A303 Sparkford to Ilchester Dualling Scheme
TR010036
6.3 Environmental Statement
Appendix 4.4 HAWRAT Assessment

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A303 Sparkford to Ilchester Dualling Scheme

Development Consent Order 201[X]

6.3 Environmental Statement
Appendix 4.4 HAWRAT Assessment

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1 Introduction

1.1 Background to the report

1.1.1 This report is an appendix to the A303 Sparkford to Ilchester Dualling Environmental Statement (ES). The report presents a summary of the water quality assessment undertaken to assess potential impacts of routine runoff and accidental spillage risk to watercourses resulting from the scheme.

1.1.2 This assessment of routine runoff has been undertaken using the Highways Agency Water Risk Assessment Tool (HAWRAT), as prescribed in Method A of the *Design Manual for Roads and Bridges* (DMRB) Volume 11, Section 3, Part 10, *Road Drainage and the Water Environment* (DMRB HD45/09). The assessment of accidental spillage risk has been undertaken using Method D as prescribed in DMRB HD45/09. No assessment of groundwater has been undertaken using Method C as outlined in DMRB 45/09. This is due to no planned routine runoff discharges to groundwater.

1.1.3 All outfalls from the scheme drain primarily into unnamed field drains, then into either Park Brook or Dyke Brook (tributaries of the River Cary) or into the River Cam. Park Brook is situated to the west of the scheme extent, and Dyke Brook is situated to the north; both watercourses flow in a north-westerly direction towards the River Cary. The River Cam is situated to the south of the scheme, drains into the River Yeo flowing in a westerly direction towards the Somerset Levels.

1.1.4 Distance from the main scheme (outfall locations) to the 3 main Rivers of Cary, Cam and Yeo:

- River Cary – between 2.5 to 5.5 kilometres downstream of scheme
- River Cam – approximately 600 metres downstream of scheme
- River Yeo – approximately 4 kilometres downstream of scheme

1.1.5 The nearest designated sites to the scheme are the Somerset Levels and Moors Special Protection Area (SPA), the Wet Moor Site of Special Scientific Interest (SSSI), and Somerset Levels and Moors Ramsar site, which are all located in the same area on the River Yeo, over 10 kilometres downstream of the confluence with the River Cam.

1.1.6 It is recommended that this assessment is read in conjunction with the proposed highway drainage plan layout for the scheme (appendix A), which shows the proposed outfall locations, drainage catchments and watercourses, in relation to the scheme design

1.2 Methodology

1.2.1 The general procedure for assessing impacts on the water environment follows principles set out in DMRB Volume 11, Sections 1 and 2. The HAWRAT has been developed to determine whether there is an environmental risk from the proposed scheme, and if pollution mitigation measures are therefore required.

1.2.2 This assessment has been undertaken in accordance with DMRB HD45/09, in particular:

- Method A - Effects of routine runoff on surface waters (including a comparison against WFD EQS)
- Method D - Pollution impacts from accidental spillages

Method A

1.2.3 The Method A assessment is undertaken using the HAWRAT assessment tool, which deals with soluble pollutants (associated with acute pollution impacts) and sediment related pollutants (associated with chronic pollution impacts).

Soluble (acute impacts)

1.2.4 Risks to receiving water ecology are appraised within the HAWRAT assessment tool using annual average concentrations for pollutants. The assessment tool estimates in-river annual average concentrations for soluble pollutants (dissolved copper and dissolved zinc), including the contribution from road runoff.

1.2.5 Algorithms within the HAWRAT assessment tool are able to determine pollutant impacts based on 6 hour and 24 hour ‘Runoff Specific Thresholds’ (RSTs) for copper and zinc which have been developed through collaborative research between Highways England and the Environment Agency (RSTs are show below in Table 1.1). The HAWRAT assessment tool compares the runoff outputs to these RSTs, evaluating whether predicted impacts are acceptable or not.

Table 1.1: Runoff Specific Thresholds for soluble pollution from highway runoff

Threshold	Copper (µg/l)	Zinc (µg/l) Water hardness		
		Low (<50mg $CaCO_3$ 1^{-1})	Medium (50-200mg $CaCO_3$ 1^{-1})	High (>200mg $CaCO_3$ 1^{-1})
RST 24hr	21	60	92	385
RST 6hr	42	120	184	770

RSTs obtained from DMRB HD45/09*, derivation of the RSTs is described in WRc Report UC7486 (2007)*

Sediment (chronic impacts)

1.2.6 The procedure for assessing sediment impacts is based on Threshold Effect Levels (TELs) and Probable Effect Levels (PELs), as well as toxicity thresholds. A judgement is also made about whether sediments will accumulate in the stream / river downstream of the outfall. This judgement is based on estimating the stream velocity under low flow conditions and comparing this with a threshold velocity. Velocity thresholds and deposition index thresholds are shown in Table 1.2 and 1.3 respectively.

Table 1.2: Velocity thresholds for sediment

Estimated stream velocity at low flow conditions	Type of site
≤0.1m/s	Accumulating
>0.1m/s	Dispersing

Table 1.3: Deposition Index thresholds for sediment

Estimate deposition index	Type of site
<100	Low extent of deposition
≥100	High extent of deposition

Three step approach (Method A):

1.2.7 The HAWRAT assessment adopts a tiered approach as follows:

- Step 1: Runoff quality. Predicts concentrations of pollutants in untreated and undiluted highway runoff prior to any treatment and dilution in a waterbody.
- Step 2: In-river impacts. Predicts concentrations of pollutants after mixing within the receiving waterbody. At this stage, the ability of the receiving watercourse to disperse sediments is considered. If sediment is predicted to accumulate, the potential extent of sediment coverage (that is, the deposition index (DI)) is also considered. Step 2 also incorporates 2 'tiers' of assessment for sediment accumulation, based on different levels of input parameters. If 1 or more risks are defined as unacceptable at Tier 1, that is, ‘fail’, then a more detailed Tier 2 assessment is undertaken, requiring values for additional parameters relating to the physical dimensions of the receiving watercourse.
- Step 3: In-river impacts with mitigation. Steps 1 and 2 assume that the road drainage system incorporates no mitigation measures to reduce the risk. Step 3 includes mitigation in the form of Sustainable Drainage Systems (SuDS), taking into account the risk reduction associated with any existing measures or any proposed news measures.

