Soil Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	BH21	BH23	BH24	TP11	TP13	TP14	TP15	TP16
Date	23/07/2019	15/07/2019	11/07/2019	11/07/2019	09/07/2019	10/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	-1.5	-0.5	-4.5	-0.2	-0.5	-0.5	-0.5	-2
Matrix_Description	Sand	Sand	Sand	Gravel	Sand	Sand	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC							
Demeton-O	mg/kg			-	-	-	-	<0.01	<0.01	<0.01	-
Demeton-S	mg/kg			-	-	-	-	<0.01	<0.01	<0.01	-
Phorate	mg/kg		160[#1]	-	-	-	-	<0.01	<0.01	<0.01	-
Anilines											
Aniline	mg/kg		400[#1]	-	-	<0.0001	-	-	<0.0001	-	-
4-chloroaniline	mg/kg		11[#1]	-	-	<0.0001	-	-	<0.0001	-	-
4-nitroaniline	mg/kg		110[#1]	-	-	<0.0002	-	-	<0.0002	-	-
Explosives											
2,4-Dinitrotoluene	mg/kg		3700[#3]	-	-	<0.0002	-	-	<0.0002	-	-
2,6-dinitrotoluene	mg/kg		1900[#3]	-	-	<0.0001	-	-	<0.0001	-	-
Nitrobenzene	mg/kg		22[#1]	-	-	<0.0003	-	-	<0.0003	-	-
Halogenated Benzenes											
Chlorobenzene	mg/kg		56[#2]	-	-	<0.001	-	-	<0.001	-	-
Bromobenzene	mg/kg		97[#3]	-	-	<0.001	-	-	<0.001	-	-
2-chlorotoluene	mg/kg		23000[#1]	-	-	<0.001	-	-	<0.001	-	-
4-chlorotoluene	mg/kg		23000[#1]	-	-	<0.001	-	-	<0.001	-	-
1,3-dichlorobenzene	mg/kg		30[#2]	-	-	<0.001	-	-	<0.001	-	-
1,4-dichlorobenzene	mg/kg		4400[#2]	-	-	<0.001	-	-	<0.001	-	-
1,2-dichlorobenzene	mg/kg		2000[#2]	-	-	<0.001	-	-	<0.001	-	-
1,2,4-trichlorobenzene	mg/kg		220[#2]	-	-	<0.001	-	-	<0.001	-	-
1,2,3-trichlorobenzene	mg/kg		102[#2]	-	-	<0.001	-	-	<0.001	-	-
Hexachlorobenzene	mg/kg		110[#2]	-	-	<0.0003	-	<0.01	<0.0003	<0.01	-
Pentachlorobenzene	mg/kg		640[#2]	-	-	-	-	<0.01	<0.01	<0.01	-
Trichlorobenzene (total)	mg/kg			-	-	-	-	<0.01	<0.01	<0.01	-
Halogenated Hydrocarbons											
Bromomethane	mg/kg		30[#1]	-	-	<0.001	-	-	<0.001	-	-
Trichlorofluoromethane	mg/kg		350000[#1]	-	-	<0.001	-	-	<0.001	-	-
1,2-dibromoethane	mg/kg		0.16[#1]	-	-	<0.001	-	-	<0.001	-	-
Halogenated Phenols											
2-chlorophenol	mg/kg		5800[#1]	-	-	<0.0001	-	-	<0.0001	-	<0.1
2,4-dichlorophenol	mg/kg		2500[#1]	-	-	<0.0003	-	-	<0.0003	-	<0.3
2,4,5-trichlorophenol	mg/kg		82000[#1]	-	-	<0.0002	-	-	<0.0002	-	<0.2
2,4,6-trichlorophenol	mg/kg		210[#1]	-	-	<0.0001	-	-	<0.0001	-	<0.1
Phthalates											
Butyl benzyl phthalate	mg/kg		940000[#3]	-	-	<0.0003	-	-	<0.0003	-	-
Di-n-butyl phthalate	mg/kg		15000[#3]	-	-	<0.0002	-	-	<0.0002	-	-
Diethylphthalate	mg/kg		150000[#3]	-	-	<0.0002	-	-	<0.0002	-	-
Dimethyl phthalate	mg/kg			-	-	<0.0001	-	-	<0.0001	-	-
Solvents											
Isophorone	mg/kg		2400[#1]	-	-	<0.0002	-	-	<0.0002	-	-
Metals											
Arsenic	mg/kg		640[#2]	5.4	10	4.1	180	3.4	3.3	3.9	4.3
Cadmium	mg/kg		190[#2]	<0.2	0.7	<0.2	<0.2	<0.2	<0.2	<0.2	<0.2
Copper	mg/kg		68000[#2]	13	220	11	16	10	6.9	9.7	18
Iron	mg/kg		820000[#1]	13,000	24,000	22,000	8,000	8,400	8,200	9,000	16,000
Lead	mg/kg		2300[#4]	6.1	390	3.4	21	5.3	4.6	6.9	3.2
Mercury	mg/kg			<0.3	4.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3

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Location	BH21	BH23	BH24	TP11	TP13	TP14	TP15	TP16
Date	23/07/2019	15/07/2019	11/07/2019	11/07/2019	09/07/2019	10/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	-1.5	-0.5	-4.5	-0.2	-0.5	-0.5	-0.5	-2
Matrix_Description	Sand	Sand	Sand	Gravel	Sand	Sand	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC							
Nickel	mg/kg		980[#2]	6.5	65	9	8.8	6.8	7.7	8.5	9.2
Selenium	mg/kg		12000[#2]	<1	<1	<1	<1	<1	<1	<1	<1
Zinc	mg/kg		730000[#2]	18	330	15	24	18	16	16	20
Chromium (hexavalent)	mg/kg		33[#2]	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2	<1.2
Organics											
Organic Matter	%			0.6	0.9	0.2	0.8	0.5	0.4	0.3	0.2
Inorganics											
Cyanide (Free)	mg/kg			<1	<1	<1	<1	<1	<1	<1	<1
Cyanide Total	mg/kg		150[#1]	<1	<1	<1	<1	<1	<1	<1	<1
Moisture	%			10	6.6	15	4.3	4	6.3	3.3	9
Ammoniacal Nitrogen as N	mg/kg			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH (Lab)	pH_Units			7.7	7.3	7.9	6.6	6.9	7.9	7	8
Other											
Phosalone	mg/kg			-	-	-	-	<0.01	<0.01	<0.01	-
Triazophos	mg/kg			-	-	-	-	<0.01	<0.01	<0.01	-

Comments
#1 USEPA RSL (May 2019)
#2 LQM/CIEH S4ULs 2015
#3 EIC/AGS/CL:AIRE
#4 Defra C4SL 12/2014

Soil Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP17	TP18	TP19
Date	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC			
Methacriphos	mg/kg			<0.01	-	<0.01
Trietazine	mg/kg			<0.1	-	<0.1
Boron (Water Soluble)	mg/kg			0.3	0.8	0.4
Tribromomethane	mg/kg			-	-	-
Freon 113	mg/kg		28000[#1]	-	-	-
Chlorothalonil	mg/kg		740[#1]	<0.01	-	<0.01
Tecnazene	mg/kg			<0.01	-	<0.01
Etrimphos	mg/kg			<0.01	-	<0.01
Propetamphos	mg/kg			<0.01	-	<0.01
2,4-DB	mg/kg			<0.02	-	<0.02
Xylenols & Ethylphenols	mg/kg			<0.3	<0.3	<0.3
Phosphamidon I	mg/kg			<0.01	-	<0.01
tetrachlorobenzene	mg/kg			<0.01	-	<0.01
Organic						
Terbutylazine	mg/kg			<0.1	-	<0.1
TPH						
>C5-C6 Aliphatics	mg/kg		3200[#2]	<0.001	-	-
>C6-C8 Aliphatics	mg/kg		7800[#2]	<0.001	-	-
>C8-C10 Aliphatics	mg/kg		2000[#2]	<0.001	-	-
>C10-C12 Aliphatics	mg/kg		9700[#2]	<1	-	-
>C12-C16 Aliphatics	mg/kg		59000[#2]	<2	-	-
>C16-C21 Aliphatics	mg/kg			<8	-	-
>C21-C35 Aliphatics	mg/kg			<8	-	-
>C35-C40 Aliphatics	mg/kg			<10	-	-
>C5-C35 Aliphatics	mg/kg			<10	-	-
>EC5-EC7 Aromatics	mg/kg		26000[#2]	<0.001	-	-
>EC7-EC8 Aromatics	mg/kg		56000[#2]	<0.001	-	-
>EC8-EC10 Aromatics	mg/kg		3500[#2]	<0.001	-	-
>EC10-EC12 Aromatics	mg/kg		16000[#2]	<1	-	-
>EC12-EC16 Aromatics	mg/kg		36000[#2]	<2	-	-
>EC16-EC21 Aromatics	mg/kg		28000[#2]	<10	-	-
>EC21-EC35 Aromatics	mg/kg		28000[#2]	<10	-	-
>EC35-EC40 Aromatics	mg/kg			<10	-	-
>EC5-EC35 Aromatics	mg/kg			<10	-	-
>C5-C40 Aliphatics & Aromatics	mg/kg			<10	-	-
BTEX						
Benzene	mg/kg		27[#2]	<0.001	-	-
Toluene	mg/kg		56000[#2]	<0.001	-	-
Ethylbenzene	mg/kg		5700[#2]	<0.001	-	-
Xylene (m & p)	mg/kg			<0.001	-	-
Xylene (o)	mg/kg		6600[#2]	<0.001	-	-
Oxygenates						
MTBE	mg/kg		7900[#3]	<0.001	-	-
Chlorinated Hydrocarbons						
Chloromethane	mg/kg		1[#3]	-	-	-
Vinyl chloride	mg/kg		0.059[#2]	-	-	-
Chloroethane	mg/kg		960[#3]	-	-	-

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Location	TP17	TP18	TP19
Date	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC			
1,1-dichloroethene	mg/kg		26[#3]	-	-	-
trans-1,2-dichloroethene	mg/kg		22[#3]	-	-	-
1,1-dichloroethane	mg/kg		280[#3]	-	-	-
cis-1,2-dichloroethene	mg/kg		14[#3]	-	-	-
Chloroform	mg/kg		99[#2]	-	-	-
1,1,1-trichloroethane	mg/kg		660[#2]	-	-	-
Carbon tetrachloride	mg/kg		2.9[#2]	-	-	-
Trichloroethene	mg/kg		1.2[#2]	-	-	-
1,1,2-trichloroethane	mg/kg		94[#3]	-	-	-
Tetrachloroethene	mg/kg		19[#2]	-	-	-
VOC						
2,2-dichloropropane	mg/kg			-	-	-
1,1-dichloropropene	mg/kg			-	-	-
1,2-dichloroethane	mg/kg		0.67[#2]	-	-	-
1,2-dichloropropane	mg/kg		3.3[#3]	-	-	-
Dibromomethane	mg/kg		99[#1]	-	-	-
Bromodichloromethane	mg/kg		1.3[#1]	-	-	-
cis-1,3-dichloropropene	mg/kg			-	-	-
trans-1,3-dichloropropene	mg/kg			-	-	-
1,3-dichloropropane	mg/kg		23000[#1]	-	-	-
Chlorodibromomethane	mg/kg		39[#1]	-	-	-
1,1,1,2-tetrachloroethane	mg/kg		110[#2]	-	-	-
Styrene	mg/kg		3300[#3]	-	-	-
Isopropylbenzene	mg/kg		1400[#3]	-	-	-
1,1,2,2-tetrachloroethane	mg/kg		270[#2]	-	-	-
n-propylbenzene	mg/kg		4100[#3]	-	-	-
1,3,5-trimethylbenzene	mg/kg		1500[#1]	-	-	-
tert-butylbenzene	mg/kg		120000[#1]	-	-	-
1,2,4-trimethylbenzene	mg/kg		42[#3]	-	-	-
sec-butylbenzene	mg/kg		120000[#1]	-	-	-
p-isopropyltoluene	mg/kg			-	-	-
n-butylbenzene	mg/kg		58000[#1]	-	-	-
1,2-dibromo-3-chloropropane	mg/kg		0.064[#1]	-	-	-
Hexachlorobutadiene	mg/kg		31[#2]	<0.01	<0.0001	<0.01
PAH						
Naphthalene	mg/kg		190[#2]	-	<0.05	<0.05
Acenaphthylene	mg/kg		83000[#2]	-	<0.05	<0.05
Acenaphthene	mg/kg		84000[#2]	-	<0.05	<0.05
Fluorene	mg/kg		63000[#2]	-	<0.05	<0.05
Phenanthrene	mg/kg		22000[#2]	-	<0.05	<0.05
Anthracene	mg/kg		520000[#2]	-	<0.05	<0.05
Fluoranthene	mg/kg		23000[#2]	-	<0.05	<0.05
Pyrene	mg/kg		54000[#2]	-	<0.05	<0.05
Benz(a)anthracene	mg/kg		170[#2]	-	<0.05	<0.05
Chrysene	mg/kg		350[#2]	-	<0.05	<0.05
Benzo(a) pyrene	mg/kg		35[#2]	-	<0.05	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg		500[#2]	-	<0.05	<0.05

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Location	TP17	TP18	TP19
Date	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC			
Dibenz(a,h)anthracene	mg/kg		3.5[#2]	-	<0.05	<0.05
Benzo(g,h,i)perylene	mg/kg		3900[#2]	-	<0.05	<0.05
Benzo(b)fluoranthene	mg/kg		44[#2]	-	<0.05	<0.05
Benzo(k)fluoranthene	mg/kg		1200[#2]	-	<0.05	<0.05
PAH 16 Total	mg/kg			-	<0.8	<0.8
SVOC						
2-methylnaphthalene	mg/kg		3000[#1]	-	<0.0001	-
4-bromophenyl phenyl ether	mg/kg			-	<0.0002	-
4-chlorophenyl phenyl ether	mg/kg			-	<0.0003	-
Azobenzene	mg/kg		26[#1]	-	<0.0003	-
Bis(2-chloroethoxy) methane	mg/kg		2500[#1]	-	<0.0003	-
Bis(2-chloroethyl)ether	mg/kg		1[#1]	-	<0.0002	-
Carbazole	mg/kg			-	<0.0003	-
Dibenzofuran	mg/kg		1000[#1]	-	<0.0002	-
Hexachloroethane	mg/kg		22[#3]	-	<0.00005	-
Bis(2-chloroisopropyl) ether	mg/kg		47000[#1]	-	<0.0001	-
Phenolics						
2-methylphenol	mg/kg		16000[#3]	-	<0.0003	-
2-nitrophenol	mg/kg			-	<0.0003	-
2,4-dimethylphenol	mg/kg		16000[#3]	-	<0.0003	-
4-chloro-3-methylphenol	mg/kg		82000[#1]	-	<0.0001	-
4-methylphenol	mg/kg		16000[#3]	-	<0.0002	-
Phenol	mg/kg		440[#2]	<0.1	<0.1	<0.1
2-chloronaphthalene	mg/kg		390[#3]	-	<0.0001	-
Cresol Total	mg/kg		160000[#3]	<0.3	<0.3	<0.3
Phenols	mg/kg			<1.3	<1.3	<1.3
resorcinol (m-dihydroxybenzene)	mg/kg			<0.1	<0.1	<0.1
catechol (o-dihydroxybenzene)	mg/kg			<0.1	<0.1	<0.1
2,3,5-trimethyl phenol	mg/kg			<0.1	<0.1	<0.1
2-isopropylphenol	mg/kg			<0.1	<0.1	<0.1
Fungicides						
Triadimefon	mg/kg		28000[#1]	<0.01	-	<0.01
Herbicides						
Pendimethalin	mg/kg		250000[#1]	<0.01	-	<0.01
Trifluralin	mg/kg		420[#1]	<0.01	-	<0.01
Hedonal	mg/kg		9600[#1]	<0.02	-	<0.02
Dicamba	mg/kg		25000[#1]	<0.02	-	<0.02
2,4-Dichlorprop	mg/kg			<0.02	-	<0.02
2-Methyl-4-chlorophenoxyacetic acid	mg/kg		410[#1]	<0.02	-	<0.02
2-Methyl-4-Chlorophenoxy Butanoic Acid	mg/kg		3600[#1]	<0.02	-	<0.02
2,4,5-Trichlorophenoxy Acetic Acid	mg/kg		8200[#1]	<0.02	-	<0.02
Atrazine	mg/kg		9300[#2]	<0.1	-	<0.1
Simazine	mg/kg		19[#1]	<0.1	-	<0.1
Chlorotoluron	mg/kg			<0.01	-	<0.01
Cyanazine	mg/kg		2.7[#1]	<0.1	-	<0.1
Dichlobenil	mg/kg			<0.01	-	<0.01
Dinoseb	mg/kg		820[#1]	<0.02	-	<0.02

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Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	**Units**	**Method Detection Limit**	**GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC**			
Fluometuron	mg/kg		11000[#1]	<0.01	-	<0.01
Isoproturon	mg/kg			<0.01	-	<0.01
Mecoprop	mg/kg		820[#1]	<0.02	-	<0.02
Picloram	mg/kg		57000[#1]	<0.02	-	<0.02
Prometryn	mg/kg		33000[#1]	<0.1	-	<0.1
Pronamide	mg/kg		62000[#1]	<0.01	-	<0.01
Propazine	mg/kg		16000[#1]	<0.1	-	<0.1
Tebuthiuron	mg/kg		57000[#1]	<0.01	-	<0.01
Terbutryn	mg/kg		820[#1]	<0.1	-	<0.1
Diuron	mg/kg		1600[#1]	<0.01	-	<0.01
Linuron	mg/kg		6300[#1]	<0.01	-	<0.01
Pesticides						
Isodrin	mg/kg			<0.01	-	<0.01
Parathion	mg/kg		4900[#1]	<0.01	-	<0.01
Pirimiphos-methyl	mg/kg		57[#1]	<0.01	-	<0.01
Diflubenzuron	mg/kg		16000[#1]	<0.01	-	<0.01
Organochlorine Pesticides						
Aldrin	mg/kg		170[#2]	<0.01	-	<0.01
Chlordane (cis)	mg/kg			<0.01	-	<0.01
Dieldrin	mg/kg		170[#2]	<0.01	-	<0.01
Endosulfan I	mg/kg		5600[#2]	<0.01	-	<0.01
Endosulfan II	mg/kg		6300[#2]	<0.01	-	<0.01
Endosulfan sulphate	mg/kg		4900[#1]	<0.01	-	<0.01
Endrin	mg/kg		250[#1]	<0.01	-	<0.01
Heptachlor	mg/kg		0.63[#1]	<0.01	-	<0.01
Heptachlor epoxide	mg/kg		0.33[#1]	<0.01	-	<0.01
DDT	mg/kg		8.5[#1]	<0.001	-	<0.001
Methoxychlor	mg/kg		4100[#1]	<0.01	-	<0.01
DDD	mg/kg		9.6[#1]	<0.001	-	<0.001
Chlordane (trans)	mg/kg			<0.01	-	<0.01
DDE	mg/kg			<0.001	-	<0.001
Endrin aldehyde	mg/kg			<0.01	-	<0.01
Endrin ketone	mg/kg			<0.01	-	<0.01
Organophosphorous Pesticides						
Azinphos Ethyl	mg/kg			<0.01	-	<0.01
Azinophos methyl	mg/kg		2500[#1]	<0.01	-	<0.01
Carbophenothion	mg/kg			<0.01	-	<0.01
Chlorfenvinphos	mg/kg		570[#1]	<0.01	-	<0.01
Chlorpyrifos	mg/kg		820[#1]	<0.01	-	<0.01
Diazinon	mg/kg		570[#1]	<0.01	-	<0.01
Dichlorvos	mg/kg		140[#2]	<0.01	-	<0.01
Dimethoate	mg/kg		1800[#1]	<0.01	-	<0.01
Ethion	mg/kg		410[#1]	<0.01	-	<0.01
Fenitrothion	mg/kg			<0.01	-	<0.01
Fenthion	mg/kg			<0.01	-	<0.01
Malathion	mg/kg		16000[#1]	<0.01	-	<0.01
Methyl parathion	mg/kg		210[#1]	<0.01	-	<0.01

Soil Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP17	TP18	TP19
Date	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC			
Demeton-O	mg/kg			<0.01	-	<0.01
Demeton-S	mg/kg			<0.01	-	<0.01
Phorate	mg/kg		160[#1]	<0.01	-	<0.01
Anilines						
Aniline	mg/kg		400[#1]	-	<0.0001	-
4-chloroaniline	mg/kg		11[#1]	-	<0.0001	-
4-nitroaniline	mg/kg		110[#1]	-	<0.0002	-
Explosives						
2,4-Dinitrotoluene	mg/kg		3700[#3]	-	<0.0002	-
2,6-dinitrotoluene	mg/kg		1900[#3]	-	<0.0001	-
Nitrobenzene	mg/kg		22[#1]	-	<0.0003	-
Halogenated Benzenes						
Chlorobenzene	mg/kg		56[#2]	-	-	-
Bromobenzene	mg/kg		97[#3]	-	-	-
2-chlorotoluene	mg/kg		23000[#1]	-	-	-
4-chlorotoluene	mg/kg		23000[#1]	-	-	-
1,3-dichlorobenzene	mg/kg		30[#2]	-	<0.0002	-
1,4-dichlorobenzene	mg/kg		4400[#2]	-	<0.0002	-
1,2-dichlorobenzene	mg/kg		2000[#2]	-	<0.0001	-
1,2,4-trichlorobenzene	mg/kg		220[#2]	-	<0.0003	-
1,2,3-trichlorobenzene	mg/kg		102[#2]	-	-	-
Hexachlorobenzene	mg/kg		110[#2]	<0.01	<0.0003	<0.01
Pentachlorobenzene	mg/kg		640[#2]	<0.01	-	<0.01
Trichlorobenzene (total)	mg/kg			<0.01	-	<0.01
Halogenated Hydrocarbons						
Bromomethane	mg/kg		30[#1]	-	-	-
Trichlorofluoromethane	mg/kg		350000[#1]	-	-	-
1,2-dibromoethane	mg/kg		0.16[#1]	-	-	-
Halogenated Phenols						
2-chlorophenol	mg/kg		5800[#1]	-	<0.0001	-
2,4-dichlorophenol	mg/kg		2500[#1]	-	<0.0003	-
2,4,5-trichlorophenol	mg/kg		82000[#1]	-	<0.0002	-
2,4,6-trichlorophenol	mg/kg		210[#1]	-	<0.0001	-
Phthalates						
Butyl benzyl phthalate	mg/kg		940000[#3]	-	<0.0003	-
Di-n-butyl phthalate	mg/kg		15000[#3]	-	<0.0002	-
Diethylphthalate	mg/kg		150000[#3]	-	<0.0002	-
Dimethyl phthalate	mg/kg			-	<0.0001	-
Solvents						
Isophorone	mg/kg		2400[#1]	-	<0.0002	-
Metals						
Arsenic	mg/kg		640[#2]	7.8	6.2	3.7
Cadmium	mg/kg		190[#2]	<0.2	<0.2	<0.2
Copper	mg/kg		68000[#2]	11	8.2	10
Iron	mg/kg		820000[#1]	21,000	7,600	9,700
Lead	mg/kg		2300[#4]	6.7	11	7.9
Mercury	mg/kg			<0.3	<0.3	<0.3

Soil Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP17	TP18	TP19
Date	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	-0.5	-0.5	-0.5
Matrix_Description	Sand	Sand	Gravel

Parameter	**Units**	**Method Detection Limit**	**GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC**			
Nickel	mg/kg		980[#2]	12	9.1	13
Selenium	mg/kg		12000[#2]	<1	<1	<1
Zinc	mg/kg		730000[#2]	28	25	29
Chromium (hexavalent)	mg/kg		33[#2]	<1.2	<1.2	<1.2
Organics						
Organic Matter	%			0.4	1.3	0.6
Inorganics						
Cyanide (Free)	mg/kg			<1	<1	<1
Cyanide Total	mg/kg		150[#1]	<1	<1	<1
Moisture	%			8.3	8.3	3
Ammoniacal Nitrogen as N	mg/kg			<0.5	<0.5	<0.5
pH (Lab)	pH_Units			8.6	7.7	7.4
Other						
Phosalone	mg/kg			<0.01	-	<0.01
Triazophos	mg/kg			<0.01	-	<0.01

Comments
#1 USEPA RSL (May 2019)
#2 LQM/CIEH S4ULs 2015
#3 EIC/AGS/CL:AIRE
#4 Defra C4SL 12/2014

