

A47/A11 Thickthorn Junction

Scheme Number: TR010037

6.3 Environmental Statement Appendices Appendix 13.4 – 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/A11 Thickthorn Junction Development Consent Order 202[x]

ENVIRONMENTAL STATEMENT APPENDICES Appendix 13.4 – Water Quality Assessment

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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. 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 the Environmental Statement (ES) Chapter 13 Road drainage and water environment (TR010037/APP/6.1).
- 1.1.2. The Proposed Scheme will utilise three existing outfalls and five new outfalls which discharge to Cantley Stream. The assessment methodology for estimating the routine runoff impacts and accidental spillage risk to the water features during the operational phase of the Proposed Scheme is described in Section 3 and 4, respectively. The approach follows the guidance within the Design Manual for Roads and Bridges (DMRB) LA113 (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 the ES Chapter 13 (Road drainage and water environment) (TR010037/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. Background

- 2.1.1. The Proposed Scheme comprises of ten highway drainage catchment areas discharging to watercourses via eight outfalls. Of the eight outfalls, five are new and three are existing Highways England outfalls:
 - proposed drainage catchment A and K discharges to one new outfall
 - existing drainage catchment A discharges to one existing outfall
 - drainage catchments B, H and I discharges to one new outfall
 - drainage catchment E discharges to one new outfall
 - drainage catchment E2 discharges to one new outfall
 - drainage catchment F discharges to one existing outfall
 - drainage catchment F2 discharges to one new outfall
 - drainage catchment J discharges to one existing outfall
- 2.1.2. A number of existing Highways England outfalls have been identified on Highways Agency Drainage Data Management System (HA DDMS) (Highways England, 2020) in the area where the existing A11 and A47 cross Cantley Stream (Figure 13.6 (Surface water flood risk) (TR010037/APP/6.2)). The assets need to be verified through a drainage survey. However, for the purposes of the HEWRAT assessment, the total existing drainage catchment is assumed to discharge via three existing outfalls to Cantley Stream, namely:
 - catchment A outfall reference TG1704 9384d
 - catchment F2 outfall reference TG1904 1886e
 - catchment J outfall reference TG1804 1886e
- 2.1.3. The location of the drainage catchments and outfalls for the existing and Proposed Scheme can be found in Annex A. Any outfall draining only natural catchment drainage is not assessed as it does not contain pollutants from highway drainage.
- 2.1.4. Prior to the runoff reaching the outfalls, filter drains, vegetated detention basins and swales are proposed in the drainage design. However, the filter drains and swale measures were omitted from the surface water HEWRAT assessment to represent a worst case scenario for surface water pollution risk. This is because further assessment of the pollution risk from discharging to ground via filter drains and swales is required following supplementary ground investigations due to start in March 2021. The drainage strategy for the Proposed Scheme is described in Appendix 13.2 (Drainage Strategy) (TR010037/APP/6.3).



2.1.5. Annual average daily traffic (AADT) forecasts with and without the Norwich Western Link Road scheme were reviewed. The results considered in this assessment are based on those with the Norwich Western Link Road scheme in place, which does not represent the worst case scenario traffic forecast. However, using the worst case scenario (without Norwich Western Link Road) would not affect the water quality mitigation required as the AADT forecasts do not vary enough to affect the outcome of the HEWRAT routine runoff and spillage assessments.



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 Cantley Stream.

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 (Highways England, 2019). 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.
- 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 Framework Directive (Standards and Classification) Directions (England and Wales) 2015. The ambient background copper concentrations can be manually input into HEWRAT, if known. There were no existing water quality data available for any of the water bodies or watercourses within the study area therefore water quality sampling was undertaken. Six samples were taken from Cantley Stream upstream of the Proposed Scheme as part of a 6-month sampling regime. The results show that the average ambient bioavailable copper concentration is 0.077 µg/l (see Annex B).
- 3.2.9. The EQS for dissolved copper in freshwaters is 1 μ g/l and 10.9 μ g/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 extent of the Proposed Scheme is 623mm which is sufficiently similar to the value at Huntingdon.

3.3. Assessment results

- 3.3.1. All of the outfalls passed the HEWRAT assessment with the inclusion of the measures outlined in the proposed drainage design.
- 3.3.2. A summary of the parameters used in the HEWRAT assessment can be found in Table 3.1.



Table 3.1 Parameters used in the HEWRAT assessment

	Proposed Sche	eme		Mitigation proposed in
Network	Road Area (ha)	Green/verge Area (ha)	Mitigation identified by HEWRAT	drainage design (subject to supplementary ground investigation)
A (proposed and existing) and K	2.744	0.276	N/A	Filter drains
B, H and I	6.275	9.535	Detention basin (vegetated)	Detention basin (vegetated) and filter drains
E	0.359	0.088	N/A	Filter drains and swale
E2	0.14	0.158	N/A	Filter drains and swale
F	1.79	4.555	N/A	Filter drains and vegetated detention basin
F2	1.234	0.47	N/A	Filter drains
J	0.979	0.679	N/A	Filter drains

- 3.3.3. The results from each HEWRAT assessment can be seen in Captions 3.1 to 3.16 with and without mitigation measures in place.
- 3.3.4. A summary of the HEWRAT assessment for each outfall is as follows:
 - Catchment A (proposed and existing) and K outfalls passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
 - Catchments B, H and I outfall initially failed step 2 (pre mitigation) due to acute copper concentrations, which would require treatment to mitigate this. However, with the inclusion of a vegetated detention basin as a proposed measure in step 3, this outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants. The detention basin will be grassed and dry except at times of heavy rainfall. The vegetated detention basin provides the same or better removal rate of copper than a grass channel due to it being flatter and wider, more likely to disperse the water over the surface area and will have a longer detention time. For the purpose of the HEWRAT assessment, the removal rate of a grassed channel for copper (50%) has been included in step 3 of the assessment.
 - Catchment E outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
 - Catchment E2 outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
 - Catchment F outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
 - Catchment F2 outfall passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants.
 - Catchment J outfall 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 Cantley Stream from catchments A, K, B, H, I and J as they are within 100m of each other. This cumulative area initially failed step 2 (pre mitigation) due to acute copper concentrations, which would require treatment to mitigate this. However, with the inclusion of a vegetated detention basin as a proposed measure in step 3, these outfalls passed the HEWRAT assessment for soluble pollutants and sediment bound pollutants. The results from this can be seen in Captions 3.9 and 3.10.



Solitable Soli	j	highways england		Highways Eng	land Water Risk Assessment T	ool	Version 2.0.4 June 2019	
Copper C	Г				Soluble			Sediment - Chronic Impact
Step 2 Pass			C				Acute Impact	Pass
Road number				0.22	0.38	ug/l		
Road number		Step 2						
Road number				-	-	ugil		-
Assessment type		Step 3						
Assessment type	L							
Step 1 Runoff Quality Annual Quality	_							
Step 1 Runoff Quality Step 2 River impacts Cander (him) California Cander (him) California Cander (him) Cander						luding sedim	·	•
Outfall number TG1704 9384d List of outfalls in cumulative assessment Receiving watercoarse Cantley Stream assessment Assessor and affiliation KD Sweco Date of assessment 12/02/2021 Version of assessment 2 Notes Og 5 calculated using Low Flows 2 software at Wallingtonia HydroSoulitonia). BF1 taken from FEH at TG 18350 04800. Water hardness taken from EA Water Quality Archive for River Wensum at Nonwich. River width taken from hydraulic model. Step 1 Runoff Quality AADT Notes Step 2 River Impacts Circler zero in Annual O _{th} river flow (m³/s) Bioavailable dissolved copper (µg/f) Base Flow Index (BFI) Base Flow Index (BFI) For dissolved zinc only Water hardness Hgh= >200mg cacco31 For dissolved zinc opper only For dissolved zinc opper only Water hardness Brief description It the discharge in or within 1 km upstream of a protected site for conservation? Attenuation for solubles— Settlement for router for Attenuation for solubles— For dissolved copper only Attenuation for solubles— Settlement for Settlement fo	_							
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Extremely water-Duale of River Network D Extremely of Search Sea								158
Date of assessmert 12/02/2021 Version of assessmert 2				National ID				
Notes O95 calculated using Low Flows 2 software at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness taken from EA Water Quality Archive for River Wersum at Norwich. River width taken from hydraulic model. Step 1 Runoff Quality ADT >10,000 and <0,000 Climatic region Rainfall site Hurtingdon(SAAR 600mm) Rainfall site Hurtingdon(SAAR 600mm) Rainfall site Hurtingdon(SAAR 600mm) Rainfall site Hurtingdon(SAAR 600mm) Rainfall site Freshwater EQS limits: Bloavailable dissolved copper (µg/l) 1				er ivetwork iD		2		SWeco .
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Base Flow Index (BFI) Step 3 Mitigation Brief description Brief description Brief description Brief description Step 3 Mores triction D No restriction				Permeable area drain	ing to outfall (ha)	0.278	Bioavailable dissolved zinc (µg/l) 10.9	D
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Tier 1 Estimated river width (m) Tier 2 Bed width (m) Side slope (m/m) Treatment for Solubles - Settlement of solubles - Settlement of solubles (%) Existing measures Settlement of Solubles - Settlement of Solubles - Settlement of Solubles (%) Sediments (%)		quality offiy)		Base Flow Index (BFI))	0.617	Is the discharge in or within 1 km upstream of a protected site for o	conservation? No ▼
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Tier 1		For dissolv	ed zinc only	Water hardness	High = >200mg CaCO3/I	-	For dissolved copper only Ambient background concen	ntration (µg/l)
Tier 1 Estimated river width (m) Tier 2 Bed width (m) Side slope (m/m) Side slope	-	For coding a		le there is described	- storestore letter mand or completely and			
Step 3 Mitigation Estimated effectiveness Treatment for solubles (%) Brief description Existing measures Side slope (m/m) 0.5 Long slope (m/m) 0.004 Estimated effectiveness Treatment for solubles restricted discharge rate (//s) sediments (%)		roi seullile	int impact only	is there a downstream	i structure, take, pond of canal that red	uces the veloc	within 100m of the point of discharge?	
Step 3 Mitigation Estimated effectiveness Treatment for solubles - restricted discharge rate (\(V_S \) sediments (\(\% \)) Existing measures O No restriction No restriction D D D				○ Tier 1 Estima	ated river width (m)	1		
Step 3 Mitigation Estimated effectiveness Treatment for solubles (%) Brief description Existing measures Settlement of sediments (%) No restriction No restriction				⊕ Tier 2 Bed w	ridth (m)	4.66	anning's n 0.04 Side slope (m/m) 0.5	Long slope (m/m) 0.004
Estimated effectiveness Treatment for solubles					,			
Estimated effectiveness Treatment for solubles	Г	Step 3 Miti	igation					
Brief description Solubles (%) restricted discharge rate (\(V \) \(S \) sediments (%) Existing measures O O O O O								
Existing measures O D No restriction D D D					Date to a series			
					Brief description		Sounds (70) resulted discharge rate (183) Sediment	51,701
Proposed measures 0 D No restriction 0 D		Existing mea	asures				0 No restriction • 0	D
		Proposed m	neasures				0 D No restriction T D 0	D