1.2.8 Step 3: In accordance with DMRB HD45/09, the following have been assessed:

- All outfalls associated with the A303 Sparkford to Ilchester Dualling along a river stretch within 1 kilometre of the road, in combination for soluble pollutants.
- All outfalls associated with the A303 Sparkford to Ilchester Dualling along a river stretch within 100 metres of the junction, in combination for sediment – bound pollutants.

Method D

1.2.9 The Method D assessment (DMRB HD45/09) for accidental spillages of polluting substances from roads has also been carried out. The assessment aims to ensure provision of appropriate drainage design measures where the risk of a serious pollution incident is more frequent than the 1% annual exceedance probability (AEP) (or more frequent than a 1 – in 100-year return period). For more sensitive watercourses (which are located within approximately 1 kilometre of the scheme), a higher level of protection is applied, up to the 0.5% AEP (or more frequent than 1 – in – 200 years).

1.2.10 The receiving watercourses (Park Brook, Dyke Brook, River Cary, and River Cam) are not considered to be sensitive watercourses. While there are designated conservation sites further downstream in the River Cam catchment, the sites are located more than 10 kilometres downstream from the scheme, as indicated in Section 1.1. Therefore, the 1% AEP threshold has been applied for this assessment.

1.2.11 The results of the assessment are reported as ‘pass’ or ‘fail’. The risk of an acute pollution incident, due to accidental spillage or vehicle fire, is considered proportionate to the risk of a Heavy Goods Vehicle (HGV) road traffic collision, and the volume of traffic. Therefore, the percentage of HGVs on a given road is the main parameter used in the assessment of the risk of serious pollution incidents.

1.3 Assumptions and limitations

1.3.1 The assessment point has been conducted at the same location as the outfall (coordinates of outfalls provided in Table 2.2).

1.3.2 Stream flow data for the receiving watercourse is required for the assessment. However, no gauged flows are available for the receiving watercourses. The *Flood Estimation Handbook* (FEH) Catchment Descriptors have been obtained from the FEH Webservice. Adjusted GIS shapefiles which define the catchment boundary for each receiving watercourse have been imported into the LowFlows software, to produce an estimated Flow Duration Curve (FDC), Baseflow Index (BFI) and annual Q95 flow value (the flow that is exceeded 95% of the time in any given year). The use of the Lowflows software is advocated by HD 45/09 and is the best method in the absence of gauged flow data.

1.3.3 There is no detailed topographical data available to determine channel width/depth of receiving watercourses. Assumptions have been made regarding watercourse width, bed width and side slope of receiving watercourses, based on site photographs, mapping, and aerial photography.

1.3.4 Estimations of Manning’s coefficient value for each watercourse were made using Chow’s lookup table (HAWRAT Help Guide v1.0). In the absence of water quality data, the lower water hardness value was used as a conservative estimate.

1.3.5 Annual Average Daily Traffic (AADT) data was used for the Design Year 2038. The AADT flows for the scheme fall within the >10,000 - <50,000 category (most AADTs are between 15,000 – 20,000). For the Method D spillage risk assessment, the maximum AADT value of 50,000) as a worst case scenario.

1.3.6 No values are available for the estimated effectiveness of the pollution control measures proposed for the drainage design. As stated in DMRB HD 45/09, current best practice design does not provide precise figures for the efficiencies of treatment options. As a guideline for this assessment, the indicative treatment efficiencies of drainage systems have been taken from Table 8.1 in the DMRB HD 33/16, as outlined in Figure 1.1 below.

Figure 1.1: Indicative treatment efficiencies of drainage systems

Treatment System Type	**Suspended Solids (% removal)**	**Dissolved Copper (% removal)**	**Dissolved Zinc (% removal)**
Swales and Grassed Channels[a]	80	50	50
Infiltration Basins/Soakaways	See note b	See note b	See note b
Dry/Detention Ponds[a]	50	0	0
Wet/Retention Ponds	60	40	30
Wetlands (Surface Flow)	60	30	50
Vortex Grit Separators	40	0[c]	15
Sediment Tanks	40	0[c]	0[c]
Oil Separators	0[d]	0[d]	0[d]
Reservoir Pavements/Porous Asphalt	50	0	0
Vegetated Filter Strips[a]	25	15	15
Combined Surface and Sub-surface Drains/Filter Drains[a]	60	0	45
Ditches[a]	25	15	15

a. If the treatment system is designed with an element of infiltration, the risk to groundwater should be evaluated using Method C in HD 45.

b. The effluent from infiltration systems cannot be measured in the same way as systems which discharge to surface waterbodies. While the risk to groundwater from well-designed infiltration systems is generally low, a groundwater risk assessment should be carried out using Method C in HD 45.

c. Variable and negative values recorded for dissolved copper and zinc – therefore not considered reliable by the Overseeing Organisation for removal of dissolved metals.

d. Oil separators can only be chosen for treating oils and must not be relied upon to treat suspended solids, or dissolved metals.

2 HAWRAT assessment input parameters

2.1 Input parameters

2.1.1 The HAWRAT assessment requires a series of inputs to determine the impacts of routine runoff from the proposed scheme. HAWRAT adopts a tiered, consequential approach to assessment and reports results at 3 different stages:

- **Step 1** – runoff quality (prior to any pre-treatment)
- **Step 2** – in river impacts (after dilution and dispersion)
- **Step 3** – in river impacts (post mitigation)

2.1.2 The inputs required for each stage of assessment are detailed below in Table 2.1.

Table 2.1: Inputs required at each stage of assessment

Stage of assessment	Inputs
Step 1 (Runoff quality)	• Traffic volume (AADTs) • Geographic location • 10 years of rainfall data (SAAR values embedded in HAWRAT)
Step 2 (In river impacts)	• Area draining to outfall (impermeable and permeable) • Characteristics of receiving watercourse: ○ Q_{95} ○ Base flow index ○ Water hardness ○ River width ○ Bed width ○ Manning's coefficient ○ Side slope ○ Long slope
Step 3 (Post mitigation)	• Existing and proposed mitigation measures ○ Treatment of soluble pollutants ○ Flow attenuation ○ Settlement of sediments

2.1.3 The HAWRAT tool uses a pass/fail reporting method as follows:

- **'fail'** indicates either an unacceptable impact, a need to carry out further assessment steps, or refer to specialist judgement
- **'pass'** indicates there will be no short-term impacts associated with road runoff

2.2 Outfall information

2.2.1 There are 4 outfalls proposed as part of the drainage design for the scheme. These 4 outfalls drain 6 different drainage network catchments, covering a total area of 51 hectares. Information on outfall location and total areas drained to each outfall is included in Table 2.2 below, and shown in appendix A. None of the outfalls drain into the same watercourse, or are located within 100 metres of each other, therefore a cumulative of sediment and dissolved metals is required. Similarly, none of the outfalls are located within 1 kilometre of each other, therefore no cumulative assessment of dissolved metals is required.