Soil Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH06	BH07	BH19	BH20
Date	01/07/2019	18/06/2019	26/06/2019	19/07/2019	17/07/2019
Sample_Depth_Range	-0.3	-0.3	-0.1	-0.5	-0.5
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC					
Boron (Water Soluble)	mg/kg			0.2	0.9	0.8	0.7	0.3
Tribromomethane	mg/kg			-	<0.001	-	-	-
Freon 113	mg/kg		28000[#11]	-	<0.001	-	-	-
Xylenols & Ethylphenols	mg/kg			<0.3	<0.3	<0.3	<0.3	<0.3
TPH								
>C5-C6 Aliphatics	mg/kg		3200[#15]	<0.001	<0.001	<0.001	-	-
>C6-C8 Aliphatics	mg/kg		7800[#15]	<0.001	<0.001	<0.001	-	-
>C8-C10 Aliphatics	mg/kg		2000[#15]	<0.001	<0.001	<0.001	-	-
>C10-C12 Aliphatics	mg/kg		9700[#15]	<1	<1	<1	-	-
>C12-C16 Aliphatics	mg/kg		59000[#15]	<2	<2	<2	-	-
>C16-C21 Aliphatics	mg/kg			<8	<8	<8	-	-
>C21-C35 Aliphatics	mg/kg			<8	<8	<8	-	-
>C35-C40 Aliphatics	mg/kg			<10	-	<10	-	-
>C5-C35 Aliphatics	mg/kg			<10	<10	<10	-	-
>EC5-EC7 Aromatics	mg/kg		26000[#15]	<0.001	<0.001	<0.001	-	-
>EC7-EC8 Aromatics	mg/kg		56000[#15]	<0.001	<0.001	<0.001	-	-
>EC8-EC10 Aromatics	mg/kg		3500[#15]	<0.001	<0.001	<0.001	-	-
>EC10-EC12 Aromatics	mg/kg		16000[#15]	<1	<1	<1	-	-
>EC12-EC16 Aromatics	mg/kg		36000[#15]	<2	<2	<2	-	-
>EC16-EC21 Aromatics	mg/kg		28000[#15]	<10	<10	<10	-	-
>EC21-EC35 Aromatics	mg/kg		28000[#15]	<10	<10	<10	-	-
>EC35-EC40 Aromatics	mg/kg			<10	-	<10	-	-
>EC5-EC35 Aromatics	mg/kg			<10	<10	<10	-	-
>C5-C40 Aliphatics & Aromatics	mg/kg			<10	-	<10	-	-
BTEX								
Benzene	mg/kg		27[#15]	<0.001	<0.001	<0.001	-	-
Toluene	mg/kg		56000[#15]	<0.001	<0.001	<0.001	-	-
Ethylbenzene	mg/kg		5700[#15]	<0.001	<0.001	<0.001	-	-
Xylene (m & p)	mg/kg			<0.001	<0.001	<0.001	-	-
Xylene (o)	mg/kg		6600[#15]	<0.001	<0.001	<0.001	-	-
Oxygenates								
MTBE	mg/kg		7900[#16]	<0.001	<0.001	<0.001	-	-
Chlorinated Hydrocarbons								
Chloromethane	mg/kg		1[#16]	-	<0.001	-	-	-
Vinyl chloride	mg/kg		0.059[#15]	-	<0.001	-	-	-
Chloroethane	mg/kg		960[#16]	-	<0.001	-	-	-
1,1-dichloroethene	mg/kg		26[#16]	-	<0.001	-	-	-
trans-1,2-dichloroethene	mg/kg		22[#16]	-	<0.001	-	-	-
1,1-dichloroethane	mg/kg		280[#16]	-	<0.001	-	-	-
cis-1,2-dichloroethene	mg/kg		14[#16]	-	<0.001	-	-	-
Chloroform	mg/kg		99[#15]	-	<0.001	-	-	-
1,1,1-trichloroethane	mg/kg		660[#15]	-	<0.001	-	-	-
Carbon tetrachloride	mg/kg		2.9[#15]	-	<0.001	-	-	-
Trichloroethene	mg/kg		1.2[#15]	-	<0.001	-	-	-
1,1,2-trichloroethane	mg/kg		94[#16]	-	<0.001	-	-	-
Tetrachloroethene	mg/kg		19[#15]	-	<0.001	-	-	-
VOC								

Soil Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH06	BH07	BH19	BH20
Date	01/07/2019	18/06/2019	26/06/2019	19/07/2019	17/07/2019
Sample_Depth_Range	-0.3	-0.3	-0.1	-0.5	-0.5
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC				
2,2-dichloropropane	mg/kg			-	<0.001	-	-	-
1,1-dichloropropene	mg/kg			-	<0.001	-	-	-
1,2-dichloroethane	mg/kg		0.67[#15]	-	<0.001	-	-	-
1,2-dichloropropane	mg/kg		3.3[#16]	-	<0.001	-	-	-
Dibromomethane	mg/kg		99[#11]	-	<0.001	-	-	-
Bromodichloromethane	mg/kg		1.3[#11]	-	<0.001	-	-	-
cis-1,3-dichloropropene	mg/kg			-	<0.001	-	-	-
trans-1,3-dichloropropene	mg/kg			-	<0.001	-	-	-
1,3-dichloropropane	mg/kg		23000[#11]	-	<0.001	-	-	-
Chlorodibromomethane	mg/kg		39[#11]	-	<0.001	-	-	-
1,1,1,2-tetrachloroethane	mg/kg		110[#15]	-	<0.001	-	-	-
Styrene	mg/kg		3300[#16]	-	<0.001	-	-	-
Isopropylbenzene	mg/kg		1400[#16]	-	<0.001	-	-	-
1,1,2,2-tetrachloroethane	mg/kg		270[#15]	-	<0.001	-	-	-
n-propylbenzene	mg/kg		4100[#16]	-	<0.001	-	-	-
1,3,5-trimethylbenzene	mg/kg		1500[#11]	-	<0.001	-	-	-
tert-butylbenzene	mg/kg		120000[#11]	-	<0.001	-	-	-
1,2,4-trimethylbenzene	mg/kg		42[#16]	-	<0.001	-	-	-
sec-butylbenzene	mg/kg		120000[#11]	-	<0.001	-	-	-
p-isopropyltoluene	mg/kg			-	<0.001	-	-	-
n-butylbenzene	mg/kg		58000[#11]	-	<0.001	-	-	-
1,2-dibromo-3-chloropropane	mg/kg		0.064[#11]	-	<0.001	-	-	-
Hexachlorobutadiene	mg/kg		31[#15]	<0.0001	<0.001	-	-	-
PAH								
Naphthalene	mg/kg		190[#15]	<0.00005	<0.05	<0.05	-	<0.05
Acenaphthylene	mg/kg		83000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Acenaphthene	mg/kg		84000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Fluorene	mg/kg		63000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Phenanthrene	mg/kg		22000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Anthracene	mg/kg		520000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Fluoranthene	mg/kg		23000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Pyrene	mg/kg		54000[#15]	<0.00005	<0.05	<0.05	-	<0.05
Benz(a)anthracene	mg/kg		170[#15]	<0.00005	<0.05	<0.05	-	<0.05
Chrysene	mg/kg		350[#15]	<0.00005	<0.05	<0.05	-	<0.05
Benzo(a) pyrene	mg/kg		35[#15]	<0.00005	<0.05	<0.05	-	<0.05
Indeno(1,2,3-c,d)pyrene	mg/kg		500[#15]	<0.00005	<0.05	<0.05	-	<0.05
Dibenz(a,h)anthracene	mg/kg		3.5[#15]	<0.00005	<0.05	<0.05	-	<0.05
Benzo(g,h,i)perylene	mg/kg		3900[#15]	<0.00005	<0.05	<0.05	-	<0.05
Benzo(b)fluoranthene	mg/kg		44[#15]	<0.00005	<0.05	<0.05	-	<0.05
Benzo(k)fluoranthene	mg/kg		1200[#15]	<0.00005	<0.05	<0.05	-	<0.05
PAH 16 Total	mg/kg			-	<0.8	<0.8	-	<0.8
SVOC								
2-methylnaphthalene	mg/kg		3000[#11]	<0.0001	<0.0001	-	-	-
4-bromophenyl phenyl ether	mg/kg			<0.0002	<0.0002	-	-	-
4-chlorophenyl phenyl ether	mg/kg			<0.0003	<0.0003	-	-	-
Azobenzene	mg/kg		26[#11]	<0.0003	<0.0003	-	-	-
Bis(2-chloroethoxy) methane	mg/kg		2500[#11]	<0.0003	<0.0003	-	-	-

Soil Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH06	BH07	BH19	BH20
Date	01/07/2019	18/06/2019	26/06/2019	19/07/2019	17/07/2019
Sample_Depth_Range	-0.3	-0.3	-0.1	-0.5	-0.5
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC				
Bis(2-chloroethyl)ether	mg/kg		1[#11]	<0.0002	<0.0002	-	-	-
Carbazole	mg/kg			<0.0003	<0.0003	-	-	-
Dibenzofuran	mg/kg		1000[#11]	<0.0002	<0.0002	-	-	-
Hexachloroethane	mg/kg		22[#16]	<0.00005	<0.00005	-	-	-
Bis(2-chloroisopropyl) ether	mg/kg		47000[#11]	<0.0001	<0.0001	-	-	-
Phenolics								
2-methylphenol	mg/kg		160000[#16]	<0.0003	<0.3	<0.3	-	-
2-nitrophenol	mg/kg			<0.0003	<0.3	<0.3	-	-
2,4-dimethylphenol	mg/kg		16000[#16]	<0.0003	<0.3	<0.3	-	-
4-chloro-3-methylphenol	mg/kg		82000[#11]	<0.0001	<0.1	<0.1	-	-
4-methylphenol	mg/kg		160000[#16]	<0.0002	<0.2	<0.2	-	-
Phenol	mg/kg		440[#15]	<0.1	<0.1	<0.1	<0.1	<0.1
2-chloronaphthalene	mg/kg		390[#16]	<0.0001	<0.0001	-	-	-
Cresol Total	mg/kg		160000[#16]	<0.3	<0.3	<0.3	<0.3	<0.3
Phenols	mg/kg			<1.3	<1.3	<1.3	<1.3	<1.3
resorcinol (m-dihydroxybenzene)	mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1
catechol (o-dihydroxybenzene)	mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1
2,3,5-trimethyl phenol	mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1
2-isopropylphenol	mg/kg			<0.1	<0.1	<0.1	<0.1	<0.1
Anilines								
Aniline	mg/kg		400[#11]	<0.0001	<0.0001	-	-	-
4-chloroaniline	mg/kg		11[#11]	<0.0001	<0.0001	-	-	-
4-nitroaniline	mg/kg		110[#11]	<0.0002	<0.0002	-	-	-
Explosives								
2,4-Dinitrotoluene	mg/kg		3700[#16]	<0.0002	<0.0002	-	-	-
2,6-dinitrotoluene	mg/kg		1900[#16]	<0.0001	<0.0001	-	-	-
Nitrobenzene	mg/kg		22[#11]	<0.0003	<0.0003	-	-	-
Halogenated Benzenes								
Chlorobenzene	mg/kg		56[#15]	-	<0.001	-	-	-
Bromobenzene	mg/kg		97[#16]	-	<0.001	-	-	-
2-chlorotoluene	mg/kg		23000[#11]	-	<0.001	-	-	-
4-chlorotoluene	mg/kg		23000[#11]	-	<0.001	-	-	-
1,3-dichlorobenzene	mg/kg		30[#15]	<0.0002	<0.001	-	-	-
1,4-dichlorobenzene	mg/kg		4400[#15]	<0.0002	<0.001	-	-	-
1,2-dichlorobenzene	mg/kg		2000[#15]	<0.0001	<0.001	-	-	-
1,2,4-trichlorobenzene	mg/kg		220[#15]	<0.0003	<0.001	-	-	-
1,2,3-trichlorobenzene	mg/kg		102[#15]	-	<0.001	-	-	-
Hexachlorobenzene	mg/kg		110[#15]	<0.0003	<0.0003	-	-	-
Halogenated Hydrocarbons								
Bromomethane	mg/kg		30[#11]	-	<0.001	-	-	-
Trichlorofluoromethane	mg/kg		350000[#11]	-	<0.001	-	-	-
1,2-dibromoethane	mg/kg		0.16[#11]	-	<0.001	-	-	-
Halogenated Phenols								
2-chlorophenol	mg/kg		5800[#11]	<0.0001	<0.1	<0.1	-	-
2,4-dichlorophenol	mg/kg		2500[#11]	<0.0003	<0.3	<0.3	-	-
2,4,5-trichlorophenol	mg/kg		82000[#11]	<0.0002	<0.2	<0.2	-	-
2,4,6-trichlorophenol	mg/kg		210[#11]	<0.0001	<0.1	<0.1	-	-

Soil Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH06	BH07	BH19	BH20
Date	01/07/2019	18/06/2019	26/06/2019	19/07/2019	17/07/2019
Sample_Depth_Range	-0.3	-0.3	-0.1	-0.5	-0.5
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_HH_COM/IND_SLOAM_0.58-1.45%TOC					
Phthalates								
Butyl benzyl phthalate	mg/kg		940000[#16]	<0.0003	<0.0003	-	-	-
Di-n-butyl phthalate	mg/kg		15000[#16]	<0.0002	<0.0002	-	-	-
Diethylphthalate	mg/kg		150000[#16]	<0.0002	<0.0002	-	-	-
Dimethyl phthalate	mg/kg			<0.0001	<0.0001	-	-	-
Solvents								
Isophorone	mg/kg		2400[#11]	<0.0002	<0.0002	-	-	-
Metals								
Arsenic	mg/kg		640[#15]	3.3	3.7	5.2	9.4	5.8
Cadmium	mg/kg		190[#15]	<0.2	0.3	<0.2	0.3	<0.2
Copper	mg/kg		68000[#15]	15	9.3	16	21	18
Iron	mg/kg		820000[#11]	15,000	4,800	9,600	13,000	7,500
Lead	mg/kg		2300[#17]	6.8	14	23	31	30
Mercury	mg/kg			<0.3	<0.3	<0.3	<0.3	<0.3
Nickel	mg/kg		980[#15]	8	4.9	9.3	11	6.9
Selenium	mg/kg		12000[#15]	1	<1	<1	<1	<1
Zinc	mg/kg		730000[#15]	39	100	52	56	70
Chromium (hexavalent)	mg/kg		33[#15]	<1.2	<1.2	<1.2	<1.2	<1.2
Organics								
Organic Matter	%			0.6	2.8	2.8	2.4	1.6
Inorganics								
Cyanide (Free)	mg/kg			<1	<1	<1	<1	<1
Cyanide Total	mg/kg		150[#11]	<1	<1	<1	<1	<1
Moisture	%			5.4	10	13	6.9	3.3
Ammoniacal Nitrogen as N	mg/kg			<0.5	21	<0.5	<0.5	<0.5
pH (Lab)	pH_Units			8	5.7	7.6	7.7	7

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards
#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 USEPA RSL (May 2019)
#12 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#13 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#14 PNEC (EU REACH) - Freshwater
#15 LQM/CIEH S4ULs 2015
#16 EIC/AGS/CL:AIRE
#17 Defra C4SL 12/2014
#18 California Draft health protective concentration
#19 AECOM DWG (WHO method)

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH01	BH02		BH03	
Date	03/07/2019	04/07/2019		17/07/2019	
Sample_Depth_Range	0.500-	0.500-	4.000-	1.500-	4.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tribromomethane	µg/L				<1	<1	-	<1	-
Freon 113	µg/L		10000[#10]		<1	<1	-	<1	-
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Field									
pH	pH_Units				8.4	11	8	8.1	8
TPH									
>C5-C6	µg/L				-	<1	<1	-	-
>C6-C8	µg/L				-	<1	<1	-	-
>C8-C10	µg/L				-	<10	<10	-	-
>C10-C12	µg/L				-	<10	<10	-	-
>C12-C16	µg/L				-	<10	<10	-	-
>C16-C21	µg/L				-	<10	<10	-	-
>C21-C35	µg/L				-	<10	<10	-	-
>C35-C40	µg/L				-	<10	<10	-	-
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	<1	<1	-	-
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	<1	<1	-	-
>C8-C10 Aliphatics	µg/L		300[#2]		<1	<1	<1	-	-
>C10-C12 Aliphatics	µg/L		300[#2]		<10	<10	<10	-	-
>C12-C16 Aliphatics	µg/L		300[#2]		<10	<10	<10	-	-
>C16-C21 Aliphatics	µg/L		300[#2]		<10	<10	<10	-	-
>C21-C35 Aliphatics	µg/L		300[#2]		<10	<10	<10	-	-
>C35-C40 Aliphatics	µg/L				<10	<10	<10	-	-
>C5-C35 Aliphatics	µg/L				<10	<10	<10	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	<1	<1	-	-
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	<1	<1	-	-
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	<1	<1	-	-
>EC10-EC12 Aromatics	µg/L		90[#2]		<10	<10	<10	-	-
>EC12-EC16 Aromatics	µg/L		90[#2]		<10	<10	<10	-	-
>EC16-EC21 Aromatics	µg/L		90[#2]		<10	<10	<10	-	-
>EC21-EC35 Aromatics	µg/L		90[#2]		<10	<10	<10	-	-
>EC35-EC40 Aromatics	µg/L				<10	<10	<10	-	-
>EC5-EC35 Aromatics	µg/L				<10	<10	<10	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				<10	<10	<10	-	-
BTEX									
Benzene	µg/L		1[#1]	10[#8]	<1	<1	<1	<1	-
Toluene	µg/L		700[#3]	74[#7]	<1	<1	<1	<1	-
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	<1	<1	<1	-
Xylene (m & p)	µg/L				<1	<1	<1	<1	-
Xylene (o)	µg/L		190[#10]		<1	<1	<1	<1	-
Oxygenates									
MTBE	µg/L		1800[#15]	5100[#13]	<1	<1	<10	<1	-
Chlorinated Hydrocarbons									
Chloromethane	µg/L		190[#10]		<1	<1	-	<1	-
Vinyl chloride	µg/L		0.5[#1]		<1	<1	-	<1	-
Chloroethane	µg/L		21000[#10]		<1	<1	-	<1	-
1,1-dichloroethene	µg/L		140[#3]		<1	<1	-	<1	-

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH01	BH02		BH03	
Date	03/07/2019	04/07/2019		17/07/2019	
Sample_Depth_Range	0.500-	0.500-	4.000-	1.500-	4.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
trans-1,2-dichloroethene	µg/L		50[#3]		<1	<1	-	<1	-
1,1-dichloroethane	µg/L		2.8[#10]		<1	<1	-	<1	-
cis-1,2-dichloroethene	µg/L		50[#3]		<1	<1	-	<1	-
Chloroform	µg/L		100[#1]	2.5[#8]	<1	<1	-	<1	-
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	<1	<1	-	<1	-
Carbon tetrachloride	µg/L		3[#1]	12[#8]	<1	<1	-	<1	-
Trichloroethene	µg/L			10[#8]	<1	<1	-	<1	-
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	<1	<1	-	<1	-
Tetrachloroethene	µg/L			10[#8]	<1	<1	-	<1	-
VOC									
2,2-dichloropropane	µg/L				<1	<1	-	<1	-
1,1-dichloropropene	µg/L				<1	<1	-	<1	-
1,2-dichloroethane	µg/L		3[#1]	10[#8]	<1	<1	-	<1	-
1,2-dichloropropane	µg/L		40[#3]		<1	<1	-	<1	-
Dibromomethane	µg/L		8.3[#10]		<1	<1	-	<1	-
Bromodichloromethane	µg/L		100[#1]		<1	<1	-	<1	-
cis-1,3-dichloropropene	µg/L				<1	<1	-	<1	-
trans-1,3-dichloropropene	µg/L				<1	<1	-	<1	-
1,3-dichloropropane	µg/L		370[#10]		<1	<1	-	<1	-
Chlorodibromomethane	µg/L		100[#1]		<1	<1	-	<1	-
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		<1	<1	-	<1	-
Styrene	µg/L		20[#3]	50[#12]	<1	<1	-	<1	-
Isopropylbenzene	µg/L		450[#10]		<1	<1	-	<1	-
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	<1	<1	-	<1	-
n-propylbenzene	µg/L		660[#10]		<1	<1	-	<1	-
1,3,5-trimethylbenzene	µg/L		60[#10]		<1	<1	-	<1	-
tert-butylbenzene	µg/L		690[#10]		<1	<1	-	<1	-
1,2,4-trimethylbenzene	µg/L		56[#10]		<1	<1	-	<1	-
sec-butylbenzene	µg/L		2000[#10]		<1	<1	-	<1	-
p-isopropyltoluene	µg/L				<1	<1	-	<1	-
n-butylbenzene	µg/L		1000[#10]		<1	<1	-	<1	-
1,2-dibromo-3-chloropropane	µg/L		1[#3]		<1	<1	-	<1	-
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.05	<0.05	-	<0.05	-
PAH									
Naphthalene	µg/L	0.01	6[#15]	2[#8]	<0.01	<0.01	-	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		<0.01	<0.01	-	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		<0.01	<0.01	-	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		<0.01	<0.01	-	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		<0.01	<0.01	-	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	<0.01	<0.01	-	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	<0.01	<0.01	-	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		<0.01	<0.01	-	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	-	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	-	<0.01	<0.01
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	-	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	-	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	-	<0.01	<0.01

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH01	BH02		BH03	
Date	03/07/2019	04/07/2019		17/07/2019	
Sample_Depth_Range	0.500-	0.500-	4.000-	1.500-	4.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	-	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	-	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	-	<0.01	<0.01
PAH 16 Total	µg/L	0.2			<0.2	<0.2	-	<0.2	<0.2
SVOC									
2-methylnaphthalene	µg/L		36[#10]		<0.05	<0.05	-	<0.05	-
4-bromophenyl phenyl ether	µg/L				<0.05	<0.05	-	<0.05	-
4-chlorophenyl phenyl ether	µg/L				<0.05	<0.05	-	<0.05	-
Azobenzene	µg/L		0.12[#10]		<0.05	<0.05	-	<0.05	-
Bis(2-chloroethoxy) methane	µg/L		59[#10]		<0.05	<0.05	-	<0.05	-
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		<0.05	<0.05	-	<0.05	-
Carbazole	µg/L				<0.05	<0.05	-	<0.05	-
Dibenzofuran	µg/L		7.9[#10]		<0.05	<0.05	-	<0.05	-
Hexachloroethane	µg/L		0.33[#10]		<0.05	<0.05	-	<0.05	-
9,10-Anthracenedione	µg/L		1.4[#10]		<0.05	<0.05	-	<0.05	-
Phenolics									
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		<0.05	<0.05	-	<0.05	<0.05
2-nitrophenol	µg/L				<0.05	<0.05	-	<0.05	<0.05
2,4-dimethylphenol	µg/L		360[#10]		<0.05	<0.05	-	<0.05	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	<0.05	-	<0.05	<0.05
4-methylphenol	µg/L		1900[#10]		<0.05	<0.05	-	<0.05	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.05	<0.5	<0.05	<0.05
2-chloronaphthalene	µg/L		750[#10]		<0.05	<0.05	-	<0.05	-
Phenols	µg/L				<0.5	<0.5	-	<0.5	<0.5
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Anilines									
4-chloroaniline	µg/L		0.37[#10]		<0.05	<0.05	-	<0.05	-
4-nitroaniline	µg/L		3.8[#10]		<0.05	<0.05	-	<0.05	-
Explosives									
2,4-Dinitrotoluene	µg/L		0.24[#10]		<0.05	<0.05	-	<0.05	-
2,6-dinitrotoluene	µg/L		0.049[#10]		<0.05	<0.05	-	<0.05	-
Nitrobenzene	µg/L		63[#3]		<0.05	<0.05	-	<0.05	-
Halogenated Benzenes									
Chlorobenzene	µg/L		300[#3]		<1	<1	-	<1	-
Bromobenzene	µg/L		62[#10]		<1	<1	-	<1	-
2-chlorotoluene	µg/L		240[#10]		<1	<1	-	<1	-
4-chlorotoluene	µg/L		250[#10]		<1	<1	-	<1	-
1,3-dichlorobenzene	µg/L				<0.05	<0.05	-	<0.05	-
1,4-dichlorobenzene	µg/L		300[#3]		<0.05	<0.05	-	<0.05	-
1,2-dichlorobenzene	µg/L		1000[#3]		<0.05	<0.05	-	<0.05	-
1,2,4-trichlorobenzene	µg/L		0.1[#1]		<0.05	<0.05	-	<0.05	-
1,2,3-trichlorobenzene	µg/L		0.1[#1]		<1	<1	-	<1	-
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.02	<0.02	-	<0.02	-

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH01	BH02		BH03	
Date	03/07/2019	04/07/2019		17/07/2019	
Sample_Depth_Range	0.500-	0.500-	4.000-	1.500-	4.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Halogenated Hydrocarbons								
Bromomethane	µg/L		7.5[#10]		<1	<1	-	<1	-
1,2-dibromoethane	µg/L		0.4[#3]		<1	<1	-	<1	-
Halogenated Phenols								
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	<0.05	-	<0.05	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	<0.05	-	<0.05	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	<0.05	-	<0.05	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	<0.05	-	<0.05	<0.05
Phthalates								
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	<0.05	<0.05	-	<0.05	-
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	<0.05	<0.05	-	<0.05	-
Diethylphthalate	µg/L		15000[#10]	200[#12]	<0.05	<0.05	-	<0.05	-
Dimethyl phthalate	µg/L			800[#12]	<0.05	<0.05	-	<0.05	-
Solvents								
Isophorone	µg/L		78[#10]		<0.05	<0.05	-	<0.05	-
Metals								
Arsenic	µg/L	1.1	10[#1]	50[#7]	7	4.9	7.1	<1.1	2.7
Boron	µg/L	10	1000[#1]	2000[#12]	50	<10	<10	<10	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			3.3	62	16	24	14
Chromium (III+VI)	µg/L	0.4	50[#1]		1.4	17	2.9	<0.4	<0.4
Copper	µg/L	0.7	2000[#1]	1[#7]	3.6	6.9	14	6.7	4.5
Iron	µg/L	4	200[#1]	1000[#7]	170	38	930	43	12
Lead	µg/L	1	10[#1]	1.2[#8]	<1	<1	<1	<1	<1
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	<0.3	<0.3	1.1	0.9	<0.3
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	4.6	5.2	4.9	2.2	0.6
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	16	<5	<5	<5
Organics								
Dissolved Organic Carbon	mg/L	0.1			3.24	3.84	5.11	6.37	5.37
TOC	mg/L	0.1			3.74	4.2	5.35	6.37	5.47
Inorganics								
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.02	0.036	0.036	<0.015	0.18
Other								
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH01	BH02		BH03	
Date	03/07/2019	04/07/2019		17/07/2019	
Sample_Depth_Range	0.500-	0.500-	4.000-	1.500-	4.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh

#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH04	BH09	BH10	BH12	BH24
Date	02/07/2019	19/06/2019	28/06/2019	24/07/2019	11/07/2019
Sample_Depth_Range	0.500-	0.500-	1.200-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tribromomethane	µg/L				-	<1	-	-	-
Freon 113	µg/L		10000[#10]		-	<1	-	-	-
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Field									
pH	pH_Units				8.1	7.9	7.2	7.2	6.7
TPH									
>C5-C6	µg/L				-	-	-	-	-
>C6-C8	µg/L				-	-	-	-	-
>C8-C10	µg/L				-	-	-	-	-
>C10-C12	µg/L				-	-	-	-	-
>C12-C16	µg/L				-	-	-	-	-
>C16-C21	µg/L				-	-	-	-	-
>C21-C35	µg/L				-	-	-	-	-
>C35-C40	µg/L				-	-	-	-	-
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	<1	-	<1	-
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	<1	-	<1	-
>C8-C10 Aliphatics	µg/L		300[#2]		<1	<1	-	<1	-
>C10-C12 Aliphatics	µg/L		300[#2]		<10	<10	-	<10	-
>C12-C16 Aliphatics	µg/L		300[#2]		<10	<10	-	<10	-
>C16-C21 Aliphatics	µg/L		300[#2]		<10	<10	-	<10	-
>C21-C35 Aliphatics	µg/L		300[#2]		<10	<10	-	<10	-
>C35-C40 Aliphatics	µg/L				<10	<10	-	<10	-
>C5-C35 Aliphatics	µg/L				<10	<10	-	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	<1	-	<1	-
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	<1	-	<1	-
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	<1	-	<10	-
>EC10-EC12 Aromatics	µg/L		90[#2]		<10	<10	-	<10	-
>EC12-EC16 Aromatics	µg/L		90[#2]		<10	<10	-	<10	-
>EC16-EC21 Aromatics	µg/L		90[#2]		<10	<10	-	<10	-
>EC21-EC35 Aromatics	µg/L		90[#2]		<10	<10	-	<10	-
>EC35-EC40 Aromatics	µg/L				<10	<10	-	<10	-
>EC5-EC35 Aromatics	µg/L				<10	<10	-	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				<10	<10	-	-	-
BTEX									
Benzene	µg/L		1[#1]	10[#8]	<1	<1	-	<1	-
Toluene	µg/L		700[#3]	74[#7]	<1	<1	-	<1	-
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	<1	-	<1	-
Xylene (m & p)	µg/L				<1	<1	-	<1	-
Xylene (o)	µg/L		190[#10]		<1	<1	-	<1	-
Oxygenates									
MTBE	µg/L		1800[#15]	5100[#13]	<10	<1	-	<10	-
Chlorinated Hydrocarbons									
Chloromethane	µg/L		190[#10]		-	<1	-	-	-
Vinyl chloride	µg/L		0.5[#1]		-	<1	-	-	-
Chloroethane	µg/L		21000[#10]		-	<1	-	-	-
1,1-dichloroethene	µg/L		140[#3]		-	<1	-	-	-

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH04	BH09	BH10	BH12	BH24
Date	02/07/2019	19/06/2019	28/06/2019	24/07/2019	11/07/2019
Sample_Depth_Range	0.500-	0.500-	1.200-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
trans-1,2-dichloroethene	µg/L		50[#3]		-	<1	-	-	-
1,1-dichloroethane	µg/L		2.8[#10]		-	<1	-	-	-
cis-1,2-dichloroethene	µg/L		50[#3]		-	<1	-	-	-
Chloroform	µg/L		100[#1]	2.5[#8]	-	<1	-	-	-
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	-	<1	-	-	-
Carbon tetrachloride	µg/L		3[#1]	12[#8]	-	<1	-	-	-
Trichloroethene	µg/L			10[#8]	-	<1	-	-	-
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	-	<1	-	-	-
Tetrachloroethene	µg/L			10[#8]	-	<1	-	-	-
VOC									
2,2-dichloropropane	µg/L				-	<1	-	-	-
1,1-dichloropropene	µg/L				-	<1	-	-	-
1,2-dichloroethane	µg/L		3[#1]	10[#8]	-	<1	-	-	-
1,2-dichloropropane	µg/L		40[#3]		-	<1	-	-	-
Dibromomethane	µg/L		8.3[#10]		-	<1	-	-	-
Bromodichloromethane	µg/L		100[#1]		-	<1	-	-	-
cis-1,3-dichloropropene	µg/L				-	<1	-	-	-
trans-1,3-dichloropropene	µg/L				-	<1	-	-	-
1,3-dichloropropane	µg/L		370[#10]		-	<1	-	-	-
Chlorodibromomethane	µg/L		100[#1]		-	<1	-	-	-
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		-	<1	-	-	-
Styrene	µg/L		20[#3]	50[#12]	-	<1	-	-	-
Isopropylbenzene	µg/L		450[#10]		-	<1	-	-	-
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	-	<1	-	-	-
n-propylbenzene	µg/L		660[#10]		-	<1	-	-	-
1,3,5-trimethylbenzene	µg/L		60[#10]		-	<1	-	-	-
tert-butylbenzene	µg/L		690[#10]		-	<1	-	-	-
1,2,4-trimethylbenzene	µg/L		56[#10]		-	<1	-	-	-
sec-butylbenzene	µg/L		2000[#10]		-	<1	-	-	-
p-isopropyltoluene	µg/L				-	<1	-	-	-
n-butylbenzene	µg/L		1000[#10]		-	<1	-	-	-
1,2-dibromo-3-chloropropane	µg/L		1[#3]		-	<1	-	-	-
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	-	<0.05	-	-	-
PAH									
Naphthalene	µg/L	0.01	6[#15]	2[#8]	<0.01	<0.01	<0.01	-	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	-	<0.01
Acenaphthene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	-	<0.01
Fluorene	µg/L	0.01	12[#15]		<0.01	<0.01	<0.01	-	<0.01
Phenanthrene	µg/L	0.01	4[#15]		<0.01	<0.01	<0.01	-	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	<0.01	<0.01	<0.01	-	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	<0.01	<0.01	<0.01	-	<0.01
Pyrene	µg/L	0.01	9[#15]		<0.01	<0.01	<0.01	-	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	<0.01	-	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	<0.01	-	<0.01
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	<0.01	-	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	<0.01	-	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	<0.01	-	<0.01

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH04	BH09	BH10	BH12	BH24
Date	02/07/2019	19/06/2019	28/06/2019	24/07/2019	11/07/2019
Sample_Depth_Range	0.500-	0.500-	1.200-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	<0.01	-	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	-	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	-	<0.01
PAH 16 Total	µg/L	0.2			<0.2	-	<0.2	-	<0.2
SVOC									
2-methylnaphthalene	µg/L		36[#10]		-	<0.05	-	-	-
4-bromophenyl phenyl ether	µg/L				-	<0.05	-	-	-
4-chlorophenyl phenyl ether	µg/L				-	<0.05	-	-	-
Azobenzene	µg/L		0.12[#10]		-	<0.05	-	-	-
Bis(2-chloroethoxy) methane	µg/L		59[#10]		-	<0.05	-	-	-
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		-	<0.05	-	-	-
Carbazole	µg/L				-	<0.05	-	-	-
Dibenzofuran	µg/L		7.9[#10]		-	<0.05	-	-	-
Hexachloroethane	µg/L		0.33[#10]		-	<0.05	-	-	-
9,10-Anthracenedione	µg/L		1.4[#10]		-	<0.05	-	-	-
Phenolics									
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		<0.05	<0.05	<0.05	-	<0.05
2-nitrophenol	µg/L				<0.05	<0.05	<0.05	-	<0.05
2,4-dimethylphenol	µg/L		360[#10]		<0.05	<0.05	<0.05	-	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	<0.05	<0.05	-	<0.05
4-methylphenol	µg/L		1900[#10]		<0.05	<0.05	<0.05	-	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.05	<0.05	<0.5	<0.05
2-chloronaphthalene	µg/L		750[#10]		-	<0.05	-	-	-
Phenols	µg/L				<0.5	-	<0.5	-	<0.5
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Anilines									
4-chloroaniline	µg/L		0.37[#10]		-	<0.05	-	-	-
4-nitroaniline	µg/L		3.8[#10]		-	<0.05	-	-	-
Explosives									
2,4-Dinitrotoluene	µg/L		0.24[#10]		-	<0.05	-	-	-
2,6-dinitrotoluene	µg/L		0.049[#10]		-	<0.05	-	-	-
Nitrobenzene	µg/L		63[#3]		-	<0.05	-	-	-
Halogenated Benzenes									
Chlorobenzene	µg/L		300[#3]		-	<1	-	-	-
Bromobenzene	µg/L		62[#10]		-	<1	-	-	-
2-chlorotoluene	µg/L		240[#10]		-	<1	-	-	-
4-chlorotoluene	µg/L		250[#10]		-	<1	-	-	-
1,3-dichlorobenzene	µg/L				-	<0.05	-	-	-
1,4-dichlorobenzene	µg/L		300[#3]		-	<0.05	-	-	-
1,2-dichlorobenzene	µg/L		1000[#3]		-	<0.05	-	-	-
1,2,4-trichlorobenzene	µg/L		0.1[#1]		-	<0.05	-	-	-
1,2,3-trichlorobenzene	µg/L		0.1[#1]		-	<1	-	-	-
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	-	<0.02	-	-	-

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH04	BH09	BH10	BH12	BH24
Date	02/07/2019	19/06/2019	28/06/2019	24/07/2019	11/07/2019
Sample_Depth_Range	0.500-	0.500-	1.200-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Halogenated Hydrocarbons								
Bromomethane	µg/L		7.5[#10]		-	<1	-	-	-
1,2-dibromoethane	µg/L		0.4[#3]		-	<1	-	-	-
Halogenated Phenols								
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	<0.05	<0.05	-	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	<0.05	<0.05	-	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	<0.05	<0.05	-	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	<0.05	<0.05	-	<0.05
Phthalates								
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	-	<0.05	-	-	-
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	-	<0.05	-	-	-
Diethylphthalate	µg/L		15000[#10]	200[#12]	-	<0.05	-	-	-
Dimethyl phthalate	µg/L			800[#12]	-	<0.05	-	-	-
Solvents								
Isophorone	µg/L		78[#10]		-	<0.05	-	-	-
Metals								
Arsenic	µg/L	1.1	10[#1]	50[#7]	<1.1	<1.1	1.6	60	1.7
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	28	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			16	8.9	6.3	5.8	0.51
Chromium (III+VI)	µg/L	0.4	50[#1]		1.1	0.8	<0.4	4	1.1
Copper	µg/L	0.7	2000[#1]	1[#7]	6.4	5.1	1.7	17	3.4
Iron	µg/L	4	200[#1]	1000[#7]	270	200	15	3,200	21
Lead	µg/L	1	10[#1]	1.2[#8]	2.1	<1	1.5	30	<1
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	1.2	0.6	0.6	3.8	<0.3
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	27	1	7.7	17	<0.4
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5
Organics								
Dissolved Organic Carbon	mg/L	0.1			4.59	5.53	3.09	13.8	<0.1
TOC	mg/L	0.1			4.82	5.53	3.41	13.9	1.61
Inorganics								
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.019	<0.015	<0.015	0.028	<0.015
Other								
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH04	BH09	BH10	BH12	BH24
Date	02/07/2019	19/06/2019	28/06/2019	24/07/2019	11/07/2019
Sample_Depth_Range	0.500-	0.500-	1.200-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh
#8 WFD England/Wales. 2015 - AA-EQS Inland				

#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH29	BH30	TP01	TP02	TP03
Date	05/07/2019	18/07/2019	02/07/2019	03/07/2019	02/07/2019
Sample_Depth_Range	3.000-	0.500-	1.000-	2.000-	1.000-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Tribromomethane	µg/L				<1	<1	-	<1	<1
Freon 113	µg/L		10000[#10]		<1	<1	-	<1	<1
Ethylphenol & Dimethylphenol	µg/L	0.5			460	<0.5	<0.5	<0.5	<0.5
Field									
pH	pH_Units				7.5	7.3	7.8	7.9	7.6
TPH									
>C5-C6	µg/L				-	-	-	-	-
>C6-C8	µg/L				-	-	-	-	-
>C8-C10	µg/L				-	-	-	-	-
>C10-C12	µg/L				-	-	-	-	-
>C12-C16	µg/L				-	-	-	-	-
>C16-C21	µg/L				-	-	-	-	-
>C21-C35	µg/L				-	-	-	-	-
>C35-C40	µg/L				-	-	-	-	-
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	<1	-	-	<1
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	<1	-	-	<1
>C8-C10 Aliphatics	µg/L		300[#2]		<1	<1	-	-	<1
>C10-C12 Aliphatics	µg/L		300[#2]		<10	<10	-	-	<10
>C12-C16 Aliphatics	µg/L		300[#2]		<10	<10	-	-	<10
>C16-C21 Aliphatics	µg/L		300[#2]		<10	<10	-	-	<10
>C21-C35 Aliphatics	µg/L		300[#2]		<10	<10	-	-	<10
>C35-C40 Aliphatics	µg/L				<10	<10	-	-	<10
>C5-C35 Aliphatics	µg/L				<10	<10	-	-	<10
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	<1	-	-	<1
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	<1	-	-	<1
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	<1	-	-	<1
>EC10-EC12 Aromatics	µg/L		90[#2]		600	<10	-	-	<10
>EC12-EC16 Aromatics	µg/L		90[#2]		1,700	<10	-	-	<10
>EC16-EC21 Aromatics	µg/L		90[#2]		1,600	<10	-	-	<10
>EC21-EC35 Aromatics	µg/L		90[#2]		210	<10	-	-	<10
>EC35-EC40 Aromatics	µg/L				<10	<10	-	-	<10
>EC5-EC35 Aromatics	µg/L				4,100	<10	-	-	<10
>C5-C40 Aliphatics & Aromatics	µg/L				4,100	<10	-	-	<10
BTEX									
Benzene	µg/L		1[#1]	10[#8]	<1	<1	-	<1	<1
Toluene	µg/L		700[#3]	74[#7]	<1	<1	-	<1	<1
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	<1	-	<1	<1
Xylene (m & p)	µg/L				<1	<1	-	<1	<1
Xylene (o)	µg/L		190[#10]		<1	<1	-	<1	<1
Oxygenates									
MTBE	µg/L		1800[#15]	5100[#13]	<1	<1	-	<1	<1
Chlorinated Hydrocarbons									
Chloromethane	µg/L		190[#10]		<1	<1	-	<1	<1
Vinyl chloride	µg/L		0.5[#1]		<1	<1	-	<1	<1
Chloroethane	µg/L		21000[#10]		<1	<1	-	<1	<1
1,1-dichloroethene	µg/L		140[#3]		<1	<1	-	<1	<1

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH29	BH30	TP01	TP02	TP03
Date	05/07/2019	18/07/2019	02/07/2019	03/07/2019	02/07/2019
Sample_Depth_Range	3.000-	0.500-	1.000-	2.000-	1.000-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
trans-1,2-dichloroethene	µg/L		50[#3]		<1	<1	-	<1	<1
1,1-dichloroethane	µg/L		2.8[#10]		<1	<1	-	<1	<1
cis-1,2-dichloroethene	µg/L		50[#3]		<1	<1	-	<1	<1
Chloroform	µg/L		100[#1]	2.5[#8]	<1	<1	-	<1	<1
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	<1	<1	-	<1	<1
Carbon tetrachloride	µg/L		3[#1]	12[#8]	<1	<1	-	<1	<1
Trichloroethene	µg/L			10[#8]	<1	<1	-	<1	<1
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	<1	<1	-	<1	<1
Tetrachloroethene	µg/L			10[#8]	<1	<1	-	<1	<1
VOC									
2,2-dichloropropane	µg/L				<1	<1	-	<1	<1
1,1-dichloropropene	µg/L				<1	<1	-	<1	<1
1,2-dichloroethane	µg/L		3[#1]	10[#8]	<1	<1	-	<1	<1
1,2-dichloropropane	µg/L		40[#3]		<1	<1	-	<1	<1
Dibromomethane	µg/L		8.3[#10]		<1	<1	-	<1	<1
Bromodichloromethane	µg/L		100[#1]		<1	<1	-	<1	<1
cis-1,3-dichloropropene	µg/L				<1	<1	-	<1	<1
trans-1,3-dichloropropene	µg/L				<1	<1	-	<1	<1
1,3-dichloropropane	µg/L		370[#10]		<1	<1	-	<1	<1
Chlorodibromomethane	µg/L		100[#1]		<1	<1	-	<1	<1
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		<1	<1	-	<1	<1
Styrene	µg/L		20[#3]	50[#12]	<1	<1	-	<1	<1
Isopropylbenzene	µg/L		450[#10]		<1	<1	-	<1	<1
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	<1	<1	-	<1	<1
n-propylbenzene	µg/L		660[#10]		<1	<1	-	<1	<1
1,3,5-trimethylbenzene	µg/L		60[#10]		<1	<1	-	<1	<1
tert-butylbenzene	µg/L		690[#10]		<1	<1	-	<1	<1
1,2,4-trimethylbenzene	µg/L		56[#10]		<1	<1	-	<1	<1
sec-butylbenzene	µg/L		2000[#10]		<1	<1	-	<1	<1
p-isopropyltoluene	µg/L				<1	<1	-	<1	<1
n-butylbenzene	µg/L		1000[#10]		<1	<1	-	<1	<1
1,2-dibromo-3-chloropropane	µg/L		1[#3]		<1	<1	-	<1	<1
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.05	<0.05	-	<0.05	<0.05
PAH									
Naphthalene	µg/L	0.01	6[#15]	2[#8]	110	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		0.47	<0.01	<0.01	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		13	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		6.4	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		6.7	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	1.4	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	0.56	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		0.33	<0.01	<0.01	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	<0.01	<0.01	<0.01

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH29	BH30	TP01	TP02	TP03
Date	05/07/2019	18/07/2019	02/07/2019	03/07/2019	02/07/2019
Sample_Depth_Range	3.000-	0.500-	1.000-	2.000-	1.000-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
PAH 16 Total	µg/L	0.2			140	-	<0.2	<0.2	<0.2
SVOC									
2-methylnaphthalene	µg/L		36[#10]		14	<0.05	-	<0.05	<0.05
4-bromophenyl phenyl ether	µg/L				<0.05	<0.05	-	<0.05	<0.05
4-chlorophenyl phenyl ether	µg/L				<0.05	<0.05	-	<0.05	<0.05
Azobenzene	µg/L		0.12[#10]		<0.05	<0.05	-	<0.05	<0.05
Bis(2-chloroethoxy) methane	µg/L		59[#10]		<0.05	<0.05	-	<0.05	<0.05
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		<0.05	<0.05	-	<0.05	<0.05
Carbazole	µg/L				59	<0.05	-	<0.05	<0.05
Dibenzofuran	µg/L		7.9[#10]		3.3	<0.05	-	<0.05	<0.05
Hexachloroethane	µg/L		0.33[#10]		<0.05	<0.05	-	<0.05	<0.05
9,10-Anthracenedione	µg/L		1.4[#10]		<0.05	<0.05	-	<0.05	<0.05
Phenolics									
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		2.5	<0.05	<0.05	<0.05	<0.05
2-nitrophenol	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
2,4-dimethylphenol	µg/L		360[#10]		46	<0.05	<0.05	<0.05	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
4-methylphenol	µg/L		1900[#10]		3.1	<0.05	<0.05	<0.05	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.05	<0.05	<0.05	<0.05
2-chloronaphthalene	µg/L		750[#10]		<0.05	<0.05	-	<0.05	<0.05
Phenols	µg/L				51	-	<0.5	<0.5	<0.5
Cresols by HPLC (W)	µg/L	0.5			250	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			710	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Anilines									
4-chloroaniline	µg/L		0.37[#10]		<0.05	<0.05	-	<0.05	<0.05
4-nitroaniline	µg/L		3.8[#10]		<0.05	<0.05	-	<0.05	<0.05
Explosives									
2,4-Dinitrotoluene	µg/L		0.24[#10]		<0.05	<0.05	-	<0.05	<0.05
2,6-dinitrotoluene	µg/L		0.049[#10]		<0.05	<0.05	-	<0.05	<0.05
Nitrobenzene	µg/L		63[#3]		<0.05	<0.05	-	<0.05	<0.05
Halogenated Benzenes									
Chlorobenzene	µg/L		300[#3]		<1	<1	-	<1	<1
Bromobenzene	µg/L		62[#10]		<1	<1	-	<1	<1
2-chlorotoluene	µg/L		240[#10]		<1	<1	-	<1	<1
4-chlorotoluene	µg/L		250[#10]		<1	<1	-	<1	<1
1,3-dichlorobenzene	µg/L				<0.05	<0.05	-	<0.05	<0.05
1,4-dichlorobenzene	µg/L		300[#3]		<0.05	<0.05	-	<0.05	<0.05
1,2-dichlorobenzene	µg/L		1000[#3]		<0.05	<0.05	-	<0.05	<0.05
1,2,4-trichlorobenzene	µg/L		0.1[#1]		<0.05	<0.05	-	<0.05	<0.05
1,2,3-trichlorobenzene	µg/L		0.1[#1]		<1	<1	-	<1	<1
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.02	<0.02	-	<0.02	<0.02

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH29	BH30	TP01	TP02	TP03
Date	05/07/2019	18/07/2019	02/07/2019	03/07/2019	02/07/2019
Sample_Depth_Range	3.000-	0.500-	1.000-	2.000-	1.000-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Halogenated Hydrocarbons									
Bromomethane	µg/L		7.5[#10]		<1	<1	-	<1	<1
1,2-dibromoethane	µg/L		0.4[#3]		<1	<1	-	<1	<1
Halogenated Phenols									
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	<0.05	<0.05	<0.05	<0.05
Phthalates									
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	<0.05	<0.05	-	<0.05	<0.05
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	<0.05	<0.05	-	<0.05	<0.05
Diethylphthalate	µg/L		15000[#10]	200[#12]	<0.05	<0.05	-	<0.05	<0.05
Dimethyl phthalate	µg/L			800[#12]	<0.05	<0.05	-	<0.05	<0.05
Solvents									
Isophorone	µg/L		78[#10]		<0.05	<0.05	-	<0.05	<0.05
Metals									
Arsenic	µg/L	1.1	10[#1]	50[#7]	<1.1	1.1	5.5	3.2	5.6
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	260	17	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			0.12	2.7	39	16	15
Chromium (III+VI)	µg/L	0.4	50[#1]		<0.4	<0.4	1.7	2.3	1.5
Copper	µg/L	0.7	2000[#1]	1[#7]	<0.7	6.8	31	8.5	21
Iron	µg/L	4	200[#1]	1000[#7]	95	9	410	1,500	55
Lead	µg/L	1	10[#1]	1.2[#8]	<1	<1	5.8	3.3	2.9
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	<0.3	1.8	2.1	1.6	1.2
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	<0.4	5.6	17	9.5	10
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5
Organics									
Dissolved Organic Carbon	mg/L	0.1			21.4	0.97	6.68	8.93	7.31
TOC	mg/L	0.1			23.6	1.68	7.07	9.21	8.43
Inorganics									
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.17	<0.015	0.07	1.5	<0.015
Other									
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	BH29	BH30	TP01	TP02	TP03
Date	05/07/2019	18/07/2019	02/07/2019	03/07/2019	02/07/2019
Sample_Depth_Range	3.000-	0.500-	1.000-	2.000-	1.000-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh
#8 WFD England/Wales. 2015 - AA-EQS Inland				

