

12 Appendix 12 - Water Resources

12.1 Severn RBMP Data

12.1.1 The following tables are extracted from the Severn River Basin Management Plan (issued December 2009, Environment Agency) where available for watercourses and waterbodies within the study area. The following are appended:

- Colliter's Brook source to confluence River Avon (Bristol New Cut)
- Bristol Avon (Estuarine)
- Bristol Triassic (Groundwater)

12.2 HAWRAT Pollutants Assessment (HD45/09)

Step 1 Assessment

12.2.1 An assessment of the risk to the watercourses that are likely to receive highway drainage has been completed using the HAWRAT (HD45/09) methodology.

12.2.2 The Step 1 Methodology assesses the anticipated risk based on a combination of predicted AADT, climatic region, and predicted rainfall. The climatic region is Warm and Wet, and predicted rainfall in Bristol is recorded as 850mm annually.

12.2.3 It is noted that the methodology is designed for the assessment of motorways/trunk roads where high volumes of traffic are recorded/expected. The volume of traffic as a result of the Rapid Transit Route is highly insignificant when compared to volume of traffic flows on major motorways and trunk roads. HAWRAT does not allow an assessment of traffic flow below 10,000 AADT. Therefore, a conservative AADT of between 10,000 and 50,000 has been used.

12.2.4 The results of the Step 1 Assessment indicates a failure on both copper and zinc soluble pollutants, and a failure of sediment. Therefore a Step 2 Assessment is conducted using additional information.

Step 2 Assessment

12.2.5 Three receiving watercourses have been identified for the new route between Ashton Vale and Temple Meads. At this stage, drainage has not been fully designed.. Therefore, a number of assumptions have been made on likely drainage networks based on contours observed during a site walkover.

- Longmoor Brook is anticipated to receive surface water drainage from the Park and Ride site to the mid point of the former Landfill.

- Colliter’s Brook is anticipated to receive drainage from the route to the point where it enters into culvert adjacent to the existing BCFC Stadium.
- The remainder of the route is anticipated to be discharged to the tidal River Avon.

12.2.6 Q95 flow is not available for Longmoor Brook or Colliter’s Brook. The Q95 in these watercourses has been estimated using similar sized watercourses and catchments in the area. A Q95 flow of 0.01ms³/sec is taken for the purpose of this assessment adopting the precautionary principle. For the assessment of sediments, the river width for Colliter’s Brook and Longmoor Brook are assumed to be 1m, as identified via site observations. The River Avon is approximately 30m in width.

12.2.7 Hardness data is not available for any of the watercourses. Adopting the precautionary principle, a default hardness of <50mg/l is applied in all assessments.

12.2.8 The results of the Step 2 Assessment indicate that the watercourses pass on all assessment criteria, despite a highly precautionary approach. The HAWRAT methodology outputs predicted annual average concentrations of copper and zinc for comparison to the annual average Environmental Quality Standards (EQS). Table 12.A.1 below summarises the output and compares to the relevant EQS.

Watercourse	Impermeable Area Drained (ha)	Predicted Copper Annual Average	Copper EQS (hardness <50mg/l)	Predicted Zinc Annual Average	Zinc EQS
Longmoor Brook	0.775	0.07	1	0.39	7.8
Colliter’s Brook (old)	1.250	0.11	1	0.39	7.8
River Avon	1.890	0.00	1	0.00	7.8

Table 12A.1 – Results of soluble pollutants assessment

12.2.9 When compared to EQS as provided by the Environment Agency for River Basin Management Plans under the WFD, the predicted concentrations of copper and zinc as soluble pollutants are considered acceptable. Therefore the predicted pollution from the proposed new route of the RTR, despite adopting a highly precautionary approach is considered to be acceptable in the context of soluble pollutants. The HAWRAT output sheets are included as follows:

Risk of Accidental Spillage

12.2.10 The Assessment of Risk from Accidental Spillage follows the Method D Assessment method set out in HA45/09 DMRB11.3.10 (Highways Agency, 2009). The method considers the risk of accidental spillage occurring causing a significant pollutant incident in the watercourse. The factors that affect the assessment are % Heavy Good Vehicles, in this case is 100%; AADT; length and type of road along which outfall is located.