Table 2.2: Drainage catchment and outfall information

Drainage catchment no.	Outfall no.	Area (ha)			Outfall location	
		Permeable	Impermeable	Total	Easting	Northing
1	1	1.2041	2.2730	3.4771	354977	125192
2 + 3	2	15.3160	9.0238	24.3399	355880	124904
4	3	2.7957	0.6628	3.4585	357291	125034
5 + 6	4	12.4767	8.5306	21.0073	359439	126090

2.3 Input data

2.3.1 The input data used for this assessment is contained within Tables 2.3, 2.4, 2.5 and 2.6.

Table 2.3: HAWRAT parameters

HAWRAT parameter	Chosen parameter	Source
Step 1 (runoff quality)		
AADT	AADT data was used for the Design Year 2038. The AADT flows for the scheme fall within the >10,000 - <50,000 category. (Average AADTs are approximately 16,000 in the year 2023, and approximately 22,000 for the year 2038).	Project Traffic Team
Climatic region	The A303 is located in the ‘warm wet’ climatic region of the UK.	HAWRAT Help Guide v1.0
Rainfall site	SAAR rainfall taken from the Southampton rainfall series. Although the Bristol rainfall series is geographically nearest to the A303, Southampton SAAR (820mm) was closer to the 720mm provided by the FEH catchment information obtained for the four catchments.	HAWRAT Help Guide v1.0
Step 2 (in river impacts)		
Impermeable drained road area (ha)	See Table 2.2	Project Drainage Design Team
Permeable drained road area (ha)	See Table 2.2	
Q95 (m^3/s)	Individually assessed - see Table 2.4	Calculated using Lowflows2™ in absence of flow gauge data
BFI	Individually assessed - see Table 2.4	
Proximity of designated sites	The nearest conservation sites to the scheme are located on the River Yeo, over 10km downstream of the confluence with the River Cam (none within 1km, therefore not considered)	MAGIC maps
Water hardness	Lowest water hardness value used a conservative estimate for all watercourses.	Default value within HAWRAT used, as no water quality data available.
Watercourse dimensions	A standard river width value of 1m was assumed for all watercourses Standard values of 0.5m bed width and 3.2m/m side slope were used for each watercourse.	No detailed topographic information on channel width/depth of receiving watercourses available. Desk-based research using

HAWRAT parameter	Chosen parameter	Source
	Estimates of long slope for each watercourse were made using GIS terrain tool on a 5m digital terrain model (DTM) for the study area. See Table 4 for a summary	site photographs, mapping and aerial photography used to estimate watercourse dimensions.
Manning's n Coefficient	Individually assessed - see Table 2.4	Manning's coefficient value for each watercourse estimated using Chow's lookup table in HAWRAT Help Guide v1.0.
Step 3 (post mitigation)		
Proposed mitigation	See Table 2.5	Project Drainage Design Team
Treatment of solubles (%)	See Table 2.6	DMRB HD 33/16 (see Figure 1)
Restricted discharge rate (l/s)	See Table 2.6	Project Drainage Design Team
Settlement of sediments (%)	See Table 2.6	DMRB HD 33/16 (see Figure 1)

Table 2.4: Watercourses

Watercourse	Outfall No.	Q95 (m/s^3)	Base Flow Index	Manning's n	Long slope (m/m)
Unnamed watercourse, draining into Park Brook	1	0.001	0.42	0.06	0.004
Unnamed watercourse, draining into Park Brook	2	0.001	0.44	0.06	0.0025
Unnamed watercourse, draining into River Cam	3	0.001	0.44	0.04	0.03
Unnamed watercourse, draining into Dyke Brook	4	0.001	0.51	0.04	0.01

Table 2.5: Drainage areas and proposed mitigation

Drainage area	Outfall no.	Receiving watercourse	Proposed mitigation		
			Stage 1	Stage 2	Stage 3
1	1	Unnamed watercourse, draining into Park Brook	Surface/ subsurface drains	Drainage ditches	Wet Retention Pond, with flow control device restricting discharge rate to 9.97l/s
2 + 3	2	Unnamed watercourse, draining into Park Brook	Surface/ subsurface drains	Drainage ditches	Wet Retention Pond with flow control device restricting discharge rate to 117.91l/s
4	3	Unnamed watercourse, draining into River Cam	Surface/ subsurface drains	Drainage ditches	Wet Retention Pond with flow control device restricting discharge rate to 16.81/s
5 + 6	4	Unnamed watercourse, draining into Dyke Brook	Surface/ subsurface drains	Drainage ditches	Wet Retention Pond with flow control device restricting discharge rate to 104.95/s

Table 2.6: Treatment options

Treatment option	Surface/ subsurface drains	Ditches	Wet retention pond	% Total
	Stage 1 Treatment %	Stage 2 Treatment %	Stage 3 Treatment %	
Sediment	60%	25%	60%	88
Cu	0%	15%	40%	49
Zn	45%	15%	30%	67

3 Method A Results

3.1 Introduction

3.1.1 This section summarises the results of the HAWRAT routine runoff Method A assessment. Sections 3.2 to 3.6 below summarise the relevant information for the outfalls and HAWRAT assessments carried out. HAWRAT output spreadsheets are provided in appendix B.

3.2 Outfall 1 (west of Podimore)

3.2.1 **Step 1:** The results of the Step 1 Assessment indicated that the outfall would fail the Toxicity Test for acute copper and zinc impacts, and for chronic sediment impacts.

3.2.2 **Step 2:** The results of the Step 2 -Tier 2 assessment (in-river impacts without consideration of mitigation measures) indicated that the impacts of the runoff from Outfall 1 would fail Environmental Quality Standards (EQS) for copper and zinc, with mitigation required. The sediment impact achieved a pass, with sediment deposition for the site judged as accumulating but not extensive due to low velocities in the receiving watercourse (0.09m/s velocity, Deposition Index 93) - failure occurs at the deposition index threshold of 100.