Caption 3.1 Routine runoff assessment results for the outfalls from catchment A and K (prior to mitigation)

ES Appendix 13.4 - Water Quality Assessment



highways england	Highways England	d Water Risk Assessment Too	ol	Version 2.0.4 June 2019
		Soluble		Sediment - Chronic Impact
Step 2 Step 3	EQS - Annual Average Co Copper 0.65	oncentration Zinc 2.17	ug/l ug/l	Acute Impact Copper Zinc River Falls Toxicity Test. Try mitigation Pass Sediment deposition for this site is judged as: Accumulating? No 0.14 Low flow Velm/s Extensive? No - Deposition Index
Road number		A47		HE Area / DBFO number
Assessment type		Non-cumulative assessment	(single outfal	fall)
OS grid reference of assessmen	nt point (m)	Easting 617896		Northing 304867
OS grid reference of outfall struc	ture (m)	Easting 617888		Northing 304939
Outfall number		В		List of outfalls in cumulative
Receiving watercourse		Cantley Stream		asse ssment asse ssment
EA receiving water Detailed Riv	er Network ID	eaew1001000000564062		Assessor and affiliation KD Sweco
Date of assessment Notes		12/02/2021		Version of assessment 2 vare at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness taken from
Step 1 Runoff Quality	AADT >=100,000	assessment point to be on cal	ntley stream.	
Step 2 River Impacts	Annual Q ₉₅ river flow (m³/s	s)	0.013	Freshwater EQS limits:
(Enter zero in Annual Q ₉₅ river flow box to	Impermeable road area dra	ained (ha)	6.275	Bioavailable dissolved copper (μg/l)
assess Step 1 runoff	Permeable area draining to	o outfall (ha)	9.535	Bioavailable dissolved zinc (μg/l)
quality only)	Base Flow Index (BFI)		0.617	Is the discharge in or within 1 km upstream of a protected site for conservation?
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	-	For dissolved copper only Ambient background concentration (μg/l)
For sediment impact only	Is there a downstream stru	ucture, lake, pond or canal that reduc	es the veloci	ocity within 100m of the point of discharge?
	○ Tier 1 Estimated	river width (m)	8.75	
	Tier 2 Bed width	(m)	4.66	Manning's n 0.04 Side slope (m/m) 0.5 Long slope (m/m) 0.004
Step 3 Mitigation		Brief description		Estimated effectiveness Treatment for solubles - Settlement of solubles (%) restricted discharge rate (\(\s \) sediments (%)
Existing measures				0 No restriction D O D
Proposed measures				0 D No restriction - D 0 D

Caption 3.2 Routine runoff assessment results for the outfall from catchments B, H and I (prior to mitigation)

Planning Inspectorate Scheme Ref: TR010037 Application Document Ref: TR010037/APP/6.3



Soluble Sediment -Circolic Impact Copper Zinc Copper Zinc Copper Zinc Pass	highways england	Highways Englar	nd Water Risk Assessment To	ol	Version 2.0.4 June 2019
Copper Zinc District Copper Zinc District Copper Zinc Plass			Soluble		Sediment - Chronic Impact
Road number		Copper	Zinc	ug/l	Copper Zinc Sediment deposition for this site is judged as: Pass Pass Accumulating? No 0.14 Low flow Vel m/s
Assessment type Non-cumulative assessment (single outfall) OS oil deference of ossessment point (m) Eastina 617896 Northina 304867 OS oil deference of outfall structure (m) Eastina 617898 List of outfalls in cumulative DATE Receiving water Curse Savessment EA receiving water Detailed River Network D Date of assessment 12/02/2021 Version of assessment Notes OS calculated using Low Flows 2 software at (Wallingtort Hydros Outloors) BFI taken from FEH at TG 18350 04800. Water hardness taken from EA Water Cusility Anchive for River Wersum at Norwich. River width taken from hydraulic model. Outfall be also nonly an approximate, assumed assessment One on carely of the one of		0.36	1.08	ug/l	Extensive? No - Deposition Index
Assessment type Non-cumulative assessment (single outfall) OS oil deference of ossessment point (m) Eastina 617896 Northina 304867 OS oil deference of outfall structure (m) Eastina 617898 List of outfalls in cumulative DATE Receiving water Curse Savessment EA receiving water Detailed River Network D Date of assessment 12/02/2021 Version of assessment Notes OS calculated using Low Flows 2 software at (Wallingtort Hydros Outloors) BFI taken from FEH at TG 18350 04800. Water hardness taken from EA Water Cusility Anchive for River Wersum at Norwich. River width taken from hydraulic model. Outfall be also nonly an approximate, assumed assessment One on carely of the one of	Road number		A47		HE Area / DBFO number
Step 1 Runoff Quality Step 2 River Impacts Step 2 River Impacts Cantal of the care of author Company Com	Assessment type			(single outfa	fall)
Control reference of outfall structure (m) Easting 617888 Northing 304939	OS grid reference of assessmen	t point (m)		(
Receiving watercourse EA receiving water Detailed River Network D acamyl 0.01000000564062 Assessment EA receiving water Detailed River Network D acamyl 0.01000000564062 Assessment 12/02/2021 Notes OB5 calculated using Low Flows 2 software at (Wallingford HydroSolutions) BFI taken from FEH at TG 18350 04900. Water hardness taken from EA water Coulsily Archive for Triver Wensum at Norwich River width taken from hydraulic model. Outfail location only an approximate, assumed assessment point to be on cartiley stream. Step 1 Runoff Quality AADT >=100.000 Climatic region Warm Dry Rainfall site Hurtingdon (SAAR 600mm) Freshwater EQS limits: (Enter zero in Annual Ober fiver Ifflow (m ³ /s) Impermeable road area drained (ha) Ober fiver Indoor Detailed area draining to outfall (ha) assess Step 1 runoff quality only) Base Flow Index (BFI) Bioavailable dissolved zinc (µg/l) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO31 For dissolved copper only Ambient background concentration (µg/li) For dissolved zinc only Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles. Settlement of	OS grid reference of outfall struc	ture (m)			Northing 304939
Step 1 Runoff Quality AADT >=100,000 Climatic region Warm Dry Rainfall site Hurtingdon (SAAR 600mm) Freshwater EQS limits	Outfall number		В		
Date of assessment 12/02/2021 Version of assessment 2 OB5 calculated using Low Flows 2 software at (Wallingtond HydroSouthations). BFI taken from FEH at TG 18350 04800. Water hardness taken from EA Water Quality Archive for River Wensum at Nowich. River width taken from hydraulic model. Outfall location only an approximate, assumed assessment point to be on cardiesy stream. Step 1 Runoff Quality AADT ADT Climatic region Rainfall site Hurtingdon (SAAR 600mm) Freshwater EQS limits: (Enter zero in Annual Querter flow (m³/s) Impermeable road area drained (ha) Quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CacO31 For dissolved copper only Ambient background concentration (µg/l) Step 3 Mittigation Step 3 Mittigation Estimated effectiveness Treatment for Alternation for Solubles. Settlement of Settle	Receiving watercourse		Cantley Stream		assessment
Notes C95 calculated using Low Flows 2 software at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness taken from EA Water Quality Archive for River Wersum at Norwich. River width taken from hydraulic model. Outfall location only an approximate, assumed assessment point to be on cartiley stream. Step 1 Runoff Quality ADT -100,000 Climatic region Warm Dry Rainfall site Hurtingdon (SAAR 600mm) Participation Partici	EA receiving water Detailed Rive	er Network ID	eaew1001000000564062		Assessor and affiliation KD Sweco
EA Water Quality Archive for River Wereum at Norwich. River width taken from hydraulic model. Outfall location only an approximate, assumed assessment point to be on cardley stream. Step 1 Runoff Quality	Date of assessment		12/02/2021		Version of assessment 2
Step 2 River Impacts Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Impermeable road area drained (ha) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Impermeable road area drained (ha) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Impermeable road area drained (ha) [Enter zero in Annual Q ₉₅ river flow (m³/s) [Impermeable road area drained (ha) [Impermeable road area draining to outfall (ha) [Impermeable road area drained (ha) [Im					
Annual Q ₉₅ river flow (m ¹ /5) (Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CacO3/1 For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Tier 1 Estimated river width (m) Step 3 Mittigation Freshwater EQS limits: Bioavailable dissolved copper (µg/l) Bioavailable dissolved copper (µg/l) 1 Bioavailable dissolved zinc (µg/l) 1 For dissolved zinc (µg/l) For dissolved zinc only Step 3 Mittigation From the point of discharge? No Tier 1 Estimated river width (m) 488 Manning's n 0.04 Side slope (m/m) Step 3 Mittigation Estimated effectiveness Treatment for Atternation for solubles Settlement of Mittigation Estimated effectiveness Treatment for Atternation for Solubles Settlement of Mitigation Estimated effectiveness Treatment for Atternation for Solubles Settlement of Mitigation	Step 1 Runoff Quality	AADT >=100,000	•	Climatic re	region Warm Dry Rainfall site Huntingdon (SAAR 600mm)
O _{gs} river flow box to assess Step 1 runoff quality only) Base Flow Index (BFI) For dissolved zinc only For dissolved copper only Ambient background concentration (μg/l) O.077 For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? O Tier 1 Estimated river width (m) Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles - Settlement of the point of the point of solubles - Settlement of the point of solubles - Settlement of the point of the point of the point of solubles - Settlement of the point of the point of the point of the point o	Step 2 River Impacts	Annual Q ₉₅ river flow (m ³	/s)	0.013	Freshwater EQS limits:
quality only) Base Flow Index (BFI) O.817 Is the discharge in or within 1 km upstream of a protected site for conservation? For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper only Ambient background concentration (µg/I) O.77 For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? O Tier 1 Estimated river width (m) O.875 O Tier 2 Bed width (m) Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles. Settlement of Attenuation for solubles. Settlement of Intervent of		Impermeable road area of	drained (ha)	6.275	Bioavailable dissolved copper (μg/l)
Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CsCO3/I For dissolved copper only Ambient background concentration (µg/I)	assess Step 1 runoff	Permeable area draining	to outfall (ha)	9.535	Bioavailable dissolved zinc (μg/l)
For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? Tier 1 Estimated river width (m) Tier 2 Bed width (m) Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles - Settlement of Attenuation for solubles - Settlement of Settlement o	quality only)	Base Flow Index (BFI)		0.617	Is the discharge in or within 1 km upstream of a protected site for conservation?
Tier 1 Estimated river width (m) Tier 2 Bed width (m) Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles - Settlement of	For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	-	For dissolved copper only Ambient background concentration (µg/l)
Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles - Settlement of S	For sediment impact only	Is there a downstream st	ructure, lake, pond or canal that reduc	ces the veloc	ocity within 100m of the point of discharge?
Step 3 Mitigation Estimated effectiveness Treatment for Attenuation for solubles - Settlement of S		○ Tier 1 Estimate	d river width (m)	8.75	
Treatment for Attenuation for solubles - Settlement of		Tier 2 Bed widt	h (m)	4.66	Manning's n 0.04 Side slope (m/m) 0.5 Long slope (m/m) 0.004
Ruet description Solution 1 Solution 1 100 Institute of the Property of the Pr	Step 3 Mitigation		Brief description		
Existing measures 0 D Norestriction V D 0 D	Existing measures				0 D No restriction D 0 D
Proposed measures detention bas in (grass lined) 50 No restriction 🔻 🕞 50	Proposed measures	detention bas in (grass lined)			50 No restriction D 50

