

**APPENDIX H**

**UCL<sub>95</sub> Calculation**

Table H1: Summary of Dioxin Data Used to Calculate UCL<sub>95</sub>

EnviroNZ Limited  
Kopeopeo Canal Remediation

Section	Sample number	NZTM X	NZTM Y	Sample Type	Sediment Dioxin (Total PCDD/F I-TEQ - Upperbound) Concentration	Sediment Validation Phase (Phase 1, Phase 2 or Phase 3)	Included in UCL	Comments
1	KC001a	1945427.83	5791941.728	Primary	51	Phase 1	Yes	
1	KC002a	1945458.715	5791930.793	Primary	25	Phase 1	Yes	
1	KC003a	1945491.83	5791926.671	Primary	20	Phase 1	Yes	
1	KC004a	1945524.345	5791916.112	Primary	41	Phase 1	Yes	
1	KC005a	1945555.972	5791905.494	Primary	21	Phase 1	Yes	
1	KC005DQ (Duplicate KC005a)	1945555.972	5791905.494	Duplicate	21	Phase 1	No	Excluded from UCL as primary sample (KC005a) has a higher result
1	KC006a	1945588.451	5791900.895	Primary	28	Phase 1	Yes	
1	KC007a	1945621.105	5791890.114	Primary	51	Phase 1	Yes	
2	KC008c	1945653.526	5791878.749	Primary	64	Phase 1	Yes	Not over 120pg/g and within UCL target
2	KC009c	1945684.814	5791877.164	Primary	56	Phase 1	Yes	
2	KC010c	1945718.762	5791862.916	Primary	27	Phase 1	Yes	
2	KC011c	1945749.882	5791853.538	Primary	21	Phase 1	Yes	
2	KC012c	1945784.868	5791851.823	Primary	31	Phase 1	Yes	
2	KC012DQ (Duplicate KC012c)	1945784.868	5791851.823	Duplicate	23	Phase 1	No	Excluded from UCL as primary sample (KC012a) has a higher result
2	KC013c	1945817.436	5791838.075	Primary	28	Phase 1	Yes	
2	KC014c	1945846.139	5791826.807	Primary	34	Phase 1	Yes	
2	KC015c	1945879.985	5791824.582	Primary	20	Phase 1	Yes	
2	KC016c	1945914.012	5791812.724	Primary	25	Phase 1	Yes	
2	KC016DQ (Duplicate KC016c)	1945914.012	5791812.724	Duplicate	20	Phase 1	No	Excluded from UCL as primary sample (KC016a) has a higher result
2	KC017c	1945944.705	5791801.806	Primary	54	Phase 1	Yes	
2	KC018c	1945976.847	5791797.459	Primary	21	Phase 1	Yes	
2	KC019a	1946011.1	5791785.915	Primary	46	Phase 1	Yes	
3	KC020a	1946044.845	5791774.945	Primary	21	Phase 1	Yes	
3	KC021a	1946077.869	5791770.746	Primary	21	Phase 1	Yes	
3	KC022a	1946110.593	5791760.618	Primary	34	Phase 1	Yes	
3	KC022DQ (Duplicate KC022a)	1946110.593	5791760.618	Duplicate	21	Phase 1	No	Excluded from UCL as primary sample (KC022a) has a higher result
3	KC023a	1946140.632	5791749.843	Primary	22	Phase 1	Yes	
3	KC024a	1946174.981	5791747.663	Primary	40	Phase 1	Yes	
3	KC025a	1946207.431	5791736.252	Primary	35	Phase 1	Yes	
3	KC025DQ (Duplicate KC025a)	1946207.431	5791736.252	Duplicate	21	Phase 1	No	Excluded from UCL as primary sample (KC025a) has a higher result
3	KC026a	1946237.707	5791725.038	Primary	23	Phase 1	Yes	
3	KC027a	1946278.102	5791721.53	Primary	61	Phase 1	Yes	Not over 120pg/g and within UCL target
3	KC028a	1946313.146	5791724.987	Primary	35	Phase 1	Yes	
3	KC029a	1946346.101	5791727.791	Primary	24	Phase 1	Yes	
3	KC030a	1946371.318	5791742.663	Primary	27	Phase 1	Yes	