3.2.3 **Step 3:** For Step 3, the proposed drainage mitigation was added to the assessment. With the inclusion of surface / subsurface drains, drainage ditches and a wet retention pond (with flow control device restricting the discharge rate to 9.97l/s). The treatment efficiencies required to pass were at 15% and 29% respectively for copper and zinc. With proposed mitigation providing 49% and 67% treatment efficiencies respectively, the solubles passed the required EQS standards. The inclusion of 88% settlement for sediments also reduced the sediment Deposition Index to 11.

3.2.4 The HAWRAT assessment for Outfall 1 showed that, with drainage mitigation measures applied, routine runoff from the outfall was of an acceptable level. Assessment results for Outfall 1 are provided in Table 3.1.

Table 3.1: Assessment results for Outfall 1

Assessment Step	Copper (µg/l)	Zinc (µg/l)	Sediment deposition index	Overall - pass / fail
Step 1	Fail	Fail	Fail	Fail
Step 2	0.76	2.79	93	Fail
Step 3	0.25	0.92	11	Pass

3.3 Outfall 2 (east of Podimore):

3.3.1 **Step 1:** The results of the Step 1 Assessment indicated that the outfall would fail the Toxicity Test for acute copper and zinc impacts, and for chronic sediment impacts.

3.3.2 **Step 2:** The results of the Step 2 -Tier 2 assessment (in-river impacts without consideration of mitigation measures) indicated that the impacts of the runoff from Outfall 2 would fail EQS for copper, zinc, and sediments with 86% settlement for sediments required.

3.3.3 **Step 3:** For Step 3, the proposed drainage mitigation was added to the assessment. With the inclusion of surface/subsurface drains, drainage ditches and a wet retention pond (with flow control device restricting the discharge rate to 117.91/s). The settlement of sediments with the proposed mitigation was at 88%, so sediment impact achieved a pass with sediment deposition for the site judged as accumulating but not extensive due to low velocities in the receiving watercourse (0.08m/s velocity, Deposition Index: 86). The treatment efficiencies required to pass were at 42% and 58% respectively for copper and zinc. With proposed mitigation providing 49% and 67% treatment efficiencies respectively, the solubles passed the required EQS standards.

3.3.4 The HAWRAT assessment for Outfall 2 showed that, with drainage mitigation measures applied, routine runoff from the outfall was of an acceptable level. Assessment results for Outfall 2 are provided in Table 3.2.

Table 3.2: Assessment results for Outfall 2

Assessment Step	Copper (µg/l)	Zinc (µg/l)	Sediment deposition index	Overall - pass / fail
Step 1	Fail	Fail	Fail	Fail
Step 2	1.51	5.63	Fail	Fail
Step 3	0.50	1.86	86	Pass

3.4 Outfall 3 (northwest of Camel):

3.4.1 **Step 1:** The results of the Step 1 Assessment indicated that the outfall would fail the Toxicity Test for acute copper and zinc impacts, and for chronic sediment impacts.

3.4.2 **Step 2:** The results of the Step 2 -Tier 2 assessment (in-river impacts without consideration of mitigation measures) indicated that the impacts of the runoff from Outfall 1 would pass EQS for copper and zinc, without mitigation required. The sediment impact achieved a pass, with sediment deposition judged as non-accumulating (0.22l/s velocity).

3.4.3 The HAWRAT assessment for Outfall 3 showed that, without drainage mitigation measures applied routine runoff from the outfall was of an acceptable level. Assessment results for Outfall 3 are provided in Table 3.3.

Table 3.3: Assessment results for Outfall 3

Assessment Step	Copper (µg/l)	Zinc (µg/l)	Sediment deposition index	Overall - pass / fail
Step 1	Fail	Fail	Fail	Fail
Step 2	0.27	0.98	Pass	Pass
Step 3	-	-	-	Pass

3.5 Outfall 4 (west of Sparkford):

3.5.1 **Step 1:** The results of the Step 1 Assessment indicated that the outfall would fail the Toxicity Test for acute copper and zinc impacts, and for chronic sediment impacts.

3.5.2 **Step 2:** The results of the Step 2 -Tier 2 assessment (in-river impacts without consideration of mitigation measures) indicated that the impacts of the runoff from Outfall 1 would fail EQS for copper and zinc, with mitigation required. The sediment impact achieved a pass, with sediment deposition judged as non-accumulating (0.16l/s velocity).

3.5.3 **Step 3:** For Step 3, the proposed drainage mitigation was added to the assessment. With the inclusion of surface/subsurface drains, drainage ditches and a wet retention pond (with flow control device restricting the discharge rate to 104.95/s). The treatment efficiencies required to pass were at 43% and 58% respectively for copper and zinc. With proposed mitigation providing 49% and 67% treatment efficiencies respectively, the solubles passed the required EQS standards.

3.5.4 The HAWRAT assessment for Outfall 4 showed that, with drainage mitigation measures applied routine runoff from the outfall was of an acceptable level. Assessment results for Outfall 4 are provided in Table 3.4.

Table 3.4: Assessment results for Outfall 4

Assessment Step	Copper (µg/l)	Zinc (µg/l)	Sediment deposition index	Overall - pass / fail
Step 1	Fail	Fail	Fail	Fail
Step 2	1.57	5.84	Fail	Fail
Step 3	0.52	1.93	Pass	Pass

3.6 Comparison against WFD EQS

3.6.1 The HAWRAT assessment tool is designed to make an assessment of the short-term risks to ecology in receiving watercourses by comparing contaminant levels in runoff outputs to RSTs. The approach used to generate the RSTs is consistent with that adopted for the derivation of Environmental Quality Standards (EQSs) under the Water Framework Directive (WFD).

3.6.2 In addition to the HAWRAT assessment, an assessment of the long-term risks is also required to complete the risk assessment process. HAWRAT estimates in-river annual average concentrations for soluble pollutants (dissolved copper and zinc) which include the contribution from road runoff. These concentrations can be compared with published Environmental Quality Standards (EQSs) to assess whether there is likely to be a long-term impact on ecology.

3.6.3 The relevant EQSs are provided in Table 3.5 below. As water hardness values for receiving watercourses are unknown, the EQS value for the lowest water hardness will be used as a conservative estimate.

