

16. Drainage Calculations



1. Drainage Calculations

Project A9 Kincaig - Dalraddy			Job ref 510 9850	
Part of structure Wallingford Cales			Calc sheet no rev 1 12 1	
Drawing ref.	Calc by MC	Date 06/06/13	Check by EM	Date 6/06/13

Ref	Calculations	Output
	<p>Calculating rainfall intensity using the "Wallingford Modified Rational Method".</p> <p>Determine M5 - 60 min for site using rainfall depth map from Wallingford.</p> <p>M5 - 60 min = 16mm</p> <p>Allow + 20% for climate change:</p> <p>M5 - 60 min = 19.2mm</p> <p>Determine R for site.</p> <p>100 x R = 17</p> <p>R = 0.17</p> <p>Determine Z1 values using Fig. A.3a from Wallingford.</p> <p>5 min = 0.26 10 min = 0.40 15 min = 0.50 30 min = 0.70 1 hr = 1.00 2 hr = 1.38 4 hr = 1.90 6 hr = 2.30 10 hr = 2.82 24 hr = 4.50 48 hr = 6.30</p> <p>Determine M5 - D values for each duration where M5 - D = Z1 x M5 - 60 min.</p> <p>5 min = 0.26 x 19.2 = 4.99 mm 10 min = 0.40 x 19.2 = 7.68 mm 15 min = 0.50 x 19.2 = 9.60 mm 30 min = 0.70 x 19.2 = 13.44 mm 1 hr = 1.00 x 19.2 = 19.20 mm 2 hr = 1.38 x 19.2 = 26.50 mm 4 hr = 1.90 x 19.2 = 36.48 mm 6 hr = 2.30 x 19.2 = 44.16 mm 10 hr = 2.82 x 19.2 = 54.14 mm 24 hr = 4.50 x 19.2 = 86.40 mm 48 hr = 6.30 x 19.2 = 120.96 mm</p>	

Project A9 Kincaig - Dalraddy		Job ref 510 9850	
Part of structure Wallingford Calcs		Calc sheet no rev 2 12 1	
Drawing ref.	Calc by MC	Date 06/06/13	Check by EM
			Date 6/6/13

Ref	Calculations	Output
	Determine Z2 values using Table A2 from Wallingford.	
	5 min = 2.100	
	10 min = 2.180	
	15 min = 2.238	
	30 min = 2.257	
	1 hr = 2.210	
	2 hr = 2.111	
	4 hr = 2.019	
	6 hr = 1.955	
	10 hr = 1.898	
	24 hr = 1.740	
	48 hr = 1.634	
	Determine M200 - D values for each duration where M200 - D = Z2 x M5 - D.	
	5 min = 2.100 x 4.99 = 10.483 mm	
	10 min = 2.180 x 7.68 = 16.745 mm	
	15 min = 2.238 x 9.60 = 21.485 mm	
	30 min = 2.257 x 13.44 = 30.332 mm	
	1 hr = 2.210 x 19.20 = 42.424 mm	
	2 hr = 2.111 x 26.50 = 55.933 mm	
	4 hr = 2.019 x 36.48 = 73.643 mm	
	6 hr = 1.955 x 44.16 = 86.335 mm	
	10 hr = 1.898 x 54.14 = 102.791 mm	
	24 hr = 1.740 x 86.40 = 150.322 mm	
	48 hr = 1.634 x 120.96 = 197.635 mm	
M200	Determine the Point Intensity for each duration where i = depth / duration.	
	5 min = 10.483 / 0.083 = 125.798 mm/hr	
	10 min = 16.745 / 0.167 = 100.473 mm/hr	
	15 min = 21.485 / 0.25 = 85.939 mm/hr	
	30 min = 30.332 / 0.5 = 60.665 mm/hr	
	1 hr = 42.424 / 1 = 42.424 mm/hr	
	2 hr = 55.933 / 2 = 27.967 mm/hr	
	4 hr = 73.643 / 4 = 18.411 mm/hr	
	6 hr = 86.335 / 6 = 14.389 mm/hr	
	10 hr = 102.791 / 10 = 10.279 mm/hr	
	24 hr = 150.322 / 24 = 6.263 mm/hr	
	48 hr = 197.635 / 48 = 4.117 mm/hr	

M200 - 5

5min point intensity

125.7984 mm/hr	81
0.034944 mm/sec	0.0225
3.494E-05 m/sec	0.0000225

Existing Network

Network	Area (ha)	Area (m2)	Flow (m3/sec)	Flow (litres/sec)
1	1.7	16810	0.59	587.41
2A	0.9	8500	0.30	297.02
2B	1.2	11790	0.41	411.99
3	1.0	10320	0.36	360.62
4	1.3	12740	0.45	445.19
5	3.0	30140	1.05	1053.21
6	0.3	3440	0.12	120.21

Proposed Network

Network	Area (ha)	Area (m2)	Flow (m3/sec)	Flow (litres/sec)
1	3.389	33890	1.18	1184.25
2A	1.797	17970	0.63	627.94
2B	2.759	27590	0.96	964.10
3	2.717	27170	0.95	949.43
4	2.82	28200	0.99	985.42
5	8.066	80660	2.82	2818.58
6	0.723	7230	0.25	252.65

2. HAWRAT Calculations – Existing

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.00 ug/l
Step 3	0.01 ug/l

Copper

Zinc

Pass

Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.71	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Pass

Road number: A9 - Kincaig to Dalraddy

Assessment type: Non-cumulative assessment (single outfall)

OS grid reference of assessment point (m): Easting 285300, Northing 809100

OS grid reference of outfall structure (m): Easting [blank], Northing [blank]

Outfall number: Network 6

Receiving watercourse: Allt an Fhearna

EA receiving water Detailed River Network ID: [blank]

Date of assessment: 29/09/2013

Notes: [blank]

HA Area / DBFO number: [blank]

RAI: [blank]

RAI2: [blank]

RAI3: [blank]

RAI4: [blank]

RAI5: [blank]

RAI6: [blank]

RAI7: [blank]

RAI8: [blank]

RAI9: [blank]

RAI10: [blank]

RAI11: [blank]

RAI12: [blank]

RAI13: [blank]

RAI14: [blank]

RAI15: [blank]

RAI16: [blank]

RAI17: [blank]

RAI18: [blank]

RAI19: [blank]

RAI20: [blank]

RAI21: [blank]

RAI22: [blank]

RAI23: [blank]

RAI24: [blank]

RAI25: [blank]

RAI26: [blank]

RAI27: [blank]

RAI28: [blank]

RAI29: [blank]

RAI30: [blank]

RAI31: [blank]

RAI32: [blank]

RAI33: [blank]

RAI34: [blank]

RAI35: [blank]

RAI36: [blank]

RAI37: [blank]

RAI38: [blank]

RAI39: [blank]

RAI40: [blank]

RAI41: [blank]

RAI42: [blank]

RAI43: [blank]

