presented in DMRB LA113 (Ref 17) and the spillage risk was lower than EQS. The Drainage Strategy (Appendix 13.2 of the Environment Statement incorporates a range of treatments for routine road runoff and accidental spillages to mitigate any adverse effects. Water quality impacts that could affect ecological and physicochemical WFD parameters are therefore considered to be negligible. Maintenance of the drainage system would be required to ensure the treatment train continues to operate properly and efficiently. During the colder months, there would be sporadic release of de-icant salts which may potentially impact ecological and physiochemical parameters of Watercourses 4-7. However, since the application of de-icants salts would be infrequently applied and frequent higher flows to dilute the salt would be experienced in between applications, significant long term adverse impacts are not expected. The presence of ponds online within Watercourses 3 and 4 may also provide a positive benefit, allowing for the salt to become diluted, there is however potential for metals deposited to become remobilised. The greatest impacts would be localised within each watercourse, with higher flows within Watercourse 3 and Watercourse 5 (Latherford Brook) unlikely to transmit downstream to Saredon Brook due to dilution effect over distance.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Dissolved Oxygen	Moderate	Good (2027)							
pH	High	Good (2015)							
Phosphate	Moderate	Good (2021)							
Temperature	High	Good (2015)							
Specific pollutants	**High**	**High (2015)**							
Triclosan	High	High (2015)	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	Triclosan may be found in certain construction products and could be released to Latherford 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 the Saredon Brook itself due to distance form the proposed scheme boundary (1.9km) with sufficient dilution upstream to prevent impact to the WFD watercourse.	Triclosan can be derived from numerous sources (e.g. soaps, construction products) and could be deposited on the road in small quantities. There is potential for any spillages of triclosan to be transported in runoff to Latherford Brook through the two road outfalls. Saredon Brook is considered too far away (1.9km) 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 quantities 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.				
Manganese	High	-		Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, affecting physicochemical status of Latherford Brook and Watercourse 6. However, the WFD designated reach of Saredon Brook is considered too far away (1.9km) to be at significant risk of adverse impacts.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the Saredon Brook would be indirect via Latherford Brook and Watercourse 6. At its closest point, Saredon Brook is 1.9km downstream of Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the Saredon Brook. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 of the ES. According to the results of this assessment adequate treatment is provided and no significant impacts are predicted.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Copper	High	High (2015)							
Iron	High	-							
Zinc	High	High (2015)							
Priority substances	**Good**								
Lead and its compounds	Good	CHECK	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, affecting physicochemical status of Latherford Brook and Watercourse 6. However, the WFD designated reach of Saredon Brook is considered too far away (1.9km) to be at significant risk of adverse impacts.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the Saredon Brook would be indirect via Latherford Brook and Watercourse 6. At its closest point, Saredon Brook is 1.9km downstream of Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the Saredon Brook. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 of the ES. According to the results of this assessment adequate treatment is provided and no significant impacts are predicted.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Nickel and its compounds	Good	CHECK							