12.2.11 AADT is estimated along the route for HGVs as follows:

- Vehicle movements every 10 minutes = 6 per/hour
- Assumes 24hr running = $6 \times 24 = 144$
- Assumes 2 way running = $144 \times 2 = \text{AADT } 298$
- Adopting the precautionary principle, an AADT of 1000 is assumed.

12.2.12 The worksheets used to produce the spill risk calculations are appended to this section.

12.2.13 The components used for, and the output from the Method D Assessment are summarised in Table 12A.2 below:

Watercourse	Road Length	Road Type	AADT (%HGV)	Risk Return Period
Longmoor Drain	650	Urban Side Road	1000	1 in 5175 years
New Colliter's Brook	1,250	Urban Side Road	1000	1 in 2691 years
River Avon	1,700	Urban Side Road	1000	1 in 1979 years
Floating Harbour	450	Urban Side Road	1000	1 in 7475 years
Groundwater	3,950	Urban Side Road	1000	1 in 1277 years

Table 12A.2 Method D Assessment

12.2.14 The results of the Method D Assessment indicate that the risks associated with the Rapid Transit Route with regard to accidental spillage are acceptable. The trigger point for a normal watercourse (e.g. not SSSI, SAC, SPA etc.) is a risk greater than 1 in 100 year.

12.3 Method C Groundwater Risk Assessment

12.3.1 Table 12A.3 below summarises the qualitative assumptions made for the assessment of risk to the minor aquifer understood from geological mapping to underly the majority of the study site. This assessment is completed on the assumption that all drainage will discharge to groundwater, however it is noted that the likely drainage design will encompass a combination of positive drainage discharging to surface water courses and discharges to groundwater.

Component Number		Weighting Factor	Property or Parameter	Low Risk (Score 1)	Medium Risk (Score 2)	High Risk (Score 3)	Score
1	SOURCE	15	Traffic Density	<50,000 AADT	≥50,000 to <100,000 AADT	≥100,000 AADT	15
2		15	Rainfall Volume (annual averages)	<740mm rainfall	740-1060mm	>1060mm rainfall	30
			Rainfall Intensity	Even (<35mm FEH 1 hour rainfall)	Uneven (35-47mm FEH 1 hour rainfall)	Concentrated (>47mm FEH 1 hour rainfall)	
3	PATHWAY	15	Soakaway geometry	Continuous linear (e.g. ditch, grassed channel)	Single point, or shallow soakaway (e.g. lagoon) serving low road area)	Single point, deep serving high road area (>5,000m ²)	15
4		20	Unsaturated Zone	Depth to water table >15m and unproductive strata	Depth to water table <15 - <5m	Depth to water table <5m	40
5		20	Flow type	Unconsolidated or non-fractured consolidated deposits (i.e. dominantly intergranular flow)	Consolidated deposits (i.e. mixed fracture and intergranular flow)	Heavily consolidated sedimentary deposits, igneous and metamorphic rocks (dominated by fracture porosity)	20
6		7.5	Effective grain size	Fine sand and below	Coarse sand	Very coarse sand and above	7.5
7		7.5	Lithology	>15% clay minerals	<5% 0 >1% clay minerals	<1% clay minerals	7.5
						Total Score	135

Table 12.A.3 Method C – Matrix to Determine Risk of Impact of Pollution to Groundwater from Routine Runoff

Waterbody Category and Map Code.:	River - R115	Surveillance site:	No
Waterbody ID and Name:	GB109053027360	Colliters Bk source to conf R Avon (Brist New Cut)	
National Grid Reference:	ST 56343 70528		
Current Overall Potential	Moderate		
Status Objective (Overall):	Good by 2027		
Status Objective(s):	Good Ecological Potential by 2027		
Justification if overall objective is not good status by 2015:	Disproportionately expensive, Technically infeasible		
Protected Area Designation:	Not Designated		
SSSI (Non-N2K) related:	No		
Hydromorphological Designation:	Heavily Modified		
Reason for Designation:	Flood Protection, Land Drainage, Urbanisation, Water Regulation (impoundment release)		
Downstream Waterbody ID:	GB530905415400		

