HIGHWAYS AGENCY

M1 Junction 19 Improvement

Environmental Statement

Volume 2

Chapter 9 – Road Drainage and the Water Environment

Final

HIGHWAYS AGENCY

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9.1 INTRODUCTION

9.1.1 This chapter is an assessment of the potential environmental effects of the proposed M1 Junction 19 Improvement on road drainage and the water environment. It comprises the environmental assessment of surface water, groundwater and flood risk during both construction and operation of the scheme. It includes calculations in line with the Design Manual for Roads and Bridges (DMRB) Volume 11, Section 3, Part 10, Annex 1. The chapter also provides recommendations for best practice and mitigation based on the outcomes of the assessment.

9.1.2 In common with other Chapters, the Road Drainage and the Water Environment assessment recognises that the Catthorpe Viaduct, which carries the M6 to M1 Southbound link over the M1, is being replaced as a maintenance project. The scope of this work includes the replacement of the bridge on a new alignment immediately to the south west of the existing. It also requires the creation of new approach embankments either side of the M1. The work is programmed to begin in June 2010, for completion in November 2011.

9.1.3 The bridge and earthworks either side of the M1 would be retained in the proposed layout for the M1 Junction 19 Improvement, as would the alignment of the M6 to M1 Southbound link east of the M1. To the west of M1 this link would have to be amended to accommodate the proposed M6 to A14 link.

9.1.4 A separate environmental assessment[49] has been carried out for the bridge replacement as a stand alone maintenance project.

9.1.5 This ES for the M1 Junction 19 Improvement takes into account the new bridge both:-

- As part of the existing junction, assuming the M1 Junction 19 Improvement is not built; the 'do-minimum' scenario
- As part of the completed M1 Junction 19 Improvement; the 'do-something' scenario.

9.1.6 In terms of road drainage and the water environment, the proposals for the viaduct replacement will be to match the existing drainage arrangements as far as possible, with only negligible differences in the locations of pipes and gulleys. There will also be some reduction in the highway area to be drained as the replacement viaduct will be narrower than the existing.

9.1.7 These issues are dealt with in Section 9.6 Environmental Impact.

Objectives

9.1.8 The objectives for the road drainage and water environment assessment are:-

- To protect the water environment
- To reduce the risk of pollution and flooding

9.1.9 In addition, there is a general scheme objective that the impact on the natural and built environment should be minimised. It is also considered that appropriate measures should be taken and best practice followed during and after construction, by the use of sustainable drainage techniques.

Study Area

9.1.10 The Study Area consists of all of the surface water and groundwater resources likely to be directly or indirectly affected including, in particular, the River Avon and its tributaries.

9.1.11 Sensitive surface water and groundwater features within the study area are identified and the potential impacts arising from the construction and operation of the scheme are assessed. The extent of the study area and features identified are illustrated on Figure 9.1. A glossary of technical terms used in this Chapter is at Appendix B.

The Project

9.1.12 Junction 19 of the M1 currently forms an interchange between the M1, M6 and A14 Trunk Road. In addition, it provides access to two minor roads, Rugby Road to Swinford and Swinford Road to Catthorpe, both of which connect to the A14 Trunk Road.

9.1.13 A Comparative Environmental Assessment published in 2008 considered the potential impacts of five different options for the junction and the local road network. Following that assessment, the Red Junction and Orange Local Road Network was announced as the Preferred Route.

9.1.14 The project is illustrated by a series of plans bound into a separate Appendix 1 to Volume 1 of the ES as follows:-

- Figure A : Location Plan
- Figure B : Environmental Master Plan
- Figure C : Environmental Resources Plan
- Figure G : Areas Required During Construction
- Figure H : Cross Sections

Interaction

9.1.15 There are interactions between this chapter and other chapters as follows:-

- Chapter 3, Ecology and Nature Conservation, sets out the value of water features, and potential impacts upon them, as wildlife habitats.
- Chapter 5, Materials, interacts with the groundwater element of this chapter.

9.1.16 Care has been taken to avoid significant overlap or double counting of adverse impacts or benefits resulting from the proposals.

9.2 METHODOLOGY

9.2.1 This assessment has been carried out in accordance with the requirements of DMRB Volume 11, Section 3, Part 10, HA216/06 2006[2]. It should be noted that in November 2009, HA216/06 was replaced with HA45/09. However, this new guidance document was issued after the assessment reported in this chapter had been completed. For this reason, all references to Volume 11, Section 3, Part 10 of DMRB within this chapter are references to HA216/06, which was current at the time of the assessment.

9.2.2 Baseline information has been compiled from documentary research, site reconnaissance, and liaison with appropriate organisations. Reference to specific sources is made as appropriate within the chapter. In addition to the Environment Agency,(EA), the following principal sources were consulted:-

- Ordnance Survey (OS) maps
- British Geological Survey (BGS) maps and memoirs
- Previous site investigations

9.2.3 A Scoping Report for the Environmental Assessment was produced in March 2009[3], and a copy was sent to the EA. A consultation meeting was held with the EA on 24th March 2009, and a written response was sent from the EA to the Highways Agency on 26th May 2009. A further consultation meeting was held on 2nd July 2009.

9.2.4 The EA's written comments included the following:-

- A Flood Risk Assessment is required in accordance with PPS25. The Flood Risk Assessment[48] is at Appendix C.
- Surface water should be managed in a sustainable manner.
- The opportunity should be taken to improve on the existing situation to reduce the overall flood risk.
- The Environmental Statement should assess the potential effects on the water environment during the construction phase and the operational phase.
- Mitigation measures and residual impacts should be detailed within the Environmental Statement.

9.2.5 The assessment has been undertaken within the framework of national and local planning policies, environmental guidance and legislation. These are set out in Section 9.3 below. The methodology follows that of DMRB[2]. Tables 9.1 to 9.4 summarise the DMRB grading (importance) of water features.

9.2.6 Prediction of the nature and magnitude of the potential environmental impacts is based on knowledge of the proposed development (both construction phase and subsequent operation) and the environmental resources of the area, by identifying the different ways in which particular aspects of the development could affect particular aspects of the environment. This includes the size of the impact, for instance an increase in pollutant concentrations above threshold levels.

9.2.7 The assessment of the significance of environmental effects of an action is determined by combining the magnitude of the impact with the environmental importance of the water resource, resulting in the prediction of the significance of the effects on that receptor. Table 9.1 below sets out criteria for estimating the importance of water resources or 'attributes'. Table 9.2 sets out the criteria for determining the magnitude of impact and the matrix in Table 9.3 combines the two to determine the significance of effect. Table 9.4 provides

further guidance on the overall assessment of significance. Effects can be direct, indirect, secondary or cumulative, and can be permanent or temporary. Prediction also takes into account mitigation measures which have already been incorporated into the design, such as drainage design measures, or proposals for phasing parts of the development to restrict operations to a limited part of the year or day. Judgement may be made on the likelihood of an impact occurring.

9.2.8 Prediction of the magnitude of impacts should not be confused with evaluation of their significance. The significance of an effect is the product of the magnitude and the sensitivity / importance / quality of the environmental resource which is affected.

Table 9.1: Estimating the Importance of Water Environmental Attributes
(Reproduced from DMRB Volume 11, section 3, Part 10, table 5.3)[2]

Importance	Criteria	Typical Examples
Very High	Attribute has a high quality and rarity on regional or national scale	**Surface Water:** EC Salmonid/Cyprinid fishery; RQO River Ecosystem Class RE1 Site protected under EU or UK wildlife legislation (SAC, SPA, SSSI, Ramsar Site) **Groundwater:** Major aquifer providing a regionally important resource or supporting site protected under wildlife legislation; SPZ I **Flood Risk:** Flood Plain or defence protecting more than 100 residential properties from flooding
High	Attribute has a high quality and rarity on local scale	**Surface Water:** RQO River Ecosystem Class RE2; Major Cyprinid Fishery; Species protected under EU or UK wildlife legislation **Groundwater:** Major aquifer providing locally important resource or supporting river ecosystem; SPZ II **Flood Risk:** Flood plain or defence protecting between 1 and 100 residential properties or industrial premises from flooding
Medium	Attribute has a medium quality and rarity on local scale	**Surface Water:** RQO River Ecosystem Class RE3 or RE4 **Groundwater:** Aquifer providing water for agricultural or industrial use with limited connection to surface water; SPZ III **Flood Risk:** Flood plain or defence protecting 10 or fewer industrial properties from flooding
Low	Attribute has a low quality and rarity on local scale	**Surface Water:** RQO River Ecosystem Class RE5 **Groundwater:** Non-aquifer **Flood Risk:** Floodplain with limited constraints and a low probability of flooding of residential and industrial properties

Notes :

EC	:	European Community
Salmonid	:	Fish species including salmon and trout
Cyprinid	:	A family of soft finned mainly freshwater fish including carp, tench, rudd and dace
RQO	:	River Quality Objective, set by the EA
RE	:	River Ecosystem, set by the EA
EU	:	European Union
SAC	:	Special Area of Conservation. European designated wildlife site.
SPA	:	Special Protection Area. European designated wildlife site
Ramsar	:	European designated wildlife site.
SPZ	:	Source Protection Zone

Table 9.2: Criteria for Determining Magnitude of Impact
(Based on DMRB, Volume 11, section 3, Part 10, table 5.4)[2]

Magnitude	Criteria	Example
Major Adverse	Loss of attribute and/or quality and integrity of attribute	High risk of surface water pollution and potential failure of total zinc and dissolved copper, extensive change to a fishery or nature conservation site, loss of an aquifer or high risk of groundwater pollution, 100mm increase in flood peak level (1% annual probability)
Moderate Adverse	Effect on integrity of attribute or loss of part of attribute	High risk of surface water pollution and potential failure of either total zinc or dissolved copper, partial loss in productivity of a fishery, partial loss or change to an aquifer, medium risk of groundwater pollution, greater than 50mm increase in flood peak level (1% annual probability)
Minor Adverse	Measurable change in attribute's quality or integrity	High risk of surface water pollution but no change in total zinc and dissolved copper, low risk of pollution to groundwater, greater than 10mm increase in flood peak level (1% annual probability)
Negligible	Effects of insufficient magnitude to affect the attribute's use or integrity	Unlikely to affect the integrity of the water environment
Minor Beneficial	Some beneficial effect or reduced risk of negative effect	Reduction in spillage risk by 50% or more (where existing risk is less than 1% per annum), greater than 10mm reduction in flood peak level (1% annual probability)
Moderate Beneficial	Moderate improvement to attribute quality	Reduction in spillage risk by 50% or more (where existing risk is greater than 1% per annum), greater than 50mm reduction in flood peak level (1% annual probability)
Major Beneficial	Major improvement to attribute quality	Removal of existing polluting discharge or of existing potential polluting discharge, recharge of an aquifer, greater than 100mm reduction in flood peak level (1% annual probability)

Table 9.3 Criteria for Estimating the Significance of Potential Effects
(Based on DMRB Volume 11, section 3, Part 10, table 5.5)[2]

Criteria for Estimating the Significance of Potential Effects				
Magnitude of potential impact	**Importance**			
	Very High	**High**	**Medium**	**Low**
Major	VERY LARGE	LARGE / VERY LARGE	LARGE	SLIGHT / MODERATE
Moderate	LARGE / VERY LARGE	MODERATE / LARGE	MODERATE	SLIGHT
Minor	MODERATE / LARGE	SLIGHT / MODERATE	SLIGHT	NEUTRAL
Negligible	NEUTRAL	NEUTRAL	NEUTRAL	NEUTRAL

9.2.9 Significance should be assigned after consideration of proposed mitigation. In some cases, two alternatives are given for significance. In such cases, a reasoned judgement should be used to decide on a single description of significance.

