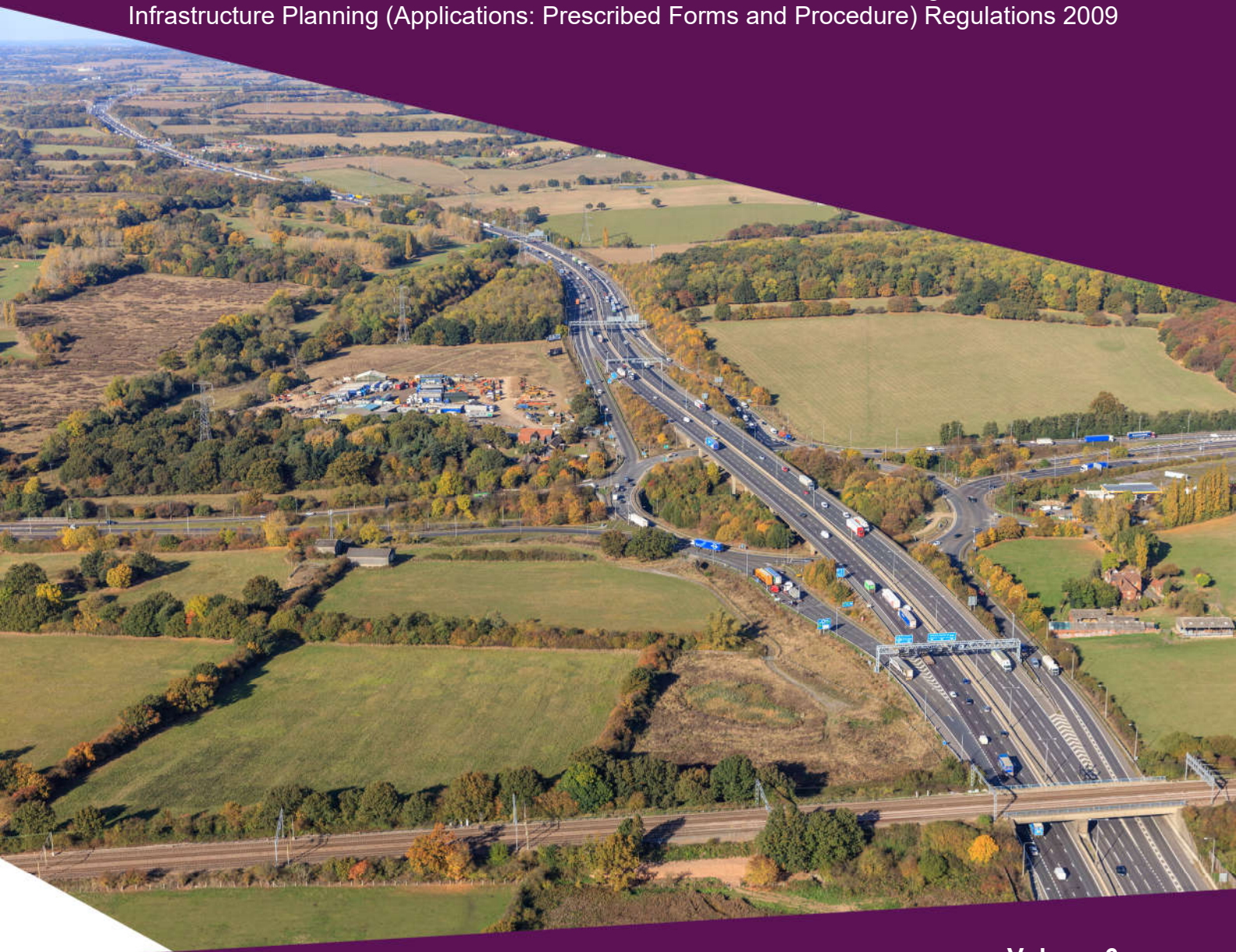
M25 junction 28 improvement scheme
TR010029
6.3 Environmental Statement
Appendix 8.1: HAWRAT outputs

