

Schedule 11

Compilation Of Acceptance Guidelines

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2. CSQG Summary table is from "Canadian Environmental Quality Guidelines", Canadian Council of Ministers of the Environment, CCME 1991 (update 2002).	404
3. Module 4 Tables are from "Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand", Ministry for the Environment, 1999.	405
4. Table A.5 Sheep Dip Guidelines is from "Identifying, Investigating and Managing Risks Associated with former Sheep-dip Sites: A guide for Local Authorities", Ministry for the Environment, 2006.	422
5. Tables 3.4.1 and 3.5.1 are from "Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) Guidelines", October 2000.	423

Table 3 and Appendix 1 & 2 are from ARC Technical Publication “Background concentrations of inorganic elements in soils from the Auckland region”, TP 153, October 2001.

Background Concentrations of Inorganic Elements in Soils in the Auckland Region
(all values in mg/kg unless otherwise specified)

Element (Total Recoverable)	Non-Volcanic Range	Volcanic Range
Arsenic (As)	0.4 - 12	
Barium (Ba)	8 - 350	
Boron (B)	2 - 45	< 2 - 260
Cadmium (Cd)	< 0.1 - 0.65	
Chromium (Cr)	2 - 55	3 - 125*
Cobalt (Co)	0.2 - 35	10 - 170
Copper (Cu)	1 - 45	20 - 90
Lead (Pb)	< 1.5 - 65*	
Magnesium (Mg)	470 - 10,300	190 - 76,600
Manganese (Mn)	10 - 2,500*	
Mercury (Hg)	<0.03 - 0.45	
Nickel (Ni)	0.9 - 35	4 - 320
Nitrogen (total, N)	300 - 8,500	
Phosphorus (P)	75 - 1,220	245 - 3,730
Potassium (K)	220 - 3,660	
Sulphur (S)	85 - 2,300	
Tin (Sn)	< 0.7 - 4*	
Vanadium (V)	8 - 160*	15 - 370
Zinc (Zn)	9 - 180	54 - 1,160
Total Organic Carbon (TOC)	0.6 - 14%	

- Notes:
- 1. Background ranges for major elements (N, P, S, TOC) include statistical outlier and extreme values outside the non-outlier volcanic soil range. All other elements do not include values obtained that were statistical outliers or extremes outside the non-outlier volcanic range.
 - 2. *Work suggests special cases have been found to apply for Ti Point Basalts (Cr), Mt Smart Volcanics (Pb, Sn), Franklin Basalts (Sn), and Awhitu-type Mineral Sands (Mn,V) and as such these lithologies need to be considered individually.

Sampling Site Locations of Auckland Soils

(TCLP) indicates that sample was additionally submitted for TCLP testing

Soil Parent Rock	Sample ID	Site Name	Map Reference
Volcanics	101	Ti Point	R09:715410
	TP01-TP04	Ti Point	R09:711409
	102	Smales Quarry	R11:675895
	LP01-LP04	Lake Pupuke (Killarney St Reserve)	R11:681891
	103	Mt Victoria	R11:708846
	104	North Head	R11:721844
	105	Riteakawarau	Q10:496113
	106	Mt Roskill	R11:652752
	107	Mt Albert	R11:637776
	108	Mt Eden (& TCLP)	R11:675790
	ME01-ME02	Mt Eden	R11:677790
	ME03-ME04	Mt Eden	R11:677795
	109	Mt Hobson	R11:697788
	110	Mt Smart (& TCLP)	R11:719743
	111	Mt Wellington (& TCLP)	R11:749771
	112	Mt Mangere	R11:691709
	113	Mt Richmond	R11:743727
	114	One Tree Hill (& TCLP)	R11:693765
	OT01-OT04	One Tree Hill	R11:689760
	115	Greenmount	R11:797716
	GM01-GM02	Greenmount	R11:801717
	116	Ihumatao	R11:660660
	IH01-IH04	Ihumatao	R11:665656
	117	Puhinui Crater	R11:731672
	118	McLaughlins Mt	R11:757648
	119	Three Kings	R11:667762
	120	Pigeon Mountain	R11:800774
	121	Orakei Basin	R11:716803
	122	Panmure Basin	R11:750760
	124	Puketutu Is	R11:663693
	125	Mt St John	R11:690784
	126	Auckland Domain	R11:684805
	AD01-AD04	Auckland Domain	R11:687813
	127	Glenbrook School	R12:658427
	128	Puni School	R12:749395
	129	Patumahoe Reserve	R12:738443
Soil Parent Rock	Sample ID	Site Name	Map Reference
Volcanics	130	Kiwi Rd	R12:691391
	131	Pukekohe Hill	R12:783397
	132	Adams Rd	R12:769428
	133	Rutherford Rd	R12:843444
	RR01-RR04	Rutherford Rd	R12:875445
	134	Paparata Rd	R12:880444
	PR01-PR04	Paparata Rd	R12:839442
	310	Pt England Reserve	R11:773785
	PE01-PE04	Pt England Reserve	R11:771782

Soil Parent Rock	Sample ID	Site Name	Map Reference
Waitematas	201	Pakiri Reserve	R08:590538
	202	Burma Rd	Q09:317342
	203	Kaipara Hills Rd	Q09:424248
	204	Green Hollows Rd	R10:592161
	205	The Dome	R09:563368
	206	Inland Rd	Q10:430023
	207	Kumeu Heights	Q10:473931
	KH01-KH04	Kumeu Heights	Q10:471929
	208	Whangaparaoa	R10:693083
	209	Long Bay Regional Park	R10:640000
	KP01-KP04	Kauri Point Centennial Park	R11:628853
	211	Cottle Rd	Q11:475852
	212	Cape Horn	R11:646725
	213	Kepa Bush Park	R11:738806
	214	Redoubt Rd	R11:830657
	215	Cyclades Reserve	R11:841755
	216	Kaipara Rd	R12:866584
	217	Beaver Rd	R12:865417
	218	McKenzie Rd	S11:004621
	219	Takapuna Grammar	R11:703875
Soil Parent Rock	Sample ID	Site Name	Map Reference
Quaternary Sediments	301	Sandspit Rd	R12:635395
	302	Waiau Pa	R12:660501
	WP01-WP04	Waiau Pa Domain Reserve	R12:659504
	303	Urquhart Rd	R12:752563
	304	Manukau City	R11:768659
	305	Orere Point	S11:106670
	306	Monument Rd	S11:923640
	307	Omana Regional Park	S11:908782
Soil Parent Rock	Sample ID	Site Name	Map Reference
Quaternary Sediments	308	Highland Park	R11:803764
	309	New Lynn	R11:600766
	311	Hobsonville Airbase	R11:590885
	312	Kumeu A&P Showgrounds	Q10:495902
Soil Parent Rock	Sample ID	Site Name	Map Reference
Sands	401	South Head	Q09:222232
	402	Wilson Rd	Q10:263134
	403	Rimmer Rd Lookout	Q10:355007
	404	Pulpit Rd	Q10:391915
	405	Okahukura Peninsula	Q09:273381
	406	Pakiri Block Rd	R08:623522
	407	Pakiri River Rd	R09:654492
	408	Omaha Bay	R09:704385
	409	Awhitu Central	R12:509550
	AW01-AW04	Awhitu Central	R12:509550
	410	Douglas Rd	R12:541451
	411	Kariotahi School Rd	R12:597355
	412	Orewa	R10:622155

Soil Parent Rock	Sample ID	Site Name	Map Reference
Greywacke	501	Cape Rodney Rd	R09:730451
	502	Lilburne Rd	S12:998521
	503	Tapapakanga Hill	S11:119661
	504	Maraetai	S11:907772
	505	Waiheke	S11:941887
	506	Waiheke	S11:028840
Soil Parent Rock	Sample ID	Site Name	Map Reference
Limestone	601	Marsh Rd	Q09:353404
	602	North Shore Aerodrome	R10:583038
	603	Snells Algies	R09:663293
	604	Partridge Rd	Q09:417410
Soil Parent Rock	Sample ID	Site Name	Map Reference
Onerahi Chaos Breccia	701	Glorit-Kaipara Hills Rd	Q09:487313
	702	Pebblebrook Rd	R10:508092
Soil Parent Rock	Sample ID	Site Name	Map Reference
Manukau Breccia	801	Anawhata Rd	Q11:463718
	802	Goldie Bush	Q11:418830