RAI44: [blank]

RAI45: [blank]

RAI46: [blank]

RAI47: [blank]

RAI48: [blank]

RAI49: [blank]

RAI50: [blank]

Step 1 Runoff Quality

AADT: >10,000 and <50,000

Climatic region: Colder/Wet

Rainfall site: Keighley (SAAR 1000mm)

Step 2 River Impacts

Annual 95%ile river flow (m³/s): 0.110

Impermeable road area drained (ha): 0.3

Base Flow Index (BFI): 0.436

Water hardness: Low = <50mg CaCO₃/l

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

Permeable area draining to outfall (ha): 0

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

For dissolved zinc only

Water hardness: Low = <50mg 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): 3.4

Tier 2 Bed width (m): 3.1

Manning's n: 0.03

Side slope (m/m): 0.5

Long slope (m/m): 0.02

Step 3 Mitigation

Brief description: [blank]

Treatment for solubles (%): [blank]

Estimated effectiveness: [blank]

Attenuation for solubles - restricted discharge rate (l/s): [blank]

Settlement of sediments (%): [blank]

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
39.50	39.40
53	50

Copper	Zinc
RST6	
1	1
11.40	14.20
18	19

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	23.22	68.11
	45.10	142.80
	57.14	182.03
	91.61	388.90

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
52.50	71.40	1.00	30.30	72.50	30.30	14.40	59.40
65	81	3	37	81	37	21	66

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
	305	1133	1	15615	2701	2592	166	731
	690	2629	1	35481	6138	5890	376	1661
	869	3668	2	35481	6138	5890	376	1661
	1221	6393	3	89125	15419	14795	945	4171

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

Copper	Zinc
RST6	
1	1
0	0
0	0
0	0

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	0.02	0.05
	0.03	0.10
	0.06	0.20
	0.16	0.62

Step 2

Velocity m/s Tier 2 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
-	-
-	-
-	-

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

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

DI

Details of the chosen rainfall site	
SAAR (mm)	1000
Altitude (m)	200
Easting	4060
Northing	4410
Coastal distance (km)	70

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Surface watercourse						
D2 Length of road draining to outfall (m)	400						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ³ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00018	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.60						
D11 Risk of pollution incident	0.00011	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00011	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00011	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00011	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0001 9461
							0.0001 9461
							0.0001 9461

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	400						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00018	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00005	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0001
							18923
							0.0001
							18923
							0.0001
							18923

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.18 ug/l
Step 3	0.64 ug/l

Copper
Pass

Zinc
Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.38	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Road number	A9 - Kincaig to Dalraddy	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 283450	Northing	806300
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	Network 4	List of outfalls in cumulative assessment	
Receiving watercourse	Baldow Smiddy	Assessor and affiliation	
EA receiving water Detailed River Network ID		Version of assessment	
Date of assessment	29/09/2013		
Notes			

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Aldergrove (SAAR 862.4mm)
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Step 2 River Impacts

Annual 95%ile river flow (m ³ /s)	0.007	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	1.4	Permeable area draining to outfall (ha)	0
Base Flow Index (BFI)	0.687	Is the discharge in or within 1 km upstream of a protected site for conservation?	No <input type="checkbox"/> D <input type="checkbox"/>

For dissolved zinc only

Water hardness	Low = <50mg CaCO ₃ /l	
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For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?				
<input type="checkbox"/> Tier 1	Estimated river width (m)	2.6	No <input type="checkbox"/> D <input type="checkbox"/>	
<input checked="" type="checkbox"/> Tier 2	Bed width (m)	2.2	Long slope (m/m)	0.06
	Manning's n	0.03	Side slope (m/m)	0.5

Step 3 Mitigation

Brief description	Estimated effectiveness				
	<table border="1"> <tr> <td>Treatment for solubles (%)</td> <td>Settlement of sediments (%)</td> </tr> <tr> <td>Attenuation for solubles - restricted discharge rate (l/s)</td> <td></td> </tr> </table>	Treatment for solubles (%)	Settlement of sediments (%)	Attenuation for solubles - restricted discharge rate (l/s)	
Treatment for solubles (%)	Settlement of sediments (%)				
Attenuation for solubles - restricted discharge rate (l/s)					

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64
RST6	
1	1
19.60	20.00
24	26
(ug/l)	(ug/l)
RST24	21
RST6	42
24.75	68.24
48.24	141.08
63.59	194.64
100.22	350.11

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245
346	1190	1	16084	2783	2670	170	753
787	2737	1	35481	6138	5890	376	1661
1018	3570	2	70795	12247	11752	750	3313
1449	5695	4	89125	15419	14795	945	4171

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	0.2
0	1
0	0.2
0	1
RST6	
1	1
0	0.1
0	1
0	0.1
0	1
0.18	0.64
(ug/l)	(ug/l)
RST24	21
RST6	42
0.61	1.98
1.59	5.00
2.66	9.49
7.31	22.18

Velocity m/s Tier 2 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	42
-	-
-	-
-	-
-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

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)	1,050					
D3 Road Type (A-road or Motorway)	A					
D4 If A road, is site urban or rural?	Rural					
D5 Junction type	Slip road					
D6 Location	< 1 hour					
D7 Traffic flow (AADT two way)	8,551					
D8 % HGV	17					
D8 Spillage factor (no/10 ³ HG/km/year)	0.83					
D9 Risk of accidental spillage	0.00046	0.00000	0.00000	0.00000	0.00000	0.00000
D10 Probability factor	0.60					
D11 Risk of pollution incident	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000
D12 Is risk greater than 0.01?	No					
D13 Return period without pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000
D14 Existing measures factor	1					
D15 Return period with existing pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000
D16 Proposed measures factor	1					
D17 Residual with proposed Pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000
						Totals
						0.00003
						0.00003
						0.00003
						3604
						3604
						3604

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	1,050						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ³ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00046	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0001
							7209
							0.0001
							7209
							0.0001
							7209

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.03
Step 3	-

Copper
Pass

Zinc
Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.73	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Alert. Protected Area.