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**	**Poor (2015)**							
Chemical status-priority hazardous substances	**Good**	**Good (2015)**							
Cadmium and its compounds	Good	Good (2015)	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, affecting physicochemical status of Latherford Brook and Watercourse 6. However, the WFD designated reach of Saredon Brook is considered too far away (1.9km) to be at significant risk of adverse impacts.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment(grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the Saredon Brook would be indirect via Latherford Brook and Watercourse 6. At its closest point, Saredon Brook is 1.9km downstream of Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the Saredon Brook. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	Routine road runoff contains both dissolved and particulate contaminates which, if untreated, would adversely impact the water quality of Watercourses 4, 5 (Latherford Brook), Watercourse 6, and Watercourse 7 with subsequent impacts on ecological and physicochemical parameters of each watercourse. The Drainage Strategy (Appendix 13.2 [TR010054/APP/6.3]) states that treatment trains will consist of a combination of filter drains, wet ponds, swales, ditches and HVS. These treatment trains have been assessed according to the HEWRAT and M-BAT methods, which is presented in Appendix 13.3 of the ES. According to the results of this assessment adequate treatment is provided and no significant impacts are predicted.	No significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Di(2-ethylhexil)phthalate	Good	Good (2015)		Di(2-ethylhexil)phthalate is a plasticiser that may be used during construction to enable concrete to be worked when strong mixes are required. It is not expected that it would be used in very large quantities, and its use would be carefully controlled, as is any use of concrete. Wherever possible concrete will be batched off-side further minimising the risk of this priority hazardous substance getting into site runoff and tributaries leading to the River Penk.	None identified.	The use of chemicals on the construction site will be carefully controlled. It is expected that all chemicals will be stored on impermeable hard standing or in secure containers. Where possible concrete will be delivered to the site ready-mixed. Where concrete needs to be mixed on site this will be done in carefully defined areas away from watercourses. The use of wet concrete will also be controlled by the use of wooden shutters and any waste concrete quickly cleared up. Adequate concrete washout facilities will need to be provided so that waste water is stored for off-site disposal at a suitable waste management facility.		There is the potential for small spillages on site but it is not expected that there will be a significant source of this plasticiser on site and mitigation measures will be put in place to manage any spillage risk and ensure rapid remediation of any spillage.	No impact
Nonylphenols	Good	-		Nonylphenols may be found in certain construction products (e.g. road paint) and could be released to Latherford 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 Saredon Brook itself due to distance from the proposed scheme boundary (1.9km) with sufficient dilution upstream to prevent impact to the WFD watercourse.	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 Latherford Brook, since there will be two outfalls to this watercourse . However, Saredon Brook is considered too far away (1.9km) 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 quantities 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 pollution control measures in place to treat routine road runoff from the outfalls would provide some treatment for nonylphenols. As nonylphenols are not expected to be deposited on the road in any great quantity any remaining triclosan that enters watercourses would be diluted prior to reaching Saredon Brook (1.9km from the proposed scheme boundary).	No impact	No impact
Hydromorphological Status	**Supports Good**	**Supports Good (2015)**							
Hydrological Regime	Supports Good	Supports Good (2015)	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	During construction there may be a temporary increase in the rate and volume of runoff from the construction site due to vegetation clearance, bare working areas, and the construction of new hard standing. A temporary drainage system will be put in place and it is anticipated that much of this additional runoff will be directed to open areas to soakaway or will be attenuated prior to discharge using simple earth ponds and bunds etc. During works to install new watercourse crossings or minor diversions there may be the need to over pump or flume flows around the working area. However, this will seek to maintain the current hydrological regime as much as possible. Construction of the new road outfalls to Latherford Brook and new culvert 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 and culverts to result in direct impacts to the receiving watercourses.	Watercourse 5 (Latherford Brook) has been historically straightened, however, there is evidence that the watercourse is returning to its natural form. At the location of the proposed crossing the watercourse is showing signs of lateral movement, most likely as a result of localised change in gradient, and secondary channels active during high flow events. Culverting or straightening of the watercourse would result in further modification of the Latherford Brook at the crossing location, therefore representing a risk to the current WFD ecological and overall status. Therefore, it is recommended that the new link road crosses Watercourse 5 (Latherford Brook) supported on a 10 m clear-span bridge structure. This solution allows the naturally returning morphology of the waterbody to be retained as far as possible. A topographical channel survey shows that the wetted river corridor at the crossing location (split section) to be approximately 18 m total width – this includes two channels, a primary channel and secondary channel (utilised during higher flows), and the bank section between the two channels. The wetted river corridor of the existing primary channel at the crossing location is approximately 14 m wide. Ideally, a structure at this location would be at least wide enough to encompass both the primary and secondary channels in their existing alignments (18 m). This would allow the channel to continue to function and evolve naturally, therefore having minimal impact on the hydromorphology of the channel. However, the watercourse is a low energy stream with relatively cohesive banks and therefore the channel planform does not naturally actively change. What is occurring at the crossing location is considered to be adjustment, triggered by historic anthropogenic modification (e.g. straightening), as the watercourse attempts to re-establish equilibrium. Taking this into account it is considered that an acceptable compromise for the width of the structure at this location would be a minimum width of 10 m. This would allow the primary channel to be accommodated with minimal modification to channel geometry. It is considered that there is limited residual risk that the modifications required to build the structure would result in sufficient acceleration of the secondary currents to cause significant morphological adjustments to the channel. The minimum 10 m width allows for a 0.5 m buffer either side of the new channel cross-section to provide a residual floodplain. This buffer would allow for some lateral re-working of gravels as the channel adjusts to a new equilibrium post-construction. A culvert would be constructed to convey Watercourse 3 and Watercourse 4 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this report. The construction of a new culvert would result in the loss of a proportion of the channel and associated habitats, although the realignment of the channel presents an opportunity to provide enhancement over the current form. No new surface water concrete / pipe outfalls will be constructed for highway runoff. All highway drainage to Watercourse s-7 from the Scheme would be via new ditchcourses or existing outfalls associated with the existing road runoff network. However, two new outfalls supported by concrete headwalls will be required for drainage catchments 11 and 12, which is embankment drainage only. This is because the topography in the area prohibits the inclusion of new ditchcourses. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls. New outfalls would cause the loss of a small amount of riparian habitat, and if not well designed can result in bank and bed erosion, especially where watercourses have easily erodible substrates (for example, by locating them with a downstream angle and not protruding into the channel). It will also be important that the rate of any discharge is attenuated to reduce the risk of scour. However, the effects from installing new outfalls would tend to be localised and not significant at the waterbody level. The size of any supporting headwall should also be kept to a minimum and where possible pre-fabricated structures used to avoid having to pour concrete close to a watercourse. Given the small number of outfalls required, ability to ensure that the design is sympathetic to the environmental circumstances, and the localised nature of the impacts, no significant adverse impacts are predicted.	Appropriate measures to manage construction site runoff and any works in watercourses will be included in the Environmental Statement.	The rate of runoff from the Scheme will be controlled to ensure no detrimental change to the natural flow regime. The capacity of the culvert proposed for Latherford Brook will be designed to ensure adequate flow conditions from low to high conditions. The design will also ensure that there are no step changes in the bed and to maintain natural sediment transport processes through the structure to avoid local adjustment downstream or the build up of material upstream. It is important that the number of new outfalls is kept to a minimum and that they are well sited to avoid adverse impacts occurring (for example, at an angle pointing downstream) or the need to provide bank and bed scour protection. The size of any supporting headwall should also be kept to a minimum and where possible pre-fabricated structures used to avoid having to pour concrete close to a watercourse.	Potential for localised, temporary impacts during the long term. Assessment subject to review as culvert design progresses.	No impact
Mitigation measures assessment	**Moderate or less**	**Moderate or less (2015)**							
Retain marginal aquatic and riparian habitats (channel alteration)	N/A	N/A	The waterbody is in Nitrate Vulnerable Zone 308 (NVZ12SW013080). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted.	Temporary works to install the new outfalls and culverts will involve operating within and near the channel. Activities within these areas have potential to result in a lost of riparian habitat along short sections of the watercourses.	The new culvert and to a lesser extent outfalls will result in the loss of some riparian and bed habitat.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An OEMP has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment and preserve and minimise impacts to the riparian habitats within and adjacent to the Scheme.	The design of the culvert for Watercourse 4 aims to maintain the channel alignment, will be over-sized to accommodate peak flows, and include a sunken bed to enable development of a naturalised bed. The loss of riparian habitat and shading impacts are minimised at Watercourse 5 (Latherford Brook) by the crossing structure being a 10 m clear-span bridge. A culvert would also be constructed to convey Watercourses 3 and 4 beneath the Scheme. The dimensions and lengths of these culverts are described earlier in this report. The base of each culvert would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. With the exception of Watercourse 5 (Latherford Brook), there is limited evidence along the other small watercourses in the study area of any functional flows and sediment transport processes. However, the provision of a naturalised bed would help maintain channel/process continuum. The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities. The number of outfalls have been minimised by using ditchcourses to discharge from the treatment train to the receiving watercourse.	Potential for localised, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted at the waterbody scale given appropriate design. Therefore, the Scheme would be compliant with all WFD objectives.	No impact
Preserve and where possible enhance ecological value of marginal aquatic habitat, banks and riparian zone	N/A	N/A							
Preserve and, where possible, restore historic aquatic habitats	N/A	N/A							
Increase in-channel morphological diversity	N/A	N/A		During works to install new watercourse crossings or minor diversions there may be the need to over pump or flume flows around the working area. However, this will seek to maintain the current hydrological regime as much as possible.	The new culvert and to a lesser extent outfalls will result in localised changes to the flow regime which may impact morphological diversity around the outfalls and crossing.	Appropriate measures to manage construction site runoff and any works in watercourses are detailed in the OEMP.	The rate of runoff from outfalls will be controlled and any culverts will aim to maintain the channel alignment and will be over-sized to accommodate peak flows. Culverts will include a sunken bed if possible to enable development of a naturalised bed .		
Structures or other mechanisms in place and managed to enable fish to access waters upstream and downstream of the impounding works.	N/A	N/A		It is not clear what 'impoundment' this measure is seeking to address, but it most likely refers to a structure along the main stem channel of Saredon Brook, which will not be affected by the proposed Scheme. During works to install new watercourse crossings or minor diversions there may be the need to over pump or flume flows around the working area which would provide an impasse to any fish attempting to pass through. This is most likely on Watercourses 3 and 4, and less likely for Watercourse 5 (Latherford Brook), which will be crossed using a 10 m clear-span bridge.	Aquatic surveys have been undertaken by the project for six watercourses located within the vicinity of the Scheme, including fish surveys along Watercourses 3 to 6 that are tributaries of Saredon Brook, and macroinvertebrate surveys on Watercourse 5 Latherford Brook. The results are summarised below. The majority of fish captured at the running waterbodies were common freshwater fish in the UK with no protected status. Bullhead were of interest and captured at Watercourse 3 and 5 downstream of the Scheme boundary. These species are listed on Annex II of the EC Habitats Directive. Brown trout, a BAP species, are known to be present within Watercourse 5. Fish are mobile species and their presence should be considered when developing mitigation options as they have the ability to move in to the Scheme boundary. The proposal to install new culverts on Watercourses 3 and 4 could provide a discontinuation between habitats for any fish.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An OEMP has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary impacts on aquatic ecology. during the construction of the bridge or new culverts, a fish rescue and removal would need to be completed. In addition, areas of the Latherford Brook channel beyond the primary channel would need to be sectioned off with stop nets and fish captured within this area during the draw-down of water. Any water pumps used would need to be fitted with a fine mesh to stop fish being pulled though the pump in addition to a fisheries consultant monitoring the area of the pump abstraction to reduce the risk of fish entrainment. Captured fish should be kept in aerated holding facilities on the river bank until all fish have been captured. The fish should then be moved upstream of the construction works (approx. 100 m) where they would not be impacted and then released safely in to the watercourse. The construction work should only go ahead when the fisheries team/Ecological Clerk of Works have approved that all fish have been removed and with the appropriate consents from SCC and the Environment Agency. If over-pumping/fluming is required, water would be returned to the channel in the shortest possible distance downstream to minimise the depleted reach.	A culvert would also be constructed to convey Watercourses 3 and 4 beneath the Scheme. The dimensions and lengths of these culverts are described earlier in this report. The base of each culvert would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. The provision of a naturalised bed would help maintain channel/process continuum and maintain access for fish. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring.	Potential for localised, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted at the waterbody scale given appropriate design. During operation, embedded mitigation should prevent severance of the catchment for fish passage. Overall, the Scheme would be compliant with all WFD objectives.	No impact

Surface Water Body (name/ID/RBMP):	Penk from Source to Saredon Brook (GB104028046680)	**Current status or potential:**	Poor Status		
Water body length:	14.015 km	**Target status or potential (2027):**	Poor (2015)		
water body catchment area:	6386.87 ha	**Protected Areas:**	Nitrates Directives 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID: NVZ12SW016010) and River Penk (Urban Waste Water Treatment Directive).		
Heavily modified?	Not designated artificially or heavily modified				
Summary of scheme components:	The River Penk is located 1.7km west of the eastern extent of the works at M54 Junction 2. No direct impacts will occur to the main channel due its distances from the Scheme. However, as all watercourses potentially affected by the Scheme are tributaries of the River Penk, there is the potential for indirect water quality effects on WFD quality elements during construction and operation phases. New or modified structures to cross watercourses or outfalls to discharge highway or embankment runoff will be provided and will have direct physical impacts to tributaries of The River Penk.				