9.2.10 Potential effects can either be beneficial or adverse.

Table 9.4 Overall Assessment Scoring
(Based on DMRB, Volume 11, Section 3, Part 10, Table 5.6)

Criteria	Overall Score	Predicted Outcome / Comment
Very significant potential adverse impact on one or several water attributes.	Very Large Adverse Effect	Degradation of water environment
At least one highly significant potential adverse impact, and/or significant potential adverse impacts on several water attributes	Large Adverse Effect	Degradation of water environment
Moderate adverse impact on at least one water attribute	Moderate Adverse Effect	Degradation of water environment
Slight adverse impact on one or more water attributes	Slight Adverse Impact	Degradation of water environment
No appreciable effects on water attributes	Neutral	Generally impacts slight or moderate, possible but more difficult to balance more diverse adverse / beneficial impacts
Proposal provides an opportunity to enhance the water environment or provide an improved level of protection for a water attribute	Slight Beneficial Effect	Enhancement opportunity
Proposal provides an opportunity to enhance the water environment, with a moderate improvement to a water attribute	Moderate Beneficial Effect	Improvement opportunity (improvements should greatly outweigh negative impacts)
At least one very significant /highly significant potential beneficial impact, and all potential adverse impacts insignificant	Large Beneficial Effect	Unlikely for major road scheme

9.3 LEGISLATION AND POLICY FRAMEWORK

UK and EC Legislation

9.3.1 Relevant legislation comprises UK Acts and Regulations (many of the latter represent the incorporation of specific EC Directives into UK law), EC Directives and regulatory guidance. These are listed below in Table 9.5. The EA as statutory / regulatory authority applies these various forms of legislation to support the EA's role to maintain and improve water quality within England and Wales.

Table 9.5 Relevant UK and EC Legislation

Title	Water Feature	Summary
Water Resources Act 1991[4]	All waters, but specifically main rivers and groundwater abstraction	Consolidates previous water legislation in respect of both the quality and quantity of water resources. Sets statutory objectives, giving the Government and the EA a legal duty to ensure that they are achieved. Gives EA power to grant licences for groundwater abstraction. Covers works in, over or under main river, control of pollution of waters, including discharge consents
UK Town and Country Planning Act 1990[5]	Flood Protection	Enables local authorities to enter into agreements with developers about how their land and flood defences should be managed.
Land Drainage Act 1991[6]	Ordinary (i.e. not main) Rivers	Gives local authorities powers to undertake flood defence works on watercourses which have not been designated as "main" and which are not within internal drainage board areas. Covers works within the river channel including discharge consents
Environment Act 1995[7]	Main Rivers	Establishment of the EA, and introduction of measures to enhance protection of the environment, including further powers for the prevention and remediation of water pollution.
Control of Pollution Act 1974[8]	Surface waters and groundwater	Makes it an offence for anyone to cause or knowingly permit any poisonous, noxious or polluting matter to enter any stream or controlled waters or any specified underground waters.
The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003[9], and EC Water Framework Directive 2000 (2000/60/EC)[10]	Integrated river basin management of all surface waters, transitional waters and coastal waters in England and Wales	The directive sets out environmental objectives for water status based on parameters of monitoring and assessment strategies, and sets a Programme of Measures in order to meet the objectives. The Regulations transpose the directive and deal with the responsibility and timescales for setting up River Basin Districts, characterisation, economic analysis of water use, bodies of water used for abstraction for drinking water, register of protected areas etc. leading to the development of River Basin Management Plans
The Surface Water (River Ecosystem) Regulations 1994[11]		Sets out River Ecosystem Classification system used as River Quality Objectives by the EA.

Title	Water Feature	Summary
The Groundwater Regulations 1998[12] and EC Groundwater Directive 1980 (80/68/EEC)[13]	Groundwater	Gives the EA powers to issue notices to control activities other than licensed disposal, where these are likely to result in an indirect or direct discharge of a listed substance to groundwater.
Surface Waters (Dangerous Substances) Regulations 1992, 1997 and 1998[14]; and Surface Water (Classification) Regulations 1989[15], and EC Dangerous Substances Directive (76/464/EEC)[16]	Surface Waters	Addresses specific hazardous substances such as mercury, cadmium and chloroform that may be discharged into surface waters and sets limit values for discharges and Environmental Quality Objectives (EQOs) for receiving waters.
The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996[17], and EC Surface Water Abstraction Directive (75/440/EEC)[18]	Potable Abstraction from surface waters	Sets quality objectives for the surface water sources from which drinking water is taken
The Surface Waters (Fishlife) (Classification) Regulations 1997[19], the Surface Waters (Fishlife) (Classification) (Amendment) Regulations 2003 and EC Freshwater Fish Directive 2006(2006/44/EC)[20]	Fisheries	Protection of the health of freshwater fish and shellfish populations, by designating waters in need of protection and setting quality standards for those waters.
Salmon and Freshwater Fisheries Act 1975[21]	Fisheries	In England and Wales, it aims to prevent the spread of fish diseases and to minimise damage to fisheries or their habitat.

Environment Agency Pollution Prevention Guidelines

9.3.2 The proposed scheme would also need to take note of the EA's Pollution Prevention Guidelines (PPGs)[22], which provide advice on statutory responsibilities and good environmental practice. The following PPGs are considered to be relevant to the scheme:-

- PPG1 – General guide to the prevention of pollution of controlled waters
- PPG3 – The use and design of oil separators
- PPG5 – Works in, near or liable to affect watercourses
- PPG6 – Working at construction or demolition sites
- PPG8 – Safe storage and disposal of used oils

- PPG21 – Pollution incident response planning
- PPG22 – Dealing with spillages on highways

UK Planning Policy Guidance

9.3.3 The Department for Communities and Local Government (DCLG) provides guidance in the form of Planning Policy Statements (PPSs) and Planning Policy Guidance Notes (PPGs). Relevant PPSs and PPGs are as follows:-

- PPS 25 Development and Flood Risk, 2006[23]. This provides guidance on the protection of development to ensure public safety and prevent damage to property as a result of flooding. A Flood Risk Assessment[48] carried out in accordance with PPS25 is at Appendix C.
- PPS23 Planning and Pollution Control, 2004[24]. This provides guidance on the protection of the environment and humans from pollution from development in England.
- PPG13 Transport, 2001[25]. This provides guidance to local authorities and others on transport and land use planning.

Regional Planning Policy

West Midlands Regional Spatial Strategy (2008)[26]

9.3.4 The Regional Spatial Strategy for the West Midlands was adopted in 2008 and includes provisions for the protection and improvement of water quality and the reduction of flood risk. These aims can be found in policies CC1: Climate Change and QE9: The Water Environment.

East Midlands Regional Plan (2009)[27]

9.3.5 The East Midlands Regional Plan was adopted in 2009 and includes the provision of up-to-date policies which cover drainage and the water environment. In particular policy 32: A Regional Approach to Water Resources and Water Quality covers the protection and improvement of water quality and seeks to insure that development does not increase the risk of pollution to vulnerable water resources. Policy 35: A Regional Approach to Managing Flood Risk aims to ensure that development does not increase the risk of flooding.

Local Authority Planning Policy

Daventry District Council Local Plan (1997)[28]

9.3.6 The Daventry District Council Local Plan was adopted in 1997. In September 2007 any policies not “saved” expired, among these expired policies were all policies relating to drainage and the water environment.

9.3.7 These policies are to be eventually replaced with emerging policies under the Local Development Framework (LDF). Daventry are producing a joint Core Strategy as part of the LDF which is the West Northamptonshire Joint Core Strategy (2007)[29] which is currently at the Issues and Options Stage. This means that any policies are currently only in draft form. As the Core Strategy is currently at Issues and Options Stage there are not yet any policies, but the strategy does set out Strategic Objectives which will inform the basis of future policies. Strategic Objective 8 of the Core Strategy aims to ensure that development is sensitive to its environment.

Harborough District Council Local Plan (2001)[30]

9.3.8 The Harborough District Local Plan was adopted in 2001 and all policies that were not formally saved expired in September 2007. There are no saved policies which relate to drainage and the water environment.

9.3.9 Harborough are in the process of producing their Core Strategy which is currently at the Final Draft stage. Within this document (2009), Potential Strategy ST1 states that all development must help mitigate and adapt to climate change and that development in areas liable to be at risk of flooding will therefore be avoided.

Rugby Borough Council Local Plan (2006)[31]

9.3.10 The Rugby Borough Local Plan was adopted in 2006 and contains a number of saved policies. Policies GP10: Flooding and Surface Water Drainage and GP11: Pollution Control of the local plan cover issues relating to drainage and the water environment. Policy GP10 aims to ensure that development does not increase the risk of flooding and that all developments should incorporate sustainable drainage systems. Policy GP11 requires development proposals to show that there would not be any resulting pollution to surface or ground water.

9.3.11 In addition to the saved policies in the Local Plan, the emerging Core Strategy for Rugby is currently at the Proposed Submission Draft Stage. Within the Draft Submission Core Strategy Document (2009), there are no specific policies which relate to drainage or the water environment.

North Northamptonshire Core Strategy (2008)[32]

9.3.12 The North Northamptonshire Core Strategy was adopted in 2008 and is a joint Core Strategy covering the areas of Corby, Kettering, Wellingborough and East Northamptonshire. Within this document Policy 13: General Sustainable Development Principles covers issues relating to the protection of ground water and surface water from pollution, as well as ensuring that the development does not increase flood risk. In addition to these requirements it also states that development should incorporate sustainable drainage systems.

9.4 BASELINE CONDITIONS

Surface Water

9.4.1 The existing distribution of surface waters in the area is shown on Figure 9.1. Junction 19 of the M1 lies within the upper catchment of the River Avon. The River Avon flows in a broadly south-westerly direction; it is crossed by the eastern extent of the A14 Trunk Road within the study area, and is also crossed further downstream by the southern extent of the M1 within the study area.

9.4.2 There are a number of tributaries in the vicinity of the junction which predominantly flow southwards / south-westwards / south-eastwards to the River Avon. These include the Swinford Lodge Brook, which is located to the north east of the junction and flows beneath the eastern extent of the A14 Trunk Road. Another tributary, the Clay Coton Yelvertoft Brook, is located to the south east of the junction and flows westwards, converging with the River Avon adjacent to and east of the M1.

9.4.3 The River Avon and Clay Coton Yelvertoft Brook are classified as 'main' rivers. All others are 'ordinary' watercourses.