Note: Current Status and Status Objectives for this water body are based on Expert Judgement

Ecological Potential

Current Status (and certainty that status is less than good) Moderate

Ecological Potential Assessment

Element	Current status	Predicted Status by 2015	Justification for not achieving good status by 2015
Mitigation Measures Assessment	Moderate	Moderate	Technically infeasible (M3a, M3b, M3c)

Mitigation Measures that have defined Ecological Potential

Mitigation Measure	Status
Appropriate timing (vegetation control)	In Place
Appropriate vegetation control technique	In Place
Selective vegetation control regime	In Place
Educate landowners on sensitive management practices (urbanisation)	Not In Place

Chemical Status

Current Status (and certainty that status is less than good) Does not require assessment

Waterbody Category and Map Code.:	Transitional - T6	Surveillance site: No
Waterbody ID and Name:	GB530905415405	BRISTOL AVON
National Grid Reference:	ST 54934 75281	
Current Overall Potential	Good	
Status Objective (Overall):	Good by 2015	(For Protected Area Objectives see Annex D)
Status Objective(s):	Good Ecological Potential by 2015	
Justification if overall objective is not good status by 2015:		
Protected Area Designation:	Freshwater Fish Directive, Natura 2000 (Habitats and/or Birds Directive)	
SSSI (Non-N2K) related:	No	
Hydromorphological Designation:	Heavily Modified	
Reason for Designation:	Flood Protection, Navigation, Quayline	
Downstream Waterbody ID:	GB530905415401	

Note: Current Status and Status Objectives for this water body are based on Expert Judgement

Ecological Potential (note: no biology data)

Current Status (and certainty that status is less than good) Good

Supporting conditions

Element	Current status (and certainty of less than good)	Predicted Status by 2015	Justification for not achieving good status by 2015
Tidal Regime - Freshwater Flow	Supports Good	Supports Good	

Ecological Potential Assessment

Element	Current status	Predicted Status by 2015	Justification for not achieving good status by 2015
Mitigation Measures Assessment	Good	Good	

Chemical Status

Current Status (and certainty that status is less than good) Does not require assessment

Waterbody Category and Map Code.:	Groundwater - G23
Waterbody ID and Name:	GB40902G804800 Bristol Triassic
Current Overall Status	Poor
Status Objective (Overall):	Good by 2027
Status Objective(s):	Good Quantitative Status by 2015, Good Chemical Status by 2027
Justification if overall objective is not good status by 2015:	Disproportionately expensive
Protected Area Designation:	Drinking Water Protected Area
Groundwater body has an upward trend in pollutant concentrations:	Yes

Quantitative Status

Current Status (and confidence in this assessment) Good (Low)

Quantitative elements

Element	Current status (and confidence)	Predicted Status by 2015	Justification for not achieving good status by 2015
Impact on Wetlands	Good (Low)	Good	
Impact On Surface Waters	Good (Low)	Good	
Saline Intrusion	Good (High)	Good	
Water Balance	Good (Low)	Good	

Chemical Status

Current Status (and confidence in this assessment) Poor (High)

Chemical elements

Element	Current status (and confidence)	Predicted Status by 2015	Justification for not achieving good status by 2015
Drinking Water Protected Area	Poor (High)	Poor	Disproportionately expensive (GC4a)
General Chemical Test	Good (Low)	Good	
Impact on Wetlands	Good (Low)	Good	
Impact On Surface Waters	Good (Low)	Good	
Saline Intrusion	Good (High)	Good	