Caption 3.3 Routine runoff assessment results for the outfall from catchments B, H and I with proposed measures included



highways england	Highways Engla	nd Water Risk Assessment To	ol	Version 2.0.4 June 2019	
		Soluble		Sediment - Chronic Impact	
Step 2	EQS - Annual Average Copper 0.10	Concentration Zinc 0.06	ug/l ug/l		ped as: v flow Vel m/s position Index
Road number		Cantley Lane S		HE Area / DBFO number	
Assessment type		Non-cumulative assessment	(single outfa	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1	-
OS grid reference of assessmer	nt point (m)	Easting 618408	(Northing 304838	
OS grid reference of outfall struc	ture (m)	Easting 618408		Northing 304838	
Outfall number		E		List of outfalls in cumulative	
Receiving watercourse		Cantley Stream		asse ssment asset as	
EA receiving water Detailed Riv	er Network ID	eaew1001000000555330		Assessor and affiliation KD Sweco	
Date of assessment Notes		12/02/2021		Version of assessment 2 are at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness to	
Step 1 Runoff Quality	AADT >10,000 an	discharge to Cantley Stream	Climatic re	region Warm Dry Rainfall site Huntingdon (SAAR 600mm)	·
Step 2 River Impacts	Annual Q ₉₅ river flow (m ³	3/s)	0.013	Freshwater EQS limits:	
(Enter zero in Annual	Impermeable road area	drained (ha)	0.359	Bioavailable dissolved copper (µg/l)	
Q ₉₅ river flow box to assess Step 1 runoff	Permeable area draining		0.088	Bioavailable dissolved zinc (µg/l)	
quality only)	Base Flow Index (BFI)	y to outlan (na)	0.617	Is the discharge in or within 1 km upstream of a protected site for conservation?	7 D
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	•	For dissolved copper only Ambient background concentration (µg/l)	077
For sediment impact only	Is there a downstream st	tructure, lake, pond or canal that reduc	ces the veloci	city within 100m of the point of discharge?	
	○ Tier 1 Estimate	ed river width (m)	1		
	© Tier 2 Bed widt	th (m)	1.481	Manning's n 0.04 Side slope (m/m) 0.5 Long slope (m/m)	0.007
Step 3 Mitigation		Brief description		Estimated effectiveness Treatment for solubles - Settlement of restricted discharge rate (\(V_S \) sediments (\(% \) \ No restriction	
Proposed measures				0 No restriction - D 0 D	— <u>÷</u>

Caption 3.4 Routine runoff assessment results for the outfall from catchment E (prior to mitigation)



highways england Water Risk Assessment Tool Version 2.0.4 June 2019			
Soluble		Sediment - Chron	nic Impact
EQS - Annual Average Concentration Acute Impact	t		
Copper Zinc	Zinc	Pass	
Step 2 0.09 0.02 ug/l Copper	ZIIIC	Sediment deposition for this	site is judged as:
Pass	Pass		0.25 Low flow Vel m/s
ug/i ug/i		Extensive? No	 Deposition Index
Step 3			
Road number ES HE Area / DBFO number	er		
Assessment type Non-cumulative assessment (single outfall)	11.		
	orthing 30476		
	orthing 30476	53	
Outfall number E2 List of outfalls in cumula	ative		
Receiving watercourse Cambey Stream		L/D O	
EA receiving water Detailed River Network ID eaew1001000000555330 Assessor and affiliation Date of assessment 12/02/2021 Version of assessment		KD Sweco	
Notes Q95 calculated using Low Flows 2 software at (Wallingford HydroSolutions).		L at TC 19350 04900 Water b	ardness taken from
EA Water Quality Archive for River Wensum at Nowich. River width found to			
Stream			
Step 1 Runoff Quality AADT >10,000 and <50,000 TO Climatic region Warm Dry	Rainfall site	Huntingdon (SAAR 600mm)	-
Step 2 River Impacts Annual Q ₉₅ river flow (m³/s) Oo13 Freshwater EQS limits:			
(Enter zero in Annual Impermeable road area drained (ha) 0.14 Bioavailable dissolved of	copper (µg/l)	1	
Q ₉₅ river flow box to assess Step 1 runoff Permeable area draining to outfall (ha) 0.158 Bioavailable dissolved z			
	ZINC (µg/I)	10.9 D	
quality only) Base Flow Index (BFI) 0.617 Is the discharge in or within 1 kg			No v D
quality only)			No v
quality only)	km upstream of a prot		No ▼ □
quality only) Base Flow Index (BFI) 0.817 Is the discharge in or within 1 kg	mupstream of a protein	ected site for conservation?	
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on	mupstream of a protein	pround concentration (µg/l)	
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved zopper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 km. Tier 1 Estimated river width (m)	mupstream of a proteinity Ambient backg	ground concentration (µg/l)	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For sediment impact only Is the discharge in or within 1 kincher. For dissolved copper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge.	mupstream of a proteinity Ambient backg	pround concentration (µg/l)	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 kg. Tier 1 Estimated river width (m) Tier 2 Bed width (m) 1.48 Manning's n 0.04 Step 3 Mitigration	km upstream of a proteintly Ambient backgrge?	ground concentration (µg/l)	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 kg. Tier 1 Estimated river width (m) Tier 2 Bed width (m) Step 3 Mitigation Estim	mupstream of a proteinity Ambient backgrape? Side slope	ected site for conservation? ground concentration (μg/l) No Long slop	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 kg Tier 1 Estimated river width (m) Tier 2 Bed width (m) Step 3 Mitigation Estim Treatment for Atter	mated effectiveness	ected site for conservation? ground concentration (µg/l) No	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 kg Tier 1 Estimated river width (m) Tier 2 Bed width (m) 1.48 Manning's n 0.04 Step 3 Mitigation Estim Treatment for Atter	mupstream of a proteinity Ambient backgrape? Side slope	ected site for conservation? ground concentration (µg/l) No	0.077
quality only) Base Flow Index (BFI) For dissolved zinc only Water hardness High = >200mg CaCO3/I For dissolved copper on For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge in or within 1 kinched copper on Tier 1 Estimated river width (m) Tier 2 Bed width (m) Step 3 Mitigation Estim Treatment for Atter	mated effectiveness nuation for solubles-ed discharge rate (\(V \)	ected site for conservation? ground concentration (µg/l) No	0.077

Caption 3.5 Routine runoff assessment results for the outfall from catchment E2 (prior to mitigation)



highways england	Highways Engla	nd Water Risk Assessmer	nt Tool	Version 2.0.4 June 2019
		Soluble		Sediment - Chronic Impact
Step 2	EQS - Annual Average Copper 0.19	Concentration Zinc 0.31	ugil	Copper Zinc Pass Pass Pass Pass Pass Pass Pass Pa
Road number		A47		HE Area / DBFO number
Assessment type		Non-cumulative assess	ment (single outfa	fall)
OS grid reference of assessmen	nt point (m)	Easting 61893	4	Northing 304882
OS grid reference of outfall struc	ture (m)	Easting 61893	4	Northing 304882
Outfall number		F		List of outfalls in cumulative
Receiving watercourse		Cantley Stream		asse ssment asse ssment
EA receiving water Detailed Riv	er Network ID	eaew1001000001408	8946	Assessor and affiliation KD Sweco
Date of assessment Notes		12/02/2021		Version of assessment 2 vare at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness taken from
Step 1 Runoff Quality	AADT >=50,000 s	discharge to Cantley Str		region Warm Dry Rainfall site Huntingdon (SAAR 600mm)
Step 2 River Impacts	Annual Q ₉₅ river flow (m	³ /s)	0.013	Freshwater EQS limits:
(Enter zero in Annual	Impermeable road area	drained (ha)	1.79	Bioavailable dissolved copper (µg/l) 1 □
Q ₉₅ river flow box to assess Step 1 runoff	Permeable area draining	g to outfall (ha)	4.555	Bioavailable dissolved zinc (μg/l)
quality only)	Base Flow Index (BFI)		0.617	Is the discharge in or within 1 km upstream of a protected site for conservation?
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	•	For dissolved copper only Ambient background concentration (µg/l)
For sediment impact only	Is there a downstream s	tructure, lake, pond or canal that	t reduces the veloci	ocity within 100m of the point of discharge?
	○ Tier 1 Estimate	ed river width (m)	1	
	© Tier 2 Bed wid	th (m)	2.41	Manning's n 0.04 Side slope (m/m) 0.5 Long slope (m/m) 0.005
Step 3 Mitigation		Brief description		Estimated effectiveness Treatment for Solubles - Settlement of restricted discharge rate (\(\begin{align*}{ll} V_S \end{align*} \) Settlements (\(\begin{align*}{ll} W_S \end{align*} \) Settlement of sediments (\(\begin{align*}{ll} W_S \end{align*} \)
Existing measures				0 D No restriction D D
Proposed measures				0 No restriction 0 D

