A47 North Tuddenham to Easton Dualling

Scheme Number: TR010038

Volume 6
6.3 Environmental Statement Appendices
Appendix 13.3 - Water Quality Assessment

APFP Regulation 5(2)(a)

Planning Act 2008

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

March 2021

Infrastructure Planning

Planning Act 2008

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

The A47 North Tuddenham to Easton Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES
Appendix 13.3 - Water Quality Assessment

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Captions

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1. Introduction

1.1.1. This appendix describes the approach and findings of the surface water quality impact assessment for the Proposed Scheme. This appendix should be read in conjunction with Chapter 13 (Road Drainage and Water Environment) of the Environmental Statement (ES) (**TR010038/APP/6.1**). The methodologies are presented in this appendix, whilst the assessment of the magnitude and significance of impacts and any subsequent requirements for mitigation are presented in ES Chapter 13 (Road Drainage and Water Environment) (**TR010038/APP/6.1**).

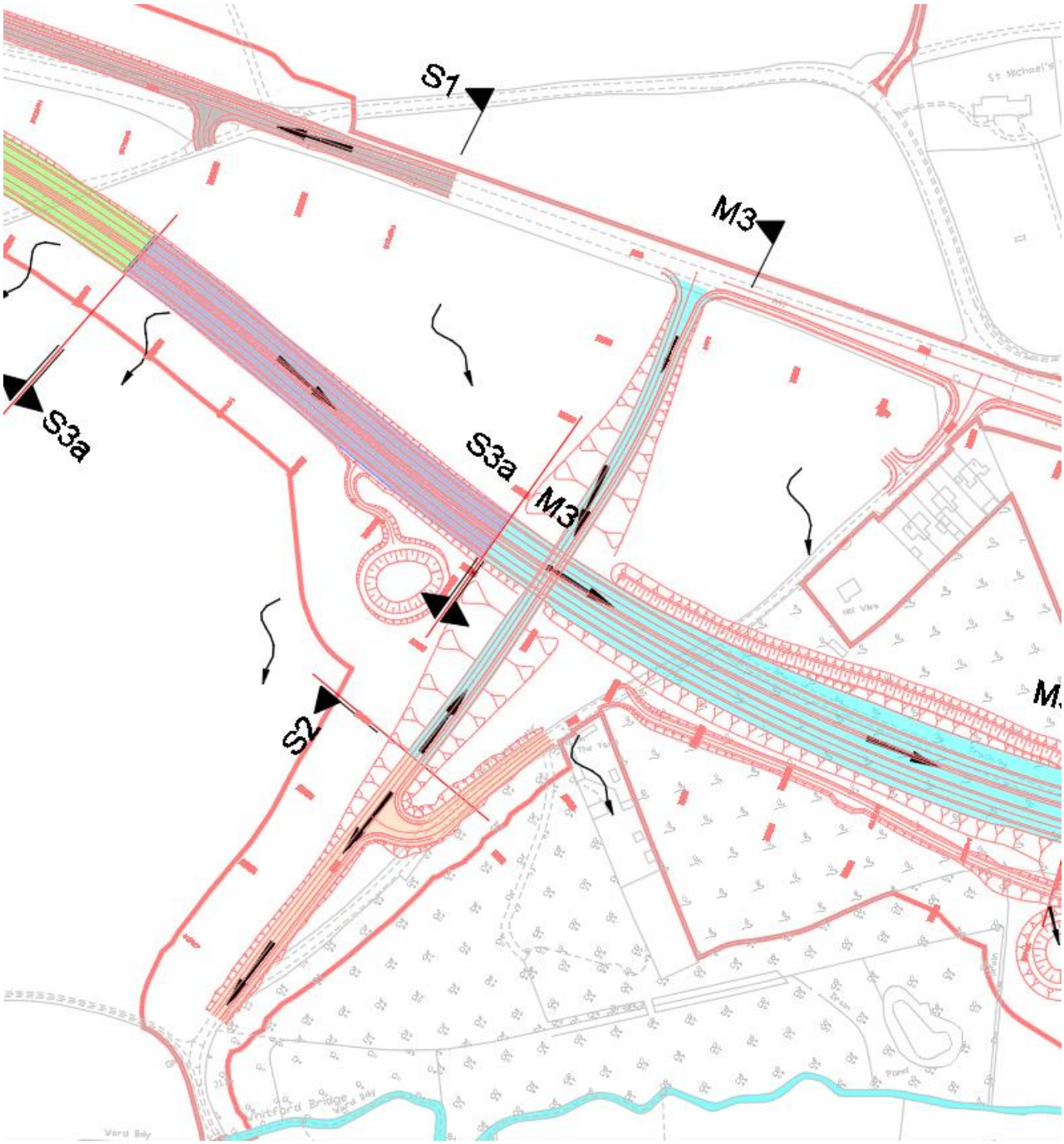
1.1.2. The Proposed Scheme will utilise three existing outfalls (subject to drainage survey) and nine new outfalls which discharge to the River Tud or its tributaries. The assessment methodology for estimating the routine runoff impacts and accidental spillage risk to the water features during the operational phase of the Scheme is described in Section 3 and 4, respectively. The approach follows the guidance within the Design Manual for Roads and Bridges (DMRB) LA 113 (Highways England, 2019). The purpose of the assessment is to determine whether mitigation measures in the form of pollution control or spillage containment are required during the operational phase. Surface water quality impacts during construction are considered in ES Chapter 13 (Road Drainage and Water Environment) (**TR010038/APP/6.1**).

1.1.3. The DMRB LA113 guidance proposes the use of the Highways England Water Risk Assessment Tool (HEWRAT), a pollution risk screening tool to determine the routine runoff impacts of surface water discharges.

2. Discharge locations

2.1.1. The Proposed Scheme comprises of 19 drainage catchment areas (see Annex A) discharging via 12 outfalls:

- drainage catchment M1
- drainage catchment M2 and S1
- drainage catchment S2 and S3a
- drainage catchment M3
- drainage catchment M4
- drainage catchment M5
- drainage catchment M6 and NW
- drainage catchment M7
- drainage catchment M8
- drainage catchment M9, M10, NE, S5 and W1
- drainage catchment S3
- drainage catchment S4



Caption 2.1 Location of drainage catchment S3a

2.1.2. Three existing Highways England outfalls, as identified on Highways Agency Drainage Data Management System (HA DDMS) (Highways England, 2020) will be utilised by the Proposed Scheme where it ties into the existing drainage:

- drainage catchment M1 - outfall reference TG0213_9151b
- drainage catchment S3 - outfall location and reference unknown.
- drainage catchment S4 – outfall reference TG1011_8756b

2.1.3. The proposed drainage area of M1 only makes a small contribution (estimated to be less than 10%) to the existing drainage catchment outfall which is located outside the DCO boundary. The outfall location for the existing drainage area to which M1 contributes is assumed to be to the west of the Proposed Scheme at location M1, again outside the DCO boundary.

2.1.4. A further six existing Highways England outfalls, as identified on HA DDMS (Highways England, 2020) will be utilised by the existing A47 where it is to be retained (de-trunked) as a local access road. No construction works are proposed in this area:

- TG0712_9092b (immediately east of Hockering)
- TG0712_8587d (immediately east of Hockering)
- TG1011_6183b (existing A47 River Tud crossing, east of Honingham)
- TG1011_5982b (existing A47 River Tud crossing, east of Honingham)
- TG1011_5981a (existing A47 River Tud crossing, east of Honingham)
- TG1011_8556b (east of existing A47 River Tud crossing)

2.1.5. The approximate location of the proposed outfalls and the existing outfalls to be utilised by the Proposed Scheme and the de-trunked section of the existing A47 can be seen in Annex B.

2.1.6. Where the existing drainage is to be utilised, the drainage areas have been estimated from the topography, measuring between the high points along the carriageway. The existing drainage catchment areas and unknown existing outfall locations within the DCO boundary are to be confirmed once the drainage survey has been completed at detailed design.

2.1.7. Prior to the runoff reaching the outfall, filter drains, swales, detention ponds and wetlands are proposed in the drainage design. However, the filter drains were omitted from the surface water HEWRAT assessment to represent a worst case scenario for surface water pollution risk. The inclusion of filter drains as part of the proposed drainage is to be reviewed at detailed design stage due to the potential for groundwater pollution risk. The drainage strategy for the Proposed Scheme is described in ES Appendix 13.2 (Drainage Strategy) (**TR010038/APP/6.3**).

3. Routine runoff quality

3.1. Overview

3.1.1. This section presents the results of HEWRAT assessment that considers the risk of routine runoff from the road drainage catchments that discharge to the River Tud and its tributaries.

3.1.2. Due to the outfalls discharging into, or near to, sensitive designated sites, HEWRAT was undertaken on all outfalls that receive drainage from the Proposed Scheme.

3.2. Method

3.2.1. The water quality impacts of routine road drainage on surface water bodies have been assessed using HEWRAT as described in DMRB LA113. The HEWRAT assessment adopts a tiered approach assessing the impacts of both soluble and sediment-bound pollutants and determines whether the drainage system would 'pass' or 'fail' (or prompt an 'alert') in terms of water quality in the receiving water features during operation. The three-step approach is as follows:

- Step 1 assesses the quality of direct highway runoff against toxicity thresholds, assuming no in-river dilution, treatment or attenuation.
- Step 2 assesses the diluting capacity of the watercourse for acute impacts of soluble pollutants, and the likelihood and extent of sediment deposition for chronic impacts of sediment-bound pollutants.
- Step 3 assesses the effectiveness of existing and proposed treatment systems for soluble pollutants and if the site is predicted to accumulate sediments, the percentage of settlement required to ensure that the extent of sediment coverage complies with the threshold deposition index value.

3.2.2. Step 2 and 3 also contain two tiers of assessment for sediment accumulation: Tier 1 is a simple assessment requiring only an estimate of the river width, while Tier 2 is a more detailed assessment which requires further watercourse parameters including Manning's roughness, bed gradient, side slopes and channel width. Tier 2 assessments are only undertaken where outfalls fail for sediment impacts under Tier 1.

3.2.3. For assessment of impacts associated with soluble pollutants, outfalls within 1km (measured along the watercourse) shall be aggregated for purposes of cumulative assessment. For assessment of impacts associated with sediment related pollutants, outfalls within 100m (measured along the watercourse) shall be aggregated for purposes of cumulative assessment.

3.2.4. The assessment considers the impact of dissolved copper and zinc on the water quality of the receiving waters. These metals are used as indicators of the level of impact as they are generally the main metallic pollutants associated with road drainage and can be toxic to aquatic life.

3.2.5. An alert is given for outfalls that would otherwise pass the assessment for sediment-bound pollutants, were it not for the following features being present downstream:

- a protected site within 1km of the point of discharge; and
- a structure, lake or pond within 100m of the point of discharge.

3.2.6. If any specific issues are raised then further measures should be agreed, otherwise the alert message can then be dismissed.

3.2.7. Where the discharge fails the HEWRAT assessment for annual average concentrations of soluble pollutants, and proportionate mitigation cannot be readily incorporated, a detailed assessment shall be carried out using the UKTAG Rivers and Lakes Metal Bioavailability Assessment Tool (M-BAT).