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	282400	Northing	804250	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network 2		List of outfalls in cumulative assessment		
Receiving watercourse	Dunachton Burn				
EA receiving water Detailed River Network ID	Assessor and affiliation				
Date of assessment	29/09/2013				
Notes	Version of assessment				

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Keighley (SAAR 1000mm)
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Step 2 River Impacts

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

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

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only

Water hardness

For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m)

Tier 2 Bed width (m) Manning's n Side slope (m/m) Long slope (m/m)

Step 3 Mitigation

Brief description	Estimated effectiveness				
	<table border="1"> <tr> <td>Treatment for solubles (%)</td> <td>Settlement of sediments (%)</td> </tr> <tr> <td>Attenuation for solubles - restricted discharge rate (l/s)</td> <td></td> </tr> </table>	Treatment for solubles (%)	Settlement of sediments (%)	Attenuation for solubles - restricted discharge rate (l/s)	
Treatment for solubles (%)	Settlement of sediments (%)				
Attenuation for solubles - restricted discharge rate (l/s)					

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64
RST6	
1	1
19.60	20.00
24	26
(ug/l)	(ug/l)
RST24	RST6
21	60
42	120
24.75	68.24
48.24	141.08
63.59	194.64
100.22	350.11

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene	
Toxicity Threshold								
1	1	1	1	1	1	1	1	
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60	
91	125	5	57	114	57	35	97	
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	
Toxicity	197	315	3.5	16770	875	2355	245	515
346	1190	1	16084	2783	2670	170	753	
787	2737	1	35481	6138	5890	376	1661	
1018	3570	2	70795	12247	11752	750	3313	
1449	5695	4	89125	15419	14795	945	4171	

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	
1	1
0	0
0	0
0	0
0	0
RST6	
0.5	0.5
0	0
0	0
0	0
0	0
0.03	0.10
(ug/l)	(ug/l)
RST24	RST6
21	60
42	120
0.10	0.33
0.24	0.75
0.41	1.49
1.34	3.91

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	
1	1
-	-
-	-
-	-
RST6	
0.5	0.5
-	-
-	-
-	-
-	-
-	-
(ug/l)	(ug/l)
RST24	RST6
21	60
42	120
-	-
-	-
-	-
-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

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	Totals	Return Period (years)
D1	Water body type	Surface watercourse						
D2	Length of road draining to outfall (m)	1,050						
D3	Road Type (A-road or Motorway)	A						
D4	If A road, is site urban or rural?	Rural						
D5	Junction type	Slip road						
D6	Location	< 1 hour						
D7	Traffic flow (AADT two way)	8,551						
D8	% HGV	17						
D8	Spillage factor (no/10 ³ HG/km/year)	0.83						
D9	Risk of accidental spillage	0.00046	0.00000	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.60						
D11	Risk of pollution incident	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No						
D13	Return period without pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00003	3604
D14	Existing measures factor	1						
D15	Return period with existing pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00003	3604
D16	Proposed measures factor	1						
D17	Residual with proposed Pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00003	3604

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Groundwater				
D2	Length of road draining to outfall (m)	1,050				
D3	Road Type (A-road or Motorway)	A				
D4	If A road, is site urban or rural?	Rural				
D5	Junction type	Slip road				
D6	Location	< 1 hour				
D7	Traffic flow (AADT two way)	8,551				
D8	% HGV	17				
D8	Spillage factor (no/10 ³ HG/km/year)	0.83				
D9	Risk of accidental spillage	0.00046	0.00000	0.00000	0.00000	0.00000
D10	Probability factor	0.30				
D11	Risk of pollution incident	0.00014	0.00000	0.00000	0.00000	0.00000
D12	Is risk greater than 0.01?	No				
D13	Return period without pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000
D14	Existing measures factor	1				
D15	Return period with existing pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000
D16	Proposed measures factor	1				
D17	Residual with proposed Pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000
						Totals
						0.0001
						7209
						0.0001
						7209
						0.0001
						7209

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.05
Step 3	0.19
	ug/l
	ug/l

Copper
Pass

Zinc
Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.31	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Road number	A9 - Kincaig to Dalraddy	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 283200	Northing	806050
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	Network 3	List of outfalls in cumulative assessment	
Receiving watercourse	Leault Burn	Assessor and affiliation	
EA receiving water Detailed River Network ID		Version of assessment	
Date of assessment	29/09/2013		
Notes			

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Penrith (SAAR 900mm)
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Step 2 River Impacts

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

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

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only

Water hardness

For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m)

Tier 2 Bed width (m) Manning's n Side slope (m/m) Long slope (m/m)

Step 3 Mitigation

Brief description	Estimated effectiveness				
	<table border="1"> <tr> <td>Treatment for solubles (%)</td> <td>Settlement of sediments (%)</td> </tr> <tr> <td>Attenuation for solubles - restricted discharge rate (l/s)</td> <td></td> </tr> </table>	Treatment for solubles (%)	Settlement of sediments (%)	Attenuation for solubles - restricted discharge rate (l/s)	
Treatment for solubles (%)	Settlement of sediments (%)				
Attenuation for solubles - restricted discharge rate (l/s)					

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
63.00	52.70
75	63
RST6	
1	1
19.20	19.20
26	28
(ug/l)	(ug/l)
RST24	21
RST6	42
24.92	70.24
49.03	147.03
62.83	203.85
95.08	359.43

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
80.90	104.70	1.60	44.30	101.70	44.30	21.10	83.50
98	123	3	60	121	60	31	102
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245
349	1203	1	16079	2782	2669	170	752
798	2797	1	35481	6138	5890	376	1661
969	3854	2	70795	12247	11752	750	3313
1486	5830	4	89125	15419	14795	945	4171

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
0.05	0.19
(ug/l)	(ug/l)
RST24	21
RST6	42
0.16	0.58
0.42	1.32
0.74	2.92
1.93	8.51

Velocity 0.31 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	42
-	-
-	-
-	-
-	-

DI -

Details of the chosen rainfall site	
SAAR (mm)	900
Altitude (m)	200
Easting	3514
Northing	5304
Coastal distance (km)	45

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	2,400						
D3 Road Type (A-road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00106	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0003
							3154
							0.0003
							3154
							0.0003
							3154

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	700						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00031	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00009	0.00000	0.00000	0.00000	0.00000	0.00000	
							Totals
							0.0001
							1081.3
							0.0001
							1081.3
							0.0001
							1081.3

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc
Step 2	0.10	0.35
Step 3	-	-

Copper

Pass

Zinc

Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	Extensive?	Low flow Vel m/s	Deposition Index
No	No	0.29	-

Pass

Road number: A9 - Kincaig to Dalraddy
 Assessment type: Non-cumulative assessment (single outfall)
 OS grid reference of assessment point (m): Easting 285550
 OS grid reference of outfall structure (m): Easting
 Outfall number: Network 5
 Receiving watercourse: Unnamed watercourse @ Dalraddy
 EA receiving water Detailed River Network ID:
 Date of assessment: 29/09/2013
 Notes:

HA Area / DBFO number: 809100
 Northing
 Northing
 List of outfalls in cumulative assessment:
 Assessor and affiliation:
 Version of assessment:

Step 1 Runoff Quality
 AADT: >10,000 and <50,000
 Climatic region: Colder/Wet
 Rainfall site: Aldergrove (SAAR 862.4mm)

Step 2 River Impacts
 Annual 95%ile river flow (m³/s): 0.03
 (Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)
 Impermeable road area drained (ha): 3.0
 Permeable area draining to outfall (ha): 0
 Base Flow Index (BFI): 0.816
 Is the discharge in or within 1 km upstream of a protected site for conservation? No [D]

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

For sediment impact only
 Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?
 Tier 1 Estimated river width (m): 4.09
 Tier 2 Bed width (m): 3.9
 Manning's n: 0.03
 Side slope (m/m): 0.5
 Long slope (m/m): 0.008