Table 3.5: Environmental Quality Standards for dissolved zinc and copper

Parameter	Hardness range (mg/l CaCO3)	Freshwater EQS (µg/l) (annual average)
Dissolved copper	0 – 50	1
Dissolved copper	>50 – 100	6
Dissolved copper	>100 - 250	10
Dissolved copper	>250	28
Dissolved zinc	0 – 50	8
Dissolved zinc	>50 – 100	50
Dissolved zinc	>100 – 250	75
Dissolved zinc	>250	125

Information on Environmental Quality Standards (EQS) obtained from Environment Agency Chemical Standards Database, available online at: http://evidence.environment-agency.gov.uk/ChemicalStandards/Home.aspx *(accessed April 2018, last updated April 2011)*

3.6.4 A summary of the HAWRAT assessment outputs compared with the WFD EQSs is provided in Table 3.6.

Table 3.6: HAWRAT assessment output summary, comparison with WFD EQSs

Outfall no.	Receiving watercourse	Annual average concentrations (Method A, Step 3)		Assessment against HAWRAT RSTs (soluble impact)	Assessment against HAWRAT RSTs (sediment impact)	Mitigation required?	Proposed mitigation	Assessment against WFD EQSs*
		Copper (µg/l)	Zinc (µg/l)					
1	Unnamed watercourse, draining into Park Brook	0.25	0.92	Pass	Pass**	Yes	Comprehensive drainage mitigation for the scheme includes surface/subsurface drains, drainage ditches and wet retention ponds with flow control structures installed.	Pass
2	Unnamed watercourse, draining into Park Brook	0.50	1.86	Pass	Pass	Yes		Pass
3	Unnamed watercourse, draining into River Cam	0.27	0.96	Pass	Pass	Yes		Pass
4	Unnamed watercourse, draining into Dyke Brook	0.52	1.93	Pass	Pass	Yes		Pass

* *WFD EQSs provided in Table 3.5, maximum copper value of 1*µg/l, and maximum zinc value of 8 µg/l to pass.
***alert for potential sediment deposition due to the natural low velocity of flows within the unnamed watercourse*

4 Method D

4.1 Introduction

4.1.1 This section summarises the results of the HAWRAT Method D accidental spillage risk assessment.

4.1.2 The Method D assessment is required for each receiving watercourse into which runoff is discharged. Given that each outfall for the scheme discharges into a different watercourse, 4 separate assessments are required.

4.1.3 Parameters considered in the Method D assessment include:

- The type, location and length of road draining to the watercourse
- 2-way Annual Average Daily Traffic (AADT) flow (projected for the design year 2023 / 2038 “do something” scenarios)
- % HGV using the road
- Emergency services response time (dependant on whether a site is in an urban, rural, or remote setting)
- Spillage factor

4.1.4 Values (and assumptions) used for each parameter are described in Table 4.1 below.

Table 4.1: Parameter assumptions

Parameters	Assumptions*
The type, location and length of road draining to the watercourse	• ***Type:*** main carriageway = ‘no junction’, roundabouts = ‘roundabouts’ and side roads / slipways = ‘side roads’ (conservative estimate) • ***Length:*** road lengths for each drainage catchment taken from drainage plans • ***Location:*** all roads considered to be ‘rural’ road types
Two-way annual average daily traffic (AADT) flow	• Maximum AADT value of 50,000 used for all roads as a conservative estimate
%HGV using the road	• %HGV in 2023 at 8%, and at 7% in 2038, 8% used for all roads a conservative estimate
Emergency services response time	• Due to semi-rural location of site <1hr emergency response time (>20mins) used as a conservative estimate
Spillage factor	• Values determined from Table D1.1, DMRB HD 45 09.

**Assumptions based on scheme information from project design, traffic and drainage teams.*

4.1.5 To calculate the annual probability of a spillage, the following formula (from DMRB HD 45 09) is used:

$$\mathbf{P_{SPL} = RL \times SS \times (AADT \times 365 \times 10^{-9}) \times (\%HGV/100)}$$

P_{SPL} = annual probability of a spillage with potential to cause pollution incident

RL = road length (km)

SS = spillage rates (from table D1.1, DMRB HD 45 09)

AADT = annual average daily traffic

%HGV = percentage of heavy goods vehicles

4.1.6 To calculate the predicted annual probability of a serious pollution incident on each section of road, the following formula is used:

$$\mathbf{P_{INC} = P_{SPL} \times P_{POL}}$$

P_{INC} = probability of a spillage with associated risk of a serious pollution event occurring

P_{POL} = the probability, given a spillage, that a serious pollution incident will result. Dependant on sensitivity of watercourse and response time of emergency services (it is assumed A303 has <1hr response time).

4.1.7 The Method D assessment will determine what the ‘risk of accidental spillage’ and a ‘risk of pollution incident’. If the accidental spillage is less than or equal to 1% AEP, the risk is considered acceptable. The assessment will also provide a ‘return period’, which calculates the risk of a pollution incident with and without pollution reduction measures.

4.1.8 It should be noted that mitigation measures which are to be implemented in the drainage design have not been applied to these calculations. Therefore, the assessment forms a worst case scenario, following the conservative approach.

4.2 Outfall 1 (west of Podimore)

4.2.1 The results of the Method D assessment for Outfall 1 are shown in Table 4.2. The results show that, without consideration of the drainage scheme, there would be no discharge with a serious spillage risk more frequent than the 1% threshold (1 in 100 year return period). The annual probability of a spillage with potential to cause pollution incident is 0.0003, and the probability of a spillage with associated risk of a serious pollution event occurring is 0.0002, both of which are below the risk factor of 0.01 (1%). The calculated return period for the risk of a pollution incident occurring without existing pollution reduction measures is 1 in 4,920 years.

4.2.2 The spillage risk for Outfall 1 (west of Podimore) is therefore considered to be acceptable.

Table 4.2: Method D assessment results for Outfall 1

Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT24- 2way	%HGV	Designated Area?	P_{SPL}	P_{INC}	Annual Probability 1 in x
1	0.8	Rural	No Junction	0.29	50,000	8	No	0.0003	0.0002	4920

4.3 Outfall 2 (east of Podimore)

4.3.1 The results of the Method D assessment for Outfall 2 are shown in Table 4.3. The results show that, without consideration of the drainage scheme, there would be no discharge with a serious spillage risk more frequent than the 1% threshold (1 in 100 year return period). The overall probability of a spillage with associated risk of a serious pollution event occurring is 0.0013, which is below the risk factor of 0.01 (1%). The calculated return period for the risk of a pollution incident occurring without existing pollution reduction measures is 1 in 742 years.