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**	**Poor (2015)**							
Invertebrates	Moderate	Good (2027)	The waterbody flows within three Nitrate Vulnerable Zones: 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID: NVZ12SW016010). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted. However, as the Scheme will not affect nitrate levels no further consideration of this Protected Area is made. The River Penk is also protected under the Urban Waste Water treatment Directive which protects the river from potentially adverse effects from urban and industrial waste water discharges. Again, as the Scheme will not affect discharges from waste water treatment works no further assessment is required of this Protected Area.	During the construction phase construction works may result in a reduction in water quality, both surface and groundwater, due to deposition or spillage of soils, sediments, oils, fuels, or other construction chemicals, or through mobilisation of contamination following disturbance of contaminated ground or groundwater, or through uncontrolled site run-off. Any reduction in water quality could impact invertebrate and fish communities through toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. Impacts to the River Penk would be indirect via construction site discharges of runoff to the various tributaries that cross the scheme.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the River Penk would be indirect via highway discharges to the various tributaries that cross the Scheme. The River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required. The drainage strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80 m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme. Assuming this is the case, there are no significant impacts anticipated. There would be sporadic release of de-icant salts in winter with potential for impacts on ecological and physicochemical parameters of Watercourse 2. No impacts are anticipated upon the Staffordshire and Worcestershire Canal as there is no hydrological connectivity between the Scheme and this watercourse. Generally, it is considered that because de-icing salts are used infrequently and in the colder months, over short periods and with frequent higher flows in between in which to dilute and disperse 'salty' water, significant long term adverse impacts would be unlikely to occur. SuDS systems, such as the attenuation pond in place, 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. There is existing de-icing pressure on the watercourse 2, but there would be an increase in de-icant applied to treat the larger impermeable road area drained associated with the re-design of the junction. However, given the River Penk is 4 km downstream, any impacts associated with de-icant salts during operation would not be significant at the waterbody scale. Two culverts would be constructed to convey Watercourse 2 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this report. Each culvert would result in the loss of a proportion of the channel and associated habitats. For Watercourse 2, to minimise the length of the culvert it is proposed to realignment and regrade this minor watercourse over approximately 80 m. Realignment and culverting of this watercourse would be done in such a way as to ensure conveyance of flow, and any coarse sediment transport processes. The form of the diversions will be determined during the detailed design stage and informed by appropriate hydromorphological and ecological surveys, and would replicate, as far as reasonably practically, the natural form of the channel. The OEMP [TR010054/APP/6.11] includes a commitment to this. No new surface water concrete / pipe outfalls will be constructed. All highway and land drainage to Watercourse 1 and 2 from the Scheme would be via new ditchcourses or existing outfalls associated with the existing road runoff network. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	The drainage strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80 m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme. Through the application of mitigation measures the adverse impact of proposed culverts along Watercourse 2 can be mitigated and compensated for. It is proposed that the base of the culverts would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. There is limited evidence along Watercourse 2 of any natural functional flows and sediment transport processes that can support the creation of geomorphic bedforms and channel features, as these watercourses are first order headwater streams that has already been significantly modified by past land use and construction of the M54. However, the provision of a naturalised bed would help maintain channel/process continuum. The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities. For Watercourse 2, to minimise the length of the culvert it is proposed to realignment and regrade this minor watercourse over approximately 80 m. Realignment and culverting of this watercourse through the junction would ensure conveyance of flow. The form of this diversion will be determined during detailed design and informed by appropriate hydromorphological and ecological surveys.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges and appropriate design of the Latherford Brook crossing. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Macrophytes and Phytobenthos	Poor	Good (2027)							
Fish	Poor	Poor (2015)							
Physicochemical status	**Moderate**	**Good (2027)**							
Ammonia	High	Good (2015)	The waterbody flows within three Nitrate Vulnerable Zones: 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID: NVZ12SW016010). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted. However, as the Scheme will not affect nitrate levels no further consideration of this Protected Area is made. The River Penk is also protected under the Urban Waste Water treatment Directive which protects the river from potentially adverse effects from urban and industrial waste water discharges. Again, as the Scheme will not affect discharges from waste water treatment works no further assessment is required of this Protected Area.	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 River Penk indirectly. However, the River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. Nevertheless, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the River Penk would be indirect via highway discharges to the various tributaries that cross the scheme. The River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	The drainage strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the 'Penk from Source to Saredon Brook.'
Dissolved Oxygen	Moderate	Good (2027)							
pH	High	Good (2015)							
Phosphate	Poor	Good (2021)							
Temperature	High	Good (2015)							
Specific pollutants	**High**	**High (2015)**							
Triclosan	High	High (2015)	The waterbody flows within three Nitrate Vulnerable Zones: 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID:	Triclosan can be derived from numerous sources (e.g. soaps, construction products). Triclosan may be found in certain construction products and could find its way into the River Penk via tributaries that cross the working areas via spillages and uncontrolled site runoff. However, it is not expected to be present or stored in large quantities on site and the River Penk is a minimum >2 km from the site, with dilution and dispersion expected along tributaries. Standard mitigation measures to control the use of chemical substances on site and the risk of spillages will be required.	Triclosan could be deposited on the road surface in small quantities but would be diluted in highway runoff and again in the receiving watercourses prior to the River Penk.	Following best construction practice will minimise potential for adverse impacts, and any remaining impacts would be temporary and localised particularly given the minor quantities of triclosan expected to be on site. A temporary site drainage system would be implemented along with an appropriate Water Management Plan. Any spillage that is observed would be contained and water removed for disposal off site.	As triclosan is not expected to be deposited on the road in any great quantity any remaining triclosan that enters watercourses would be first passed through a highway treatment train (including a combination of wet ponds, filter drains, swales, and ditches) and then diluted and dispersed along tributaries before the River Penk.		

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**	**Poor (2015)**							
Manganese	High	-	NVZ12SW015940) and 601 (ID: NVZ12SW016010). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted. However, as the Scheme will not affect nitrate levels no further consideration of this Protected Area is made. The River Penk is also protected under the Urban Waste Water treatment Directive which protects the river from potentially adverse effects from urban and industrial waste water discharges. Again, as the Scheme will not affect discharges from waste water treatment works no further assessment is required of this Protected Area.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, may introduce specific pollutants to the River Penk indirectly. However, the River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. Nevertheless, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the River Penk would be indirect via highway discharges to the various tributaries that cross the scheme. The River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	The drainage strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme.	Potential for localise, temporary impacts during construction works with the application of mitigation measures. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source.to Saredon Brook.'
Copper	High	High (2015)							
Iron	High	-							
Zinc	High	High (2015)							
Priority substances									
Lead and its compounds	Good	Good (2015)	The waterbody flows within three Nitrate Vulnerable Zones: 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID: NVZ12SW016010). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted. However, as the Scheme will not affect nitrate levels no further consideration of this Protected Area is made. The River Penk is also protected under the Urban Waste Water treatment Directive which protects the river from potentially adverse effects from urban and industrial waste water discharges. Again, as the Scheme will not affect discharges from waste water treatment works no further assessment is required of this Protected Area.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, may introduce priority substances in small amounts to the River Penk indirectly. However, the River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. Nevertheless, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the River Penk would be indirect via highway discharges to the various tributaries that cross the scheme. The River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	The Drainage Strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme.	No significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Nickel and its compounds	Good	Good (2015)							
Chemical status-priority hazardous substances	**Good**	**Good (2015)**							
Cadmium and its compounds	Good	Good (2015)	The waterbody flows within three Nitrate Vulnerable Zones: 308 (ID: NVZ12SW013080), 594 (ID: NVZ12SW015940) and 601 (ID: NVZ12SW016010). Within these zones the use of nitrogen fertilisers and storage of organic manure is restricted. However, as the Scheme will not affect nitrate levels no further consideration of this Protected Area is made. The River Penk is also protected under the Urban Waste Water treatment Directive which protects the river from potentially adverse effects from urban and industrial waste water discharges. Again, as the Scheme will not affect discharges from waste water treatment works no further assessment is required of this Protected Area.	Construction works adjacent to or over surface watercourses can lead to excessive levels of fine sediment and spillages of chemicals, may introduce priority substances in small amounts to the River Penk indirectly. However, the River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. Nevertheless, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	Highway runoff can include a range of substances that can be harmful to the water environment resulting in poor water quality, smothering habitats with fine sediment, and adversely impacting aquatic ecosystems. The quality and effects of highway runoff is influenced by many parameters and is difficult to predict accurately. Common roadway pollutants include sediment/grit, dissolved and particulate heavy metals, hydrocarbons, pesticides and other organic-compounds, nutrients, de-icing salt, and litter. There is also the risk that a serious road traffic accident could result in a significant chemical spillage which may involve for example fuels, acids, or liquid food products that can exert a biochemical oxygen demand as they degrade. Any reduction in water quality could potentially adversely impact invertebrate and fish communities through chronic or acute toxic effects, reductions in dissolved oxygen, smothering of habitat, and direct physical impacts. Fine sediments may also smother macrophytes and diatoms and reduce the potential for photosynthesis. However, impacts to the River Penk would be indirect via highway discharges to the various tributaries that cross the scheme. The River Penk is at least > 2 km downstream of the Scheme, and in most cases significantly further. Any pollutants discharged into these tributaries would begin to be diluted, dispersed, and potentially deposited before it reaches the River Penk. However, to avoid significant impacts and the potential for non-compliance with WFD objectives mitigation will be required.	At this stage full details of out construction risks to the water environment will be managed have not yet been determined. An Outline Environmental Management Plan (OEMP) has been produced which outlines the mitigation measures that would be undertaken during construction of the Scheme to mitigate temporary effects on the water environment. The OEMP refers to a Water Management Plan (WMP) that would provide details on the following key areas of concern: - managing the risk of pollution to surface waters and the groundwater environment from all works (including construction of foundations and dewatering of excavations); - measures to control the storage, handling and disposal of substances during construction; - emergency procedure for how to respond to a serious pollution incident; - the management of activities in, over, under and near watercourses and their floodplains and other ponds and lakes; - the scope of any pre-, during-, and post-construction water quality or other relevant environmental monitoring; and - details of what permits and consents are required for works to water bodies.	The Drainage Strategy (Appendix 13.2 of the Environmental Statement [TR010054/APP/6.3]) includes a treatment train consisting of a wet attenuation pond followed by a swale/grassed channel (lined) and approximately 70-80m of open ditch. In order for the treatment train to remain effective at all times, it will require maintenance through the lifecycle of the Scheme.	No significant impacts are predicted provided adequate mitigation of construction and operation phase highway discharges. Therefore, the Scheme would be compliant with all WFD objectives.	The downstream waterbody is Penk - Saredon Brook to Whiston Brook. This waterbody is also a Poor Status overall (2016). The assessment of this water body is the same as for the Penk 'from Source to Saredon Brook.'
Di(2-ethylhexil)phthalate	Good	Good (2015)		Di(2-ethylhexil)phthalate is a plasticiser that may be used during construction to enable concrete to be worked when strong mixes are required. It is not expected that it would be used in very large quantities, and its use would be carefully controlled, as is any use of concrete. Wherever possible concrete will be batched off-side further minimising the risk of this priority hazardous substance getting into site runoff and tributaries leading to the River Penk.	None identified.	The use of chemicals on the construction site will be carefully controlled. It is expected that all chemicals will be stored on impermeable hard standing or in secure containers. Where possible concrete will be delivered to the site ready-mixed. Where concrete needs to be mixed on site this will be done in carefully defined areas away from watercourses. The use of wet concrete will also be controlled by the use of wooden shutters and any waste concrete quickly cleared up. Adequate concrete washout facilities will need to be provided so that waste water is stored for off-site disposal at a suitable waste management facility.		There is the potential for small spillages on site but it is not expected that there will be a significant source of this plasticiser on site and mitigation measures will be put in place to manage any spillage risk and ensure rapid remediation of any spillage.	No impact