Appendix 2: Analytical Results for Auckland Soils

VOLCANIC SAMPLES

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
TP01	3.68	120	174	0.32	89.5	286	82	0.081	903	1151	1826	3842	128	1260	1280*	733	411.3*	196	84	4.97
TP02	-	-	-	-	-	195	-	-	-	-	-	-	-	-	14.6	-	0.9	-	-	-
TP03	-	-	-	-	-	196	-	-	-	-	-	-	-	-	15.8	-	0.9	-	-	-
TP04	-	-	-	-	-	200	-	-	-	-	-	-	-	-	13.4	-	0.8	-	-	-
LP01	1.67	119	224	0.19	228.4*	124	36.5	0.265	751	8612	2110	3779	253	804	23.3	700	<0.7	256	748	4.39
LP02	-	-	-	-	51.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LP03	-	-	-	-	34.7	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
LP04	-	-	-	-	22.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
103	1.99	66.4	243	0.27	90.9	72.1	28.3	0.215	1130	3767	1354	4817	315	1259	46.6	915	<0.7	125	362	5.97
104	2.02	18.5	149	0.27	57.4	53.8	25.5	0.146	1280	8558	1008	3028	120	1014	13.7	601	<0.7	41.6	108	4.07
105	0.41	239	220	0.15	143.4	3.6	38	0.085	3660	7230	1498	5190	4.6	592	3.04	1036	<0.7	268	114	8.77
106	1.08	71.5	288	0.28	83.2	101	53.1	0.125	2530	34188	1006	1762	251	1325	13.1	407	<0.7	127	280	3.78
107	0.48	40.1	34	0.18	32.9	101	53.8	0.06	1580	30483	848	530	235	246	3.3	389	<0.7	74.2	127	0.85
108	2.15	249	123	0.31	223*	98.8	79.9	0.235	1270	22612	1502	4732	223	1592	34.1	805	<0.7	366	1038	6.47
ME01	-	-	-	-	49.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ME02	-	-	-	-	45.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ME03	-	-	-	-	33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
ME04	-	-	-	-	41.2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
109	7.8	31.8	76	0.28	63.6	35.3	36.6	0.098	1520	31820	788	2976	229	2344	23.9	422	<0.7	72.2	191	3.37
110	6.61	57*	116	0.77*	45.7	61.3	88.6	0.271	498	22217	2484	8422	317*	3729	475*	1520	<0.7	104	484*	11.64
MS01	4.5	4	-	0.33	26.3	55.1	65	0.11	-	-	-	-	50.8	-	88.5	-	3.1	-	142	-
MS02	3.7	3	-	0.27	24.4	42.5	65.9	0.06	-	-	-	-	28.7	-	61.7	-	1.8	-	116	-
MS03	4.8	5	-	0.4	29.8	64.4	84.1	0.18	-	-	-	-	46.7	-	102	-	5.5	-	205	-
MS04	4.8	17	-	0.48	37.9	71.6	81.2	0.13	-	-	-	-	104	-	143	-	4.5	-	258	-
111	1.92	15.4	49	0.59	30.5	9.1	26.6	0.059	681	23384	429	6366	121	1373	11.8	669	<0.7	15.6	54.5	10.68
112	5.82	163	207	0.63	121	105	39.1	0.12	1290	10705	1325	5093	168	2228	21.9	762	<0.7	291	549	6.78
113	2.8	43.1	88	0.57	36.2	15.5	34.7	0.084	1350	16273	877	3669	93.4	1992	15.7	539	<0.7	28	143	4.85
114	4.33	179	197	0.39	119	54.5	33.9	2.303*	1480	4157	1565	5790	98.3	1935	16.3	938	<0.7	508*	742	6.55
OT01	-	-	-	-	-	-	-	0.08	-	-	-	-	-	-	-	-	-	120	-	-
OT02	-	-	-	-	-	-	-	0.11	-	-	-	-	-	-	-	-	-	137	-	-
OT03	-	-	-	-	-	-	-	0.1	-	-	-	-	-	-	-	-	-	132	-	-
OT04	-	-	-	-	-	-	-	0.09	-	-	-	-	-	-	-	-	-	116	-	-
115	3.55	196	786*	0.39	124	73.2	42.1	0.146	1880	11964	1749	5689	149	2830	32.8	887	<0.7	331	1160	6.32
GM01	-	-	193	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GM02	-	-	128	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GM03	-	-	150	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
GM04	-	-	139	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
116	5.29	55.9	239	0.48	34.7	72.5	28.7	0.167	1930	3948	2420	5149	84.1	1086	128*	679	<0.7	87.9	547	6.56
IH01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	16.8	-	-	-	-	-
IH02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	33.7	-	-	-	-	-
IH03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	14.3	-	-	-	-	-
IH04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	15.4	-	-	-	-	-
117	0.69	198	123	0.24	138	114	75.9	0.047	747	37795	1063	1577	227	1152	11.2	2288	<0.7	313	853	1.88
118	4.14	29.4	151	0.21	27.6	38.4	22.9	0.148	1280	3579	1010	3505	41.4	901	55.4	496	<0.7	66	235	3.94
119	2.27	107	72	0.43	105	89.1	53.2	0.147	1510	33794	1321	7237	320	2068	43	1026	<0.7	155	421	9.47
120	1.99	35.7	347	0.31	61.1	46.8	51.4	0.093	2110	64998	1088	3392	207	2590	19.2	1593	<0.7	326	728	3.91
121	4.12	227	142	0.15	128	79.6	48.5	0.143	2160	13300	1217	2709	164	1610	60.2	790	<0.7	310	913	4.72
122	6.61	73	301	0.3	50	53.1	55.1	0.107	2080	76564	992	3730	137	3366	39.6	649	<0.7	128	363	4.43
124	1.93	18.7	69	0.11	29.1	39.7	37.2	<0.03	1600	17327	634	324	95.6	1269	13.1	475	<0.7	23	88.3	1.42
125	1.6	81	279	0.27	93.6	110	41.5	0.169	927	14992	1436	3240	223	972	23.2	732	<0.7	208	288	5.42
126	0.62	243	691*	0.15	134	67.3	81	0.219	978	3594	710	3172	161	1343	27.4	783	<0.7	603*	835	4.56
AD01	-	-	112	-	-	-	-	-	-	-	-	-	-	-	-	-	-	68	-	-
AD02	-	-	83.8	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58	-	-
AD03	-	-	77.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50	-	-
AD04	-	-	98.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	57	-	-
127	7.77	54.6	230	<0.1	23.4	13.7	20.6	0.333	489	1419	497	2678	13.6	333	26.2	753	1.85	147	70.6	4.58
128	6.85	60.9	216	0.13	53.4	11.6	51	0.377	1150	1414	675	2147	11.9	361	52.1	801	3.14	158	166	2.65
129	6.83	61.7	204	<0.1	33.5	27.2	33.4	0.351	1200	194	1516	2904	30.1	598	31	767	3.44	150	109	4.49
130	8.45	57.3	213	<0.1	34.1	14.2	24.9	0.401	496	1753	2094	2798	9.7	376	36.9	742	3.13	151	86.1	4.22
131	0.78	255	132	0.22	114	49.4	57.2	0.184	735	1004	436	4347	17.8	1122	21.2	769	<0.7	158	789	7.11
132	2.41	190	97	0.12	166	98.4	21.8	0.208	493	3281	362	1107	22.7	399	14.1	313	<0.7	155	71.4	1.89
133	2.56	157	157	0.31	93.1	80.3	111*	0.187	275	750	1480	3767	116	1812	13.4	775	<0.7	158	70	5.4
RR01	-	-	-	-	-	-	56.7	-	-	-	-	-	-	-	-	-	-	-	-	-
RR02	-	-	-	-	-	-	51.3	-	-	-	-	-	-	-	-	-	-	-	-	-
RR03	-	-	-	-	-	-	51	-	-	-	-	-	-	-	-	-	-	-	-	-
RR04	-	-	-	-	-	-	60.3	-	-	-	-	-	-	-	-	-	-	-	-	-
134	3.17	839*	181	0.24	385*	64	46.6	0.202	406	860	685	4118	107	955	15.4	863	<0.7	181	87.5	5.83
PR01	-	<2	-	-	11.1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PR02	-	2	-	-	11	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PR03	-	3	-	-	10.6	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PR04	-	3	-	-	10.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
310	3.15	190	803*	<0.1	75.8	40.1	20.8	0.074	1900	4812	907	3750	57.2	2148	17.3	670	<0.7	335	689	4.76
PE01	-	-	287	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PE02	-	-	325	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PE03	-	-	304	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
PE04	-	-	317	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

WAITEMATA GROUP SAMPLES

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
201	2.63	42.2	188	0.25	23.6	20	35.3	0.113	2730	10261	876	607	23.2	770	6.6	1064	<0.7	56.3	106	7.93
202	4.57	19.2	27	0.21	3	8.1	5.7	0.18	389	872	376	4322	3.6	454	7.22	902	<0.7	49.3	43	5
203	1.58	14.8	218	0.14	18.3	25	9.3	0.058	830	3095	966	1982	6.9	227	6.08	425	<0.7	61	46	2.41
204	2.48	30.8	95.3	<0.1	6.2	26.3	21.8	0.096	2310	5110	133	5141	11.7	580	7.2	819	1.49	91.1	98.3	6.43
205	1.36	41.1	30	0.15	5.3	38.3	29	0.13	1300	3844	334	1934	15.7	482	8	1532	<0.7	135	123	4.43
206	4.02	23.6	81	<0.1	8.5	16.9	16.8	0.074	3070	3601	332	3844	6.8	531	21.1	661	<0.7	54.3	57.1	5.03
207	2.12	8.4	12.1	<0.1	0.2	3.7	2.2	0.137	520	654	56	1650	0.93	163	3.74	2513*	1.87	41	11.5	2.44
KH01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	500	-	-	-	-
KH02	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	-	-
KH03	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	-	-
KH04	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	400	-	-	-	-
208	1.93	7.4	16.1	<0.1	0.7	2.2	4.1	0.071	275	474	338	1083	1.5	92	13.9	265	<0.7	40.3	16.3	2.36
209	1.32	4.8	8.7	<0.1	1	2.4	4	0.131	226	743	42	1032	2.38	76	10.7	180	<0.7	21.9	9.6	2.05
KP01	-	-	-	-	-	-	7.1	0.06	-	-	-	-	-	216	8.26	-	0.5	-	-	-
KP02	-	-	-	-	-	-	6.7	0.06	-	-	-	-	-	217	8.34	-	0.4	-	-	-
KP03	-	-	-	-	-	-	4.9	0.07	-	-	-	-	-	185	7.36	-	0.4	-	-	-
KP04	-	-	-	-	-	-	5	0.09	-	-	-	-	-	158	9.07	-	0.5	-	-	-
211	5	20.8	15.2	<0.1	1.9	5.5	10.8	0.145	348	904	28	1626	3.3	250	9.64	1145	2.11	114	32.2	3.88
212	11.54	5.8	29	0.14	2.4	7.6	7.5	0.092	401	597	384	2363	3.46	309	17.6	401	<0.7	33.5	24.9	2.67
213	2.93	30.2	71	<0.1	26.3	40.4	11.1	0.154	908	1585	1121	2821	19.5	417	25.7	586	<0.7	65.4	71.3	4.14
214	5.17	11.5	58	<0.1	1.7	14.6	13.9	0.035	2490	2394	13	805	11.5	122	12.7	103	1.18	29	45.5	0.84
215	2.29	8.2	74	<0.1	5.3	19.8	4.6	0.196	724	951	60	1168	12	137	9.8	338	<0.7	63.8	28.1	1.7
216	1.7	13.6	182	<0.1	5.5	4.9	2.8	0.049	847	909	61	1944	2.5	173	2.78	322	1.55	45.8	43.6	3.18
217	6.07	34.2	31.2	<0.1	3.6	149*	11.7	0.048	1230	2092	33	532	25.8	237	6.31	168	1.8	96.7	82.3	0.63
218	10.16	37.3	313	0.15	9.3	18.5	21.3	0.313	1030	782	586	3198	15	824	40.9	748	3.91	105	68.5	4.5
219	3.1	16.7	53	0.17	18.6	25.4	21.5	0.067	2040	7563	104	4644	34.1	597	8.9	913	<0.7	41.3	70.6	6.84

QUATERNARY SEDIMENTS

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
301	3.98	14.8	179	<0.1	10.9	16.5	20.5	0.325	1380	2411	389	4127	20.2	666	44.3	802	2.41	64	92.5	5.99
302	17.83*	30.6	117	0.5*	13.4	11.5	23.7	0.302	447	1417	520	5202	10.7	1213	28.7	1191	<0.7	111	111	7.45
WP01	8.2	-	-	0.32	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WP02	10.1	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WP03	10.6	-	-	0.23	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
WP04	8.3	-	-	0.33	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
303	6.97	35.2	198	<0.1	8.8	8	27.4	0.337	1510	1172	150	346	12.6	454	26.7	1202	1.5	113	78.7	2.14
304	3.11	17.7	98	0.27	17.1	21.1	8.3	0.11	861	2344	1391	2070	11	457	21.3	475	2.44	43.2	63.9	2.65
305	7.07	21	211	0.46	3.7	5.4	8.3	0.165	281	645	284	3749	5.9	756	19.3	722	3.61	74	90	4.92
306	1.91	9.6	47.2	<0.1	0.5	3.9	7.6	0.169	777	847	83	2728	5.4	363	11.2	426	1.21	34.2	36.9	3.49
307	3.76	9	47.1	0.15	2.9	3.9	4.8	0.107	624	656	397	3416	2.7	486	16.4	570	1.49	30.1	28.2	3.89
308	2.75	17.6	68	<0.1	15.8	28.1	11.5	0.106	1270	3529	612	3101	23.2	632	12.9	562	<0.7	51.8	55.9	3.78
309	6.09	12.1	28	0.15	3.4	7.9	15.2	0.247	700	1118	39	2066	8.53	350	56.2	585	11.47*	41.8	52.1	6.67
311	7.6	29.6	183	0.21	5.6	11.1	25.7	0.311	906	1555	96	2327	23.3	401	52.6	529	7.48*	118	96.6	3.74
312	9.11	8.7	42.1	<0.1	1.5	4.8	17.7	0.421	648	886	39	6108	2.8	465	22.6	1178	2.17	33	21	13.96