4.3.2 The spillage risk for Outfall 2 (east of Podimore) is therefore considered to be acceptable.

Table 4.3: Method D assessment results for Outfall 2

Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT 24- 2way	%HGV	Designated area?	P_{SPL}	P_{INC}	Annual Probability 1 in x	Overall probability	Overall return period (years)
2	2.1	Rural	No Junction	0.29	50,000	8	No	0.0009	0.0005	1874	0.0013	742
2	0.4	Rural	Side Road	0.93	50,000	8	No	0.0005	0.0003	3069		
2	0.6	Rural	Side Road	0.93	50,000	8	No	0.0008	0.0005	2046		

4.4 Outfall 3 (northwest of Camel)

4.4.1 The results of the Method D assessment for Outfall 3 are shown in Table 4.4. The results show that, without consideration of the drainage scheme, there would be no discharge with a serious spillage risk more frequent than the 1%

threshold (1 in 100 year return period). The overall probability of a spillage with associated risk of a serious pollution event occurring is 0.0023, which is below the risk factor of 0.01 (1%). The calculated return period for the risk of a pollution incident occurring without existing pollution reduction measures is 1 in 430 years.

4.4.2 The spillage risk for Outfall 3 (northwest of Camel) is therefore considered to be acceptable.

Table 4.4: Method D assessment results for Outfall 3

Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT 24- 2way	%HGV	Designated area?	P_{SPL}	P_{INC}	Annual Probability 1 in x	Overall probability	Overall return period (years)
3	1.1	Rural	No Junction	0.29	50,000	8	No	0.0005	0.0003	3579	0.0023	430
3	0.5	Rural	Round-about	3.09	50,000	8	No	0.0023	0.0014	739		
3	0.85	Rural	Side Road	0.93	50,000	8	No	0.0012	0.0007	1444		

4.5 Outfall 4 – (west of Sparkford)

4.5.1 The results of the Method D assessment for Outfall 4 are shown in Table 4.5. The results show that, without consideration of the drainage scheme, there would be no discharge with a serious spillage risk more frequent than the 1% threshold (1 in 100 year return period). The overall probability of a spillage with associated risk of a serious pollution event occurring is 0.0038, which is below the risk factor of 0.01 (1%). The calculated return period for the risk of a pollution incident occurring without existing pollution reduction measures is 1 in 263 years. The spillage risk for Outfall 4 (west of Sparkford) is therefore considered to be acceptable.

Table 4.5: Method D assessment results for Outfall 3

Outfall Network	Road Length (km)	Road Type	Junction Type	Spillage Accident Rates (SS)	AADT 24- 2way	%HGV	Designated area?	P_{SPL}	P_{INC}	Annual Probability 1 in x	Overall probability	Overall return period (years)
4	1.6	Rural	No Junction	0.29	50,000	8	No	0.0007	0.0004	2460	0.0038	263
4	0.65	Rural	Round-about	3.09	50,000	8	No	0.0029	0.0018	568		
4	2	Rural	Side Road	0.93	50,000	8	No	0.0027	0.0016	614		

5 Conclusions

5.1 Method A – Assessment of impacts from routine runoff

5.1.1 The HAWRAT Method A assessment tool was used to make an assessment of the short-term risk (acute and chronic pollutant impacts) on ecology in receiving watercourses by comparing soluble pollutants and sediment pollutants runoff outputs to turnoff specific thresholds (RSTs). The results from the assessment indicate that the RSTs would not be breached by routine runoff from the scheme for any outfalls, provided that the proposed pollution reduction measures are included.

5.1.2 An assessment of long term risks to ecology showed that the annual average concentrations of soluble pollutants (dissolved copper and zinc) do not exceed the water framework directive (WFD) environmental quality standards (EQSs), indicating that there will be no long term impacts to ecology as a result of the scheme.

5.2 Method D – Assessment of spillage risk

5.2.1 The results from the spillage risk assessment indicate for all outfalls, and without consideration of the drainage scheme, there would be no discharge with a serious spillage risk more frequent than the 1% (1 in 100 year return period). With inclusion of the drainage scheme, the risk would be even lower.

Appendix A: Proposed highway drainage plan layout

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KEY TO SYMBOLS ON ALL SHEETS:

GENERAL:

TERRAIN CONTOURS (1M)

EXISTING ASSETS:

EXISTING CULVERT

EXISTING HIGHWAY DRAINAGE

EXISTING DITCHES (INDICATIVE)

DEVELOPMENT CONSENT ORDER (DCO) BOUNDARY

ATTENUATION PONDS:

PERMANENT POND

ATTENUATION POND

HYDRAULIC CONTROL DEVICE

ASSET OWNERSHIP (COLOURED AS: **HIGHWAYS ENGLAND** OR **SOMERSET COUNTY COUNCIL**):

CULVERT (REF. CU/CHAINAGE)

EXTERIOR CATCHMENT DITCHES

KERB AND GULLY PIPED SYSTEM

SURFACE WATER CHANNEL

ANCILLARY PIPEWORK

HEADWALL

HIGHWAY DRAINAGE DITCHES

KERB AND GULLY DITCH SYSTEM

EXISTING HIGHWAY DRAINAGE FOR ADOPTION

CATCHMENT AREAS (IMPERMEABLE/PERMEABLE):

CATCHMENT 1

CATCHMENT 2

CATCHMENT 3

CATCHMENT 4

CATCHMENT 5

CATCHMENT 6

EXISTING CATCHMENT

NOTES:

1. DRAWING TO BE READ IN CONJUNCTION WITH DRAINAGE STRATEGY REPORT, INCLUDED WITH ENVIRONMENTAL STATEMENT (REF: HE551507-MMSJV-LSI-000-RP-UU-6100)
2. ALL DIMENSIONS ARE IN METRES UNLESS STATED OTHERWISE
3. THESE PLANS SHOULD BE READ IN CONJUNCTION WITH OTHER PLANS AND DOCUMENTS IN THE DEVELOPMENT CONSENT ORDER, IN PARTICULAR THE BOOK OF REFERENCE.