APFP Regulation 5(2)(a)
Planning Act 2008 APFP
Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Volume 6
May 2020

Infrastructure Planning

Planning Act 2008

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

M25 junction 28 scheme
Development Consent Order 202[x]

6.3 ENVIRONMENTAL STATEMENT
APPENDIX 8.1: HAWRAT OUTPUTS

Regulation Number:	Regulation 5(2)(a)
Planning Inspectorate Scheme Reference:	TR010029
Application Document Reference:	TR010029/APP/6.3
Author:	M25 junction 28 improvement scheme project team, Highways England

Version	Date	Status of Version
1	May 2020	Application issue

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Chapter Pages

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Appendix 8.1
HAWRAT outputs

8. HAWRAT outputs

8.1 Introduction

8.1.1 This appendix provides the modelling outputs from the water quality modelling tool HAWRAT reported in the Environmental Statement Chapter 8 (application document TR010029/APP/6.1). For transparency the results are simply presented in screen-shot format. The following is presented:

- HAWRAT Method A – Surface water quality – Individual outfalls
- HAWRAT Method A – Surface water quality – Cumulative outfalls
- HAWRAT Method D – Spillage risk

8.1.2 HAWRAT tests have been undertaken for three scenarios these are:

1. Existing baseline for existing catchments (i.e. catchment 1 is new and thus no existing baseline conditions to assess).
2. Proposed Scheme without mitigation - to understand the need/requirement for surface water quality mitigation.
3. Proposed Scheme with mitigation.

8.1.3 For the cumulative tests, not all outputs show the sediment test (simply a blank box displayed) as these outfalls are more than 100 m in distance apart, and thus in line with industry guidance only soluble tests have been undertaken in such cases.

8.1.4 The data sources used are presented in Chapter 8. However, for ease these are provided in Table 8.1 below.

Table 8.1: Input data sources

Parameter	Data source
Impermeable catchment area	Atkins drainage / engineering team
Permeable catchment area	Atkins drainage / engineering team
Traffic data	Atkins traffic modelling
Q95 Flow	Low Flows Modelling software
BFI	from Low Flows Modelling software
Water hardness	DEFRAS hardness map
Channel width	Master map
Mitigation removal efficiency	HD 33/16. Note, for the cumulative assessments, the % of the catchment with the mitigation was factored from the total catchment area as to avoid over-estimating the % removal

8.2 HAWRAT outputs

8.2.1 Method A - HAWRAT outputs

EXISTING

OUTFALL 1

N.A - new catchment - page left intentionally blank

EXISTING

OUTFALL 2

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.01	0.04	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	7	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.132 | Permeable area draining to outfall (ha): 0.108

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 — Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.01	0.03	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	6	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.114 | Permeable area draining to outfall (ha): 0.046

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 4

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.03	0.07	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	9	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.143 | Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.35 | 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 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): 2.5

Tier 2 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 5A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.02	0.05	ug/l	Pass	Pass	Pass
Step 3	-	-	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	5	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.105 | Permeable area draining to outfall (ha): 0.538

Base Flow Index (BFI): 0.35 | 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 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): 3.3

( ) Tier 2 Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.25	0.62	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	85	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.637 | Permeable area draining to outfall (ha): 0.538

Base Flow Index (BFI): 0.35 | 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 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): 3.3

( ) Tier 2 Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 6A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.05	0.13	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	25	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.465 | Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 6B +6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.09	0.23	ug/l
Step 3	-	-	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	45	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 0.830 Permeable area draining to outfall (ha) 0

Base Flow Index (BFI) 0.323 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 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) 1.5

Tier 2 Bed width (m) 3 Manning's n 0.07 Side slope (m/m) 0.5 Long slope (m/m) 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 7

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.15	0.39	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	58	Deposition Index

