HIGHWAYS AGENCY

APPENDICES

Appendix A – Pollution and Spillage Risk Calculations

Appendix A – Pollution and Spillage Risk Calculations

Method A – Simple Assessment of Pollution Impacts from Routine Runoff

Drainage Zones	Road Area	Run-off co efficient	Rainfall Depth	Run-Off Volume (Vh)	Daily River Flow (Vr)	Dilution	Relevant AADT	Assessed Risk
	(m2)		(m/day)	(m3/day)	(m3)			
Existing layout								
Drainage zone 1	8209	0.5	0.0085	34.89	864	24.76	124400	Low
Drainage zone 2	54064	0.5	0.0085	229.77	2992	13.02	124400	High
Drainage zone 3	61383	0.5	0.0085	260.88	29376	112.60	160800	Low
Drainage zone 4	8753	0.5	0.0085	37.20	31968	859.35	160800	Low
Drainage zone 5	20800	0.5	0.0085	88.40	29376	332.31	160800	Low
Drainage zone 6	32421	0.5	0.0085	137.79	1382	10.03	97600	High
Drainage zone 7	21614	0.5	0.0085	91.86	2992	32.57	65600	Low
Drainage zone 8	11492	0.5	0.0085	48.84	1382	28.30	97600	Low
Drainage zone 9	1174	0.5	0.0085	4.99	29376	5887.56	65600	Low
All zones combined	**219910**	**0.5**	**0.0085**	**934.62**	**31968**	**34.20**	**221800**	**Low**
Proposed 2029 - Do Something								
Drainage zone 1	10048	0.5	0.0085	42.70	864	20.23	135400	high
Drainage zone 2	38080	0.5	0.0085	161.84	2992	18.49	135400	high
Total zones 1 and 2 combined	48128	0.5	0.0085	204.54	2992	14.63	135400	high
Drainage zone 3	63875	0.5	0.0085	271.47	29376	108.21	159000	low
Drainage zone 4	8758	0.5	0.0085	37.22	31968	858.86	159000	low
Drainage zone 5	20795	0.5	0.0085	88.38	29376	332.39	159000	low
Total zones 3,4 and 5 combined	93428	0.5	0.0085	397.07	29376	73.98	159000	low
Drainage zone 6	29795	0.5	0.0085	126.63	1382	10.91	123600	high
Drainage zone 8	12760	0.5	0.0085	54.23	1382	25.48	123600	low
Total zones 6 and 8 combined	42555	0.5	0.0085	180.86	1382	7.64	123600	high
Drainage zone 7	87928	0.5	0.0085	373.69	2992	8.01	100100	high
Drainage zone 9	4782	0.5	0.0085	20.32	29376	1445.42	100100	low
Total zones 7 and 9 combined	92710	0.5	0.0085	394.02	29376	74.56	100100	low
Combined drainage zones	**276821**	**0.5**	**0.0085**	**1176.49**	**31968**	**27.17**	**259100**	**high**

Method B - Detailed Assessment of Pollution Impacts from Routine Runoff

Method B results for those drainage zones highlighted by Method A as high risk and therefore requiring detailed assessment:

RE Classification = 1
EQS for copper = < 22µg/l
EQS for zinc = < 200µg/l

Drainage Zones	River flow (m^3)	Runoff volume (m3)	Upstream Copper (µg/l)	Dissolved copper 5-day build up (kg)	Downstream copper (µg/l)	Upstream Zinc (µg/l)	Dissolved zinc 5-day build up (kg)	Downstream zinc(µg/l)	Mitigation Required?
Existing Layout									
Zones 1 and 2 combined	2992	265	2.52	0.070	24	1.99	0.301	94	No
Zones 6 and 8 combined	1382	180.86	2.52	0.052	35	1.99	0.220	143	Yes
Proposed 2029 – Do Something									
Zones 1 and 2 combined	2992	204.54	2.52	0.059	21	1.99	0.253	81	No
Zones 3, 4 and 5 combined	31968	397.07	2.52	0.121	6	1.99	0.518	18	No
Zones 6 and 8 combined	1382	180.86	2.52	0.047	32	1.99	0.202	131	Yes
Zones 7 and 9 combined	29376	394.01	2.52	0.110	6	1.99	0.464	18	No
All zones combined	31968	1176.49	2.52	0.338	13	1.99	1.437	45	No

Method D – Assessment of Pollution Impacts from Accidental Spillages

Maximum acceptable annual probability = 1%

Drainage Zones	Annual Accident Probability (Pacc)	Pollution Probability Factor (Ppol)	Annual Probability of Pollution Incident	Pollution Incident Return Period (years)	Annual Probability (%)
Do Minimum					
Zones 1 and 2 combined	0.00483	0.6	0.0029	345	0.29
Zones 3, 4 and 5 combined	0.00214	0.6	0.0013	778	0.13
Zones 6 and 8 combined	0.00104	0.6	0.0006	1607	0.06
Zones 7 and 9 combined	0.00113	0.6	0.0007	1481	0.07
All zones combined	**0.00913**	**0.6**	**0.0055**	**183**	**0.55**
Do Something					
Zones 1 and 2 combined	0.00104	0.6	0.0006	1602	0.06
Zones 3, 4 and 5 combined	0.00454	0.6	0.0027	367	0.27
Zones 6 and 8 combined	0.00121	0.6	0.0007	1374	0.07
Zones 7 and 9 combined	0.00293	0.6	0.0018	569	0.18
All zones combined	**0.00973**	**0.6**	**0.0058**	**171**	**0.58**

Please note that the AADT traffic figures used in Methods A, B and D are taken from the individual link flows extracted from SATURN and may differ slightly from those presented elsewhere in the Traffic Forecasting Report (Ref:- B0531000/OD/108)