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	16/07/18	DCO SUBMISSION	BS	CS	ER

Scale 1:10000 — 0, 500m, 1000m

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: OUTLINE DRAINAGE WORKS PLANS
REGULATION 5(2)(p)
KEY PLAN

Drawing Status	Suitability
Published - DEFINITION	A3

Scale	Designed	Drawn	Checked	Approved
1:10000	SO	BS	CS	ER
Original Size: A1	Date: 04/05/20	Date: 16/07/18	Date: 16/07/18	Date: 16/07/18

Drawing Number (HE PIN | Originator | Volume | Location | Type | Role | Number): HE551507 - MMSJV - LSI - 000 - DR - UU - 2111

Project Ref. No.: 389107

Revision: C01

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Catchment Reference	Proposed Area (Ha)		Watercourse Destination	Pond Volume (m^3)		Qbar discharge rate (l/s)
	Permeable	Impermeable		Flood Storage	Permanent	
1	1.20	2.27	River Cary via Park Brook	1835	402	9.97
2	6.77	4.82	River Cary via Park Brook	3922	946	56.05

NOTES

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING HE5515-MMSJV-LSI-000-DR-UU-2111 TO IDENTIFY THE KEY FOR SYMBOLS.

Scale 1:2500 — 0, 125m, 250m

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	16/07/18	DCO SUBMISSION	AC	CS	ER

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: OUTLINE DRAINAGE WORKS PLANS REGULATION 5(2)(p) SHEET 1 OF 4

Drawing Status: Published - DEFINITION | Suitability: A3

Scale	Designed	Drawn	Checked	Approved
1:2500	AC	AC	CS	ER
Original Size: A1	Date: 04/05/18	Date: 16/07/18	Date: 16/07/18	Date: 16/07/18

Drawing Number: HE PIN HE551507 - Originator MMSJV - Volume LSI - Location 000 - Type DR - Role UU - Number 2112

Project Ref. No. 389107

Revision C01

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Catchment Reference	Proposed Area (Ha)		Watercourse Destination	Pond Volume (m³)		Qbar discharge rate (l/s)
	Permeable	Impermeable		Flood Storage	Permanent	
2	6.77	4.82	River Cary via Park Brook	3922	946	56.05
3	8.54	4.21	River Cary via Park Brook	3759	940	61.86
4	2.80	0.66	River Cam	715	224	16.81
3 (EXISTING)	0.33	0.30	ACCOUNTED FOR IN CATCHMENT 3			
4 (EXISTING)	1.33	0.31	ACCOUNTED FOR IN CATCHMENT 4			

NOTES

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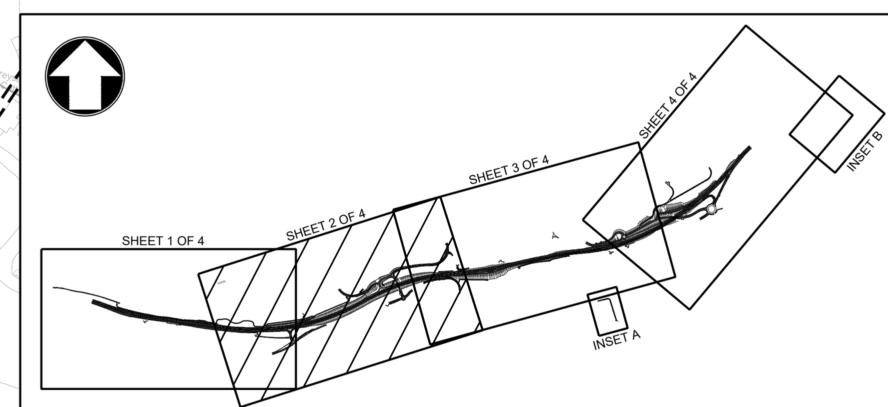
Scale 1:2500 — 0, 125m, 250m



REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	16/07/18	DCO SUBMISSION	AC	CS	ER

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: OUTLINE DRAINAGE WORKS PLANS
REGULATION 5(2)(p)
SHEET 2 OF 4

Drawing Status: Published - DEFINITION | Suitability: A3

Scale	Designed	Drawn	Checked	Approved
1:2500	AC	AC	CS	ER
Original Size	Date	Date	Date	Date
A1	04/05/18	16/07/18	16/07/18	16/07/18

Drawing Number (HE PIN | Originator | Volume | Location | Type | Role | Number): HE551507 - MMSJV - LSI - 000 - DR - UU - 2113

Project Ref. No.: 389107

Revision: C01

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Catchment Reference	Proposed Area (Ha)		Watercourse Destination	Pond Volume (m³)		Qbar discharge rate (l/s)
	Permeable	Impermeable		Flood Storage	Permanent	
2	6.77	4.82	River Cary via Park Brook	3922	946	56.05
3	8.54	4.21	River Cary via Park Brook	3759	940	61.86
4	2.80	0.66	River Cam	715	224	16.81
5	5.99	2.55	River Cary via Dyke Brook	8283	1706	104.95
6	6.49	5.98	River Cary via Dyke Brook	1195	0	
(6 EXISTING)	0.22	2.56	ACCOUNTED FOR IN CATCHMENT 6			

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NOTES

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Scale 1:2500 — 0, 125m, 250m

SHEET 1 OF 4 · SHEET 2 OF 4 · SHEET 3 OF 4 · SHEET 4 OF 4 · INSET A · INSET B

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	16/07/18	DCO SUBMISSION	AC	CS	ER

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: OUTLINE DRAINAGE WORKS PLANS
REGULATION 5(2)(p)
SHEET 3 OF 4

Drawing Status: Published - DEFINITION | Suitability: A3

Scale	Designed	Drawn	Checked	Approved
1:2500	AC	AC	CS	ER
Original Size: A1	Date: 04/05/18	Date: 16/07/18	Date: 16/07/18	Date: 16/07/18

Drawing Number: HE PIN | Originator | Volume — HE551507 - MMSJV - LSI - 000 - DR - UU - 2114 (Location | Type | Role | Number)

Project Ref. No. 389107

Revision C01

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Catchment Reference	Proposed Area (Ha)		Watercourse Destination	Pond Volume (m³)		Qbar discharge rate (l/s)
	Permeable	Impermeable		Flood Storage	Permanent	
5	5.99	2.55	River Cary via Dyke Brook	8283	1706	104.95
6	6.49	5.98	River Cary via Dyke Brook	1195	0	
6 (EXISTING)	0.22	2.56	ACCOUNTED FOR IN CATCHMENT 6			

NOTES

THIS DRAWING SHOULD BE READ IN CONJUNCTION WITH DRAWING HE5515-MMSJV-LSI-000-DR-UU-2111 TO IDENTIFY THE KEY FOR SYMBOLS.