Notes

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.932

Permeable area draining to outfall (ha): 0.260

Base Flow Index (BFI): 0.35

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 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): 2.5

Tier 2 Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 1

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact					Sediment - Chronic Impact			
Annual Average Concentration	Copper	Zinc		Copper	Zinc		Sediment deposition for this site is judged as:			
Step 2	0.12	0.31	ug/l	Pass	Pass	Pass	Accumulating?	Yes	0.03	Low flow Vel m/s
Step 3	-	-	ug/l				Extensive?	No	71	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.321 | Permeable area draining to outfall (ha): 9.417

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 — Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 2

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.17	0.43	ug/l
Step 3	-	-	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	94	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.748 | Permeable area draining to outfall (ha): 2.547

Base Flow Index (BFI): 0.323 | 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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc	
Step 2	0.12	0.30	ug/l
Step 3	-	-	ug/l

Soluble - Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	60	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.114 | Permeable area draining to outfall (ha): 0.613

Base Flow Index (BFI): 0.323 | 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 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 / Tier 2 — Estimated river width (m): 1.5 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 4

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc	Sediment - Chronic Impact
Step 2	0.08	0.20	ug/l	Pass	Pass	Pass
Step 3	-	-	ug/l			

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	28	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.457 | Permeable area draining to outfall (ha): 0.356

Base Flow Index (BFI): 0.35 | 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 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 / Tier 2 — Estimated river width (m): 2.5 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 5A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.07	0.17	ug/l
Step 3	-	-	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	20	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 0.375 Permeable area draining to outfall (ha) 0.15

Base Flow Index (BFI) 0.35 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 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) 3.3

Tier 2 Bed width (m) 3 Manning's n 0.07 Side slope (m/m) 0.5 Long slope (m/m) 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.25	0.62	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	85	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.637 | Permeable area draining to outfall (ha): 0.538

Base Flow Index (BFI): 0.35 | 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 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): 3.3

( ) Tier 2 Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 6A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.06	0.15	ug/l
Step 3	-	-	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	28	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.523 | Permeable area draining to outfall (ha): 0.133

Base Flow Index (BFI): 0.323 | 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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 6B +6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.11	0.27	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	54	Deposition Index

Notes

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.004

Permeable area draining to outfall (ha): 0.41

Base Flow Index (BFI): 0.323

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 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): 1.5

Tier 2 Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 7

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc	
Step 2	0.15	0.39	ug/l
Step 3	0.13	0.33	ug/l

Soluble - Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	43	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.93 | Permeable area draining to outfall (ha): 0.26

Base Flow Index (BFI): 0.35 | 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 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): 2.5

Tier 2 — Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Existing ditch	15	Unlimited	25

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 1

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.12	0.31	ug/l
Step 3	0.11	0.28	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	27	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.321 | Permeable area draining to outfall (ha): 9.417

Base Flow Index (BFI): 0.323 | 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 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 ( ) Tier 2

Estimated river width (m): 1.5

Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditch and dry pond	7.5	Unlimited	62.5

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 2

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc	
Step 2	0.17	0.43	ug/l
Step 3	0.16	0.40	ug/l

Soluble - Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	35	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.748 | Permeable area draining to outfall (ha): 2.547

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 — Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	D	Unlimited	D	0	D
Proposed measures	Ditch and dry pond	7.5		Unlimited	D	62.5	

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc		Copper	Zinc
Step 2	0.12	0.30	ug/l	Pass	Pass
Step 3	0.11	0.28	ug/l		

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	22	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 1.114 Permeable area draining to outfall (ha) 0.613

Base Flow Index (BFI) 0.323 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 sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 Estimated river width (m) 1.5

Tier 2 Bed width (m) 3 Manning's n 0.07 D Side slope (m/m) 0.5 Long slope (m/m) 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	D	Unlimited	D	0	D
Proposed measures	Ditch and dry pond	7.5		Unlimited	D	62.5	