Step 3 Mitigation
 Brief description:
 Estimated effectiveness:
 Treatment for solubles (%):
 Attenuation for solubles - restricted discharge rate (l/s):
 Settlement of sediments (%):
 Predict Impact
 Show Detailed Results

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Return To Interface

Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact Step1 Step2 Step3

Copper	Zinc

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
62.40	54.30
71	64

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97

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

Copper	Zinc
RST6	
1	1
19.60	20.00
24	26

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

Thresholds
 Thresholds

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

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

24.75	68.24
48.24	141.08
63.59	194.64
100.22	350.11

346	1190	1	16084	2783	2670	170	753
787	2737	1	35481	6138	5890	376	1661
1018	3570	2	70795	12247	11752	750	3313
1449	5695	4	89125	15419	14795	945	4171

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	0.1
0	1
0	0.1
0	1

Velocity 0.29 m/s Tier 2 is used for the calculation

DI -

% settlement needed - %

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
0	0
0	0
0	0

Annual average concentration (ug/l)

0.10	0.35
------	------

Thresholds
 Thresholds

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

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

0.34	1.11
0.84	2.68
1.46	5.04
4.78	12.79

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
-	-
-	-
-	-
-	-

DI -

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)

-	-
---	---

Thresholds
 Thresholds

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

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

-	-
-	-
-	-
-	-

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

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	B	C	D	E	F
D1 Water body type	Groundwater					
D2 Length of road draining to outfall (m)	2,400					
D3 Road Type (A-road or Motorway)	A					
D4 If A road, is site urban or rural?	Rural					
D5 Junction type	Slip road					
D6 Location	< 1 hour					
D7 Traffic flow (AADT two way)	8,551					
D8 % HGV	17					
D8 Spillage factor (no/10 ³ HG/km/year)	0.83					
D9 Risk of accidental spillage	0.00106	0.00000	0.00000	0.00000	0.00000	0.00000
D10 Probability factor	0.30					
D11 Risk of pollution incident	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000
D12 Is risk greater than 0.01?	No					
D13 Return period without pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000
D14 Existing measures factor	1					
D15 Return period with existing pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000
D16 Proposed measures factor	1					
D17 Residual with proposed Pollution reduction measures	0.00032	0.00000	0.00000	0.00000	0.00000	0.00000
Totals						
						Return Period (years)
						0.0003 3154
						0.0003 3154
						0.0003 3154

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Surface watercourse					
D2	Length of road draining to outfall (m)	2,400					
D3	Road Type (A-road or Motorway)	A					
D4	If A road, is site urban or rural?	Rural					
D5	Junction type	Slip road					
D6	Location	< 1 hour					
D7	Traffic flow (AADT two way)	8,551					
D8	% HGV	17					
D8	Spillage factor (no/10 ³ HG/km/year)	0.83					
D9	Risk of accidental spillage	0.00106	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.60					
D11	Risk of pollution incident	0.00063	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No					
D13	Return period without pollution reduction measures	0.00063	0.00000	0.00000	0.00000	0.00000	
D14	Existing measures factor	1					
D15	Return period with existing pollution reduction measures	0.00063	0.00000	0.00000	0.00000	0.00000	
D16	Proposed measures factor	1					
D17	Residual with proposed Pollution reduction measures	0.00063	0.00000	0.00000	0.00000	0.00000	
			Totals			Return Period (years)	
			0.0006			1577	
			0.0006			1577	
			0.0006			1577	

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc
Step 2	0.15 ug/l	0.53 ug/l
Step 3	-	-

Copper

Pass

Zinc

Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	Extensive?	Low flow Vel m/s	Deposition Index
No	No	0.50	-

Alert. Protected Area.

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	281140	Northing	803720	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network 1		List of outfalls in cumulative assessment		
Receiving watercourse	Unnamed watercourse @ Meadowside				
EA receiving water Detailed River Network ID	Assessor and affiliation				
Date of assessment	29/09/2013				
Notes	Version of assessment				

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Aldergrove (SAAR 862.4mm)
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Step 2 River Impacts

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

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

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only

Water hardness

For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m) Side slope (m/m)

Tier 2 Bed width (m) Manning's n Long slope (m/m)

Step 3 Mitigation

Brief description	Estimated effectiveness				
	<table border="1"> <tr> <td>Treatment for solubles (%)</td> <td>Settlement of sediments (%)</td> </tr> <tr> <td></td> <td></td> </tr> </table>	Treatment for solubles (%)	Settlement of sediments (%)		
Treatment for solubles (%)	Settlement of sediments (%)				

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64
RST6	
1	1
19.60	20.00
24	26
(ug/l)	(ug/l)
RST24	21
RST6	42
24.75	68.24
48.24	141.08
63.59	194.64
100.22	350.11

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245
346	1190	1	16084	2783	2670	170	753
787	2737	1	35481	6138	5890	376	1661
1018	3570	2	70795	12247	11752	750	3313
1449	5695	4	89125	15419	14795	945	4171

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	
1	1
0	0.2
0	1
0	0.2
0	1
RST6	
0.5	0.5
0	0.1
0	1
0	0.1
0	1
0.15	0.53
(ug/l)	(ug/l)
RST24	21
RST6	42
0.52	1.67
1.32	4.12
2.21	7.87
6.52	19.14

Velocity m/s

Tier 2 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	
1	1
-	-
-	-
-	-
RST6	
0.5	0.5
-	-
-	-
-	-
-	-
(ug/l)	(ug/l)
RST24	21
RST6	42
-	-
-	-
-	-
-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Surface watercourse						
D2 Length of road draining to outfall (m)	1,060						
D3 Road Type (A-road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	8,551						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00047	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.60						
D11 Risk of pollution incident	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00028	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0003
							3570
							0.0003
							3570
							0.0003
							3570

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Groundwater					
D2 Length of road draining to outfall (m)	1,060					
D3 Road Type (A=road or Motorway)	A					
D4 If A road, is site urban or rural?	Rural					
D5 Junction type	Slip road					
D6 Location	< 1 hour					
D7 Traffic flow (AADT two way)	8,551					
D8 % HGV	17					
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83					
D9 Risk of accidental spillage	0.00047	0.00000	0.00000	0.00000	0.00000	0.00000
D10 Probability factor	0.30					
D11 Risk of pollution incident	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000
D12 Is risk greater than 0.01?	No					
D13 Return period without pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000
D14 Existing measures factor	1					
D15 Return period with existing pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000
D16 Proposed measures factor	1					
D17 Residual with proposed Pollution reduction measures	0.00014	0.00000	0.00000	0.00000	0.00000	0.00000
Totals						
						Return Period (years)
						0.0001 7141
						0.0001 7141
						0.0001 7141