SANDS

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
401	5.33	20.4	81	<0.1	9.9	10.6	8.3	0.26	867	1805	376	1950	7.1	358	10.4	470	<0.7	68.3	95.3	3.49
402	8.34	24.1	170	<0.1	6.8	9.1	8.6	0.296	1050	1328	101	1069	9.3	240	12.4	358	1.24	80.3	91.7	1.45
403	6.73	39.3	109	<0.1	13.6	11.6	1.1	0.191	1020	2084	429	2491	8.9	548	12.8	545	<0.7	95.6	179	4.31
404	3.4	17.9	47.9	<0.1	8.8	5.9	2.8	0.124	350	1020	393	336	5.6	140	14.2	325	<0.7	72.3	61.8	1.21
405	4.02	23.7	78	0.18	20.9	19.1	10.2	0.12	873	2310	1704	1993	11.7	303	9.6	618	<0.7	81	106	2.23
406	7.44	3.6	13.4	0.11	1.5	5.5	1.1	<0.03	308	583	58	926	1.94	611	1.7	103	<0.7	12.2	16.6	1.04
407	5.23	3.6	12.2	<0.1	1.3	4.9	1.1	<0.03	547	802	45	1509	1.94	196	3.04	197	<0.7	9.6	12.8	2.12
408	3.92	3	11	<0.1	1.6	5.8	2.2	<0.03	259	635	49	538	2.21	220	<1.5	85	<0.7	8.6	10.7	0.85
409	5.49	63.3*	202	0.22	54.4*	33.1	33.1	0.319	1060	2212	8496*	4224	18.1	633	31.4	1009	<0.7	303	158	5.39
AW01	-	2	-	-	28.2	52.3	52.3	-	-	-	3390	-	-	-	15.1	-	-	320	-	-
AW02	-	2	-	-	30.4	47.4	47.4	-	-	-	3730	-	-	-	38.3	-	-	299	-	-
AW03	-	2	-	-	24.3	48.2	48.2	-	-	-	4050	-	-	-	22.5	-	-	301	-	-
AW04	-	2	-	-	29.3	41.3	41.3	-	-	-	5840	-	-	-	538*	-	-	271	-	-
410	5.09	23.7	55	<0.1	23.1	20.2	20.2	0.047	750	3107	544	2265	9.5	598	4.14	411	<0.7	151	78.1	2.69
411	7.56	23.6	73.5	<0.1	17	11.1	11.1	0.198	676	2324	462	3624	9.6	505	12.7	787	<0.7	129	70.4	4.98
412	7.22	5.2	30	<0.1	2.4	4.5	4.5	<0.03	436	1468	61	1954	3.4	281	11.6	180	<0.7	19	20.7	2.03

GREYWACKE

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
501	9.78	20.4	36	0.12	4.2	13.3	28.2	<0.03	2380	1171	453	1563	3	855	26.7	345	1.5	26.5	29.8	2.06
502	4.74	13.2	178	<0.1	5.2	6.1	12.9	0.117	1550	1903	337	1776	5.6	233	13.5	392	1.76	47.7	42.2	2.42
503	6.98	20.2	85.5	<0.1	2.7	4.8	8.4	0.12	448	843	179	558	3	316	17.8	349	2.71	86.1	43.7	0.96
504	3.91	10.9	63.1	<0.1	2.8	8.5	7.3	0.031	1380	1182	142	1685	2.7	321	13.6	219	0.91	46.4	36.1	2.33
505	8.6	21.1	212	0.17	31.8	23.8	44.8	0.104	5840*	590	1450	732	26.3	471	25.7	370	<0.7	17	103	3.86
506	7.01	13.4	181	0.17	4.4	12.1	25.6	0.081	3500	2109	924	3535	8.96	439	19.1	448	<0.7	14	34	4.69

LIMESTONE

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
601	1.72	9.7	31.1	0.12	0.6	7.9	1.5	0.073	888	1540	50	1028	2.11	177	2.42	375	<0.7	26.5	10.5	2.85
602	2.3	22.1	120	0.18	9.3	10.2	17.1	0.086	949	2487	464	4427	8.29	448	12.6	755	<0.7	38.4	63.9	4.54
603	1.19	7.5	17	<0.1	0.5	3.5	1.3	0.063	601	814	28	1141	0.94	117	6.6	607	0.94	20.6	9.2	2.68
604	1.57	10	63	<0.1	2	8.6	5.1	0.097	1160	1539	85	4085	3.32	260	4.83	525	<0.7	27	17.7	3.2

ONERAHI CHAOS BRECCIA

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
701	3.03	16.6	78	0.2	10.4	11.2	8.6	0.091	1890	2312	1202	3392	6.6	348	9.13	537	<0.7	362	143	7.19
702	4.88	28.7	49.5	<0.1	<0.2	10.9	4	0.099	1580	2504	14	1495	2.5	223	13	255	3.69	506	333	2.91

MANUKAU BRECCIA

ID	As	B	Ba	Cd	Co	Cr	Cu	Hg	K	Mg	Mn	N	Ni	P	Pb	S	Sn	V	Zn	TOC
801	1.49	77.8	41	0.12	7.4	4	53.2	0.245	434	1283	117	3543	4.96	420	16	767	<0.7	362	143	7.19
802	4.92	184	50.6	<0.1	2.3	13.8	49.5	0.114	1340	5315	193	1500	5.4	188	10.8	597	3.69	506	333	2.91

2. CSQG Summary table is from “Canadian Environmental Quality Guidelines,” Canadian Council of Ministers of the Environment, CCME 1991 (update 2002).

Canadian Soil Quality Guidelines for the Protection of Environmental and Human Health

SUMMARY TABLES
Update 2002

Table 1. Canadian soil quality guidelines (mg kg⁻¹)

Substance	Year revised/ released ^a	Landuse			
		Agricultural	Residential/parkland	Commercial	Industrial
Arsenic (inorganic)	1997	12 ^b	12 ^b	12 ^b	12 ^b
Barium	1999	750 ^c	500 ^c	2000 ^c	2000 ^c
Benzene	1997	0.05 ^d	0.5 ^d	5 ^d	5 ^d
Benzo(a) pyrene	1997	0.1 ^e	0.7 ^f	0.7 ^f	0.7 ^f
Cadmium	1999	1.4 ^b	10 ^g	22 ^b	22 ^b
Chromium					
Total chromium	1997	64 ^b	64 ^b	87 ^b	87 ^b
Hexavalent chromium (VI)	1999	0.4 ^h	0.4 ^h	1.4 ^h	1.4 ^h
Copper	1999	63 ^b	63 ^b	91 ^b	91 ^b
Cyanide (free)	1997	0.9 ^b	0.9 ^b	8.0 ^b	8.0 ^b
DDT (total)	1999	0.7 ⁱ	0.7 ⁱ	0.7 ^{i,j}	0.7 ^{i,j}
Ethylbenzene	1997	0.1 ^d	1.2 ^h	20 ^h	20 ^h
Ethylene glycol	1999	960 ^k	960 ^k	960 ^k	960 ^k
Lead	1999	70 ^b	140 ^b	260 ^b	600 ^b
Mercury (inorganic)	1999	6.6 ^b	6.6 ^b	24 ^b	50 ^b
Naphthalene	1997	0.1 ^d	0.6 ^h	22 ^h	22 ^h
Nonylphenol	2002	5.7 ^p	5.7 ^p	14 ^p	14 ^p
Nickel	1999	50 ⁱ	50 ⁱ	50 ⁱ	50 ⁱ
Pentachlorophenol	1997	7.6 ^b	7.6 ^b	7.6 ^b	7.6 ^b
Phenol	1997	3.8 ^b	3.8 ^b	3.8 ^b	3.8 ^b
Polychlorinated dibenzo- <i>p</i> -dioxins/ dibenzofurans (PCDD/Fs)	2002	4 ng TEQ·kg ^{-1q}	5 ng TEQ·kg ^{-1q}	6 ng TEQ·kg ^{-1r}	7 ng TEQ·kg ^{-1s}
Polychlorinated biphenyls (PCBs)	1999	0.5 ^m	1.3 ⁱ	33 ^{ij}	33 ^{ij}
Selenium	2002	1 ^b	1 ^b	3.9 ^b	3.9 ^b
Tetrachloroethylene	1997	0.1 ^e	0.2 ^f	0.5 ^f	0.6 ^f
Thallium	1999	1 ⁿ	1 ^o	1 ^o	1 ^o
Toluene	1997	0.1 ^e	0.8 ^f	0.8 ^f	0.8 ^f
Trichloroethylene	1997	0.1 ^d	3 ^h	31 ^h	31 ^h
Vanadium	1997	130 ⁱ	130 ⁱ	130 ⁱ	130 ⁱ
Xylene	1997	0.1 ^e	1 ^f	17 ^f	20 ^f
Zinc	1999	200 ⁱ	200 ⁱ	360 ⁱ	360 ⁱ

Notes: SQG_E = soil quality guideline for environmental health; SQG_{HH} = soil quality guideline for human health.

^aGuidelines released in 1997 were originally published in the working document entitled "Recommended Canadian Soil Quality Guidelines" (CCME 1997) and have been revised, edited, and reprinted here. Guidelines revised/released in 1999 are published here for the first time (see Table 2).

^bData are sufficient and adequate to calculate an SQG_{HH} and an SQG_E. Therefore the soil quality guideline is the lower of the two and represents a fully integrated de novo guideline for this land use, derived in accordance with the soil protocol (CCME 1996). The corresponding interim soil quality criterion (CCME 1991) is superseded by the soil quality guideline.

^cData are insufficient/inadequate to calculate an SQG_{HH}, a provisional SQG_{HH}, an SQG_E, or a provisional SQG_E. Therefore the interim soil quality

Module 4 Tables are from "Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand, Ministry for the Environment, 1999.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.10 Tier 1 Soil acceptance criteria *Residential Use* ^(1,3,6) ALL PATHWAYS (all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
SAND MAHS	Benzene	1.1 ^(v)	1.9 ^(7,v)	2.4 ^(7,v)
	Toluene	(68) ^(4,v)	(94) ^(4,m)	(230) ^(4,v)
	Ethylbenzene	(53) ^(4,v)	(92) ^(4,7,v)	(120) ^(4,v)
	Xylenes	(48) ^(4,v)	(130) ^(4,7,v)	(180) ^(4,v)
	PAHS			
	Napthalene	58 ^(v)	70 ^(v)	80 ^(v)
	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
SANDY SILT MAHS	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾
	Benzene	1.1 ^(v)	1.9 ^(v)	2.4 ^(v)
	Toluene	(82) ^(4,v)	(170) ^(4,v)	(240) ^(4,v)
	Ethylbenzene	(59) ^(4,v)	(92) ^(4,v)	(140) ^(4,v)
	Xylenes	(59) ^(4,v)	(130) ^(4,v)	(180) ^(4,v)
	PAHS			
	Napthalene	63 ^(v)	83 ^(v)	(130) ^(4,v)
SANDY SILT MAHS	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾
SILTY CLAY MAHS	Benzene	1.7 ^(v)	4.6 ^(v)	12 ^(v)
	Toluene	(210) ^(4,v)	(950) ^(4,v)	(3,000) ^(4,v)
	Ethylbenzene	(110) ^(4,v)	(800) ^(4,v)	(2,800) ^(4,v)
	Xylenes	(160) ^(4,v)	(710) ^(4,v)	(2,200) ^(4,v)
	PAHS			
	Napthalene	69 ^(v)	(330) ^(4,v)	(1,100) ^(4,v)
	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
SILTY CLAY MAHS	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾
CLAY MAHS	Benzene	2.7 ^(v)	8.8 ^(v)	(26) ^(4,v)
	Toluene	(320) ^(4,v)	(2,400) ^(4,v)	(8,500) ^(4,v)
	Ethylbenzene	(160) ^(4,v)	NA ⁽²⁾	NA ⁽²⁾
	Xylenes	(250) ^(4,v)	(1,800) ^(4,v)	(6,500) ^(4,v)
	PAHS			
	Napthalene	71 ^(v)	(360) ^(4,v)	(1,200) ^(4,v)
	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
CLAY MAHS	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾

Table 4.10 (CONTINUED)
Tier 1 Soil acceptance criteria *Residential Use* ^(1,3,6) ALL PATHWAYS (all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
PUMICE				
MAHS	Benzene	1.2 ^(v)	2.4 ^(4,v)	3.1 ^(v)
	Toluene	(73) ^(4,v)	(240) ^(4,v)	(350) ^(4,v)
	Ethylbenzene	(48) ^(4,v)	(140) ^(4,v)	(220) ^(4,v)
	Xylenes	(53) ^(4,v)	(180) ^(4,v)	(260) ^(4,v)
PAHS				
	Napthalene	49 ^(v)	140 ^(v)	(220) ^(4,v)
	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾
PEATS AND HIGHLY ORGANIC SOILS				
MAHS	Benzene	5.7 ^(v)	10 ^(v)	13 ^(v)
	Toluene	(2,500) ^(4,v)	(2,900) ^(4,v)	(3,800) ^(4,v)
	Ethylbenzene	(2,200) ^(4,v)	(2,500) ^(4,v)	(3,200) ^(4,v)
	Xylenes	(1,700) ^(4,v)	(2,000) ^(4,v)	(2,600) ^(4,v)
PAHS				
	Napthalene	72 ^(p)	(2,700) ^(4,v)	(3,500) ^(4,v)
	Non-carc. (Pyrene)	(1,600) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.27 ^(p)	(25) ^(4,m)	NA ⁽²⁾

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.

2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.

3. Surface soils acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (4.19). Criteria for soils at 1m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4m are based on volatilisation only.

4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4m.

5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.

6. The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation

7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.11 Tier 1 Soil acceptance criteria Commercial/ Industrial Use^(1,3,6) ALL PATHWAYS
(all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
SAND MAHS	Benzene	3.0 ^(m)	3.0 ^(m)	9.3 ^(7,v)
	Toluene	(94) ^(4,m)	(94) ^(4,m)	(770) ^(4,v)
	Ethylbenzene	(180) ^(4,v)	(300) ^(4,7,v)	(390) ^(4,v)
	Xylenes	(150) ^(4,m)	(150) ^(4,m)	(580) ^(4,v)
	PAHS			
	Napthalene	190 ^(4,v)	(230) ^(4,v)	(260) ^(4,v)
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾
SANDY SILT MAHS	Benzene	3.6 ^(v)	7.2 ^(v)	9.3 ^(v)
	Toluene	(270) ^(4,v)	(480) ^(4,m)	(790) ^(4,v)
	Ethylbenzene	(200) ^(4,v)	(300) ^(4,v)	(450) ^(4,v)
	Xylenes	(200) ^(4,v)	(420) ^(4,v)	(590) ^(4,v)
	PAHS			
	Napthalene	210 ^(4,v)	270 ^(4,v)	(420) ^(4,v)
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾
SILTY CLAY MAHS	Benzene	7.2 ^(v)	(20) ^(4,v)	54 ^(4,v)
	Toluene	(670) ^(4,v)	(3,100) ^(4,v)	(10,000) ^(4,v)
	Ethylbenzene	(350) ^(4,v)	(2,600) ^(4,v)	(9,100) ^(4,v)
	Xylenes	(510) ^(4,v)	(2,300) ^(4,v)	(7,300) ^(4,v)
	PAHS			
	Napthalene	(230) ^(4,v)	(1,100) ^(4,v)	(3,500) ^(4,v)
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾
CLAY MAHS	Benzene	11 ^(v)	(41) ^(4,v)	(120) ^(4,v)
	Toluene	(1,000) ^(4,v)	(7,900) ^(4,v)	NA ⁽²⁾
	Ethylbenzene	(540) ^(4,v)	NA ⁽²⁾	NA ⁽²⁾
	Xylenes	(810) ^(4,v)	6,000 ^(4,v)	NA ⁽²⁾
	PAHS			
	Napthalene	(230) ^(4,v)	(1,200) ^(4,v)	(3,800) ^(4,v)
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.11 (CONTINUED)
Tier 1 Soil acceptance criteria *Commercial/ Industrial Use*^(1,3,6) ALL PATHWAYS
(all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
PUMICE MAHS	Benzene	4.0 ^(v)	9.0 ^(v)	12 ^(v)
	Toluene	(250) ^(4,v)	(780) ^(4,v)	(1,100) ^(4,v)
	Ethylbenzene	(170) ^(4,v)	(470) ^(4,v)	(710) ^(4,v)
	Xylenes	(180) ^(4,v)	(880) ^(4,v)	(850) ^(4,v)
	PAHS			
	Napthalene	170 ^(v)	450 ^(4,v)	(710) ^(4,v)
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
PEATS AND HIGHLY ORGANIC SOILS MAHS	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾
	Benzene	28 ^(v)	44 ^(4,v)	55 ^(4,v)
	Toluene	(7,500) ^(4,m)	(7,500) ^(4,m)	NA ⁽²⁾
	Ethylbenzene	(7,200) ^(4,v)	(8,100) ^(4,v)	(10,000) ^(4,v)
	Xylenes	(5,700) ^(4,v)	(6,600) ^(4,v)	(8,500) ^(4,v)
	PAHS			
	Napthalene	(8,000) ^(4,v)	(9,000) ^(4,v)	NA ⁽²⁾
	Non-carc. (Pyrene)	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	(11) ^(4,d)	(25) ^(4,m)	NA ⁽²⁾

- NOTES:
1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
 2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
 3. Surface soils acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (4.19). Criteria for soils at 1m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4m are based on volatilisation only.
 4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4m.
 5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
 6. The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation
 7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Table 4.12

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.12 Tier 1 Soil acceptance criteria *Agricultural Use*^(1,3,6) **ALL PATHWAYS**
(all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	>4m
SAND			
MAHS			
Benzene	1.1 ^(v)	1.9 ^(7,v)	2.4 ^(7,v)
Toluene	(68) ^(4,v)	(94) ^(4,m)	(230) ^(4,v)
Ethylbenzene	(53) ^(4,v)	(92) ^(4,7,v)	(120) ^(4,v)
Xylenes	(48) ^(4,v)	(130) ^(4,7,v)	(180) ^(4,v)
PAHS			
Napthalene	7.2 ^(p)	70 ^(v)	80 ^(v)
Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾
SANDY SILT			
MAHS			
Benzene	1.1 ^(v)	1.9 ^(v)	2.4 ^(v)
Toluene	(82) ^(4,v)	(170) ^(4,v)	(240) ^(4,v)
Ethylbenzene	(59) ^(4,v)	(92) ^(4,v)	(140) ^(4,v)
Xylenes	(59) ^(4,v)	(130) ^(4,v)	(180) ^(4,v)
PAHS			
Napthalene	7.2 ^(p)	83 ^(v)	(130) ^(4,v)
Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.12 (CONTINUED)
Tier 1 Soil acceptance criteria *Agricultural Use*^(1,3,6) ALL PATHWAYS
(all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
SILTY CLAY MAHS	Benzene	1.7 ^(v)	4.6 ^(.v)	12 ^(v)
	Toluene	(210) ^(4,v)	(950) ^(4,v)	(3,000) ^(4,v)
	Ethylbenzene	(110) ^(4,v)	(800) ^(4,v)	(2,800) ^(4,v)
	Xylenes	(160) ^(4,v)	(710) ^(4,v)	(2,200) ^(4,v)
	PAHS			
	Napthalene	7.2 ^(p)	(330) ^(4,v)	(1,100) ^(4,v)
	Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
CLAY MAHS	Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾
	Benzene	2.7 ^(v)	8.8 ^(v)	(26) ^(4,v)
	Toluene	(320) ^(4,v)	(2,400) ^(4,v)	8,500 ^(4,v)
	Ethylbenzene	(160) ^(4,v)	NA ⁽²⁾	NA ⁽²⁾
	Xylenes	(250) ^(4,v)	1,800 ^(4,v)	6,500 ^(4,v)
	PAHS			
	Napthalene	7.2 ^(p)	(360) ^(4,v)	(1,200) ^(4,v)
PUMICE MAHS	Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾
	Benzene	1.2 ^(v)	2.4 ^(v)	3.1 ^(v)
	Toluene	(73) ^(4,v)	(240) ^(4,v)	(350) ^(4,v)
	Ethylbenzene	(48) ^(4,v)	(140) ^(4,v)	(220) ^(4,v)
	Xylenes	(53) ^(4,v)	(180) ^(4,v)	(260) ^(4,v)
	PAHS			
	Napthalene	7.2 ^(p)	140 ^(v)	(220) ^(4,v)
	Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.12 (CONTINUED)

Tier 1 Soil acceptance criteria *Agricultural Use*^(1,3,6) ALL PATHWAYS
 (all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
PEATS AND HIGHLY ORGANIC SOILS				
MAHS				
	Benzene	5.7 ^(v)	10 ^(v)	13 ^(v)
	Toluene	(2,500) ^(4,m)	(2,900) ^(4,v)	(3,800) ^(4,v)
	Ethylbenzene	(2,200) ^(4,v)	(2,500) ^(4,v)	(3,200) ^(4,v)
	Xylenes	(1,700) ^(4,v)	(2,000) ^(4,v)	(2,600) ^(4,v)
PAHS				
	Napthalene	7.2 ^(p)	(2,700) ^(4,v)	(3,500) ^(4,v)
	Non-carc. (Pyrene)	(160) ^(4,p)	NA ⁽²⁾	NA ⁽²⁾
	Benzo(a)pyrene eq. ⁽⁵⁾	0.027 ^(p)	(25) ^(4,m)	NA ⁽²⁾

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site-specific consideration of aesthetic and ecological impacts is required.
2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.
3. Surface soils acceptance criteria are based on the lower value of volatilisation criteria (Table 4.16), other pathway criteria (Table 4.18) and criteria for the protection of maintenance workers (4.19). Criteria for soils at 1m are based on the lower value of those arising from volatilisation and maintenance criteria. Criteria for soils at 4m are based on volatilisation only.
4. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4m.
5. Risk associated with mixture of carcinogenic PAHs assessed by comparison with criteria based on benzo(a)pyrene equivalent concentration. Refer to Section 4.4.3 for details of the calculation of Benzo(a)pyrene equivalent concentrations.
6. The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation
7. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil type. Therefore, the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.13 Tier 1 Soil acceptance criteria TPH ^(1,3,5,6) Residential use ALL PATHWAYS (all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	>4m
SAND	C ₇ -C ₉ ⁽⁴⁾	120 ^(m)	120 ^(m)
	C ₁₀ -C ₁₄	(470) ^(7,x)	(560) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾
SANDY SILT	C ₇ -C ₉ ⁽⁴⁾	(500) ^(7,m)	(500) ^(7,m)
	C ₁₀ -C ₁₄	(510) ^(7,x)	(670) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾
SILTY CLAY	C ₇ -C ₉ ⁽⁴⁾	(2,700) ^(7,v)	(7,300) ^(7,v)
	C ₁₀ -C ₁₄	(560) ^(7,x)	(2,700) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾
CLAY	C ₇ -C ₉ ⁽⁴⁾	(15,000) ^(7,v)	NA ⁽²⁾
	C ₁₀ -C ₁₄	(570) ^(7,x)	(2,900) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾
PUMICE	C ₇ -C ₉ ⁽⁴⁾	(810) ^(7,m)	(810) ^(7,m)
	C ₁₀ -C ₁₄	(400) ^(7,x)	(1,100) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾

NOTES:

1. Criteria for C10-C14 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)

2. NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.

3. Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.

4. Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e BTEX) is required.

5. Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1m are based on volatilisation and maintenance workers, and criteria for soils at 4m are based on volatilisation only. PAH surrogate considerations apply at all depths.

6. The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate

7. Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.

8. Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil types. Therefore the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.13 (Continued)

Tier 1 Soil acceptance criteria TPH^(1,3,5,6) Residential use ALL PATHWAYS
(all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	>4m
PEATS AND HIGHLY ORGANIC SOILS			
C ₇ -C ₉ ⁽⁴⁾	(6,700) ^(7,m)	(6,700) ^(7,m)	NA ⁽²⁾
C ₁₀ -C ₁₄	(580) ^(7,x)	NA ⁽²⁾	NA ⁽²⁾
C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾

NOTES:

- Criteria for C10-C14 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
- NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
- Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
- Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e BTEX) is required.
- Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1m are based on volatilisation and maintenance workers, and criteria for soils at 4m are based on volatilisation only. PAH surrogate considerations apply at all depths.
- The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
- Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
- Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil types. Therefore the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.14

Tier 1 Soil acceptance criteria TPH ^(1,3,5,6) *Commercial/ Industrial Use ALL PATHWAYS*
(all values in mg/kg)

Soil Type/ Contaminant		Depth of contamination		
		Surface (<1m)	1m - 4m	>4m
SAND	C ₇ -C ₉ ⁽⁴⁾	120 ^(m)	120 ^(m)	(12,000) ^(7,8,v)
	C ₁₀ -C ₁₄	(1,500) ^(7,x)	(1,900) ^(7,x)	(2,100) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
SANDY SILT	C ₇ -C ₉ ⁽⁴⁾	(500) ^(7,m)	(500) ^(7,m)	(12,000) ^(7,v)
	C ₁₀ -C ₁₄	(1,700) ^(7,x)	(2,200) ^(7,x)	(3,400) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
SILTY CLAY	C ₇ -C ₉ ⁽⁴⁾	(8,800) ^(7,v)	(20,000) ^(7,m)	NA ⁽²⁾
	C ₁₀ -C ₁₄	(1,900) ^(7,x)	(8,900) ^(7,x)	NA ⁽²⁾
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
CLAY	C ₇ -C ₉ ⁽⁴⁾	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	C ₁₀ -C ₁₄	(1,900) ^(7,x)	(9,700) ^(7,x)	NA ⁽²⁾
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
PUMICE	C ₇ -C ₉ ⁽⁴⁾	(810) ^(7,m)	(810) ^(7,m)	(16,000) ^(7,v)
	C ₁₀ -C ₁₄	(1,400) ^(7,x)	(3,600) ^(7,x)	(5,700) ^(7,x)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
PEATS AND HIGHLY ORGANIC SOILS	C ₇ -C ₉ ⁽⁴⁾	(6,700) ^(7,m)	(6,700) ^(7,m)	NA ⁽²⁾
	C ₁₀ -C ₁₄	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾	NA ⁽²⁾

- NOTES:
- Criteria for C10-C14 are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
 - NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
 - Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
 - Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e BTEX) is required.
 - Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1m are based on volatilisation and maintenance workers, and criteria for soils at 4m are based on volatilisation only. PAH surrogate considerations apply at all depths.
 - The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
 - Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
 - Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil types. Therefore the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.15

Tier 1 Soil acceptance criteria TPH^(1,3,5,6) Agricultural Use ALL PATHWAYS
(all values in mg/kg)

Soil Type/ Contaminant	Depth of contamination		
	Surface (<1m)	1m - 4m	>4m
SAND	C ₇ -C ₉ ⁽⁴⁾	120 ^(m)	120 ^(m)
	C ₁₀ -C ₁₄	58 ^(x)	(3,800) ^(7,8,v)
	C ₁₅ -C ₃₆	(560) ^(7,x)	(650) ^(7,x)
SANDY SILT	C ₇ -C ₉ ⁽⁴⁾	NA ⁽²⁾	NA ⁽²⁾
	C ₁₀ -C ₁₄	(4,000) ^(7,x)	(500) ^(7,m)
	C ₁₅ -C ₃₆	(500) ^(7,m)	(3,800) ^(7,v)
SILTY CLAY	C ₇ -C ₉ ⁽⁴⁾	(500) ^(7,m)	(500) ^(7,m)
	C ₁₀ -C ₁₄	(670) ^(7,x)	(4,900) ^(7,v)
	C ₁₅ -C ₃₆	NA ⁽²⁾	NA ⁽²⁾
CLAY	C ₇ -C ₉ ⁽⁴⁾	(2,700) ^(7,v)	(7,300) ^(7,v)
	C ₁₀ -C ₁₄	58 ^(x)	(2,900) ^(7,x)
	C ₁₅ -C ₃₆	(4,000) ^(7,x)	NA ⁽²⁾
PUMICE	C ₇ -C ₉ ⁽⁴⁾	(15,000) ^(7,v)	NA ⁽²⁾
	C ₁₀ -C ₁₄	58 ^(x)	(2,900) ^(7,x)
	C ₁₅ -C ₃₆	(4,000) ^(7,x)	NA ⁽²⁾
PEATS AND HIGHLY ORGANIC SOILS	C ₇ -C ₉ ⁽⁴⁾	(810) ^(7,m)	(810) ^(7,m)
	C ₁₀ -C ₁₄	58 ^(x)	(1,100) ^(7,x)
	C ₁₅ -C ₃₆	(4,000) ^(7,x)	NA ⁽²⁾
PEATS AND HIGHLY ORGANIC SOILS	C ₇ -C ₉ ⁽⁴⁾	(6,700) ^(7,m)	(6,700) ^(7,m)
	C ₁₀ -C ₁₄	58 ^(x)	NA ⁽²⁾
	C ₁₅ -C ₃₆	(4,000) ^(7,x)	NA ⁽²⁾

NOTES:

- Criteria for C₁₀-C₁₄ are based on consideration of aliphatic component of TPH measurement and consideration of TPH as a surrogate measure for PAH, consideration of PAHs completed by extrapolation of PAH content of diesel and PAH criteria (refer Table 4.10)
- NA indicates estimated criterion exceeds 20,000 mg/kg. At 20,000 mg/kg residual separate phase is expected to have formed in soil matrix. Some aesthetic impact may be noted.
- Based on protection of human health only. Site specific consideration of aesthetic and ecological impact is required.
- Based on health effects associated with aliphatic component only. Separate consideration of the health effects associated with the aromatic component (i.e BTEX) is required.
- Soil acceptance criteria are based on the lower value of criteria based on volatilisation (Table 4.16), other pathways (Table 4.18), criteria for the protection of maintenance workers (4.19) and TPH criteria developed as surrogates for PAHs (Table 4.22). Surface soils criteria are based on all three pathways, criteria for soils at 1m are based on volatilisation and maintenance workers, and criteria for soils at 4m are based on volatilisation only. PAH surrogate considerations apply at all depths.
- The following notes indicate the limiting pathway for each criterion: v - volatilisation, s - Soil Ingestion, d - Dermal, p - Produce, m - Maintenance/Excavation, x - PAH surrogate
- Brackets denote values exceed threshold likely to correspond to formation of residual separate phase hydrocarbons. For further explanation refer to Appendix 4M.
- Due to the nature of boundary conditions in volatilisation model, calculated criteria for sandy soils are higher than that for silt soil types. Therefore the criteria for sand are set equal to the criteria for silt. Refer Appendix 4D for details.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.19

Tier 1 Soil acceptance criteria *Maintenance/Excavation workers*
(all values in mg/kg)

Soil Type/ Contaminant		Surface Soil (mg/kg)
SAND	Alkanes	
	C ₇ -C ₉	120
	C ₁₀ -C ₁₄	6,500
	C ₁₅ -C ₃₆	NA ⁽²⁾
	MAHS	
	Benzene	3.0
	Toluene	94
	Ethylbenzene	670
	Xylenes	150
	PAHS	
	Naphthalene	640
	Non-carc. (Pyrene)	NA ⁽²⁾
	Benzo(a)pyrene eq.	25
SANDY SILT	Alkanes	
	C ₇ -C ₉	500
	C ₁₀ -C ₁₄	31,000
	C ₁₅ -C ₃₆	NA ⁽²⁾
	MAHS	
	Benzene	17
	Toluene	480
	Ethylbenzene	3,200
	Xylenes	780
	PAHS	
	Naphthalene	3,100
	Non-carc. (Pyrene)	NA ⁽²⁾
	Benzo(a)pyrene eq.	25

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site specific consideration of aesthetic and ecological impacts is required.

2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.

3. Criteria based on lower of criteria for maintenance workers (Appendix 4G Table 4G4) and excavation workers (Appendix K).

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.19 (Continued)
Tier 1 Soil acceptance criteria *Maintenance/Excavation workers*
(all values in mg/kg)

Soil Type/ Contaminant		Surface Soil (mg/kg)
SILTY CLAY Alkanes MAHS PAHS	C ₇ -C ₉	20,000
	C ₁₀ -C ₁₄	NA ⁽²⁾
	C ₁₅ -C ₃₆	NA ⁽²⁾
	Benzene	700
	Toluene	NA ⁽²⁾
	Ethylbenzene	NA ⁽²⁾
	Xylenes	NA ⁽²⁾
	Naphthalene	NA ⁽²⁾
	Non-carc. (Pyrene)	NA ⁽²⁾
	Benzo(a)pyrene eq.	25
CLAY Alkanes MAHS PAHS	C ₇ -C ₉	NA ⁽²⁾
	C ₁₀ -C ₁₄	NA ⁽²⁾
	C ₁₅ -C ₃₆	NA ⁽²⁾
	Benzene	870
	Toluene	NA ⁽²⁾
	Ethylbenzene	NA ⁽²⁾
	Xylenes	NA ⁽²⁾
	Naphthalene	NA ⁽²⁾
	Non-carc. (Pyrene)	NA ⁽²⁾
	Benzo(a)pyrene eq.	25

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site specific consideration of aesthetic and ecological impacts is required.

2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.

3. Criteria based on lower of criteria for maintenance workers (Appendix G Table G4) and excavation workers (Appendix K).

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.19 (Continued)
Tier 1 Soil acceptance criteria *Maintenance/Excavation workers*
(all values in mg/kg)

Soil Type/ Contaminant		Surface Soil (mg/kg)	
PUMICE	Alkanes	C ₇ -C ₉	810
		C ₁₀ -C ₁₄	NA ⁽²⁾
		C ₁₅ -C ₃₆	NA ⁽²⁾
	MAHS	Benzene	28
		Toluene	820
		Ethylbenzene	5,600
		Xylenes	1,300
	PAHS	Naphthalene	5,300
		Non-carc. (Pyrene)	NA ⁽²⁾
		Benzo(a)pyrene eq.	25
PEATS AND HIGHLY ORGANIC SOILS			
Alkanes	C ₇ -C ₉	6,700	
	C ₁₀ -C ₁₄	NA ⁽²⁾	
	C ₁₅ -C ₃₆	NA ⁽²⁾	
MAHS	Benzene	190	
	Toluene	7,500	
	Ethylbenzene	NA ⁽²⁾	
	Xylenes	NA ⁽²⁾	
PAHS	Naphthalene	NA ⁽²⁾	
	Non-carc. (Pyrene)	NA ⁽²⁾	
	Benzo(a)pyrene eq.	25	

NOTES:

1. Based on protection of human health. Refer to Table 4.20 for protection of groundwater. Site specific consideration of aesthetic and ecological impacts is required.

2. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site.

3. Criteria based on lower of criteria for maintenance workers (Appendix G Table G4) and excavation workers (Appendix K).

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand
Module 4 - Tier 1 Soil Screening Criteria

Table 4.20 Tier 1 Soil acceptance criteria PROTECTION OF GROUNDWATER QUALITY
(all values in mg/kg)

Soil Type/ Contaminant		Depth of Contamination					
		Surface (<1m)			1m - 4m		>4m
		GW 2m ⁽⁵⁾	GW 4m	GW 8m	GW 4m ⁽⁵⁾	GW 8m	GW 8m
SAND TPHs	C ₇ -C ₉	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₀ -C ₁₄	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS	Benzene	0.17	2.8	9.2	0.78	5.1	1.3
	Toluene	(39)	(700)	(6,000)	(200)	(1,300)	(320)
	Ethylbenzene	(50)	NA ⁽¹⁾	NA ⁽¹⁾	(280)	NA ⁽¹⁾	(790)
	Xylenes	(24)	(410)	(1,400)	(120)	(750)	(190)
PAHS	Naphthalene	1.9	53	NA ⁽¹⁾	3.7	NA ⁽¹⁾	20
	Non-carc. (Pyrene)	(56)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Benzo(a)pyrene eq.	(40)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
SANDY SILT							
TPHs	C ₇ -C ₉	(5,200)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₀ -C ₁₄	(9,200)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS	Benzene	0.029	0.46	4.8	0.084	2.0	0.21
	Toluene	6.0	(100)	NA ⁽¹⁾	18	(540)	45
	Ethylbenzene	7.2	(2,600)	NA ⁽¹⁾	(23)	NA ⁽¹⁾	(170)
	Xylenes	3.7	(61)	(1400)	11	(250)	(27)
PAHS	Naphthalene	0.28	16	NA ⁽¹⁾	0.62	NA ⁽¹⁾	NA ⁽¹⁾
	Non-carc. (Pyrene)	7.9	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Benzo(a)pyrene eq.	(5.7)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾

NOTE:

1. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site (i.e 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
2. Based on Tier 1 groundwater acceptance criteria for potable use.
3. Each depth is measured from surface to top of contaminated soil layer or to the groundwater table. Contaminated soil layer assumed to be 2 m thick.
4. Criteria based on assumption of absorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.
5. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.

Table 4.20 (CONTINUED)
Tier 1 Soil acceptance criteria PROTECTION OF GROUNDWATER QUALITY
(all values in mg/kg)

Soil Type/ Contaminant	Depth of Contamination					
	Surface (<1m)			1m - 4m		>4m
	GW 2m ⁽⁵⁾	GW 4m	GW 8m	GW 4m ⁽⁵⁾	GW 8m	GW 8m
SILTY CLAY						
TPHs						
C ₇ -C ₉	(710)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
C ₁₀ -C ₁₄	(1500)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS						
Benzene	0.0057	0.66	NA ⁽¹⁾	0.11	NA ⁽¹⁾	0.34
Toluene	1.1	(8,900)	NA ⁽¹⁾	8.3	NA ⁽¹⁾	(8,800)
Ethylbenzene	1.2	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Xylenes	0.67	(51)	NA ⁽¹⁾	5.9	NA ⁽¹⁾	(50)
PAHS						
Naphthalene	0.047	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Non-carc. (Pyrene)	1.3	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Benzo(a)pyrene eq.	0.93	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
SAND						
TPHs						
C ₇ -C ₉	(590)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
C ₁₀ -C ₁₄	(1,400)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS						
Benzene	0.0054	(850)	NA ⁽¹⁾	0.75	NA ⁽¹⁾	(830)
Toluene	1.0	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Ethylbenzene	1.1	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Xylenes	0.61	NA ⁽¹⁾	NA ⁽¹⁾	(840)	NA ⁽¹⁾	NA ⁽¹⁾
PAHS						
Naphthalene	0.043	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Non-carc. (Pyrene)	1.2	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
Benzo(a)pyrene eq.	0.85	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾

NOTE:

1. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site (i.e 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).

2. Based on Tier 1 groundwater acceptance criteria for potable use.

3. Each depth is measured from surface to top of contaminated soil layer or to the groundwater table. Contaminated soil layer assumed to be 2 m thick.

4. Criteria based on assumption of absorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.

5. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.

Guidelines for Assessing and Managing Petroleum Hydrocarbon Contaminated Sites in New Zealand

Module 4 - Tier 1 Soil Screening Criteria

Table 4.20 (CONTINUED)

Tier 1 Soil acceptance criteria PROTECTION OF GROUNDWATER QUALITY
(all values in mg/kg)

Soil Type/ Contaminant		Depth of Contamination					
		Surface (<1m)			1m - 4m		>4m
		GW 2m ⁽⁵⁾	GW 4m	GW 8m	GW 4m ⁽⁵⁾	GW 8m	GW 8m
TPHs	C ₇ -C ₉	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₀ -C ₁₄	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS	Benzene	0.24	0.25	17	0.52	8.1	1.1
	Toluene	51	(560)	(10,000)	(120)	(1,600)	(250)
	Ethylbenzene	63	(1,800)	NA ⁽¹⁾	(150)	NA ⁽¹⁾	(730)
	Xylenes	32	(330)	(2,200)	(70)	(1,100)	(150)
PAHS	Naphthalene	2.4	60	NA ⁽¹⁾	4.0	NA ⁽¹⁾	NA ⁽¹⁾
	Non-carc. (Pyrene)	(70)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Benzo(a)pyrene eq.	(50)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
SILTY CLAY							
TPHs							
	C ₇ -C ₉	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₀ -C ₁₄	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	C ₁₅ -C ₃₆	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
MAHS	Benzene	3.7	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Toluene	(1,000)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Ethylbenzene	(1,400)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Xylenes	(630)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
PAHS	Naphthalene	55	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Non-carc. (Pyrene)	(1,600)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾
	Benzo(a)pyrene eq.	(1,200)	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾	NA ⁽¹⁾

NOTE:

1. NA indicates contaminant not limiting as estimated health-based criterion is significantly higher than that likely to be encountered on site (i.e 20,000 mg/kg for TPH, 10,000 mg/kg for other contaminants).
2. Based on Tier 1 groundwater acceptance criteria for potable use.
3. Each depth is measured from surface to top of contaminated soil layer or to the groundwater table. Contaminated soil layer assumed to be 2 m thick.
4. Criteria based on assumption of absorbed phase hydrocarbons only and 1st order biodegradation. Migration of separate phase hydrocarbons through soil profile may result in greater impact than indicated by above criteria.
5. Contaminated soil layer is in direct contact with groundwater and hence no attenuation associated with vertical migration through the soil column occurs.

4. Table A.5 Sheep Dip Guidelines is from “Identifying, Investigating and Managing Risks Associated with former Sheep-dip Sites: A guide for Local Authorities”, Ministry for the Environment, 2006.

Table A.5 Summary of soil guideline values (mg/kg) for individual pathways

Contaminant	Scenario	Soil Ingestion	Dermal absorption	Produce Ingestion	Combined*
ΣDDTs	Rural/lifestyle	72	2,735	9.6	8.4
	Standard Residential	72	2,735	48	28
	High-density urban residential	72	2,735	-	70
	Parks/recreation	143	4,100	-	139
	Commercial/ Industrial	1,955	15,600	-	1,740
Dieldrin	Rural/lifestyle	16	60	0.7	0.7
	Standard Residential	16	60	3.4	2.7
	High-density urban residential	16	60	-	12
	Parks/recreation	31	89	-	23
	Commercial/ Industrial	425	339	-	190
Lindane	Rural/lifestyle	782	7,450	35	33
	Standard Residential	782	7,450	173	139
	High-density urban residential	782	7,450	-	707
	Parks/recreation	1,560	11,200	-	1,370
	Commercial/ Industrial	>20,000	>20,000	-	14,180

* The combined value is calculated by taking the inverse of the sum of the inverse value of each pathway.

5. Tables 3.4.1 and 3.5.1 are from “Australian and New Zealand Guidelines for Fresh and Marine Water Quality (ANZECC) Guidelines”, October 2000.

Table 3.4.1 Trigger values for toxicants at alternative levels of protection. Values in grey shading are the trigger values applying to typical *slightly-moderately disturbed systems*; see table 3.4.2 and Section 3.4.2.4 for guidance on applying these levels to different ecosystem conditions.

Chemical		Trigger values for freshwater				Trigger values for marine			
		(µg/L ⁻¹)				(µg/L ⁻¹)			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
METALS & METALLOIDS									
Aluminium	pH>6.5	27	55	80	150	ID	ID	ID	ID
Aluminium	pH<6.5	ID	ID	ID	ID	ID	ID	ID	ID
Antimony		ID	ID	ID	ID	ID	ID	ID	ID
Arsenic (As III)		1	24	94 ^C	360 ^C	ID	ID	ID	ID
Arsenic (As V)		0.8	13	42	140 ^C	ID	ID	ID	ID
Beryllium		ID	ID	ID	ID	ID	ID	ID	ID
Bismuth		ID	ID	ID	ID	ID	ID	ID	ID
Boron		90	370 ^C	680 ^C	1300 ^C	ID	ID	ID	ID
Cadmium	H	0.06	0.2	0.4	0.8 ^C	0.7 ^B	5.5 ^{B,C}	14 ^{B,C}	36 ^{B,A}
Chromium (Cr III)	H	ID	ID	ID	ID	7.7	27.4	48.6	90.6
Chromium (Cr VI)		0.01	1.0 ^C	6 ^A	40 ^A	0.14	4.4	20 ^C	85 ^C
Cobalt		ID	ID	ID	ID	0.005	1	14	150 ^C
Copper	H	1.0	1.4	1.8 ^C	2.5 ^C	0.3	1.3	3 ^C	8 ^A
Gallium		ID	ID	ID	ID	ID	ID	ID	ID
Iron		ID	ID	ID	ID	ID	ID	ID	ID
Lanthanum		ID	ID	ID	ID	ID	ID	ID	ID
Lead	H	1.0	3.4	5.6	9.4 ^C	2.2	4.4	6.6 ^C	12 ^C
Manganese		1200	1900 ^C	2500 ^C	3600 ^C	ID	ID	ID	ID
Mercury (inorganic)	B	0.06	0.6	1.9 ^C	5.4 ^A	0.1	0.4 ^C	0.7 ^C	1.4 ^C
Mercury (methyl)		ID	ID	ID	ID	ID	ID	ID	ID
Molybdenum		ID	ID	ID	ID	ID	ID	ID	ID
Nickel	H	8	11	13	17 ^C	7	70 ^C	200 ^A	560 ^A
Selenium (Total)	B	5	11	18	34	ID	ID	ID	ID
Selenium (SeIV)	B	ID	ID	ID	ID	ID	ID	ID	ID
Silver		0.02	0.05	0.1	0.2 ^C	0.8	1.4	1.8	2.6 ^C
Thallium		ID	ID	ID	ID	ID	ID	ID	ID
Tin (inorganic, SnIV)		ID	ID	ID	ID	ID	ID	ID	ID
Tributyltin (as µg/L Sn)		ID	ID	ID	ID	0.0004	0.006 ^C	0.02 ^C	0.05 ^C
Uranium		ID	ID	ID	ID	ID	ID	ID	ID
Vanadium		ID	ID	ID	ID	50	100	160	280
Zinc	H	2.4	8.0 ^C	15 ^C	31 ^C	7	15 ^C	23 ^C	43 ^C
NON-METALLIC INORGANICS									
Ammonia	D	320	900 ^C	1430 ^C	2300 ^A	500	910	1200	1700
Chlorine	E	0.4	3	6 ^A	13 ^A	ID	ID	ID	ID
Cyanide	F	4	7	11	18	2	4	7	14
Nitrate	J	17	700	3400 ^C	17000 ^A	ID	ID	ID	ID
Hydrogen sulfide	G	0.5	1.0	1.5	2.6	ID	ID	ID	ID
ORGANIC ALCOHOLS									
Ethanol		400	1400	2400 ^C	4000 ^C	ID	ID	ID	ID
Ethylene glycol		ID	ID	ID	ID	ID	ID	ID	ID
Isopropyl alcohol		ID	ID	ID	ID	ID	ID	ID	ID
CHLORINATED ALKANES									
Chloromethanes									
Dichloromethane		ID	ID	ID	ID	ID	ID	ID	ID
Chloroform		ID	ID	ID	ID	ID	ID	ID	ID
Carbon tetrachloride		ID	ID	ID	ID	ID	ID	ID	ID
Chloroethanes									
1,2-dichloroethane		ID	ID	ID	ID	ID	ID	ID	ID
1,1,1-trichloroethane		ID	ID	ID	ID	ID	ID	ID	ID