9.4.4 A network of drains and ditches currently collects highway runoff from the M1, M6 and A14 Trunk Road, which is then discharged at some 11 locations to the adjacent watercourses (as shown on Figure 9.2). Summary details of the drainage areas or 'zones' and their discharge points to the receiving watercourses are shown in Table 9.6 below. The areas quoted in the table are those within the limits of the scheme as illustrated on Figure 9.2. The drainage of highways outside the scheme limits as noted on Figure 9.2 has not been included in the assessment. In some areas, land and highway drainage are combined prior to discharge, which is sometimes direct, to the various receiving watercourses. Water courses are currently culverted at three locations within the scheme area, beneath the M1, M6 and A14 Trunk Road. There are two bridges over the River Avon.

Table 9.6 Summary Details of Existing Highway Drainage

Drainage Zone	Highway Sections	Area (m^2)	Receiving Water Course
1	Northern extent of M1	8209	Tributary of Swinford Lodge Brook
2	Majority section of M1 between Zone 1 and north of interchange including various slip roads	54064	Swinford Lodge Brook
3	M1 south of Zone 2 extending southwards to just north of River Avon	61383	River Avon
4	South of Zone 3, section of M1 over River Avon	8753	River Avon
5	South of Zone 4, comprising most of remaining southern extent of M1	20800	Clay Coton Yelvertoft Brook
6	Mostly westbound section M6, west of interchange including various slip roads, between Zones 1, 3 and 9	32421	Tributary of River Avon (name unknown)

Drainage Zone	Highway Sections	Area (m^2)	Receiving Water Course
7	Majority section of A14, south of Zone 2	21614	Swinford Lodge Brook
8	Western extent of M6, west of Zones 1 and 7	11492	Tributary of River Avon (name unknown)
9	Eastern extent of A14, east of Zone 8	1174	River Avon

9.4.5 A number of ponds exist within the vicinity of the junction, of which some 16 are within 100 metres of the highway edge. These vary in size from small field ponds to an ornamental lake within the grounds of Catthorpe Manor. Figure 9.1 shows the distribution of ponds. Ponds are described in more detail in Chapter 4 Ecology and Nature Conservation.

Surface Water Abstractions

9.4.6 There are three surface water abstractions, licensed by the EA, within 1km of the proposed junction improvement. These abstractions are from an un-named brook to the north west of the junction, and are for general farming and domestic purposes. There are no licensed surface water abstractions within 500 metres of the proposed scheme.

9.4.7 Severn Trent Water Ltd. abstracts water from the River Avon for public supply some 7km downstream of the junction, at Brownsover Mill, Rugby.

Fisheries

9.4.8 The EA has stated that the River Avon at Ryton (some 17km west-south-west of Junction 19) is a 'prime coarse fishing river containing most coarse fish species and a prime spawning area for Chubb, Barbell and Dace', and the stretch of the River Avon downstream of Rugby (some 5km south-west of Junction 19) to Tewkesbury is considered one of the most important river coarse fisheries in the West Midlands.

9.4.9 The EC Freshwater Fish Directive (2006/44/EC) seeks to protect those water bodies identified by Member States as waters suitable for sustaining fish populations. Under the Surface Waters (Fishlife) (Classification) Regulations 1997, and the Surface Waters (Fishlife) (Classification) (Amendment) Regulations 2003[19], a number of cyprinid fisheries are designated along the River Avon.

Surface Water Quality

9.4.10 The EA uses the General Quality Assessment (GQA), based on the chemical parameters of dissolved oxygen, biochemical oxygen demand and ammonia, to measure the water quality characteristics of water bodies.

9.4.11 The EA takes samples of water quality in the River Avon at Welford, approximately 11 kilometres upstream of Junction 19. The water chemistry was consistently at Grade A (very good) between 1999 and 2007. No more recent data is available. Grade A rivers have natural ecosystems and may be used for any type of abstractions including potable supply. Nitrate levels in 2007 at this location were Grade 3 (moderately low), and Phosphate levels were Grade 2 (low). Nitrates and Phosphates are both indicators of nutrient loading, often resulting from the run off of agricultural fertilisers. As indicated by the grading system, low levels are considered to be better in terms of water quality.

9.4.12 The EA also takes samples on the River Avon at the confluence with Clifton Brook, approximately seven kilometres downstream of Junction 19. The water chemistry at this location in 2007 (the most recent available data) was Grade B (good), and has varied between Grades B and C (fairly good) over recent years. Nitrate levels in 2007 at this location were Grade 3 (moderately low), but Phosphate levels were Grade 4 (high). At this downstream location, the EA also measures the biological quality of the water samples by taking into account the number and diversity of macro-invertebrates present. The biological water quality at this location is Grade C (fairly good).

9.4.13 EA water quality sampling data is also available for the Clay Coton Yelvertoft Brook immediately before its confluence with the River Avon. However, the most recent available data for this location is from 2005. The water chemistry varied between Grade B (good) in 2002 and Grade D (fair) in 2004 at this location. Data from 2005 shows that nitrate and phosphate nutrient levels were very high.

9.4.14 River Ecosystem Classifications were introduced under the Surface Water (River Ecosystem) (Classification) Regulations 1994. For each River Ecosystem (RE) Class, River Quality Objectives (RQOs) are set. These relate directly to measured GQA parameters. As the River Avon upstream of the proposed junction improvements is of GQA Grade A, it is understood be of RE Class 1.

9.4.15 Hardness, dissolved copper, total zinc and pH values have been recorded in the River Avon, both at Welford (upstream of Junction 19) and at the confluence with Clifton Brook (downstream of Junction 19). The most recent available data is from 2006. At Welford, the average hardness was 322 milligrammes per litre (mg/l) $CaCO_3$, average dissolved copper was 2.52 micrograms per litre (µg/l), average total zinc was 1.99 µg/l, and the pH was 7.88. At Clifton Brook, the average hardness was 368 mg/l $CaCO_3$, average dissolved copper was 1.46 µg/l, average total zinc was 3.95 µg/l, and the pH was 7.91.

9.4.16 The potential impact of discharges from the highway runoff on water quality in the receiving watercourses has been estimated for the do minimum scenario (i.e. the situation without the scheme in place) for 2029 for dissolved copper and total zinc, in accordance with DMRB guidance (see Appendix A). This indicates that, for most drainage zones, the risk of pollution from routine runoff from all drainage zones combined is low. However, the risk in two areas was higher, and required further assessment using Method B. These were drainage zones 2 and 6. The Method B assessment found that no mitigation would be needed for the discharge from the existing drainage zone 2, but that the discharge from the existing drainage zone 6 would require mitigation if it were to be designed in line with current guidance.

Pollution Incidents Affecting Surface Water

9.4.17 In addition to routine highway discharges, there have been a number of pollution incidents associated with the road traffic network recorded by the EA. These have not been comprehensively listed here but include spillage of cattle slurry at M1 Junction 19 in September 1997, spillage of 500 litres of caustic soda at M1 Junction 19 in November 1997 and diesel spillage from a traffic accident between M1 Junction 19 and Junction 20 in April 1999. One diesel spillage at the Junction in 1995 affected public water supply abstraction from the River Avon.

9.4.18 The pollution risk is expressed as the probability of an incident in any one year. In most circumstances, the acceptable risk of a serious pollution incident occurring will be where the annual probability is predicted to be less than 1%. Using the DMRB methodology, the assessment indicated that, for the do-minimum scenario for 2029, the accident probability

would be below 1% for each drainage zone, and would be 0.5% for all drainage zones combined. This means that the do-minimum scenario would present an acceptable risk of a pollution incident occurring.

Surface Water Discharges

9.4.19 In addition to the highway discharges described earlier, which are currently exempt from licensing, there are a number of consented discharges to the various watercourses in the area. The majority comprise treated sewage / storm effluent from both water companies and private residences. There are also a few site drainage trade effluent discharges.

Groundwater

9.4.20 Published geological and ground investigation information form the basis of the geological baseline conditions. The geology is described in more detail in Chapter 5 Materials.

9.4.21 The general geological sequence is of Glacial Till overlying Jurassic Lower Lias Group mudstones, which has been dissected by the River Avon and its tributaries causing erosion and removal of the Glacial Till cover in places and deposition of overlying younger river terrace gravels and alluvium. Thus there are small outcrops of Glacial Till along the western extent of the M6, the most northern and southern extents of the M1 (although the cuttings have exposed the underlying solid strata in places) and also beneath part of the area of the Junction. Extensive deposits of river terrace gravels and alluvium are associated with the River Avon and Clay Coton Yelvertoft Brook. There are lesser fluvial / alluvial deposits associated with the Swinford Lodge Brook and tributary and also some un-named watercourses which are crossed by the M6.

9.4.22 There are some areas of made ground (described in more detail in Chapter 5 Materials), mainly associated with borrow pits from various earlier phases of road construction, which appear to have been infilled with ‘inert’ construction waste. There is a former Cleanaway landfill site (Catthorpe Landfill, NGR SP 553 787) located adjacent to the south of the M6, which was licensed between 1977 and 1986 to receive domestic and industrial wastes.

9.4.23 The alluvium generally comprises soft to firm alluvial clay and silt up to about 5m deep in the vicinity of the River Avon. The river terrace gravels comprise interbedded very gravelly clay, gravelly sand, and gravel (mainly of flint) between about 1 to 3m thickness. The Glacial Till, varying between gravelly clay to firm to still clay is up to 10m thick. The Lower Lias strata comprise a sequence of horizontal to sub-horizontal, predominantly ‘hard’ clays / mudstones with occasional thin limestone and (separate) ironstone bands. The Lower Lias is between 140-170m thick.

9.4.24 The river terrace and fluvio-glacial / alluvial deposits are classified as minor aquifers. The distribution of the minor aquifer is shown on Figure 9.1. Minor aquifers are usually of only local importance for supporting abstractions or providing baseflow to surface waters. The Lower Lias strata and Glacial Till deposits are generally classified as non-aquifers, although specific units within the former can have minor aquifer status. Non-aquifers usually do not support any abstractions or provide significant baseflow to surface waters. However, some of the thin limestones within the Lias can yield significant quantities of water. The proportion of water-bearing limestones increases towards the base of the Lower Lias Group, forming the Blue Lias or Scunthorpe Mudstone Formation, which can be classified as a minor aquifer. On the basis of interpretation of the published geological map, the strata below the proposed scheme are towards the top of the Lower Lias Group sequence, and therefore would indicate non-aquifer status.

Groundwater Abstractions and Source Protection Zones

Private Supplies

9.4.25 Abstractions below 20m^3/day (with a number of exceptions) do not require a licence from the EA; these private supplies are registered with the relevant Local Authority. There is one private well (NGR SP 5610 7775) within 1km radius of the proposed scheme, registered with Harborough District Council, located at Station House, Lilbourne, 250m west of the M1. On the basis of location, it would appear to be sourced by groundwater within the river terrace gravels / alluvial deposits.

Licensed Abstractions and Source Protection Zones

9.4.26 The Envirocheck Report for the site, dated March 2009, shows two abstractions from groundwater within 500 metres of the proposed junction improvement. These abstractions are for general farming and domestic use. In addition, there are 26 abstractions from groundwater between 500m and 1km from the site. Of these, 21 are for mineral washing / mineral products at Gibbett Quarry in Shawell, to the north west of the Junction, and six are for general farming and domestic use at other locations.