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

3. HAWRAT Calculations - Proposed

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.01
Step 3	0.03
	ug/l
	ug/l

Copper
Pass

Zinc
Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.71	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Road number	A9 - Kincaig to Dalraddy	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 285300	Northing	809100
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	Network 6	List of outfalls in cumulative assessment	
Receiving watercourse	Allt an Fhearna	Assessor and affiliation	
EA receiving water Detailed River Network ID		Version of assessment	
Date of assessment	29/09/2013		
Notes			

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Keighley (SAAR 1000mm)
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Step 2 River Impacts

Annual 95%ile river flow (m ³ /s)	0.110	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	0.723	Permeable area draining to outfall (ha)	0
Base Flow Index (BFI)	0.436	Is the discharge in or within 1 km upstream of a protected site for conservation?	No <input type="checkbox"/> D <input type="checkbox"/>

For dissolved zinc only

Water hardness	Low = <50mg CaCO ₃ /l	
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For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?				
<input type="checkbox"/> Tier 1	Estimated river width (m)	3.4	No <input type="checkbox"/> D <input type="checkbox"/>	
<input checked="" type="checkbox"/> Tier 2	Bed width (m)	3.1	Long slope (m/m)	0.02
	Manning's n	0.03	Side slope (m/m)	0.5

Step 3 Mitigation

Brief description	
Estimated effectiveness	
Treatment for solubles (%)	Settlement of sediments (%)
Attenuation for solubles - restricted discharge rate (l/s)	

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
39.50	39.40
53	50

Copper	Zinc
RST6	
1	1
11.40	14.20
18	19

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

	Mean	90%ile	95%ile	99%ile
23.22	68.11	45.10	142.80	57.14
91.61	388.90	57.14	182.03	91.61

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
1	1	1	1	1	1	1	1
52.50	71.40	1.00	30.30	72.50	30.30	14.40	59.40
65	81	3	37	81	37	21	66

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

	Mean	90%ile	95%ile	99%ile
305	1133	690	2629	869
1221	6393	1221	6393	1221

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

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

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

	Mean	90%ile	95%ile	99%ile
0.04	0.12	0.08	0.24	0.14
0.39	1.50	0.39	1.50	0.39

Velocity m/s Tier 2 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
-	-
-	-
-	-

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

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

	Mean	90%ile	95%ile	99%ile
-	-	-	-	-
-	-	-	-	-
-	-	-	-	-

DI

Details of the chosen rainfall site	
SAAR (mm)	1000
Altitude (m)	200
Easting	4060
Northing	4410
Coastal distance (km)	70

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

		Additional columns for use if other roads drain to the same outfall					
	A (main road)	B	C	D	E	F	
D1	Water body type	Surface watercourse					
D2	Length of road draining to outfall (m)	400					
D3	Road Type (A=road or Motorway)	A					
D4	If A road, is site urban or rural?	Rural					
D5	Junction type	Slip road					
D6	Location	< 1 hour					
D7	Traffic flow (AADT two way)	9,375					
D8	% HGV	17					
D8	Spillage factor (no/10 ⁹ HG/km/year)	0.83					
D9	Risk of accidental spillage	0.00019	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.60					
D11	Risk of pollution incident	0.00012	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No					
D13	Return period without pollution reduction measures	0.00012	0.00000	0.00000	0.00000	0.00000	
D14	Existing measures factor	1					
D15	Return period with existing pollution reduction measures	0.00012	0.00000	0.00000	0.00000	0.00000	
D16	Proposed measures factor	1					
D17	Residual with proposed Pollution reduction measures	0.00012	0.00000	0.00000	0.00000	0.00000	
	Totals		0.00001	0.00001	0.00001	0.00001	
	Return Period (years)		8630	8630	8630	8630	

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Groundwater				
D2	Length of road draining to outfall (m)	400				
D3	Road Type (A-road or Motorway)	A				
D4	If A road, is site urban or rural?	Rural				
D5	Junction type	Slip road				
D6	Location	< 1 hour				
D7	Traffic flow (AADT two way)	9,375				
D8	% HGV	17				
D8	Spillage factor (no/10 ³ HG/km/year)	0.83				
D9	Risk of accidental spillage	0.00019	0.00000	0.00000	0.00000	0.00000
D10	Probability factor	0.30				
D11	Risk of pollution incident	0.00006	0.00000	0.00000	0.00000	0.00000
D12	Is risk greater than 0.01?	No	0.00000	0.00000	0.00000	0.00000
D13	Return period without pollution reduction measures	0.00006	0.00000	0.00000	0.00000	0.00000
D14	Existing measures factor	1				
D15	Return period with existing pollution reduction measures	0.00006	0.00000	0.00000	0.00000	0.00000
D16	Proposed measures factor	1				
D17	Residual with proposed Pollution reduction measures	0.00006	0.00000	0.00000	0.00000	0.00000
						Totals
						0.0001
						17259
						0.0001
						17259
						0.0001
						17259

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Sediment - Chronic Impact

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.34 ug/l
Step 3	1.19 ug/l

Copper
Pass

Zinc
Pass

Pass

Sediment deposition for this site is judged as:
Accumulating? No
Extensive? No
Low flow Vel m/s 0.38
Deposition Index -

Road number	A9 - Kincaig to Dalraddy	HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)		
OS grid reference of assessment point (m)	Easting 283450	Northing	806300
OS grid reference of outfall structure (m)	Easting	Northing	
Outfall number	Network 4	List of outfalls in cumulative assessment	
Receiving watercourse	Baldow Smiddy	Assessor and affiliation	
EA receiving water Detailed River Network ID		Version of assessment	
Date of assessment	29/09/2013		
Notes			

Step 1 Runoff Quality AADT Climatic region Rainfall site

Step 2 River Impacts

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

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

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only Water hardness

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m) Long slope (m/m)

Tier 2 Bed width (m) Manning's n Side slope (m/m)

Step 3 Mitigation

Brief description

Estimated effectiveness

Treatment for solubles (%)	Settlement of sediments (%)
Attenuation for solubles - restricted discharge rate (l/s)	

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64

Copper	Zinc
RST6	
1	1
19.60	20.00
24	26

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	24.75	68.24
	48.24	141.08
	63.59	194.64
	100.22	350.11

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
	346	1190	1	16084	2783	2670	170	753
	787	2737	1	35481	6138	5890	376	1661
	1018	3570	2	70795	12247	11752	750	3313
	1449	5695	4	89125	15419	14795	945	4171

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
0.2	0.4
1	1
0.2	0.3
1	1

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

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	1.09	3.50
	2.92	9.20
	4.81	16.94
	11.85	38.27

Velocity 0.38 m/s

Tier 2 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
-	-
-	-
-	-

Copper	Zinc
RST6	
1	1
-	-
-	-
-	-

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

DI -

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	1,050						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	9,375						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	6575
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00015	0.00000	0.00000	0.00000	0.00000	0.00000	6575