3	KC031a	1946403.894	5791759.301	Primary	37	Phase 1	Yes	
3	KC032a	1946436.728	5791776.269	Primary	21	Phase 1	Yes	
3	KC033a	1946463.465	5791801.218	Primary	58	Phase 1	Yes	
3	KC034b	1946498.418	5791817.336	Primary	23	Phase 1	Yes	
3	KC035a	1946525.352	5791828.558	Primary	22	Phase 1	Yes	
4	KC036a	1946552.356	5791852.805	Primary	21	Phase 1	Yes	
4	KC037a	1946595.562	5791873.786	Primary	53	Phase 1	Yes	
4	KC038a	1946626.637	5791885.785	Primary	32	Phase 1	No	Excluded from UCL as area dredged. Phase 2 sampling KC038c-M, KC038e-L and KC038g-R
4	KC038b (Duplicate KC038a)	1946626.637	5791885.785	Duplicate	110	Phase 1	No	
4	KC038c-M	1946622.625	5791891.561	Primary	38	Phase 2	Yes	
4	KC038e-L	1946618.281	5791896.828	Primary	40	Phase 2	Yes	
4	KC038g-R	1946625.439	5791885.586	Primary	87	Phase 2	No	Excluded from UCL as area dredged. Phase 3 sample KC038I
4	KC038I	1946626.09	5791884.961	Primary	51	Phase 3	Yes	Final revalidation of KC038g-R
4	KC039a	1946651.254	5791911.902	Primary	23	Phase 1	Yes	
4	KC040a	1946680.757	5791923.485	Primary	21	Phase 1	Yes	
4	KC041a	1946712.636	5791936.696	Primary	32	Phase 1	Yes	
4	KC042a	1946733.039	5791958.728	Primary	150	Phase 1	No	Excluded from UCL. Phase 2 samples KC042c-M, KC042e-L and KC042g-R
4	KC042c-M	1946734.099	5791956.217	Primary	34	Phase 2	Yes	
4	KC042e-L	1946731.354	5791959.894	Primary	93	Phase 2	No	Excluded from UCL as area dredged. Phase 3 sample KC042I
4	KC042g-R	1946735.77	5791952.281	Primary	27	Phase 2	Yes	
4	KC042I	1946731.077	5791959.291	Primary	31	Phase 3	Yes	Final revalidation of KC042e-L
4	KC043a	1946762.438	5791972.983	Primary	37	Phase 1	No	Excluded from UCL as duplicate sample (KC043b) has a higher result
4	KC043b (Duplicate KC043a)	1946762.694	5791972.603	Duplicate	43	Phase 1	Yes	
4	KC044a	1946789.916	5791985.618	Primary	48	Phase 1	Yes	
4	KC045a	1946813.341	5792012.329	Primary	39	Phase 1	Yes	
4	KC046a	1946852.722	5792032.728	Primary	26	Phase 1	Yes	
4	KC047a	1946869.881	5792048.667	Primary	180	Phase 1	No	Excluded from UCL as area dredged. Phase 2 samples KC047c-M, KC047e-L and KC047g-R
4	KC047c-M	1946868.166	5792049.33	Primary	50	Phase 2	Yes	
4	KC047e-L	1946865.611	5792051.712	Primary	57	Phase 2	Yes	
4	KC047g-R	1946872.324	5792047.112	Primary	34	Phase 2	Yes	
4	KC048a	1946878.86	5792063.532	Primary	24	Phase 1	Yes	

Table H1: Summary of Dioxin Data Used to Calculate UCL<sub>95</sub>

EnviroNZ Limited  
Kopeopeo Canal Remediation

Section	Sample number	NZTM X	NZTM Y	Sample Type	Sediment Dioxin (Total PCDD/F I-TEQ - Upperbound) Concentration	Sediment Validation Phase (Phase 1, Phase 2 or Phase 3)	Included in UCL	Comments
4	KC049a	1946893.658	5792077.745	Primary	29	Phase 1	Yes	
4	KC050a	1946926.847	5792104.609	Primary	33	Phase 1	Yes	
4	KC051a	1946944.865	5792132.285	Primary	27	Phase 1	Yes	