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**	**Poor (2015)**							
Nonylphenols	Good	_		Nonylphenols may be found in certain construction products (e.g. road paint) and could be released to Latherford 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 Saredon Brook itself due to distance from the Scheme boundary (1.9km) with sufficient dilution upstream to prevent impact to the WFD watercourse.	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 Latherford Brook, since there will be two outfalls to this watercourse . However, Saredon Brook is considered too far away (1.9km) 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 quantities 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 pollution control measures in place to treat routine road runoff from the outfalls would provide some treatment for nonylphenols. As nonylphenols are not expected to be deposited on the road in any great quantity any remaining triclosan that enters watercourses would be diluted prior to reaching Saredon Brook (1.9km from the Scheme boundary).	No impact	No impact
Hydromorphological Status	**Supports Good**	**Supports Good (2015)**							
Hydrological Regime	Supports Good	Supports Good (2015)	None identified	During construction there may be a temporary increase in the rate and volume of runoff from the construction site due to vegetation clearance, bare working areas, and the construction of new hard standing. A temporary drainage system will be put in place and it is anticipated that much of this additional runoff will be directed to open areas to soakaway or will be attenuated prior to discharge using simple earth ponds and bunds etc. During works to install new watercourse crossings or minor diversions there may be the need to over pump or flume flows around the working area. However, this will seek to maintain the current hydrological regime as much as possible.	Two culverts would be constructed to convey Watercourse 2 beneath the Scheme. The dimensions and lengths of these culverts are described in Section 1.2 of this report. Each culvert would result in the loss of a proportion of the channel and associated habitats. For Watercourse 2, to minimise the length of the culvert it is proposed to realign and regrade this minor watercourse over approximately 80 m. Realignment and culverting of this watercourse through the junction would ensure conveyance of flow. The form of this diversion will be determined during the detailed design stage and informed by appropriate hydromorphological and ecological surveys. No new surface water concrete / pipe outfalls will be constructed. All highway and land drainage to Watercourse 1, 2 or 3 from the Scheme would be via new ditchcourses or existing outfalls associated with the existing road runoff network. Therefore, no adverse impact on the morphology of these waterbodies is predicted from new outfalls.	Appropriate measures to manage construction site runoff and any works in watercourses will be included in the Environmental Statement.	The rate of runoff from the Scheme will be controlled to ensure no detrimental change to the natural flow regime. The capacity of the culverts proposed for Watercourse 2 have been designed to ensure adequate flow conditions from low to high conditions. The design will also ensure that there are no step changes in the bed and to maintain natural sediment transport processes through the structure to avoid local adjustment downstream or the build up of material upstream. Through the application of mitigation measures the adverse impact of proposed culverts along Watercourse 2 can be mitigated and compensated for. It is proposed that the base of the culverts would be sunken below the current bed level by a minimum of 300 mm and backfilled with excavated bed material or a suitable grade substrate to ensure a naturalised bed is provided through the extended culvert structure. They have also been sized appropriately to carry the watercourse without constriction or narrowing to ensure that they do not accumulate sediment upstream due to afflux cause by too narrow a culvert, or starve the channel downstream of sediment leading to excessive bed scouring. There is limited evidence along Watercourse 2 of any natural functional flows and sediment transport processes that can support the creation of geomorphic bedforms and channel features, as these watercourses are first order headwater streams that has already been significantly modified by past land use and construction of the M54. However, the provision of a naturalised bed would help maintain channel/process continuum. The loss of channel would also be compensated by the creation of new ditchcourses as part of the highway drainage system, linking new treatment ponds to existing waterways. These ditches will be carefully designed to reflect natural forms and to maximise biodiversity opportunities. The diversion of Watercourse 2 will be determined during detailed design and informed by appropriate hydromorphological and ecological surveys. The OEMP [TR010054/APP/6.11] includes a commitment to this.	Potential for localise, temporary impacts during the long term. Assessment subject to review as culvert design progresses.	No impact
Morphology	Supports Good	Supports Good (2015)	None identified					Potential for localise, temporary impacts during the long term. Assessment subject to review as culvert design progresses.	No impact

Groundwater Body (name/ID/RBMP):	PT Sandstone Staffordshire (GB40401G300500)	**Current status or potential:**	Poor
Groundwater area:	31126.753 ha	**Target status or potential (2027):**	Poor (2015)
Summary of scheme components:	This groundwater body underlies the southern section of the study area (See Figure 13.1 of the ES [TR010054/APP/6.2]). The northern section is underlain the Mercia Mudstone East & Coal Measures Groundwater, assessed separately	**Protected Areas:**	Nitrate Vulnerable Zones (NVZ); 27 (NVZ12GW010270), 30 (NVNVZ12GW010300) and 149 (NVZ12GW011490) and PT Sandstone Staffordshire Drinking Water Protected Area (UKGB40401G300500)