3.2.8. The annual average concentrations predicted by HEWRAT or M-BAT must be lower than the Environmental Quality Standards (EQS) to achieve compliance with the Water Environment (Water Framework Directive) (England and Wales) Regulations 2017. The ambient background copper concentrations can be manually input into HEWRAT, if known. There was no existing water quality data available for any of the water bodies or watercourses within the study area therefore water quality sampling has been undertaken. Six samples from the River Tud, upstream of the Proposed Scheme, and five samples from a tributary of the River Tud at Oak Farm (upstream of existing discharge) were taken as part of a 6-month sampling regime which started in September 2020. Only five samples were taken from the tributary of the River Tud due to low water levels in September. The results show that the average bioavailable copper concentrations for the River Tud and the tributary at Oak Farm across the sampling period are 0.07µg/l and 0.16µg/l respectively (see Annex B).

3.2.9. The EQS for dissolved copper in freshwaters is 1µg/l and 10.9µg/l for dissolved zinc (UKTAG, 2014).

3.2.10. The rainfall site selected for the HEWRAT assessment is Huntingdon, as it is the closest rainfall gauge geographically. The standard average annual rainfall (SAAR) for Huntingdon is identified in HEWRAT as 600mm. The site-specific SAAR at the downstream end of the Proposed Scheme is 649mm which is sufficiently similar the value at Huntingdon.

3.2.11. Annual average daily traffic (AADT) forecasts with and without the Norwich Western Link Road scheme were considered. The results considered in this assessment are based on those with the Norwich Western Link Road scheme in place, which represents the worst case scenario.

3.3. Assessment results

3.3.1. All but one of the outfalls passed the HEWRAT assessment with the inclusion of the required measures outlined in Table 3.1. The only catchment outfall to fail was M1. However, this assessment includes the existing A47 drainage catchment area outside of the proposed DCO boundary as well as proposed catchment M1. The drainage area of proposed catchment M1 only makes a small contribution to the existing drainage catchment and only the impermeable area was assessed as a worst case scenario. Outfall M1 is also located outside of the DCO boundary to the west of the Proposed Scheme (Annex B).

3.3.2. A summary of the parameters used in the HEWRAT assessment can be found in Table 3.1. The mitigation measures shown in Table 3.1 are split into two columns; the first shows mitigation required to pass the HEWRAT assessment; the last column shows the mitigation proposed in the drainage design.

Table 3.1 Parameters used in the HEWRAT assessment

Network	Discharge location	Proposed Scheme		Existing road area tie in (ha)	Total impermeable area (ha)	Required water quality mitigation	Mitigation proposed in drainage design
		Road Area (ha)	Green/verge Area (ha)				
M1 (including existing catchment)	River Tud tributary (unnamed outside of DCO boundary)	0.241	0.125	2.61	2.851	Filter drains	N/A
M2 & S1	River Tud tributary (Oak Farm)	3.529	0.902	N/A	3.529	Wetland (M2), swale (S1)	Filter drains, wetland (M2), swale (S1)
S2 and S3A	River Tud	0.678	0.608	N/A	0.678	Not required	Filter drains and vegetated detention basin
M3	River Tud	1.369	1.716	N/A	1.369	Not required	Filter drains and vegetated detention basin
M4	River Tud	3.461	2.151	N/A	3.461	Not required	Filter drains and vegetated detention basin
M5	River Tud	2.493	1.463	N/A	2.493	Not required	Filter drains and wetland
M6&NW	River Tud	4.665	5.475	N/A	4.665	Not required	Filter drains and vegetated detention basin
M7	River Tud	1.789	1.309	N/A	1.789	Not required	Filter drains and vegetated detention basin
M8	River Tud	0.832	0.691	N/A	0.832	Not required	Filter drains and wetland
M9, M10, NE, S5 & W1	River Tud	10.285	10.002	N/A	10.285	Not required	Filter drains and vegetated detention basin
S3	River Tud	0.123	0.175	0	0.123	Not required	Filter drains
S4	River Tud	0.107	0.028	0.485	0.592	Not required	N/A

3.3.3. The results from each HEWRAT assessment can be seen in Captions 3.1 to 3.15 with (where required) and without mitigation measures in place.

3.3.4. A summary of the HEWRAT assessment for each outfall is provided below:

- Outfall M1 (including M1 drainage catchment plus existing catchment area downstream) passed the HEWRAT assessment for soluble zinc (acute and annual average concentrations), soluble copper (annual average concentrations) and sediment bound pollutants. However, it failed for acute copper, with and without the inclusion of filter drains, which were included on the M1 catchment area only. HA DDMS (Highways England, 2020) indicates the existing outfall (TG0213_9151b) is currently classed as medium pollution risk and thus requires mitigation and the assessment presented here confirms this status remains. In addition, the existing outfall and the majority of the existing catchment area lie outside the DCO boundary. However, filter drains are incorporated into the drainage design for the M1 catchment. This results in a reduction in pollutant load from the proposed M1 catchment compared to the baseline scenario. Confirmation via survey is required to verify the river information used in Tier 2 of the assessment. Tier 2 information used for the purpose of this assessment was obtained from LiDAR data, a nearby watercourse (Oak Farm tributary) and OS maps.
- Outfall which drains catchments M2 and S1 and discharges to Oak Farm tributary initially failed step 2 (pre mitigation) due to acute and annual average copper concentrations and sediment, this would require treatment to mitigate this. However, with the inclusion of swales treating S1 catchment and a wetland treating M2 catchment as proposed measures in step 3, this outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchments S2 and S3a passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment M3 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment M4 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment M5 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchments M6 and NW passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment M7 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment M8 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchments M9, M10, NE, S5 and W1 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.

- Outfall which drains catchment S3 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
- Outfall which drains catchment S4 passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.

3.3.5. A cumulative assessment was undertaken for the three outfalls which discharge to the River Tud from catchment M7 and M8 as they are within 100m of each other. This cumulative area assessment passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants. The results from this can be seen in Caption 3.14.

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Soluble			Sediment - Chronic Impact
EQS – Annual Average Concentration		Acute Impact	Pass
	Copper / Zinc	Copper: River Fails Toxicity Test. Try mitigation	Sediment deposition for this site is judged as:
Step 2	0.96 / 2.26 ug/l	Zinc: Pass	Accumulating? No 0.16 Low flow Vel m/s
Step 3	- / - ug/l		Extensive? No - Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	604452	Northing	313618	
OS grid reference of outfall structure (m)	Easting	604452	Northing	313618	
Outfall number	Network M1		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud Tributary				
EA receiving water Detailed River Network ID	eaw1001000000574310		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 taken from Low Flow. Assessment point is assumed to be on a tributary of the River Tud. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 2 river information taken from OS mapping, lidar data and M2/S1 outfall as a surrogate. Unknow ambient copper concentrations. Outfall location/drainage catchment still TBC .				

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.00108
Impermeable road area drained (ha)	2.851
Permeable area draining to outfall (ha)	0
Base Flow Index (BFI)	0.49

Freshwater EQS limits:
Bioavailable dissolved copper (µg/l): 1
Bioavailable dissolved zinc (µg/l): 10.9

Is the discharge in or within 1 km upstream of a protected site for conservation? No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0

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

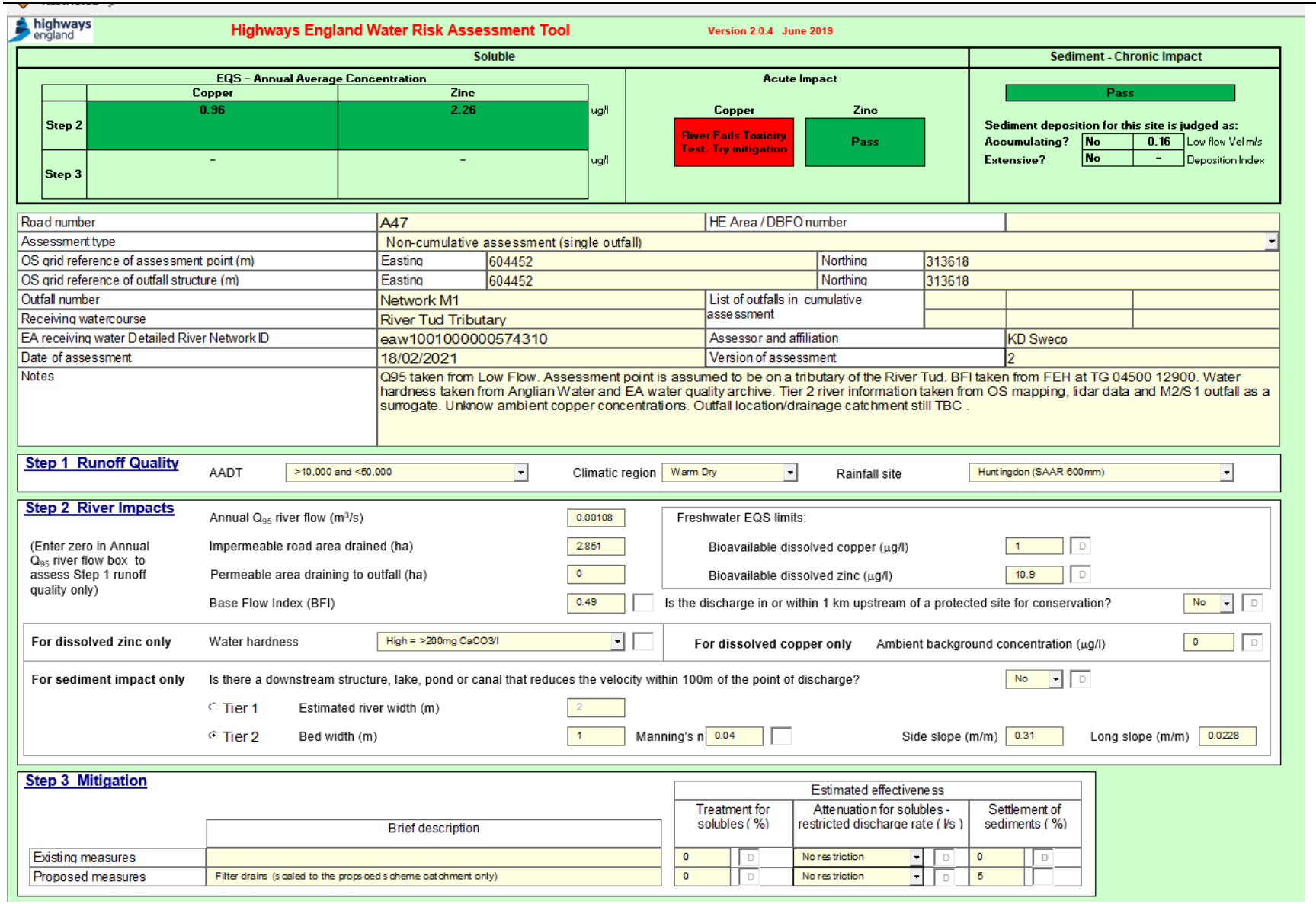
Tier 1 — Estimated river width (m): 2

Tier 2 — Bed width (m): 1 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0228

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.1 Routine runoff assessment results for the outfall from the existing drainage area and catchment M1 of the Proposed Scheme (prior to mitigation)



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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration				Pass
	Copper	Zinc		
Step 2	0.96	2.26	ug/l	
Step 3	–	–	ug/l	

Acute Impact

Copper	Zinc
River Fails Toxicity Test. Try mitigation	Pass

Sediment deposition for this site is judged as:

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

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	604452	Northing	313618	
OS grid reference of outfall structure (m)	Easting	604452	Northing	313618	
Outfall number	Network M1		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud Tributary				
EA receiving water Detailed River Network ID	eaw1001000000574310		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 taken from Low Flow. Assessment point is assumed to be on a tributary of the River Tud. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 2 river information taken from OS mapping, lidar data and M2/S1 outfall as a surrogate. Unknow ambient copper concentrations. Outfall location/drainage catchment still TBC .				