4	KC051b (Duplicate KC051a)	1946944.865	5792132.285	Duplicate	23	Phase 1	No	Excluded from UCL as primary sample (KC051a) has a higher result
4	KC052a	1946973.694	5792157.832	Primary	30	Phase 1	Yes	
4	KC053a	1946998.615	5792177.7	Primary	22	Phase 1	Yes	
4	KC054a	1947014.027	5792202.875	Primary	71	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC054C, KC054E and KC054G
4	KC054C	1947015.553	5792201.139	Primary	41	Phase 2	Yes	
4	KC054E	1947013.725	5792202.412	Primary	24	Phase 2	Yes	
4	KC054G	1947018.136	5792199.219	Primary	37	Phase 2	Yes	
4	KC055a	1947036.67	5792228.409	Primary	23	Phase 1	Yes	
5	KC056a	1947074.454	5792258.843	Primary	83	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC056c, KC056e and KC056g
5	KC056b (Duplicate KC056a)	1947074.53	5792259.001	Duplicate	150	Phase 1	No	
5	KC056c	1947069.841	5792260.187	Primary	60	Phase 2	No	Excluded from UCL as area redredged. Phase 2 samples KC056i, KC056k and KC056m
5	KC056e	1947068.318	5792261.662	Primary	140	Phase 2	No	
5	KC056g	1947072.608	5792258.96	Primary	58	Phase 2	No	
5	KC056i	1947071.281	5792258.294	Primary	34	Phase 2	Yes	
5	KC056k	1947070.109	5792261.694	Primary	61	Phase 2	Yes	Not over 120pg/g and within UCL target.
5	KC056m	1947071.136	5792256.6	Primary	32	Phase 2	Yes	
5	KC057a	1947082.64	5792266.833	Primary	22	Phase 1	Yes	
5	KC057b (Duplicate KC057a)	1947082.736	5792266.93	Duplicate	22	Phase 1	No	Excluded from UCL, same dioxin concentration as primary sample (KC057a)
5	KC058a	1947111.109	5792263.267	Primary	50	Phase 1	Yes	
5	KC058.5a	1947145.602	5792261.009	Primary	150	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC058.5c, KC058.5e and KC058.5h.
5	KC058.5c	1947146.972	5792261.582	Primary	53	Phase 2	Yes	
5	KC058.5e	1947145.447	5792266.382	Primary	42	Phase 2	Yes	
5	KC058.5g	1947148.988	5792257.465	Primary	31	Phase 2	No	Excluded from UCL as duplicate sample KC058.5h has a higher result
5	KC058.5h (Duplicate KC058.5g)	1947149.243	5792257.519	Duplicate	32	Phase 2	Yes	
5	KC059a	1947155.079	5792257.841	Primary	45	Phase 1	Yes	
5	KC060a	1947191.015	5792261.116	Primary	220	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC060c, KC060e2 and KC060g
5	KC060c	1947191.909	5792260.383	Primary	30	Phase 2	Yes	
5	KC060e2	1947191.458	5792263.101	Primary	23	Phase 2	Yes	
5	KC060g	1947191.481	5792254.583	Primary	27	Phase 2	Yes	
5	KC061a	1947229.865	5792258.428	Primary	140	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC061c, KC061e2 and KC061g
5	KC061c	1947230.76	5792258.307	Primary	32	Phase 2	Yes	
5	KC061e2	1947227.739	5792261.894	Primary	25	Phase 2	Yes	
5	KC061g	1947230.934	5792253.026	Primary	22	Phase 2	Yes	
5	KC062a	1947261.747	5792252.722	Primary	110	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC062c3, KC062e3, KC062g
5	KC062b (Duplicate KC062a)	1947261.757	5792252.754	Duplicate	180	Phase 1	No	
5	KC062c3	1947260.497	5792258.405	Primary	28	Phase 2	Yes	