Chemical	Trigger values for freshwater				Trigger values for marine			
	(µg/L ⁻¹)				(µg/L ⁻¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
1,1,2-trichloroethane	5400	6500	7300	8400	140	1900	5800 ^C	18000 ^C
1,1,2,2-trichloroethane	ID	ID	ID	ID	ID	ID	ID	ID
Pentachloroethane	ID	ID	ID	ID	ID	ID	ID	ID
Hexachloroethane	B	290	360	420	500	ID	ID	ID
Chloropropanes								
1,1-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
CHLORINATED ALKENES								
Chloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1-dichloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1,2-trichloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
1,1,2,2-tetrachloroethylene	ID	ID	ID	ID	ID	ID	ID	ID
3-chloropropane	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloropropane	ID	ID	ID	ID	ID	ID	ID	ID
ANILINES								
Aniline	8	250 ^A	1100 ^A	4800 ^A	ID	ID	ID	ID
2,4-dichloroaniline	0.6	7	20	60 ^C	ID	ID	ID	ID
2,5-dichloroaniline	ID	ID	ID	ID	ID	ID	ID	ID
3,4-dichloroaniline	1.3	3	6 ^C	13 ^C	85	150	190	260
3,5-dichloroaniline	ID	ID	ID	ID	ID	ID	ID	ID
Benzidine	ID	ID	ID	ID	ID	ID	ID	ID
Dichlorobenzidine	ID	ID	ID	ID	ID	ID	ID	ID
AROMATIC HYDROCARBONS								
Benzene	600	950	1300	2000	500 ^C	700 ^C	900 ^C	1300 ^C
Toluene	ID	ID	ID	ID	ID	ID	ID	ID
Ethylbenzene	ID	ID	ID	ID	ID	ID	ID	ID
<i>o</i> -xylene	200	350	470	640	ID	ID	ID	ID
<i>m</i> -xylene	ID	ID	ID	ID	ID	ID	ID	ID
<i>p</i> -xylene	140	200	250	340	ID	ID	ID	ID
<i>m+p</i> -xylene	ID	ID	ID	ID	ID	ID	ID	ID
Cumene	ID	ID	ID	ID	ID	ID	ID	ID
Polycyclic Aromatic Hydrocarbons								
Naphthalene	2.5	16	37	85	50 ^C	70 ^C	90 ^C	1300 ^C
Anthracene	B	ID	ID	ID	ID	ID	ID	ID
Phenanthrene	B	ID	ID	ID	ID	ID	ID	ID
Fluoranthene	B	ID	ID	ID	ID	ID	ID	ID
Benzo(a)pyrene	B	ID	ID	ID	ID	ID	ID	ID
Nitrobenzenes								
Nitrobenzene	230	550	820	1300	ID	ID	ID	ID
1,2-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3,5-trinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-methoxy-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-methoxy-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-chloro-2,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichloro-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3-dichloro-5-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,4-dichloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
2,4-dichloro-2-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID

Chemical	Trigger values for freshwater				Trigger values for marine			
	(µg/L ¹)				(µg/L ¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
1,2,4,5-tetrachloro-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,5-dichloro-2,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,3,5-trichloro-2,4-dinitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1-fluoro-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
Nitrotoluenes								
2-nitrotoluene	ID	ID	ID	ID	ID	ID	ID	ID
3-nitrotoluene	ID	ID	ID	ID	ID	ID	ID	ID
4-nitrotoluene	ID	ID	ID	ID	ID	ID	ID	ID
2,3-dinitrotoluene	ID	ID	ID	ID	ID	ID	ID	ID
2,4-dinitrotoluene	16	65 ^C	130 ^C	250 ^C	ID	ID	ID	ID
2,4,6-dinitrotoluene	100	140	160	210	ID	ID	ID	ID
1,2-dimethyl-3-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dimethyl-4-nitrobenzene	ID	ID	ID	ID	ID	ID	ID	ID
4-chloro-3-nitrotoluene	ID	ID	ID	ID	ID	ID	ID	ID
Chlorobenzenes and Chloronaphthalenes								
Monochlorobenzene	ID	ID	ID	ID	ID	ID	ID	ID
1,2-dichlorobenzene	120	160	200	270	ID	ID	ID	ID
1,3-dichlorobenzene	160	260	350	520 ^C	ID	ID	ID	ID
1,4-dichlorobenzene	40	60	75	100	ID	ID	ID	ID
1,2,3-trichlorobenzene	B 3	10	16	30 ^C	ID	ID	ID	ID
1,2,4-trichlorobenzene	B 85	170 ^C	220 ^C	300 ^C	20	80	140	240
1,2,5-trichlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
1,2,3,4-tetrachlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
1,2,3,5-tetrachlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
1,2,4,5-tetrachlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
Pentachlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorobenzene	B ID	ID	ID	ID	ID	ID	ID	ID
1-chloronaphthalene	ID	ID	ID	ID	ID	ID	ID	ID
Polychlorinated Biphenyls (PCBs) & Dioxins								
Capacitor 21	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1016	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1221	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1232	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1242	B 0.3	0.6	1.0	1.7	ID	ID	ID	ID
Aroclor 1248	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1254	B 0.01	0.03	0.07	0.2	ID	ID	ID	ID
Aroclor 1260	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1262	B ID	ID	ID	ID	ID	ID	ID	ID
Aroclor 1268	B ID	ID	ID	ID	ID	ID	ID	ID
2,3,4'-trichlorobiphenyl	B ID	ID	ID	ID	ID	ID	ID	ID
4,4'-dichlorobiphenyl	B ID	ID	ID	ID	ID	ID	ID	ID
2,4,6,2',4',6'-hexachlorobiphenyl	B ID	ID	ID	ID	ID	ID	ID	ID
2,2',4,5,5'-pentachloro-1,1'-biphenyl	B ID	ID	ID	ID	ID	ID	ID	ID
Total PCBs	B ID	ID	ID	ID	ID	ID	ID	ID
2,3,7,8-TCDD	B ID	ID	ID	ID	ID	ID	ID	ID
PHENOLS and XYLENOLS								
Phenols	85	320	600	1200 ^C	270	400	520	720
2,4-dimethylphenol	ID	ID	ID	ID	ID	ID	ID	ID
Nonylphenol	ID	ID	ID	ID	ID	ID	ID	ID
2-chlorophenol	T 340 ^C	490 ^C	630 ^C	870 ^C	ID	ID	ID	ID
3-chlorophenol	T ID	ID	ID	ID	ID	ID	ID	ID
4-chlorophenol	T 160	220	280 ^C	360 ^C	ID	ID	ID	ID
2,3-dichlorophenol	T ID	ID	ID	ID	ID	ID	ID	ID
2,4-dichlorophenol	T 120	160 ^C	200 ^C	270 ^C	ID	ID	ID	ID

Chemical		Trigger values for freshwater				Trigger values for marine			
		(µg/L ⁻¹)				(µg/L ⁻¹)			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
2,5-dichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,6-dichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
3,4-dichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
3,5-dichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,4-trichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,5-trichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,3,6-trichlorophenol	T	ID	ID	ID	ID	ID	ID	ID	ID
2,4,5-trichlorophenol	T,B	ID	ID	ID	ID	ID	ID	ID	ID
2,4,6-trichlorophenol	T,B	3	20	40	95	ID	ID	ID	ID
2,3,4,5-tetrachlorophenol	T,B	ID	ID	ID	ID	ID	ID	ID	ID
2,3,4,6-tetrachlorophenol	T,B	10	20	25	30	ID	ID	ID	ID
2,3,5,6-tetrachlorophenol	T,B	ID	ID	ID	ID	ID	ID	ID	ID
Pentachlorophenol	T,B	3.6	10	17	27 ^A	11	22	33	55 ^A
Nitrophenols									
2-nitrophenol		ID	ID	ID	ID	ID	ID	ID	ID
3-nitrophenol		ID	ID	ID	ID	ID	ID	ID	ID
4-nitrophenol		ID	ID	ID	ID	ID	ID	ID	ID
2,4-dinitrophenol		13	45	80	140	ID	ID	ID	ID
2,4,6-trinitrophenol		ID	ID	ID	ID	ID	ID	ID	ID
ORGANIC SULPUR COMPOUNDS									
Carbon disulfide		ID	ID	ID	ID	ID	ID	ID	ID
Isopropyl disulfide		ID	ID	ID	ID	ID	ID	ID	ID
n-propyl sulfide		ID	ID	ID	ID	ID	ID	ID	ID
Propyl disulfide		ID	ID	ID	ID	ID	ID	ID	ID
Tert-butyl sulfide		ID	ID	ID	ID	ID	ID	ID	ID
Phenyl disulfide		ID	ID	ID	ID	ID	ID	ID	ID
Bis(dimethylthiocarbamyl) sulfide		ID	ID	ID	ID	ID	ID	ID	ID
Bis(diethylthiocarbamyl) disulfide		ID	ID	ID	ID	ID	ID	ID	ID
2-methoxy-4H-1,3,2-benzodioxaphosphorium-2-sulfide		ID	ID	ID	ID	ID	ID	ID	ID
Xanthates									
Potassium amyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Potassium ethyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Potassium hexyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Potassium isopropyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Sodium ethyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Sodium isobutyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Sodium isopropyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
Sodium sec-butyl xanthate		ID	ID	ID	ID	ID	ID	ID	ID
PHTHALATES									
Dimethylphthalate		3000	3700	4300	5100	ID	ID	ID	ID
Diethylphthalate		900	1000	1100	1300	ID	ID	ID	ID
Dibutylphthalate	B	9.9	26	40.2	64.6	ID	ID	ID	ID
Di(2-ethylhexyl)phthalate	B	ID	ID	ID	ID	ID	ID	ID	ID
MISCELLANEOUS INDUSTRIAL CHEMICALS									
Acetonitrile		ID	ID	ID	ID	ID	ID	ID	ID
Acrylonitrile		ID	ID	ID	ID	ID	ID	ID	ID
Poly(acrylonitrile-co-butadiene-co-styrene)		200	530	800 ^C	1200 ^C	200	250	280	340
Dimethylformamide		ID	ID	ID	ID	ID	ID	ID	ID
1,2-diphenylhydrazine		ID	ID	ID	ID	ID	ID	ID	ID
Diphenylnitrosamine		ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorobutadiene		ID	ID	ID	ID	ID	ID	ID	ID
Hexachlorocyclopentadiene		ID	ID	ID	ID	ID	ID	ID	ID