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Surface watercourse					
D2 Length of road draining to outfall (m)	1,050					
D3 Road Type (A-road or Motorway)	A					
D4 If A road, is site urban or rural?	Rural					
D5 Junction type	Slip road					
D6 Location	< 1 hour					
D7 Traffic flow (AADT two way)	9,375					
D8 % HGV	17					
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83					
D9 Risk of accidental spillage	0.00051	0.00000	0.00000	0.00000	0.00000	0.00000
D10 Probability factor	0.60					
D11 Risk of pollution incident	0.00030	0.00000	0.00000	0.00000	0.00000	0.00000
D12 Is risk greater than 0.01?	No					
D13 Return period without pollution reduction measures	0.00030	0.00000	0.00000	0.00000	0.00000	0.00000
D14 Existing measures factor	1					
D15 Return period with existing pollution reduction measures	0.00030	0.00000	0.00000	0.00000	0.00000	0.00000
D16 Proposed measures factor	1					
D17 Residual with proposed Pollution reduction measures	0.00030	0.00000	0.00000	0.00000	0.00000	0.00000
						Totals
						0.0003
						0.0003
						0.0003
						3288
						3288
						3288

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc
Step 2	0.07	0.26
Step 3	-	-

Copper
Pass

Zinc
Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	Extensive?	Low flow Vel m/s	Deposition Index
No	No	0.73	-

Alert. Protected Area.

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	282400		Northing	804250
OS grid reference of outfall structure (m)	Easting			Northing	
Outfall number	Network 2		List of outfalls in cumulative assessment		
Receiving watercourse	Dunachton Burn				
EA receiving water Detailed River Network ID	Assessor and affiliation				
Date of assessment	29/09/2013				
Notes	Version of assessment				

Step 1 Runoff Quality

AAADT Climatic region Rainfall site

Step 2 River Impacts

Annual 95%ile river flow (m³/s)
 Annual 95%ile river flow box to assess Step 1 runoff quality only
 Impermeable road area drained (ha)
 Permeable area draining to outfall (ha)
 Base Flow Index (BFI)
 Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only

Water hardness

For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?
 Tier 1 Estimated river width (m)
 Tier 2 Bed width (m) Manning's n Side slope (m/m) Long slope (m/m)

Step 3 Mitigation

Brief description

Estimated effectiveness
 Treatment for solubles (%)
 Attenuation for solubles - restricted discharge rate (l/s)
 Settlement of sediments (%)

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
39.50	39.40
53	50

Copper	Zinc
RST6	
1	1
11.40	14.20
18	19

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	23.22	68.11
	45.10	142.80
	57.14	182.03
	91.61	388.90

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
52.50	71.40	1.00	30.30	72.50	30.30	14.40	59.40
65	81	3	37	81	37	21	66

	(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245	515
	305	1133	1	15615	2701	2592	166	731
	690	2629	1	35481	6138	5890	376	1661
	869	3668	2	35481	6138	5890	376	1661
	1221	6393	3	89125	15419	14795	945	4171

In River (no mitigation)

Allowable Exceedances/year
No. of exceedances/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	
1	1
0	0
0	0
0	0

Copper	Zinc
RST6	
0.5	0.5
0	0
0	0
0	0
0	0

	(ug/l)	(ug/l)
RST24	21	60
RST6	42	120
	0.35	1.12
	0.81	2.38
	1.33	4.73
	3.63	14.24

Velocity 0.73 m/s

Tier 2 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	
1	1
-	-
-	-
-	-

Copper	Zinc
RST6	
0.5	0.5
-	-
-	-
-	-
-	-

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

DI -

Details of the chosen rainfall site	
SAAR (mm)	1000
Altitude (m)	200
Easting	4060
Northing	4410
Coastal distance (km)	70

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	Totals	Return Period (years)
D1	Water body type	Groundwater					0.0003	3968
D2	Length of road draining to outfall (m)	1,740					0.0003	3968
D3	Road Type (A-road or Motorway)	A					0.0003	3968
D4	If A road, is site urban or rural?	Rural					0.0003	3968
D5	Junction type	Slip road					0.0003	3968
D6	Location	< 1 hour					0.0003	3968
D7	Traffic flow (AADT two way)	9,375					0.0003	3968
D8	% HGV	17					0.0003	3968
D8	Spillage factor (no/10 ⁹ HG/km/year)	0.83					0.0003	3968
D9	Risk of accidental spillage	0.00084	0.00000	0.00000	0.00000	0.00000	0.0003	3968
D10	Probability factor	0.30					0.0003	3968
D11	Risk of pollution incident	0.00025	0.00000	0.00000	0.00000	0.00000	0.0003	3968
D12	Is risk greater than 0.01?	No					0.0003	3968
D13	Return period without pollution reduction measures	0.00025	0.00000	0.00000	0.00000	0.00000	0.0003	3968
D14	Existing measures factor	1					0.0003	3968
D15	Return period with existing pollution reduction measures	0.00025	0.00000	0.00000	0.00000	0.00000	0.0003	3968
D16	Proposed measures factor	1					0.0003	3968
D17	Residual with proposed Pollution reduction measures	0.00025	0.00000	0.00000	0.00000	0.00000	0.0003	3968

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Serious Accidental Spillages (Billion HGV km/year)			
	Motorways	Rural Trunk	Urban Trunk	Total
No junction	0.36	0.29	0.31	0.96
Slip road	0.43	0.83	0.36	1.62
Roundabout	3.09	3.09	5.35	11.53
Cross road	-	0.88	1.46	2.34
Side road	-	0.93	1.81	2.74
Total	0.37	0.45	0.85	1.67

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

The worksheet should be read in conjunction with DMRB 11.3.10.

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	Surface watercourse					
D2	Length of road draining to outfall (m)	1,740					
D3	Road Type (A=road or Motorway)	A					
D4	If A road, is site urban or rural?	Rural					
D5	Junction type	Slip road					
D6	Location	< 1 hour					
D7	Traffic flow (AADT two way)	9,375					
D8	% HGV	17					
D8	Spillage factor (no/10 ⁹ HG/km/year)	0.83					
D9	Risk of accidental spillage	0.00084	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.60					
D11	Risk of pollution incident	0.00050	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No	0.00000	0.00000	0.00000	0.00000	
D13	Return period without pollution reduction measures	0.00050	0.00000	0.00000	0.00000	0.00000	0.0005 1984
D14	Existing measures factor	1					
D15	Return period with existing pollution reduction measures	0.00050	0.00000	0.00000	0.00000	0.00000	0.0005 1984
D16	Proposed measures factor	1					
D17	Residual with proposed Pollution reduction measures	0.00050	0.00000	0.00000	0.00000	0.00000	0.0005 1984

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

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Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration	
Copper	Zinc
Step 2	0.13
Step 3	-

Copper

Zinc

Pass

Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.64	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Pass

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	283200	Northing	806050	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network 3				
Receiving watercourse	Leault Burn			List of outfalls in cumulative assessment	
EA receiving water Detailed River Network ID				Assessor and affiliation	
Date of assessment	29/09/2013			Version of assessment	
Notes					

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Penrith (SAAR 900mm)
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Step 2 River Impacts

Annual 95%ile river flow (m ³ /s)	0.02	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)			
Impermeable road area drained (ha)	2.717	Permeable area draining to outfall (ha)	0		
Base Flow Index (BFI)	0.583	Is the discharge in or within 1 km upstream of a protected site for conservation?			