Pressures and Risks

Pressures	Risk Category	Element against which assessed
Hazardous Substances and other pollutants	Urbanisation	General Chemical Test, GWDTE Test, DrWPA Test, GW-SW Test
Nutrients	Nitrate	General Chemical Test, GWDTE Test, DrWPA Test
Nutrients	Trends in Nitrate	GWDTE Test, DrWPA Test
Hazardous Substances and other pollutants, Nutrients, Abstraction and other artificial flow pressures	DrWPA	DrWPA Test

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

Soluble - Acute Impact

Copper	Zinc

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

DETAILED RESULTS

In Runoff

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

Step 1

Copper	Zinc
RST24	
1	1
65.90	61.70
72	68

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

Copper	Zinc
RST6	
1	1
23.00	27.40
32	34

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

	27.16	87.80
	51.99	190.33
	67.25	241.87
	109.71	487.10

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
75.80	99.00	1.50	17.00	55.80	17.00	14.80	31.00
88	107	3	25	64	25	20	39

Toxicity Threshold

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
	197	315	3.5	16770	875	2355	245

	342	1173	1	11090	1919	1841	118	519
	752	2770	1	28184	4876	4679	299	1319
	963	3820	2	56234	9729	9335	596	2632
	1534	6015	4	112202	19411	18626	1189	5251

In River (no mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Step 2

Copper	Zinc
RST24	
2	2
0	0.3
0	1
0	0.1
0	1

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
0	0.1
0	1
0	0
0	0

Annual average concentration (ug/l)

	0.11	0.39
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Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

	0.42	1.75
	1.00	3.16
	2.11	7.00
	5.11	29.12

Velocity 0.09 m/s

Tier 1 is used for the calculation

DI 37.15

% settlement needed 0 %

In River (with mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-
-	-

Annual average concentration (ug/l)

	-	-
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Thresholds hresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

	-	-
	-	-
	-	-
	-	-

DI -

Details of the chosen rainfall site

SAAR (mm)	850
Altitude (m)	70
Easting	3561
Northing	1754
Coastal distance (km)	10

User parameters

Location Details			
Road Number		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number		Receiving watercourse	
OS grid reference of assessment point (m)	Eastings	EA receiving water Detailed River Network ID	
	Northing	Assessor and affiliation	
OS grid reference of outfall structure (m)	Eastings	Date of assessment	
	Northing	Version of assessment	
Outfall number			
List of outfalls in cumulative assessment			
Notes			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
Runoff Risk Assessments				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	Actual AADT <10k but adopting precautionary principle.
Climatic Region	-	Warm Dry	Warm Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Bristol (SAAR 850mm)	
95%ile River flow	m3/s	0	0.01	Assumes low flow given Q95 unknown
Baseflow Index	-	0.5	0.5	
Impermeable road area drained	ha	1	1.225	Calculated based on DF3 drawings
Permeable area draining to outfall	ha	1	0	Assumed to be 0 adopting precautionary principle
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	Assumed using precautionary principle to be <50mg/l
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	m	5	1	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

Spillage Risk Assessments

A Main Road				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
B				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
C				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
D				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
E				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
F				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		

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	RE3 watercourse	RE1 watercourse						
D2	Length of road draining to outfall (m)	0	1,250						
D3	Road Type (A-road or Motorway)	A							
D4	If A road, is site urban or rural?	Rural	Urban						
D5	Junction type	No junction	Side road						
D6	Location	< 1 hour	< 20 minutes						
D7	Traffic flow	1,000	1,000						
D8	% HGV	0	100						
D8	Spillage factor (no/10 ⁹ HGVkm/year)		1.81						
D9	Risk of accidental spillage	0.00000	0.00083	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor from Table D.2	0.40	0.45						
D11	Risk of pollution incident	0.00000	0.00037	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	0.00000	0.00037	0.00000	0.00000	0.00000	0.00000	0.0004	2691
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00000	0.00037	0.00000	0.00000	0.00000	0.00000	0.0004	2691
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00000	0.00037	0.00000	0.00000	0.00000	0.00000	0.0004	2691

Table 7.1

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

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

Table D2

Water Quality Objective of Receiving Watercourse	Urban (response time to site < 20 min)	Rural (response time to site < 1 hour)	Remote (response time to site > 1 hour)
RE1 watercourse	0.45	0.60	0.75
RE2 watercourse	0.45	0.60	0.75
RE3 watercourse	0.30	0.40	0.50
RE4 watercourse	0.30	0.40	0.50
Aquifer	0.30	0.30	0.50

The worksheet should be read in conjunction with the Guidance Document and HA 216.