9.4.27 No groundwater source protection zones (SPZs) are shown on the EA website records within 1km of the proposed scheme. The nearest SPZs are approximately 7km to the north east, near to Welford and North Kilworth.

Groundwater Levels and Flow

9.4.28 No published hydrogeological map exists for the area. It is understood that the nearest EA observation borehole information is located some 3km to the north-west of the scheme. However, a number of ground investigations have been undertaken within the area and monthly groundwater monitoring was carried out between April 2004 and August 2006. There is little / no groundwater information near the northern section of the M1 and east along the A14. Groundwater level and monitoring data was recorded within the underlying Lower Lias bedrock and also in the localized Alluvium, River Terrace Deposits and Glacial Till. Analysis of the data indicates that groundwater is in hydraulic continuity across the geological strata; however, shallow perched groundwater may be present within highly permeable lenses in the superficial deposits.

9.4.29 Monitoring data shows groundwater levels fall from 112.5m AOD along the M6 in the west to 110m AOD in the vicinity of the interchange, 108.5m AOD along the A14 to the east and 93.5m AOD to the south along the M1. Groundwater levels therefore appear to fall to the south and east, towards local surface waters and broadly ‘shadowing’ topography. Hence, surface waters are likely to be in hydraulic continuity with the underlying aquifer.

Groundwater Vulnerability

9.4.30 The Environment Agency’s Groundwater Vulnerability Map, Sheet 30, 1996, shows soils of low leaching potential over the minor aquifer. This means that pollutants are unlikely to travel through the soil layer into the groundwater, and the groundwater vulnerability is therefore low. The non-aquifer is of negligible vulnerability.

9.4.31 At the time of writing, further Ground Investigation works are underway which will provide further data on ground water levels. However, as the data is not currently available, it cannot be taken into account in this assessment.

Surface Water Flows and Flood Risk

9.4.32 The EA previously supplied flow summary statistical data from the gauging station at Lilbourne for the River Avon. This indicated Q_{95} flows (95 percentile flows taken as equivalent to 'dry weather or low flow', i.e. flow rate which is exceeded 95% of the time) of 0.474m^3/s (1963-2002). The Comparative Assessment Report[1] noted that there were considerable discrepancies between these values and those estimated for verification purposes using the Flood Estimation Handbook Volume 4 – Institute of Hydrology, 1999, Flood Studies Report Rainfall Runoff Method (FEH method)[33]. The EA values were significantly lower. The FEH method estimated Q_{95} flow of 0.71m^3/s for the River Avon where it is crossed by the M1.

9.4.33 Following discussion with the EA, it was ascertained that there was 'low confidence in the accuracy of the data supplied', and the FEH method was therefore used to estimate flows, as would be necessary for the majority of the watercourses where flow monitoring is not routinely carried out.

9.4.34 The floodplain of the River Avon and the Clay Coton Yelvertoft Brook is crossed by the A14 Trunk Road to the east of the junction and the M1 to the south. The indicative floodplain is shown on Figure 9.1. The indicative floodplain is interpreted as the flood risk area based on an event with a 1% chance or occurring in any given year, otherwise described as a 1 in 100 year flood event. Figure 9.1 also indicates the floodplain with a 0.1% chance of occurrence in any given year, i.e. a 1 in 1,000 year flood event.

Sensitivity Assessment of Receptors

9.4.35 Table 9.7 summarises the importance of the various features using the criteria set out in Table 9.1.

Table 9.7 – Water Environment Features Summary

Feature & Attribute / Service	Quality Indicator	Scale[A], Details and Grading	Importance
Surface Water			
River: Water supply Transport & dilution of waste products	Chemical water quality	Regional / Local: River Avon RE1	Very High
		Regional / Local: Clay Coton Yelvertoft Brook RE2	High
		Local: Status of other water courses not recorded	(assumed) Medium - Low
	Non potable abstraction	Local: No abstractions within 2 km downstream:	Low
	Drinking water supply	National / Regional: River Avon drinking water supply downstream of development.	High

Feature & Attribute / Service	Quality Indicator	Scale[A], Details and Grading	Importance
River: Biodiversity[B]	Biological water quality	Regional / Local: River Avon GQA C (monitored downstream of site)	Medium
		Local: Status of other water courses not recorded	(assumed) Medium
	Fisheries quality	Regional: River Avon designated cyprinid fishery	High
		Local: Status of other watercourses not recorded, assumed undesignated / non fishery	Medium
River: Conveyance of flow and material	Nature of watercourses	Regional / Local: River Avon and Clay Coton Yelvertoft Brook both main rivers assumed <10m wide	Medium
		Local: Swinford Lodge Brook and other ordinary rivers assumed <5m wide, and other water courses	Low
Still Waters: Biodiversity		Local: A number of ponds within close vicinity to proposed route. Some of ecological importance (see Chapter 3 Ecology and Nature Conservation)	Low
Groundwater			
Groundwater: Water supply Transport and dilution of waste products	Non potable abstraction	Local: Two licensed abstractions within 500 metres of the Junction include agricultural use. Other abstractions up to 1km away, but assumed to be outside of zone of influence	Low
	Drinking water supply	National / Regional: No public supplies	Low
		Local: Two licensed abstractions within 500 metres of the Junction and five licensed abstractions up to 1km away include domestic use. Private water supply at Station House, Lilbourne, assumed to be <10m^3/d	Medium
	Vulnerability	National / Regional: No source protection zones & no major aquifers	Low

Feature & Attribute / Service	Quality Indicator	Scale[A], Details and Grading	Importance
		Local: Minor alluvial & river terrace gravel deposits aquifer with low leaching soils	Low
		Local: Non aquifer Lower Lias Group strata & Glacial Till	Low
Flood Risk			
Floodplain: Conveyance of flood flows	Surface waters	Regional / Local: Proposed Development within River Avon and Clay Coton Yelvertoft Brook 1:100 year indicative floodplain	Medium
	Groundwater	Local: Alluvial and river terrace gravel deposits with water table in places below 1m	Medium
		Local: Clay soils	Low

[A] The majority of features are deemed to be of 'local' scale. Regional / national status has been afforded to important main rivers, public water supplies, major aquifers etc.
[B] Conservation value is not included; this is covered within Chapter 3 Ecology and Nature Conservation

9.5 MITIGATION

9.5.1 During the construction and subsequent operation of the junction improvement, there would be a number of activities which have the potential to impact upon controlled waters, as described below.

Potential Impacts

Construction

9.5.2 The following potential impacts could occur during construction:-

- Generation of surface runoff containing high suspended solids arising from various activities including soil stripping and landscaping, demolition, excavation, infilling, embankments, importation and exportation of soil or fill material, storage and stockpiling, dust suppression, wheel washes, etc.
- Spillages of oil, fuel or other construction chemicals
- Piling for any of the larger structures
- Watercourse crossings and diversions
- Works within the floodplain
- Disturbance of contaminated land, such as the former landfill
- Dewatering
- Creation and removal of ponds, diversion and culverting of existing watercourses
- Development within the floodplain

Operation

9.5.3 The operational phase covers the use of the junction once construction has been completed. The following potential impacts could occur over the long term:-

- Highway runoff discharges including spillages of predominantly oil/fuel and de-icing
- Piled foundations providing pathways for migration
- Changes to land drainage, surface runoff and water quality

Construction Environmental Management Plan

9.5.4 A Construction Environmental Management Plan (CEMP) is being developed for the junction improvement. An outline CEMP[34] has been prepared and is reported in Volume 1 of this ES. This identifies potential areas and / or activities which may lead to water pollution or other adverse consequences, and sets out good site practice and management which would avoid or minimise such outcomes while also providing instruction on emergency response procedures to be adopted following a specific incident. The outline CEMP sets out the key measures that would be implemented on the site to manage water resources on the site throughout the construction works.

9.5.5 Proposed environmental protection measures relevant to protection of the water environment would include:-

- First construction activities would be the construction of drainage ponds, and the extension of the drainage outfall culvert and ditch system
- Fuel storage: All fuel would be stored, in accordance with the Control of Pollution (Oil Storage) Regulations 2001[35], away from watercourses, drains and other sensitive receptors. Emergency spillage clean up kits would be provided at all refuelling points

and strategic points around the work site. Emergency grab packs would be provided in site vehicles. Fuel storage points would be located in the site compound. Refuelling would be carried out by trained operatives. Regular checks would be carried out on fuel storage areas.

- Drainage: An effective temporary drainage system would be maintained for the duration of the works. In general, the permanent drainage ponds providing attenuation, pollution control and water treatment shown on Figure 9.3 would be constructed early in the works to enable these pollution control measures to be utilised during the construction phase. The operation of these ponds is described under drainage below. Where the permanent locations of the ponds would conflict with ongoing construction operations, for example pond 2b shown on Figure 9.3, then temporary ponds would be provided. Mobile settlement tanks and temporary oil interceptors (in the compound area) would be used to control and treat all water produced during the construction process. Where necessary, the features would be reinstated to their full design standard before completion of the project.
- Dewatering: Where small volumes of water would be required to be removed from an excavation, water would, where possible (and with appropriate EA consent) be pumped to a local soakaway point to return to the underlying groundwater.
- The flood compensation areas required as a consequence of the scheme, described under flood compensation below, would be constructed at an early phase of the project.
- A site environmental management team would be employed to oversee implementation and monitoring of the CEMP.
- Site Compound: The setting up procedures would include installation of temporary drainage and material storage areas, including fuel storage. Environmental measures taken to minimise impacts would include: fuel storage (double bunded tank arrangement, pollution control measures and a site based emergency response team, all in accordance with the fuel storage regulations) and drainage (temporary foul and surface water drainage system would be installed, and the surface water system would include interceptors. These interceptors would be emptied regularly and following any spills).

9.5.6 Similar measures, where appropriate, will also apply to the Catthorpe Viaduct Replacement which will be provided as a maintenance project in advance of the junction improvement. No flood compensation will be required for these works.

Permanent Drainage

9.5.7 The permanent solution for the drainage of the M1 Junction 19 Improvement would maintain the existing drainage patterns, with improved pollution control and reduced overall discharge rates compared with the existing situation.

9.5.8 Figure 9.3 shows the proposed drainage arrangements for the junction improvement. They include mitigation measures for 'normal' runoff and pollution incidents for the main road network.

9.5.9 Water quality treatment and pollution incident control would be provided by ponds for drainage catchments 2a, 3b, 2c, 3b, 3c, 3d, 7a, 7b and 7c. Figure 9.4 shows the plan and section of a typical drainage pond designed to attenuate or reduce the flow of highway run-off, to provide pollution control in the event of a spillage and to treat the water by removing pollutants. The plan and section are diagrammatic, intended to illustrate in principle the functional design of the system. Actual outlines are illustrated on Figure B, the Environmental Master Plan. The typical design includes a two pond system to collect sediment and pollutants, with the majority of sediment settlement occurring in the first

pond, and vegetation within the second pond enabling 'polishing' of the flow prior to discharge to the receiving water courses. The first pond is designed to take the first flush of water from the drainage network, which would carry the heaviest pollution load. If a storm event continues, cleaner water would then bypass the first pond and go direct into the second pond. A baffle between the two ponds would also trap any floating oils in the first pond. The ponds would be lined so that there would be no discharges to groundwater. A system of penstocks and baffles would be designed to isolate any pollution incident spillage that may enter the drainage network.