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.00108
Impermeable road area drained (ha)	2.851
Permeable area draining to outfall (ha)	0
Base Flow Index (BFI)	0.49

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1
Bioavailable dissolved zinc (µg/l)	10.9

Is the discharge in or within 1 km upstream of a protected site for conservation? No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0

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

Tier 1 — Estimated river width (m): 2

Tier 2 — Bed width (m): 1 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0228

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures	Filter drains (scaled to the proposed scheme catchment only)	0	No restriction	5

Caption 3.2 Routine runoff assessment results for the outfall from the existing drainage area and catchment M1 of the Proposed Scheme with mitigation included.

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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	Fail. 7 % settlement needed.
	Copper	Zinc	Copper / Zinc	Settlement needed = 7 %, proposed = 0 %
Step 2	2.41 Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.	8.07 ug/l	River Fails Toxicity Test. Try mitigation / Pass	Sediment deposition for this site is judged as:
Step 3	-	- ug/l		Accumulating? Yes 0.08 Low flow Vel m/s
				Extensive? Yes 107 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	606238	Northing	313483	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network S1 and M2		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud Tributary				
EA receiving water Detailed River Network ID	eaw1001000000554631		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on a tributary of the River Tud, taken at most downstream point. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 2 river information taken from cross section information collected for the A47 River Tud hydraulic model. Outfall locations still TBC.				

Step 1 Runoff Quality

AADT: >=100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.001	Freshwater EQS limits:	
Impermeable road area drained (ha)	3.529	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	0.902	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.49	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D
For dissolved zinc only Water hardness	High = >200mg CaCO3/l	**For dissolved copper only** Ambient background concentration (µg/l)	0.07
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)	5		
Tier 2 Bed width (m)	2.07	Manning's n 0.04	Side slope (m/m) 0.31 Long slope (m/m) 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.3 Routine runoff assessment results for the outfall from catchment M2 and S1 (prior to mitigation)

Highways England Water Risk Assessment Tool Version 2.0.4 June 2019

Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	Pass
	Copper	Zinc		
Step 2	2.41 Tier 1 fail. Go to Tier 2 (using UK TAG M-BAT tool), or Step 3 mitigation.	8.07 ug/l	Copper: Pass	Sediment deposition for this site is judged as:
Step 3	0.77	2.42 ug/l	Zinc: Pass	Accumulating? Yes 0.08 Low flow Vel m/s
				Extensive? No 11 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	606238	Northing	313483	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network S1 and M2		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud Tributary				
EA receiving water Detailed River Network ID	eaw1001000000554631		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on a tributary of the River Tud, taken at most downstream point. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 2 river information taken from cross section information collected for the A47 River Tud hydraulic model. Outfall locations still TBC.				

Step 1 Runoff Quality

AADT: >=100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

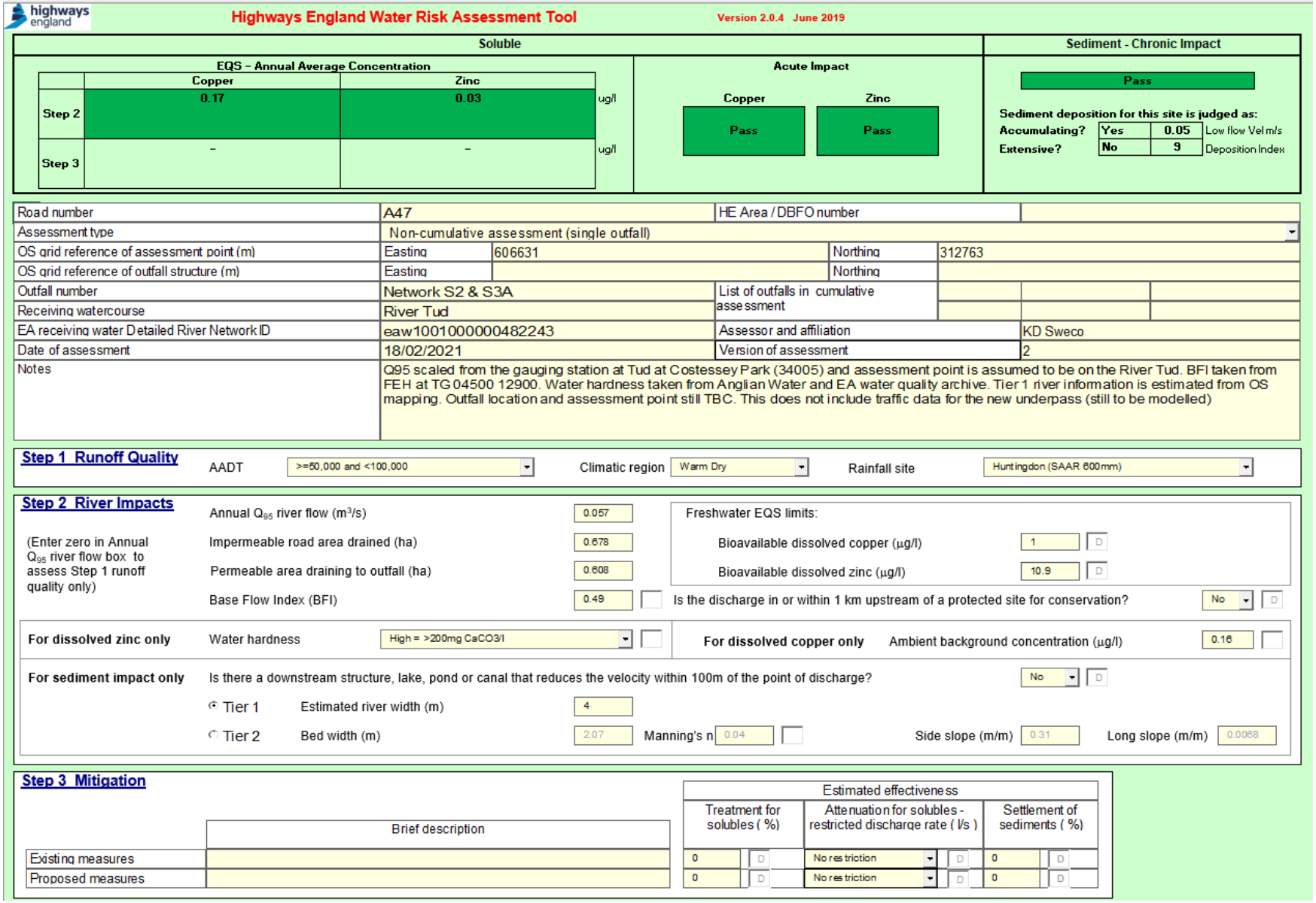
(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.001	Freshwater EQS limits:	
Impermeable road area drained (ha)	3.529	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	0.902	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.49	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D
For dissolved zinc only Water hardness	High = >200mg CaCO3/l	**For dissolved copper only** Ambient background concentration (µg/l)	0.07
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)	5		
Tier 2 Bed width (m)	2.07	Manning's n 0.04	Side slope (m/m) 0.31 Long slope (m/m) 0.0068

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	No restriction D	0 D
Proposed measures	Swale and wetland	80	No restriction D	90

Caption 3.4 Routine runoff assessment results for the outfall from catchment M2 and S1 with mitigation included



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Highways England Water Risk Assessment Tool Version 2.0.4 June 2019

Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.17 ug/l	0.03 ug/l	Copper: Pass	Sediment deposition for this site is judged as:
Step 3	- ug/l	- ug/l	Zinc: Pass	Accumulating? Yes 0.05 Low flow Vel m/s
				Extensive? No 9 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	606631	Northing	312763	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network S2 & S3A		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000482243		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location and assessment point still TBC. This does not include traffic data for the new underpass (still to be modelled)				

Step 1 Runoff Quality

AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.057	Freshwater EQS limits:	
Impermeable road area drained (ha)	0.678	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	0.608	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.49	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D

For dissolved zinc only Water hardness: High = >200mg CaCO3/l

For dissolved copper only Ambient background concentration (µg/l): 0.16

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): 4

Tier 2 Bed width (m): 2.07 Manning's n: 0.04 Side slope (m/m): 0.31 Long slope (m/m): 0.0088

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.5 Routine runoff assessment results for the outfall from catchment S2 and S3a (prior to mitigation)

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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.18 ug/l	0.07 ug/l	Copper: Pass; Zinc: Pass	Sediment deposition for this site is judged as: Accumulating? Yes 0.03 Low flow Vel m/s; Extensive? No 23 Deposition Index
Step 3	-	-		

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	607115	Northing	312703	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network M3		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000558222		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.				

Step 1 Runoff Quality

AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.057
Impermeable road area drained (ha)	1.369
Permeable area draining to outfall (ha)	1.716
Base Flow Index (BFI)	0.49

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1
Bioavailable dissolved zinc (µg/l)	10.9

Is the discharge in or within 1 km upstream of a protected site for conservation? No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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

Tier 1 — Estimated river width (m): 5

Tier 2 — Bed width (m): 2.07 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0068

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.6 Routine runoff assessment results for the outfall from catchment M3 (prior to mitigation)

Highways England Water Risk Assessment Tool Version 2.0.4 June 2019

Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.21	0.14 ug/l	Copper: Pass; Zinc: Pass	Sediment deposition for this site is judged as: Accumulating? Yes 0.06 Low flow Vel m/s; Extensive? No 34 Deposition Index
Step 3	-	- ug/l		

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	608024	Northing	312462	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network M4		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000557488		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 04500 12900. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.				