For further advice on the application of this worksheet, contact a Highways Agency Regional Environmental Advisor in the area of interest.

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

Soluble - Acute Impact

Copper	Zinc

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

DETAILED RESULTS

In Runoff

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

Thresholds
Thresholds

Event Statistics Mean
90%ile
95%ile
99%ile

Step 1

Copper	Zinc
RST24	
1	1
65.90	61.70
72	68
RST6	
1	1
23.00	27.40
32	34
(ug/l)	(ug/l)
RST24	21
RST6	60
	42
	120
27.16	87.80
51.99	190.33
67.25	241.87
109.71	487.10

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
75.80	99.00	1.50	17.00	55.80	17.00	14.80	31.00
88	107	3	25	64	25	20	39
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
197	315	3.5	16770	875	2355	245	515
342	1173	1	11090	1919	1841	118	519
752	2770	1	28184	4876	4679	299	1319
963	3820	2	56234	9729	9335	596	2632
1534	6015	4	112202	19411	18626	1189	5251

In River (no mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Annual average concentration (ug/l)

Thresholds
Thresholds

Event Statistics Mean
90%ile
95%ile
99%ile

Step 2

Copper	Zinc
RST24	
2	2
0	0.3
0	1
0	0.1
0	1
RST6	
1	1
0	0
0	0
0	0
0	0
0.07	0.26
(ug/l)	(ug/l)
RST24	21
RST6	60
	42
	120
0.28	1.19
0.64	2.03
1.37	4.53
3.62	19.15

Velocity m/s Tier 1 is used for the calculation

DI

% settlement needed %

In River (with mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Annual average concentration (ug/l)

Thresholds
Thresholds

Event Statistics Mean
90%ile
95%ile
99%ile

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
-	-
(ug/l)	(ug/l)
RST24	21
RST6	60
	42
	120
-	-
-	-
-	-
-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	850
Altitude (m)	70
Easting	3561
Northing	1754
Coastal distance (km)	10

User parameters

Location Details			
Road Number		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number		Receiving watercourse	
OS grid reference of assessment point (m)	Eastings	EA receiving water Detailed River Network ID	
OS grid reference of outfall structure (m)	Northings	Assessor and affiliation	
Outfall number		Date of assessment	
List of outfalls in cumulative assessment		Version of assessment	
Notes			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
Runoﬀ Risk Assessments				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	Actual AADT <10k but adopting precautionary principle.
Climatic Region	-	Warm Dry	Warm Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Bristol (SAAR 850mm)	
95%ile River flow	m3/s	0	0.01	Assumes low flow given Q95 unknown
Baseflow Index	-	0.5	0.5	
Impermeable road area drained	ha	1	0.775	Calculated based on DF3 drawings
Permeable area draining to outfall	ha	1	0	Assumed to be 0 adopting precautionary principle
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	Assumed using precautionary principle to be <50mg/l
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	m	5	1	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

Spillage Risk Assessments

A Main Road				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	
B				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	
C				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	
D				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	
E				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	
F				
Water body type	-	-	-	
Length of road draining to outfall	m	-	-	
Road Type (A-road or Motorway)	-	-	-	
If A road, is site urban or rural?	-	-	-	
Junction type	-	-	-	
Location	-	-	-	
Traffic flow (AADT two way)	-	-	-	
% HGV	-	-	-	
Spillage factor	no/109H GVkm/ye ar	-	-	
Existing measures factor	-	-	-	
Proposed measures factor	-	-	-	