#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	TP04	TP05	TP06	TP07	TP10
Date	11/07/2019	01/07/2019	03/07/2019	03/07/2019	05/07/2019
Sample_Depth_Range	1.000-	1.000-	0.500-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	-
Tribromomethane	µg/L				<1	-	-	<1	-
Freon 113	µg/L		10000[#10]		<1	-	-	<1	-
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-
Field									
pH	pH_Units				10.7	7.1	8	7.3	7.5
TPH									
>C5-C6	µg/L				-	-	-	-	-
>C6-C8	µg/L				-	-	-	-	-
>C8-C10	µg/L				-	-	-	-	-
>C10-C12	µg/L				-	-	-	-	-
>C12-C16	µg/L				-	-	-	-	-
>C16-C21	µg/L				-	-	-	-	-
>C21-C35	µg/L				-	-	-	-	-
>C35-C40	µg/L				-	-	-	-	-
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	-	-	-	-
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	-	-	-	-
>C8-C10 Aliphatics	µg/L		300[#2]		<1	-	-	-	-
>C10-C12 Aliphatics	µg/L		300[#2]		<10	-	-	-	-
>C12-C16 Aliphatics	µg/L		300[#2]		<10	-	-	-	-
>C16-C21 Aliphatics	µg/L		300[#2]		<10	-	-	-	-
>C21-C35 Aliphatics	µg/L		300[#2]		<10	-	-	-	-
>C35-C40 Aliphatics	µg/L				<10	-	-	-	-
>C5-C35 Aliphatics	µg/L				<10	-	-	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	-	-	-	-
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	-	-	-	-
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	-	-	-	-
>EC10-EC12 Aromatics	µg/L		90[#2]		<10	-	-	-	-
>EC12-EC16 Aromatics	µg/L		90[#2]		<10	-	-	-	-
>EC16-EC21 Aromatics	µg/L		90[#2]		<10	-	-	-	-
>EC21-EC35 Aromatics	µg/L		90[#2]		<10	-	-	-	-
>EC35-EC40 Aromatics	µg/L				<10	-	-	-	-
>EC5-EC35 Aromatics	µg/L				<10	-	-	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				<10	-	-	-	-
BTEX									
Benzene	µg/L		1[#1]	10[#8]	<1	-	-	<1	-
Toluene	µg/L		700[#3]	74[#7]	<1	-	-	<1	-
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	-	-	<1	-
Xylene (m & p)	µg/L				<1	-	-	<1	-
Xylene (o)	µg/L		190[#10]		<1	-	-	<1	-
Oxygenates									
MTBE	µg/L		1800[#15]	5100[#13]	<1	-	-	<1	-
Chlorinated Hydrocarbons									
Chloromethane	µg/L		190[#10]		<1	-	-	<1	-
Vinyl chloride	µg/L		0.5[#1]		<1	-	-	<1	-
Chloroethane	µg/L		21000[#10]		<1	-	-	<1	-
1,1-dichloroethene	µg/L		140[#3]		<1	-	-	<1	-

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	TP04	TP05	TP06	TP07	TP10
Date	11/07/2019	01/07/2019	03/07/2019	03/07/2019	05/07/2019
Sample_Depth_Range	1.000-	1.000-	0.500-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
trans-1,2-dichloroethene	µg/L		50[#3]		<1	-	-	<1	-
1,1-dichloroethane	µg/L		2.8[#10]		<1	-	-	<1	-
cis-1,2-dichloroethene	µg/L		50[#3]		<1	-	-	<1	-
Chloroform	µg/L		100[#1]	2.5[#8]	<1	-	-	<1	-
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	<1	-	-	<1	-
Carbon tetrachloride	µg/L		3[#1]	12[#8]	<1	-	-	<1	-
Trichloroethene	µg/L			10[#8]	<1	-	-	<1	-
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	<1	-	-	<1	-
Tetrachloroethene	µg/L			10[#8]	<1	-	-	<1	-
VOC									
2,2-dichloropropane	µg/L				<1	-	-	<1	-
1,1-dichloropropene	µg/L				<1	-	-	<1	-
1,2-dichloroethane	µg/L		3[#1]	10[#8]	<1	-	-	<1	-
1,2-dichloropropane	µg/L		40[#3]		<1	-	-	<1	-
Dibromomethane	µg/L		8.3[#10]		<1	-	-	<1	-
Bromodichloromethane	µg/L		100[#1]		<1	-	-	<1	-
cis-1,3-dichloropropene	µg/L				<1	-	-	<1	-
trans-1,3-dichloropropene	µg/L				<1	-	-	<1	-
1,3-dichloropropane	µg/L		370[#10]		<1	-	-	<1	-
Chlorodibromomethane	µg/L		100[#1]		<1	-	-	<1	-
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		<1	-	-	<1	-
Styrene	µg/L		20[#3]	50[#12]	<1	-	-	<1	-
Isopropylbenzene	µg/L		450[#10]		<1	-	-	<1	-
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	<1	-	-	<1	-
n-propylbenzene	µg/L		660[#10]		<1	-	-	<1	-
1,3,5-trimethylbenzene	µg/L		60[#10]		<1	-	-	<1	-
tert-butylbenzene	µg/L		690[#10]		<1	-	-	<1	-
1,2,4-trimethylbenzene	µg/L		56[#10]		<1	-	-	<1	-
sec-butylbenzene	µg/L		2000[#10]		<1	-	-	<1	-
p-isopropyltoluene	µg/L				<1	-	-	<1	-
n-butylbenzene	µg/L		1000[#10]		<1	-	-	<1	-
1,2-dibromo-3-chloropropane	µg/L		1[#3]		<1	-	-	<1	-
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.05	<0.05	<0.05	<0.05	<0.05
PAH									
Naphthalene	µg/L	0.01	6[#15]	2[#8]	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	<0.01	<0.01	<0.01

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	TP04	TP05	TP06	TP07	TP10
Date	11/07/2019	01/07/2019	03/07/2019	03/07/2019	05/07/2019
Sample_Depth_Range	1.000-	1.000-	0.500-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01
PAH 16 Total	µg/L	0.2			<0.2	-	<0.2	-	<0.2
SVOC									
2-methylnaphthalene	µg/L		36[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
4-bromophenyl phenyl ether	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
4-chlorophenyl phenyl ether	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
Azobenzene	µg/L		0.12[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-chloroethoxy) methane	µg/L		59[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Carbazole	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
Dibenzofuran	µg/L		7.9[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Hexachloroethane	µg/L		0.33[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
9,10-Anthracenedione	µg/L		1.4[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Phenolics									
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-
2-methylphenol	µg/L		930[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
2-nitrophenol	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
2,4-dimethylphenol	µg/L		360[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
4-methylphenol	µg/L		1900[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.05	<0.05	<0.05	<0.05
2-chloronaphthalene	µg/L		750[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Phenols	µg/L				<0.5	-	-	-	-
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	-
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-
Anilines									
4-chloroaniline	µg/L		0.37[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
4-nitroaniline	µg/L		3.8[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Explosives									
2,4-Dinitrotoluene	µg/L		0.24[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
2,6-dinitrotoluene	µg/L		0.049[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Nitrobenzene	µg/L		63[#3]		<0.05	<0.05	<0.05	<0.05	<0.05
Halogenated Benzenes									
Chlorobenzene	µg/L		300[#3]		<1	-	-	<1	-
Bromobenzene	µg/L		62[#10]		<1	-	-	<1	-
2-chlorotoluene	µg/L		240[#10]		<1	-	-	<1	-
4-chlorotoluene	µg/L		250[#10]		<1	-	-	<1	-
1,3-dichlorobenzene	µg/L				<0.05	<0.05	<0.05	<0.05	<0.05
1,4-dichlorobenzene	µg/L		300[#3]		<0.05	<0.05	<0.05	<0.05	<0.05
1,2-dichlorobenzene	µg/L		1000[#3]		<0.05	<0.05	<0.05	<0.05	<0.05
1,2,4-trichlorobenzene	µg/L		0.1[#1]		<0.05	<0.05	<0.05	<0.05	<0.05
1,2,3-trichlorobenzene	µg/L		0.1[#1]		<1	-	-	<1	-
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.02	<0.02	<0.02	<0.02	<0.02

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	TP04	TP05	TP06	TP07	TP10
Date	11/07/2019	01/07/2019	03/07/2019	03/07/2019	05/07/2019
Sample_Depth_Range	1.000-	1.000-	0.500-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Halogenated Hydrocarbons									
Bromomethane	µg/L		7.5[#10]		<1	-	-	<1	-
1,2-dibromoethane	µg/L		0.4[#3]		<1	-	-	<1	-
Halogenated Phenols									
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	<0.05	<0.05	<0.05	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	<0.05	<0.05	<0.05	<0.05
Phthalates									
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	<0.05	<0.05	<0.05	<0.05	<0.05
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
Diethylphthalate	µg/L		15000[#10]	200[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
Dimethyl phthalate	µg/L			800[#12]	<0.05	<0.05	<0.05	<0.05	<0.05
Solvents									
Isophorone	µg/L		78[#10]		<0.05	<0.05	<0.05	<0.05	<0.05
Metals									
Arsenic	µg/L	1.1	10[#1]	50[#7]	5.9	6.6	5.5	3.4	2.5
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	23	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			48	2.8	13	2.6	0.98
Chromium (III+VI)	µg/L	0.4	50[#1]		2.9	1.3	0.7	4.1	0.7
Copper	µg/L	0.7	2000[#1]	1[#7]	99	2.7	9.2	5.8	12
Iron	µg/L	4	200[#1]	1000[#7]	650	410	350	1,800	18
Lead	µg/L	1	10[#1]	1.2[#8]	4.9	3.7	3	1.7	<1
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	13	1.4	0.8	2.8	0.9
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	7.7	5.8	8	6.9	7.1
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5
Organics									
Dissolved Organic Carbon	mg/L	0.1			25.2	3.96	4.42	3.75	5.08
TOC	mg/L	0.1			27.6	4.52	4.3	4.18	6.14
Inorganics									
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.45	0.032	0.016	<0.015	0.057
Other									
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	-

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards

Soil Leachate Results for Made Ground
Analytical Results
M54-M6 Link Road
Highways England

Location	TP04	TP05	TP06	TP07	TP10
Date	11/07/2019	01/07/2019	03/07/2019	03/07/2019	05/07/2019
Sample_Depth_Range	1.000-	1.000-	0.500-	0.500-	0.500-
Matrix_Description	Made Ground	Made Ground	Made Ground	Made Ground	Made Ground

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh
#8 WFD England/Wales. 2015 - AA-EQS Inland				

#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	BH06	BH11	BH13	BH14	BH16	BH17	BH18
Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methacriphos	mg/L				-	-	-	-	-	-	-
Trietazine	mg/L		0.0001[#1]		-	-	-	-	-	-	-
Tribromomethane	µg/L				-	-	-	<1	-	-	-
Freon 113	µg/L		10000[#10]		-	-	-	<1	-	-	-
Chlorothalonil	µg/L		0.1[#1]	0.035[#7]	-	-	-	-	-	-	-
Tecnazene	mg/L		0.0001[#1]	0.001[#12]	-	-	-	-	-	-	-
Etrimphos	mg/L		0.0001[#1]		-	-	-	-	-	-	-
Propetamphos	mg/L		0.0001[#1]	0.00003[#12]	-	-	-	-	-	-	-
2,4-DB	µg/L				-	-	-	-	-	-	-
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Monuron	µg/L				-	-	-	-	-	-	-
Phosphamidon I	µg/L		0.1[#1]		-	-	-	-	-	-	-
Organic											
Terbutylazine	mg/L		0.007[#3]		-	-	-	-	-	-	-
Field											
pH	pH_Units				6.7	7.4	8	7.5	7.2	6.8	7.3
TPH											
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	-	<1	<1	<1	-	<1
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	-	<1	<1	<1	-	<1
>C8-C10 Aliphatics	µg/L		300[#2]		<1	-	<1	<1	<1	-	<1
>C10-C12 Aliphatics	µg/L		300[#2]		<10	-	<10	<10	<10	-	<10
>C12-C16 Aliphatics	µg/L		300[#2]		<10	-	<10	<10	<10	-	<10
>C16-C21 Aliphatics	µg/L		300[#2]		<10	-	<10	<10	<10	-	<10
>C21-C35 Aliphatics	µg/L		300[#2]		<10	-	<10	<10	<10	-	<10
>C35-C40 Aliphatics	µg/L				<10	-	<10	<10	<10	-	<10
>C5-C35 Aliphatics	µg/L				<10	-	<10	<10	<10	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	-	<1	<1	<1	-	<1
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	-	<1	<1	<1	-	<1
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	-	<1	<1	<1	-	<10
>EC10-EC12 Aromatics	µg/L		90[#2]		<10	-	<10	<10	<10	-	<10
>EC12-EC16 Aromatics	µg/L		90[#2]		<10	-	<10	<10	<10	-	<10
>EC16-EC21 Aromatics	µg/L		90[#2]		<10	-	<10	<10	<10	-	<10
>EC21-EC35 Aromatics	µg/L		90[#2]		<10	-	<10	<10	<10	-	<10
>EC35-EC40 Aromatics	µg/L				<10	-	<10	<10	<10	-	<10
>EC5-EC35 Aromatics	µg/L				<10	-	<10	<10	<10	-	<10
>C5-C40 Aliphatics & Aromatics	µg/L				<10	-	<10	<10	<10	-	-
BTEX											
Benzene	µg/L		1[#1]	10[#8]	<1	-	<1	<1	<1	-	<1
Toluene	µg/L		700[#3]	74[#7]	<1	-	<1	<1	<1	-	<1
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	-	<1	<1	<1	-	<1
Xylene (m & p)	µg/L				<1	-	<1	<1	<1	-	<1
Xylene (o)	µg/L		190[#10]		<1	-	<1	<1	<1	-	<1
Oxygenates											
MTBE	µg/L		1800[#15]	5100[#13]	<10	-	<10	<1	<10	-	<10
Chlorinated Hydrocarbons											
Chloromethane	µg/L		190[#10]		-	-	-	<1	-	-	-

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	BH06	BH11	BH13	BH14	BH16	BH17	BH18
Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh						
Vinyl chloride	µg/L		0.5[#1]		-	-	-	<1	-	-	-
Chloroethane	µg/L		21000[#10]		-	-	-	<1	-	-	-
1,1-dichloroethene	µg/L		140[#3]		-	-	-	<1	-	-	-
trans-1,2-dichloroethene	µg/L		50[#3]		-	-	-	<1	-	-	-
1,1-dichloroethane	µg/L		2.8[#10]		-	-	-	<1	-	-	-
cis-1,2-dichloroethene	µg/L		50[#3]		-	-	-	<1	-	-	-
Chloroform	µg/L		100[#1]	2.5[#8]	-	-	-	<1	-	-	-
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	-	-	-	<1	-	-	-
Carbon tetrachloride	µg/L		3[#1]	12[#8]	-	-	-	<1	-	-	-
Trichloroethene	µg/L			10[#8]	-	-	-	<1	-	-	-
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	-	-	-	<1	-	-	-
Tetrachloroethene	µg/L			10[#8]	-	-	-	<1	-	-	-
VOC											
2,2-dichloropropane	µg/L				-	-	-	<1	-	-	-
1,1-dichloropropene	µg/L				-	-	-	<1	-	-	-
1,2-dichloroethane	µg/L		3[#1]	10[#8]	-	-	-	<1	-	-	-
1,2-dichloropropane	µg/L		40[#3]		-	-	-	<1	-	-	-
Dibromomethane	µg/L		8.3[#10]		-	-	-	<1	-	-	-
Bromodichloromethane	µg/L		100[#1]		-	-	-	<1	-	-	-
cis-1,3-dichloropropene	µg/L				-	-	-	<1	-	-	-
trans-1,3-dichloropropene	µg/L				-	-	-	<1	-	-	-
1,3-dichloropropane	µg/L		370[#10]		-	-	-	<1	-	-	-
Chlorodibromomethane	µg/L		100[#1]		-	-	-	<1	-	-	-
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		-	-	-	<1	-	-	-
Styrene	µg/L		20[#3]	50[#12]	-	-	-	<1	-	-	-
Isopropylbenzene	µg/L		450[#10]		-	-	-	<1	-	-	-
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	-	-	-	<1	-	-	-
n-propylbenzene	µg/L		660[#10]		-	-	-	<1	-	-	-
1,3,5-trimethylbenzene	µg/L		60[#10]		-	-	-	<1	-	-	-
tert-butylbenzene	µg/L		690[#10]		-	-	-	<1	-	-	-
1,2,4-trimethylbenzene	µg/L		56[#10]		-	-	-	<1	-	-	-
sec-butylbenzene	µg/L		2000[#10]		-	-	-	<1	-	-	-
p-isopropyltoluene	µg/L				-	-	-	<1	-	-	-
n-butylbenzene	µg/L		1000[#10]		-	-	-	<1	-	-	-
1,2-dibromo-3-chloropropane	µg/L		1[#3]		-	-	-	<1	-	-	-
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.05	-	-	<0.05	-	-	<0.05
PAH											
Naphthalene	µg/L	0.01	6[#15]	2[#8]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01

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Location	BH06	BH11	BH13	BH14	BH16	BH17	BH18
Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PAH 16 Total	µg/L	0.2			<0.2	<0.2	<0.2	-	<0.2	<0.2	<0.2
SVOC											
2-methylnaphthalene	µg/L		36[#10]		<0.05	-	-	<0.05	-	-	<0.05
4-bromophenyl phenyl ether	µg/L				<0.05	-	-	<0.05	-	-	<0.05
4-chlorophenyl phenyl ether	µg/L				<0.05	-	-	<0.05	-	-	<0.05
Azobenzene	µg/L		0.12[#10]		<0.05	-	-	<0.05	-	-	<0.05
Bis(2-chloroethoxy) methane	µg/L		59[#10]		<0.05	-	-	<0.05	-	-	<0.05
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		<0.05	-	-	<0.05	-	-	<0.05
Carbazole	µg/L				<0.05	-	-	<0.05	-	-	<0.05
Dibenzofuran	µg/L		7.9[#10]		<0.05	-	-	<0.05	-	-	<0.05
Hexachloroethane	µg/L		0.33[#10]		<0.05	-	-	<0.05	-	-	<0.05
9,10-Anthracenedione	µg/L		1.4[#10]		<0.05	-	-	<0.05	-	-	<0.05
Phenolics											
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		<0.05	-	-	<0.05	-	-	<0.05
2-nitrophenol	µg/L				<0.05	-	-	<0.05	-	-	<0.05
2,4-dimethylphenol	µg/L		360[#10]		<0.05	-	-	<0.05	-	-	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	-	-	<0.05	-	-	<0.05
4-methylphenol	µg/L		1900[#10]		<0.05	-	-	<0.05	-	-	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.5	<0.5	<0.05	<0.5	<0.5	<0.05
2-chloronaphthalene	µg/L		750[#10]		<0.05	-	-	<0.05	-	-	<0.05
Phenols	µg/L				-	-	-	-	-	-	-
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fungicides											
Triadimefon	µg/L		0.1[#1]		-	-	-	-	-	-	-
Herbicides											
Pendimethalin	µg/L		0.1[#1]	0.3[#7]	-	-	-	-	-	-	-
Trifluralin	µg/L		0.1[#1]	0.03[#8]	-	-	-	-	-	-	-
Bentazone	µg/L		500[#3]	500[#12]	-	-	-	-	-	-	-
Hedonal	µg/L		30[#3]	0.3[#7]	-	-	-	-	-	-	-
Dicamba	µg/L		570[#10]		-	-	-	-	-	-	-
2,4-Dichlorprop	µg/L		100[#3]		-	-	-	-	-	-	-
2,4,5-TP (Silvex)	µg/L		110[#10]		-	-	-	-	-	-	-
2-Methyl-4-chlorophenoxyacetic acid	µg/L		700[#3]	12[#12]	-	-	-	-	-	-	-
2-Methyl-4-Chlorophenoxy Butanoic Acid	µg/L		65[#10]		-	-	-	-	-	-	-
2,4,5-Trichlorophenoxy Acetic Acid	µg/L		9[#3]		-	-	-	-	-	-	-
Atrazine	µg/L		0.1[#1]	0.6[#8]	-	-	-	-	-	-	-
Simazine	µg/L		0.1[#1]	1[#8]	-	-	-	-	-	-	-

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Location	BH06	BH11	BH13	BH14	BH16	BH17	BH18
Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Chlorotoluron	µg/L		30[#3]	2[#12]	-	-	-	-	-	-	-
Cyanazine	µg/L		0.1[#1]		-	-	-	-	-	-	-
Dichlobenil	µg/L		0.1[#1]		-	-	-	-	-	-	-
Dinoseb	µg/L		15[#10]		-	-	-	-	-	-	-
Fluometuron	µg/L		240[#10]		-	-	-	-	-	-	-
Isoproturon	µg/L		9[#3]	0.3[#8]	-	-	-	-	-	-	-
Mecoprop	µg/L		10[#3]	18[#7]	-	-	-	-	-	-	-
Picloram	µg/L		1400[#10]		-	-	-	-	-	-	-
Prometryn	µg/L		0.1[#1]		-	-	-	-	-	-	-
Pronamide	µg/L		0.1[#1]	100[#12]	-	-	-	-	-	-	-
Propazine	µg/L		0.1[#1]		-	-	-	-	-	-	-
Tebuthiuron	µg/L		1400[#10]		-	-	-	-	-	-	-
Terbutryn	µg/L		0.1[#1]		-	-	-	-	-	-	-
Diuron	µg/L		36[#10]	0.2[#8]	-	-	-	-	-	-	-
Linuron	µg/L		130[#10]	0.5[#7]	-	-	-	-	-	-	-
Pesticides											
Isodrin	µg/L		0.1[#1]		-	-	-	-	-	-	-
Parathion	µg/L		0.1[#1]		-	-	-	-	-	-	-
Pirimiphos-methyl	µg/L		0.1[#1]	0.015[#12]	-	-	-	-	-	-	-
Diflubenzuron	µg/L		290[#10]	0.001[#12]	-	-	-	-	-	-	-
Pirimphos-ethyl	µg/L		0.1[#1]		-	-	-	-	-	-	-
Organochlorine Pesticides											
Aldrin	µg/L		0.03[#1]		-	-	-	-	-	-	-
a-BHC	µg/L		0.0072[#10]		-	-	-	-	-	-	-
b-BHC	µg/L		0.025[#10]		-	-	-	-	-	-	-
Chlordane (cis)	µg/L		0.1[#1]		-	-	-	-	-	-	-
Dieldrin	µg/L		0.03[#1]		-	-	-	-	-	-	-
Endosulfan I	µg/L		0.1[#1]		-	-	-	-	-	-	-
Endosulfan II	µg/L		0.1[#1]		-	-	-	-	-	-	-
Endosulfan sulphate	µg/L		0.1[#1]		-	-	-	-	-	-	-
Endrin	µg/L		0.1[#1]		-	-	-	-	-	-	-
g-BHC (Lindane)	µg/L		2[#3]		-	-	-	-	-	-	-
Heptachlor	µg/L		0.03[#1]		-	-	-	-	-	-	-
Heptachlor epoxide	µg/L		0.03[#1]		-	-	-	-	-	-	-
o,p''-DDE	µg/L				-	-	-	-	-	-	-
2,4-DDT	µg/L				-	-	-	-	-	-	-
o,p-DDD	µg/L				-	-	-	-	-	-	-
4,4-DDE	µg/L		0.1[#1]		-	-	-	-	-	-	-
DDT	µg/L		0.1[#1]	0.01[#8]	-	-	-	-	-	-	-
Methoxychlor	µg/L		0.1[#1]		-	-	-	-	-	-	-
DDD	µg/L		0.1[#1]		-	-	-	-	-	-	-
Chlordane (trans)	µg/L		0.1[#1]		-	-	-	-	-	-	-
d-BHC	µg/L				-	-	-	-	-	-	-
Endrin aldehyde	µg/L				-	-	-	-	-	-	-
Endrin ketone	µg/L				-	-	-	-	-	-	-
Organophosphorous Pesticides											
Azinphos Ethyl	µg/L		0.1[#1]		-	-	-	-	-	-	-

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Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Azinophos methyl	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	-	-
Carbophenothion	µg/L		0.1[#1]		-	-	-	-	-	-	-
Chlorfenvinphos	µg/L		0.1[#1]	0.1[#8]	-	-	-	-	-	-	-
Chlorpyrifos	µg/L		0.1[#1]	0.03[#8]	-	-	-	-	-	-	-
Diazinon	µg/L		0.1[#1]	0.01[#7]	-	-	-	-	-	-	-
Dichlorvos	µg/L		0.1[#1]		-	-	-	-	-	-	-
Dimethoate	µg/L		0.1[#1]	0.48[#7]	-	-	-	-	-	-	-
Ethion	µg/L		0.1[#1]		-	-	-	-	-	-	-
Fenitrothion	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	-	-
Fenthion	µg/L		0.1[#1]		-	-	-	-	-	-	-
Malathion	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	-	-
Methyl parathion	µg/L		0.1[#1]		-	-	-	-	-	-	-
Mevinphos (Phosdrin)	µg/L		0.1[#1]	0.02[#11]	-	-	-	-	-	-	-
Demeton-O	µg/L				-	-	-	-	-	-	-
Demeton-S	µg/L				-	-	-	-	-	-	-
Phorate	µg/L		0.1[#1]		-	-	-	-	-	-	-
Anilines											
4-chloroaniline	µg/L		0.37[#10]		<0.05	-	-	<0.05	-	-	<0.05
4-nitroaniline	µg/L		3.8[#10]		<0.05	-	-	<0.05	-	-	<0.05
Explosives											
2,4-Dinitrotoluene	µg/L		0.24[#10]		<0.05	-	-	<0.05	-	-	<0.05
2,6-dinitrotoluene	µg/L		0.049[#10]		<0.05	-	-	<0.05	-	-	<0.05
Nitrobenzene	µg/L		63[#3]		<0.05	-	-	<0.05	-	-	<0.05
Halogenated Benzenes											
1,2,4,5-tetrachlorobenzene	µg/L		1.7[#10]		-	-	-	-	-	-	-
1,3,5-Trichlorobenzene	µg/L		0.1[#1]		-	-	-	-	-	-	-
Chlorobenzene	µg/L		300[#3]		-	-	-	<1	-	-	-
Bromobenzene	µg/L		62[#10]		-	-	-	<1	-	-	-
2-chlorotoluene	µg/L		240[#10]		-	-	-	<1	-	-	-
4-chlorotoluene	µg/L		250[#10]		-	-	-	<1	-	-	-
1,3-dichlorobenzene	µg/L				<0.05	-	-	<0.05	-	-	<0.05
1,4-dichlorobenzene	µg/L		300[#3]		<0.05	-	-	<0.05	-	-	<0.05
1,2-dichlorobenzene	µg/L		1000[#3]		<0.05	-	-	<0.05	-	-	<0.05
1,2,4-trichlorobenzene	µg/L		0.1[#1]		<0.05	-	-	<0.05	-	-	<0.05
1,2,3-trichlorobenzene	µg/L		0.1[#1]		-	-	-	<1	-	-	-
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.02	-	-	<0.02	-	-	<0.02
Pentachlorobenzene	µg/L		0.1[#1]	0.007[#8]	-	-	-	-	-	-	-
Halogenated Hydrocarbons											
Bromomethane	µg/L		7.5[#10]		-	-	-	<1	-	-	-
1,2-dibromoethane	µg/L		0.4[#3]		-	-	-	<1	-	-	-
Halogenated Phenols											
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	-	-	<0.05	-	-	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	-	-	<0.05	-	-	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	-	-	<0.05	-	-	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	-	-	<0.05	-	-	<0.05
Phthalates											
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	<0.05	-	-	<0.05	-	-	<0.05