9.5.10 Fixtures known as booming eyes would be included to enable the emergency services to fit temporary booms to catch contaminants in the event of a pollution incident. The emergency services would also be made aware of the location of the ponds, their access points and penstock operation and specific signs would be erected to show how best to access the systems. A small spillage could be contained within the first pond, and the second pond could also be used where necessary. The drainage ponds would be incorporated into a maintenance and management programme in order that the ponds would continue to function effectively as designed. For this reason the drainage ponds have been included in the Compulsory Purchase Order for the project and would be retained by the Highways Agency for permanent management. Access roads have been provided as illustrated on Figure B for maintenance vehicles.

9.5.11 Catchments 1, 3a, 4, 5, 8 and 9 would be retained without any modifications to the highway drainage network. The impermeable area draining to 3a, 4 and 5 would not change, and the impermeable areas of catchments 1, 8 and 9 would increase only slightly. Therefore, attenuation ponds are not proposed for these catchments. The EA have asked for pollution control measures to be provided for all outfalls within the scheme limits, including those that discharge water collected from catchments which extend beyond the scheme area. In response, pollution control measures are proposed as follows:

- For Catchment 1, a petrol interceptor and penstock would be installed, subject to detailed surveys
- For Catchment 3a, a penstock would be installed to contain pollution spillage incidents
- For Catchments 4 and 5, no pollution controls are proposed. The only work to the highway proposed within these catchments is white-lining. There would be no increase in the impermeable area draining to these outfalls.
- For Catchments 8 and 9, more surveys are required during the detailed design. As a minimum, the aim is to include penstocks to control pollution incidents.

9.5.12 In terms of run-off discharge rates, the ponds have been designed in accordance with EA requirements. The EA have requested that, in accordance with PPS 25, the improvement scheme should reduce the net discharge rate from the existing sections of motorway within the limits of the scheme (21.99 hectares in extent) by at least 20% to allow for the effect of climate change. The proposed discharge rates from the ponds have been designed to achieve this net reduction in discharge flow with an allowance being made for a greenfield run-off rate of five litres per second per hectare plus an additional allowance of 20% for climate change, as agreed with the EA, for the new sections of carriageway within the limits of the scheme (5.70 hectares in total). The scheme limits are defined on Figures 9.2 and 9.3. The storage volume of the ponds is designed to achieve these proposed discharge rates based on the run-off from a 1 in 100 year storm event.

9.5.13 Drainage from the local road network is not included in these arrangements. Over-the-edge drainage into adjacent ditches is proposed for the local road network when at ground level or on embankment.

9.5.14 Where the local roads are in cutting, kerb and gully drainage is proposed on the low side of the carriageway to drain the carriageway run-off, and filter drainage is proposed on the high side of the carriageway to collect the run-off from the earthworks slopes. The water from these areas would drain into the treatment ponds. Swinford Road would be in a particularly deep cutting beneath the M6. This water would therefore be incorporated into the mainline drainage for the M6-A14 via deep pipes, and would outfall via drainage pond 7.

9.5.15 As set out in the introduction the proposals for Catthorpe Viaduct Replacement will be to match the existing drainage arrangements as far as possible, with only negligible differences to the locations of pipes and gulleys. There will also be some reduction in the highway area to be drained as the replacement viaduct will be narrower than the existing.

9.5.16 No provision of drainage ponds or petrol interceptors as described for the junction improvement above is included for the viaduct replacement works.

9.5.17 There will be some widening as a precautionary measure of approximately 400 metres of an existing drainage ditch along the eastern side of M1 to the north of the River Avon. Mitigation measures will be used to minimise the risk of any suspended solids reaching the River Avon, including phasing the regrading to reduce the duration of disturbance.

Flood Compensation

9.5.18 Proposed works to widen the A14 embankments would displace part of the floodplain of the River Avon, and thereby reduce flood storage capacity. In addition, two bridleway bridges would be built in the floodplain, and would also reduce the capacity. To mitigate these impacts, several flood compensation areas would be excavated to provide 587m^3 of additional flood storage capacity. The locations are illustrated on Figure 3.13.

9.5.19 As set out in Development and Flood Risk – Guidance for the Construction Industry Report C624 by CIRIA[36], compensatory flood storage must become effective at the same point in a flood event as the lost storage would have done. It therefore has to provide the same volume and be at the same level relative to flood level as the lost storage. This requirement is often referred to as “level for level” or “direct” compensation.

9.5.20 The various areas shown on Figure 3.13 have been selected to be at the appropriate level. Some of the proposed compensation areas would be returned to agricultural use. Others have been sited to coincide with proposals for habitat creation and these are described in detail in Chapter 3 Ecology and Nature Conservation.

9.5.21 Unlike the drainage ponds described above, the Highways Agency does not intend to take permanent title to the areas required for flood compensation. The intention is to hand them back to the original landowners on completion of the works. However, as a precaution the areas will be included in the CPO to ensure certainty that they can be provided. Upon completion the areas would become part of the flood plain regulated by the EA.

River Channel Regrading

9.5.22 Figure 3.13 also shows sections of the river bank between the A14 and M1 which would be graded to a shallower profile. The objective of these works is not hydrological but ecological, and the measure is described in more detail in Chapter 3 Ecology and Nature Conservation. Enlarging the channel would not provide any direct flood compensation. The locations have been agreed with the EA and the intention of the regrading is to encourage the development of marginal vegetation to provide greater cover for otters and to improve

their habitat. The regrading is proposed on the inside of river meanders to complement the flow pattern of the river and to minimise the risk of erosion. The measures are in mitigation of the potential disturbance to otters arising from the provision of a new bridleway alongside the river, also shown on Figure 3.13. The proposal is to leave the existing bed of the river undisturbed, though precautions would need to be taken during the regrading works to avoid silt being carried downstream. Care would be taken to phase the regrading works to minimise the duration of disturbance to the banks, perhaps by beginning the excavations from the landward side, and breaking through the bank as late as possible. Material arising from the regrading would not be left within the flood plain. As indicated on Figure 3.13, the bridleway would be sited at least 8 metres from the top of the river bank as required by the EA to enable long term maintenance of the river channel.

9.5.23 Figure 3.13 also illustrates the proposed realignment of the Swinford Lodge Brook, a tributary of the River Avon. The existing line of the brook would be affected by the works to the A14 and a new section replicating a narrow meandering channel is proposed, integrated with flood compensation and habitat creation.

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9.6 ENVIRONMENTAL IMPACT

9.6.1 The potential impacts of both the construction and operation of the junction improvement are considered for surface waters and groundwaters respectively below, together with proposed mitigation measures where necessary.

9.6.2 Highway runoff and accidental spillages present the most significant risk. The Design Manual for Roads and Bridges (DMRB), Volume 11, Section 3, Part 10[2] identifies ranges of pollutant concentrations in highway runoff. It lists 39 different pollutants which may arise in road runoff. DMRB states that, in broad terms, metals and hydrocarbons affect water quality and impair biological functions, and sediments affect aquatic habitat by smothering feeding and breeding grounds and by physically altering the habitat.

9.6.3 Potential impacts on flood risk are also dealt with below, and in more detail in the Flood Risk Assessment.

Catthorpe Viaduct Replacement

9.6.4 As set out in the introduction, there are proposals to replace the Catthorpe Viaduct in advance of the junction improvement.

Surface Water

9.6.5 During construction EA Pollution Prevention Guidelines (PPG's)[22] will be followed and control measures included in a project CEMP similar to the junction improvement as set out under Section 9.5 Mitigation above. The main concern at this stage will be run-off containing high concentrations of suspended solids into the River Avon and temporary silt traps may be required to prevent this. If a pollution event were to occur to the River Avon, despite the measures in place, it would have a *Moderate Adverse* impact.

9.6.6 In operation any impacts will be *Negligible* compared with the existing junction. There will be some reduction in the amount of run-off as the surface area of highway will be reduced.

Groundwater

9.6.7 The viaduct replacement is over an area of non-aquifer and there is no known source of contaminated land, although there is always a risk of leaks and spills during construction. This would be controlled by the CEMP. The risk of adverse impacts is considered to be *Negligible.*

9.6.8 During operation there would be no change in risks to groundwater compared with the existing road. Run-off from the carriageway would not be discharged to groundwater.

Flood Risk

9.6.9 The viaduct replacement is not within a flood zone. There would be a reduction in the quantity of surface run-off.

Summary for Catthorpe Viaduct

9.6.10 At construction there would be a risk of a *Moderate Adverse* effect. In operation, the drainage measures will match the existing arrangements as far as possible resulting in a *Neutral* effect.

9.6.11 These comments consider the viaduct replacement as a stand alone project, and reference should be made to the Catthorpe Viaduct Replacement Environmental Assessment[49].

9.6.12 The detailed assessment that follows includes the viaduct replacement as part of the completed M1 Junction 19 Improvement.

Surface Waters

9.6.13 Surface water resources can be impacted either by changes in levels / flows or by changes in quality. Changes in water quality and flows can significantly impact on flora and fauna supported by surface water. Changes in quality and flows can also affect abstractions.

Construction

9.6.14 Leaks and spills of hydrocarbons or other pollutants could cause localised pollution of surface waters. The surface waters which flow through the study area are of good quality, and such pollution incidents would have serious effects on water quality downstream, if they were allowed to occur. These can be avoided through good site practice and management in line with the CEMP as described in the preceding section, and through the additional measures outlined in this section. In particular, measures have been described above to safeguard water resources from the effects of the proposed site compound. The location of the site compound is shown on Figure G Areas Required During Construction included in Appendix 1 to Volume 1 of the ES.

9.6.15 EA Pollution Prevention Guidelines (PPGs)[22] would be followed. Precautionary measures for the protection of surface waters during site works would be agreed with advice from the EA, including authorisation of any consented discharges.

9.6.16 The effects of spillage events associated with construction are likely to be temporary. By definition, any such occurrence would be accidental, and its precise nature and scale could not be precisely predicted.

9.6.17 The main concern during construction, as for most construction works, would be discharge of runoff containing high concentrations of suspended solids into nearby watercourses. Of most concern are the main rivers and any existing ponds. Potential impacts would include increased sediment accumulation (blanketing of the stream bed, directly destroying aquatic life and indirectly removing part of the food chain), turbidity, discolouration and possible nutrient enrichment. Similar impacts can arise during earthworks, culverting, diversion or channel regrading works. In order to mitigate the impacts of silt-laden runoff during rain events, standard precautions (good site practice) would be necessary. Typical measures, in addition to the early provision of drainage ponds already described, include temporary run-off drainage, suitable location of stockpiles, etc. Such measures are outlined in the EA PPGs. The main risks are during conditions of comparatively low flow. In addition, the River Avon, as a designated cyprinid fishery, is vulnerable during the fish spawning season, from October to January. Temporary silt traps may be required for site works drainage to prevent silt-laden discharges. Other measures include maintaining / retaining as much of the vegetation and ground cover as possible along the margins of the works as a buffer to surface drainage from the site. In addition, surface vegetation alongside any watercourse should be retained wherever possible in order to obtain benefits in terms of runoff retardation and filtration / deposition of suspended materials. These measures would mean that the risk of siltation incidents would be very low.