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	RE3 watercourse	RE1 watercourse						
D2	Length of road draining to outfall (m)	0	650						
D3	Road Type (A-road or Motorway)		A						
D4	If A road, is site urban or rural?	Rural	Urban						
D5	Junction type	No junction	Side road						
D6	Location	< 1 hour	< 20 minutes						
D7	Traffic flow	1,000	1,000						
D8	% HGV	0	100						
D8	Spillage factor (no/10 ⁹ HGVkm/year)		1.81						
D9	Risk of accidental spillage	0.00000	0.00043	0.00000	0.00000	0.00000	0.00000		
D10	Probability factor from Table D.2	0.40	0.45						
D11	Risk of pollution incident	0.00000	0.00019	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	0.00000	0.00019	0.00000	0.00000	0.00000	0.00000	0.0002	5175
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00000	0.00019	0.00000	0.00000	0.00000	0.00000	0.0002	5175
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00000	0.00019	0.00000	0.00000	0.00000	0.00000	0.0002	5175

Table 7.1

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

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

Table D2

Water Quality Objective of Receiving Watercourse	Urban (response time to site < 20 min)	Rural (response time to site < 1 hour)	Remote (response time to site > 1 hour)
RE1 watercourse	0.45	0.60	0.75
RE2 watercourse	0.45	0.60	0.75
RE3 watercourse	0.30	0.40	0.50
RE4 watercourse	0.30	0.40	0.50
Aquifer	0.30	0.30	0.50

The worksheet should be read in conjunction with the Guidance Document and HA 216.

For further advice on the application of this worksheet, contact a Highways Agency Regional Environmental Advisor in the area of interest.

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

Soluble - Acute Impact

Copper	Zinc

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene

DETAILED RESULTS

In Runoff

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year

Thresholds
 Thresholds

Event Statistics Mean
 90%ile
 95%ile
 99%ile

Step 1

Copper	Zinc
RST24	
1	1
65.90	61.70
72	68
RST6	
1	1
23.00	27.40
32	34
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
27.16	87.80
51.99	190.33
67.25	241.87
109.71	487.10

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
75.80	99.00	1.50	17.00	55.80	17.00	14.80	31.00
88	107	3	25	64	25	20	39
(mg/kg)							
197	315	3.5	16770	875	2355	245	515
(ug/kg)							
342	1173	1	11090	1919	1841	118	519
752	2770	1	28184	4876	4679	299	1319
963	3820	2	56234	9729	9335	596	2632
1534	6015	4	112202	19411	18626	1189	5251

In River (no mitigation)

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year
 No. of exceedances/summer
 No. of exceedances/worst summer

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year
 No. of exceedances/summer
 No. of exceedances/worst summer

Annual average concentration (ug/l)

Thresholds
 Thresholds

Event Statistics Mean
 90%ile
 95%ile
 99%ile

Step 2

Copper	Zinc
RST24	
2	2
0	0
0	0
0	0
0	0
RST6	
1	1
0	0
0	0
0	0
0	0
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
0.00	0.00
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
0.00	0.01
0.00	0.01
0.01	0.03
0.03	0.16

Step 2

Velocity m/s Tier 1 is used for the calculation

DI

% settlement needed %

In River (with mitigation)

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year
 No. of exceedances/summer
 No. of exceedances/worst summer

Allowable Exceedances/year
No. of exceedances/year
 No. of exceedances/worst year
 No. of exceedances/summer
 No. of exceedances/worst summer

Annual average concentration (ug/l)

Thresholds
 Thresholds

Event Statistics Mean
 90%ile
 95%ile
 99%ile

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-
-	-
RST6	
1	1
-	-
-	-
-	-
-	-
(ug/l)	
RST24	RST6
21	60
42	120
(ug/l)	
-	-
-	-
-	-
-	-

Step 3

DI

Details of the chosen rainfall site	
SAAR (mm)	850
Altitude (m)	70
Easting	3561
Northing	1754
Coastal distance (km)	10