For dissolved zinc only

Water hardness	Low = <50mg CaCO ₃ /l	
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For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?					
Tier 1	Estimated river width (m)	0.7	Manning's n	0.03	Side slope (m/m)
Tier 2	Bed width (m)	0.5	Manning's n	0.5	Long slope (m/m)

Step 3 Mitigation

Brief description	
Treatment for solubles (%)	Estimated effectiveness
Attenuation for solubles - restricted discharge rate (l/s)	Settlement of sediments (%)

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
63.00	52.70
75	63
RST6	
1	1
19.20	19.20
26	28
(ug/l)	(ug/l)
RST24	21
RST6	42
24.92	70.24
49.03	147.03
62.83	203.85
95.08	359.43

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
80.90	104.70	1.60	44.30	101.70	44.30	21.10	83.50
98	123	3	60	121	60	31	102
(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
Toxicity	197	315	3.5	16770	875	2355	245
349	1203	1	16079	2782	2669	170	752
798	2797	1	35481	6138	5890	376	1661
969	3854	2	70795	12247	11752	750	3313
1486	5830	4	89125	15419	14795	945	4171

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	0.1
0	1
0	0.1
0	1
RST6	
1	1
0	0
0	0
0	0
0	0
0.13	0.49
(ug/l)	(ug/l)
RST24	21
RST6	42
0.42	1.47
1.10	3.51
1.87	7.58
4.85	21.66

Velocity **0.64** m/s

Tier 2 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	42
-	-
-	-
-	-
-	-

DI **-**

Details of the chosen rainfall site	
SAAR (mm)	900
Altitude (m)	200
Easting	3514
Northing	5304
Coastal distance (km)	45

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Surface watercourse						
D2 Length of road draining to outfall (m)	700						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	9,375						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00034	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.60						
D11 Risk of pollution incident	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00020	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0002 4931
							0.0002 4931
							0.0002 4931

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Groundwater						
D2 Length of road draining to outfall (m)	700						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	9,375						
D8 % HGV	17						
D8 Spillage factor (no/10 ³ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00034	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.30						
D11 Risk of pollution incident	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	
D12 Is risk greater than 0.01?	No						
D13 Return period without pollution reduction measures	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	9863
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	9863
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00010	0.00000	0.00000	0.00000	0.00000	0.00000	9863

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	No	0.29	Low flow Vel m/s
Extensive?	No	-	Deposition Index

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	285550	Northings	809100	
OS grid reference of outfall structure (m)	Easting		Northings		
Outfall number	Network 5				
Receiving watercourse	Unnamed watercourse @ Dalraddy			List of outfalls in cumulative assessment	
EA receiving water Detailed River Network ID				Assessor and affiliation	
Date of assessment	29/09/2013			Version of assessment	
Notes					

Step 1 Runoff Quality AADT Climatic region Rainfall site

Step 2 River Impacts

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

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

Base Flow Index (BFI) Is the discharge in or within 1 km upstream of a protected site for conservation?

For dissolved zinc only Water hardness

For sediment impact only Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?

Tier 1 Estimated river width (m) Long slope (m/m)

Tier 2 Bed width (m) Side slope (m/m) Manning's n

Step 3 Mitigation

Brief description

Estimated effectiveness

Treatment for solubles (%)	Settlement of sediments (%)
Attenuation for solubles - restricted discharge rate (l/s)	

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97

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

Copper	Zinc
RST6	
1	1
19.60	20.00
24	26

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

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity							
(ug/l)	(ug/l)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
RST24	21	60	197	315	3.5	16770	875
RST6	42	120					

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

(ug/l)	(ug/l)
RST24	21
RST6	42
Mean	24.75
90%ile	48.24
95%ile	63.59
99%ile	100.22

(mg/kg)	(mg/kg)	(mg/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)	(ug/kg)
346	1190	1	16084	2783	2670	170	753
787	2737	1	35481	6138	5890	376	1661
1018	3570	2	70795	12247	11752	750	3313
1449	5695	4	89125	15419	14795	945	4171

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	0.3
0	1

Velocity **0.29** m/s Tier 2 is used for the calculation

DI **-**

% settlement needed **-** %

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	0.1
0	1

Annual average concentration (ug/l)
Thresholds
Thresholds
Event Statistics Mean
90%ile
95%ile
99%ile

(ug/l)	(ug/l)
RST24	21
RST6	42
Mean	0.80
90%ile	2.10
95%ile	3.58
99%ile	9.03

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
-	-
-	-
-	-

DI **-**

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
-	-
-	-
-	-

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

(ug/l)	(ug/l)
RST24	21
RST6	42
Mean	-
90%ile	-
95%ile	-
99%ile	-

Details of the chosen rainfall site	
SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

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	Totals	Return Period (years)
D1	Water body type	Groundwater						
D2	Length of road draining to outfall (m)	2,400						
D3	Road Type (A-road or Motorway)	A						
D4	If A road, is site urban or rural?	Rural						
D5	Junction type	Slip road						
D6	Location	< 1 hour						
D7	Traffic flow (AADT two way)	9,375						
D8	% HGV	17						
D8	Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9	Risk of accidental spillage	0.00116	0.00000	0.00000	0.00000	0.00000	0.00000	
D10	Probability factor	0.30						
D11	Risk of pollution incident	0.00035	0.00000	0.00000	0.00000	0.00000	0.00000	
D12	Is risk greater than 0.01?	No						
D13	Return period without pollution reduction measures	0.00035	0.00000	0.00000	0.00000	0.00000	0.00000	2877
D14	Existing measures factor	1						
D15	Return period with existing pollution reduction measures	0.00035	0.00000	0.00000	0.00000	0.00000	0.00000	2877
D16	Proposed measures factor	1						
D17	Residual with proposed Pollution reduction measures	0.00035	0.00000	0.00000	0.00000	0.00000	0.00000	2877

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Assessment of Priority Outfalls

Method D - assessment of risk from accidental spillage

	Additional columns for use if other roads drain to the same outfall						Return Period (years)
	A (main road)	B	C	D	E	F	
D1 Water body type	Surface watercourse						
D2 Length of road draining to outfall (m)	2,400						
D3 Road Type (A=road or Motorway)	A						
D4 If A road, is site urban or rural?	Rural						
D5 Junction type	Slip road						
D6 Location	< 1 hour						
D7 Traffic flow (AADT two way)	9,375						
D8 % HGV	17						
D8 Spillage factor (no/10 ⁹ HG/km/year)	0.83						
D9 Risk of accidental spillage	0.00116	0.00000	0.00000	0.00000	0.00000	0.00000	
D10 Probability factor	0.60						
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						
D13 Return period without pollution reduction measures	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	
D14 Existing measures factor	1						
D15 Return period with existing pollution reduction measures	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	
D16 Proposed measures factor	1						
D17 Residual with proposed Pollution reduction measures	0.00070	0.00000	0.00000	0.00000	0.00000	0.00000	
Totals							0.0007
							1438
							0.0007
							1438
							0.0007
							1438

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

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

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

The worksheet should be read in conjunction with DMRB 11.3.10.