Scale 1:2500 — 0, 125m, 250m

Project Title: A303 SPARKFORD TO ILCHESTER DUALLING

Drawing Title: OUTLINE DRAINAGE WORKS PLANS REGULATION 5(2)(p) SHEET 4 OF 4

Drawing Status: Published - DEFINITION

Suitability: A3

Scale	Designed	Drawn	Checked	Approved
1:2500	AC	AC	CS	ER
Original Size A1	Date 04/05/18	Date 16/07/18	Date 16/07/18	Date 16/07/18

Drawing Number: HE551507 - MMSJV - LSI - 000 - DR - UU - 2115 (HE PIN | Originator | Volume | Location | Type | Role | Number)

Project Ref. No. 389107

Revision C01

REV.	DATE	AMENDMENT DETAILS	ORIG	CHK'D	APP'D
C01	16/07/18	DCO SUBMISSION	AC	CS	ER

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Appendix B: Spreadsheet outputs

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool

version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.76	2.79	ug/l
Step 3	0.25	0.92	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.09	Low flow Vel m/s
Extensive?	No	11	Deposition Index

Location Details

Road number	A303	HA Area / DBFO number	2
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 354977	Northing	125192
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	1 - WEST OF PODIMORE	List of outfalls in cumulative assessment	
Receiving watercourse	Undefined		
EA receiving water Detailed River Network ID		Assessor and affiliation	Katie Bishop
Date of assessment	18/06/2018	Version of assessment	1.1
Notes	(Catchment reference: 1) Proposed mitigation: Stage 1 - combined surface/sub-surface drains, Stage 2 - ditches and Stage 3 - wet retention pond using flow control device.		

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Wet | Rainfall site: Southampton (SAAR 820mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.2730 Permeable area draining to outfall (ha): 1.2041

Base Flow Index (BFI): 0.42 Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only Water hardness: Low = <50mg CaCO3/l D

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 Estimated river width (m): 1

Tier 2 Bed width (m): .5 Manning's n: 0.06 Side slope (m/m): 3.2 Long slope (m/m): 0.004

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	D	Unlimited	D	0	D
Proposed measures	Combined surface/sun-surface drains, ditches and wet retention pond with FCD	67		9.97		88	

Predict Impact

Show Detailed Results

Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool

version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	1.51	5.63	ug/l
Step 3	0.50	1.86	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.08	Low flow Vel m/s
Extensive?	No	86	Deposition Index

Location Details

Road number	A303	HA Area / DBFO number	2
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 355880	Northing 124904	
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	2 - EAST OF PODIMORE	List of outfalls in cumulative assessment	
Receiving watercourse	Undefined		
EA receiving water Detailed River Network ID		Assessor and affiliation	Katie Bishhop
Date of assessment	18/06/2018	Version of assessment	1.1
Notes	(Catchment reference: 2&3) Proposed mitigation: Stage 1 - combined surface/sub-surface drains, Stage 2 - ditches and Stage 3 - wet retention pond using flow control device.		

Step 1 Runoff Quality

AADT: >10,000 and <50,000 — Climatic region: Warm Wet — Rainfall site: Southampton (SAAR 820mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.001 — (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 9.0238 — Permeable area draining to outfall (ha): 15.3160

Base Flow Index (BFI): 0.44 — Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only — Water hardness: Low = <50mg CaCO3/l D

For sediment impact only — Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 — Estimated river width (m): 1

Tier 2 — Bed width (m): .5 — Manning's n: 0.06 — Side slope (m/m): 3.2 — Long slope (m/m): 0.0025

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	Unlimited D	0 D
Proposed measures	Combined surface/sun-surface drains, ditches and wet retention pond with FCD	67	117.91	88

Predict Impact

Show Detailed Results

Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool

version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	1.57	5.84	ug/l
Step 3	0.52	1.93	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	No	0.16	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A303	HA Area / DBFO number	2
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 359439	Northing	126090
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	4 - WEST OF SPARKFORD	List of outfalls in cumulative assessment	
Receiving watercourse	Undefined		
EA receiving water Detailed River Network ID		Assessor and affiliation	Katie Bishhop
Date of assessment	18/06/2018	Version of assessment	1.1
Notes	(Catchment reference: 5&6) Proposed mitigation: Stage 1 - combined surface/sub-surface drains, Stage 2 - ditches and Stage 3 - wet retention pond using flow control device.		

Step 1 Runoff Quality

AADT: >10,000 and <50,000 Climatic region: Warm Wet Rainfall site: Southampton (SAAR 820mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 8.5306 Permeable area draining to outfall (ha): 12.4767

Base Flow Index (BFI): 0.51 Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only Water hardness: Low = <50mg CaCO3/l D

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 Estimated river width (m): 1

Tier 2 Bed width (m): .5 Manning's n: 0.04 Side slope (m/m): 3.2 Long slope (m/m): 0.01

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	Unlimited D	0 D
Proposed measures	Combined surface/sun-surface drains, ditches and wet retention pond with FCD	67	104.95	88

Predict Impact

Show Detailed Results

Exit Tool

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool

version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.27	0.98	ug/l
Step 3	-	-	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	No	0.22	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Location Details

Road number	A303	HA Area / DBFO number	2
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 357291	Northing 125034	
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	3 - NORTHWEST OF CAMEL	List of outfalls in cumulative assessment	
Receiving watercourse	Undefined		
EA receiving water Detailed River Network ID		Assessor and affiliation	Katie Bishop
Date of assessment	18/06/2018	Version of assessment	1.1
Notes	(Catchment reference: 4) Proposed mitigation: Stage 1 - combined surface/sub-surface drains, Stage 2 - ditches and Stage 3 - wet retention pond using flow control device.		

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Wet | Rainfall site: Southampton (SAAR 820mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.001 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.6628 | Permeable area draining to outfall (ha): 2.7957

Base Flow Index (BFI): 0.44 | Is the discharge in or within 1 km upstream of a protected site for conservation? No D

For dissolved zinc only Water hardness: Low = <50mg CaCO3/l D

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 Estimated river width (m): 1

Tier 2 Bed width (m): .5 | Manning's n: 0.04 | Side slope (m/m): 3.2 | Long slope (m/m): 0.03

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0 D	Unlimited D	0 D
Proposed measures		0 D	Unlimited D	0 D

Predict Impact

Show Detailed Results

Exit Tool