Step 1 Runoff Quality AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.066	Freshwater EQS limits:	
Impermeable road area drained (ha)	3.461	Bioavailable dissolved copper (µg/l)	1
Permeable area draining to outfall (ha)	2.151	Bioavailable dissolved zinc (µg/l)	10.9
Base Flow Index (BFI)	0.49	Is the discharge in or within 1 km upstream of a protected site for conservation?	No

For dissolved zinc only Water hardness: High = >200mg CaCO3/l

For dissolved copper only Ambient background concentration (µg/l): 0.16

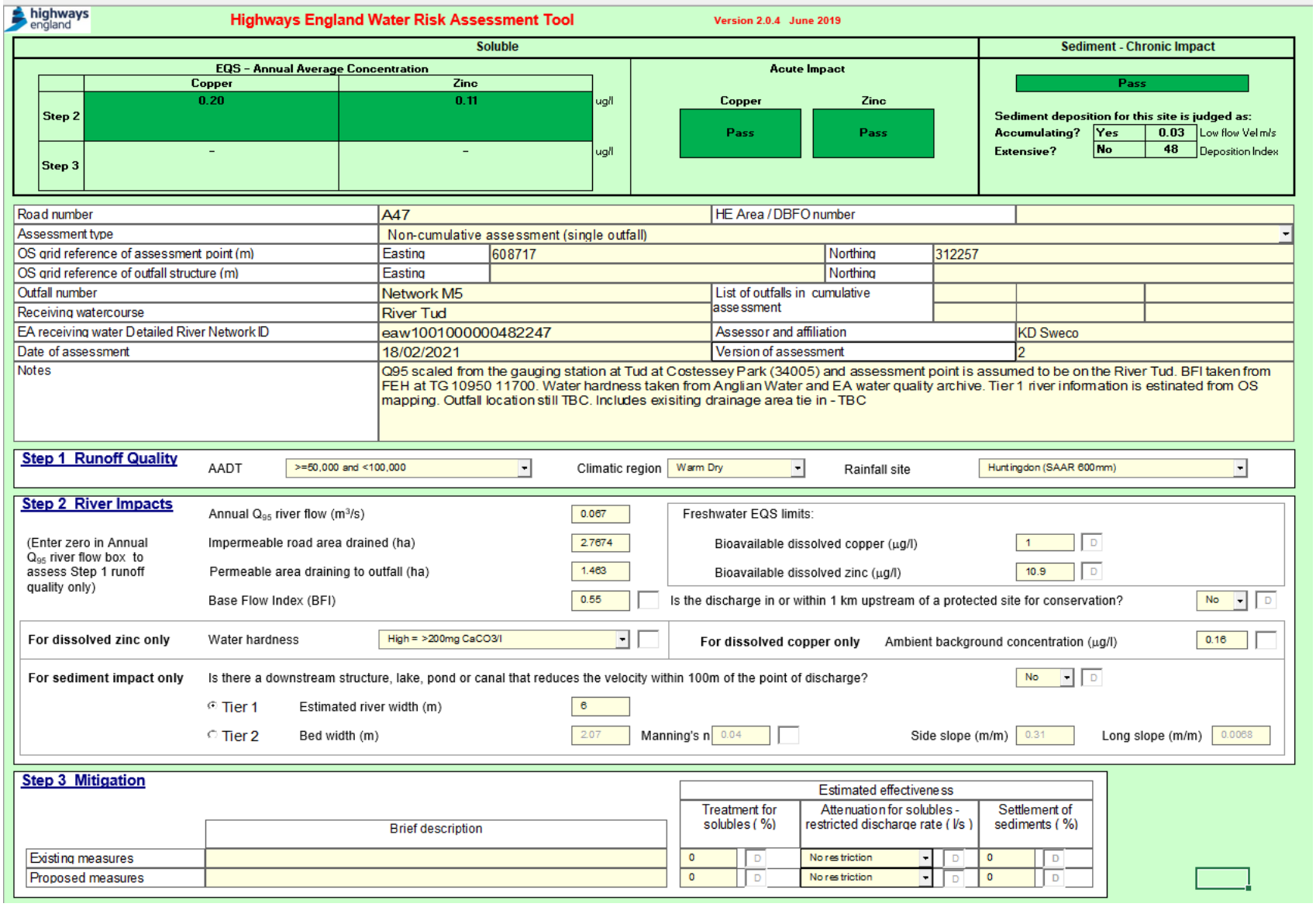
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No

- Tier 1: Estimated river width (m): 4
- Tier 2: Bed width (m): 2.07; Manning's n: 0.04; Side slope (m/m): 0.31; Long slope (m/m): 0.0068

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.7 Routine runoff assessment results for the outfall from catchment M4 (prior to mitigation)



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Soluble			Sediment - Chronic Impact
EQS – Annual Average Concentration		Acute Impact	Pass
	Copper / Zinc	Copper: Pass; Zinc: Pass	Sediment deposition for this site is judged as:
Step 2	0.20 / 0.11 ug/l		Accumulating? Yes 0.03 Low flow Vel m/s
Step 3	- / - ug/l		Extensive? No 48 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	608717	Northing	312257	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network M5		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000482247		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC. Includes exisiting drainage area tie in - TBC				

Step 1 Runoff Quality

AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

		Freshwater EQS limits:	
Annual Q_{95} river flow (m^3/s)	0.067		
Impermeable road area drained (ha)	2.7674	Bioavailable dissolved copper (µg/l)	1
Permeable area draining to outfall (ha)	1.463	Bioavailable dissolved zinc (µg/l)	10.9
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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

- Tier 1 — Estimated river width (m): 6
- Tier 2 — Bed width (m): 2.07; Manning's n: 0.04; Side slope (m/m): 0.31; Long slope (m/m): 0.0068

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.8 Routine runoff assessment results for the outfall from catchment M5 (prior to mitigation)

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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.22 ug/l	0.17 ug/l	Copper: Pass	Sediment deposition for this site is judged as:
Step 3	- ug/l	- ug/l	Zinc: Pass	Accumulating? Yes 0.04 Low flow Vel m/s
				Extensive? No 63 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	610615	Northing	311834	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Networks M6 and NW		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000549161		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.				

Step 1 Runoff Quality

AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.073
Impermeable road area drained (ha)	4.666
Permeable area draining to outfall (ha)	5.475
Base Flow Index (BFI)	0.55

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1
Bioavailable dissolved zinc (µg/l)	10.9

Is the discharge in or within 1 km upstream of a protected site for conservation? No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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

Tier 1: Estimated river width (m): 5

Tier 2: Bed width (m): 2.07 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0068

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.9 Routine runoff assessment results for the outfall from catchment M6 and NW (prior to mitigation)

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Soluble				Acute Impact		Sediment - Chronic Impact
EQS – Annual Average Concentration				Copper	Zinc	Pass
	Copper	Zinc				Sediment deposition for this site is judged as:
Step 2	0.18	0.05	ug/l	Pass	Pass	Accumulating? Yes 0.07 Low flow Vel m/s
Step 3	-	-	ug/l			Extensive? No 12 Deposition Index

Road number	A47	HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)			
OS grid reference of assessment point (m)	Easting 611002	Northing 311750		
OS grid reference of outfall structure (m)	Easting	Northing		
Outfall number	Network M7	List of outfalls in cumulative assessment		
Receiving watercourse	River Tud			
EA receiving water Detailed River Network ID	eaw1001000000483725	Assessor and affiliation	KD Sweco	
Date of assessment	19/11/2020	Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.			

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.078	Freshwater EQS limits:	
Impermeable road area drained (ha)	1.789	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	1.309	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D
For dissolved zinc only Water hardness	High = >200mg CaCO3/l	**For dissolved copper only** Ambient background concentration (µg/l)	0.16

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): 4

Tier 2 Bed width (m): 2.07 Manning's n: 0.04 Side slope (m/m): 0.31 Long slope (m/m): 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.10 Routine runoff assessment results for the outfall from catchment M7 (prior to mitigation)

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Soluble			Sediment - Chronic Impact
EQS – Annual Average Concentration	Acute Impact		Pass
Copper / Zinc	Copper	Zinc	Sediment deposition for this site is judged as:
Step 2: 0.17 ug/l / 0.02 ug/l	Pass	Pass	Accumulating? Yes 0.07 Low flow Vel m/s
Step 3: - ug/l / - ug/l			Extensive? No 5 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	610923	Northing	311682	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network M8		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000483725		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.				

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.078
Impermeable road area drained (ha)	0.832
Permeable area draining to outfall (ha)	0.691
Base Flow Index (BFI)	0.55

Freshwater EQS limits:

Bioavailable dissolved copper (µg/l)	1
Bioavailable dissolved zinc (µg/l)	10.9

Is the discharge in or within 1 km upstream of a protected site for conservation? No

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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

Tier 1 — Estimated river width (m): 4

Tier 2 — Bed width (m): 2.07 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0068

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	No restriction	0
Proposed measures		0	No restriction	0

Caption 3.11 Routine runoff assessment results for the outfall from catchment M8 (prior to mitigation)

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Soluble				Acute Impact		Sediment - Chronic Impact
EQS – Annual Average Concentration				Copper	Zinc	Pass
	Copper	Zinc				Sediment deposition for this site is judged as:
Step 2	0.33	0.71	ug/l	Pass	Pass	Accumulating? Yes 0.05 Low flow Vel m/s
Step 3	-	-	ug/l			Extensive? No 97 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	611822	Northing	311263	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Networks M9, M10, NE, S5 and W1		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000549161		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estinated from OS mapping. Outfall location still TBC.				

Step 1 Runoff Quality

AADT: >=100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

		Freshwater EQS limits:		
Annual Q_{95} river flow (m^3/s)	0.087	Bioavailable dissolved copper (µg/l)	1	D
Impermeable road area drained (ha)	10.285	Bioavailable dissolved zinc (µg/l)	10.9	D
Permeable area draining to outfall (ha)	10.002			
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No	D

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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): 5

Tier 2 — Bed width (m): 2.07 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.12 Routine runoff assessment results for the outfall from catchment M9, M10, NE, S5 & W1 (prior to mitigation)

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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.16 ug/l	0.00 ug/l	Copper: Pass	Sediment deposition for this site is judged as:
Step 3	- ug/l	- ug/l	Zinc: Pass	Accumulating? Yes 0.06 Low flow Vel m/s
				Extensive? No 1 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	609958	Northing	311974	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network S3		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000548402		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location and assessment point still TBC. This does not include exisiting drainage catchemnt area as awaiting drainage survey results.				

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.07	Freshwater EQS limits:	
Impermeable road area drained (ha)	0.123	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	0.175	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D