5	KC062e3	1947259.961	5792258.151	Primary	26	Phase 2	Yes	
5	KC062g	1947261.645	5792251.506	Primary	120	Phase 2	No	Excluded from UCL as area redredged. Phase 3 sample KC062g2
5	KC062g2	1947262.204	5792252.357	Primary	34	Phase 3	Yes	Final revalidation of KC062g2
5	KC063a	1947288.858	5792259.803	Primary	36	Phase 1	Yes	
5	KC064a	1947311.123	5792255.682	Primary	85	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC064c2, KC064e2 and KC064g
5	KC064b (Duplicate KC064a)	1947311.265	5792255.708	Duplicate	97	Phase 1	No	
5	KC064c2	1947312.819	5792255.3	Primary	38	Phase 2	Yes	
5	KC064e2	1947315.658	5792259.673	Primary	23	Phase 2	Yes	
5	KC064g	1947315.92	5792249.576	Primary	31	Phase 2	Yes	
5	KC065a	1947349.54	5792250.504	Primary	170	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC065c, KC065e and KC065g/h
5	KC065c	1947351.218	5792250.585	Primary	25	Phase 2	Yes	
5	KC065e	1947350.045	5792258.449	Primary	26	Phase 2	Yes	
5	KC065g	1947351.296	5792249.15	Primary	29	Phase 2	No	Excluded from UCL as duplicate sample KC065h is higher
5	KC065h (Duplicate KC065g)	1947351.366	5792249.196	Duplicate	30	Phase 2	Yes	
5	KC066a	1947380.09	5792254.77	Primary	130	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC066c2, KC066e, KC066g
5	KC066c2	1947383.283	5792251.953	Primary	30	Phase 2	Yes	
5	KC066e	1947383.979	5792257.823	Primary	28	Phase 2	Yes	
5	KC066g	1947381.692	5792246.678	Primary	25	Phase 2	Yes	
5	KC067a	1947409.87	5792250.24	Primary	190	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC067c3, KC067e2, KC067g
5	KC067c3	1947413.575	5792251.686	Primary	23	Phase 2	Yes	
5	KC067e2	1947412.857	5792255.538	Primary	22	Phase 2	Yes	
5	KC067g	1947411.152	5792248.294	Primary	33	Phase 2	Yes	
5	KC068a	1947447.58	5792246.43	Primary	36	Phase 1	Yes	
5	KC069a	1947488.00	5792249.95	Primary	63	Phase 1	Yes	Not over 120pg/g and within UCL target.
5	KC070a	1947515.21	5792247.36	Primary	170	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC070c, KC070e, KC070g
5	KC070c	1947516.463	5792247.271	Primary	48	Phase 2	Yes	
5	KC070e	1947516.596	5792250.702	Primary	120	Phase 2	No	Excluded from UCL as area redredged. Phase 3 sample KC070e2
5	KC070e2	1947517.567	5792249.512	Primary	24	Phase 3	Yes	Final revalidation of KC070e
5	KC070g	1947516.449	5792242.691	Primary	37	Phase 2	Yes	

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Section	Sample number	NZTM X	NZTM Y	Sample Type	Sediment Dioxin (Total PCDD/F I-TEQ - Upperbound) Concentration	Sediment Validation Phase (Phase 1, Phase 2 or Phase 3)	Included in UCL	Comments
5	KC071a	1947539.37	5792245.6	Primary	49	Phase 1	Yes	
5	KC072a	1947573.21	5792249.74	Primary	35	Phase 1	No	Excluded from UCL as duplicate sample KC072b is higher
5	KC072b (Duplicate KC072a)	1947573.025	5792249.591	Duplicate	63	Phase 1	Yes	Duplicate sample (KC072b) of KC072a. Not over 120pg/g and within UCL target.