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 4

N.A - no mitigation is proposed - page left intentionally blank

PROPOSED WITH MITIGATION

OUTFALL 5A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.07	0.17	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	8	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.375 | Permeable area draining to outfall (ha): 0.15

Base Flow Index (BFI): 0.35 | 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 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): 3.3

Tier 2 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Filter drain	0	Unlimited	60

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 5B

N.A - no mitigation is proposed - page left intentionally blank

PROPOSED WITH MITIGATION

OUTFALL 6A

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.06	0.15	ug/l
Step 3	0.05	0.13	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	21	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.523 | Permeable area draining to outfall (ha): 0.133

Base Flow Index (BFI): 0.323 | 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 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): 1.5

( ) Tier 2 Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditch	15	Unlimited	25

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 6B +6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.11	0.27	ug/l
Step 3	0.09	0.23	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	40	Deposition Index

Notes

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.004

Permeable area draining to outfall (ha): 0.41

Base Flow Index (BFI): 0.323

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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditch	15	Unlimited	25

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

7

N.A - no mitigation is proposed - page left intentionally blank

8.2.2 Method A - Cumulative HAWRAT outputs

EXISTING

OUTFALL 2+3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc	
Step 2	0.03	0.07	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	13	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 0.246 Permeable area draining to outfall (ha): 0.153

Base Flow Index (BFI): 0.323 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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3 Manning's n: 0.07 Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 2 + 3 + 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.16	0.40	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	83	Deposition Index

Notes

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.541

Permeable area draining to outfall (ha): 0.153

Base Flow Index (BFI): 0.323

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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.13	0.34	ug/l
Step 3	-	-	ug/l

Copper: Pass — Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	69	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.295 — Permeable area draining to outfall (ha): 0

Base Flow Index (BFI): 0.323 — 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 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): 1.5

Tier 2: Bed width (m): 3 — Manning's n: 0.07 — Side slope (m/m): 0.5 — Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 4 + 5A + 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.31	0.75	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating? Low flow Vel m/s

Extensive? Deposition Index

Date of assessment		Version of assessment	
Notes			

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.067

Permeable area draining to outfall (ha): 0.538

Base Flow Index (BFI): 0.35

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 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): 3.3

Tier 2 Bed width (m): 3

Manning's n: 0.07 D

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

EXISTING

OUTFALL 4 + 5A + 5B + 7

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.41	1.00	ug/l
Step 3	0.39	0.95	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating? | Low flow Vel m/s

Extensive? | Deposition Index

Date of assessment | Version of assessment

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.999 | Permeable area draining to outfall (ha): 0.798

Base Flow Index (BFI): 0.35 | 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 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): 3.3

Tier 2 Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditch	5	Unlimited	0

Predict Impact

Show Detailed Results

Exit Tool

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PROPOSED WITHOUT MITIGATION

OUTFALL 1+2

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.26	0.63	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Fail. Try Tier 2 for Velocity

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	Yes	165	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.069

Permeable area draining to outfall (ha): 11.964

Base Flow Index (BFI): 0.323

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 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): 1.5
- ( ) Tier 2 — Bed width (m): 3; Manning's n: 0.07; Side slope (m/m): 0.5; Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 1+2+3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.34	0.81	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Fail. Try Tier 2 for Velocity

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	Yes	224	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 4.183 | Permeable area draining to outfall (ha): 12.557

Base Flow Index (BFI): 0.323 | 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 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): 1.5

Tier 2 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 1 + 2 + 3 + 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc		Soluble - Acute Impact: Copper	Soluble - Acute Impact: Zinc
Step 2	0.44	1.04	ug/l	Pass	Pass
Step 3	-	-	ug/l		

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?			Low flow Vel m/s
Extensive?			Deposition Index