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Location	BH06	BH11	BH13	BH14	BH16	BH17	BH18
Date	18/06/2019	05/07/2019	16/07/2019	07/07/2019	18/07/2019	11/07/2019	16/07/2019
Sample_Depth_Range	3.000-	2.500-	2.500-	1.500-	2.500-	1.500-	0.500-
Matrix_Description	Clay	Sand	Sand	Sand	Sand	Gravel	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh						
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	<0.05	-	-	<0.05	-	-	<0.05
Diethylphthalate	µg/L		15000[#10]	200[#12]	<0.05	-	-	<0.05	-	-	<0.05
Dimethyl phthalate	µg/L			800[#12]	<0.05	-	-	<0.05	-	-	<0.05
Solvents											
Isophorone	µg/L		78[#10]		<0.05	-	-	<0.05	-	-	<0.05
Metals											
Arsenic	µg/L	1.1	10[#1]	50[#7]	<1.1	2.1	5.5	6.3	2.4	<1.1	4.2
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	<10	<10	<10	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			3.6	4.6	2.1	2.8	1.3	3.3	2.7
Chromium (III+VI)	µg/L	0.4	50[#1]		0.6	0.5	0.4	<0.4	0.7	0.6	0.6
Copper	µg/L	0.7	2000[#1]	1[#7]	4.2	3	<0.7	<0.7	11	5	3.2
Iron	µg/L	4	200[#1]	1000[#7]	240	12	20	15	280	18	26
Lead	µg/L	1	10[#1]	1.2[#8]	<1	<1	2.1	<1	<1	<1	2.9
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	1.2	1	0.3	0.6	1.1	1.8	<0.3
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	0.6	1.1	1.9	1.9	12	<0.4	<0.4
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5	<5	<5
Organics											
Dissolved Organic Carbon	mg/L	0.1			0.32	6.16	3.43	6.34	12.9	<0.1	3.93
TOC	mg/L	0.1			0.32	6.48	4.91	6.35	20.6	1.8	7.77
Inorganics											
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	<0.015	<0.015	0.023	0.018	<0.015	<0.015	<0.015
Other											
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosalone	mg/L		0.0001[#1]		-	-	-	-	-	-	-
Triazophos	mg/L		0.0001[#1]	0.000005[#12]	-	-	-	-	-	-	-

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards
#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methacriphos	mg/L				-	-	-	-	-	<0.00003	<0.00003
Trietazine	mg/L		0.0001[#1]		-	-	-	-	-	<0.0005	<0.0005
Tribromomethane	µg/L				-	<1	-	-	-	-	<1
Freon 113	µg/L		10000[#10]		-	<1	-	-	-	-	<1
Chlorothalonil	µg/L		0.1[#1]	0.035[#7]	-	-	-	-	-	<0.03	<0.03
Tecnazene	mg/L		0.0001[#1]	0.001[#12]	-	-	-	-	-	<0.00003	<0.00003
Etrimphos	mg/L		0.0001[#1]		-	-	-	-	-	<0.00003	<0.00003
Propetamphos	mg/L		0.0001[#1]	0.00003[#12]	-	-	-	-	-	<0.00003	<0.00003
2,4-DB	µg/L				-	-	-	-	-	<0.02	<0.02
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Monuron	µg/L				-	-	-	-	-	<0.1	<0.1
Phosphamidon I	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Organic											
Terbutylazine	mg/L		0.007[#3]		-	-	-	-	-	<0.0005	<0.0005
Field											
pH	pH_Units				7.3	6.9	7.4	6.9	6.5	6.8	7.1
TPH											
>C5-C6 Aliphatics	µg/L		15000[#2]		-	<1	-	-	-	-	-
>C6-C8 Aliphatics	µg/L		15000[#2]		-	<1	-	-	-	-	-
>C8-C10 Aliphatics	µg/L		300[#2]		-	<1	-	-	-	-	-
>C10-C12 Aliphatics	µg/L		300[#2]		-	<10	-	-	-	-	-
>C12-C16 Aliphatics	µg/L		300[#2]		-	<10	-	-	-	-	-
>C16-C21 Aliphatics	µg/L		300[#2]		-	<10	-	-	-	-	-
>C21-C35 Aliphatics	µg/L		300[#2]		-	<10	-	-	-	-	-
>C35-C40 Aliphatics	µg/L				-	<10	-	-	-	-	-
>C5-C35 Aliphatics	µg/L				-	<10	-	-	-	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	-	<1	-	-	-	-	-
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	-	<1	-	-	-	-	-
>EC8-EC10 Aromatics	µg/L		300[#2]		-	<1	-	-	-	-	-
>EC10-EC12 Aromatics	µg/L		90[#2]		-	<10	-	-	-	-	-
>EC12-EC16 Aromatics	µg/L		90[#2]		-	<10	-	-	-	-	-
>EC16-EC21 Aromatics	µg/L		90[#2]		-	<10	-	-	-	-	-
>EC21-EC35 Aromatics	µg/L		90[#2]		-	<10	-	-	-	-	-
>EC35-EC40 Aromatics	µg/L				-	<10	-	-	-	-	-
>EC5-EC35 Aromatics	µg/L				-	<10	-	-	-	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				-	<10	-	-	-	-	-
BTEX											
Benzene	µg/L		1[#1]	10[#8]	-	<1	-	-	-	-	<1
Toluene	µg/L		700[#3]	74[#7]	-	<1	-	-	-	-	<1
Ethylbenzene	µg/L		300[#3]	20[#12]	-	<1	-	-	-	-	<1
Xylene (m & p)	µg/L				-	<1	-	-	-	-	<1
Xylene (o)	µg/L		190[#10]		-	<1	-	-	-	-	<1
Oxygenates											
MTBE	µg/L		1800[#15]	5100[#13]	-	<1	-	-	-	-	<1
Chlorinated Hydrocarbons											
Chloromethane	µg/L		190[#10]		-	<1	-	-	-	-	<1

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Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh						
Vinyl chloride	µg/L		0.5[#1]		-	<1	-	-	-	-	<1
Chloroethane	µg/L		21000[#10]		-	<1	-	-	-	-	<1
1,1-dichloroethene	µg/L		140[#3]		-	<1	-	-	-	-	<1
trans-1,2-dichloroethene	µg/L		50[#3]		-	<1	-	-	-	-	<1
1,1-dichloroethane	µg/L		2.8[#10]		-	<1	-	-	-	-	<1
cis-1,2-dichloroethene	µg/L		50[#3]		-	<1	-	-	-	-	<1
Chloroform	µg/L		100[#1]	2.5[#8]	-	<1	-	-	-	-	<1
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	-	<1	-	-	-	-	<1
Carbon tetrachloride	µg/L		3[#1]	12[#8]	-	<1	-	-	-	-	<1
Trichloroethene	µg/L			10[#8]	-	<1	-	-	-	-	<1
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	-	<1	-	-	-	-	<1
Tetrachloroethene	µg/L			10[#8]	-	<1	-	-	-	-	<1
VOC											
2,2-dichloropropane	µg/L				-	<1	-	-	-	-	<1
1,1-dichloropropene	µg/L				-	<1	-	-	-	-	<1
1,2-dichloroethane	µg/L		3[#1]	10[#8]	-	<1	-	-	-	-	<1
1,2-dichloropropane	µg/L		40[#3]		-	<1	-	-	-	-	<1
Dibromomethane	µg/L		8.3[#10]		-	<1	-	-	-	-	<1
Bromodichloromethane	µg/L		100[#1]		-	<1	-	-	-	-	<1
cis-1,3-dichloropropene	µg/L				-	<1	-	-	-	-	<1
trans-1,3-dichloropropene	µg/L				-	<1	-	-	-	-	<1
1,3-dichloropropane	µg/L		370[#10]		-	<1	-	-	-	-	<1
Chlorodibromomethane	µg/L		100[#1]		-	<1	-	-	-	-	<1
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		-	<1	-	-	-	-	<1
Styrene	µg/L		20[#3]	50[#12]	-	<1	-	-	-	-	<1
Isopropylbenzene	µg/L		450[#10]		-	<1	-	-	-	-	<1
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	-	<1	-	-	-	-	<1
n-propylbenzene	µg/L		660[#10]		-	<1	-	-	-	-	<1
1,3,5-trimethylbenzene	µg/L		60[#10]		-	<1	-	-	-	-	<1
tert-butylbenzene	µg/L		690[#10]		-	<1	-	-	-	-	<1
1,2,4-trimethylbenzene	µg/L		56[#10]		-	<1	-	-	-	-	<1
sec-butylbenzene	µg/L		2000[#10]		-	<1	-	-	-	-	<1
p-isopropyltoluene	µg/L				-	<1	-	-	-	-	<1
n-butylbenzene	µg/L		1000[#10]		-	<1	-	-	-	-	<1
1,2-dibromo-3-chloropropane	µg/L		1[#3]		-	<1	-	-	-	-	<1
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	-	<0.05	-	<0.05	-	<0.03	<0.03
PAH											
Naphthalene	µg/L	0.01	6[#15]	2[#8]	-	<0.01	<0.01	<0.01	-	-	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Acenaphthene	µg/L	0.01	18[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Fluorene	µg/L	0.01	12[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Phenanthrene	µg/L	0.01	4[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	-	<0.01	<0.01	<0.01	-	-	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	-	<0.01	<0.01	<0.01	-	-	<0.01
Pyrene	µg/L	0.01	9[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Chrysene	µg/L	0.01	7[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01

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Highways England

Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh						
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	-	<0.01	<0.01	<0.01	-	-	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		-	<0.01	<0.01	<0.01	-	-	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		-	<0.01	<0.01	<0.01	-	-	<0.01
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	-	<0.01	<0.01	<0.01	-	-	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	-	<0.01	<0.01	<0.01	-	-	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	-	<0.01	<0.01	<0.01	-	-	<0.01
PAH 16 Total	µg/L	0.2			-	-	<0.2	<0.2	-	-	-
SVOC											
2-methylnaphthalene	µg/L		36[#10]		-	<0.05	-	<0.05	-	-	<0.05
4-bromophenyl phenyl ether	µg/L				-	<0.05	-	<0.05	-	-	<0.05
4-chlorophenyl phenyl ether	µg/L				-	<0.05	-	<0.05	-	-	<0.05
Azobenzene	µg/L		0.12[#10]		-	<0.05	-	<0.05	-	-	<0.05
Bis(2-chloroethoxy) methane	µg/L		59[#10]		-	<0.05	-	<0.05	-	-	<0.05
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		-	<0.05	-	<0.05	-	-	<0.05
Carbazole	µg/L				-	<0.05	-	<0.05	-	-	<0.05
Dibenzofuran	µg/L		7.9[#10]		-	<0.05	-	<0.05	-	-	<0.05
Hexachloroethane	µg/L		0.33[#10]		-	<0.05	-	<0.05	-	-	<0.05
9,10-Anthracenedione	µg/L		1.4[#10]		-	<0.05	-	<0.05	-	-	<0.05
Phenolics											
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		-	<0.05	-	<0.05	-	-	<0.05
2-nitrophenol	µg/L				-	<0.05	-	<0.05	-	-	<0.05
2,4-dimethylphenol	µg/L		360[#10]		-	<0.05	-	<0.05	-	-	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	-	<0.05	-	<0.05	-	-	<0.05
4-methylphenol	µg/L		1900[#10]		-	<0.05	-	<0.05	-	-	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.5	<0.05	<0.5	<0.05	<0.5	<0.5	<0.05
2-chloronaphthalene	µg/L		750[#10]		-	<0.05	-	<0.05	-	-	<0.05
Phenols	µg/L				-	-	-	-	-	-	-
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Fungicides											
Triadimefon	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Herbicides											
Pendimethalin	µg/L		0.1[#1]	0.3[#7]	-	-	-	-	-	<0.03	<0.03
Trifluralin	µg/L		0.1[#1]	0.03[#8]	-	-	-	-	-	<0.03	<0.03
Bentazone	µg/L		500[#3]	500[#12]	-	-	-	-	-	<0.02	<0.02
Hedonal	µg/L		30[#3]	0.3[#7]	-	-	-	-	-	<0.02	<0.02
Dicamba	µg/L		570[#10]		-	-	-	-	-	<0.02	<0.02
2,4-Dichlorprop	µg/L		100[#3]		-	-	-	-	-	<0.02	<0.02
2,4,5-TP (Silvex)	µg/L		110[#10]		-	-	-	-	-	<0.02	<0.02
2-Methyl-4-chlorophenoxyacetic acid	µg/L		700[#3]	12[#12]	-	-	-	-	-	<0.02	<0.02
2-Methyl-4-Chlorophenoxy Butanoic Acid	µg/L		65[#10]		-	-	-	-	-	<0.02	<0.02
2,4,5-Trichlorophenoxy Acetic Acid	µg/L		9[#3]		-	-	-	-	-	<0.02	<0.02
Atrazine	µg/L		0.1[#1]	0.6[#8]	-	-	-	-	-	<0.5	<0.5
Simazine	µg/L		0.1[#1]	1[#8]	-	-	-	-	-	<0.5	<0.5

Soil Leachate Results for Natural Deposits
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Highways England

Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Chlorotoluron	µg/L		30[#3]	2[#12]	-	-	-	-	-	<0.1	<0.1
Cyanazine	µg/L		0.1[#1]		-	-	-	-	-	<0.5	<0.5
Dichlobenil	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Dinoseb	µg/L		15[#10]		-	-	-	-	-	<0.02	<0.02
Fluometuron	µg/L		240[#10]		-	-	-	-	-	<0.1	<0.1
Isoproturon	µg/L		9[#3]	0.3[#8]	-	-	-	-	-	<0.1	<0.1
Mecoprop	µg/L		10[#3]	18[#7]	-	-	-	-	-	<0.02	<0.02
Picloram	µg/L		1400[#10]		-	-	-	-	-	<0.02	<0.02
Prometryn	µg/L		0.1[#1]		-	-	-	-	-	<0.5	<0.5
Pronamide	µg/L		0.1[#1]	100[#12]	-	-	-	-	-	<0.03	<0.03
Propazine	µg/L		0.1[#1]		-	-	-	-	-	<0.5	<0.5
Tebuthiuron	µg/L		1400[#10]		-	-	-	-	-	<0.1	<0.1
Terbutryn	µg/L		0.1[#1]		-	-	-	-	-	<0.5	<0.5
Diuron	µg/L		36[#10]	0.2[#8]	-	-	-	-	-	<0.1	<0.1
Linuron	µg/L		130[#10]	0.5[#7]	-	-	-	-	-	<0.1	<0.1
Pesticides											
Isodrin	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Parathion	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Pirimiphos-methyl	µg/L		0.1[#1]	0.015[#12]	-	-	-	-	-	<0.03	<0.03
Diflubenzuron	µg/L		290[#10]	0.001[#12]	-	-	-	-	-	<0.1	<0.1
Pirimphos-ethyl	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Organochlorine Pesticides											
Aldrin	µg/L		0.03[#1]		-	-	-	-	-	<0.03	<0.03
a-BHC	µg/L		0.0072[#10]		-	-	-	-	-	<0.03	<0.03
b-BHC	µg/L		0.025[#10]		-	-	-	-	-	<0.03	<0.03
Chlordane (cis)	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Dieldrin	µg/L		0.03[#1]		-	-	-	-	-	<0.03	<0.03
Endosulfan I	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Endosulfan II	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Endosulfan sulphate	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Endrin	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
g-BHC (Lindane)	µg/L		2[#3]		-	-	-	-	-	<0.03	<0.03
Heptachlor	µg/L		0.03[#1]		-	-	-	-	-	<0.03	<0.03
Heptachlor epoxide	µg/L		0.03[#1]		-	-	-	-	-	<0.03	<0.03
o,p''-DDE	µg/L				-	-	-	-	-	<0.03	<0.03
2,4-DDT	µg/L				-	-	-	-	-	<0.03	<0.03
o,p-DDD	µg/L				-	-	-	-	-	<0.03	<0.03
4,4-DDE	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
DDT	µg/L		0.1[#1]	0.01[#8]	-	-	-	-	-	<0.03	<0.03
Methoxychlor	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
DDD	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Chlordane (trans)	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
d-BHC	µg/L				-	-	-	-	-	<0.03	<0.03
Endrin aldehyde	µg/L				-	-	-	-	-	<0.03	<0.03
Endrin ketone	µg/L				-	-	-	-	-	<0.03	<0.03
Organophosphorous Pesticides											
Azinphos Ethyl	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
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Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh							
Azinophos methyl	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	<0.03	<0.03
Carbophenothion	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Chlorfenvinphos	µg/L		0.1[#1]	0.1[#8]	-	-	-	-	-	<0.03	<0.03
Chlorpyrifos	µg/L		0.1[#1]	0.03[#8]	-	-	-	-	-	<0.03	<0.03
Diazinon	µg/L		0.1[#1]	0.01[#7]	-	-	-	-	-	<0.03	<0.03
Dichlorvos	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Dimethoate	µg/L		0.1[#1]	0.48[#7]	-	-	-	-	-	<0.03	<0.03
Ethion	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Fenitrothion	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	<0.03	<0.03
Fenthion	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Malathion	µg/L		0.1[#1]	0.01[#12]	-	-	-	-	-	0.04	<0.03
Methyl parathion	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Mevinphos (Phosdrin)	µg/L		0.1[#1]	0.02[#11]	-	-	-	-	-	<0.03	<0.03
Demeton-O	µg/L				-	-	-	-	-	<0.03	<0.03
Demeton-S	µg/L				-	-	-	-	-	<0.03	<0.03
Phorate	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Anilines											
4-chloroaniline	µg/L		0.37[#10]		-	<0.05	-	<0.05	-	-	<0.05
4-nitroaniline	µg/L		3.8[#10]		-	<0.05	-	<0.05	-	-	<0.05
Explosives											
2,4-Dinitrotoluene	µg/L		0.24[#10]		-	<0.05	-	<0.05	-	-	<0.05
2,6-dinitrotoluene	µg/L		0.049[#10]		-	<0.05	-	<0.05	-	-	<0.05
Nitrobenzene	µg/L		63[#3]		-	<0.05	-	<0.05	-	-	<0.05
Halogenated Benzenes											
1,2,4,5-tetrachlorobenzene	µg/L		1.7[#10]		-	-	-	-	-	<0.03	<0.03
1,3,5-Trichlorobenzene	µg/L		0.1[#1]		-	-	-	-	-	<0.03	<0.03
Chlorobenzene	µg/L		300[#3]		-	<1	-	-	-	-	<1
Bromobenzene	µg/L		62[#10]		-	<1	-	-	-	-	<1
2-chlorotoluene	µg/L		240[#10]		-	<1	-	-	-	-	<1
4-chlorotoluene	µg/L		250[#10]		-	<1	-	-	-	-	<1
1,3-dichlorobenzene	µg/L				-	<0.05	-	<0.05	-	-	<0.05
1,4-dichlorobenzene	µg/L		300[#3]		-	<0.05	-	<0.05	-	-	<0.05
1,2-dichlorobenzene	µg/L		1000[#3]		-	<0.05	-	<0.05	-	-	<0.05
1,2,4-trichlorobenzene	µg/L		0.1[#1]		-	<0.05	-	<0.05	-	-	<0.05
1,2,3-trichlorobenzene	µg/L		0.1[#1]		-	<1	-	-	-	<0.03	<0.03
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	-	<0.02	-	<0.02	-	<0.03	<0.02
Pentachlorobenzene	µg/L		0.1[#1]	0.007[#8]	-	-	-	-	-	<0.03	<0.03
Halogenated Hydrocarbons											
Bromomethane	µg/L		7.5[#10]		-	<1	-	-	-	-	<1
1,2-dibromoethane	µg/L		0.4[#3]		-	<1	-	-	-	-	<1
Halogenated Phenols											
2-chlorophenol	µg/L		91[#10]	50[#12]	-	<0.05	-	<0.05	-	-	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	-	<0.05	-	<0.05	-	-	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		-	<0.05	-	<0.05	-	-	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		-	<0.05	-	<0.05	-	-	<0.05
Phthalates											
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	-	<0.05	-	<0.05	-	-	<0.05

Soil Leachate Results for Natural Deposits
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Location	BH21	BH24	BH25	TP09	TP11	TP13	TP14
Date	23/07/2019	11/07/2019	02/07/2019	05/07/2019	11/07/2019	09/07/2019	10/07/2019
Sample_Depth_Range	1.500-	4.500-	2.500-	1.000-	0.200-	0.500-	0.500-
Matrix_Description	Sand	Sand	Clay	Sand	Gravel	Sand	Sand

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh						
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	-	<0.05	-	<0.05	-	-	<0.05
Diethylphthalate	µg/L		15000[#10]	200[#12]	-	<0.05	-	<0.05	-	-	<0.05
Dimethyl phthalate	µg/L			800[#12]	-	<0.05	-	<0.05	-	-	<0.05
Solvents											
Isophorone	µg/L		78[#10]		-	<0.05	-	<0.05	-	-	<0.05
Metals											
Arsenic	µg/L	1.1	10[#1]	50[#7]	<1.1	<1.1	3.5	<1.1	180	<1.1	5.4
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	<10	<10	<10	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	0.1	<0.08	<0.08
Calcium	mg/L	0.012			2.7	2.6	0.51	1.1	0.42	1.8	0.79
Chromium (III+VI)	µg/L	0.4	50[#1]		<0.4	1	3.4	0.5	1.8	3.4	2.3
Copper	µg/L	0.7	2000[#1]	1[#7]	2.9	5.6	2.2	11	21	20	8.8
Iron	µg/L	4	200[#1]	1000[#7]	16	34	62	10	1,900	1,900	1,400
Lead	µg/L	1	10[#1]	1.2[#8]	2.8	<1	1.4	<1	5.3	2.3	1.5
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	1.6	0.3	0.8	0.8	1.4	1.4	1.3
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	0.4	1.2	2.5	6.8	11	15	8.1
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5	<5	<5
Organics											
Dissolved Organic Carbon	mg/L	0.1			7.78	<0.1	2.39	6.28	5.5	6.01	<0.1
TOC	mg/L	0.1			8.34	0.55	4.04	6.51	5.17	6.66	1.07
Inorganics											
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	<0.015	0.019	<0.015	0.053	0.023	0.025	<0.015
Other											
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Phosalone	mg/L		0.0001[#1]		-	-	-	-	-	<0.00003	<0.00003
Triazophos	mg/L		0.0001[#1]	0.000005[#12]	-	-	-	-	-	<0.00003	<0.00003