5	KC073a	1947612.35	5792244.4	Primary	150	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC073c, KC073e, KC073g
5	KC073c	1947611.798	5792243.829	Primary	50	Phase 2	Yes	
5	KC073e	1947612.596	5792249.403	Primary	34	Phase 2	Yes	
5	KC073g	1947612.889	5792240.097	Primary	47	Phase 2	Yes	
5	KC074a	1947638.06	5792241.18	Primary	45	Phase 1	Yes	
5	KC075a	1947673.65	5792245.191	Primary	29	Phase 1	Yes	
5	KC076a	1947713.32	5792241.82	Primary	100	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC076c, KC076e, KC076g.
5	KC076b (Duplicate KC076a)	1947713.328	5792241.882	Duplicate	110	Phase 1	No	Duplicate sample of KC076a.
5	KC076c	1947710.857	5792240.141	Primary	30	Phase 2	Yes	
5	KC076e	1947711.837	5792246.581	Primary	27	Phase 2	Yes	
5	KC076g	1947708.94	5792237.469	Primary	30	Phase 2	Yes	
5	KC077a	1947743.51	5792235.54	Primary	61	Phase 1	Yes	Not over 120pg/g and within UCL target.
5	KC078a	1947770.559	5792241.91	Primary	56	Phase 1	Yes	
5	KC079a	1947808.98	5792237.217	Primary	350	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC079c, KC079e and KC079g
5	KC079c	1947809.636	5792237.112	Primary	54	Phase 2	Yes	
5	KC079e	1947810.684	5792240.727	Primary	28	Phase 2	Yes	
5	KC079g	1947810.873	5792234.425	Primary	23	Phase 2	Yes	
5	KC080a	1947832.68	5792234.34	Primary	520	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC080c, KC080e and KC080g
5	KC080c	1947831.598	5792234.775	Primary	29	Phase 2	Yes	
5	KC080e	1947834.561	5792240.645	Primary	61	Phase 2	Yes	Not over 120pg/g and within UCL target.
5	KC080g	1947832.599	5792232.766	Primary	52	Phase 2	Yes	
5	KC081a	1947869.569	5792237.536	Primary	96	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC081c, KC081e2, KC081g
5	KC081b (Duplicate KC081a)	1947869.743	5792237.556	Duplicate	110	Phase 1	No	Duplicate sample of KC081a
5	KC081c	1947870.55	5792234.198	Primary	40	Phase 2	Yes	
5	KC081e2	1947870.852	5792239.221	Primary	22	Phase 2	Yes	
5	DUPE01 (Duplicate KC081e2)	1947870.852	5792239.221	Duplicate	21	Phase 2	No	Excluded from UCL as primary sample (KC081e2) has a higher result
5	KC081g	1947871.238	5792232.034	Primary	40	Phase 2	Yes	
5	KC082a	1947911.536	5792234.566	Primary	72	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC082c, KC082f, KC082g
5	KC082c	1947908.26	5792234.128	Primary	27	Phase 2	Yes	
5	KC082d (Duplicate KC082c)	1947908.26	5792234.128	Duplicate	24	Phase 2	No	Excluded from UCL as primary sample (KC082c) has a higher result
5	KC082e	1947907.329	5792237.582	Primary	27	Phase 2	No	Excluded from UCL as duplicate sample (KC082f) has a higher result
5	KC082f (Duplicate KC082e)	1947907.329	5792237.582	Duplicate	29	Phase 2	Yes	
5	KC082g	1947908.039	5792230.938	Primary	30	Phase 2	Yes	
5	KC083a	1947943.73	5792232.08	Primary	190	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC083c2, KC083e2, KC083g2
5	KC083c2	1947943.76	5792231.258	Primary	20	Phase 2	Yes	
5	KC083e2	1947945.181	5792234.113	Primary	22	Phase 2	Yes	
5	KC083g2	1947943.532	5792229.943	Primary	57	Phase 2	Yes	
5	KC084a	1947971.81	5792233.72	Primary	160	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC084c2, KC084e2, KC084g2
5	KC084c2	1947972.321	5792230.355	Primary	27	Phase 2	Yes	
5	KC084e2	1947973.542	5792235.064	Primary	160	Phase 2	Yes	Area has been dredged 3 times. Validation samples taken showed no visible signs of target material. IM has done multiple push tube cores in the area following third dredging phase and concurred cleared as best as practicable and no visible signs of target material remaining.