For dissolved zinc only — Water hardness: High = >200mg CaCO3/l

For dissolved copper only — Ambient background concentration (µg/l): 0.16

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

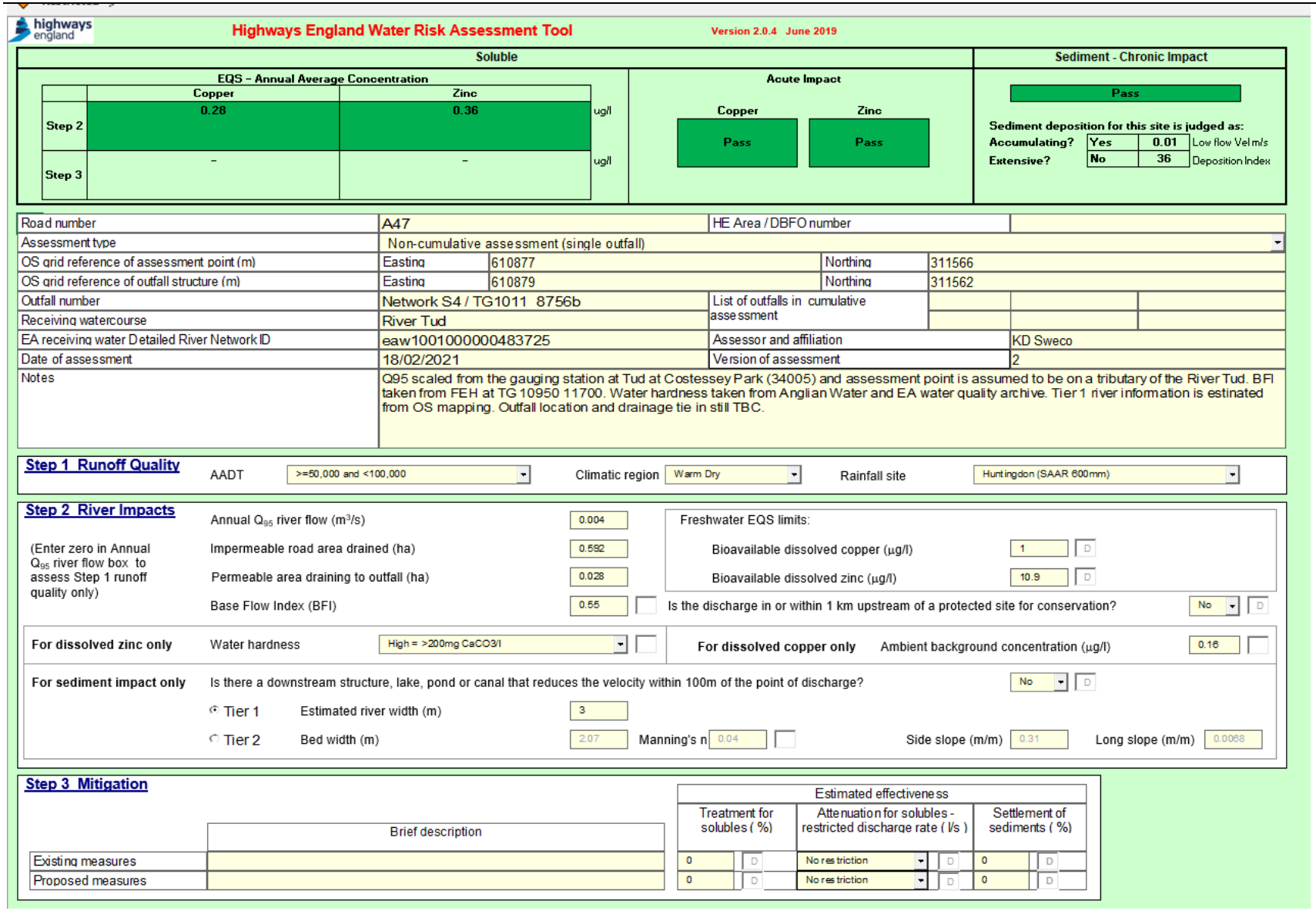
Tier 1 — Estimated river width (m): 4

Tier 2 — Bed width (m): 2.07 | Manning's n: 0.04 | Side slope (m/m): 0.31 | Long slope (m/m): 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.13 Routine runoff assessment results for the outfall from catchment S3 (prior to mitigation)



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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	Pass
	Copper	Zinc	Copper / Zinc	Sediment deposition for this site is judged as:
Step 2	0.28	0.36 ug/l	Pass / Pass	Accumulating? Yes 0.01 Low flow Vel m/s
Step 3	-	- ug/l		Extensive? No 36 Deposition Index

Road number	A47		HE Area / DBFO number		
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	610877	Northing	311566	
OS grid reference of outfall structure (m)	Easting	610879	Northing	311562	
Outfall number	Network S4 / TG1011 8756b		List of outfalls in cumulative assessment		
Receiving watercourse	River Tud				
EA receiving water Detailed River Network ID	eaw1001000000483725		Assessor and affiliation	KD Sweco	
Date of assessment	18/02/2021		Version of assessment	2	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on a tributary of the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estinated from OS mapping. Outfall location and drainage tie in still TBC.				

Step 1 Runoff Quality AADT: >=50,000 and <100,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.004	Freshwater EQS limits:	
Impermeable road area drained (ha)	0.592	Bioavailable dissolved copper (µg/l)	1 D
Permeable area draining to outfall (ha)	0.028	Bioavailable dissolved zinc (µg/l)	10.9 D
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No D
For dissolved zinc only Water hardness	High = >200mg CaCO3/l	**For dissolved copper only** Ambient background concentration (µg/l)	0.16
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)	3		
Tier 2 Bed width (m)	2.07	Manning's n 0.04	Side slope (m/m) 0.31 Long slope (m/m) 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.14 Routine runoff assessment results for the outfall from catchment S4 (prior to mitigation)

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Soluble				Sediment - Chronic Impact
EQS – Annual Average Concentration			Acute Impact	
	Copper	Zinc		Pass
Step 2	0.19	0.07 ug/l	Copper: Pass	Sediment deposition for this site is judged as:
Step 3	-	- ug/l	Zinc: Pass	Accumulating? Yes 0.07 Low flow Vel m/s
				Extensive? No 17 Deposition Index

Road number	A47		HE Area / DBFO number			
Assessment type	Cumulative assessment including sediments (outfalls within 100m)					
OS grid reference of assessment point (m)	Easting	610923	Northing	311682		
OS grid reference of outfall structure (m)	Easting		Northing			
Outfall number	Network M7 and M8		List of outfalls in cumulative assessment		611002	311750
Receiving watercourse	River Tud					
EA receiving water Detailed River Network ID	eaw1001000000483725		Assessor and affiliation		KD Sweco	
Date of assessment	18/02/2021		Version of assessment		1	
Notes	Q95 scaled from the gauging station at Tud at Costessey Park (34005) and assessment point is assumed to be on the River Tud. BFI taken from FEH at TG 10950 11700. Water hardness taken from Anglian Water and EA water quality archive. Tier 1 river information is estimated from OS mapping. Outfall location still TBC.					

Step 1 Runoff Quality

AADT: >10,000 and <50,000 | Climatic region: Warm Dry | Rainfall site: Huntingdon (SAAR 600mm)

Step 2 River Impacts

(Enter zero in Annual Q_{95} river flow box to assess Step 1 runoff quality only)

Annual Q_{95} river flow (m^3/s)	0.078	Freshwater EQS limits:		
Impermeable road area drained (ha)	2.621	Bioavailable dissolved copper (µg/l)	1	D
Permeable area draining to outfall (ha)	2	Bioavailable dissolved zinc (µg/l)	10.9	D
Base Flow Index (BFI)	0.55	Is the discharge in or within 1 km upstream of a protected site for conservation?	No	D
For dissolved zinc only Water hardness	High = >200mg CaCO3/l	**For dissolved copper only** Ambient background concentration (µg/l)	0.16	
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)	4			
Tier 2 Bed width (m)	2.07	Manning's n 0.04	Side slope (m/m) 0.31	Long slope (m/m) 0.0068

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	No restriction D	0 D
Proposed measures		0 D	No restriction D	0 D

Caption 3.15 Cumulative routine runoff assessment results for the outfall at catchments M7 and M8 (prior to mitigation)

3.4. Retained outfalls unaffected by proposed drainage design

3.4.1. The existing A47 is to be retained (de-trunked) as a local access road and there are six existing outfalls which will be retained as part of the existing drainage. These outfalls are located immediately east of Hockering (TG0712_9092b and TG0712_8587d), at the existing River Tud crossing (TG1011_6183b, TG1011_5982b and TG1011_5981a) and east of this crossing (TG1011_8556b). The existing outfalls are currently classed as low pollution risk on HA DDMS (Highways England, 2020) which means they do not require mitigation; this assumes an AADT of between approximately 23,000 ('Do minimum' – 2040 forecast). Once the existing A47 is changed to a local access road the AADT traffic forecast will significantly reduce to less than 5,000 AADT ('Do something' - 2040 forecast). This would result in a reduction in road runoff pollutant concentrations from these outfalls when compared to the baseline scenario.

4. Accidental spillage assessment

4.1. Overview

4.1.1. This section presents the results of the accidental spillage assessment. This considers the risk of pollution impacts from accidental spillages onto the drainage catchments which discharge to the River Tud water body and its tributaries.

4.2. Method

4.2.1. Spillage assessments were completed for all outfalls, using the approach as detailed within the DMRB LA 113. The methodology uses a prepared spreadsheet to input parameters relating to waterbody type, road type, AADT and location. This determines an overall risk expressed as probability. For this methodology, the probability is defined in two ways:

- The probability that there will be a spillage with the potential to cause a serious pollution incident
- The probability, assuming such a spillage has occurred, that the pollutant will cause a serious pollution incident

4.2.2. The following formula is used to calculate the annual probability of a spillage for each section of road:

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

4.2.3. Where:

- P_{SPL} = annual probability of a spillage with the potential to cause a serious pollution incident
- RL = Road Length (in km)
- SS = Spillage rates from Table D1 (which is included with the results below)
- AADT = annual average daily traffic (design year for new road used)
- %HGV = Percentage of heavy goods vehicles

4.2.4. The predicted annual probability of a serious pollution incident for each section of road, using this formula:

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

4.2.5. Where:

- P_{INC} = the probability of a spillage with an associated risk of a serious pollution incident occurring

- P_{POL} = the probability, given a spillage, that a serious pollution incident will result. An appropriate value for this is selected from Table D2 in LA113 for outfalls. This will depend on the sensitivity of the water course and how soon it can be reached by the emergency services.

4.2.6. The AADT and HGV % forecasts with and without the Norwich Western Link Road scheme were considered. The results considered in this assessment are based on those with the Norwich Western Link Road scheme in place, which represents the worst case scenario.

4.3. Assessment results

4.3.1. All of the outfalls passed the accidental spillage assessment with the results indicating all drainage areas would have <0.5% annual risk of pollution, which is the annual acceptable threshold for discharge to a sensitive designated site. The annual acceptable pollution risk threshold is set at 0.5% due to the presence of coastal and floodplain grazing and lowland fen Priority Habitats located within the vicinity of, and downstream of, the outfalls.. This assessment included the additional measures noted in section 3.3.

4.3.2. The results from each accidental spillage assessment can be seen in Captions 4.1 to 4.12.

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	1,361.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	No junction							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	49,284							
D8	% HGV	4.1							
D8	Spillage factor *(no/10^8 HGVkm/year)*	0.29							
D9	Risk of accidental spillage	0.00029	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60							
D11	Risk of pollution incident	0.00017	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**						**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00017	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5725
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction	0.00017	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5725
D16	Proposed measures factor	1							
D17	Residual with proposed Pollution reduction measures	0.00017	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5725

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.1 Accidental spillage assessment results for the outfall draining the existing highway outside the DCO boundary and catchment M1

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse						
D2	Length of road draining to outfall *(m)*	87.00	120.00						
D3	Road Type *(A-road or Motorway)*	A	A						
D4	If A road, is site urban or rural?	Rural	Rural						
D5	Junction type	No junction	Side road						
D6	Location (response time for emergency services)	< 1 hour	< 1 hour						
D7	Traffic flow (AADT two way)	51,807	51,807						
D8	% HGV	4	8						
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.29	0.93						
D9	Risk of accidental spillage	0.00002	0.00017	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60						
D11	Risk of pollution incident	0.00001	0.00010	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**					**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00001	0.00010	0.00000	0.00000	0.00000	0.00000	0.0001	8870
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction	0.00001	0.00010	0.00000	0.00000	0.00000	0.00000	0.0001	8870
D16	Proposed measures factor	0.4	0.6						
D17	Residual with proposed Pollution reduction measures	0.00000	0.00006	0.00000	0.00000	0.00000	0.00000	0.0001	15301

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

wetland and swale

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.2 Accidental spillage assessment results for the outfall from catchments M2 and S1

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse						
D2	Length of road draining to outfall *(m)*	343.00	426.00						
D3	Road Type *(A-road or Motorway)*	A	A						
D4	If A road, is site urban or rural?	Rural	Rural						
D5	Junction type	No junction	Side road						
D6	Location (response time for emergency services)	< 1 hour	< 1 hour						
D7	Traffic flow (AADT two way)	51,807	2,330						
D8	% HGV	4	0						
D8	Spillage factor *(no/10^8 HGVkm/year)*	0.29	0.93		0.6				
D9	Risk of accidental spillage	0.00008	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60						
D11	Risk of pollution incident	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**					**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	22152
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	22152
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	22152