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards
#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Natural Deposits
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M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Methacriphos	mg/L				<0.00003	-	-	-	-
Trietazine	mg/L		0.0001[#1]		<0.0005	-	-	-	-
Tribromomethane	µg/L				-	-	-	-	-
Freon 113	µg/L		10000[#10]		-	-	-	-	-
Chlorothalonil	µg/L		0.1[#1]	0.035[#7]	<0.03	-	-	-	-
Tecnazene	mg/L		0.0001[#1]	0.001[#12]	<0.00003	-	-	-	-
Etrimphos	mg/L		0.0001[#1]		<0.00003	-	-	-	-
Propetamphos	mg/L		0.0001[#1]	0.00003[#12]	<0.00003	-	-	-	-
2,4-DB	µg/L				<0.02	-	-	-	-
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Monuron	µg/L				<0.1	-	-	-	-
Phosphamidon I	µg/L		0.1[#1]		<0.03	-	-	-	-
Organic									
Terbutylazine	mg/L		0.007[#3]		<0.0005	-	-	-	-
Field									
pH	pH_Units				7	6.6	7.2	7.4	7.1
TPH									
>C5-C6 Aliphatics	µg/L		15000[#2]		-	-	<1	-	-
>C6-C8 Aliphatics	µg/L		15000[#2]		-	-	<1	-	-
>C8-C10 Aliphatics	µg/L		300[#2]		-	-	<1	-	-
>C10-C12 Aliphatics	µg/L		300[#2]		-	-	<10	-	-
>C12-C16 Aliphatics	µg/L		300[#2]		-	-	<10	-	-
>C16-C21 Aliphatics	µg/L		300[#2]		-	-	<10	-	-
>C21-C35 Aliphatics	µg/L		300[#2]		-	-	<10	-	-
>C35-C40 Aliphatics	µg/L				-	-	<10	-	-
>C5-C35 Aliphatics	µg/L				-	-	<10	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	-	-	<1	-	-
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	-	-	<1	-	-
>EC8-EC10 Aromatics	µg/L		300[#2]		-	-	<1	-	-
>EC10-EC12 Aromatics	µg/L		90[#2]		-	-	<10	-	-
>EC12-EC16 Aromatics	µg/L		90[#2]		-	-	<10	-	-
>EC16-EC21 Aromatics	µg/L		90[#2]		-	-	<10	-	-
>EC21-EC35 Aromatics	µg/L		90[#2]		-	-	<10	-	-
>EC35-EC40 Aromatics	µg/L				-	-	<10	-	-
>EC5-EC35 Aromatics	µg/L				-	-	<10	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				-	-	<10	-	-
BTEX									
Benzene	µg/L		1[#1]	10[#8]	-	-	<1	-	-
Toluene	µg/L		700[#3]	74[#7]	-	-	<1	-	-
Ethylbenzene	µg/L		300[#3]	20[#12]	-	-	<1	-	-
Xylene (m & p)	µg/L				-	-	<1	-	-
Xylene (o)	µg/L		190[#10]		-	-	<1	-	-
Oxygenates									
MTBE	µg/L		1800[#15]	5100[#13]	-	-	<10	-	-
Chlorinated Hydrocarbons									
Chloromethane	µg/L		190[#10]		-	-	-	-	-

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Vinyl chloride	µg/L		0.5[#1]		-	-	-	-	-
Chloroethane	µg/L		21000[#10]		-	-	-	-	-
1,1-dichloroethene	µg/L		140[#3]		-	-	-	-	-
trans-1,2-dichloroethene	µg/L		50[#3]		-	-	-	-	-
1,1-dichloroethane	µg/L		2.8[#10]		-	-	-	-	-
cis-1,2-dichloroethene	µg/L		50[#3]		-	-	-	-	-
Chloroform	µg/L		100[#1]	2.5[#8]	-	-	-	-	-
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	-	-	-	-	-
Carbon tetrachloride	µg/L		3[#1]	12[#8]	-	-	-	-	-
Trichloroethene	µg/L			10[#8]	-	-	-	-	-
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	-	-	-	-	-
Tetrachloroethene	µg/L			10[#8]	-	-	-	-	-
VOC									
2,2-dichloropropane	µg/L				-	-	-	-	-
1,1-dichloropropene	µg/L				-	-	-	-	-
1,2-dichloroethane	µg/L		3[#1]	10[#8]	-	-	-	-	-
1,2-dichloropropane	µg/L		40[#3]		-	-	-	-	-
Dibromomethane	µg/L		8.3[#10]		-	-	-	-	-
Bromodichloromethane	µg/L		100[#1]		-	-	-	-	-
cis-1,3-dichloropropene	µg/L				-	-	-	-	-
trans-1,3-dichloropropene	µg/L				-	-	-	-	-
1,3-dichloropropane	µg/L		370[#10]		-	-	-	-	-
Chlorodibromomethane	µg/L		100[#1]		-	-	-	-	-
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		-	-	-	-	-
Styrene	µg/L		20[#3]	50[#12]	-	-	-	-	-
Isopropylbenzene	µg/L		450[#10]		-	-	-	-	-
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	-	-	-	-	-
n-propylbenzene	µg/L		660[#10]		-	-	-	-	-
1,3,5-trimethylbenzene	µg/L		60[#10]		-	-	-	-	-
tert-butylbenzene	µg/L		690[#10]		-	-	-	-	-
1,2,4-trimethylbenzene	µg/L		56[#10]		-	-	-	-	-
sec-butylbenzene	µg/L		2000[#10]		-	-	-	-	-
p-isopropyltoluene	µg/L				-	-	-	-	-
n-butylbenzene	µg/L		1000[#10]		-	-	-	-	-
1,2-dibromo-3-chloropropane	µg/L		1[#3]		-	-	-	-	-
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.03	-	-	-	-
PAH									
Naphthalene	µg/L	0.01	6[#15]	2[#8]	-	-	-	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		-	-	-	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		-	-	-	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		-	-	-	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		-	-	-	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	-	-	-	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	-	-	-	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		-	-	-	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		-	-	-	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		-	-	-	<0.01	<0.01

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	-	-	-	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		-	-	-	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		-	-	-	<0.01	<0.01
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	-	-	-	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	-	-	-	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	-	-	-	<0.01	<0.01
PAH 16 Total	µg/L	0.2			-	-	-	<0.2	<0.2
SVOC									
2-methylnaphthalene	µg/L		36[#10]		-	-	-	-	-
4-bromophenyl phenyl ether	µg/L				-	-	-	-	-
4-chlorophenyl phenyl ether	µg/L				-	-	-	-	-
Azobenzene	µg/L		0.12[#10]		-	-	-	-	-
Bis(2-chloroethoxy) methane	µg/L		59[#10]		-	-	-	-	-
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		-	-	-	-	-
Carbazole	µg/L				-	-	-	-	-
Dibenzofuran	µg/L		7.9[#10]		-	-	-	-	-
Hexachloroethane	µg/L		0.33[#10]		-	-	-	-	-
9,10-Anthracenedione	µg/L		1.4[#10]		-	-	-	-	-
Phenolics									
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		-	<0.05	-	-	-
2-nitrophenol	µg/L				-	<0.05	-	-	-
2,4-dimethylphenol	µg/L		360[#10]		-	<0.05	-	-	-
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	-	<0.05	-	-	-
4-methylphenol	µg/L		1900[#10]		-	<0.05	-	-	-
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.5	<0.05	<0.5	<0.5	<0.5
2-chloronaphthalene	µg/L		750[#10]		-	-	-	-	-
Phenols	µg/L				-	<0.5	-	-	-
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Fungicides									
Triadimefon	µg/L		0.1[#1]		<0.03	-	-	-	-
Herbicides									
Pendimethalin	µg/L		0.1[#1]	0.3[#7]	<0.03	-	-	-	-
Trifluralin	µg/L		0.1[#1]	0.03[#8]	<0.03	-	-	-	-
Bentazone	µg/L		500[#3]	500[#12]	<0.02	-	-	-	-
Hedonal	µg/L		30[#3]	0.3[#7]	<0.02	-	-	-	-
Dicamba	µg/L		570[#10]		<0.02	-	-	-	-
2,4-Dichlorprop	µg/L		100[#3]		<0.02	-	-	-	-
2,4,5-TP (Silvex)	µg/L		110[#10]		<0.02	-	-	-	-
2-Methyl-4-chlorophenoxyacetic acid	µg/L		700[#3]	12[#12]	<0.02	-	-	-	-
2-Methyl-4-Chlorophenoxy Butanoic Acid	µg/L		65[#10]		<0.02	-	-	-	-
2,4,5-Trichlorophenoxy Acetic Acid	µg/L		9[#3]		<0.02	-	-	-	-
Atrazine	µg/L		0.1[#1]	0.6[#8]	<0.5	-	-	-	-
Simazine	µg/L		0.1[#1]	1[#8]	<0.5	-	-	-	-

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Chlorotoluron	µg/L		30[#3]	2[#12]	<0.1	-	-	-	-
Cyanazine	µg/L		0.1[#1]		<0.5	-	-	-	-
Dichlobenil	µg/L		0.1[#1]		<0.03	-	-	-	-
Dinoseb	µg/L		15[#10]		<0.02	-	-	-	-
Fluometuron	µg/L		240[#10]		<0.1	-	-	-	-
Isoproturon	µg/L		9[#3]	0.3[#8]	<0.1	-	-	-	-
Mecoprop	µg/L		10[#3]	18[#7]	<0.02	-	-	-	-
Picloram	µg/L		1400[#10]		<0.02	-	-	-	-
Prometryn	µg/L		0.1[#1]		<0.5	-	-	-	-
Pronamide	µg/L		0.1[#1]	100[#12]	<0.03	-	-	-	-
Propazine	µg/L		0.1[#1]		<0.5	-	-	-	-
Tebuthiuron	µg/L		1400[#10]		<0.1	-	-	-	-
Terbutryn	µg/L		0.1[#1]		<0.5	-	-	-	-
Diuron	µg/L		36[#10]	0.2[#8]	<0.1	-	-	-	-
Linuron	µg/L		130[#10]	0.5[#7]	<0.1	-	-	-	-
Pesticides									
Isodrin	µg/L		0.1[#1]		<0.03	-	-	-	-
Parathion	µg/L		0.1[#1]		<0.03	-	-	-	-
Pirimiphos-methyl	µg/L		0.1[#1]	0.015[#12]	<0.03	-	-	-	-
Diflubenzuron	µg/L		290[#10]	0.001[#12]	<0.1	-	-	-	-
Pirimphos-ethyl	µg/L		0.1[#1]		<0.03	-	-	-	-
Organochlorine Pesticides									
Aldrin	µg/L		0.03[#1]		<0.03	-	-	-	-
a-BHC	µg/L		0.0072[#10]		<0.03	-	-	-	-
b-BHC	µg/L		0.025[#10]		<0.03	-	-	-	-
Chlordane (cis)	µg/L		0.1[#1]		<0.03	-	-	-	-
Dieldrin	µg/L		0.03[#1]		<0.03	-	-	-	-
Endosulfan I	µg/L		0.1[#1]		<0.03	-	-	-	-
Endosulfan II	µg/L		0.1[#1]		<0.03	-	-	-	-
Endosulfan sulphate	µg/L		0.1[#1]		<0.03	-	-	-	-
Endrin	µg/L		0.1[#1]		<0.03	-	-	-	-
g-BHC (Lindane)	µg/L		2[#3]		<0.03	-	-	-	-
Heptachlor	µg/L		0.03[#1]		<0.03	-	-	-	-
Heptachlor epoxide	µg/L		0.03[#1]		<0.03	-	-	-	-
o,p''-DDE	µg/L				<0.03	-	-	-	-
2,4-DDT	µg/L				<0.03	-	-	-	-
o,p-DDD	µg/L				<0.03	-	-	-	-
4,4-DDE	µg/L		0.1[#1]		<0.03	-	-	-	-
DDT	µg/L		0.1[#1]	0.01[#8]	<0.03	-	-	-	-
Methoxychlor	µg/L		0.1[#1]		<0.03	-	-	-	-
DDD	µg/L		0.1[#1]		<0.03	-	-	-	-
Chlordane (trans)	µg/L		0.1[#1]		<0.03	-	-	-	-
d-BHC	µg/L				<0.03	-	-	-	-
Endrin aldehyde	µg/L				<0.03	-	-	-	-
Endrin ketone	µg/L				<0.03	-	-	-	-
Organophosphorous Pesticides									
Azinphos Ethyl	µg/L		0.1[#1]		<0.03	-	-	-	-

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Azinophos methyl	µg/L		0.1[#1]	0.01[#12]	<0.03	-	-	-	-
Carbophenothion	µg/L		0.1[#1]		<0.03	-	-	-	-
Chlorfenvinphos	µg/L		0.1[#1]	0.1[#8]	<0.03	-	-	-	-
Chlorpyrifos	µg/L		0.1[#1]	0.03[#8]	<0.03	-	-	-	-
Diazinon	µg/L		0.1[#1]	0.01[#7]	<0.03	-	-	-	-
Dichlorvos	µg/L		0.1[#1]		<0.03	-	-	-	-
Dimethoate	µg/L		0.1[#1]	0.48[#7]	<0.03	-	-	-	-
Ethion	µg/L		0.1[#1]		<0.03	-	-	-	-
Fenitrothion	µg/L		0.1[#1]	0.01[#12]	<0.03	-	-	-	-
Fenthion	µg/L		0.1[#1]		<0.03	-	-	-	-
Malathion	µg/L		0.1[#1]	0.01[#12]	0.04	-	-	-	-
Methyl parathion	µg/L		0.1[#1]		<0.03	-	-	-	-
Mevinphos (Phosdrin)	µg/L		0.1[#1]	0.02[#11]	<0.03	-	-	-	-
Demeton-O	µg/L				<0.03	-	-	-	-
Demeton-S	µg/L				<0.03	-	-	-	-
Phorate	µg/L		0.1[#1]		<0.03	-	-	-	-
Anilines									
4-chloroaniline	µg/L		0.37[#10]		-	-	-	-	-
4-nitroaniline	µg/L		3.8[#10]		-	-	-	-	-
Explosives									
2,4-Dinitrotoluene	µg/L		0.24[#10]		-	-	-	-	-
2,6-dinitrotoluene	µg/L		0.049[#10]		-	-	-	-	-
Nitrobenzene	µg/L		63[#3]		-	-	-	-	-
Halogenated Benzenes									
1,2,4,5-tetrachlorobenzene	µg/L		1.7[#10]		<0.03	-	-	-	-
1,3,5-Trichlorobenzene	µg/L		0.1[#1]		<0.03	-	-	-	-
Chlorobenzene	µg/L		300[#3]		-	-	-	-	-
Bromobenzene	µg/L		62[#10]		-	-	-	-	-
2-chlorotoluene	µg/L		240[#10]		-	-	-	-	-
4-chlorotoluene	µg/L		250[#10]		-	-	-	-	-
1,3-dichlorobenzene	µg/L				-	-	-	-	-
1,4-dichlorobenzene	µg/L		300[#3]		-	-	-	-	-
1,2-dichlorobenzene	µg/L		1000[#3]		-	-	-	-	-
1,2,4-trichlorobenzene	µg/L		0.1[#1]		-	-	-	-	-
1,2,3-trichlorobenzene	µg/L		0.1[#1]		<0.03	-	-	-	-
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.03	-	-	-	-
Pentachlorobenzene	µg/L		0.1[#1]	0.007[#8]	<0.03	-	-	-	-
Halogenated Hydrocarbons									
Bromomethane	µg/L		7.5[#10]		-	-	-	-	-
1,2-dibromoethane	µg/L		0.4[#3]		-	-	-	-	-
Halogenated Phenols									
2-chlorophenol	µg/L		91[#10]	50[#12]	-	<0.05	-	-	-
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	-	<0.05	-	-	-
2,4,5-trichlorophenol	µg/L		1200[#10]		-	<0.05	-	-	-
2,4,6-trichlorophenol	µg/L		200[#3]		-	<0.05	-	-	-
Phthalates									
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	-	-	-	-	-

Soil Leachate Results for Natural Deposits
Analytical Results
M54-M6 Link Road
Highways England

Location	TP15	TP16	TP17	TP18	TP19
Date	09/07/2019	10/07/2019	10/07/2019	11/07/2019	10/07/2019
Sample_Depth_Range	0.500-	2.000-	0.500-	0.500-	0.500-
Matrix_Description	Sand	Sand	Sand	Sand	Gravel

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh					
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	-	-	-	-	-
Diethylphthalate	µg/L		15000[#10]	200[#12]	-	-	-	-	-
Dimethyl phthalate	µg/L			800[#12]	-	-	-	-	-
Solvents									
Isophorone	µg/L		78[#10]		-	-	-	-	-
Metals									
Arsenic	µg/L	1.1	10[#1]	50[#7]	2.4	<1.1	5.7	<1.1	<1.1
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	<10	<10
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			0.18	0.92	1.8	1	1.7
Chromium (III+VI)	µg/L	0.4	50[#1]		<0.4	2.9	5	3.8	2.8
Copper	µg/L	0.7	2000[#1]	1[#7]	<0.7	8.7	5	22	18
Iron	µg/L	4	200[#1]	1000[#7]	55	1,800	2,100	2,100	1,800
Lead	µg/L	1	10[#1]	1.2[#8]	1.8	2.1	1.5	4.1	1.7
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	0.6	1.4	2.2	2.4	1.8
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	2.2	6.1	7.6	12	8.7
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5	<5
Organics									
Dissolved Organic Carbon	mg/L	0.1			6.67	2.54	3.22	6.09	5.7
TOC	mg/L	0.1			7.31	4.77	3.47	6.38	6.6
Inorganics									
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.032	0.021	<0.015	0.024	<0.015
Other									
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5	<0.5
Phosalone	mg/L		0.0001[#1]		<0.00003	-	-	-	-
Triazophos	mg/L		0.0001[#1]	0.000005[#12]	<0.00003	-	-	-	-

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards
#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Isopropyl phenol	mg/L	0.0005			<0.0005	<0.0005	<0.0005	<0.0005
Methacriphos	mg/L				-	-	-	<0.00003
Trietazine	mg/L		0.0001[#1]		-	-	-	<0.0005
Tribromomethane	µg/L				-	-	-	<1
Freon 113	µg/L		10000[#10]		-	-	-	<1
Chlorothalonil	µg/L		0.1[#1]	0.035[#7]	-	-	-	<0.03
Tecnazene	mg/L		0.0001[#1]	0.001[#12]	-	-	-	<0.00003
Etrimphos	mg/L		0.0001[#1]		-	-	-	<0.00003
Propetamphos	mg/L		0.0001[#1]	0.00003[#12]	-	-	-	<0.00003
2,4-DB	µg/L				-	-	-	<0.02
Ethylphenol & Dimethylphenol	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
Monuron	µg/L				-	-	-	<0.1
Phosphamidon I	µg/L		0.1[#1]		-	-	-	<0.03
Organic								
Terbutylazine	mg/L		0.007[#3]		-	-	-	<0.0005
Field								
pH	pH_Units				8.1	7.5	6.7	7.4
TPH								
>C5-C6 Aliphatics	µg/L		15000[#2]		<1	<1	-	<1
>C6-C8 Aliphatics	µg/L		15000[#2]		<1	<1	-	<1
>C8-C10 Aliphatics	µg/L		300[#2]		<1	<1	-	<1
>C10-C12 Aliphatics	µg/L		300[#2]		<10	<10	-	<10
>C12-C16 Aliphatics	µg/L		300[#2]		<10	<10	-	<10
>C16-C21 Aliphatics	µg/L		300[#2]		<10	<10	-	<10
>C21-C35 Aliphatics	µg/L		300[#2]		<10	<10	-	<10
>C35-C40 Aliphatics	µg/L				<10	<10	-	<10
>C5-C35 Aliphatics	µg/L				<10	<10	-	-
>EC5-EC7 Aromatics	µg/L		1[#1]	10[#8]	<1	<1	-	<1
>EC7-EC8 Aromatics	µg/L		700[#2]	74[#7]	<1	<1	-	<1
>EC8-EC10 Aromatics	µg/L		300[#2]		<1	<1	-	<1
>EC10-EC12 Aromatics	µg/L		90[#2]		<10	<10	-	<10
>EC12-EC16 Aromatics	µg/L		90[#2]		<10	<10	-	<10
>EC16-EC21 Aromatics	µg/L		90[#2]		<10	<10	-	<10
>EC21-EC35 Aromatics	µg/L		90[#2]		<10	<10	-	<10
>EC35-EC40 Aromatics	µg/L				<10	<10	-	<10
>EC5-EC35 Aromatics	µg/L				<10	<10	-	-
>C5-C40 Aliphatics & Aromatics	µg/L				<10	<10	-	<10
BTEX								
Benzene	µg/L		1[#1]	10[#8]	<1	<1	-	<1
Toluene	µg/L		700[#3]	74[#7]	<1	<1	-	<1
Ethylbenzene	µg/L		300[#3]	20[#12]	<1	<1	-	<1
Xylene (m & p)	µg/L				<1	<1	-	<1
Xylene (o)	µg/L		190[#10]		<1	<1	-	<1
Oxygenates								
MTBE	µg/L		1800[#15]	5100[#13]	<10	<10	-	<1
Chlorinated Hydrocarbons								
Chloromethane	µg/L		190[#10]		-	-	-	<1

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Vinyl chloride	µg/L		0.5[#1]		-	-	-	<1
Chloroethane	µg/L		21000[#10]		-	-	-	<1
1,1-dichloroethene	µg/L		140[#3]		-	-	-	<1
trans-1,2-dichloroethene	µg/L		50[#3]		-	-	-	<1
1,1-dichloroethane	µg/L		2.8[#10]		-	-	-	<1
cis-1,2-dichloroethene	µg/L		50[#3]		-	-	-	<1
Chloroform	µg/L		100[#1]	2.5[#8]	-	-	-	<1
1,1,1-trichloroethane	µg/L		2000[#3]	100[#12]	-	-	-	<1
Carbon tetrachloride	µg/L		3[#1]	12[#8]	-	-	-	<1
Trichloroethene	µg/L			10[#8]	-	-	-	<1
1,1,2-trichloroethane	µg/L		0.28[#10]	400[#12]	-	-	-	<1
Tetrachloroethene	µg/L			10[#8]	-	-	-	<1
VOC								
2,2-dichloropropane	µg/L				-	-	-	<1
1,1-dichloropropene	µg/L				-	-	-	<1
1,2-dichloroethane	µg/L		3[#1]	10[#8]	-	-	-	<1
1,2-dichloropropane	µg/L		40[#3]		-	-	-	<1
Dibromomethane	µg/L		8.3[#10]		-	-	-	<1
Bromodichloromethane	µg/L		100[#1]		-	-	-	<1
cis-1,3-dichloropropene	µg/L				-	-	-	<1
trans-1,3-dichloropropene	µg/L				-	-	-	<1
1,3-dichloropropane	µg/L		370[#10]		-	-	-	<1
Chlorodibromomethane	µg/L		100[#1]		-	-	-	<1
1,1,1,2-tetrachloroethane	µg/L		0.57[#10]		-	-	-	<1
Styrene	µg/L		20[#3]	50[#12]	-	-	-	<1
Isopropylbenzene	µg/L		450[#10]		-	-	-	<1
1,1,2,2-tetrachloroethane	µg/L		0.076[#10]	140[#7]	-	-	-	<1
n-propylbenzene	µg/L		660[#10]		-	-	-	<1
1,3,5-trimethylbenzene	µg/L		60[#10]		-	-	-	<1
tert-butylbenzene	µg/L		690[#10]		-	-	-	<1
1,2,4-trimethylbenzene	µg/L		56[#10]		-	-	-	<1
sec-butylbenzene	µg/L		2000[#10]		-	-	-	<1
p-isopropyltoluene	µg/L				-	-	-	<1
n-butylbenzene	µg/L		1000[#10]		-	-	-	<1
1,2-dibromo-3-chloropropane	µg/L		1[#3]		-	-	-	<1
Hexachlorobutadiene	µg/L		0.1[#1]	0.6[#6]	<0.05	-	-	<0.05 - 0.19
PAH								
Naphthalene	µg/L	0.01	6[#15]	2[#8]	<0.01	<0.01	<0.01	<0.01
Acenaphthylene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01
Acenaphthene	µg/L	0.01	18[#15]		<0.01	<0.01	<0.01	<0.01
Fluorene	µg/L	0.01	12[#15]		<0.01	<0.01	<0.01	<0.01
Phenanthrene	µg/L	0.01	4[#15]		<0.01	<0.01	<0.01	<0.01
Anthracene	µg/L	0.01	90[#15]	0.1[#8]	<0.01	<0.01	<0.01	<0.01
Fluoranthene	µg/L	0.01	4[#3]	0.0063[#8]	<0.01	<0.01	<0.01	<0.01
Pyrene	µg/L	0.01	9[#15]		<0.01	<0.01	<0.01	<0.01
Benz(a)anthracene	µg/L	0.01	3.5[#15]		<0.01	<0.01	<0.01	<0.01
Chrysene	µg/L	0.01	7[#15]		<0.01	<0.01	<0.01	<0.01