5	KC084g2	1947972.284	5792226.699	Primary	68	Phase 2	Yes	Not over 120pg/g and within UCL target.
5	KC084a-1	1947973.19	5792233.929	Primary	24	Phase 3	Yes	Final revalidation of KC084e
5	DUPE04-25062019 (Duplicate KC084a-1)	1947973.19	5792233.929	Duplicate	24	Phase 3	No	Excluded from UCL. Same dioxin concentration as primary sample (KC084a-1)

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Section	Sample number	NZTM X	NZTM Y	Sample Type	Sediment Dioxin (Total PCDD/F I-TEQ - Upperbound) Concentration	Sediment Validation Phase (Phase 1, Phase 2 or Phase 3)	Included in UCL	Comments
6	KC085c	1948007.272	5792229.739	Primary	48	Phase 1	Yes	
6	KC086e	1948043.263	5792225.597	Primary	46	Phase 1	Yes	
6	KC087a	1948069.774	5792231.304	Primary	27	Phase 1	Yes	
6	KC088d	1948108.4	5792226.47	Primary	380	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC088c1, KC088c-2, KC099c3
6	DUPE01-27032019 (Duplicate KC088c-1)	1948108.351	5792222.188	Duplicate	210	Phase 2	No	Excluded from UCL as area redredged. Phase 3 sample KC088c-1b
6	KC088c-1	1948108.351	5792222.188	Primary	190	Phase 2	No	
6	KC088c-1b	1948107.18	5792221.31	Primary	96	Phase 3	Yes	Not over 120pg/g and within UCL target.
6	KC088c-2	1948109.089	5792225.698	Primary	51	Phase 2	Yes	
6	KC088c-3	1948109.816	5792230.752	Primary	45	Phase 2	Yes	
6	KC089a	1948136.598	5792220.329	Primary	120	Phase 1	Yes	Not over 120pg/g and within UCL target. Area redredged under instruction by Principal.
6	KC090a	1948170.567	5792227.585	Primary	990	Phase 1	No	Excluded from UCL as area was redredged. Phase 2 samples KC090a-1, KC090a-2, KC090a-3
6	KC090a-1	1948170.754	5792219.246	Primary	59	Phase 2	Yes	
6	DUPE01-20012019 (Duplicate KC090a-1)	1948170.754	5792219.246	Duplicate	36	Phase 2	No	Excluded from UCL as primary sample (KC090a-1) has a higher result
6	KC090a-2	1948170.846	5792223.756	Primary	24	Phase 2	Yes	
6	KC090a-3	1948171.582	5792227.53	Primary	28	Phase 2	Yes	
6	KC091a	1948208.128	5792222.104	Primary	26	Phase 1	Yes	
6	KC092a	1948239.119	5792217.096	Primary	23	Phase 1	Yes	
6	KC093a	1948277.373	5792222.918	Primary	23	Phase 1	Yes	
6	DUPE02-27032019 (Duplicate KC093a)	1948277.373	5792222.918	Duplicate	23	Phase 1	No	Excluded from UCL as primary sample (KC093a) has a higher result
6	KC094a	1948307.665	5792218.686	Primary	21	Phase 1	Yes	
6	KC095a	1948338.535	5792214.195	Primary	21	Phase 1	Yes	
6	KC096a	1948377.684	5792218.586	Primary	34	Phase 1	Yes	
6	KC097a	1948408.736	5792217.864	Primary	39	Phase 1	Yes	
6	KC098a	1948448.372	5792208.573	Primary	170	Phase 1	No	Excluded from UCL as area redredged. Phase 2 samples KC098a-1, KC098a-2, KC098a-3
6	DUPE01-16042019 (Duplicate KC098a)	1948448.372	5792208.573	Duplicate	150	Phase 1	No	
6	KC098a-1	1948448.562	5792209.58	Primary	28	Phase 2	Yes	
6	KC098a-2	1948448.102	5,792,213.26	Primary	75	Phase 2	Yes	Not over 120pg/g and within UCL target.
6	KC098a-3	1948448.47	5,792,217.87	Primary	21	Phase 2	Yes	
6	KC099a	1948478.536	5792217.99	Primary	28	Phase 1	Yes	
6	KC100a	1948508.379	5792211.542	Primary	62	Phase 1	Yes	Not over 120pg/g and within UCL target.
6	KC101a	1948537.539	5792205.712	Primary	38	Phase 1	Yes	
6	KC102a	1948567.874	5792213.592	Primary	37	Phase 1	Yes	
6	KC103a	1948608.5	5792207.978	Primary	53	Phase 1	Yes	
6	DUPE02-16042019 (Duplicate KC103a)	1948608.5	5792207.978	Duplicate	37	Phase 1	No	Excluded from UCL as primary sample (KC103a) has a higher result
6	KC104a	1948643.708	5792202.713	Primary	34	Phase 1	Yes	
6	KC105a	1948677.151	5792208.696	Primary	31	Phase 1	Yes	
6	KC106a	1948708.719	5792203.938	Primary	47	Phase 1	Yes	
6	KC107a	1948727.038	5792199.229	Primary	26	Phase 1	Yes	
6	KC108a	1948748.522	5792206.71	Primary	25	Phase 1	Yes	
6	DUPE03-16042019 (Duplicate KC108a)	1948748.522	5792206.71	Duplicate	22	Phase 1	No	Excluded from UCL as primary sample (KC108a) has a higher result