Date of assessment		Version of assessment	
Notes			

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s)	0.008	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	5.710	Permeable area draining to outfall (ha)	13.120
Base Flow Index (BFI)	0.323	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 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)	1.5					
Tier 2	Bed width (m)	3	Manning's n	0.07	Side slope (m/m)	0.5	Long slope (m/m)	0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.16	0.39	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	82	Deposition Index

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.527

Permeable area draining to outfall (ha): 0.543

Base Flow Index (BFI): 0.323

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 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): 1.5
- Tier 2: Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 4 + 5A + 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.35	0.86	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating? Low flow Vel m/s

Extensive? Deposition Index

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.469

Permeable area draining to outfall (ha): 1.044

Base Flow Index (BFI): 0.35

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 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): 3.3

Tier 2 Bed width (m): 3

Manning's n: 0.07 D

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 5A + 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.30	0.74	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Fail. Try Tier 2 for Velocity

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	Yes	105	Deposition Index

Date of assessment		Version of assessment	
Notes			

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 2.021 | Permeable area draining to outfall (ha): 0.688

Base Flow Index (BFI): 0.35 | 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 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 ( ) Tier 2

Estimated river width (m): 3.3

Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITHOUT MITIGATION

OUTFALL 4 + 5A + 5B + 7

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.45	1.09	ug/l
Step 3	-	-	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating? Low flow Vel m/s

Extensive? Deposition Index

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.401

Permeable area draining to outfall (ha): 1.304

Base Flow Index (BFI): 0.35

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 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): 3.3

Tier 2 Bed width (m): 3 Manning's n: 0.07 D Side slope (m/m): 0.5 Long slope (m/m): 0.0001

Step 3 Mitigation

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

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 1+2

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.26	0.63	ug/l
Step 3	0.24	0.58	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	61	Deposition Index

Notes

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.069 | Permeable area draining to outfall (ha): 11.964

Base Flow Index (BFI): 0.323 | 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 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 / Tier 2 — Estimated river width (m): 1.5 | Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Dry ponds + ditches	8	Unlimited	63

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 1+2+3

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.34	0.81	ug/l
Step 3	0.31	0.75	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	83	Deposition Index

Notes

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s) 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha) 4.183 Permeable area draining to outfall (ha) 12.557

Base Flow Index (BFI) 0.323 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 sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge? No D

Tier 1 Estimated river width (m) 1.5

Tier 2 Bed width (m) 3 Manning's n 0.07 D Side slope (m/m) 0.5 Long slope (m/m) 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)		Attenuation for solubles - restricted discharge rate (l/s)		Settlement of sediments (%)	
Existing measures		0	D	Unlimited	D	0	D
Proposed measures	Dry ponds + ditches	8		Unlimited	D	63	

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 1 + 2 + 3 + 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.44	1.04	ug/l
Step 3	0.39	0.94	ug/l

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?			Low flow Vel m/s
Extensive?			Deposition Index

Date of assessment		Version of assessment	
Notes			

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m³/s)	0.008	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	5.710	Permeable area draining to outfall (ha)	13.120
Base Flow Index (BFI)	0.323	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 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): 1.5

Tier 2 — Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Dry ponds + ditches	10	Unlimited	0

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 6A + 6B + 6C

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc	
Step 2	0.16	0.39	ug/l
Step 3	0.13	0.34	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.03	Low flow Vel m/s
Extensive?	No	61	Deposition Index

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.008 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 1.527 | Permeable area draining to outfall (ha): 0.543

Base Flow Index (BFI): 0.323 | 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 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 / Tier 2

Estimated river width (m): 1.5

Bed width (m): 3 | Manning's n: 0.07 | Side slope (m/m): 0.5 | Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditches	15	Unlimited	25

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 4 + 5A + 5B

N.A - no mitigation is proposed - page left intentionally blank

PROPOSED WITH MITIGATION

OUTFALL 5A + 5B

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Annual Average Concentration	Copper	Zinc	
Step 2	0.30	0.74	ug/l
Step 3	-	-	ug/l