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.3 Accidental spillage assessment results for the outfall from catchments S2 and S3a

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	150.00							
D3	Road Type *(A-road or Motorway)*	M							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	No junction							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	51,807							
D8	% HGV	4							
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.29							
D9	Risk of accidental spillage	0.00003	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60						
D11	Risk of pollution incident	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	Totals	Return Period (years)
D12	Is risk greater than 0.01?	No	No						
D13	Return period without pollution reduction measures	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	50655
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	50655
D16	Proposed measures factor	1							
D17	Residual with proposed Pollution reduction measures	0.00002	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	50655

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.4 Accidental spillage assessment results for the outfall from catchment M3

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	1,707.00							
D3	Road Type *(A-road or Motorway)*	M							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	No junction							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	51,807							
D8	% HGV	4							
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.29							
D9	Risk of accidental spillage	0.00037	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60						
D11	Risk of pollution incident	0.00022	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**					**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00022	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	4451
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction	0.00022	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	4451
D16	Proposed measures factor	1							
D17	Residual with proposed Pollution reduction measures	0.00022	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	4451

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.5 Accidental spillage assessment results for the outfall from catchment M4

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

		A (main road)	Additional columns for use if other roads drain to the same outfall: B	C	D	E	F	Totals	Return Period (years)
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse				
D2	Length of road draining to outfall *(m)*	736.00	375.00	260.00	160.00				
D3	Road Type *(A-road or Motorway)*	A	A	A	A				
D4	If A road, is site urban or rural?	Rural	Rural	Rural	Rural				
D5	Junction type	No junction	Slip road	Slip road	Side road				
D6	Location (response time for emergency services)	< 1 hour	< 1 hour	< 1 hour	< 1 hour				
D7	Traffic flow (AADT two way)	51,807	9,706	8,326	2,330				
D8	% HGV	4	3.3	1.8	0				
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.29	0.83	0.83	0.6				
D9	Risk of accidental spillage	0.00016	0.00004	0.00001	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60				
D11	Risk of pollution incident	0.00010	0.00002	0.00001	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**				
D13	Return period without pollution reduction measures	0.00010	0.00002	0.00001	0.00000	0.00000	0.00000	0.0001	7950
D14	Existing measures factor	1	1	1	0.6				
D15	Return period with existing pollution reduction	0.00010	0.00002	0.00001	0.00000	0.00000	0.00000	0.0001	7950
D16	Proposed measures factor	1	1	1	1				
D17	Residual with proposed Pollution reduction measures	0.00010	0.00002	0.00001	0.00000	0.00000	0.00000	0.0001	7950

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.6 Accidental spillage assessment results for the outfall from catchment M5

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse		
D2	Length of road draining to outfall *(m)*	600.00	460.00	531.00	318.00	283.00	350.00		
D3	Road Type *(A-road or Motorway)*	A	A	A	A	A	A		
D4	If A road, is site urban or rural?	Rural	Rural	Rural	Rural	Rural	Rural		
D5	Junction type	No junction	Slip road	Slip road	Slip road	Slip road	Side road		
D6	Location (response time for emergency services)	< 1 hour	< 1 hour	< 1 hour	< 1 hour	< 1 hour	< 1 hour		
D7	Traffic flow (AADT two way)	51,807	4,206	6,161	9,706	8,327	2330		
D8	% HGV	4	0.4	1.4	3.3	1.8	0		
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.29	0.83	0.83	1	0.83	0.93		
D9	Risk of accidental spillage	0.00013	0.00000	0.00001	0.00004	0.00001	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00008	0.00000	0.00001	0.00002	0.00001	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**	**No**	**No**	**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00008	0.00000	0.00001	0.00002	0.00001	0.00000	0.0001	8424
D14	Existing measures factor	1	1	1	0.6	1	1		
D15	Return period with existing pollution reduction	0.00008	0.00000	0.00001	0.00001	0.00001	0.00000	0.0001	9108
D16	Proposed measures factor	1	1	1	1	1	1		
D17	Residual with proposed Pollution reduction measures	0.00008	0.00000	0.00001	0.00001	0.00001	0.00000	0.0001	9108

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	600.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	Roundabout							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	17,155							
D8	% HGV	2							
D8	Spillage factor *(no/10^9 HGVkm/year)*	3.09							
D9	Risk of accidental spillage	0.00023	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**	**No**	**No**	**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	7178
D14	Existing measures factor	1			0.6				
D15	Return period with existing pollution reduction	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	7178
D16	Proposed measures factor	1			0.6				
D17	Residual with proposed Pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	7178

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.7 Accidental spillage assessment results for the outfall from catchments M6 and NW

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall						
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	861.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	No junction							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	44,146							
D8	% HGV	3.8							
D8	Spillage factor *(no/10⁸ HGVkm/year)*	0.29							
D9	Risk of accidental spillage	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	No	No	No	No	No	No	Totals	Return Period (years)
D13	Return period without pollution reduction measures	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	10901
D14	Existing measures factor	1			0.6				
D15	Return period with existing pollution reduction	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	10901
D16	Proposed measures factor	1			0.6				
D17	Residual with proposed Pollution reduction measures	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	0.0001	10901

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.8 Accidental spillage assessment results for the outfall from catchment M7

highways england

View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall						
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	433.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	No junction							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	44,146							
D8	% HGV	3.8							
D8	Spillage factor *(no/10^8 HGVkm/year)*	0.29							
D9	Risk of accidental spillage	0.00008	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**	**No**	**No**	**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	21677
D14	Existing measures factor	1			0.6				
D15	Return period with existing pollution reduction	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	21677
D16	Proposed measures factor	1			0.6				
D17	Residual with proposed Pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	21677

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.9 Accidental spillage assessment results for the outfall from catchment M8

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall						
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse	Surface watercourse		
D2	Length of road draining to outfall *(m)*	2,193.00	900.00	550.00	515.00	470.00	560.00		
D3	Road Type *(A-road or Motorway)*	A	A	A	A	A	A		
D4	If A road, is site urban or rural?	Rural	Rural	Rural	Rural	Rural	Rural		
D5	Junction type	No junction	No junction	Slip road	Slip road	Slip road	Slip road		
D6	Location (response time for emergency services)	< 1 hour	< 1 hour	< 1 hour	< 1 hour	< 1 hour	< 1 hour		
D7	Traffic flow (AADT two way)	44,146	51,807	1,801	2,392	3,100	3088		
D8	% HGV	3.8	8	1	1	1	1		
D8	Spillage factor *(no/10^8 HGVkm/year)*	0.29	0.29	0.83	0.6	0.83	0.83		
D9	Risk of accidental spillage	0.00039	0.00039	0.00000	0.00000	0.00000	0.00001		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00023	0.00024	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**	**No**	**No**	**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00023	0.00024	0.00000	0.00000	0.00000	0.00000	0.0005	2084
D14	Existing measures factor	1	1	1	0.6	1	1		
D15	Return period with existing pollution reduction	0.00023	0.00024	0.00000	0.00000	0.00000	0.00000	0.0005	2087
D16	Proposed measures factor	1	1	1	1	1	1		
D17	Residual with proposed Pollution reduction measures	0.00023	0.00024	0.00000	0.00000	0.00000	0.00000	0.0005	2087

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse	Surface watercourse	Surface watercourse					
D2	Length of road draining to outfall *(m)*	490.00	1,500.00	900.00					
D3	Road Type *(A-road or Motorway)*	A	A	A					
D4	If A road, is site urban or rural?	Rural	Rural	Rural					
D5	Junction type	Roundabout	Side road	Side road					
D6	Location (response time for emergency services)	< 1 hour	< 1 hour	< 1 hour					
D7	Traffic flow (AADT two way)	4,995	5,363	28,043					
D8	% HGV	2	2.6	4					
D8	Spillage factor *(no/10⁸ HGVkm/year)*	3.09	0.93	0.93					
D9	Risk of accidental spillage	0.00006	0.00007	0.00034	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60	0.60	0.60		
D11	Risk of pollution incident	0.00003	0.00004	0.00021	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	No	No	No	No	No	No	Totals	Return Period (years)
D13	Return period without pollution reduction measures	0.00003	0.00004	0.00021	0.00000	0.00000	0.00000	0.0003	3554
D14	Existing measures factor	1	1	1					
D15	Return period with existing pollution reduction	0.00003	0.00004	0.00021	0.00000	0.00000	0.00000	0.0003	3554
D16	Proposed measures factor	1	1	1					
D17	Residual with proposed Pollution reduction measures	0.00003	0.00004	0.00021	0.00000	0.00000	0.00000	0.0003	3554

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

The worksheet should be read in conjunction with DMRB 11.3.10.

Caption 4.10 Accidental spillage assessment results for the outfall from catchments M9, M10, NE, S5 and W1

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	260.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	Side road							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	5,780							
D8	% HGV	1							
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.93			0.6				
D9	Risk of accidental spillage	0.00001	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60							
D11	Risk of pollution incident	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**						**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	326717
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	326717
D16	Proposed measures factor	1			0.6				
D17	Residual with proposed Pollution reduction measures	0.00000	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	326717

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

Caption 4.11 Accidental spillage assessment results for the outfall from catchment S3

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View Parameters | Reset Spillage Risk | Go To Interface

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

			Additional columns for use if other roads drain to the same outfall							
		A (main road)	B	C	D	E	F		
D1	Water body type	Surface watercourse							
D2	Length of road draining to outfall *(m)*	400.00							
D3	Road Type *(A-road or Motorway)*	A							
D4	If A road, is site urban or rural?	Rural							
D5	Junction type	Roundabout							
D6	Location (response time for emergency services)	< 1 hour							
D7	Traffic flow (AADT two way)	51,807							
D8	% HGV	8							
D8	Spillage factor *(no/10^8 HGVkm/year)*	3.09							
D9	Risk of accidental spillage	0.00187	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.60	0.60	0.60	0.60				
D11	Risk of pollution incident	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000		
D12	Is risk greater than 0.01?	**No**	**No**	**No**	**No**			**Totals**	**Return Period (years)**
D13	Return period without pollution reduction measures	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000	0.0011	891
D14	Existing measures factor	1							
D15	Return period with existing pollution reduction	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000	0.0011	891
D16	Proposed measures factor	1							
D17	Residual with proposed Pollution reduction measures	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000	0.0011	891

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Spillage Factor

Location	Serious Accidental Spillages *(Billion HGV km/ year)*	Motorways	Rural Trunk	Urban Trunk
	No junction	0.36	0.29	0.31
	Slip road	0.43	0.83	0.36
	Roundabout	3.09	3.09	5.35
	Cross road	-	0.88	1.46
	Side road	-	0.93	1.81
	Total	0.37	0.45	0.85

Indicative Pollution Risk Reduction Factors for Spillages

System	Optimum Risk Reduction Factor
Filter Drain	0.6
Grassed Ditch / Swale	0.6
Pond	0.5
Wetland	0.4
Soakaway / Infiltration basin	0.6
Sediment Trap	0.6
Unlined Ditch	0.7
Penstock / valve	0.4
Notched Weir	0.6
Oil Separator	0.5

Spillage Risk

Caption 4.12 Accidental spillage assessment results for the outfall from catchment S4

5. Summary of impacts

5.1.1. The routine runoff assessment for outfalls was undertaken using HEWRAT. The assessment indicates that there is a negligible impact following dilution in the channel for both soluble and sediment-bound pollutants for all outfalls as a result of the Proposed Scheme. A wetland and swale have been proposed at catchment M2 and S1 respectively to mitigate against copper pollution impacts and filters drains have been provided on catchment M1 to provide treatment for suspended solids and dissolved zinc. The results of the HEWRAT assessment can be seen in Table 5.1.