Soluble - Acute Impact

Annual Average Concentration

	Copper	Zinc
Step 2	0.29 ug/l	1.00 ug/l
Step 3	-	-

Copper

Pass

Zinc

Pass

Sediment - Chronic Impact

Sediment deposition for this site is judged as:

Accumulating?	Extensive?	Low flow Vel m/s	Deposition Index
No	No	0.50	-

Alert. Protected Area.

Road number	A9 - Kincaig to Dalraddy			HA Area / DBFO number	
Assessment type	Non-cumulative assessment (single outfall)				
OS grid reference of assessment point (m)	Easting	281140	Northing	803720	
OS grid reference of outfall structure (m)	Easting		Northing		
Outfall number	Network 1			List of outfalls in cumulative assessment	
Receiving watercourse	Unnamed watercourse @ Meadowside			Assessor and affiliation	
EA receiving water Detailed River Network ID				Version of assessment	
Date of assessment	29/09/2013				
Notes					

Step 1 Runoff Quality

AAADT	>10,000 and <50,000	Climatic region	Colder/Wet	Rainfall site	Aldergrove (SAAR 862.4mm)
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Step 2 River Impacts

Annual 95%ile river flow (m ³ /s)	0.01	(Enter zero in Annual 95%ile river flow box to assess Step 1 runoff quality only)	
Impermeable road area drained (ha)	3.4	Permeable area draining to outfall (ha)	0
Base Flow Index (BFI)	0.619	Is the discharge in or within 1 km upstream of a protected site for conservation?	Yes

For dissolved zinc only

Water hardness	Low = <50mg CaCO ₃ /l	
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For sediment impact only

Is there a downstream structure, lake, pond or canal that reduces the velocity within 100m of the point of discharge?	<input type="checkbox"/> Tier 1	Estimated river width (m)	2.14	<input type="checkbox"/> Tier 2	Bed width (m)	2.0	Manning's n	0.03	Side slope (m/m)	0.5	Long slope (m/m)	0.08
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Step 3 Mitigation

Brief description	
Treatment for solubles (%)	
Estimated effectiveness	
Attenuation for solubles - restricted discharge rate (l/s)	
Settlement of sediments (%)	

Predict Impact

Show Detailed Results

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Summary of predictions

Soluble - Acute Impact

Sediment - Chronic Impact

Prediction of impact
Step1
Step2
Step3

Copper	Zinc

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
62.40	54.30
71	64

Step 1

Copper	Zinc	Cadmium	Total PAH	Pyrene	Fluoranthene	Anthracene	Phenanthrene
Toxicity Threshold							
1	1	1	1	1	1	1	1
84.00	108.40	1.80	45.40	104.50	45.40	21.80	85.60
91	125	5	57	114	57	35	97

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

Copper	Zinc
RST6	
1	1
19.60	20.00
24	26

Step 2

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

Thresholds
Thresholds

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

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

	Mean	90%ile	95%ile	99%ile
RST24	24.75	68.24	48.24	141.08
RST6	63.59	194.64	40.8	14.39
	100.22	350.11	11.01	33.33

	Mean	90%ile	95%ile	99%ile
Copper	346	787	1018	1449
Zinc	1190	2737	3570	5695
Cadmium	1	1	2	4
Total PAH	16084	35481	70795	89125
Pyrene	2783	6138	12247	15419
Fluoranthene	2670	5890	11752	14795
Anthracene	170	376	750	945
Phenanthrene	753	1661	3313	4171

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	
1	1
0	0.3
0	1
0	0.3
0	1

Velocity m/s

Tier 2 is used for the calculation

DI

% settlement needed %

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
RST6	
0.5	0.5
0	0.1
0	1
0	0.1
0	1

Annual average concentration (ug/l)

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

Thresholds
Thresholds

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

	Mean	90%ile	95%ile	99%ile
RST24	0.93	2.98	2.46	7.61
RST6	4.08	14.39	11.01	33.33

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	
1	1
-	-
-	-
-	-

DI

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
RST6	
0.5	0.5
-	-
-	-
-	-

Annual average concentration (ug/l)

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

Thresholds
Thresholds

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

	Mean	90%ile	95%ile	99%ile
RST24	-	-	-	-
RST6	-	-	-	-

Details of the chosen rainfall site

SAAR (mm)	862.4
Altitude (m)	63
Easting	1263
Northing	5358
Coastal distance (km)	21.6

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	Totals	Return Period (years)
D1	Water body type	Surface watercourse					0.0003	3257
D2	Length of road draining to outfall (m)	1,060					0.0003	3257
D3	Road Type (A-road or Motorway)	A					0.0003	3257
D4	If A road, is site urban or rural?	Rural					0.0003	3257
D5	Junction type	Slip road					0.0003	3257
D6	Location	< 1 hour					0.0003	3257
D7	Traffic flow (AADT two way)	9,375					0.0003	3257
D8	% HGV	17					0.0003	3257
D8	Spillage factor (no/10 ⁹ HG/km/year)	0.83					0.0003	3257
D9	Risk of accidental spillage	0.00051	0.00000	0.00000	0.00000	0.00000	0.0003	3257
D10	Probability factor	0.60					0.0003	3257
D11	Risk of pollution incident	0.00031	0.00000	0.00000	0.00000	0.00000	0.0003	3257
D12	Is risk greater than 0.01?	No					0.0003	3257
D13	Return period without pollution reduction measures	0.00031	0.00000	0.00000	0.00000	0.00000	0.0003	3257
D14	Existing measures factor	1					0.0003	3257
D15	Return period with existing pollution reduction measures	0.00031	0.00000	0.00000	0.00000	0.00000	0.0003	3257
D16	Proposed measures factor	1					0.0003	3257
D17	Residual with proposed Pollution reduction measures	0.00031	0.00000	0.00000	0.00000	0.00000	0.0003	3257

Justification for choice of existing measures factors:

Justification for choice of proposed measures factors:

Table D1

Location	Motorways	Rural Trunk	Urban Trunk
No junction	0.36	0.29	0.31
Slip road	0.43	0.83	0.36
Roundabout	3.09	3.09	5.35
Cross road	-	0.88	1.46
Side road	-	0.93	1.81
Total	0.37	0.45	0.85

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

The worksheet should be read in conjunction with DMRB 11.3.10.