6	KC109a	1948777.805	5792200.991	Primary	41	Phase 1	Yes	
6	KC110a	1948808.154	5792195.344	Primary	66	Phase 1	Yes	Not over 120pg/g and within UCL target.
6	KC111a	1948838.234	5792202.764	Primary	23	Phase 1	Yes	
6	KC112a	1948868.342	5792197.009	Primary	47	Phase 1	Yes	
6	KC113a	1948897.941	5792193.158	Primary	37	Phase 1	Yes	
6	DUPE01-01052019 (Duplicate KC113a)	1948897.941	5792193.158	Duplicate	28	Phase 1	No	Excluded from UCL as primary sample (KC113a) has a higher result
6	KC114a	1948929.016	5792199.006	Primary	23	Phase 1	Yes	
6	KC115a	1948957.008	5792193.46	Primary	28	Phase 1	Yes	
6	KC116a	1948988.661	5792190.697	Primary	29	Phase 1	Yes	
6	KC117a	1949018.134	5792194.966	Primary	22	Phase 1	Yes	
6	KC118a	1949047.364	5792190.778	Primary	28	Phase 1	No	Excluded from UCL as duplicate sample (DUPE02-0152019) has a higher result
6	DUPE02-010519 (Duplicate KC118a)	1949047.364	5792190.778	Duplicate	31	Phase 1	Yes	
6	KC120a	1949107.299	5792194.804	Primary	28	Phase 1	Yes	
6	KC121a	1949146.746	5792189.238	Primary	22	Phase 1	Yes	

Table H1: Summary of Dioxin Data Used to Calculate UCL<sub>95</sub>

EnviroNZ Limited  
Kopeopeo Canal Remediation

Section	Sample number	NZTM X	NZTM Y	Sample Type	Sediment Dioxin (Total PCDD/F I-TEQ - Upperbound) Concentration	Sediment Validation Phase (Phase 1, Phase 2 or Phase 3)	Included in UCL	Comments
7	KC122a	1949176.522	5792178.218	Primary	20	Phase 1	No	Excluded from UCL as duplicate sample (DUPE02-20052019) has a higher result
7	DUPE02-200519 (Duplicate KC122a)	1949176.522	5792178.218	Duplicate	21	Phase 1	Yes	
7	KC123a	1949205.319	5792197.289	Primary	36	Phase 1	Yes	
7	KC124a	1949232.754	5792218.172	Primary	59	Phase 1	Yes	
7	KC125a	1949257.39	5792242.005	Primary	20	Phase 1	Yes	
7	KC126a	1949270.756	5792272.925	Primary	46	Phase 1	Yes	
7	CS3-HA01	1949358.13	5792243.37	Primary	25	Phase 1	Yes	Pump Channel
7	CS3-HA02	1949337.25	5792253.13	Primary	25	Phase 1	Yes	Pump Channel
7	CS3-HA03	1949325.61	5792265.98	Primary	25	Phase 1	Yes	Pump Channel
7	KC127a	1949304.769	5792290.34	Primary	32	Phase 1	No	Excluded from UCL as duplicate sample (DUPE03-20052019) has a higher result