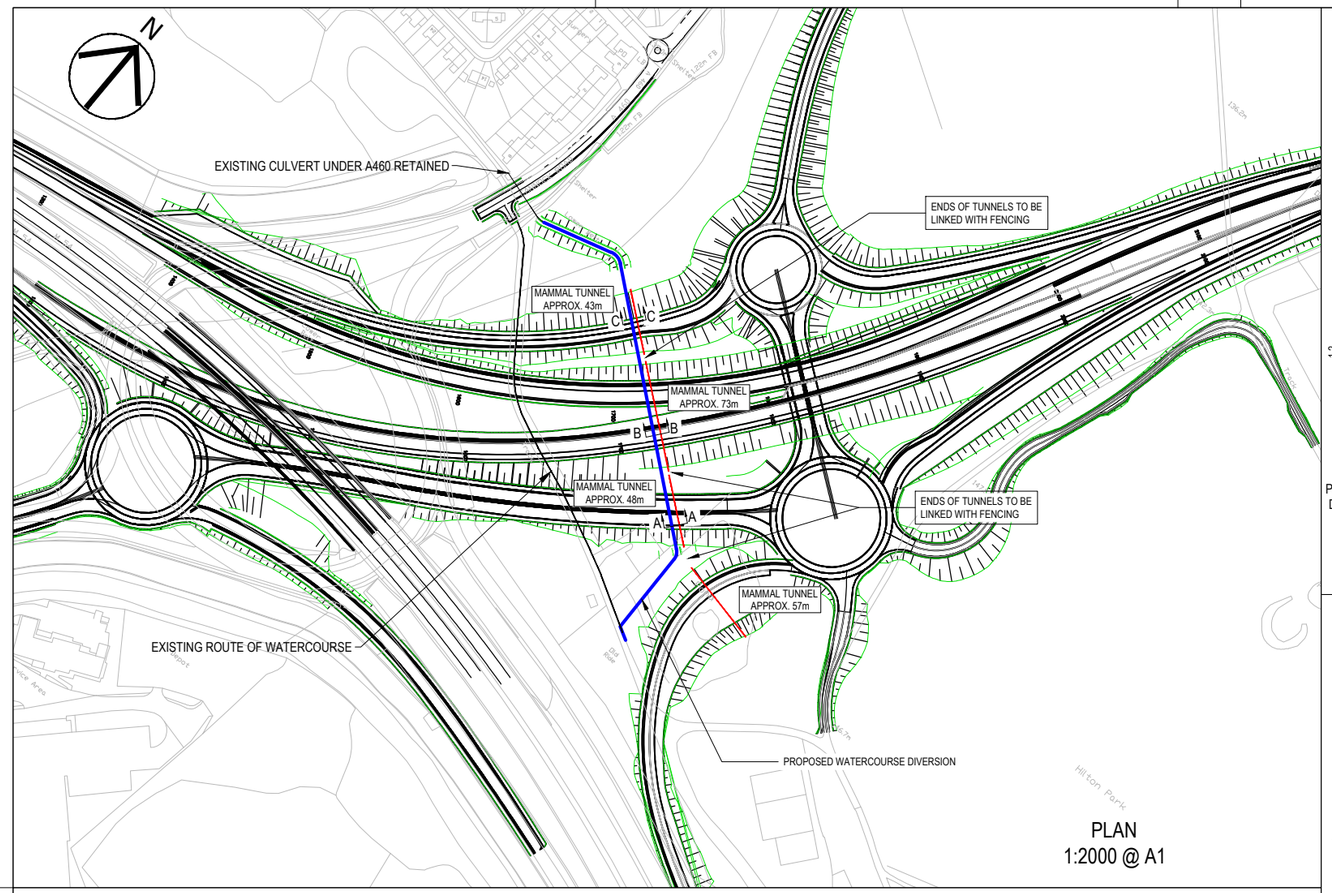
WFD Parameter	Current Status/Potential	Target Status/ Potential	Description of other Protected Areas objectives	Brief description of impact		Brief description of mitigation measures		Residual impacts and WFD compliance	Consideration of impact to adjacent waterbodies
				Construction	Operation	Construction	Operation		
Quantitative Status Element	**Poor**	**Poor (2015)**							
Saline or other intrusions	Good	Good (2015)	There are three NVZ's; 27 (NVZ12GW010270), 30 (NVNVZ12GW010300) and 149 (NVZ12GW011490). NVZ's are zones where restrictions apply for use of nitrogen fertiliser and storage of organic manure.	No direct or indirect impacts are predicted.	No direct or indirect impacts are predicted.	No comment	No comment	Potential localised / temporary impacts to groundwater levels are resources are predicted during the construction and operation of the Scheme. However, no significant impacts are predicted provided adequate mitigation of construction and operation phase are implemented. Therefore, the Scheme would be compliant with all WFD objectives.	No applicable
Dependent Surface Water Body Status	Poor	Good (2027)		There are potential risk that deep excavations and cuttings associated with the scheme will intercept shallow groundwater flows including baseflow to the watercourses across the Scheme.	There is potential indirect impacts on groundwater baseflow to the surrounding watercourses	All dewatering and groundwater management activities should be undertaken based on the requirements of appropriate permits and licences. It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13: Road Drainage and Water Environment and Chapter 9: Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	It is anticipated that the dewatering impacts will be temporary and the drainage strategy will redirect any intercepted groundwater appropriately to minimise any significant impacts on baseflow to water courses		
Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good	Good (2015)		No direct or indirect impacts are predicted.	No licenced or private groundwater abstractions or GWDTEs within 100m and 200m of the Scheme Boundary.	It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13: Road Drainage and Water Environment and Chapter 9: Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	No comment		
Water Balance	Poor	Poor (2015)		Excavations may remove the protective layers of soil and subsoil making the groundwater below more vulnerable to pollution from leaks or spills from vehicles or plant. Excavation may also liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted.	The scheme may potentially reduce infiltration where areas of hard surfaces are introduced	It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13: Road Drainage and Water Environment and Chapter 9: Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	It is anticipated that the dewatering impacts will be temporary and the drainage strategy will redirect any intercepted groundwater appropriately to minimise any significant impacts on baseflow to water courses		
Chemical Status Element	**Good**	**Good (2015)**							
Saline or other intrusions	Good	Good (2015)	There are three NVZ's; 27 (NVZ12GW010270), 30 (NVNVZ12GW010300) and 149 (NVZ12GW011490). NVZ's are zones where restrictions apply for use of nitrogen fertiliser and storage of organic manure.	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 small agricultural ditches (including chemical spillages) is minimal but still present. Road runoff may contain pollutants associated with vehicle traffic (that include metals such as copper and zinc and hydrocarbons). Road traffic accidents may also lead to chemical spillages.	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 or similar. 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 will be assessed through a HEWRAT analysis as described in DMRB LA 113. Mitigation will be implemented to ensure adequate protection of the water environment from runoff and the risk of chemical spillages. This may include the provision of a clay rich soil matrix or a liner beneath ponds.	No impacts to groundwater quality is predicted. Therefore, the Scheme would be compliant with all WFD objectives.	No applicable
Dependent Surface Water Body Status	Poor	Good (2027)							
GWDTEs	Good	Good (2015)							
Drinking Water Protected Areas (FrWPAs)	Good	Good (2027)							
General Chemical Test	Good	Good (2015)							

Groundwater Body (name/ID/RBMP):	Mercia Mudstone East & Coal Measures (GB40402G300300)	**Current status or potential:**	Good
Groundwater area:	41847.788 ha	**Target status or potential (2027):**	Good (2015)
Summary of scheme components:	Underlies the northern section of the study area within proximity to the M6 Junction 11	**Protected Areas:**	Nitrate Vulnerable Zones (NVZs); 30 (NVZ12GW010300) and 33 (NVZ12GW010330)

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)	There are two NVZ's; 30 (NVNVZ12GW010300) and 33 (NVZ12GW010330). NVZ's are zones where restrictions apply for use of nitrogen fertiliser and storage of organic manure.	No direct or indirect impacts are predicted.	No direct or indirect impacts are predicted.	No comment	No comment	No impacts to groundwater quantities are predicted. Therefore, the Scheme would be compliant with all WFD objectives.	Not applicable
Dependent Surface Water Body Status	Good	Good (2015)		There are potential risk that deep excavations and cuttings associated with the scheme will intercept shallow groundwater flows including baseflow to the watercourses across the Scheme.	There is potential indirect impacts on groundwater baseflow to the surrounding watercourses.	All dewatering and groundwater management activities should be undertaken based on the requirements of appropriate permits and licences. It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13: Road Drainage and Water Environment and Chapter 9: Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	It is anticipated that the dewatering impacts will be temporary and the drainage strategy will redirect any intercepted groundwater appropriately to minimise any significant impacts on baseflow to watercourses.		
Groundwater Dependent Terrestrial Ecosystems (GWDTEs)	Good	Good (2015)		No direct or indirect impacts are predicted.	No licenced or private groundwater abstractions within 100m of the Scheme Boundary. There are no GWDTEs within 200m of the Scheme Boundary.	It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13 Road Drainage and Water Environment and Chapter 9 Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	No comment		

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)**							
Water Balance	Good	Good (2015)		Excavations may remove the protective layers of soil and subsoil making the groundwater below more vulnerable to pollution from leaks or spills from vehicles or plant. Excavation may also liberate groundwater in the form of seepages from any areas of permeable ground or superficial deposits (sands, clays, gravels) that are intercepted.	The scheme may potentially reduce infiltration where areas of hard surfaces are introduced	It is proposed that appropriate working practices, plans and equipment required to deal with dewatering of groundwater would be included in the Construction Environmental Management Plan, Water Management Plan and described in a comprehensive groundwater mitigation strategy, that should be considered at the detailed design stage. Please refer to Chapter 13: Road Drainage and Water Environment and Chapter 9: Geology and Soils of the Environmental Statement [TR010054/APP/6.1].	It is anticipated that the dewatering impacts will be temporary and the drainage strategy will redirect any intercepted groundwater appropriately to minimise any significant impacts on baseflow to watercourses.		
Chemical Status Element	**Good**	**Good (2015)**							
Saline or other intrusions	Good	Good (2015)	There are two NVZ's; 30 (NVNVZ12GW010300) and 33 (NVZ12GW010330). NVZ's are zones where restrictions apply for use of nitrogen fertiliser and storage of organic manure.	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 small agricultural ditches (including chemical spillages) is minimal but still present. 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. 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 HEWRAT analysis as described in DMRB LA113, and is compliant.	No impacts to groundwater quantities are predicted. Therefore, the proposed development would be compliant with all WFD objectives.	Not applicable
Dependent Surface Water Body Status	Good	Good (2015)							
GWDTEs	Good	Good (2015)							
Drinking Water Protected Areas (FrWPAs)	Good	Good (2015)							
General Chemical Test	Good	Good (2015)							

Annex C – Watercourse Crossing Design Drawings



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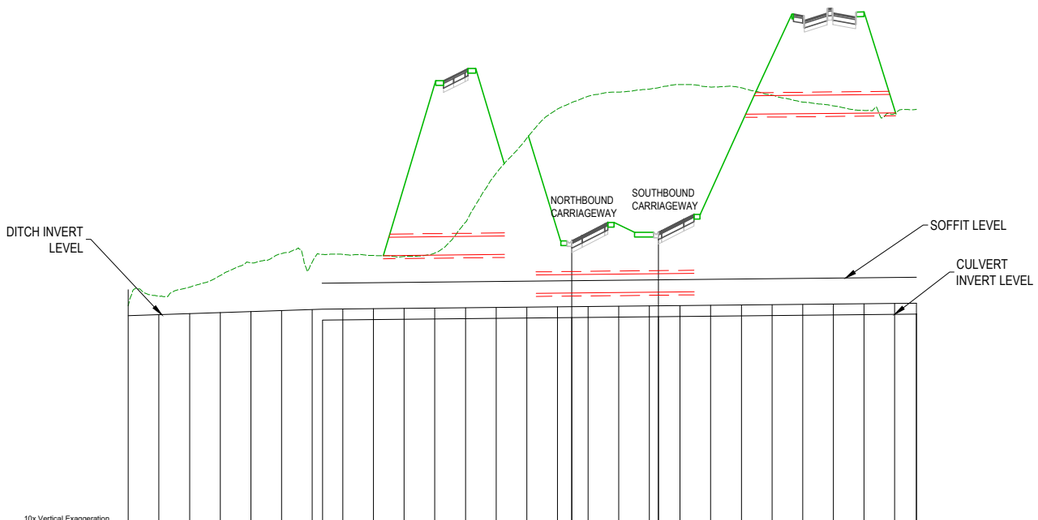