9.6.18 During construction there would be a number of temporary haulage road crossings required across various watercourses. The locations of these are shown on Figure G. These are

likely to require the temporary placement of pipe, geotextile membrane and gravel backfill within the smaller watercourses. The placement of these structures would cause temporary increases in suspended solids downstream and would also cause an in-river obstruction which would remain as long as the haulage route was required, potentially for the whole duration of the construction period. These structures would result in a short-to-medium term change to the form of the river channel and temporary smothering of small sections of the water course bed.

9.6.19 There would be extension and/or modification of existing culverts, together with decommissioning of others. Such works could potentially cause deterioration in water quality due to sediment mobilisation from the disturbance of the river banks and riverbed, breaking up of structures, generation of silty runoff, spillages / release of materials. Precautions and procedures would be followed. Depending on the nature and location of an incident, the impact could migrate through the new surface water network. Works on culverts would be in accordance with legislation. Diversion, culverting and bridge arrangements would be agreed with the EA as required.

9.6.20 Existing ponds in the vicinity of the junction improvement are not expected to be affected by runoff or spillages, as runoff would be collected within the surface water management system and disposed of as appropriate.

9.6.21 Water levels in all rivers, except very locally in the River Avon, are not predicted to change during the works. The impact on water levels in the River Avon due to dewatering operations during construction is considered in the groundwater section.

Operation

9.6.22 The main risk to surface waters is from runoff discharges and accidental spillages with the potential impact(s) as described for the construction works. Summary details of the drainage areas or 'zones' and discharge points are shown in Table 9.8. Their locations are illustrated on Figure 9.3.

Table 9.8 Summary Details of Proposed Highway Drainage

Drainage Zone	Area (m^2)	Receiving Watercourse
1	10048	Tributary of Swinford Lodge Brook
2	38080*	Swinford Lodge Brook
3	63875	River Avon
4	8758	River Avon
5	20795	Clay Coton Yelvertoft Brook
6	29795	Tributary of River Avon (name unknown)
7	87928*	Swinford Lodge Brook
8	12760*	Tributary of River Avon (name unknown)
9	4782	River Avon

*Drainage zones 2, 7 and 8 include drainage from some of the local road network.

9.6.23 Increases in highway area and traffic have the potential to lead to increased pollutant loading within the runoff. The potential impact of the proposed discharges from the highway

runoff on water quality in the receiving watercourses has been estimated (see Appendix A) for dissolved copper and total zinc, in accordance with DMRB guidance[2]. Copper and zinc are two of the most important pollutants present in soluble form, and have been selected as a proxy for other dissolved pollutants, serving as an indicator of whether there is sufficient dispersion and dilution within the receiving water.

9.6.24 As set out in the DMRB, the simple assessment (method A) is used to determine whether the routine runoff is likely to have an impact on the receiving surface watercourses. If it shows that an impact is possible, further assessment is required using the detailed assessment (method B). Where two or more outfalls discharge to the same reach or adjacent reaches, their runoff volumes are combined for the purposes of assessment.

9.6.25 The results are summarised in tables 9.10 and 9.11. More detailed results are shown in Appendix A, Pollution and Spillage Risk Calculations.

Table 9.9 Summary Results of Simple Assessment of Pollution Impacts from Routine Runoff (DMRB Method A)

Junction Option	Drainage Zones				
	1 and 2 combined	3, 4 and 5 combined	6 and 8 combined	7 and 9 combined	All zones combined
2029 Do Minimum	X	✓	X	✓	✓
2029 Do Something	X	✓	X	✓	X

✓ = DMRB Method A calculations show that required dilution is achieved
X = DMRB Method A calculations show that detailed assessment (Method B) is required
Drainage zones are combined according to the location of the relevant discharge points – see Figures 9.2 and 9.3

Table 9.10 Summary Results of Detailed Assessment of Pollution Impacts from Routine Runoff (DMRB Method B)

	2029 Do Minimum		2029 Do Something	
	Downstream Copper (µg/l) (EQS < 22 µg/l)	Downstream Zinc (µg/l) (EQS < 200 µg/l)	Downstream Copper (µg/l) (EQS < 22 µg/l)	Downstream Zinc (µg/l) (EQS < 200 µg/l)
Zones 1 and 2 combined	24	94	21	81
Zones 3, 4 and 5 combined	n/a	n/a	6	18
Zones 6 and 8 combined	35	143	32	131
Zones 7 and 9 combined	n/a	n/a	6	18
All zones combined	n/a	n/a	13	45

9.6.26 The estimations indicate that the discharges from the proposed junction improvement would cause the concentration of copper in an un-named tributary of the River Avon to exceed the EQS. This watercourse would receive runoff from drainage zones 6 and 8. All other receiving watercourses would continue to meet the standards for copper and zinc. Under the do minimum scenario in 2029, the EQS for copper would also be exceeded in the tributary receiving runoff from drainage zones 6 and 8. In addition, under the do minimum scenario for 2029, Swinford Lodge Brook, receiving discharges from drainage zones 1 and 2, would fail to meet the EQS for copper.

9.6.27 The routine runoff estimations are conservative as they do not include for mitigation measures. The proposed arrangement of treatment ponds and other precautionary pollution prevention measures, including penstocks and petrol interceptors, would further reduce the potential for pollution from surface water discharges. Given that there is little treatment available for the existing discharges, there is potential for the water quality to improve within the receiving watercourses.

9.6.28 The probability of pollution from an accidental spillage reaching a receiving watercourse has been assessed for the proposed junction improvement, using DMRB methodology (method D). The pollution risk is expressed as the probability of an incident in any one year. The acceptable risk of a serious pollution incident occurring is where the annual probability is predicted to be less than 1%.

9.6.29 The results are summarised in Table 9.11 below. More detailed results are shown in Appendix A.

Table 9.11 Summary Results of Assessment of Pollution Impacts from Accidental Spillages (DMRB Method D)

	Annual Probability of Pollution Incident (%)	
Drainage Zones	**2029 Do Minimum**	**2029 Do Something**
Zones 1 and 2 combined	0.29	0.06
Zones 3, 4 and 5 combined	0.13	0.27
Zones 6 and 8 combined	0.06	0.07
Zones 7 and 9 combined	0.07	0.18
All zones combined	0.55	0.68

9.6.30 Where two or more outfalls discharge to the same reach (section of river) or adjacent reaches, their runoff volumes are combined for the purposes of assessment – see Figures 9.2 and 9.3.

9.6.31 The calculations indicate that, for all drainage zones, both for the do minimum scenario and for the proposed junction improvement, the annual probability of a serious pollution incident is less than 1%. Therefore, the risk of pollution is assessed as being acceptable.

9.6.32 While the serious spillage calculations assume some risk reduction due to emergency response (use of booms, absorbent pads etc), the initial calculations do not take into account the mitigation measures of the proposed treatment and attenuation ponds. DMRB guidance states that the inclusion of ponds within a scheme can reduce the pollution incident risk by 50%.

Groundwater

9.6.33 Groundwater resources can be affected by changes in groundwater elevations / flows or quality. Changes in quality and flows can affect abstractions.

Construction

9.6.34 Leaks and spills of hydrocarbons or other pollutants could cause localised pollution of groundwater anywhere within the extent of the works where such incidents could occur. The main contaminants of concern are List 1 substances under the 1998 Groundwater Regulations[12], and should be prevented from discharge, direct or indirect, to groundwater. List 1 substances are defined on the basis of toxicity, persistence and bio-accumulation via the aquatic environment, and include organohalogen, organophosphorus and organotin compounds, substances with carcinogenic, mutagenic or teratogenic properties, mercury and cadmium and their compounds, mineral oils and hydrocarbons, and cyanides. Some 299 specific compounds have currently been determined as List 1 substances by the Environment Agency.

9.6.35 Although much of the study area is underlain by a minor aquifer, it is designated of low vulnerability and therefore groundwater should not be particularly susceptible to pollution. The site compound and re-fuelling depot would be located partly over the minor aquifer. A pollution incident could lead to pollution of the minor aquifer. Remediation of groundwater is usually difficult and rarely totally effective. Furthermore, it is likely that the alluvial / fluvial minor aquifer provides baseflow to surface waters, so such a pollution incident could also lead to pollution of a surface water.

9.6.36 The majority of the proposed drainage ponds, and the flood compensation areas, would be located over the minor aquifer. It is not expected that the excavation of these structures would be below the water table and therefore there should be no requirement for dewatering. The proposed drainage arrangements are shown on Figure 9.3. Flood compensation is discussed further in the next section.

9.6.37 The risk of encountering groundwater during the construction of both the Swinford Road Cutting and the A14-M6 link is considered to be high, although the volume of groundwater seepage into the cuttings is likely to be slow (around 1-2m^3 per hour) as a result of the presence of glacial till and clay, through which water flow is restricted. Groundwater seepage is to be taken into account during the detailed design of the drainage system.

9.6.38 The majority of the road widening or realignment over the minor aquifer would be on embankments, constructed using clay obtained from excavating the cuttings. There would also be areas of embankments over the non-aquifer. The breaking out of existing structures is unlikely to require deep excavations and associated dewatering operations. Foundations for some of the larger structures, such as the overbridges, may require deeper excavations and therefore there may be localised areas where dewatering operations may be required. The majority of these structures are located within the non-aquifer, but there may be some deeper excavations within the minor aquifer in places.

9.6.39 Two small groundwater abstractions are located within 1km of the proposed works; a private assumed potable supply (Station House, Lilbourne) some 250m west of the M1, and a licensed agricultural and domestic supply (Swinford Lodge), some 400m east of the M1. The private supply is located relatively close to the river Avon and may be affected by any localised groundwater lowering. The licensed supply is too distant to be affected by localised groundwater lowering. Both supplies could potentially be affected by a pollution

incident, although the licensed supply is probably too distant to receive any impact. Groundwater within the non-aquifer in the study area is still potentially at risk from pollution, although the consequence of such pollution is considerably reduced compared to the minor aquifer.

9.6.40 Another source of potential contamination is remobilisation of contaminated land. The only known source on site is the area of the former Cleanaway landfill site. However, the junction improvement has been designed to avoid the area. Thus the risk of groundwater pollution by disturbance is negligible. Chapter 5, Materials, deals with this issue in more detail.

Operation

9.6.41 A system of ditches and filter drains exists to intercept and divert groundwater at the existing highway boundary, and it is proposed to maintain and supplement this system as appropriate to control groundwater levels as necessary along the highway. Filter drains would be used at the base of embankments. Minor levels of infiltration to groundwater may occur. However, no significant change to groundwater levels or discharges is likely to arise from the operation of any of the junction options.

9.6.42 Carriageway runoff is to be collected in drainage ponds and discharged to surface water. It is proposed that the ponds would be lined to prevent potentially contaminated water migrating down to the underlying groundwater. Operational drainage is not anticipated to pose a significant pollution threat to groundwater; therefore a quantitative discharge to groundwater assessment has not been undertaken. However, potential contaminants include List 1 substances such as herbicides from verges / embankment vegetation control applications in addition to oil and fuel.