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



highways england	Highways Englan	nd Water Risk Assessment To	ool	Version 2.0.4 June 2019		
		Soluble				Sediment - Chronic Impact
Step 2	EQS - Annual Average C Copper 0.16	Concentration Zinc 0.24 -	ugil	Acute Impact Copper Zinc Pass Pass		Pass
Road number		A47		HE Area / DBFO number		
Assessment type		Non-cumulative assessmen	t (single outfall)			-
OS grid reference of assessme	nt point (m)	Easting 619183	, ,, ,	Northing	304861	
OS grid reference of outfall struc	cture (m)	Easting 619182		Northing	304863	
Outfall number		TG1904 1886e		List of outfalls in cumulative		
Receiving watercourse		Cantley Stream		asse ssment		
EA receiving water Detailed Riv	er Network ID	eaew1001000000578499	5	Assessor and affiliation		KD Sweco
Date of assessment		12/02/2021		Version of assessment		2
Step 1 Runoff Quality	AADT >=50,000 an	rd <100,000	Climatic region	Warm Dry ▼ Rainfall si	te [Huntingdon (SAAR 600mm)
Step 2 River Impacts	Annual Q ₉₅ river flow (m ³ /	's)	0.013	Freshwater EQS limits:		
(Enter zero in Annual	Annual Q ₉₅ river flow (m ³ /		0.013	Freshwater EQS limits: Bioavailable dissolved copper (μ	g/l)	1 0
(Enter zero in Annual Q ₉₅ river flow box to	Impermeable road area d	rained (ha)		Bioavailable dissolved copper (μ	g/l)	
(Enter zero in Annual		rained (ha)	1.234			10.9
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff	Impermeable road area d	rained (ha)	0.47	Bioavailable dissolved copper (μg/l) Bioavailable dissolved zinc (μg/l) Is the discharge in or within 1 km upstrea	am of a protect	10.9
(Enter zero in Annual Q ₀₅ river flow box to assess Step 1 runoff quality only)	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness	to outfall (ha) High = >200mg CaCO3/I	0.47 0.617	Bioavailable dissolved copper (μg/l) Bioavailable dissolved zinc (μg/l) Is the discharge in or within 1 km upstrea	am of a protect	ted site for conservation?
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	to outfall (ha) High = >200mg CaCO3/I	0.47 0.617	Bioavailable dissolved copper (μg/l) Bioavailable dissolved zinc (μg/l) Is the discharge in or within 1 km upstrea	am of a protect	ted site for conservation? No und concentration (μg/l)
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	rained (ha) to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (µg/l) Bioavailable dissolved zinc (µg/l) Is the discharge in or within 1 km upstrea For dissolved copper only Am thin 100m of the point of discharge?	am of a protect	ted site for conservation? No volume concentration (µg/l) No volume concentration (µg/l)
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	rained (ha) to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (μg/l) Bioavailable dissolved zinc (μg/l) Is the discharge in or within 1 km upstrea	am of a protect	ted site for conservation? No volume concentration (µg/l) No volume concentration (µg/l)
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	rained (ha) to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (µg/l) Bioavailable dissolved zinc (µg/l) Is the discharge in or within 1 km upstrea For dissolved copper only Am thin 100m of the point of discharge?	am of a protect ablent backgro Side slope (i	ted site for conservation? No volume concentration (µg/l) No volume concentration (µg/l)
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	rained (ha) to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (µg/l) Bioavailable dissolved zinc (µg/l) Is the discharge in or within 1 km upstrea For dissolved copper only Am thin 100m of the point of discharge?	am of a protect ablent backgro Side slope (i	ted site for conservation? No volume concentration (µg/l) No volume concentration (µg/l)
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	rained (ha) to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (µg/l) Bioavailable dissolved zinc (µg/l) Is the discharge in or within 1 km upstrea For dissolved copper only Am thin 100m of the point of discharge? Inning's n 0.04 Estimated effe	side slope (i	ted site for conservation? No volum concentration (µg/l) No
(Enter zero in Annual Q ₉₅ river flow box to assess Step 1 runoff quality only) For dissolved zinc only For sediment impact only	Impermeable road area d Permeable area draining Base Flow Index (BFI) Water hardness Is there a downstream str	to outfall (ha) High = >200mg CaCO3/I ructure, lake, pond or canal that red d river width (m) n (m)	1.234 0.47 0.817 uces the velocity wi	Bioavailable dissolved copper (µg/l) Bioavailable dissolved zinc (µg/l) Is the discharge in or within 1 km upstreated that the discharge in or within 100m of the point of discharge? Discription	side slope (i	in/m) 0.5 Long slope (m/m) 0.005

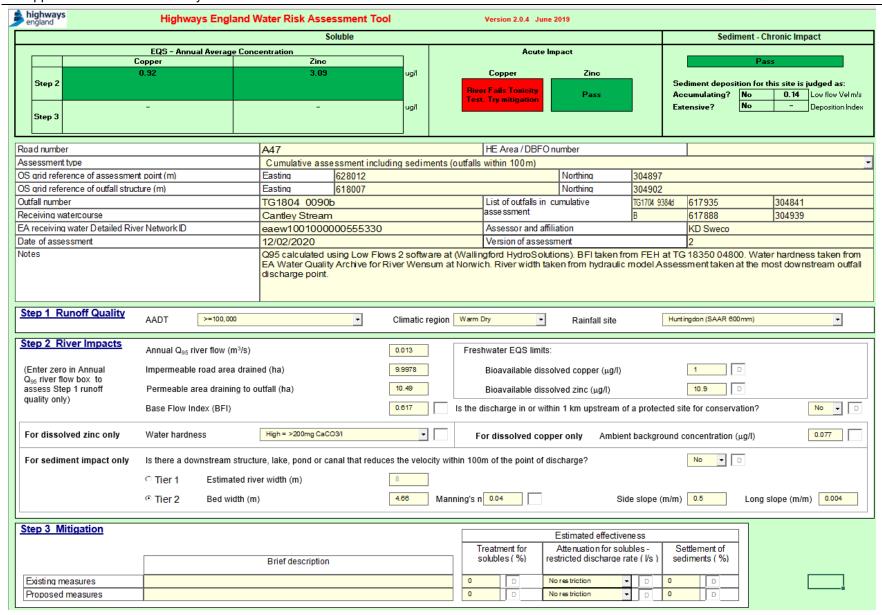
Caption 3.7 Routine runoff assessment results for the outfall from catchment F2 (prior to mitigation)



highways england	Highways England	Water Risk Assessment Too	ol	Version 2.0.4 June 2019			
		Soluble				Sediment -	Chronic Impact
	EQS - Annual Average Con	centration		Acute Impact			
	Copper	Zinc				The state of the s	Pass
Step 2	0.13	0.15	ug/l	Copper Zir	ic	Sadiment denseitien (e	or this site is judged as:
Зсер 2				Pass Pa	55	Accumulating? No	0.14 Low flow Velm/s
	-	-	ug/l			Extensive? No	- Deposition Index
Step 3							
Road number		A11		HE Area / DBFO number			
Assessment type		Non-cumulative assessment	(single outfa	l) .			-
OS grid reference of assessmer	nt point (m)	Easting 628012		Northing	304897		
OS grid reference of outfall struc	ture (m)	Easting 618007		Northing	304902		
Outfall number		TG1804 0090b		List of outfalls in cumulative			
Receiving watercourse		Cantley Stream		asse ssment			
EA receiving water Detailed Riv	er Network ID	eaew1001000000564062		Assessor and affiliation		KD Sweco	
Date of assessment		12/02/2021		Version of assessment		2	
Notes				re at (Wallingford HydroSolutions). BFI		at TG 18350 04800. W	ater hardness taken from
		EA Water Quality Archive for i	River vvenst	ım at Norwich. River width taken from h	yaraulic model.		
Step 1 Runoff Quality	AADT >10.000 and <50	0,000	Olim eti e ee	ning Wass Dr.		11tid (CAAD 900)	
	AADT >10,000 and <50	5,000	Climatic re	gion Warm Dry _ ■ Rainf	all site	Huntingdon (SAAR 600mm)	
Step 2 River Impacts							
	Annual Q ₉₅ river flow (m ³ /s)		0.013	Freshwater EQS limits:			
(Enter zero in Annual	Impermeable road area drair	ned (ha)	0.979	Bioavailable dissolved coppe	er (µg/l)	1 D	
Q ₉₅ river flow box to	Dormooble area draining to	outfall /ha)	0.679	Diagonilable diagonal size (- #3	10.9 D	
assess Step 1 runoff quality only)	Permeable area draining to	outiaii (na)	0.075	Bioavailable dissolved zinc (μg/I)	10.9	
4===, ==,,	Base Flow Index (BFI)		0.617	Is the discharge in or within 1 km up	stream of a protec	ted site for conservation?	No ▼
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	•	For dissolved copper only	Ambient backgro	ound concentration (µg/l)	0.077
For sediment impact only	Is there a downstream struct	ture. lake, pond or canal that reduc	es the veloci	ty within 100m of the point of discharge?		No - D	
				,			
	Tier 1 Estimated riv	ver width (m)	1				
	Tier 2 Bed width (m	n)	4.66	Manning's n 0.04	Side slope (m/m) 0.5 Lon	g slope (m/m) 0.004
	<u> </u>						
Step 3 Mitigation							
					effectiveness	0 11	
		Daint de naviuti			n for solubles - charge rate (Vs)	Settlement of sediments (%)	
		Brief description		Johnson 707 Testricted dis	charge rate (V3)	Scalinents (/0)	
Existing measures				0 No restriction	▼ D	0 D	
Proposed measures				0 No restriction	▼ D	0 D	

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





Caption 3.9 Cumulative routine runoff assessment results for the outfalls from catchments A, B, H, I and J (prior to mitigation)



highways england	Highways England	Water Risk Assessment Too	ol	Version 2.0.4 June 2019
		Soluble		Sediment - Chronic Impact
Step 2	EQS – Annual Average Cor Copper 0.92	Zinc 3.09	ug/l	Acute Impact Pass Copper Zinc Sediment deposition for this site is judged as:
Step 3	0.59	1.88	ug/l	Pass Pass Accumulating? Extensive? No 0.14 Low flow Vel m/s Deposition Index
Road number		A47		HE Area / DBFO number
Assessment type		Cumulative assessment inclu	ding sedime	ments (outfalls within 100m)
OS grid reference of assessme	nt point (m)	Easting 628012		Northing 304897
OS grid reference of outfall struc	cture (m)	Easting 618007		Northing 304902
Outfall number		TG1804 0090b		List of outfalls in cumulative TG1704 93841 617 935 304841
Receiving watercourse		Cantley Stream		asse ssment B 617888 304939
EA receiving water Detailed Riv	er Network ID	eaew1001000000555330		Assessor and affiliation KD Sweco
Date of assessment Notes		12/02/2020		Version of assessment 2 vare at (Wallingford HydroSolutions). BFI taken from FEH at TG 18350 04800. Water hardness taken from
		EA Water Quality Archive for i discharge point.	River Wensi	sum at Norwich. River width taken from hydraulic model Assessment taken at the most downstream outfall
Step 1 Runoff Quality	AADT >=100,000	•	Climatic re	region Warm Dry Rainfall site Huntingdon (SAAR 600mm)
Step 2 River Impacts	Annual Q ₉₅ river flow (m ³ /s))	0.013	Freshwater EQS limits:
(Enter zero in Annual Q ₉₅ river flow box to	Impermeable road area dra		9.9978	Bioavailable dissolved copper (μg/l)
assess Step 1 runoff quality only)	Permeable area draining to	outfall (ha)	10.49	Bioavailable dissolved zinc (μg/l)
quality offiy)	Base Flow Index (BFI)		0.617	Is the discharge in or within 1 km upstream of a protected site for conservation?
For dissolved zinc only	Water hardness	High = >200mg CaCO3/I	-	For dissolved copper only Ambient background concentration (µg/l)
For sediment impact only	Is there a downstream struc	cture, lake, pond or canal that reduc	es the veloc	ocity within 100m of the point of discharge?
	○ Tier 1 Estimated ri	iver width (m)	8	
	© Tier 2 Bed width (i	m)	4.66	Manning's n 0.04 Side slope (m/m) 0.5 Long slope (m/m) 0.004
Step 3 Mitigation				
Step 6 Imaganori		Brief description		Estimated effectiveness Treatment for solubles (%) Attenuation for solubles - restricted discharge rate (Vs) sediments (%)
Existing measures				0 D No restriction D D
Proposed measures	Detention basin (grass lined) for	77% of the catchment		39 No restriction No restriction 39

Caption 3.10 Routine runoff assessment results for the outfall from catchment A, B, H, I and J with proposed measures included



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 Cantley Stream.