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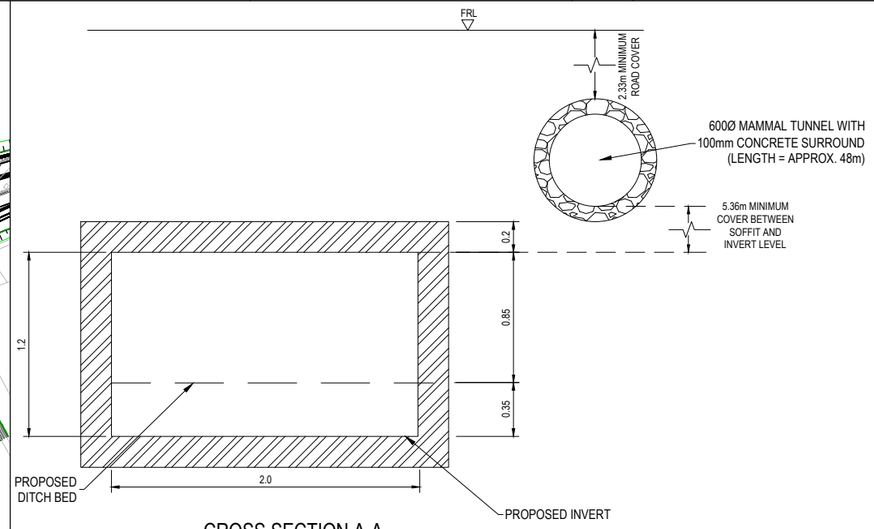

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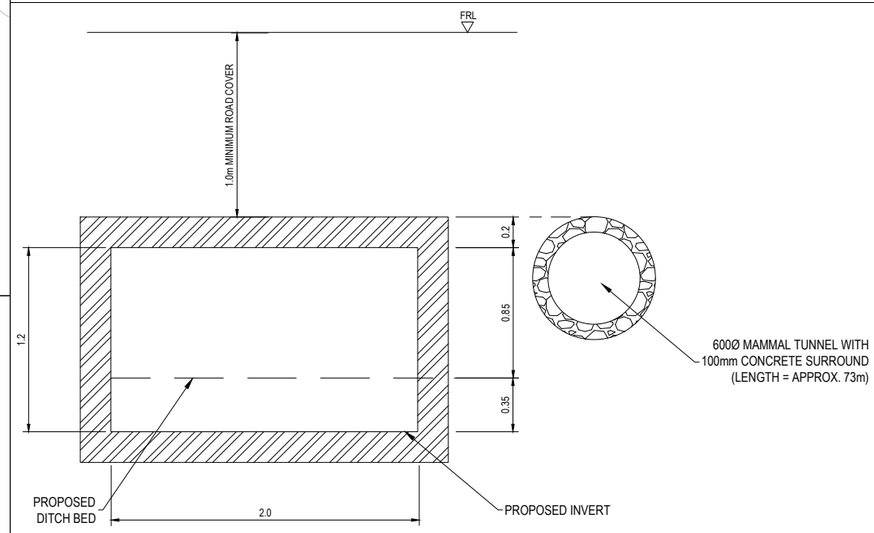

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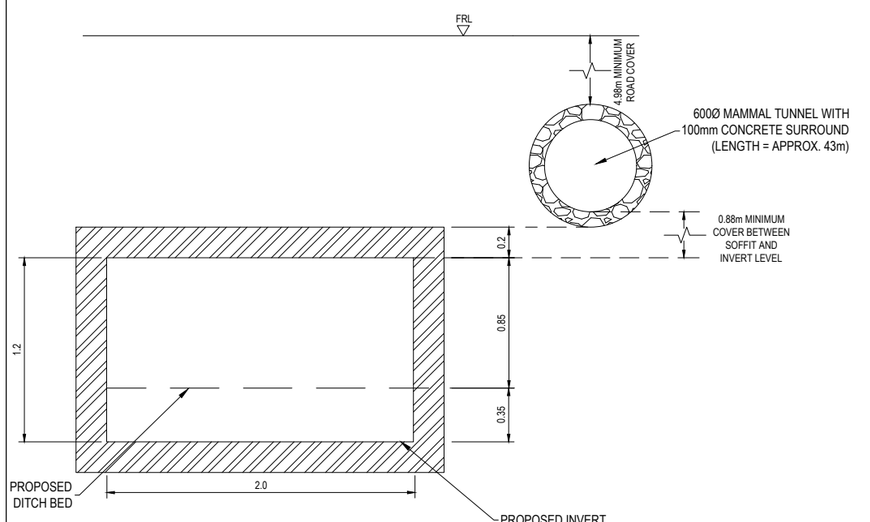

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MAINTENANCE / OPERATION / DECOMMISSIONING / DEMOLITION

NOTES

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KEY

PROPOSED DITCH ALIGNMENT

Revision Details	By / Check	Date	Suffix
First Issue	HS / AM	31/07/19	P01
Culvert cross section amended.	MW / AM	02/09/19	P02

Purpose of issue

SUITABLE FOR INFORMATION

Client
Highways England
The Cube
199 Wharfside Street
Birmingham
B1 1RN

Working on Behalf of highways england

Project Title

M54 TO M6 LINK ROAD

Drawing Title

WATERCOURSE 2
PROPOSED LEVELS

Designed	Drawn	Checked	Approved	Date
MW	MW	SB	AM	02/09/19

Internal Project No.	Suitability
60536736	S2
Scale @ A1	Zone
AS SHOWNH/AS SHOWNV	Highways General

AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
Tel01246 209221
Fax01246 209229
www.aecom.com

AECOM Infrastructure & Environment UK Limited
Registered in England Registered number: 880328
Registered office: Scott House, Alencon Link,
Basingstoke, Hampshire RG21 7PP

Drawing Number				Rev
Highways England PIN	Originator	Volume		
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Z1_SW_PR_Z		-SK-CH-1001		
Location		Type / Role / Number		

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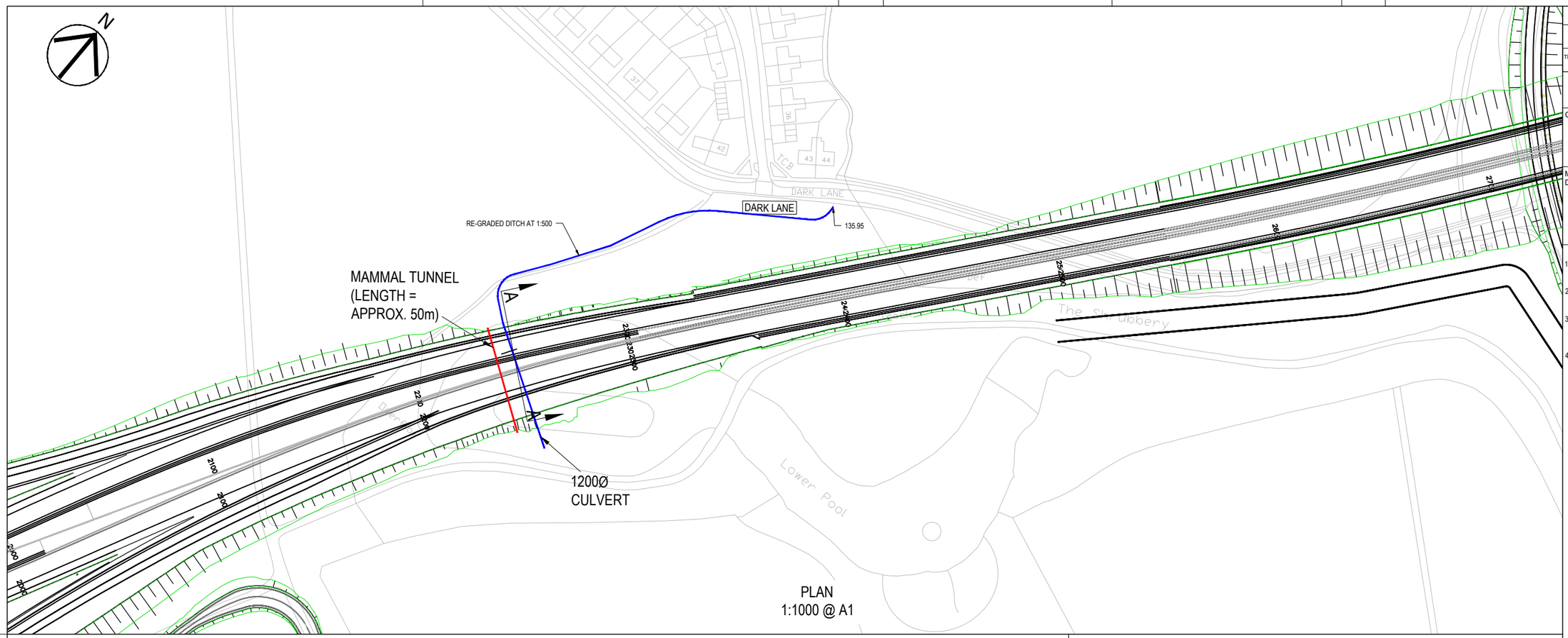