9.6.43 Recharge to groundwater would be reduced due to the increase in highway area and associated interception of incident rainfall, and subsequent drainage to surface waters. The overall reduction in recharge of groundwater is not considered to result in significant impacts because the increase in road area on the minor aquifer, as a proportion, is negligible. However, as good practice, reduction in infiltration should be limited wherever possible. Figure 9.1 shows the extent of the minor aquifer and non-aquifer in the vicinity of the junction.

9.6.44 Some works, such as bridges, would involve piled foundations through areas of the minor aquifer. These piled foundations may cause localised changes to groundwater flow and provide a potential downward migration pathway. ‘Contaminated’ land should not be piled through, and the type of pile may also be chosen to restrict downward migration. There is no piling proposed in the vicinity of the former Cleanaway landfill site.

Flood Risk

9.6.45 The A14 part of the site is situated in Flood Zone 3a High Probability, as defined by Planning Policy Statement 25 (PPS 25). The widening of the A14 would displace the existing floodplain, and would be mitigated by introducing floodplain compensation areas, as described in Section 9.5 and illustrated on Figure 3.13. With the compensation in place, there would be no increase in flood risk. A Flood Risk Assessment[48] has been carried out in accordance with PPS 25 and is at Appendix C.

9.6.46 Two bridleway crossings over the River Avon would be constructed within the 1 in 100 year floodplain. These structures would be at risk of flooding, and would not be passable during flood events. They have been allowed for in assessing the flood compensation required.

9.6.47 The increased highway area would result in a net increase in highway runoff. To ensure that there is no increase in runoff to the surface watercourses, a system of attenuation ponds has been designed. As described in Section 9.5 discharge rates would be equivalent to at least a 20% reduction for existing carriageways retained by the project. For new sections of highway run-off would be attenuated to a green field rate of 5 litres per second per hectare as agreed with the EA, less an additional allowance of 20% for climate change.

9.6.48 To mitigate against the risk of groundwater seepage in cuttings, filter drains and slope drainage would be used.

9.6.49 In summary, all flood risks associated with the junction improvement could be successfully managed.

Implications for Planning Policies

Regional Policy

9.6.50 Policy CC1 from the West Midlands Regional Spatial Strategy promotes the enhancement and extension of natural habitats, so that the opportunities for species migration are not precluded and biodiversity can adapt to climate change and hence help to mitigate its affects by absorbing flood water. This policy also requires all new development to minimise resource demand and encourage the efficient use of resources, especially water, avoid development in areas at risk of flooding and promote the use of sustainable drainage techniques.

9.6.51 Policy QE9 from the West Midlands Regional Spatial Strategy aims to protect or improve water quality and where necessary significantly reduce the risk of pollution, particularly regarding wetland species and habitats subject to local biodiversity partnerships. Where possible, the implementation of sustainable drainage systems should be considered. Development that poses an unacceptable risk to the quality of groundwater or surface water should therefore be avoided. The proposed development would accord with the Regional Policy objectives for the West Midlands where possible and would therefore have a *Neutral/Beneficial* Impact on these objectives.

9.6.52 Policies 32 and 35 from the East Midlands Regional Plan regarding Water Quality and Flood Risk, seek to promote improvements in water efficiency in new development, improve water quality, reduce the risk of pollution and flood risk. The most sustainable solutions should take account of climate change and use sustainable drainage techniques.

9.6.53 Development would not be permitted if, alone or in conjunction with other new development, it would be at unacceptable risk from flooding or create such an unacceptable risk elsewhere. However, adequate measures to mitigate negative effects, including provision for the maintenance and enhancement of biodiversity may be considered in accordance with the flood management regime for the region. As the proposed development would take drainage and sustainability into account where possible it would have a *Neutral/Beneficial* Impact on East Midlands Regional policy objectives.

Local Policy

9.6.54 Strategic Objective 8 of the Joint Core Strategy for West Northamptonshire Issues and Options document aims to ensure that development is sensitive to its environment as it states that development should be locally distinctive and of a high quality design, using sustainable construction methods.

9.6.55 Potential Strategy ST1 from the Harborough District Core Spatial Strategy Final Draft Document states that all development must help mitigate and adapt to climate change; development in areas liable to be at risk of flooding will therefore be avoided. The promotion of sustainable drainage measures that do not compromise the function of watercourses and value of river corridors in providing natural floodplains is also promoted.

9.6.56 Policy GP10 from the Rugby Borough Local Plan regarding Flooding and Surface Water Drainage which states that Planning Permission will be granted for development that does not reduce the capacity of the floodplain to store water or otherwise exacerbate, or give rise to, the risk of flooding. Any necessary flood protection and mitigation measures, to ensure that the risk of flooding and damage to buildings and related areas is reduced to an acceptable level for the lifetime of the development, should be incorporated where possible. The use of mitigation measures is also promoted, including Sustainable Drainage Systems to provide for the disposal of surface water and provide for the re-use and recycling of such water within the development.

9.6.57 Policy GP11: Pollution Control from the Rugby Local Plan covers issues relating to drainage and the water environment, requires development proposals to show that there would not be any resulting pollution to surface or ground water. This is supported by Policy CS17 from the Rugby Borough Core Strategy Proposed Submission Draft document, regarding sustainable design and construction, which states that developments should be designed to reduce the use of non-renewable resources and take into account the impact of climate change over the lifetime of the development, through the implementation of methods such as Sustainable Drainage Systems.

9.6.58 Policy 13: General Sustainable Development Principles from the North Northamptonshire Core Strategy states that development should not cause a risk to (and where possible enhance) the quality of the underlying groundwater or surface water, nor increase the risk of flooding on the site or elsewhere, and where possible incorporate Sustainable Drainage Systems.

9.6.59 Overall, it is not considered that the proposed improvement to Junction 19 would negatively impact on Regional or Local policy principles and objectives, providing that sustainable measures such as Sustainable Drainage techniques and other mitigation measures to minimise the potential for pollution and flooding are implemented where possible throughout the scheme.

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9.7 SIGNIFICANCE OF EFFECTS

9.7.1 This description of the significance of effects includes Catthorpe Viaduct Replacement as part of the completed M1 Junction 19 Improvement. An assessment of the viaduct replacement as a separate project is summarised in Section 9.6 above.

9.7.2 It is assumed that good site practice would be followed during the construction phase and that maintenance would be undertaken as necessary during operation.

9.7.3 The main potential impact of the proposed junction improvement is pollution of surface waters. Mitigation measures have been proposed within this chapter to reduce the potential for pollution and other impacts to surface waters.

9.7.4 With respect to groundwater, the potential impacts are more minor in comparison and therefore fewer mitigation measures have been proposed.

9.7.5 The significance of residual effects with mitigation in place is set out in Tables 9.12 (construction) and 9.13 (operation).

Construction

9.7.6 Summary Assessment: *Moderate Adverse* effect.

9.7.7 The effect is conservative due to two *Moderate/Large Adverse* effects relating to potential pollution of the River Avon drinking water supply and designated fishery which is of *Very High* importance. However, the risk associated with these impacts is temporary and of very short potential duration as the treatment ponds would be constructed early, providing mitigation for accidental spillage.

Operation

9.7.8 Summary Assessment: *Slight Beneficial* effect

9.7.9 There would be beneficial effects associated with improvements in water quality as a result of the treatment provided by the drainage ponds, and by penstocks and oil interceptors and improved signing of these systems for emergency personnel. In most cases, these beneficial effects would be *Slight*, although there would be a *Moderate Beneficial* effect on chemical water quality in the River Avon. There would be a *Slight Adverse* effect on the nature of the watercourses due to the addition of permanent structures in and over them. All other effects would be *Neutral.*

Overall Effect

9.7.10 Summary Assessment: *Neutral*

9.7.11 The construction impacts would be of limited duration compared with the operation, and the negative scoring for the construction reflects the risk of incidents occurring prior to implementation of mitigation measures. During operation, the effective operation of the highway drainage system and emergency procedures should ensure that there would be a *Slight Beneficial* effect on the water environment.

Table 9.12 M1 Junction 19 Water Environment Features Summary: Construction Effects

Feature & Attribute / Service	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
Surface Water							
River: Water supply Transport & dilution of waste products	Chemical water quality	Regional / Local: River Avon RE1	Very High	Pollution: Local works in, over and in the vicinity of watercourses	Unknown	Minor adverse	Moderate / Large adverse
		Regional / Local: Clay Coton Yelvertoft Brook RE2	High			Minor adverse	Slight / Moderate adverse
		Local: Status of other water courses not recorded	(assumed) Medium - Low			Minor adverse	Neutral
	Non potable abstraction	Local: No abstractions within 2 km downstream:	Low	None		(Negligible)	Neutral
	Drinking water supply	National / Regional: River Avon drinking water supply downstream of development	High	Pollution: Local works in, over and in the vicinity of watercourses		Moderate adverse	Moderate / Large adverse
River: Biodiversity	Biological water quality	Regional / Local: River Avon GQA C (monitored downstream of site)	Medium	Pollution: Local works in, over and in the vicinity of watercourses	Unknown	Minor adverse	Slight adverse
		Local: Status of other water courses not recorded	(assumed) Medium			Minor adverse	Neutral
	Fisheries quality	Regional: River Avon designated cyprinid fishery	High	Pollution: Local works in, over and in the vicinity of watercourses	Unknown	Moderate adverse	Moderate / Large adverse
		Local: Status of other watercourses not recorded, assumed undesignated / non fishery	Medium			Minor adverse	Slight adverse

Feature & Attribute / Service	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
River: Conveyance of flow and material	Nature of watercourses	Regional / Local: River Avon and Clay Coton Yelvertoft Brook both main rivers assumed <10m wide	Medium	Disruption: Local works in, over and in the vicinity of water courses (but of short duration)	Unknown	Minor adverse	Slight adverse
		Local: Swinford Lodge Brook and other ordinary rivers assumed <5m wide, and other water courses	Low			Minor adverse	Neutral
Still Waters: Biodiversity		Local: A number of ponds within close vicinity to proposed route. Some of ecological importance (see Chapter 4 Ecology and Nature Conservation)	Low	Pollution and loss of water in ponds unlikely: minimal impact with respect to water resources	Unknown	Minor adverse / negligible	Neutral
Groundwater							
Groundwater: Water supply Transport and dilution of waste products	Non potable abstraction	Local: Two licensed abstractions within 500 metres of the Junction include agricultural use. Other abstractions up to 1km away, but assumed to be outside of zone of influence	Low	Cuttings may intercept groundwater and require dewatering, leading to lowering of the water table. Potential reduction in quality or supply	Negligible	Negligible	Neutral
	Drinking water supply	National / Regional: No public supplies	Low	None	Negligible	Negligible	Neutral