Soluble - Acute Impact

Copper	Zinc
Pass	Pass

Sediment - Chronic Impact

Pass

Sediment deposition for this site is judged as:

Accumulating?	Yes	0.01	Low flow Vel m/s
Extensive?	No	94	Deposition Index

Date of assessment		Version of assessment	
Notes			

Step 1 Runoff Quality

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

Step 2 River Impacts

Annual 95%ile river flow (m^3/s)	0.005	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	2.021	Permeable area draining to outfall (ha)	0.688
Base Flow Index (BFI)	0.35	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 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)	3.3					
Tier 2	Bed width (m)	3	Manning's n	0.07	Side slope (m/m)	0.5	Long slope (m/m)	0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Filter drain	0	Unlimited	11

Predict Impact

Show Detailed Results

Exit Tool

PROPOSED WITH MITIGATION

OUTFALL 4 + 5A + 5B + 7

HIGHWAYS AGENCY

Highways Agency Water Risk Assessment Tool version 1.0 November 2009

Soluble - Acute Impact

Annual Average Concentration	Copper	Zinc	
Step 2	0.45	1.09	ug/l
Step 3	0.44	1.05	ug/l

Copper: Pass

Zinc: Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating? Low flow Vel m/s

Extensive? Deposition Index

Step 1 Runoff Quality

AADT: >=50,000 and <100,000

Climatic region: Warm Dry

Rainfall site: London (SAAR 600mm)

Step 2 River Impacts

Annual 95%ile river flow (m^3/s): 0.005 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)

Impermeable road area drained (ha): 3.401

Permeable area draining to outfall (ha): 1.304

Base Flow Index (BFI): 0.35

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 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): 3.3

Tier 2 Bed width (m): 3

Manning's n: 0.07

Side slope (m/m): 0.5

Long slope (m/m): 0.0001

Step 3 Mitigation

	Brief description	Estimated effectiveness: Treatment for solubles (%)	Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)
Existing measures		0	Unlimited	0
Proposed measures	Ditch	4	Unlimited	0

Predict Impact

Show Detailed Results

Exit Tool

8.2.3 Method D - HAWRAT outputs

EXISTING

INGREBOURNE

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment 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)*	1,065	791						
D3	Road Type *(A-road or Motorway)*	M	M						
D4	If A road, is site urban or rural?	Urban	Urban						
D5	Junction type	No junction	Slip road						
D6	Location	< 20 minutes	< 20 minutes						
D7	Traffic flow (AADT two way)	52,237	52,237						
D8	% HGV	34	34						
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36	0.43						
D9	Risk of accidental spillage	0.00249	0.00220	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45	0.45						
D11	Risk of pollution incident	0.00112	0.00099	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	0.00112	0.00099	0.00000	0.00000	0.00000	0.00000	0.0021	474
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00112	0.00099	0.00000	0.00000	0.00000	0.00000	0.0021	474
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00112	0.00099	0.00000	0.00000	0.00000	0.00000	0.0021	474

EXISTING

WEALD BROOK

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment 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)*	1,074							
D3	Road Type *(A-road or Motorway)*	M							
D4	If A road, is site urban or rural?	Urban							
D5	Junction type	No junction							
D6	Location	< 20 minutes							
D7	Traffic flow (AADT two way)	52,237							
D8	% HGV	21							
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36							
D9	Risk of accidental spillage	0.00155	0.00000	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45	0.45						
D11	Risk of pollution incident	0.00070	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	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	0.0007	1435
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	0.0007	1435
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	0.0007	1435