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Benzo(a) pyrene	µg/L	0.01	0.01[#1]	0.00017[#8]	<0.01	<0.01	<0.01	<0.01
Indeno(1,2,3-c,d)pyrene	µg/L	0.01	0.1[#1]		<0.01	<0.01	<0.01	<0.01
Dibenz(a,h)anthracene	µg/L	0.01	0.07[#15]		<0.01	<0.01	<0.01	<0.01
Benzo(g,h,i)perylene	µg/L	0.01	0.1[#1]	0.0082[#6]	<0.01	<0.01	<0.01	<0.01
Benzo(b)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01
Benzo(k)fluoranthene	µg/L	0.01	0.1[#1]	0.017[#6]	<0.01	<0.01	<0.01	<0.01
PAH 16 Total	µg/L	0.2			-	<0.2	<0.2	<0.2
SVOC								
2-methylnaphthalene	µg/L		36[#10]		<0.05	-	-	<0.05
4-bromophenyl phenyl ether	µg/L				<0.05	-	-	<0.05
4-chlorophenyl phenyl ether	µg/L				<0.05	-	-	<0.05
Azobenzene	µg/L		0.12[#10]		<0.05	-	-	<0.05
Bis(2-chloroethoxy) methane	µg/L		59[#10]		<0.05	-	-	<0.05
Bis(2-chloroethyl)ether	µg/L		0.014[#10]		<0.05	-	-	<0.05
Carbazole	µg/L				<0.05	-	-	<0.05
Dibenzofuran	µg/L		7.9[#10]		<0.05	-	-	<0.05
Hexachloroethane	µg/L		0.33[#10]		<0.05	-	-	<0.05
9,10-Anthracenedione	µg/L		1.4[#10]		<0.05	-	-	<0.05
Phenolics								
Trimethylphenols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
2-methylphenol	µg/L		930[#10]		<0.05	<0.05	-	<0.05
2-nitrophenol	µg/L				<0.05	<0.05	-	<0.05
2,4-dimethylphenol	µg/L		360[#10]		<0.05	<0.05	-	<0.05
4-chloro-3-methylphenol	µg/L		1400[#10]	40[#12]	<0.05	<0.05	-	<0.05
4-methylphenol	µg/L		1900[#10]		<0.05	<0.05	-	<0.05
Phenol	µg/L	0.5	5800[#10]	7.7[#7]	<0.05	<0.05	<0.5	<0.05
2-chloronaphthalene	µg/L		750[#10]		<0.05	-	-	<0.05
Phenols	µg/L				-	<0.5	-	<0.5
Cresols by HPLC (W)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
Phenols Total of 5 Speciated by HPLC (W)	µg/L	3.5			<3.5	<3.5	<3.5	<3.5
resorcinol (m-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
catechol (o-dihydroxybenzene)	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
Fungicides								
Triadimefon	µg/L		0.1[#1]		-	-	-	<0.03
Herbicides								
Pendimethalin	µg/L		0.1[#1]	0.3[#7]	-	-	-	<0.03
Trifluralin	µg/L		0.1[#1]	0.03[#8]	-	-	-	<0.03
Bentazone	µg/L		500[#3]	500[#12]	-	-	-	<0.02
Hedonal	µg/L		30[#3]	0.3[#7]	-	-	-	<0.02
Dicamba	µg/L		570[#10]		-	-	-	<0.02
2,4-Dichlorprop	µg/L		100[#3]		-	-	-	<0.02
2,4,5-TP (Silvex)	µg/L		110[#10]		-	-	-	<0.02
2-Methyl-4-chlorophenoxyacetic acid	µg/L		700[#3]	12[#12]	-	-	-	<0.02
2-Methyl-4-Chlorophenoxy Butanoic Acid	µg/L		65[#10]		-	-	-	<0.02
2,4,5-Trichlorophenoxy Acetic Acid	µg/L		9[#3]		-	-	-	<0.02
Atrazine	µg/L		0.1[#1]	0.6[#8]	-	-	-	<0.5
Simazine	µg/L		0.1[#1]	1[#8]	-	-	-	<0.5

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Chlorotoluron	µg/L		30[#3]	2[#12]	-	-	-	<0.1
Cyanazine	µg/L		0.1[#1]		-	-	-	<0.5
Dichlobenil	µg/L		0.1[#1]		-	-	-	<0.03
Dinoseb	µg/L		15[#10]		-	-	-	<0.02
Fluometuron	µg/L		240[#10]		-	-	-	<0.1
Isoproturon	µg/L		9[#3]	0.3[#8]	-	-	-	<0.1
Mecoprop	µg/L		10[#3]	18[#7]	-	-	-	<0.02
Picloram	µg/L		1400[#10]		-	-	-	<0.02
Prometryn	µg/L		0.1[#1]		-	-	-	<0.5
Pronamide	µg/L		0.1[#1]	100[#12]	-	-	-	<0.03
Propazine	µg/L		0.1[#1]		-	-	-	<0.5
Tebuthiuron	µg/L		1400[#10]		-	-	-	<0.1
Terbutryn	µg/L		0.1[#1]		-	-	-	<0.5
Diuron	µg/L		36[#10]	0.2[#8]	-	-	-	<0.1
Linuron	µg/L		130[#10]	0.5[#7]	-	-	-	<0.1
Pesticides								
Isodrin	µg/L		0.1[#1]		-	-	-	<0.03
Parathion	µg/L		0.1[#1]		-	-	-	<0.03
Pirimiphos-methyl	µg/L		0.1[#1]	0.015[#12]	-	-	-	<0.03
Diflubenzuron	µg/L		290[#10]	0.001[#12]	-	-	-	<0.1
Pirimphos-ethyl	µg/L		0.1[#1]		-	-	-	<0.03
Organochlorine Pesticides								
Aldrin	µg/L		0.03[#1]		-	-	-	<0.03
a-BHC	µg/L		0.0072[#10]		-	-	-	<0.03
b-BHC	µg/L		0.025[#10]		-	-	-	<0.03
Chlordane (cis)	µg/L		0.1[#1]		-	-	-	<0.03
Dieldrin	µg/L		0.03[#1]		-	-	-	<0.03
Endosulfan I	µg/L		0.1[#1]		-	-	-	<0.03
Endosulfan II	µg/L		0.1[#1]		-	-	-	<0.03
Endosulfan sulphate	µg/L		0.1[#1]		-	-	-	<0.03
Endrin	µg/L		0.1[#1]		-	-	-	<0.03
g-BHC (Lindane)	µg/L		2[#3]		-	-	-	<0.03
Heptachlor	µg/L		0.03[#1]		-	-	-	<0.03
Heptachlor epoxide	µg/L		0.03[#1]		-	-	-	<0.03
o,p''-DDE	µg/L				-	-	-	<0.03
2,4-DDT	µg/L				-	-	-	<0.03
o,p-DDD	µg/L				-	-	-	<0.03
4,4-DDE	µg/L		0.1[#1]		-	-	-	<0.03
DDT	µg/L		0.1[#1]	0.01[#8]	-	-	-	<0.03
Methoxychlor	µg/L		0.1[#1]		-	-	-	<0.03
DDD	µg/L		0.1[#1]		-	-	-	<0.03
Chlordane (trans)	µg/L		0.1[#1]		-	-	-	<0.03
d-BHC	µg/L				-	-	-	<0.03
Endrin aldehyde	µg/L				-	-	-	<0.03
Endrin ketone	µg/L				-	-	-	<0.03
Organophosphorous Pesticides								
Azinphos Ethyl	µg/L		0.1[#1]		-	-	-	<0.03

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Azinophos methyl	µg/L		0.1[#1]	0.01[#12]	-	-	-	<0.03
Carbophenothion	µg/L		0.1[#1]		-	-	-	<0.03
Chlorfenvinphos	µg/L		0.1[#1]	0.1[#8]	-	-	-	<0.03
Chlorpyrifos	µg/L		0.1[#1]	0.03[#8]	-	-	-	<0.03
Diazinon	µg/L		0.1[#1]	0.01[#7]	-	-	-	<0.03
Dichlorvos	µg/L		0.1[#1]		-	-	-	<0.03
Dimethoate	µg/L		0.1[#1]	0.48[#7]	-	-	-	<0.03
Ethion	µg/L		0.1[#1]		-	-	-	<0.03
Fenitrothion	µg/L		0.1[#1]	0.01[#12]	-	-	-	<0.03
Fenthion	µg/L		0.1[#1]		-	-	-	<0.03
Malathion	µg/L		0.1[#1]	0.01[#12]	-	-	-	<0.03
Methyl parathion	µg/L		0.1[#1]		-	-	-	<0.03
Mevinphos (Phosdrin)	µg/L		0.1[#1]	0.02[#11]	-	-	-	<0.03
Demeton-O	µg/L				-	-	-	<0.03
Demeton-S	µg/L				-	-	-	<0.03
Phorate	µg/L		0.1[#1]		-	-	-	<0.03
Anilines								
4-chloroaniline	µg/L		0.37[#10]		<0.05	-	-	<0.05
4-nitroaniline	µg/L		3.8[#10]		<0.05	-	-	<0.05
Explosives								
2,4-Dinitrotoluene	µg/L		0.24[#10]		<0.05	-	-	<0.05
2,6-dinitrotoluene	µg/L		0.049[#10]		<0.05	-	-	<0.05
Nitrobenzene	µg/L		63[#3]		<0.05	-	-	<0.05
Halogenated Benzenes								
1,2,4,5-tetrachlorobenzene	µg/L		1.7[#10]		-	-	-	<0.03
1,3,5-Trichlorobenzene	µg/L		0.1[#1]		-	-	-	<0.03
Chlorobenzene	µg/L		300[#3]		-	-	-	<1
Bromobenzene	µg/L		62[#10]		-	-	-	<1
2-chlorotoluene	µg/L		240[#10]		-	-	-	<1
4-chlorotoluene	µg/L		250[#10]		-	-	-	<1
1,3-dichlorobenzene	µg/L				<0.05	-	-	<0.05
1,4-dichlorobenzene	µg/L		300[#3]		<0.05	-	-	<0.05
1,2-dichlorobenzene	µg/L		1000[#3]		<0.05	-	-	<0.05
1,2,4-trichlorobenzene	µg/L		0.1[#1]		<0.05	-	-	<0.05
1,2,3-trichlorobenzene	µg/L		0.1[#1]		-	-	-	<1 - 0.07
Hexachlorobenzene	µg/L		0.1[#1]	0.05[#6]	<0.02	-	-	<0.02
Pentachlorobenzene	µg/L		0.1[#1]	0.007[#8]	-	-	-	<0.03
Halogenated Hydrocarbons								
Bromomethane	µg/L		7.5[#10]		-	-	-	<1
1,2-dibromoethane	µg/L		0.4[#3]		-	-	-	<1
Halogenated Phenols								
2-chlorophenol	µg/L		91[#10]	50[#12]	<0.05	<0.05	-	<0.05
2,4-dichlorophenol	µg/L		46[#10]	4.2[#7]	<0.05	<0.05	-	<0.05
2,4,5-trichlorophenol	µg/L		1200[#10]		<0.05	<0.05	-	<0.05
2,4,6-trichlorophenol	µg/L		200[#3]		<0.05	<0.05	-	<0.05
Phthalates								
Butyl benzyl phthalate	µg/L		16[#10]	7.5[#7]	<0.05	-	-	<0.05

Soil Leachate Results for Topsoil
Analytical Results
M54-M6 Link Road
Highways England

Location	BH05	BH07	BH20	BH22A
Date	01/07/2019	26/06/2019	17/07/2019	23/07/2019
Sample_Depth_Range	0.300-	0.100-	0.500-	0.500-
Matrix_Description	Topsoil	Topsoil	Topsoil	Topsoil

Parameter	Units	Method Detection Limit	GAC_WTV_EN/WA_DWS	GAC_WTV_EN/WA_EQS-Fresh				
Di-n-butyl phthalate	µg/L		900[#10]	8[#12]	<0.05	-	-	<0.05
Diethylphthalate	µg/L		15000[#10]	200[#12]	<0.05	-	-	<0.05
Dimethyl phthalate	µg/L			800[#12]	<0.05	-	-	<0.05
Solvents								
Isophorone	µg/L		78[#10]		<0.05	-	-	<0.05
Metals								
Arsenic	µg/L	1.1	10[#1]	50[#7]	<1.1	9.7	5	<1.1
Boron	µg/L	10	1000[#1]	2000[#12]	<10	<10	<10	31
Cadmium	µg/L	0.08	5[#1]	0.08[#8]	<0.08	<0.08	<0.08	<0.08
Calcium	mg/L	0.012			7.5	6.4	1.1	7.6
Chromium (III+VI)	µg/L	0.4	50[#1]		<0.4	1.8	<0.4	10
Copper	µg/L	0.7	2000[#1]	1[#7]	1.8	5.9	9	22
Iron	µg/L	4	200[#1]	1000[#7]	13	440	130	7,000
Lead	µg/L	1	10[#1]	1.2[#8]	<1	3.6	<1	8.6
Mercury	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
Nickel	µg/L	0.3	20[#1]	4[#8]	<0.3	3.4	1.4	6.1
Selenium	µg/L	4	10[#1]		<4	<4	<4	<4
Zinc	µg/L	0.4	6000[#10]	10.9[#7]	4.2	5.4	7.6	29
Chromium (hexavalent)	µg/L	5	50[#1]	3.4[#7]	<5	<5	<5	<5
Organics								
Dissolved Organic Carbon	mg/L	0.1			4.22	5.83	5.65	16
TOC	mg/L	0.1			4.71	5.89	5.79	17.6
Inorganics								
Cyanide (Free)	mg/L	0.01	0.05[#1]	0.001[#12]	<0.01	<0.01	<0.01	<0.01
Cyanide Total	mg/L	0.01	0.05[#1]	0.001[#7]	<0.01	<0.01	<0.01	<0.01
Ammoniacal Nitrogen as N	mg/L	0.015		0.3[#7]	0.053	<0.015	0.018	<0.015
Other								
Napthols	µg/L	0.5			<0.5	<0.5	<0.5	<0.5
Phosalone	mg/L		0.0001[#1]		-	-	-	<0.00003
Triazophos	mg/L		0.0001[#1]	0.000005[#12]	-	-	-	<0.00003

Comments
#1 WS Regs 2016 (Eng/Wal)
#2 WHO Petroleum DWG 2008
#3 WHO DWG 2017
#4 WHO 2017 - Taste
#5 WHO 2017 - Odour
#6 WFD England/Wales. 2015 - MAC-EQS Inland
#7 WFD England/Wales. 2015 - Freshwater Standards
#8 WFD England/Wales. 2015 - AA-EQS Inland
#9 Water Env't Regs (Scotland) 2015. AA-EQS Inland
#10 USEPA RSL (tapwater) [May 2019]
#11 SEPA WAT-SG-53 Fresh EQS - MAC - 2015
#12 SEPA WAT-SG-53 Fresh EQS - AA - 2015
#13 PNEC (EU REACH) - Freshwater
#14 California Draft health protective concentration
#15 AECOM DWG (WHO method)

Appendix D. RTM

Simulation Details

Project Number	60536736
Project Title	M54/M6 Link Road
Date	03-Dec-19

Simulation Details	Simulation detailing the contaminant concentration affecting point A9 PWS - potential drinking water abstraction (unknown)

LEVEL 3 (GROUNDWATER) ASSESSMENT - INPUTS & JUSTIFICATION

Project Number	60536736
Project Title	M54/M6 Link Road
Date	03-Dec-19

Simulation Details	Simulation detailing the contaminant concentration affecting point A9 PWS - potential drinking water abstraction (unknown)

Parameter	Units	Input Value(s)	Source / Justification
Infiltration	mm/year	14.4	Met Office - Based on unsurfaced ground wiith annual average rainfall of 57.5mm/year
Saturated aquifer thickness	m	30.0	Assumed thickness of bedrock aquifer
Plume thickness at source	m	25.0	Assumed thickness of plume
Width of plume in aquifer at source	m	550.0 | 800.0	Width at BH03 and width at BH26 (Areas of maximum concentration)
Bulk density of aquifer materials	g/cm^3	2.17	Average Value from geotechnical laboratory analysis over weathered bedrock and bedrock
Effective porosity of aquifer	fraction	0.1	Value for Sandstone from Domenico & Schwartz, 1990
Hydraulic gradient	fraction	0.012	Gradients taken from GW monitoring levels between BH18 and BH27
Hydraulic conductivity of aquifer	m/s	5.52E-06	Average value from geotechnical laboratory analysis
Hydraulic conductivity of aquifer	m/d	4.77E-01	Calculated in m/d
Fraction of Organic Carbon	fraction	0.616	Taken from chemical screening data
Distance to compliance point	m	1373	BH26 to Abstraction poin: A9 PWS - potential drinking water abstraction (unknown)
Longitudinal dispersivity	m	137.3	10% of pathway length
Transverse dispersivity	m	13.73	1% of pathway length

CONTAMINANT SPECIFIC INPUTS

Project Number	60536736
Project Title	M54/M6 Link Road
Date	03-Dec-19

Simulation Details	

Determinand	Henry's Law Constant	Source	Organic C - water partition coefficient (Koc)	Source	Soil-Water Partition Coefficient (Kd)	Source	Background Concentration in Groundwater	Source	Half-Life of Contaminant in Groundwater	Source	Initial contaminant concentration in groundwater	Source
	dimensionless		l/kg		l/kg		mg/l		days		mg/l	
>C12-C16 Aliphatics (DWS)	171	09, Trremperature co	5370317.964	LQM/CIEH 2009, Trremperature corrected to 10oC			0.15	Half of DWS	1.0E+03	**URS**: The rationale for	5.11	Chemical Sreening data
>EC16-EC21 Aliphatics (DWS)	4900	09, Trremperature co	14125.37545	LQM/CIEH 2009, Trremperature corrected to 10oC			0.15	Half of DWS	3.0E+03	**URS**: The rationale for	0.108	Chemical Sreening data
>EC21-EC35 Aliphatics (DWS)	20000	2001, USEPA, Sup	7590000000.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.15	Half of DWS	1.0E+04	**URS**: The rationale for	0.367	Chemical Sreening data
>EC16-EC21 Aromatics (DWS)	0.000695	09, Trremperature co	14125.4	LQM/CIEH 2009, Trremperature corrected to 10oC			0.15	Half of DWS	3.0E+03	**URS**: The rationale for	0.424	Chemical Sreening data
>EC21-EC35 Aromatics (DWS)	0.0000248	09, Trremperature co	125892.5	LQM/CIEH 2009, Trremperature corrected to 10oC			0.045	Half of DWS	1.0E+04	**URS**: The rationale for	1.09	Chemical Sreening data
>C8-C10 Aliphatics (DWS)	41.5	09, Trremperature co	30199.5	LQM/CIEH 2009, Trremperature corrected to 10oC			0.15	Half of DWS	5.0E+02	**URS**: The rationale for	0.412	Chemical Sreening data
Ethylbenzene (DWS)	0.139	Science Report – S	447.0	Science Report – SC050021/SR7			0.15	Half of DWS	5.0E+02	**EA**: The rationale for t	0.034	Chemical Sreening data
Xylene Total (DWS)	0.10367	Science Report – S	453.6	Science Report – SC050021/SR7			0.25	Half of DWS	5.0E+02	**EA**: The rationale for t	0.091	Chemical Sreening data
Naphthalene (DWS)	0.00662	Science Report – S	645.7	LQM/CIEH 2009, Trremperature corrected to 10oC			0.003	Half of DWS	1.0E+03	**EA**: The rationale for t	0.0093	Chemical Sreening data
Phenanthrene (DWS)	0.000143	09, Trremperature co	5495.4	LQM/CIEH 2009, Trremperature corrected to 10oC			0.002	Half of DWS	2.5E+03	**URS**: The rationale for	0.00838	Chemical Sreening data
Fluoranthene (DWS)	0.0000629	e Report – SC0500	18200.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.002	Half of DWS	5.0E+03	**URS/PAHs**: The ratio	0.01100	Chemical Sreening data
Pyrene (DWS)	0.0000564	e Report – SC0500	16200.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.0045	Half of DWS	7.5E+03	**URS/PAHs**: The ratio	0.00962	Chemical Sreening data
Benz(a)anthracene (DWS)	0.0000316	e Report – SC0500	77600	LQM/CIEH 2009, Trremperature corrected to 10oC			0.00175	Half of DWS	1.0E+04	**URS/PAHs**: The ratio	0.00654	Chemical Sreening data
Benzo(a) pyrene (DWS)	0.00000176	Science Report – S	129000.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.000005	Half of DWS	1.0E+04	**(3) URS/PAHs**: The ra	0.0159	Chemical Sreening data
Indeno(1,2,3-c,d)pyrene (DWS)	0.00000205	Science Report – S	87100.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.00005	Half of DWS	1.0E+04	**(3) URS/PAHs**: The ra	0.0128	Chemical Sreening data
Dibenz(a,h)anthracene (DWS)	0.0000054	Science Report – S	186208.7	LQM/CIEH 2009, Trremperature corrected to 10oC			0.000035	Half of DWS	10000	**(3) URS/PAHs**: The ra	0.00	Chemical Sreening data
Benzo(g,h,i)perylene (DWS)	0.00000286	LQM/CIEH 2009, T	417000.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.00005	Half of DWS	10000	**(3) URS/PAHs**: The ra	0.004	Chemical Sreening data
Benzo(b)fluoranthene (DWS)	0.00000205	Science Report – S	105000.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.00005	Half of DWS	1.0E+04	**(3) URS/PAHs**: The ra	0.02450	Chemical Sreening data
Benzo(k)fluoranthene (DWS)	0.00000174	Science Report – S	148000.0	LQM/CIEH 2009, Trremperature corrected to 10oC			0.00005	Half of DWS	1.0E+04	**(3) URS/PAHs**: The ra	0.00774	Chemical Sreening data
Bis(2-ethylhexyl) phthalate (DWS)	0.0000533	h calc, compensate	87420.0	www.toxnet.nlm.nih.gov			0.004	Half of DWS	1.0E+04	**URS/A&H**: The ration	0.12700	Chemical Sreening data
Arsenic					1800.0	CLEA UK	0.005	Half of DWS	1.0E+09	**URS CWRA DATABA**	0.03390	Chemical Sreening data
Chromium VI					4800.0	CLEA UK	0.025	Half of DWS	1.0E+09	**URS CWRA DATABA**	0.41500	Chemical Sreening data
Chromium III					4800.0	CLEA UK	0.025	Half of DWS	1.0E+09	**URS CWRA DATABA**	0.41500	Chemical Sreening data
Nickel					2000.0	CLEA UK	0.01	Half of DWS	1.0E+09	**URS CWRA DATABA**	0.02320	Chemical Sreening data

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**Arsenic**			
Target Concentration (C_T)	**0.01**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Environment Agency

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Arsenic		from Level 1
Target Concentration	C_T	1.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_o	3.39E-02	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+09	days	*See justification table*
Calculated decay rate	λ	6.93E-10	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	1.80E+03	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	3.91E+04	fraction
Decay rate used	λ	6.93E-10	d^{-1}
Rate of contaminant flow due to retardation	u	1.47E-05	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	8.47E-03	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**4.00E+00**	

Remedial Targets

Remedial Target		**4.00E-02**	**mg/l**
Ogata Banks			
Distance to compliance point		**1373**	**m**
Concentration of contaminant at compliance point	C_{ED}/C_0	**8.47E-03**	**mg/l**
after		**1.0E+100**	**days**

For comparison with measured groundwater concentration.