Feature & Attribute / Service	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
		Local: Two licensed abstractions within 500 metres of the Junction and five licensed abstractions up to 1km away include domestic use. Private water supply at Station House, Lilbourne, assumed to be <10m^3/d	Medium	Cuttings may intercept groundwater and require dewatering, leading to lowering of the water table. Potential reduction in quality or supply	Negligible	Negligible	Neutral
	Vulnerability	National / Regional: No source protection zones & no major aquifers	Low	None	(Negligible)	(Negligible)	(Neutral)
		Local: Minor alluvial & river terrace gravel deposits aquifer with low leaching soils	Low	Pollution	Unknown	Minor adverse	Neutral
		Local: Non aquifer Lower Lias Group strata & Glacial Till	Low	Pollution	Unknown	Negligible / minor adverse	Neutral
Flood Risk							
Floodplain: Conveyance of flood flows	Surface waters	Regional / Local: Proposed Development within River Avon and Clay Coton Yelvertoft Brook 1:100 year indicative floodplain	Medium	Works within floodplain (but flood compensation provided at early stage)	Minor adverse	Minor adverse / negligible	Slight adverse
	Groundwater	Local: Alluvial and river terrace gravel deposits with water table in places below 1m	Medium	Some works but minimal loss of deposits	Negligible	Negligible	Neutral
		Local: Clay soils	Low	None	(Negligible)	(Negligible)	(Neutral)

[1] Assume that quality and rarity of the same grading and that all features of limited substitutability

Table 9.13 M1 Junction 19 Water Environment Features Summary: Operation Effects

Feature & ATTRIBUTE / SERVICE	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
Surface Water							
River: Water supply Transport & dilution of waste products	Chemical water quality	Regional / Local: River Avon RE1	Very High	Increased routine runoff to watercourses. Pollutant concentrations within acceptable limits. Slight increase in pollution incident risk. The introduction of treatment ponds and other pollution prevention measures offer an improvement in the quality of discharges to receiving waters, compared with the do minimum scenario.	Negligible	Minor beneficial	Moderate beneficial
		Regional / Local: Clay Coton Yelvertoft Brook RE2	High		Negligible	Minor beneficial	Slight beneficial
		Local: Status of other water courses not recorded	(assumed) Medium - Low		Negligible	Minor beneficial	Slight beneficial
	Non potable abstraction	Local: No abstractions within 2 km downstream:	Low	None	(Negligible)	(Negligible)	(Neutral)
	Drinking water supply	National / Regional: River Avon drinking water supply downstream of development, assumed DW3 and within critical travel time	High	Increased routine runoff to watercourses. Pollutant concentrations within acceptable limits. Slight increase in pollution incident risk. The introduction of treatment ponds and other pollution prevention measures offer an improvement in the quality of discharges to receiving waters, compared with the do minimum scenario.	Negligible	Minor beneficial	Slight beneficial
River: Biodiversity	Biological water quality	Regional / Local: River Avon GQA C (monitored downstream of site)	Medium	Increased routine runoff to watercourses. Pollutant concentrations within acceptable	Negligible	Minor beneficial	Slight beneficial

Feature & ATTRIBUTE / SERVICE	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
		Local: Status of other water courses not recorded	(assumed) Medium	limits. Slight increase in pollution incident risk. The introduction of treatment ponds and other pollution prevention measures offer an improvement in the quality of discharges to receiving waters, compared with the do minimum scenario.	Negligible	Minor beneficial	Slight beneficial
	Fisheries quality	Regional: River Avon designated cyprinid fishery	High	Increased routine runoff to watercourses. Pollutant concentrations within acceptable limits. Slight increase in pollution incident risk. The introduction of treatment ponds and other pollution prevention measures offer an improvement in the quality of discharges to receiving waters, compared with the do minimum scenario.	Negligible	Minor beneficial	Slight beneficial
		Local: Status of other watercourses not recorded, assumed undesignated / non fishery	Medium		Negligible	Minor beneficial	Slight beneficial
River: Conveyance of flow and material	Nature of watercourses	Regional / Local: River Avon and Clay Coton Yelvertoft Brook both main rivers assumed <10m wide	Medium	Disruption: Local minor additional permanent structures in and over watercourses	Minor adverse / negligible	Minor adverse / negligible	Slight adverse
		Local: Swinford Lodge Brook and other ordinary rivers assumed <5m wide, and other water courses	Low		Minor adverse / negligible	Minor adverse / negligible	Neutral
Still Waters: Biodiversity		Local: A number of ponds within close vicinity to proposed route. Some of ecological importance (see Chapter	Low	No impact during operation	(Negligible)	(Negligible)	(Neutral)

Feature & ATTRIBUTE / SERVICE	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
		4 Ecology and Nature Conservation)					
Groundwater							
Groundwater: Water supply Transport and dilution of waste products	Non potable abstraction	Local: Two licensed abstractions within 500 metres of the Junction include agricultural use. Other abstractions up to 1km away, but assumed to be outside of zone of influence	Low	Potential slight loss in recharge, but unlikely reduction in supply; Quality unaffected.	Negligible	Negligible	Neutral
	Drinking water supply	National / Regional: No public supplies	Low	None	(Negligible)	(Negligible)	(Neutral)
		Local: Two licensed abstractions within 500 metres of the Junction and five licensed abstractions up to 1km away include domestic use. Private water supply at Station House, Lilbourne, assumed to be <10m^3/d	Medium	Potential slight loss in recharge, but unlikely reduction in supply; Quality unaffected.	Negligible	Negligible	Neutral
	Vulnerability	National / Regional: No source protection zones & no major aquifers	Low	None	(Negligible)	(Negligible)	(Neutral)
		Local: Minor alluvial & river terrace gravel deposits aquifer with low leaching soils	Low	None: quality unaffected	(Negligible)	(Negligible)	(Neutral)
		Local: Non aquifer Lower Lias Group strata & Glacial Till	Low	None: quality unaffected	(Negligible)	(Negligible)	(Neutral)

Feature & ATTRIBUTE / SERVICE	Quality Indicator	Scale[1], Details and Grading	Importance	Potential Impact	Magnitude without Mitigation	Magnitude with Mitigation	Significance of Effect
Flood Risk							
Floodplain: Conveyance of flood flows	Surface waters	Regional / Local: Proposed Development within River Avon and Clay Coton Yelvertoft Brook 1:100 year indicative floodplain	Medium	Potential increase in flood peak due to construction within flood plain	Minor adverse	(Negligible)	(Neutral)
				Change in road runoff rates	Minor adverse	Minor beneficial	Slight beneficial
	Groundwater	Local: Alluvial and river terrace gravel deposits with water table in places below 1m	Medium	Residual loss of deposits during construction phase	Negligible	Negligible	Neutral
		Local: Clay soils	Low	None	(Negligible)	(Negligible)	(Neutral)

[1] Assume that quality and rarity of the same grading and that all features of limited substitutability

9.8 INDICATION OF DIFFICULTIES ENCOUNTERED

9.8.1 Water quality data is not available for some of the tributaries of the River Avon in the study area. For these watercourses, it has been assumed that the quality is of the same high standard as the River Avon upstream of the junction, thus ensuring that a precautionary approach has been taken during the assessment.

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9.9 SUMMARY

9.9.1 An assessment of the effects of the proposed junction improvement, in relation to surface water, groundwater and flood risk, has been undertaken following DMRB methodology, specifically developed for the assessment of the impacts of highway schemes, and based on advice from the EA. Impacts for the Catthorpe Viaduct have been indicated separately and included in combination with an overall assessment of the junction improvement.

9.9.2 Baseline conditions have been reviewed. The site is underlain by a mixture of non-aquifer and minor aquifers. The distribution of the latter are associated with the location of the various surface watercourses. The site lies within the catchment of the River Avon, a main river, and the highway crosses the River Avon at a number of locations. There is one other main river, the Clay Coton Yelvertoft Brook. There are numerous other ordinary watercourses / drainage ditches and ponds.

9.9.3 There are some groundwater abstractions, including private potable supply, located within 1km of the highway, presumed to be sourced from the minor aquifer. There are no surface water abstractions, although there is an important public water supply abstraction some seven kilometres downstream on the River Avon.

9.9.4 The main rivers are of good water quality. However, the existing highway drainage undergoes little treatment prior to discharge and, in addition, these receiving watercourses are very vulnerable to pollution incidents.

9.9.5 Without mitigation, construction work has the potential to adversely impact the water environment. The main potential impact is pollution of surface waters. It is assumed that good site practice as incorporated within and fundamental to the CEMP would be followed during the construction phase. The overall assessment score for the construction phase is of a *Moderate Adverse* effect – however, this is considered to be conservative as it reflects the inclusion of potential pollution of the River Avon drinking water supply. This would be a temporary risk, and of very short potential duration as the treatment ponds would be constructed early, providing mitigation for accidental spillage.

9.9.6 For the proposed junction improvement, the drainage scheme for the highway operation would upgrade the existing arrangements with spillage containment, water treatment and attenuation where required. It is assumed that maintenance and management of the operational scheme would be undertaken as necessary. The overall assessment score for the operational phase is of a *Slight Beneficial* effect.

9.9.7 With respect to groundwater, there is a potential for construction of cuttings to lead to a lowering of the water table within the minor aquifer. However, this effect would be localised and of *Neutral* significance. Other impacts on groundwater are relatively insignificant, and few mitigation measures are proposed or required. This results in the residual impact being little changed from the current situation.

9.9.8 In terms of flood risk, the widening of the A14 embankments and the creation of two bridleway bridges would reduce the storage capacity in the River Avon floodplain. However, flood compensation would be provided and so there would be no net loss of flood storage. Attenuation ponds would reduce the discharge rate for highway runoff across the scheme by at least 20%, and would therefore have a *Slight Beneficial* effect on flood risk.

9.9.9 The junction improvement would satisfy the requirements of DMRB for routine runoff and pollution incidents from accidental spillages. Details of the DMRB calculations are included in Appendix A.

9.9.10 The proposals meet the objectives set out in the introduction to protect the water environment and to reduce the risk of pollution and flooding.

9.10 REFERENCES

1 M1 Junction 19 Improvement Comparative Environmental Assessment, Chapter 10, Road Drainage and the Water Environment. Highways Agency, 2008
2 Road Drainage and The Water Environment, DMRB Volume 11, Section 3, Part 10, HA 216/06, 2006.
3 M1 Junction 19 EIA Scoping Report, March 2009, Highways Agency
4 Water Resources Act 1991
5 UK Town and Country Planning Act 1990
6 Land Drainage Act 1991
7 Environment Act 1995
8 Control of Pollution Act 1974
9 The Water Environment (Water Framework Directive) (England and Wales) Regulations 2003
10 EC Water Framework Directive 2000 (2000/60/EC)
11 The Surface Water (River Ecosystem) Regulations 1994
12 The Groundwater Regulations 1998
13 EC Groundwater Directive 1980 (80/68/EEC)
14 Surface Waters (Dangerous Substances) Regulations 1992, 1997 and 1998
15 Surface Water (Classification) Regulations 1989
16 EC Dangerous Substances Directive (76/464/EEC)
17 The Surface Waters (Abstraction for Drinking Water) (Classification) Regulations 1996
18 EC Surface Water Abstraction Directive (75/440/EEC)
19 The Surface Waters (Fishlife) (Classification) Regulations 1997, as amended
20 EC Freshwater Fisheries Directive 2006 (2006/44/EC)
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