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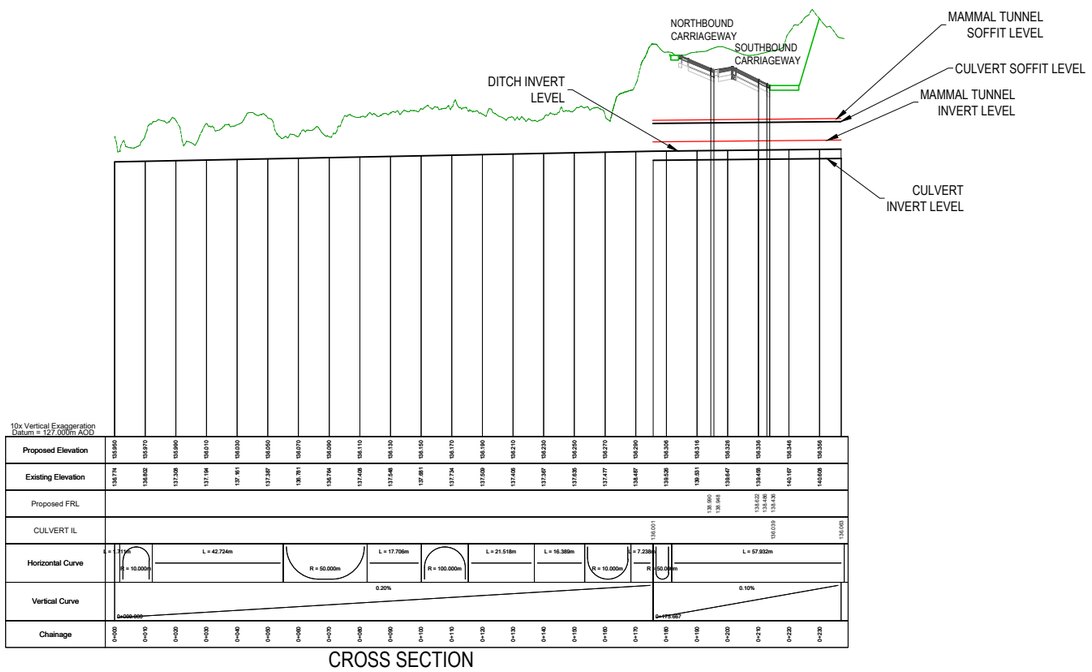

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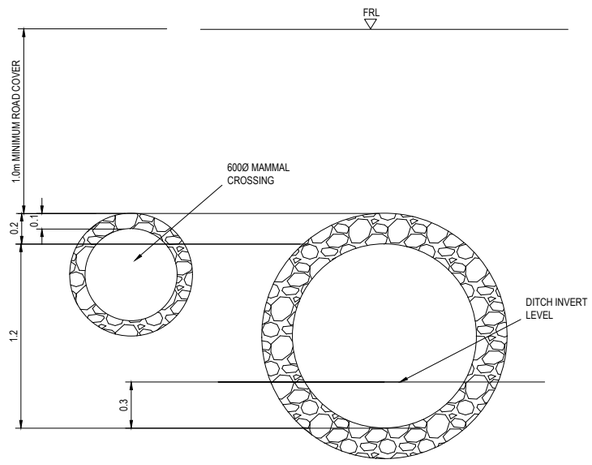

TYPICAL CROSS
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SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

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CONSTRUCTION

MAINTENANCE / OPERATION / DECOMMISSIONING / DEMOLITION

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KEY

PROPOSED DITCH ALIGNMENT

Revision Details	By / Check	Date	Suffix
First Issue	HS / AM	31/07/19	P01
Mammal tunnel included on cross section	MW / AM	02/09/19	P02

Purpose of issue

SUITABLE FOR INFORMATION

Client
Highways England
The Cube
199 Wharfside Street
Birmingham
B1 1RN

Working on behalf of highways england

Project Title

M54 TO M6 LINK ROAD

Drawing Title

WATERCOURSE 3
PROPOSED LEVELS

Designed	Drawn	Checked	Approved	Date
---	MW	SB	AM	02/09/19

Internal Project No.	Suitability
60536736	S2
Scale @ A1	Zone
AS SHOWNH/AS SHOWNV	Highways General

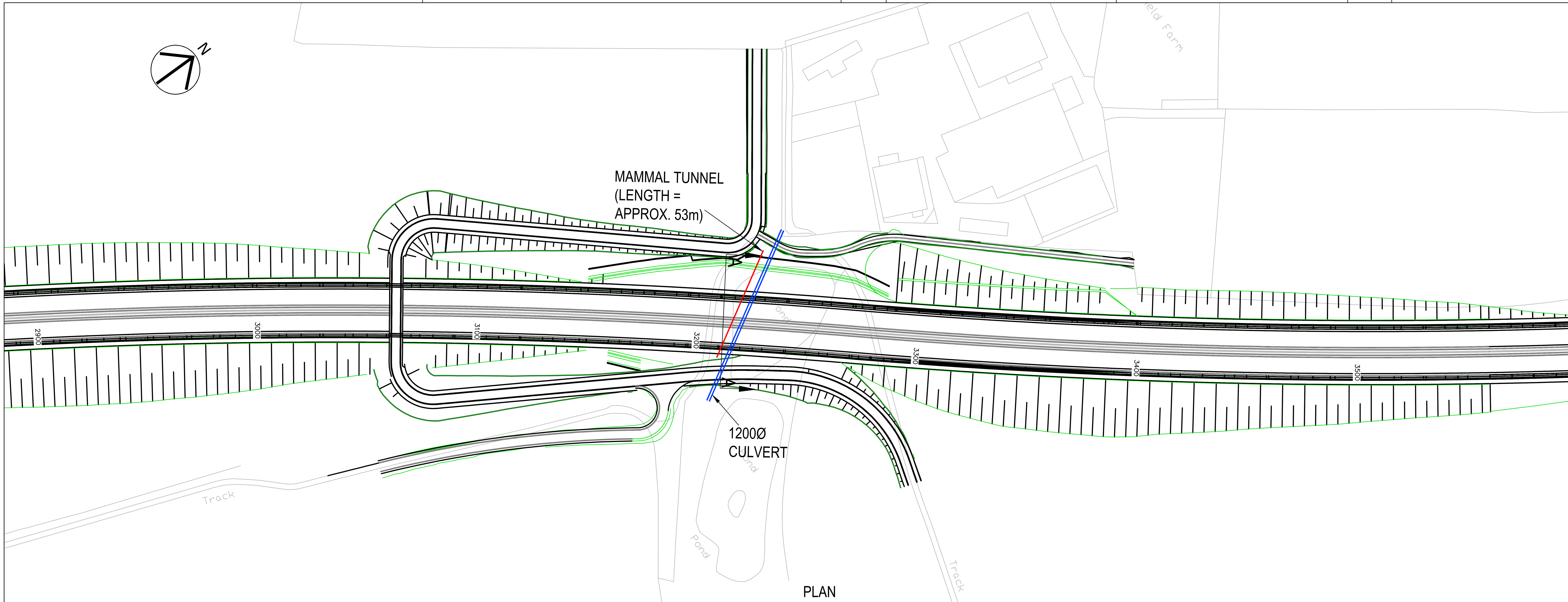
AECOM
Royal Court
Basil Close, Chesterfield
Derbyshire. S41 7SL
Tel01246 209221
Fax01246 209229
www.aecom.com

AECOM Infrastructure & Environment UK Limited
Registered in England Registered number: 880328
Registered office: Scott House, Alencon Link,
Basingstoke, Hampshire RG21 7PP

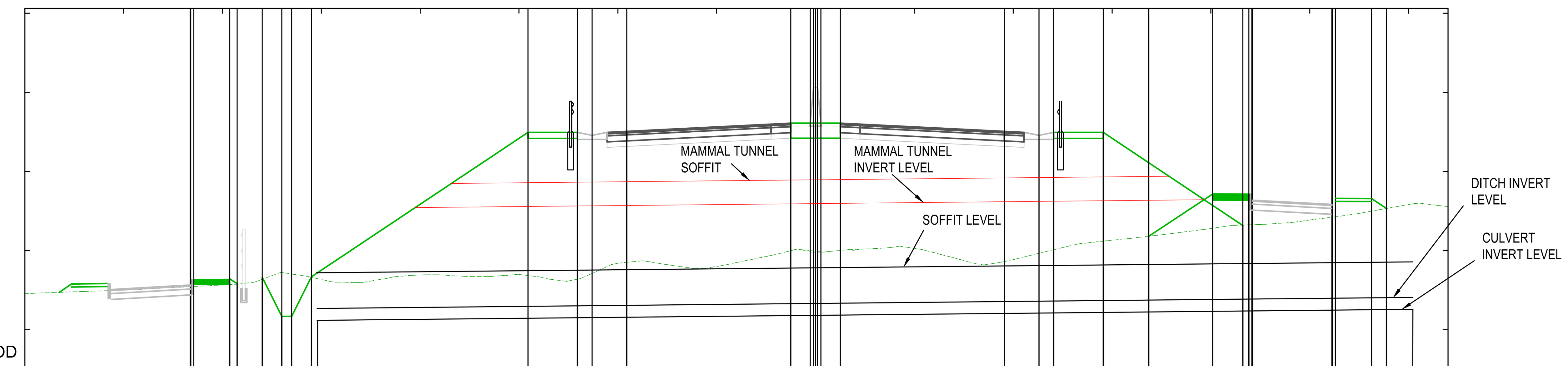
Drawing Number
Highways England PIN | Originator | Volume | Location | Type | Role | Number | Rev