User parameters

Location Details			
Road Number		Assessment type	Non-cumulative assessment (single outfall)
HA Area/DBFO number		Receiving watercourse	
OS grid reference of assessment point (m)	Eastings	EA receiving water Detailed River Network ID	
	Northings	Assessor and affiliation	
OS grid reference of outfall structure (m)	Eastings	Date of assessment	
	Northings	Version of assessment	
Outfall number			
List of outfalls in cumulative assessment			
Notes			

Parameter	Units	Default Value	Value used	Notes (Enter notes in the left-hand cells only)
Runnoff Risk Assessments				
AADT	vpd	>10,000 and <50,000	>10,000 and <50,000	Actual AADT <10k but adopting precautionary principle.
Climatic Region	-	Warm Dry	Warm Wet	
Rainfall Site	-	Ashford (SAAR 710mm)	Bristol (SAAR 850mm)	
95%ile River flow	m3/s	0	3.56	Taken upstream of Bristol
Baseflow Index	-	0.5	0.5	
Impermeable road area drained	ha	1	1.89	Calculated based on DF3 drawings
Permeable area draining to outfall	ha	1	0	Assumed to be 0 adopting precautionary principle
Is the discharge in or within 1 km upstream of a protected site for conservation?	-	No	No	
Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	-	No	No	
Hardness	-	Low = <50mg CaCO3/l	Low = <50mg CaCO3/l	Assumed using precautionary principle to be <50mg/l
Use Tier 1	-	TRUE	TRUE	
Use Tier 2	-	FALSE	FALSE	
Tier 1 Estimated river width at Q95	m	5	30	
Tier2 Bed width	m	3	3	
Tier2 Side slope	m/m	0.5	0.5	
Tier2 Long slope	m/m	0.0001	0.0001	
Tier2 Mannings' n	-	0.07	0.07	
Existing treatment for solubles	%	0	0	description for existing measures
Existing attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Existing settlement of sediments	%	0	0	description for proposed measures
Proposed treatment for solubles	%	0	0	
Proposed attenuation -restricted discharge rate	l/s	Unlimited	Unlimited	
Proposed settlement of sediments	%	0	0	

Spillage Risk Assessments

A Main Road				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
B				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
C				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
D				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
E				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		
F				
Water body type	-	-		
Length of road draining to outfall	m	-		
Road Type (A-road or Motorway)	-	-		
If A road, is site urban or rural?	-	-		
Junction type	-	-		
Location	-	-		
Traffic flow (AADT two way)	-	-		
% HGV	-	-		
Spillage factor	no/109H GVkm/ye ar	-		
Existing measures factor	-	-		
Proposed measures factor	-	-		

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	RE3 watercourse	RE1 watercourse						
D2	Length of road draining to outfall (m)	0	1,700						
D3	Road Type (A-road or Motorway)		A						
D4	If A road, is site urban or rural?	Rural	Urban						
D5	Junction type	No junction	Side road						
D6	Location	< 1 hour	< 20 minutes						
D7	Traffic flow	1,000	1,000						
D8	% HGV	0	100						
D8	Spillage factor (no/10 ⁹ HGVkm/year)		1.81						
D9	Risk of accidental spillage	0.00000	0.00112	0.00000	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor from Table D.2	0.40	0.45						
D11	Risk of pollution incident	0.00000	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No	No						
D13	Return period without pollution reduction measures	0.00000	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00000	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00000	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	
								Totals	Return Period (years)
								0.0005	1979
								0.0005	1979
								0.0005	1979

Table 7.1

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

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

Table D2

Water Quality Objective of Receiving Watercourse	Urban (response time to site < 20 min)	Rural (response time to site < 1 hour)	Remote (response time to site > 1 hour)
RE1 watercourse	0.45	0.60	0.75
RE2 watercourse	0.45	0.60	0.75
RE3 watercourse	0.30	0.40	0.50
RE4 watercourse	0.30	0.40	0.50
Aquifer	0.30	0.30	0.50

The worksheet should be read in conjunction with the Guidance Document and HA 216.