4.2. Method

- 4.2.1. Spillage assessments were completed for all outfalls, using the approach as detailed within the Appendix D of DMRB LA113. The methodology uses a prepared spreadsheet to input parameters relating to waterbody type, road type, annual average daily traffic (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:

PINC= PSPI x PPOI

4.2.5. Where:



- PINC = the probability of a spillage with an associated risk of a serious pollution incident occurring
- PPOL = the probability, given a spillage, that a serious pollution incident will result. An appropriate value for this is selected from Table D2 in DMRB LA113 for outfalls. This will depend on the sensitivity of the water course and how soon it can be reached by the emergency services.

4.3. 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 Priority Habitats located within the vicinity of, and downstream of, the outfalls. This assessment included the additional mitigation measures noted in section 3.3.
- 4.3.2. The results from each accidental spillage assessment can be seen in Captions 4.1 to 4.8.



			View Parame	eters	Reset Spillage Risk	Go To Int	erface			
thod D -	ent of Priority Outfalls									
	assessment of risk from ac	ccidental spillage		Additional col	lumns for use if other ro	ads drain to the sa	ame outfall		1	
			A (main road)	В	С	D	Е	F	1	
	body type		Surface watercours	se						
	h of road draining to outfall (1	m)	1,084.00							
	Type (A-road or Motorway)		A						4	
	ad, is site urban or rural? ion type		Rural No junction						4	
	ion (response time for emer	gency services)	< 1 hour						1	
	flow (AADT two way)	90110) 00111000)	48,800						1	
% HG			5.4						1	
	ge factor (no/10" HGVkm/ye	ar)	0.29							
	of accidental spillage		0.00030	0.00000	0.00000	0.00000	0.00000	0.00000	1	
	ability factor of pollution incident		0.60 0.00018	0.60	0.60 0.00000	0.60	0.60	0.60 0.00000		Return Period
	greater than 0.01?		0.00018 No	No	0.00000 No	No	0.00000 No	0.00000 No	Totals	(years)
	n period without pollution rec	duction measures	0.00018	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5512
	ng measures factor		1	0.0000	0.0000	0.0000	0.0000	0.0000	0.0002	
	n period with existing pollutio	on reduction	0.00018	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5512
	sed measures factor		1							
7 Resid	lual with proposed Pollution	reduction measures	0.00018	0.00000	0.00000	0.00000	0.00000	0.00000	0.0002	5512
	Snillago Factor					Indication for Spill	re Pollution Risk Re ages	eduction Factors		
F	Spillage Factor Serious Accidental Spillages							eduction Factors Optimum Risk Reduction Factor		
F		Motorways F	tural Trunk	Urban Trunk		for Spill	ages System	Optimum Risk Reduction Factor		
	Serious Accidental Spillages (Billion HGV km/ year)	0.36	0.29	0.31		for Spill	ages System	Optimum Risk		
	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road	0.36 0.43	0.29 0.83	0.31 0.36		Filter Dra Grassed Pond	System ain Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5		
	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout	0.36	0.29 0.83 3.09	0.31 0.36 5.35		Filter Dra Grassed Pond Wetland	ages System ain Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4		
ocation	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	0.36 0.43	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46		Filter Dra Grassed Pond Wetland Soakawa	System ain Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6		
Location	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Filter Dra Grassed Pond Wetland Soakawa Sedimen	ages System sin Ditch / Swale sy / Infiltration basin t Trap	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6		
Location	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	0.36 0.43	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46		Filter Dra Grassed Pond Wetland Soakawe Sedimen Unlined I	system System Ditch / Swale System Ditch / Swale System Trap Ditch	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7		
Location	Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Filter Dra Grassed Pond Wetland Soakawa Sedimen	ages System ain Ditch / Swale ay / Infiltration basin t Trap Ditch k / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6		

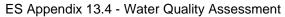
Caption 4.1 Accidental spillage assessment results for the outfall from Catchment A (existing and proposed)





3		nways and		View Parame	eters	Reset	t Spillage Risk	Go To Interf	ace			
Asse	ssn	nent of Priority Outfalls										
Mothe	M D	- assessment of risk from ac	ccidental enillar	10	Additional	columne	for use if other road	ds drain to the same	a outfall		1	
Weuld	Ju D	- assessment of fisk from at	cciuentai spinaţ	A (main road)	Additional B		C	D D	E	F		
D1 1	Wate	er body type					Surface watercourse	_		Surface watercourse) 	
D2	Leng	th of road draining to outfall (m)	653.00	1,000.00		853.00	220.00	342.00	350.00		
		d Type (A-road or Motorway)		A	Α		A	A	A	A		
		oad, is site urban or rural?		Rural	Rural		Rural		Rural	Rural		
		tion type tion (response time for emer	nancy sandras)	No junction < 1 hour	Side road < 1 hour		Slip road < 1 hour	Slip road < 1 hour	Slip road < 1 hour	Slip road < 1 hour		
		ic flow (AADT two way)	gency services)	13,300	1,100		12,200		8,900	10100		
D8				3	18		4	5	3	4		
		age factor (no/10° HGVkm/ye	ar)	0.29	0.93		0.83		0.83	0.83		
		of accidental spillage		0.00003	0.00007		0.00013		0.00003	0.00004		
		ability factor		0.60 0.00002	0.60		0.60		0.60	0.60		Return Period
		of pollution incident k greater than 0.01?		0.00002 No	No				0.00002 N o	0.00003 No	Totals	(years)
		rn period without pollution rec	duction measure		0.00004				0.00002	0.00003	0.0002	4989
		ing measures factor		1	1		1	1	1	1		
		rn period with existing pollutio	on reduction	0.00002	0.00004				0.00002	0.00003	0.0002	4989
		osed measures factor		0.6	0.6				0.6	0.6		
D17	Resi	dual with proposed Pollution	reduction meas	ures 0.00001	0.00002		0.00005	0.00002	0.00001	0.00002	0.0001	8315
	lu stif	Spillage Factor	g mea sures fact	iors:			Justification for che		Pollution Risk Red	luction Factors Optimum Risk		
		Serious Accidental Spillages							System	Reduction Factor		
		(Billion HGV km/ year)	Motorways		Jrban Trunk	2		Filter Drain		0.6		1
		No junction	0.36	0.29	0.31	I		Grassed Dit	ch / Swale	0.6		
	ie ie	Slip road Roundabout	0.43 3.09	0.83 3.09	0.36 5.35	ı		Pond		0.5		
	Location	Cross road	-	0.88	1.46	ı		Wetland	Infiltration basin	0.4 0.6		
	ادًا	Side road	-	0.93	1.81	I		Sediment To		0.6		
		Total	0.37	0.45	0.85	J		Unlined Dito		0.7		
								Penstock / Notched We	eir	0.4 0.6		
								Oil Separate	or	0.5		
The w	orks	heet should be read in conjur	nction with DMR	B 11.3.10.								

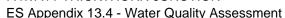
Caption 4.2 Accidental spillage assessment results for the outfall from Catchments B, H and I





highways england			View Para	meters	Reset Spillage Risk	Go To Int	terface			
Assessment of P	Priority Outfalls	•								
Method D - assessm	nent of risk from a	ccidental spilla	ge	Additiona	columns for use if other ro	ads drain to the sa	ame outfall		1	
			A (main road	j) E	C	D	E	F	1	
)1 Water body type			Surface waterco		atercourse					
2 Length of road		(m)	288.00	391.00					1	
Road Type (A-road, is site			A Rural	Rural					-	
5 Junction type	s urbair or rurar?		Roundabout	No junctio	in .				1	
	onse time for emer	gency services		< 1 hour					1	
7 Traffic flow (AAL	DT two way)		36,660	15,180						
8 % HGV			4	4						
	(no/10° HGVkm/ye	ear)	3.09	0.29	10.00000	0.00000	0.00000	0.00000		
9 Risk of accident 10 Probability factor			0.00048	0.00003	0.00000	0.00000	0.00000	0.00000	1	
11 Risk of pollution			0.00029	0.00002	0.00000	0.00000	0.00000	0.00000		Return Period
12 Is risk greater to	than 0.01?		No	No	No	No	No	No	Totals	(years)
13 Return period v		duction measur		0.00002	0.00000	0.00000	0.00000	0.00000	0.0003	3324
14 Existing measu			1	1						
15 Return period v		on reduction	0.00029	0.00002	0.00000	0.00000	0.00000	0.00000	0.0003	3324
16 Proposed mea		roduction mos	0.6 sures 0.00017	0.6	0.00000	0.00000	0.00000	0.00000	0.0002	5540
17 Residual Willia	proposed Foliation	reduction mea	sules 0.00017	0.00001	0.00000	0.00000	0.00000	0.00000	0.0002	5540
						Indicati	ve Pollution Risk Re	duction Factors		
Spillage I	Factor					for Spill				
Serious A	Accidental Spillages	Motorways	Rural Trunk	Urban Trun	k		System	Optimum Risk Reduction Factor		
No junction		0.36	0.29	0.31	H	Filter Dra		0.6		
loui		0.43	0.83	0.36	I	Pond	Ditch / Swale	0.6 0.5		
Roundabo	out	3.09	3.09	5.35	I	Wetland		0.4		
		-	0.88	1.46	I		ay / Infiltration basin	0.6		
Cross road		-	0.93	1.81 0.85	I	Sedimer		0.6		
Side road		0.27					District			
Cross road Side road Total		0.37	0.45	0.05	_	Unlined		0.7		
Side Idad		0.37	0.45	0.03	-	Penstoc	k / valve	0.4		
Side Idad		0.37	0.45	0.05	_		k / valve Weir			