5.1.2. The outfall M1 which discharges runoff from the existing drainage catchment to the west of the DCO boundary and proposed catchment M1 failed for acute copper. It is noted the existing outfall and the majority of the contributing catchment lie outside of the DCO boundary. The Proposed Scheme incorporates filter drains on the M1 catchment to provide treatment. This results in a reduction in pollutant load from the proposed M1 catchment compared to the baseline scenario and thus provides a minor benefit.

5.1.3. This assessment represents a worst case scenario for environmental impacts to surface water features. There is an intention in the proposed drainage design to provide filter drains, vegetated detention ponds and wetlands as indicated in Table 5-1. This is considered further in section 6.

5.1.4. The accidental spillages assessment was undertaken using the HEWRAT spillage assessment. The assessment indicates that the risk of serious pollution incident is considerably less than the annual acceptable threshold of 0.5% for discharge to a sensitive designated site (see Table 5.1) with the inclusion of the required measures proposed in the drainage design.

5.1.5. There are six existing outfalls draining the existing A47 where it is to be retained (de-trunked) as a local access road. These outfalls are currently classed as low pollution risk and require no mitigation, according to HA DDMS (Highways England, 2020). Once the existing A47 is changed to a local access road, the AADT traffic forecast will significantly reduce which would result in a reduction in pollutant concentrations in road runoff from these outfalls when compared to the baseline scenario.

Table 5.1 Routine runoff and accidental spillages assessment summary

Drainage Catchment	Required water quality mitigation	Mitigation proposed in drainage design	Soluble				Sediment	Spillage assessment
			EQS annual average concentration		Acute impact			
			Copper (µg/l)	Zinc (µg/l)	Copper	Zinc		
M1 (including existing catchment)	Filter drains (M1)	N/A	Pass (0.96)	Pass (2.26)	Fail	Pass	Pass	Pass
M2 & S1	Wetland (M2), swale (S1)	Filter drain, wetland (M2), swale (S1)	Pass (0.77)	Pass (2.42)	Pass	Pass	Pass	Pass
S2 and S3A	Not required	Filter drain and vegetated detention basin	Pass (0.17)	Pass (0.03)	Pass	Pass	Pass	Pass
M3	Not required	Filter drain and vegetated detention basin	Pass (0.18)	Pass (0.07)	Pass	Pass	Pass	Pass
M4	Not required	Filter drain and vegetated detention basin	Pass (0.21)	Pass (0.14)	Pass	Pass	Pass	Pass
M5	Not required	Filter drain and wetland	Pass (0.20)	Pass (0.11)	Pass	Pass	Pass	Pass
M6 & NW	Not required	Filter drain and vegetated detention basin	Pass (0.22)	Pass (0.17)	Pass	Pass	Pass	Pass
M7	Not required	Filter drain and vegetated detention basin	Pass (0.18)	Pass (0.05)	Pass	Pass	Pass	Pass
M8	Not required	Filter drain and wetland	Pass (0.17)	Pass (0.02)	Pass	Pass	Pass	Pass
M9, M10, NE, S5 & W1	Not required	Filter drains and vegetated detention basin	Pass (0.33)	Pass (0.71)	Pass	Pass	Pass	Pass
S3	Not required	Filter drains	Pass (0.16)	Pass (0.00)	Pass	Pass	Pass	Pass
S4	Not required	N/A	Pass (0.28)	Pass (0.36)	Pass	Pass	Pass	Pass
M7 and M8 (cumulative)	Not required	Filter drain and vegetated detention basin (M7) and wetland (M8)	Pass (0.19)	Pass (0.07)	Pass	Pass	Pass	N/A

6. Enhancement measures

6.1.1. Two of the attenuation features are to be developed as a wetland feature as part of enhancement measures. They shall be planted with suitable local species to provide additional pollution treatment and biodiversity enhancement at the following locations:

- catchment M5 (Gypsy Lane, south east of Hockering
- catchment M8 (South of the River Tud crossing)

6.1.2. The remaining attenuation features will be vegetated with suitable local species to provide biodiversity and further water quality enhancements.

6.1.3. The provision of wetland features would improve finer sediment removal, improve heavy metal removal and reduce nitrate and phosphate concentrations through biological uptake (Woods Ballard *et al.*, 2015). Vegetated detention basins would also reduce nitrate and phosphate concentrations through biological uptake (although less effectively than a wetland). Phosphate and nitrogen are not typically associated with road runoff but may enter the watercourse directly as the result of agricultural runoff local to the Proposed Scheme.

6.1.4. In addition to providing additional pollution treatment, the wetlands and vegetated detention basins will have the following biodiversity enhancements:

- encourage great crested newts back into an area which has been disturbed or destroyed or requires enhancement
- remediate areas of temporary land clearance important to breeding birds
- minimise risk of mortality to breeding and wintering birds by providing these as a refuge

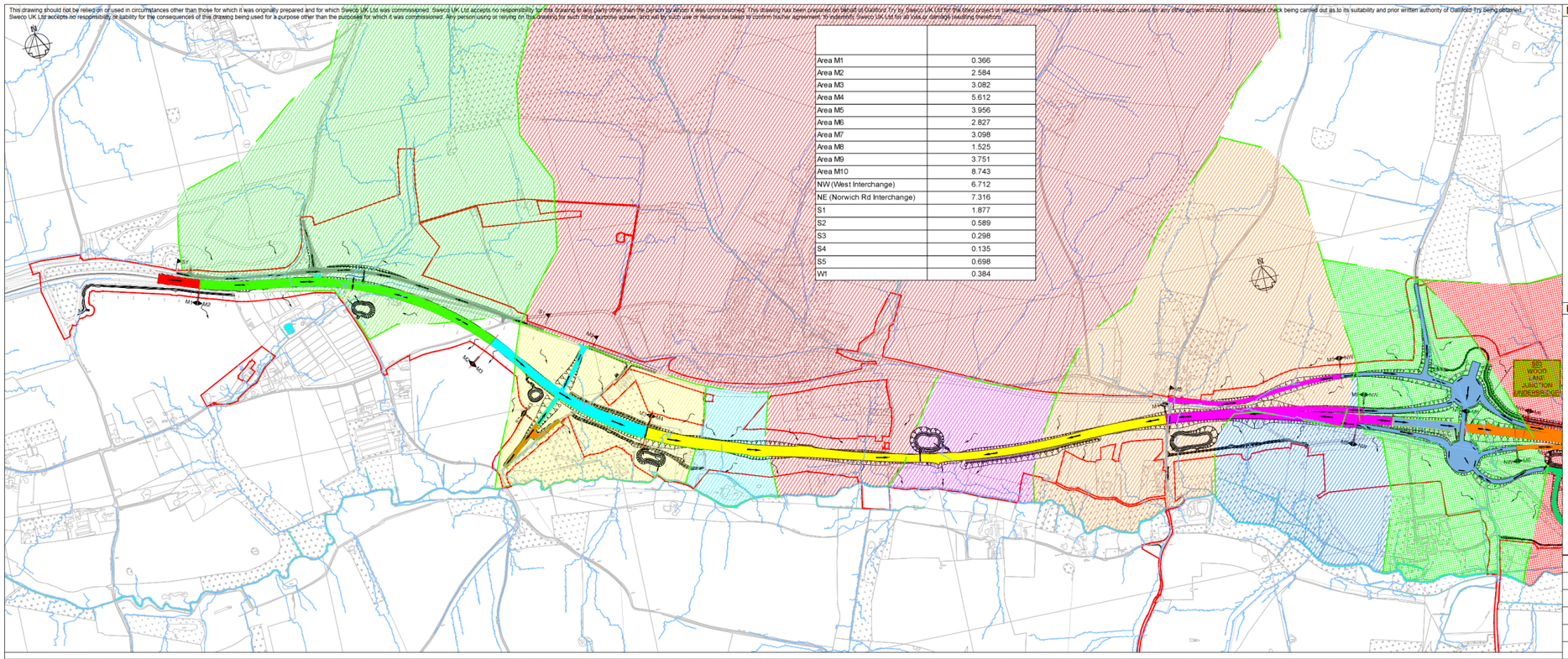
6.1.5. The provision of filter drains is to be considered further during detailed design. Should filter drains remain in the design, it is considered these will provide further suspended sediment and dissolved zinc removal benefits.

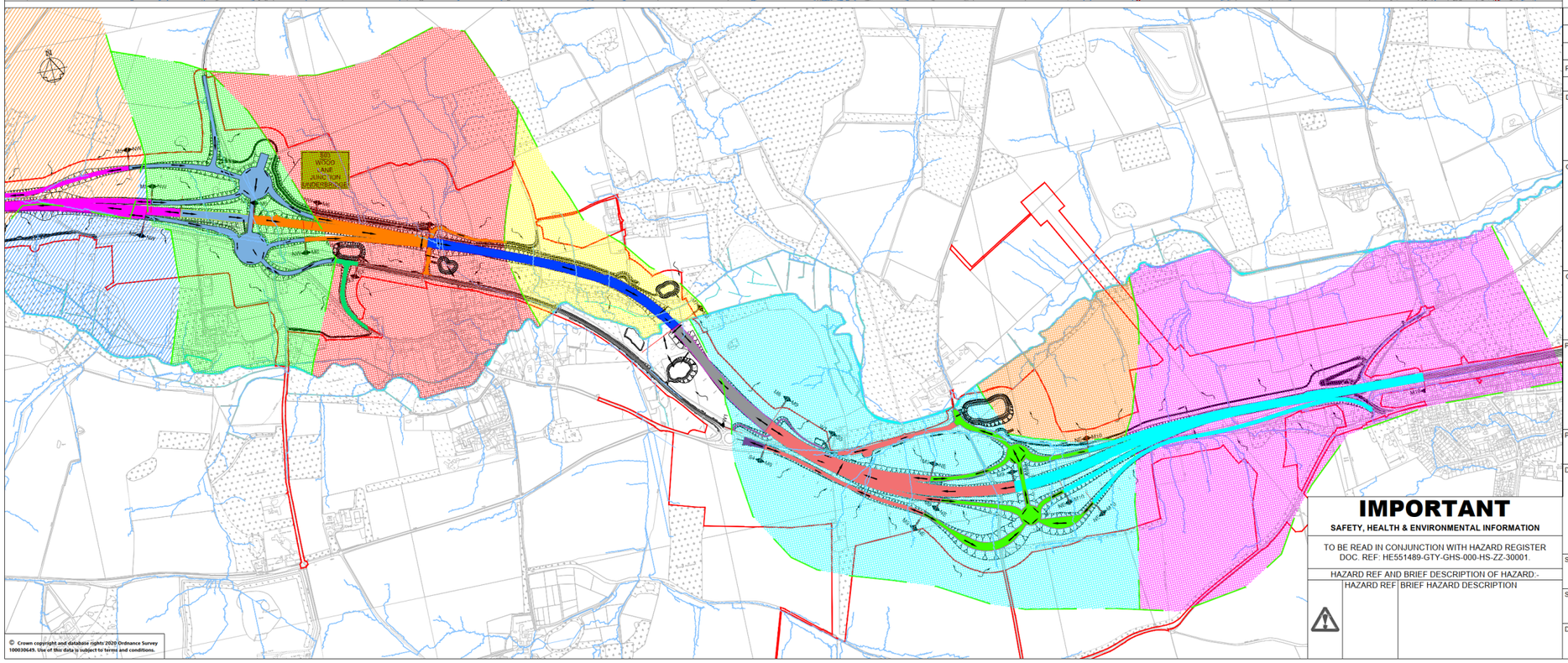
7. References

- Highways England (2019) Design Manual for Roads and Bridges LA 113 Road Drainage and the Water Environment. Available at https://www.standardsforhighways.co.uk/ha/standards/dmrb/vol11/section3/LA%20113%20Road%20drainage%20and%20the%20water%20environment-web.pdf , accessed September 2020
- Highways England (2020) Highways Agency Drainage Data Management System v5.12.0 (HADDMS). Available at: http://www.haddms.com , accessed September 2020
- UKTAG (2014) Updated recommendations on environmental standards; river basin management (2015-21). Available at: http://www.wfduk.org/sites/default/files/Media/Environmental%20standards/UKTAG%20Environmental%20Standards%20Phase%203%20Final%20Report%2004112013.pdf, accessed September 2020
- Woods Ballard, B., Wilson, S., Udale-Clarke, H., Illman, S., Scott, T., Ashley, R. and Kellagher, R. (2015). The SuDs Manual. CIRIA C753.