Ogata Banks

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	1.80E+03	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	1.80E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

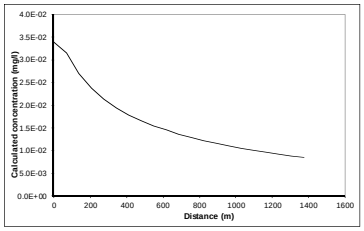
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.4E-02
68.7	3.15E-02
137.3	2.70E-02
206.0	2.37E-02
274.6	2.13E-02
343.3	1.94E-02
411.9	1.79E-02
480.6	1.66E-02
549.2	1.55E-02
617.9	1.45E-02
686.5	1.36E-02
755.2	1.29E-02
823.8	1.22E-02
892.5	1.16E-02
961.1	1.10E-02
1029.8	1.05E-02
1098.4	1.00E-02
1167.1	9.59E-03
1235.7	9.19E-03
1304.4	8.82E-03
1373.0	8.47E-03

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Benz(a)anthracene			
Target Concentration (C_T)	0.0035	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Benz(a)anthracene		from Level 1
Target Concentration	C_T	3.50E-03	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	6.54E-03	mg/l	See justification table
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	See justification table
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	See justification table
Plume thickness at source	Sy	2.50E+01	m	See justification table
Saturated aquifer thickness	da	3.00E+01	m	See justification table
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	See justification table
Effective porosity of aquifer	n	1.00E-01	fraction	See justification table
Hydraulic gradient	i	1.20E-02	fraction	See justification table
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	See justification table
Distance to compliance point	x	1.37E+03	m	See justification table
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	See justification table
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	See justification table
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.78E+04	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.04E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	5.52E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	7.76E+04	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.78E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

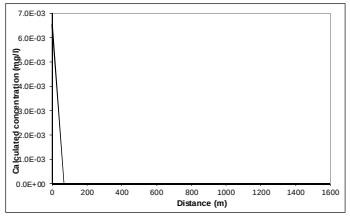
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		**No impact**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	6.5E-03
68.7	2.36E-31
137.3	7.89E-60
206.0	2.70E-88
274.6	9.42E-117
343.3	3.34E-145
411.9	1.20E-173
480.6	4.32E-202
549.2	1.57E-230
617.9	5.72E-259
686.5	2.09E-287
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

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The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Benzo(a)pyrene			
Target Concentration (C_T)	0.00001	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
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It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Benzo(a)pyrene		from Level 1
Target Concentration	C_T	1.00E-05	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.59E-02	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.95E+04	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.72E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	3.32E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Remedial Targets

Remedial Target		**No impact**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

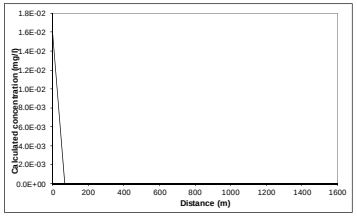
Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	1.29E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	7.95E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.
By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	02/12/2019
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.6E-02
68.7	3.22E-39
137.3	6.02E-76
206.0	1.15E-112
274.6	2.26E-149
343.3	4.49E-186
411.9	9.00E-223
480.6	1.82E-259
549.2	3.71E-296
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment

Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Benzo(b)fluoranthene			
Target Concentration (C_T)	0.00001	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Benzo(b)fluoranthene		from Level 1
Target Concentration	C_T	1.00E-05	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	2.45E-02	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	6.47E+04	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.40E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	4.08E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	1.05E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	6.47E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

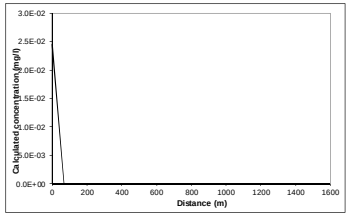
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	**2.5E-02**
68.7	**1.96E-35**
137.3	**1.45E-68**
206.0	**1.09E-101**
274.6	**8.46E-135**
343.3	**6.63E-168**
411.9	**5.26E-201**
480.6	**4.20E-234**
549.2	**3.37E-267**
617.9	**2.72E-300**
686.5	**0.00E+00**
755.2	**0.00E+00**
823.8	**0.00E+00**
892.5	**0.00E+00**
961.1	**0.00E+00**
1029.8	**0.00E+00**
1098.4	**0.00E+00**
1167.1	**0.00E+00**
1235.7	**0.00E+00**
1304.4	**0.00E+00**
1373.0	**0.00E+00**

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Benzo(g,h,i)perylene			
Target Concentration (C_T)	0.0001	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Benzo(g,h,i)perylene		from Level 1
Target Concentration	C_T	1.00E-04	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable			Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.04E-03	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.57E+05	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	5.57E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	1.03E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	4.17E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	2.57E+05	l/kg

Define dispersivity (click brown cell and use pull down list)

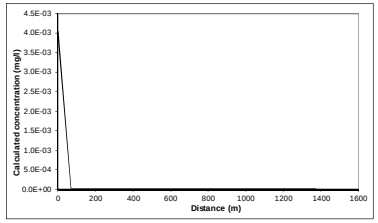
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.0E-03
68.7	3.73E-69
137.3	3.18E-135
206.0	2.78E-201
274.6	2.48E-267
343.3	0.00E+00
411.9	0.00E+00
480.6	0.00E+00
549.2	0.00E+00
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Bis(2-ethylhexyl) phthalate			
Target Concentration (C_T)	0.008	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Bis(2-ethylhexyl) phthalate		from Level 1
Target Concentration	C_T	8.00E-03	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.27E-01	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	5.39E+04	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.17E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	4.90E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	8.74E+04	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
Acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	5.39E+04	l/kg

Define dispersivity (click brown cell and use pull down list)

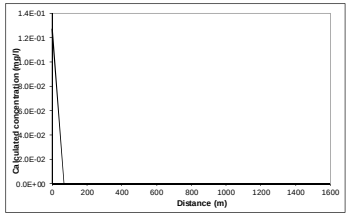
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.3E-01
68.7	8.14E-32
137.3	4.83E-62
206.0	2.93E-92
274.6	1.82E-122
343.3	1.14E-152
411.9	7.27E-183
480.6	4.66E-213
549.2	3.00E-243
617.9	1.94E-273
686.5	1.26E-303
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Remedial Targets

Remedial Target		**No impact**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions)

Details to be completed for each assessment				
Site Name:	M54 M6 Link Road			
Site Address:				
Completed by:	Gabriella Barnes			
Date:	02-Dec-19		Version:	1
Contaminant	Chromium III			
Target Concentration (C_T)	0.05	mg/l	Origin of C_T:	DWS

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Chromium III		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.15E-01	mg/l	See justification table
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+09	days	See justification table
Calculated decay rate	λ	6.93E-10	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	See justification table
Plume thickness at source	Sy	2.50E+01	m	See justification table
Saturated aquifer thickness	da	3.00E+01	m	See justification table
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	See justification table
Effective porosity of aquifer	n	1.00E-01	fraction	See justification table
Hydraulic gradient	i	1.20E-02	fraction	See justification table
Hydraulic conductivity of aquifer	K	5.20E-06	m/d	See justification table
Distance to compliance point	x	1.37E+03	m	See justification table
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	See justification table
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	See justification table
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.80E+03	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.24E-07	m/d
Retardation factor	Rf	1.04E+05	fraction
Decay rate used	λ	6.93E-10	d^{-1}
Rate of contaminant flow due to retardation	u	5.99E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{EB}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	4.80E+03	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	1.00E+00	fraction
Organic carbon partition coefficient	Koc	1.00E+00	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$	1.00E+00	l/kg
Sorption coefficient for ionised species	$K_{oc,i}$	1.00E+00	l/kg
pH value	pH	1.00E+00	
acid dissociation constant	pKa	1.00E+00	
Fraction of organic carbon in aquifer	foc	1.00E+00	fraction
Soil water partition coefficient	Kd	4.80E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	ax	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	az	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	ay	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

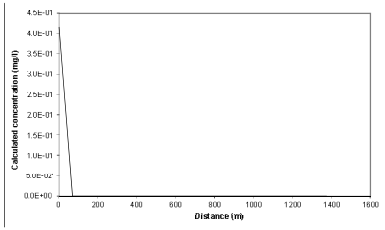
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{wk})^{2.414}$, az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	02/12/2019
Version	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.2E-01
68.7	2.12E-28
137.3	9.99E-56
206.0	4.82E-83
274.6	2.38E-110
343.3	1.19E-137
411.9	6.03E-165
480.6	3.07E-192
549.2	1.57E-219
617.9	8.11E-247
686.5	4.19E-274
755.2	2.18E-301
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**Chromium VI**			
Target Concentration (C_T)	**0.05**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		Chromium VI		from Level 1
Target Concentration	C_T	5.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.15E-01	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+09	days	*See justification table*
Calculated decay rate	λ	6.93E-10	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	5.20E-06	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.80E+03	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	6.24E-07	m/d
Retardation factor	Rf	1.04E+05	fraction
Decay rate used	λ	6.93E-10	d^{-1}
Rate of contaminant flow due to retardation	u	5.99E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

User specified value for partition coefficient

Entry if specify partition coefficient (option)

Soil water partition coefficient	Kd	4.80E+03	l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer	foc		fraction
Organic carbon partition coefficient	Koc		l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.80E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

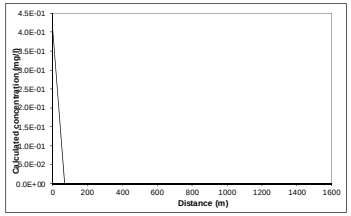
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.2E-01
68.7	2.12E-28
137.3	9.99E-56
206.0	4.82E-83
274.6	2.38E-110
343.3	1.19E-137
411.9	6.03E-165
480.6	3.07E-192
549.2	1.57E-219
617.9	8.11E-247
686.5	4.19E-274
755.2	2.18E-301
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**Dibenz(a,h)anthracene**			
Target Concentration (C_T)	**0.00007**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		Dibenz(a,h)anthracene		from Level 1
Target Concentration	C_T	7.00E-05	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.88E-03	mg/l	See justification table
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	See justification table
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	5.50E+02	m	See justification table
Plume thickness at source	Sy	2.50E+01	m	See justification table
Saturated aquifer thickness	da	3.00E+01	m	See justification table
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	See justification table
Effective porosity of aquifer	n	1.00E-01	fraction	See justification table
Hydraulic gradient	i	1.20E-02	fraction	See justification table
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	See justification table
Distance to compliance point	x	1.37E+03	m	See justification table
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	See justification table
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	See justification table
Time since pollutant entered groundwater	t	1.00E+100	days	time variant options only
Parameters values determined from options				
Partition coefficient	Kd	1.15E+05	l/kg	see options
Longitudinal dispersivity	ax	1.37E+02	m	see options
Transverse dispersivity	az	1.37E+01	m	see options
Vertical dispersivity	ay	1.37E+00	m	see options

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	0.00E+00	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	1.86E+05	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{OC,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{OC,i}$	0.00E+00	l/kg
pH value	pH	0.00E+00	
acid dissociation constant	pKa	0.00E+00	
Fraction of organic carbon in aquifer	foc	0.00E+00	fraction
Soil water partition coefficient	Kd	1.15E+05	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	1.37E+02	1.31E+01 m
Transverse dispersivity	az	0.00E+00	1.37E+01	1.31E+00 m
Vertical dispersivity	ay	0.00E+00	1.37E+00	1.31E-01

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$, az = ax/10, ay = ax/100 are assumed

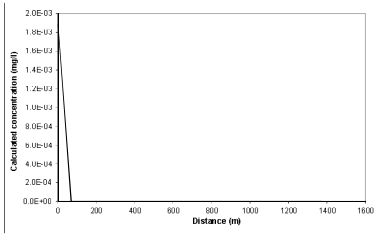
Calculated Parameters | Variable

Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	2.49E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	2.30E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.9E-03
68.7	1.49E-47
137.3	1.09E-91
206.0	8.17E-136
274.6	6.26E-180
343.3	4.87E-224
411.9	3.82E-268
480.6	0.00E+00
549.2	0.00E+00
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**>C12-C16 Aliphatics**			
Target Concentration (C_T)	**0.3**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		>C12-C16 Aliphatics		from Level 1
Target Concentration	C_T	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	5.11E+00	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+03	days	*See justification table*
Calculated decay rate	λ	6.93E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	3.75E+03	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	3.31E+06	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	7.18E+07	fraction
Decay rate used	λ	6.93E-04	d^{-1}
Rate of contaminant flow due to retardation	u	7.97E-09	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.16E-01 — fraction

Organic carbon partition coefficient — Koc — 5.37E+06 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 3.31E+06 — l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	1.37E+02	1.31E+01 m
Transverse dispersivity	az	0.00E+00	1.37E+01	1.31E+00 m
Vertical dispersivity	ay	0.00E+00	1.37E+00	1.31E-01

Note values of dispersivity must be > 0

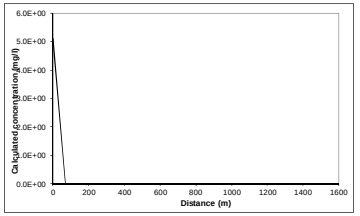
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		**No impact**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	02/12/2019
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	5.1E+00
68.7	0.00E+00
137.3	0.00E+00
206.0	0.00E+00
274.6	0.00E+00
343.3	0.00E+00
411.9	0.00E+00
480.6	0.00E+00
549.2	0.00E+00
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**>EC16-EC21 Aliphatics**			
Target Concentration (C_T)	**0.3**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		>EC16-EC21 Aliphatics		from Level 1
Target Concentration	C_t	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived value)

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.08E-01	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	3.00E+03	days	*See justification table*
Calculated decay rate	λ	2.31E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	2.00E+03	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	8.70E+03	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters | Variable

Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.89E+05	fraction
Decay rate used	λ	2.31E-04	d^{-1}
Rate of contaminant flow due to retardation	u	3.03E-06	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	0.00E+00	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	1.41E+04	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{OC,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{OC,i}$	0.00E+00	l/kg
pH value	pH	0.00E+00	
acid dissociation constant	pKa	0.00E+00	
Fraction of organic carbon in aquifer	foc	0.00E+00	fraction
Soil water partition coefficient	Kd	8.70E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value	Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	az	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	ay	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

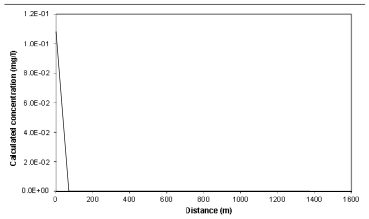
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report $ax = 0.83(\log_{10}x)^{2.414}$, az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best described by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	02/12/2019
Version:	F

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.1E-01
68.7	7.86E-24
137.3	5.29E-46
206.0	3.64E-68
274.6	2.57E-90
343.3	1.84E-112
411.9	1.33E-134
480.6	9.78E-157
549.2	7.21E-179
617.9	5.35E-201
686.5	3.99E-223
755.2	2.99E-245
823.8	2.24E-267
892.5	1.69E-289
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**>C16-C21 Aromatics**			
Target Concentration (C_T)	**0.3**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		>C16-C21 Aromatics		from Level 1
Target Concentration	C_T	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	4.24E-01	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	3.00E+03	days	*See justification table*
Calculated decay rate	λ	2.31E-04	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	8.00E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	8.70E+03	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

Variable		
Groundwater flow velocity	v	5.72E-01 m/d
Retardation factor	Rf	1.89E+05 fraction
Decay rate used	λ	2.31E-04 d^{-1}
Rate of contaminant flow due to retardation	u	3.03E-06 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00 mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

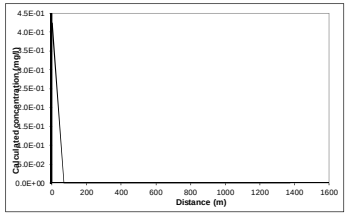
Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	1.41E+04	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	8.70E+03	l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.
By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	4.2E-01
68.7	3.09E-23
137.3	2.08E-45
206.0	1.43E-67
274.6	1.01E-89
343.3	7.25E-112
411.9	5.26E-134
480.6	3.85E-156
549.2	2.84E-178
617.9	2.11E-200
686.5	1.57E-222
755.2	1.18E-244
823.8	8.81E-267
892.5	6.63E-289
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**>EC21-EC35 Aliphatics**			
Target Concentration (C_T)	**0.3**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		>EC21-EC35 Aliphatics		from Level 1
Target Concentration	C_T	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.67E-01	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	8.00E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	4.68E+09	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.01E+11	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	5.64E-12	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd		l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.16E-01	fraction
Organic carbon partition coefficient	Koc	7.59E+09	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{oc,n}$		l/kg
Sorption coefficient for ionised species	$K_{oc,i}$		l/kg
pH value	pH		
acid dissociation constant	pKa		
Fraction of organic carbon in aquifer	foc		fraction
Soil water partition coefficient	Kd	4.68E+09	l/kg

Define dispersivity (click brown cell and use pull down list)

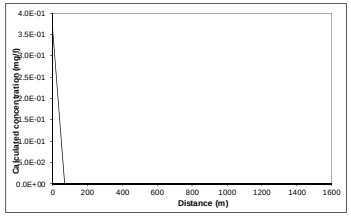
Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein		
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01	m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00	m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01	

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.7E-01
68.7	0.00E+00
137.3	0.00E+00
206.0	0.00E+00
274.6	0.00E+00
343.3	0.00E+00
411.9	0.00E+00
480.6	0.00E+00
549.2	0.00E+00
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Remedial Targets

Remedial Target		No impact	mg/l	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**>EC21-EC35 Aromatics**			
Target Concentration (C_T)	**0.09**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu)

	Variable	Value	Unit	Source
Contaminant		>EC21-EC35 Aromatics		from Level 1
Target Concentration	C_T	9.00E-02	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived va

	Variable	Value	Unit	Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	1.09E+00	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	1.00E+04	days	*See justification table*
Calculated decay rate	λ	6.93E-05	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	8.00E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	7.75E+04	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters

	Variable		
Groundwater flow velocity	v	5.72E-01	m/d
Retardation factor	Rf	1.68E+06	fraction
Decay rate used	λ	6.93E-05	d^{-1}
Rate of contaminant flow due to retardation	u	3.40E-07	m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	0.00E+00	mg/l
Attenuation factor (one way vertical dispersion, CO/CED)	**AF**	**breakthrough at compliance point**	

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)

Soil water partition coefficient — Kd — l/kg

Entry for non-polar organic chemicals (option)

Fraction of organic carbon in aquifer — foc — 6.16E-01 — fraction

Organic carbon partition coefficient — Koc — 1.26E+05 — l/kg

Entry for ionic organic chemicals (option)

Sorption coefficient for related species — $K_{oc,n}$ — l/kg

Sorption coefficient for ionised species — $K_{oc,i}$ — l/kg

pH value — pH

acid dissociation constant — pKa

Fraction of organic carbon in aquifer — foc — fraction

Soil water partition coefficient — Kd — 7.75E+04 — l/kg

Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	ax	0.00E+00	1.37E+02	1.31E+01 m
Transverse dispersivity	az	0.00E+00	1.37E+01	1.31E+00 m
Vertical dispersivity	ay	0.00E+00	1.37E+00	1.31E-01

Note values of dispersivity must be > 0

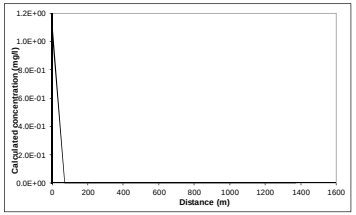
For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x

Xu & Eckstein (1995) report ax = $0.83(\log_{10}x)^{2.414}$; az = ax/10, ay = ax/100 are assumed

Remedial Targets

Remedial Target		**No impact**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**0.00E+00**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.

Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	02/12/2019
Version:	1

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	1.1E+00
68.7	6.16E-37
137.3	3.21E-73
206.0	1.72E-109
274.6	9.39E-146
343.3	5.22E-182
411.9	2.94E-218
480.6	1.67E-254
549.2	9.55E-291
617.9	0.00E+00
686.5	0.00E+00
755.2	0.00E+00
823.8	0.00E+00
892.5	0.00E+00
961.1	0.00E+00
1029.8	0.00E+00
1098.4	0.00E+00
1167.1	0.00E+00
1235.7	0.00E+00
1304.4	0.00E+00
1373.0	0.00E+00

Hydrogeological risk assessment for land contamination

Remedial Targets Worksheet , Release 3.2

First released: 2006. Version 3.2: January 2013

This worksheet has been produced in combination with the document 'Remedial Targets Methodology: Hydrogeological risk assessment for land contamination (Environment Agency 2006).

Users of this worksheet should always refer to the User Manual to the Remedial Targets Methodology and to relevant guidance on UK legislation and policy, in order to understand how this procedure should be applied in an appropriate context.

The calculation of equations in this worksheet has been independently checked by Entec (UK) Ltd on behalf of the Environment Agency.

IMPORTANT: To enable MS Excel worksheet, click Tools, Add -Ins, Analysis Tool Pak and Analysis Tool Pak-VBA (to calculate error functions).

Details to be completed for each assessment

Site Name:	**M54 M6 Link Road**			
Site Address:				
Completed by:	**Gabriella Barnes**			
Date:	**02-Dec-19**		**Version:**	**1**
Contaminant	**Ethylbenzene**			
Target Concentration (C_T)	**0.3**	**mg/l**	**Origin of C_T:**	**DWS**

This worksheet can be used to determine remedial targets for soils (Worksheets Level 1 Soil, Level 2 and Level 3 Soil) or to determine remedial targets for groundwater (Level 3 Groundwater). For Level 3, parameter values must be entered separately dependent on whether the assessment is for soil or groundwater. For soil, remedial targets are calculated as either mg/kg (for comparision with soil measurements) or mg/l (for comparison with leaching tests or pore water concentrations).
Site details entered on this page are automatically copied to Level 1, 2 and 3 Worksheets.
Worksheet options are identified by brown background and employ a pull-down menus. Data entry are identified as blue background.
Data origin / justification should be noted in cells coloured yellow and fully documented in subsequent reports.
Data carried forward from an earlier worksheet are identified by a light green background
It is recommended that a copy of the original worksheet is saved (all data fields in the original copy are blank).

The spreadsheet also includes a porosity calculation worksheet, a soil impact calculation worksheet and a worksheet that performs some simple hydrogeological calculations.

R&D Publication 20 Remedial Targets Worksheet, Release 3.2

Level 3 - Groundwater

See Note

Input Parameters (using pull down menu) | Variable | Value | Unit | Source

Contaminant		Ethylbenzene		from Level 1
Target Concentration	C_T	3.00E-01	mg/l	from Level 1

Select analytical solution (click on brown cell below, then on pull-down menu)

Ogata Banks — Equations in HRA publication

Approach for simulating vertical dispersion: Simulate vertical dispersion in 1 direction

Select nature of decay rate (click on brown cell below, then on pull-down menu)

Approach for simulating degradation of pollutants: Apply degradation rate to pollutants in all phases (e.g. field derived valu

				Source of parameter value
Initial contaminant concentration in groundwater at plume core	C_0	3.40E-02	mg/l	*See justification table*
Half life for degradation of contaminant in water	$t_{1/2}$	5.00E+02	days	*See justification table*
Calculated decay rate	λ	1.39E-03	$days^{-1}$	
Width of plume in aquifer at source (perpendicular to flow)	Sz	8.00E+02	m	*See justification table*
Plume thickness at source	Sy	2.50E+01	m	*See justification table*
Saturated aquifer thickness	da	3.00E+01	m	*See justification table*
Bulk density of aquifer materials	ρ	2.17E+00	g/cm^3	*See justification table*
Effective porosity of aquifer	n	1.00E-01	fraction	*See justification table*
Hydraulic gradient	i	1.20E-02	fraction	*See justification table*
Hydraulic conductivity of aquifer	K	4.77E+00	m/d	*See justification table*
Distance to compliance point	x	1.37E+03	m	*See justification table*
Distance (lateral) to compliance point perpendicular to flow direction	z	0.00E+00	m	*See justification table*
Distance (depth) to compliance point perpendicular to flow direction	y	0.00E+00	m	*See justification table*
Time since pollutant entered groundwater	t	1.00E+100	days	*time variant options only*
Parameters values determined from options				
Partition coefficient	Kd	2.75E+02	l/kg	*see options*
Longitudinal dispersivity	ax	1.37E+02	m	*see options*
Transverse dispersivity	az	1.37E+01	m	*see options*
Vertical dispersivity	ay	1.37E+00	m	*see options*

Calculated Parameters | Variable

Groundwater flow velocity	v	5.72E-01 m/d
Retardation factor	Rf	5.98E+03 fraction
Decay rate used	λ	1.39E-03 d^{-1}
Rate of contaminant flow due to retardation	u	9.58E-05 m/d
Contaminant concentration at distance x, assuming one-way vertical dispersion	C_{ED}	3.59E-194 mg/l
Attenuation factor (one way vertical dispersion, C0/CED)	**AF**	**9.50E+191**

Remedial Targets

Remedial Target		**2.85E+191**	**mg/l**	For comparison with measured groundwater concentration.
Ogata Banks				
Distance to compliance point		**1373**	**m**	
Concentration of contaminant at compliance point	C_{ED}/C_0	**3.59E-194**	**mg/l**	Ogata Banks
after		**1.0E+100**	**days**	

Care should be used when calculating remedial targets using the time variant options as this may result in an overestimate of the remedial target.
The recommended value for time when calculating the remedial target is 9.9E+99.

Select Method for deriving Partition Co-efficient (using pull down menu)

Calculate for non-polar organic chemicals

Entry if specify partition coefficient (option)			
Soil water partition coefficient	Kd	0.00E+00	l/kg
Entry for non-polar organic chemicals (option)			
Fraction of organic carbon in aquifer	foc	6.18E-01	fraction
Organic carbon partition coefficient	Koc	4.47E+02	l/kg
Entry for ionic organic chemicals (option)			
Sorption coefficient for related species	$K_{OC,n}$	0.00E+00	l/kg
Sorption coefficient for ionised species	$K_{OC,i}$	0.00E+00	l/kg
pH value	pH	0.00E+00	
acid dissociation constant	pKa	0.00E+00	
Fraction of organic carbon in aquifer	foc	0.00E+00	fraction
Soil water partition coefficient	Kd	2.75E+02	l/kg

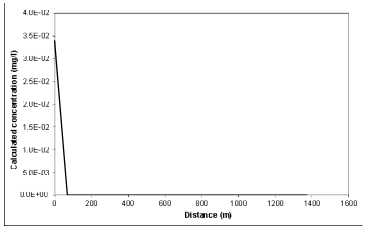
Define dispersivity (click brown cell and use pull down list)

Dispersivities 10%, 1%, 0.1% of pathway length

		Enter value	Calc value Xu & Eckstein	m
Longitudinal dispersivity	**ax**	0.00E+00	1.37E+02	1.31E+01 m
Transverse dispersivity	**az**	0.00E+00	1.37E+01	1.31E+00 m
Vertical dispersivity	**ay**	0.00E+00	1.37E+00	1.31E-01

Note values of dispersivity must be > 0

For calculated value, assumes ax = 0.1 *x, az = 0.01 * x, ay = 0.001 * x
Xu & Eckstein (1995) report ax = $0.83(\log_{wk})^{2.414}$, az = ax/10, ay = ax/100 are assumed



Note graph assumes plume disperses vertically in one direction only. An alternative solution assuming the centre of the plume is located at the mid-depth of the aquifer is presented in the calculation sheets.

Calculated concentrations for distance-concentration graph

Ogata Banks
From calculation sheet

Distance	Concentration
	mg/l
0	3.4E-02
68.7	8.46E-12
137.3	1.95E-21
206.0	4.59E-31
274.6	1.11E-40
343.3	2.71E-50
411.9	6.73E-60
480.6	1.69E-69
549.2	4.25E-79
617.9	1.08E-88
686.5	2.75E-98
755.2	7.02E-108
823.8	1.80E-117
892.5	4.62E-127
961.1	1.19E-136
1029.8	3.07E-146
1098.4	7.93E-156
1167.1	2.05E-165
1235.7	5.32E-175
1304.4	1.38E-184
1373.0	3.58E-194

Note

This sheet calculates the Level 3 remedial target for groundwater, based on the distance to the receptor or compliance located down hydraulic gradient of the source Three solution methods are included, the preferred option is Ogata Banks.

By setting a long travel time it will give the steady state solution, which should be used to calculate remedial targets.

The measured groundwater concentration should be compared with the Level 3 remedial target to determine the need for further action.
Note if contaminant is not subject to first order degradation, then set half life as 9.0E+99.

This worksheet should be used if pollutant transport and degradation is best described by a first order reaction. If degradation is best desribed by an electron limited degradation such as oxidation by O2, NO3, SO4 etc than an alternative solution should be used

Site being assessed:	M54 M6 Link Road
Completed by:	Gabriella Barnes
Date:	########
Version	1