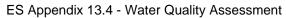
Caption 4.3 Accidental spillage assessment results for the outfall from Catchments B, H and I continued





engl	hways and		View Param	eters	Reset	t Spillage Risk	Go To In	terface			
sessr	ment of Priority Outfalls										
hod D	- assessment of risk from a	ccidental snillane		Additiona	l columns	s for use if other roa	ade drain to the e	ame outfall		٦	
illou D	- ussessment of risk from us	celucitui spiiluge	A (main road)		В	C	D	E	F	1	
Wate	er body type		Surface watercour		atercourse		_				
	gth of road draining to outfall (m)	284.00	148.00							
	d Type (A-road or Motorway)		A	Α							
	oad, is site urban or rural?		Rural	Rural							
	ction type	annov contingo)	Side road < 1 hour	No junction	on					-	
	ation (response time for emer fic flow (AADT two way)	gency services)	1,100	1,100						-	
% H			18	18							
	lage factor (no/10 HGVkm/ye	ar)	0.93	0.29	•		•			1	
Risk	of accidental spillage	,	0.00002	0.00000		0.00000	0.00000	0.00000	0.00000		
	pability factor		0.60	0.60		0.60	0.60	0.60	0.60		
	of pollution incident		0.00001	0.00000		0.00000	0.00000	0.00000	0.00000		Return Period
	sk greater than 0.01?	duation magazir	No	No		No	No	No	No	Totals	(years)
	ırn period without pollution red ting measures factor	uuciion measures	0.00001	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	75110
	ung measures racion irn period with existing pollution	on reduction	0.00001	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	75110
	osed measures factor	on readons.	1	1		0.0000	0.0000	0.0000	0.0000	0.0000	
	idual with proposed Pollution	reduction measures	0.00001	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	75110
	fication for choice of existin	g mea sures factors:				Justification for cl	hoice of propose	d measures factors			
	fication for choice of existing	g mea sures factors:				Justification for cl			eduction Factors		
		g mea sures factors:				Justification for c		ve Pollution Risk Re			
	Spillage Factor Serious Accidental Spillages		Rural Trunk	Urban Trum	7	Justification for c	Indicat for Spil	ve Pollution Risk Re lages System	Optimum Risk Reduction Factor		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year)	Motorways		Urban Trun	7	Justification for cl	Indicat for Spil	ve Pollution Risk Re lages System ain	Optimum Risk Reduction Factor 0.6		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction		Rural Trunk 0.29 0.83	Urban Trun 0.31 0.36	7	Justification for cl	Indicat for Spil Filter Di Grasset	ve Pollution Risk Re lages System	Optimum Risk Reduction Factor 0.6 0.6		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year)	Motorways 0.36	0.29	0.31	7	Justification for cl	Indicat for Spil Filter Dr Grassec Pond	ve Pollution Risk Re lages System ain I Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	Motorways 0.36 0.43	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46	7	Justification for cl	Indicat for Spil Filter Dr Grassee Pond Wetland	ve Pollution Risk Re lages System ain I Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	7	Justification for c	Indicat for Spil Filter Dr Grassee Pond Wetland	ve Pollution Risk Re lages System ain I Ditch / Swale ay / Infiltration basin	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	Motorways 0.36 0.43	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46	7	Justification for cl	Filter Dr Grassed Pond Wetland Soakaw Sedime Unlined	ve Pollution Risk Re lages System ain I Ditch / Swale ay / Infiltration basin It Trap Ditch	Optimum Risk Reduction Factor 0.6 0.5 0.4 0.6 0.6 0.7		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	7	Justification for cl	Filter Dr Grassee Pond Wetland Soakaw Sedime Unlined Penstod	ve Pollution Risk Re lages System ain I Ditch / Swale ay / Infiltration basin It Trap Ditch k / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7		
Justi	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	7	Justification for cl	Filter Dr Grassed Pond Wetland Soakaw Sedime Unlined	ve Pollution Risk Re lages System ain I Ditch / Swale ay / Infiltration basin It Trap Ditch k / valve Weir	Optimum Risk Reduction Factor 0.6 0.5 0.4 0.6 0.6 0.7		

Caption 4.4 Accidental spillage assessment results for the outfall from Catchment E





ssessment of Priority Ou		View Parame	ters	Reset	Spillage Risk	Go To Ir	iterface			
	tfalls									
thod D - assessment of risk fi	rom accidental snillage		Additional	columns	for use if other roa	ads drain to the	ame outfall		٦	
thou b - assessment of risk in	om accidental spillage	A (main road)	В		C	D	E	F	1	
1 Water body type		Surface watercours	Surface wa	atercourse						
2 Length of road draining to or		50.00	243.00							
Road Type (A-road or Motor		A	Α							
If A road, is site urban or rur	al?	Rural	Rural							
Junction type		Side road	No junctio	n					_	
Location (response time for	emergency services)	< 1 hour 1.100	< 1 hour 1.100						4	
7 Traffic flow (AADT two way) 8 % HGV		1,100	1,100						-	
Spillage factor (no/10 HGV)	km/vear)	0.93	0.29	_		•			-	
Risk of accidental spillage	uniyear)	0.00000	0.00001		0.00000	0.00000	0.00000	0.00000		
0 Probability factor		0.60	0.60		0.60	0.60	0.60	0.60		
11 Risk of pollution incident		0.00000	0.00000		0.00000	0.00000	0.00000	0.00000		Return Period
2 Is risk greater than 0.01?		No	No		No	No	No	No	Totals	(years)
13 Return period without polluti	on reduction measures	0.00000	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	197159
14 Existing measures factor		1	1							
15 Return period with existing p	ollution reduction	0.00000	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	197159
16 Proposed measures factor		1	1							
Residual with proposed Pol	lution reduction measures	0.00000	0.00000		0.00000	0.00000	0.00000	0.00000	0.0000	197159
							ive Pollution Risk Re	duction Factors		
Spillage Factor				=		Indicat for Spi				
Spillage Factor Serious Accidental Spill (Billion HGV km/ year		Rural Trunk U	Jrban Trunk			for Spi	llages System	Optimum Risk Reduction Factor		
Serious Accidental Spill (Billion HGV km/ year	Motorways F			k		for Spi	Ilages System rain	Optimum Risk Reduction Factor 0.6		
Serious Accidental Spill (Billion HGV km/ year) No junction		Rural Trunk U 0.29 0.83	1rban Trunk 0.31 0.36	k		Filter D Grasse	llages System	Optimum Risk Reduction Factor 0.6 0.6		
Serious Accidental Spill (Billion HGV km/ year) No junction	0.36 Motorways	0.29	0.31	k		Filter D Grasse Pond	System rain d Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5		
Serious Accidental Spill (Billion HGV km/ year, No junction Slip road Roundabout Cross road	0.36 0.43	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46	k		Filter D Grasse Pond Wetlan	System rain d Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6		
Serious Accidental Spill (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	k		Filter D Grasse Pond Wetlan	System rain d Ditch / Swale d vay / Infiltration basin	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4		
Serious Accidental Spill (Billion HGV km/ year, No junction Slip road Roundabout Cross road	0.36 0.43 3.09	0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46	k		Filter D Grasse Pond Wetlan Soakav	System rain d Ditch / Swale d vay / Infiltration basin nt Trap	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6		
Serious Accidental Spill (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	k		Filter D Grasse Pond Wetlan Soakav Sedime Unlined Pensto	System rain d Ditch / Swale d vay / Infiltration basin nt Trap Ditch Ck / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6		
Serious Accidental Spill (Billion HGV km/ year, No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	k		Filter D Grasse Pond Wetlan Soakaw Sedime Unlined	System rain d Ditch / Swale d vay / Infiltration basin nt Trap Ditch Ck / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7		
Serious Accidental Spill (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	0.36 0.43 3.09	0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81	k		Filter D Grasse Pond Wetlan Soakav Sedime Unlined Pensto	System rain d Ditch / Swale d vay / Infiltration basin nt Trap Ditch bck / valve d Weir	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7		

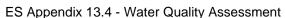
Caption 4.5 Accidental spillage assessment results for the outfall from Catchment E2





engla	nways and		View Para	ameters	Reset Spillage Risk	Go To Inte	erface			
sessn	ment of Priority Outfalls	;								
									_	
hod D	 assessment of risk from a 	ccidental spilla	je	Additional	columns for use if other ro	ads drain to the sai	me outfall			
			A (main roa	,		D	E	F		
	er body type			ourse Surface wa	atercourse					
	gth of road draining to outfall ('m)	626.00	492.00						
	d Type (A-road or Motorway)		A	A					_	
	oad, is site urban or rural?		Rural	Rural						
	ction type ation (response time for emer	annou nonicon)	No junction < 1 hour	Slip road < 1 hour				_	-	
	ic flow (AADT two way)	gency services)	68,700	12,200					-	
% H			4	4					-	
	age factor (no/10 HGVkm/ye	ar)	0.29	0.83	1	•	•	•	┥	
	of accidental spillage	,	0.00018	0.00007	0.00000	0.00000	0.00000	0.00000		
Prob	ability factor		0.60	0.60	0.60	0.60	0.60	0.60		
	of pollution incident		0.00011	0.00004	0.00000	0.00000	0.00000	0.00000		Return Period
	sk greater than 0.01?		No	No	No	No	No	No	Totals	(years)
	ırn period without pollution red	duction measure	es 0.00011	0.00004	0.00000	0.00000	0.00000	0.00000	0.0002	6540
	ting measures factor		1	1						
	ırn period with existing pollutio	on reduction	0.00011	0.00004	0.00000	0.00000	0.00000	0.00000	0.0002	6540
6 I Dron	osed measures factor		1	1						
				0.00004	0.00000	0.00000	0.00000	0.00000	0.0002	6540
7 Resi	idual with proposed Pollution			0.00004	•	choice of proposed	measures factors:			
7 Resi				0.00004	•	choice of proposed		eduction Factors		
7 Resi	fication for choice of existing			0.00004	•	choice of proposed	e Pollution Risk Re			
7 Resi				Urban Truni	Justification for o	Indicative for Spilla	e Pollution Risk Re ages System	Optimum Risk Reduction Factor		
Resi	Spillage Factor Serious Accidental Spillages (Billion HGV km/year)	g mea sures fac	iors:		Justification for o	Indicative for Spilla	e Pollution Risk Re ages System	Optimum Risk Reduction Factor 0.6		
Justif	fication for choice of existing	g mea sures fac	ors:	Urban Truni	Justification for o	Indicative for Spilla Filter Drai	e Pollution Risk Re ages System	Optimum Risk Reduction Factor 0.6 0.6		
Justif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction	g mea sures fac	Rural Trunk 0.29	Urban Truni 0.31	Justification for o	Indicative for Spilla Filter Drai Grassed I	e Pollution Risk Re ages System	Optimum Risk Reduction Factor 0.6 0.6 0.5		
Justif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	g mea sures fac	Rural Trunk 0.29 0.83 3.09 0.88	Urban Truni 0.31 0.36	Justification for o	Indicative for Spilla Filter Drai Grassed Pond Wetland	e Pollution Risk Re ages System in Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6		
Ju stiff	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	Urban Truni 0.31 0.36 5.35 1.46 1.81	Justification for o	Indicative for Spilla Filter Drai Grassed Pond Wetland	e Pollution Risk Renges System in Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4		
Justif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	Motorways 0.36 0.43 3.09	Rural Trunk 0.29 0.83 3.09 0.88	Urban Truni 0.31 0.36 5.35 1.46	Justification for o	Indicative for Spilla Filter Drai Grassed I Pond Wetland Soakaway	e Pollution Risk Re ages System in Ditch / Swale y / Infiltration basin Trap	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6		
Justif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	Urban Truni 0.31 0.36 5.35 1.46 1.81	Justification for o	Indicative for Spilla Filter Drai Grassed Pond Wetland Soakaway Sediment Unlined D Penstock	e Pollution Risk Reages System in Ditch / Swale y / Infiltration basin Trap itich / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7 0.4		
Ju stif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	Urban Truni 0.31 0.36 5.35 1.46 1.81	Justification for o	Indicative for Spilla Filter Drai Grassed I Pond Wetland Soakaway Sediment Unlined D	e Pollution Risk Reages System in Ditch / Swale y / Infiltration basin Trap itch // valve Weir	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7		