For further advice on the application of this worksheet, contact a Highways Agency Regional Environmental Advisor in the area of interest.

Summary of predictions

Prediction of impact	Step1
	Step2
	Step3

Soluble - Acute Impact

Copper	Zinc
1	1
65.90	61.70
72	68

Sediment - Chronic Impact

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
75.80	99.00	1.50	17.00	55.80	17.00	14.80	31.00
88	107	3	25	64	25	20	39

DETAILED RESULTS

In Runoff

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

Step 1

Copper	Zinc
RST24	
1	1
65.90	61.70
72	68

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year

RST6	
1	1
23.00	27.40
32	34

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

27.16	87.80
51.99	190.33
67.25	241.87
109.71	487.10

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
75.80	99.00	1.50	17.00	55.80	17.00	14.80	31.00
88	107	3	25	64	25	20	39

Toxicity Threshold

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
197	315	3.5	16770	875	2355	245	515

342	1173	1	11090	1919	1841	118	519
752	2770	1	28184	4876	4679	299	1319
963	3820	2	56234	9729	9335	596	2632
1534	6015	4	112202	19411	18626	1189	5251

In River (no mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Step 2

Copper	Zinc
RST24	
2	2
0	0
0	0
0	0
0	0

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

RST6	
1	1
0	0
0	0
0	0
0	0

Annual average concentration (ug/l)

0.03	0.12
------	------

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

0.14	0.59
0.30	0.97
0.66	2.11
1.87	9.69

Velocity **0.01** m/s

Tier 1 is used for the calculation

DI **17.76**

% settlement needed **0** %

In River (with mitigation)

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

Step 3

Copper	Zinc
RST24	
2	2
-	-
-	-
-	-

Allowable Exceedances/year
No. of exceedances/year
No. of exceedances/worst year
No. of exceedances/summer
No. of exceedances/worst summer

RST6	
1	1
-	-
-	-
-	-

Annual average concentration (ug/l)

-	-
---	---

Thresholds
Thresholds

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120

Event Statistics Mean
90%ile
95%ile
99%ile

-	-
-	-
-	-
-	-

DI **-**

Details of the chosen rainfall site

SAAR (mm)	850
Altitude (m)	70
Easting	3561
Northing	1754
Coastal distance (km)	10

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	RE3 watercourse	RE1 watercourse						
D2	Length of road draining to outfall (m)	0	450						
D3	Road Type (A-road or Motorway)		A						
D4	If A road, is site urban or rural?	Rural	Urban						
D5	Junction type	No junction	Side road						
D6	Location	< 1 hour	< 20 minutes						
D7	Traffic flow	1,000	1,000						
D8	% HGV	0	100						
D8	Spillage factor (no/10 ⁹ HGVkm/year)		1.81						
D9	Risk of accidental spillage	0.00000	0.00030	0.00000	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor from Table D.2	0.40	0.45						
D11	Risk of pollution incident	0.00000	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No	No						
D13	Return period without pollution reduction measures	0.00000	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	
D14	Existing measures factor	1	1						
D15	Return period with existing pollution reduction measures	0.00000	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	
D16	Proposed measures factor	1	1						
D17	Residual with proposed Pollution reduction measures	0.00000	0.00013	0.00000	0.00000	0.00000	0.00000	0.00000	
								Totals	Return Period (years)
								0.0001	7475
								0.0001	7475
								0.0001	7475

Table 7.1

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

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

Table D2

Water Quality Objective of Receiving Watercourse	Urban (response time to site < 20 min)	Rural (response time to site < 1 hour)	Remote (response time to site > 1 hour)
RE1 watercourse	0.45	0.60	0.75
RE2 watercourse	0.45	0.60	0.75
RE3 watercourse	0.30	0.40	0.50
RE4 watercourse	0.30	0.40	0.50
Aquifer	0.30	0.30	0.50

The worksheet should be read in conjunction with the Guidance Document and HA 216.

For further advice on the application of this worksheet, contact a Highways Agency Regional Environmental Advisor in the area of interest.