HE514465 -ACM -HGN- Z2_SW_PR_Z -SK-CH-1001 P02

Rev Date: 02 September 2019 12:23:36
File Name:C:\PWWORKING\AECOM_D302_UK-CL1\MARC.WOLSTENHOLME.@AECOM.COM\DMS225187\HE514465-ACM-HGN-Z2_SW_PR_Z-SK-CH-1001

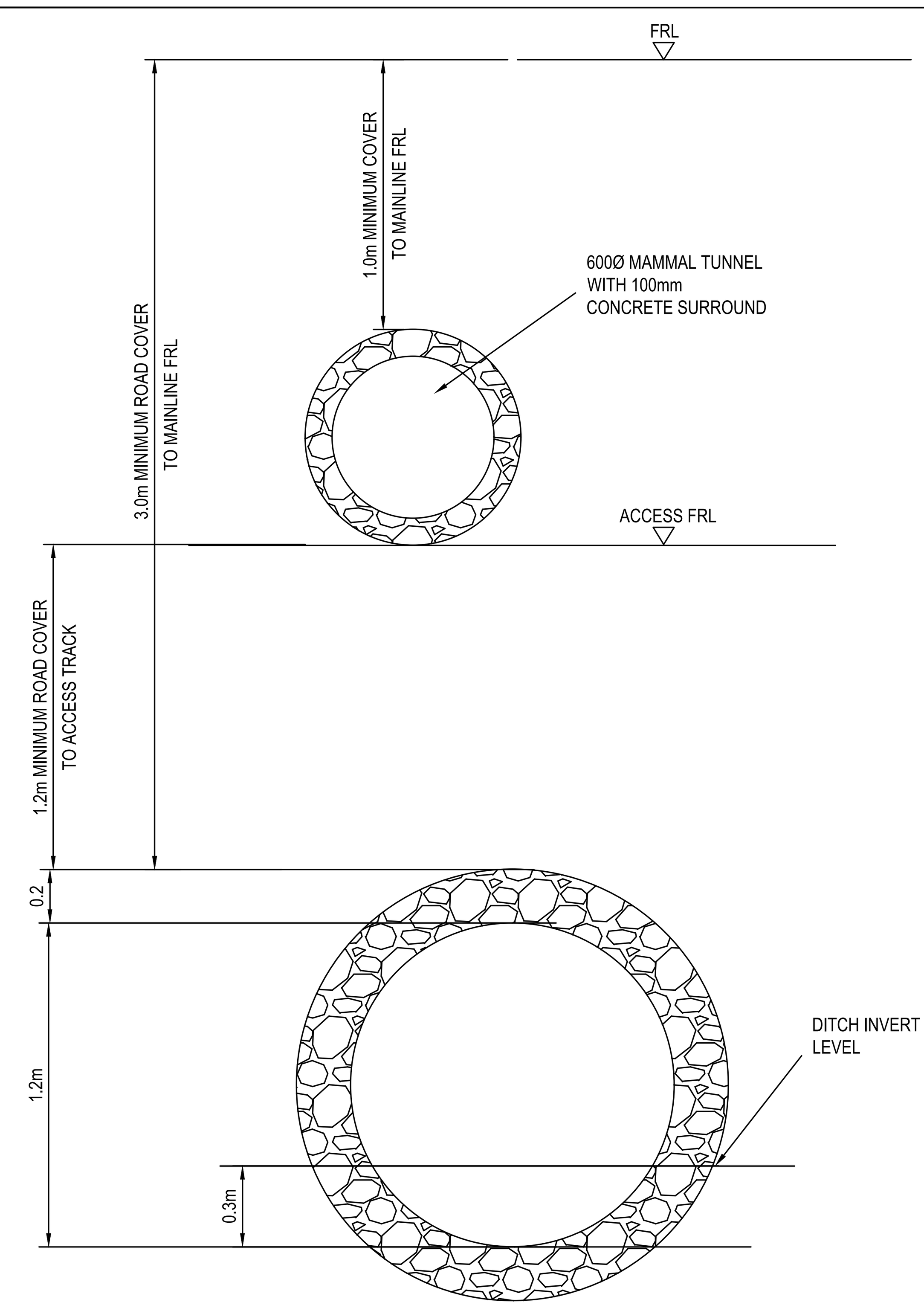


PLAN
1:1000 @ A1



Offset	Proposed Elevation	Existing Elevation	Culvert IL
-35.658		128.992	
-35.633		128.992	
-31.632	129.132	129.090	
-31.632	129.132	129.090	
-31.606	129.284	129.091	
-31.454	129.284	129.095	
-29.634	129.289	129.145	
-29.263	129.166	129.155	
-27.986	129.328	129.278	
-26.998	128.340	129.445	
-26.498	128.340	129.411	
-25.498	129.340	129.328	128.24
-14.549	132.990	129.371	
-12.049	132.990	129.279	
-11.299	132.912	129.423	
-9.549	133.015	129.705	
-1.249	133.222	130.000	
-0.270	133.222	130.002	
-0.099	134.122	129.991	
0.001	134.122	129.985	
0.101	134.122	129.979	
0.273	133.222	129.969	
1.251	133.222	130.005	
9.551	133.015	129.723	
11.301	132.912	129.934	
12.051	132.990	130.025	
14.551	132.990	130.242	
16.860	130.365	130.365	
20.091	131.431	130.567	
21.613	130.636	130.648	
21.922	131.427	130.653	
22.075	131.427	130.655	
22.100	131.274	130.655	
22.100	131.274	130.655	
26.120	131.167	130.844	
26.145	131.319	130.846	
26.298	131.319	130.856	128.517
28.129	131.316	130.999	

CROSS SECTION
Ch. 3212m
SCALE - 1:200H / 1:100V @ A1



TYPICAL CROSS
SECTION
1:20 @ A1

SAFETY, HEALTH AND ENVIRONMENTAL INFORMATION BOX

IT IS ASSUMED THAT ALL WORKS ON THIS DRAWING WILL BE CARRIED OUT BY A COMPETENT CONTRACTOR WORKING, WHERE APPROPRIATE, TO AN APPROPRIATE METHOD STATEMENT.

THIS DRAWING IS TO BE USED ONLY FOR THE PURPOSE OF ISSUE THAT IT WAS ISSUED FOR AND IS SUBJECT TO AMENDMENT.

EXCEPTIONAL RISKS RELATING TO THE WORKS ASSOCIATED WITH THIS DRAWING ARE IDENTIFIED BELOW.

CONSTRUCTION

MAINTENANCE / OPERATION / DECOMMISSIONING / DEMOLITION

NOTES

1. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH ALL OTHER RELEVANT DOCUMENTATION.
2. DO NOT SCALE FROM THIS DRAWING, USE ONLY PRINTED DIMENSIONS.
3. ALL DIMENSIONS IN MILLIMETRES, ALL CHAINAGES, LEVELS AND COORDINATES ARE IN METRES UNLESS DEFINED OTHERWISE.
4. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH THE PROJECT HEALTH & SAFETY FILE FOR ANY IDENTIFIED POTENTIAL RISKS.

KEY

PROPOSED CULVERT ALIGNMENT

Revision Details	By / Check	Date	Suffix
First Issue	MW / AM	01/08/19	P01
Mammal tunnel included on the cross section	MW / AM	02/09/19	P02

Purpose of issue
SUITABLE FOR INFORMATION

Client
Highways England
The Cube
199 Wharfside Street
Birmingham
B1 1RN

Working on behalf of highways england

Project Title
M54 TO M6 LINK ROAD

Drawing Title
WATERCOURSE 4
PROPOSED LEVELS

Designed	Drawn	Checked	Approved	Date
MW	MW	SB	AM	02/09/19

Internal Project No. 60536736
Suitability S2
Scale @ A1 1:1250H/1:1250V
Zone Highways General

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Drawing Number
Highways England PIN | Originator | Volume
HE514465 -ACM -HGN-
Z2_SW_PR_Z -SK-CH-1002
Location | Type | Role | Number

Rev
P02

Plot Date : 27 January 2020 16:06:37
File Name C:\PWWORKING\AECOM_DS02_UK-CLT\ALASTAIR.MCNEILL@AECOM.COM\DMS22587\HE514465-ACM-HGN-Z2_SW_PR_Z-SK-CH-1002