Caption 4.6 Accidental spillage assessment results for the outfall from Catchment F





No No No No No No No No	highwa england	ays		View Para	meters	Rese	t Spillage Risk	Go To Inte	rface			
Mailer body type	Assessmei	nt of Priority Outfalls	;									
Mailer body type	Method D . as	seesement of risk from a	ccidental snilla	пе	Additions	al column	s for use if other roa	ide drain to the ear	me outfall		7	
Discription Surface valericourse	wethou D - as	saesament of fisk from at	Coluental Spilla	_							1	
22 Length of road draining to outfall (m)	D1 Water h	ody type			,	ь	-	-		-	-	
13 Road Type (A-road or Michorway) A			(m)		uise						1	
Month Mont			111)	Δ							1	
No junction type No junction No juncti				Rural							1	
Spillage Factor Spillage F											1	
Spillage Factor Spillage F			gency services)								1	
Spillage Factor			<u> </u>								1	
Spillage Factor (not 0" HoVkm/year) 0.29		(,									1	
Pilits of accidental spillage		factor (no/10 HGVkm/ve	ear)							•	1	
10 Probability factor	D9 Risk of	accidental spillage			0.00000		0.00000		0.00000	0.00000	1	
12 Sink greater than 0.01? No Totals (years)	D10 Probabi	lity factor			0.60		0.60	0.60	0.60	0.60	1	
12 Sink greater than 0.01? No Totals (years)	D11 Risk of	pollution incident		0.00012	0.00000		0.00000	0.00000	0.00000	0.00000		Return Period
1											Totals	
15 Return period with existing pollution reduction 0.00012 0.000000 0.000000 0.000000 0.00000000	D13 Return	period without pollution red	duction measure	es 0.00012	0.00000		0.00000	0.00000	0.00000	0.00000	0.0001	8682
16 Proposed measures factor 1	D14 Existing	measures factor		1								
Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) Motorways Rural Trunk Urban Trunk Wigner of the Control of th			on reduction	0.00012	0.00000		0.00000	0.00000	0.00000	0.00000	0.0001	8682
Spillage Factor Serious Accidental Spillages (Billion HSV km/year) Motorways Rural Trunk Urban Trunk Silip road 0.43 0.83 0.36 0.29 0.31 0.45 0.65 0.37 0.45 0.85 0.				1								
Spillage Factor Serious Accidental Spillages Gillion HGV km/year) Motorways Rural Trunk Urban Trunk Urban Trunk System S	D17 Residua	al with proposed Pollution	reduction meas	oures 0.00012	0.00000		0.00000	0.00000	0.00000	0.00000	0.0001	8682
Spillage Factor Serious Accidental Spillages Rural Trunk Urban Trunk Urban Trunk Urban Trunk Silip road 0.43 0.83 0.36 0												
Serious Accidental Spillages (Billion HGV km/ year) Motorways Rural Trunk Urban Trunk Filter Drain 0.6	Sn	illage Factor										
No junction 0.36 0.29 0.31 Grassed Ditch / Swale 0.6		erious Accidental Spillages	Motonways	Rural Trunk	Urban Tru	nk				Reduction Factor		
Slip road 0.43 0.83 0.36 Pond 0.5 Roundabout 3.09 3.09 5.35 Wetland 0.6 Cross road - 0.88 1.46 Side road - 0.93 1.81 Total 0.37 0.45 0.85 Unlined Ditch 0.7								H THE CONTROL OF THE PARTY OF				
Roundabout 3.09 3.09 5.35 Wetland 0.4	l lou								Oitch / Swale			
Sediment Trap 0.6	ie Da											
Sediment Trap 0.6	ts C											
	2 6											
Offilited Ditch			0.37									
IPENSIOCK / VAIVE U.4		iui -	0.01	0.40	0.03							
Notched Weir 0.6												
Oil Separator 0.5												
Oil Separator U.5								Uli Separa	HUI	0.5		

Caption 4.7 Accidental spillage assessment results for the outfall from Catchment F2





engla	nways and		View P	arameters	Reset Spillage Risk	Go To Int	terface			
essn	nent of Priority Outfalls									
		:	_	A -4 -4141	-11 :f -+				¬	
lod D	- assessment of risk from a	ccidental spillag			al columns for use if other i	roads drain to the sa		F	-	
IMoto	er body type		A (main r Surface wat		В	D	E	F	-	
	gth of road draining to outfall (m)	387.00	ercourse					-	
	d Type (A-road or Motorway)	111)	Α						-	
	oad, is site urban or rural?		Rural						1	
	tion type		No junction						1	
Loca	ition (response time for emer	gency services)	< 1 hour							
	ic flow (AADT two way)		36,600							
% H			4							
	age factor <i>(no/10⁹ HGVkm/ye</i>	ar)	0.29							
	of accidental spillage		0.00006	0.00000		0.00000	0.00000	0.00000		
	ability factor		0.60	0.60	0.60 0.00000	0.60	0.60	0.60		Doturn Do
	of pollution incident k greater than 0.01?		0.00004 No	0.00000 No	0.00000 No	0.00000 No	0.00000 No	0.00000 No	Totals	Return Per (years)
	rn period without pollution rec	duction measure		0.00000		0.00000	0.00000	0.00000	0.0000	27791
	ting measures factor	addavii ilicasult	1	0.00000	0.0000	0.00000	0.00000	0.0000	3.0000	2/101
	rn period with existing pollution	on reduction	0.00004	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	27791
	osed measures factor		1							
Resi	dual with proposed Pollution	reduction meas	ures 0.00004	0.00000	0.00000	0.00000	0.00000	0.00000	0.0000	27791
Justif	fication for choice of existing	g mea sures fact	ors:		Justification for	choice of proposed	d measures factors			
Justit	fication for choice of existin _t	g mea sures fact	ors:		Justification for		d measures factors	eduction Factors		
Ju stit	fication for choice of existing	g mea sures fact	ors:		Justification for		ve Pollution Risk Re			
Ju stit	Spillage Factor Serious Accidental Spillages			lithan Tru		Indicati for Spill	ve Pollution Risk Re lages System	Optimum Risk Reduction Factor		
Ju stif	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year)	Motorways	Rural Trunk	Urban Tru		Indicati for Spill	ve Pollution Risk Re lages System sin	Optimum Risk Reduction Factor 0.6		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction	Motorways 0.36		Urban Tru 0.31 0.36		Indicati for Spill Filter Dr. Grassed	ve Pollution Risk Re lages System	Optimum Risk Reduction Factor 0.6 0.6		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year)	Motorways	Rural Trunk 0.29	0.31		Indicati for Spill Filter Dr. Grassed Pond	ve Pollution Risk Re lages System ain Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road	Motorways 0.36 0.43	Rural Trunk 0.29 0.83	0.31 0.36		Indicati for Spill Filter Dra Grassed Pond Wetland	ve Pollution Risk Re ages System ain Ditch / Swale	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4		
Location	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Indicati for Spill Filter Dra Grassed Pond Wetland Soakawa	ve Pollution Risk Re lages System ain Ditch / Swale ay / Infiltration basin	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road	Motorways 0.36 0.43 3.09	Rural Trunk 0.29 0.83 3.09 0.88	0.31 0.36 5.35 1.46		Indicati for Spill Filter Dra Grassed Pond Wetland	ve Pollution Risk Re lages System ain Ditch / Swale ay / Infiltration basin	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Indicati for Spill Filter Dr. Grassed Pond Wetland Soakaw: Sedimer	ve Pollution Risk Relages System ain Ditch / Swale ay / Infiltration basin at Trap	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Indicati for Spill Filter Dr. Grassed Pond Wetland Soakaww. Sedimer Unlined I	ve Pollution Risk Relages System ain Ditch / Swale ay / Infiltration basin tt Trap Ditch k / valve	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7 0.7		
	Spillage Factor Serious Accidental Spillages (Billion HGV km/ year) No junction Slip road Roundabout Cross road Side road	Motorways 0.36 0.43 3.09 -	Rural Trunk 0.29 0.83 3.09 0.88 0.93	0.31 0.36 5.35 1.46 1.81		Filter Dr. Grassed Pond Wetland Soakaw: Sedimer Unlined Penstoc	ve Pollution Risk Relages System ain Ditch / Swale ay / Infiltration basin at Trap Ditch k / valve Weir	Optimum Risk Reduction Factor 0.6 0.6 0.5 0.4 0.6 0.6 0.7 0.4		

Caption 4.8 Accidental spillage assessment results for the outfall from Catchment J



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. A vegetated detention basin is required to treat catchments B, H and I to mitigate an acute copper pollution risk. No other water quality mitigation is required for the remaining catchments. The results of the HEWRAT assessment are summarised in Table 5-1.
- 5.1.2. This assessment represents a worst case scenario for environmental impacts to surface water features. There is an intention to provide filter drains and swales prior to discharging via the outfall, the locations can be found in Table 5-1. However, this is subject to further assessment following the supplementary ground investigations due to start in March 2021.
- 5.1.3. 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).