Chemical		Trigger values for freshwater				Trigger values for marine			
		(µg/L ⁻¹)				(µg/L ⁻¹)			
		Level of protection (% species)				Level of protection (% species)			
		99%	95%	90%	80%	99%	95%	90%	80%
Isophorone		ID	ID	ID	ID	ID	ID	ID	ID
ORGANOCHLORINE PESTICIDES									
Aldrin	B	ID	ID	ID	ID	ID	ID	ID	ID
Chlorodane	B	0.03	0.08	0.14	0.27 ^C	ID	ID	ID	ID
DDE	B	ID	ID	ID	ID	ID	ID	ID	ID
DDT	B	0.006	0.01	0.02	0.04	ID	ID	ID	ID
Dicofol	B	ID	ID	ID	ID	ID	ID	ID	ID
Dieldrin	B	ID	ID	ID	ID	ID	ID	ID	ID
Endosulfan	B	0.03	0.2 ^A	0.6 ^A	1.8 ^A	0.005	0.01	0.02	0.05 ^A
Endosulfan alpha	B	ID	ID	ID	ID	ID	ID	ID	ID
Endosulfan beta	B	ID	ID	ID	ID	ID	ID	ID	ID
Endrin	B	0.01	0.02	0.04 ^C	0.06 ^A	0.004	0.008	0.01	0.02
Heptachlor	B	0.01	0.09	0.25	0.7 ^A	ID	ID	ID	ID
Lindane		0.07	0.2	0.4	1.0 ^A	ID	ID	ID	ID
Methoxychlor	B	ID	ID	ID	ID	ID	ID	ID	ID
Mirex	B	ID	ID	ID	ID	ID	ID	ID	ID
Toxaphene	B	0.1	0.2	0.3	0.5	ID	ID	ID	ID
ORGANOPHOSPHORUS PESTICIDES									
Azinphos methyl		0.01	0.02	0.05	0.11 ^A	ID	ID	ID	ID
Chloropyrifos	B	0.00004	0.01	0.11 ^A	1.2 ^A	0.0005	0.0009	0.04 ^A	0.3 ^A
Demeton		ID	ID	ID	ID	ID	ID	ID	ID
Demeton-S-methyl		ID	ID	ID	ID	ID	ID	ID	ID
Diazinon		0.00003	0.01	0.2 ^A	2 ^A	ID	ID	ID	ID
Dimethoate		0.1	0.15	0.2	0.3	ID	ID	ID	ID
Fenitrothion		0.1	0.2	0.3	0.4	ID	ID	ID	ID
Melathion		0.002	0.05	0.2	1.1 ^A	ID	ID	ID	ID
Parathion		0.0007	0.004 ^C	0.01 ^C	0.04 ^A	ID	ID	ID	ID
Profenofos	B	ID	ID	ID	ID	ID	ID	ID	ID
Temphos	B	ID	ID	ID	ID	0.0004	0.05	0.4	3.6 ^A
CARBAMATE & OTHER PESTICIDES									
Carbofuran		0.06	1.2 ^A	4 ^A	15 ^A	ID	ID	ID	ID
Methomyl		0.5	3.5	9.5	23	ID	ID	ID	ID
S-methoprene		ID	ID	ID	ID	ID	ID	ID	ID
PYRETHROIDS									
Deltamethrin		ID	ID	ID	ID	ID	ID	ID	ID
Esfenvalerate		ID	0.001*	ID	ID	ID	ID	ID	ID
HERBICIDES & FUNGICIDES									
Bypyridilium herbicides									
Diquat		0.01	1.4	10	80 ^A	ID	ID	ID	ID
Paraquat		ID	ID	ID	ID	ID	ID	ID	ID
Phenoxyacetic acid herbicides									
MCPA		ID	ID	ID	ID	ID	ID	ID	ID
2,4-D		140	280	450	830	ID	ID	ID	ID
2,4,5-T		3	36	100	290 ^A	ID	ID	ID	ID
Sulfonylurea herbicides									
Bensulfuron		ID	ID	ID	ID	ID	ID	ID	ID
Metsulfuran		ID	ID	ID	ID	ID	ID	ID	ID
Triocarbamate herbicides									
Molinate		0.1	3.4	14	57	ID	ID	ID	ID
Thiobencarb		1	2.8	4.6	8 ^C	ID	ID	ID	ID
Thiram		0.01	0.2	0.8 ^C	3 ^A	ID	ID	ID	ID
Triazine herbicides									
Amitrole		ID	ID	ID	ID	ID	ID	ID	ID
Atrazine		0.7	13	45 ^C	150 ^C	ID	ID	ID	ID

Chemical	Trigger values for freshwater				Trigger values for marine			
	(µg/L ⁻¹)				(µg/L ⁻¹)			
	Level of protection (% species)				Level of protection (% species)			
	99%	95%	90%	80%	99%	95%	90%	80%
Hexazinone	ID	ID	ID	ID	ID	ID	ID	ID
Simazine	0.2	3.2	11	35	ID	ID	ID	ID
Urea herbicides								
Diuron	ID	ID	ID	ID	ID	ID	ID	ID
Tebuthiuron	0.02	2.2	20	160 ^C	ID	ID	ID	ID
Miscellaneous herbicides								
Acrolein	ID	ID	ID	ID	ID	ID	ID	ID
Bromacil	ID	ID	ID	ID	ID	ID	ID	ID
Glyphosate	370	1200	2000	3600 ^A	ID	ID	ID	ID
Imazethapyr	ID	ID	ID	ID	ID	ID	ID	ID
Ioxynil	ID	ID	ID	ID	ID	ID	ID	ID
Metolachlor	ID	ID	ID	ID	ID	ID	ID	ID
Sethoxydim	ID	ID	ID	ID	ID	ID	ID	ID
Trifluralin	B	2.6	4.4	6	9 ^A	ID	ID	ID
GENERIC GROUPS OF CHEMICALS								
Surfactants								
Linear alkylbenzene sulfonates (LAS)	65	280	520 ^C	1000 ^C	ID	ID	ID	ID
Alcohol ethoxylated sulfate (AES)	340	650	850 ^C	1100 ^C	ID	ID	ID	ID
Alcohol ethoxylated surfactants (AE)	50	140	220	360 ^C	ID	ID	ID	ID
Oils & Petroleum Hydrocarbons								
Oil Spill Dispersants								
BP 1100X	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 7664	ID	ID	ID	ID	ID	ID	ID	ID
Corexit 8667		ID	ID	ID	ID	ID	ID	ID
Corexit 9527	ID	ID	ID	ID	230	1100	2200	4400 ^A
Corexit 9550	ID	ID	ID	ID	ID	ID	ID	ID

Notes: Where the final water quality guideline to be applied to a site is below current analytical practical quantitation limits, see Section 3.4.3.3 for guidance.

Most trigger values listed here for metals and metalloids are *High reliability* figures, derived from field or chronic NOEC data (see 3.4.2.3 for reference to Volume 2). The exceptions are *Moderate reliability* for freshwater aluminium (pH>6.5), manganese and marine chromium (III).

Most trigger values listed here for non-metallic inorganics and organic chemicals are *Moderate reliability* figures, derived from acute LC₅₀ data (see 3.4.2.3 for reference to Volume 2). The exceptions are *High reliability* for freshwater ammonia, 3,4-DCA, endosulfan, chlorpyrifos, esfenvalerate, tebuthiuron, three surfactants and marine for 1,1,2,-TCE and chlorpyrifos.

* = *High reliability* figure for esfenvalerate derived from mesocosm NOEC data (no alternative protection levels available).

A = Figure may not protect key test species from acute toxicity (and chronic) - check Section 8.3.7 for spread of data and its significance.

'A' indicates that trigger value > acute toxicity figure; note that trigger value should be <1/3 of acute figure (Section 8.3.4.4).

B = Chemicals for which possible bioaccumulation and secondary poisoning effects should be considered (see Section 8.3.3.4 and 8.3.5.7).

C = Figure may not protect key test species from chronic toxicity (this refers to experimental chronic figures or geometric mean for species) - check Section 8.3.7 for spread of data and its significance. Where grey shading and 'C' coincide, refer to text in Section 8.3.7.2.

D = Ammonia as TOTAL ammonia as [NH₃-N] at pH 8. For changes in trigger value with pH refer to Section 8.3.7.2

E = Chlorine as total chlorine, as [Cl]; see Section 8.3.7.2

F = Cyanide as un-ionised HCN, measured as [CN]; see Section 8.3.7.2

G = Sulfide as un-ionised H₂S, measured as [S]; see Section 8.3.7.2

H = Chemicals for which algorithms have been provided in table 3.4.3 to account for the effects of hardness. The values have been calculated using a hardness of 30mg/L CaCO₃. These should be adjusted to the site-specific hardness (see Section 3.4.3).

J = Figures protect against toxicity and do not relate to eutrophication issues. Refer to Section 3.3 if eutrophication is the issue of concern.

ID = Insufficient data to derive a reliable trigger value. Users advised to check if a low reliability value or an ECL is given in Section 8.3.7.

T = Tainting or flavour impairment of fish flesh may possibly occur at concentrations below the trigger value. See Sections 4.4.5.3/3 and 8.3.7.

Table 3.5.1 Recommended sediment quality guidelines^a

Contaminant	ISQG-Low (Trigger value)	ISQG-High
METALS (mg/kg dry wt)		
Antimony	2	25
Cadmium	1.5	10
Chromium	80	370
Copper	65	270
Lead	50	220
Mercury	0.15	1
Nickel	21	52
Silver	1	3.7
Zinc	200	410
METALLOIDS (mg/kg dry wt)		
Arsenic	20	70
ORGANOMETALLICS		
Tributyltin ($\mu\text{g Sn/kg dry wt.}$)	5	70
ORGANICS ($\mu\text{g/kg dry wt}$)^b		
Acenaphthene	16	500
Acenaphthalene	44	640
Anthracene	85	1100
Fluorene	19	540
Naphthalene	160	2100
Phenanthrene	240	1500
Low Molecular Weight PAHs ^c	552	3160
Benzo(a)anthracene	261	1600
Benzo(a)pyrene	430	1600
Dibenzo(a,h)anthracene	63	260
Chrysene	384	2800
Fluoranthene	600	5100
Pyrene	665	2600
High Molecular Weight PAHs ^c	1700	9600
Total PAHs	4000	45000
Total DDT	1.6	46
p,p'-DDE	2.2	27
o,p'-+p,p'-DDD	2	20
Chlordane	0.5	6
Dieldrin	0.02	8
Endrin	0.02	8
Lindane	0.32	1
Total PCBs	23	-

a Primarily adapted from Long et al. (1995);

b Normalised to 1% organic carbon;

c Low molecular weight PAHs are the sum of concentrations of acenaphthene, acenaphthalene, anthracene, fluorene, 2-methylnaphthalene, naphthalene and phenanthrene;

high molecular weight PAHs are the sum of concentrations of benzo(a)anthracene, benzo(a)pyrene, chrysene, dibenzo(a,h)anthracene, fluoranthene and pyrene.