EXISTING

WEALD BROOK + INGREBOURNE

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment 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)*	2,139	791					
D3	Road Type *(A-road or Motorway)*	M	M					
D4	If A road, is site urban or rural?	Urban	Urban					
D5	Junction type	No junction	Slip road					
D6	Location	< 20 minutes	< 20 minutes					
D7	Traffic flow (AADT two way)	52,237	52,237					
D8	% HGV	21	51					
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36	0.43					
D9	Risk of accidental spillage	0.00308	0.00331	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.45	0.45					
D11	Risk of pollution incident	0.00139	0.00149	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	**No**	**No**					
D13	Return period without pollution reduction measures	0.00139	0.00149	0.00000	0.00000	0.00000	0.00000	
D14	Existing measures factor	0.7	0.7					
D15	Return period with existing pollution reduction measures	0.00097	0.00104	0.00000	0.00000	0.00000	0.00000	
D16	Proposed measures factor	1	1					
D17	Residual with proposed Pollution reduction measures	0.00097	0.00104	0.00000	0.00000	0.00000	0.00000	

Totals	Return Period (years)
0.0029	348
0.0020	497
0.0020	497

PROPOSED

INGREBOURNE

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment 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)*	1,520	1,818						
D3	Road Type *(A-road or Motorway)*	M	M						
D4	If A road, is site urban or rural?	Urban	Urban						
D5	Junction type	No junction	Slip road						
D6	Location	< 20 minutes	< 20 minutes						
D7	Traffic flow (AADT two way)	62,805	62,805						
D8	% HGV	28	28						
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36	0.43						
D9	Risk of accidental spillage	0.00351	0.00502	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45	0.45						
D11	Risk of pollution incident	0.00158	0.00226	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	0.00158	0.00226	0.00000	0.00000	0.00000	0.00000	0.0038	261
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00158	0.00226	0.00000	0.00000	0.00000	0.00000	0.0038	261
D16	Proposed measures factor	0.6	0.6						
D17	Residual with proposed Pollution reduction measures	0.00095	0.00135	0.00000	0.00000	0.00000	0.00000	0.0023	434

PROPOSED

WEALD BROOK

HIGHWAYS AGENCY

View Spillage Assessment Parameters | Reset | Go To Runoff Risk Assessment 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)*	378	2,363						
D3	Road Type *(A-road or Motorway)*	M	M						
D4	If A road, is site urban or rural?	Urban	Urban						
D5	Junction type	No junction	Slip road						
D6	Location	< 20 minutes	< 20 minutes						
D7	Traffic flow (AADT two way)	62,805	62,805						
D8	% HGV	20	20						
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36	0.43						
D9	Risk of accidental spillage	0.00062	0.00466	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45	0.45						
D11	Risk of pollution incident	0.00028	0.00210	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	0.00028	0.00210	0.00000	0.00000	0.00000	0.00000	0.0024	421
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00028	0.00210	0.00000	0.00000	0.00000	0.00000	0.0024	421
D16	Proposed measures factor	0.6	0.6						
D17	Residual with proposed Pollution reduction measures	0.00017	0.00126	0.00000	0.00000	0.00000	0.00000	0.0014	701

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HIGHWAYS AGENCY

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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)*	1,898	4,181						
D3	Road Type *(A-road or Motorway)*	M	M						
D4	If A road, is site urban or rural?	Urban	Urban						
D5	Junction type	No junction	Slip road						
D6	Location	< 20 minutes	< 20 minutes						
D7	Traffic flow (AADT two way)	62,805	62,805						
D8	% HGV	28	28						
D8	Spillage factor *(no/10^9 HGVkm/year)*	0.36	0.43						
D9	Risk of accidental spillage	0.00439	0.01154	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor	0.45	0.45						
D11	Risk of pollution incident	0.00197	0.00519	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	0.00197	0.00519	0.00000	0.00000	0.00000	0.00000	0.0072	140
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00197	0.00519	0.00000	0.00000	0.00000	0.00000	0.0072	140
D16	Proposed measures factor	0.6	0.6						
D17	Residual with proposed Pollution reduction measures	0.00118	0.00312	0.00000	0.00000	0.00000	0.00000	0.0043	233

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