Table 5-1 Summary of predicted routine runoff and accidental spillages assessment

		Mitigation		Sc	oluble			
Drainage catchment	Mitigation identified by	proposed (subject to supplementary	EQS Annua	_	Acute impac	t	Sediment	Spillage assessment
Gatominent	HEWRAT	ground investigation)	Copper (µg/l)	Zinc (µg/l)	Copper	Zinc		ussessment
A (existing and proposed) and K	None	Filter drains	Pass (0.22)	Pass (0.38)	Pass	Pass	Pass	Pass
B, H and I	Detention basin (vegetated)	Detention basin (vegetated) and filter drains	Pass (0.36)	Pass (1.08)	Pass	Pass	Pass	Pass
E	None	Filter drains and swale	Pass (0.10)	Pass (0.06)	Pass	Pass	Pass	Pass
E2	None	Filter drains and swale	Pass (0.09)	Pass (0.02)	Pass	Pass	Pass	Pass
F	None	Filter drains and (vegetated) detention basin	Pass (0.19)	Pass (0.31)	Pass	Pass	Pass	Pass
F2	None	Filter drains	Pass (0.16)	Pass (0.24)	Pass	Pass	Pass	Pass
J	None	Filter drains	Pass (0.13)	Pass (0.15)	Pass	Pass	Pass	Pass
A, K, B, H, I and J (cumulative)	Detention basin (vegetated)	Detention basin (vegetated) and filter drains	Pass (0.59)	Pass (1.88)	Pass	Pass	Pass	N/A



6. Enhancement measures

6.1.1. A detention basin would attenuate highway drainage from catchment F. The detention basin will be planted with suitable local species to provide further water quality and biodiversity enhancements. Filter drains and swales are also proposed, subject to supplementary ground investigations, which would provide further water quality enhancements. Vegetated detention basins would also reduce nitrate and phosphate concentrations through biological uptake. In addition to providing additional pollution treatment, the vegetated detention basins will provide some biodiversity improvement.

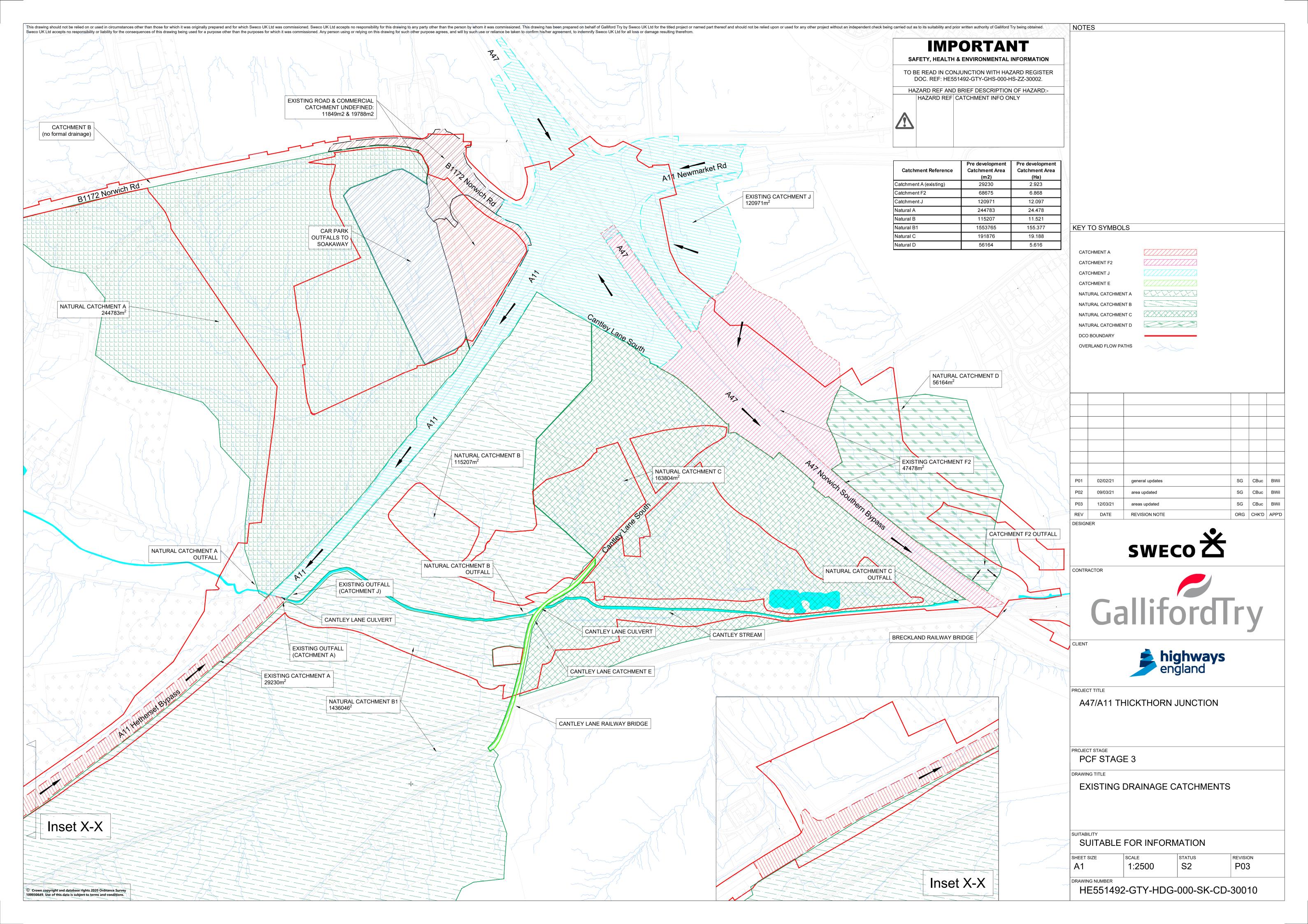


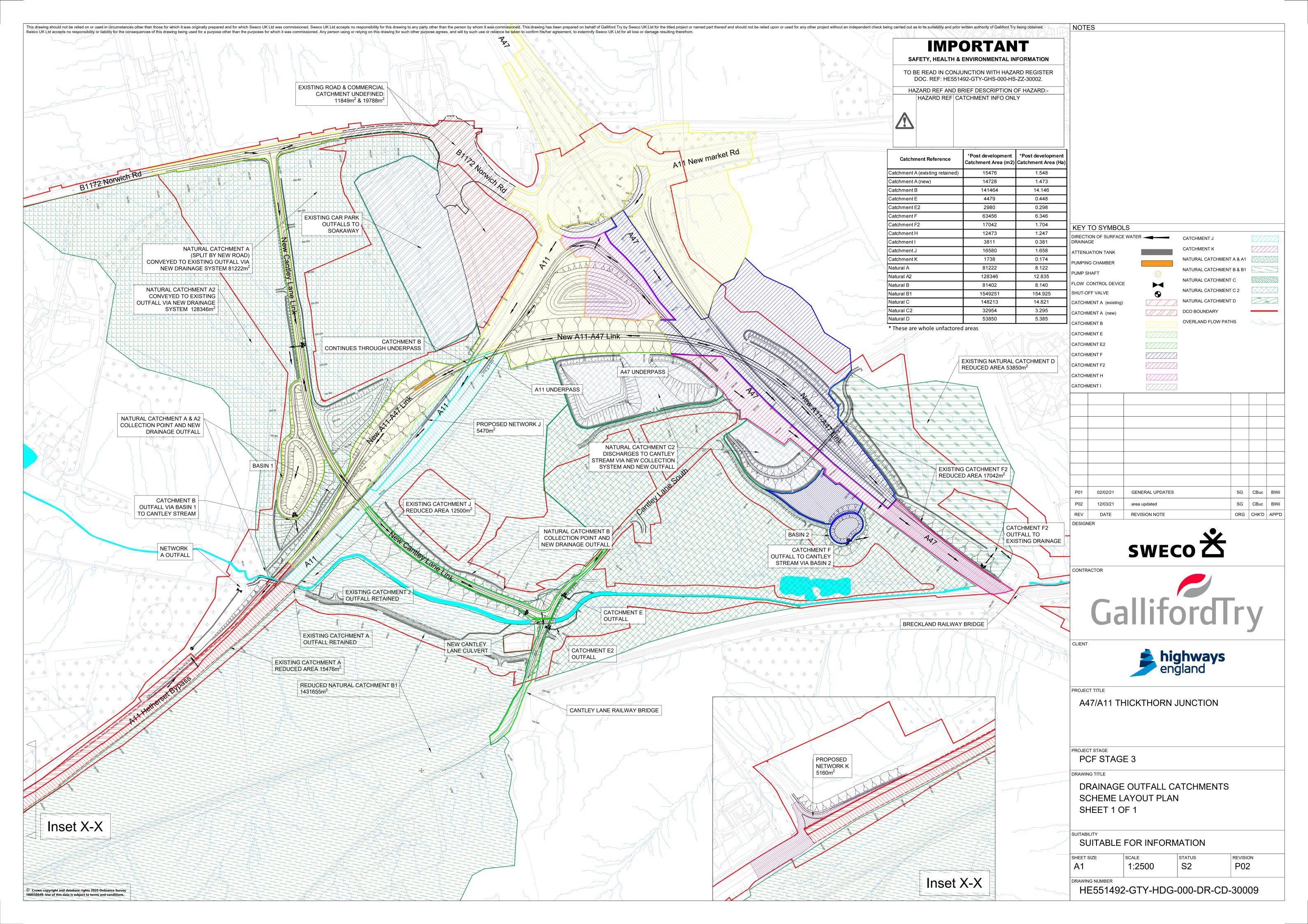
7. References

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Appendix A. Existing and proposed drainage catchment areas







Appendix B. Metal bioavailability assessment

MBAT results for copper



Metal Bioavailability Assessment Tool (M-BAT)

Back

Calculate

Clear Data

	INPUT DATA										RESU	LTS (Copper)		
ID	Location	₩aterbody	Date		Concentration	Concentration	Measured Ni Concentration (dissolved) (µg I ⁻¹)		DOC	Ca	Site-specific PNEC Dissolved Copper (µg I ⁻¹)	BioF	Bioavailable Copper Concentration (μg I ⁻¹)	Risk Characterisation Ratio
1	Thickthorn	Cantley Stream	03/09/2020	1	2	2	1	7.9	4.2	116	13.96	0.07	0.07	0.07
2	Thickthorn	Cantley Stream	24/09/2020	1	2	6	1	7.9	4.3	106	14.37	0.07	0.07	0.07
3	Thickthorn	Cantley Stream	29/10/2020	1	2	5	1	8	4.9	164	15.20	0.07	0.07	0.07
4	Thickthorn	Cantley Stream	01/12/2020	1	2	7	1	8.1	4	186	10.26	0.10	0.10	0.10
5	Thickthorn Cantley Stream 16/12/2020 1 3 2 1 8 4.3									165	12.87	0.08	0.08	0.08
6	Thickthorn	Cantley Stream	12/01/2021	2	3	43	1	8	4.2	158	12.48	0.08	0.16	0.16