Annex A Drainage catchment areas

Area M1	0.366
Area M2	2.584
Area M3	3.082
Area M4	5.612
Area M5	3.956
Area M6	2.827
Area M7	3.098
Area M8	1.525
Area M9	3.751
Area M10	8.743
NW (West Interchange)	6.712
NE (Norwich Rd Interchange)	7.316
S1	1.877
S2	0.589
S3	0.298
S4	0.135
S5	0.698
W1	0.384





NOTES

1. THIS DRAWING SHALL ONLY BE USED FOR THE DESIGN ELEMENT STATED IN THE DRAWING TITLE.
2. ALL DIMENSION IN METRES (m) UNLESS OTHERWISE STATED.
3. DO NOT SCALE FROM THIS DRAWING.
4. DRAWING IS TO BE READ IN COLOUR.

KEY TO SYMBOLS

- M1
- M2
- M3
- M4
- M5
- M6
- M7
- M8
- M9
- M10
- NW
- NE
- S1
- S2
- S3
- S4
- S5
- W1
- DCO BOUNDARY
- EXISTING WATERCOURSES /BODIES
- NATURAL CATCHMENT A & A1
- NATURAL CATCHMENT B
- NATURAL CATCHMENT C
- NATURAL CATCHMENT D
- NATURAL CATCHMENT E
- NATURAL CATCHMENT F
- NATURAL CATCHMENT G
- NATURAL CATCHMENT H
- NATURAL CATCHMENT J
- NATURAL CATCHMENT K
- NATURAL CATCHMENT L
- NATURAL CATCHMENT M
- NATURAL CATCHMENT N
- DIRECTION OF SURFACE WATER DRAINAGE
- DIRECTION OF OVERLAND FLOW
- M6 NETWORK INDICATORS
- OVERLAND FLOW PATH

REV	DATE	REVISION NOTE	ORG	CHKD	APP'D
P01	15/06/20	FOR INFORMATION	MW	JM	JM
P02	30/11/20	DESIGN FIX C	SG	JMcC	BArt
P03.01	---		---	---	---

DESIGNER: SWECO

CONTRACTOR: GallifordTry

CLIENT: highways england

PROJECT TITLE: A47 NORTH TUDDENHAM TO EASTON DUALLING

PROJECT STAGE: PCF STAGE 3

DRAWING TITLE: DRAINAGE CATCHMENT PLAN

IMPORTANT

SAFETY, HEALTH & ENVIRONMENTAL INFORMATION

TO BE READ IN CONJUNCTION WITH HAZARD REGISTER DOC. REF: HE551489-GTY-GHS-000-HS-ZZ-30001.

HAZARD REF AND BRIEF DESCRIPTION OF HAZARD:-

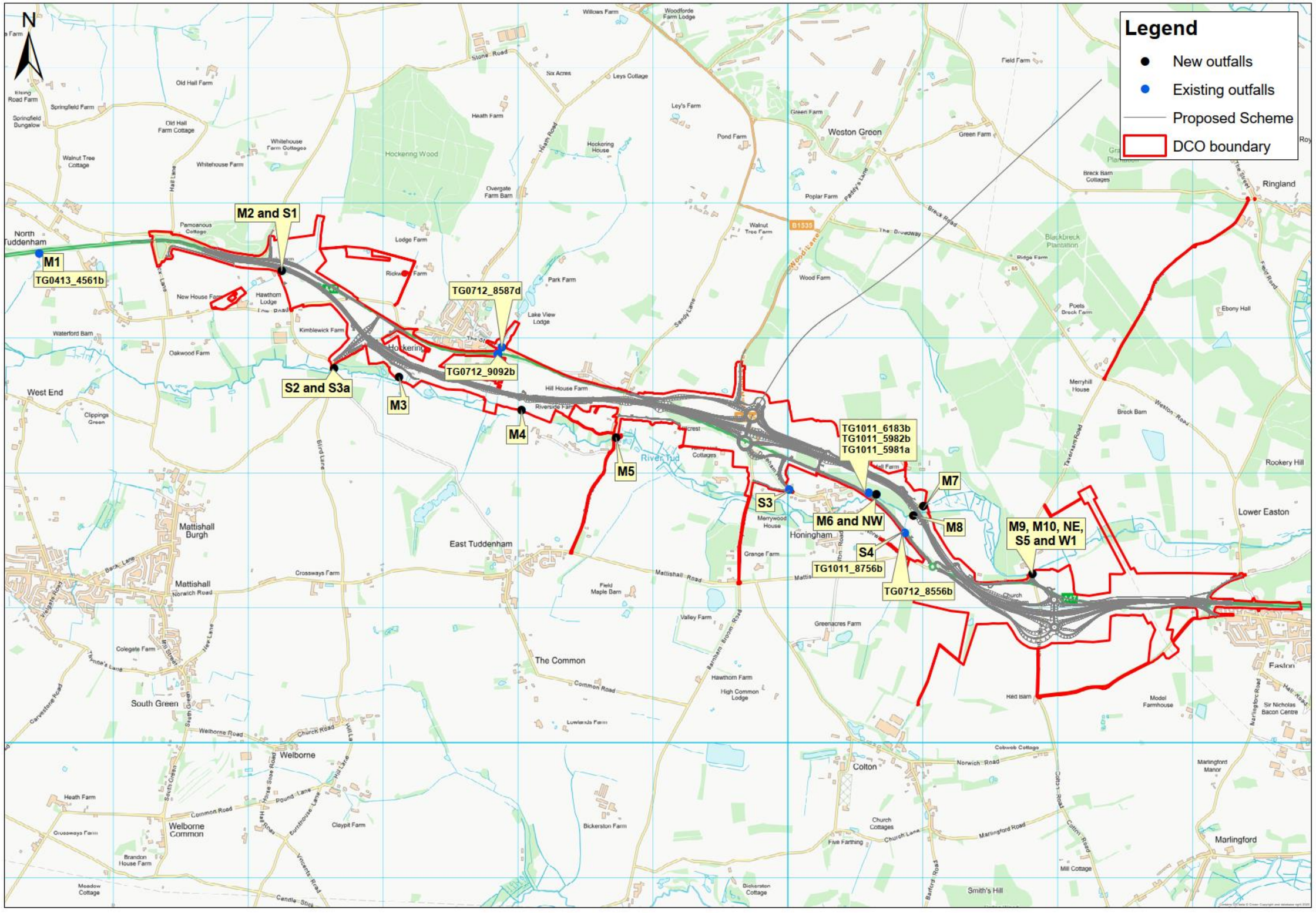
HAZARD REF	BRIEF HAZARD DESCRIPTION

SUITABILITY: WORK IN PROGRESS

SHEET SIZE	SCALE	STATUS	REVISION
A1	1:7500	S0	P03.01

DRAWING NUMBER: HE551489-GTY-HDG-000-DR-CH-30016

Annex B Outfall locations


N
Legend
New outfalls
Existing outfalls
Proposed Scheme
DCO boundary
M1
TG0413_4561b
M2 and S1
S2 and S3a
M3
M4
M5
TG0712_8587d
TG0712_9092b
TG1011_6183b
TG1011_5982b
TG1011_5981a
M7
M8
S3
M6 and NW
S4
TG1011_8756b
TG0712_8556b
M9, M10, NE, S5 and W1
North Tuddenham
West End
Hockering
Hockering Wood
East Tuddenham
Weston Green
Ringland
Honingham
Lower Easton
Mattishall Burgh
Mattishall
South Green
The Common
Welborne
Welborne Common
Colton
Marlingford
Easton
Smith's Hill
River Tud

Annex C Metal bioavailability assessment

Metal Bioavailability Assessment Tool (M-BAT)

Back

Calculate

Clear Data

INPUT DATA											RESULTS (Copper)			
ID	Location	Waterbody	Date	Measured Cu Concentration (dissolved) (µg l^{-1})	Measured Zn Concentration (dissolved) (µg l^{-1})	Measured Mn Concentration (dissolved) (µg l^{-1})	Measured Ni Concentration (dissolved) (µg l^{-1})	pH	DOC	Ca	Site-specific PNEC Dissolved Copper (µg l^{-1})	BioF	Bioavailable Copper Concentration (µg l^{-1})	Risk Characterisation Ratio
1	River Tud	River Tud	03/09/2020	1	2	2	1	7.9	4.9	148	16.88	0.06	0.06	0.06
2	Oak Farm	Tributary of the River Tud	24/09/2020	12	13	2	1	7.3	10	19	44.13	0.02	0.27	0.27
3	River Tud	River Tud	24/09/2020	2	2	2	1	7.8	6.3	120	24.63	0.04	0.08	0.08
4	Oak Farm	Tributary of the River Tud	29/10/2020	1	3	2	1	7.9	2.6	159	7.67	0.13	0.13	0.13
5	River Tud	River Tud	29/10/2020	1	6	28	1	8	6	177	19.41	0.05	0.05	0.05
6	Oak Farm	Tributary of the River Tud	01/12/2020	1	2	2	1	8.1	3.4	169	8.22	0.12	0.12	0.12
7	River Tud	River Tud	01/12/2020	1	2	42	1	8.1	5.8	194	16.60	0.06	0.06	0.06
8	Oak Farm	Tributary of the River Tud	16/12/2020	1	2	2	1	7.9	2.4	151	6.95	0.14	0.14	0.14
9	River Tud	River Tud	16/12/2020	1	3	12	1	8	5.7	165	18.28	0.05	0.05	0.05
10	Oak Farm	Tributary of the River Tud	12/01/2021	1	2	2	1	8	2.8	143	7.37	0.14	0.14	0.14
11	River Tud	River Tud	12/01/2021	2	4	29	1	8	5.5	150	17.52	0.06	0.11	0.11