7	DUPE03-200519 (Duplicate KC127a)	1949304.769	5792290.34	Duplicate	33	Phase 1	Yes	
7	KC128a	1949312.782	5792321.41	Primary	33	Phase 1	Yes	
7	KC129a	1949336.948	5792345.403	Primary	84	Phase 1	Yes	Not over 120pg/g and within UCL target.
7	KC130a	1949363.656	5792367.149	Primary	78	Phase 1	Yes	Not over 120pg/g and within UCL target.
7	KC131a	1949374.53	5792397.762	Primary	34	Phase 1	Yes	
7	KC132a	1949402.862	5792417.299	Primary	20	Phase 1	No	Excluded from UCL as duplicate sample (DUPE01-06052019) has a higher result
7	DUPE01-060519 (Duplicate KC132a)	1949402.862	5792417.299	Duplicate	21	Phase 1	Yes	
7	KC133a	1949429.143	5792439.143	Primary	41	Phase 1	Yes	
7	KC134a	1949447.575	5792466.987	Primary	130	Phase 1	No	Not used in UCL as area redredged. Phase 2 samples KC134a-1, KC134a-2, KC134a-3
7	KC134a-1	1949447.886	5792466.533	Primary	21	Phase 2	Yes	
7	KC134a-2	1949445.513	5792460.56	Primary	20	Phase 2	Yes	
7	KC134a-3	1949451.417	5792457.745	Primary	65	Phase 2	Yes	Not over 120pg/g and within UCL target.
7	KC135a	1949477.909	5792483.217	Primary	49	Phase 1	Yes	
7	KC136a	1949505.174	5792503.835	Primary	38	Phase 1	Yes	
7	KC137a	1949521.606	5792533.835	Primary	45	Phase 1	Yes	
7	DUPE02-060519 (Duplicate KC137a)	1949521.606	5792533.835	Duplicate	40	Phase 1	No	Excluded from UCL as primary sample (KC137a) has a higher result
7	KC138a	1949552.867	5792549.914	Primary	20	Phase 1	Yes	
7	KC139a	1949570.007	5792579.015	Primary	67	Phase 1	Yes	Not over 120pg/g and within UCL target.
7	KC140a	1949599.085	5792595.724	Primary	34	Phase 1	Yes	
7	KC141a	1949631.166	5792608.685	Primary	34	Phase 1	Yes	
7	KC142a	1949653.34	5792634.503	Primary	250	Phase 1	No	Excluded from UCL. Phase 2 samples KC142a-1, KC142a-2, KC142a-3
7	DUPE03-25062019 (Duplicate KC142a)	1949653.34	5792634.503	Duplicate	550	Phase 1	No	
7	KC142a-1	1949658.892	5792627.925	Primary	24	Phase 2	Yes	
7	KC142a-2	1949657.254	5792631.04	Primary	270	Phase 2	No	Not used in UCL as area redredged. Phase 3 sample KC142a-2b
7	DUPE01-02072019 (Duplicate KC142a-2)	1949657.254	5792631.04	Duplicate	290	Phase 2	No	
7	KC142a-2b	1949656.986	5792629.856	Primary	26	Phase 3	Yes	
7	KC142a-3	1949656.187	5792633.9	Primary	270	Phase 2	No	Not used in UCL as area redredged. Phase 3 sample KC142a-3b
7	KC142a-3b	1949656.324	5792630.814	Primary	21	Phase 3	Yes	
7	KC143a	1949684.215	5792650.016	Primary	21	Phase 1	Yes	
7	KC144a	1949700.354	5792678.589	Primary	39	Phase 1	Yes	
7	KC145a	1949728.485	5792697.266	Primary	40	Phase 1	Yes	
7	KC146a	1949760.682	5792709.5	Primary	20	Phase 1	Yes	
7	KC147a	1949784.272	5792733.332	Primary	59	Phase 1	Yes	
7	DUPE02-25062019 (Duplicate KC147a)	1949784.272	5792733.332	Duplicate	48	Phase 1	No	Excluded from UCL as primary sample (KC147a) has a higher result
7	KC148a	1949816.34	5792744.169	Primary	22	Phase 1	Yes	
7	KC149a	1949849.398	5792752.681	Primary	27	Phase 1	Yes	
7	KC150a	1949869.675	5792780.089	Primary	33	Phase 1	Yes	
7	KC151a	1949903.524	5792787.269	Primary	26	Phase 1	Yes	
7	KC152a	1949936.885	5792791.436	Primary	80	Phase 1	Yes	Not over 120pg/g and within UCL target.
7	DUPE01-25062019 (Duplicate KC152a)	1949936.885	5792791.436	Duplicate	80	Phase 1	No	Excluded from UCL as primary sample (KC152a) concentration adopted.
7	KC153a	1949967.209	5792807.662	Primary	96	Phase 1	Yes	Not over 120pg/g and within UCL target.
7	KC154a	1950002.164	5792807.91	Primary	38	Phase 1	Yes	
7	KC155a	1950031.953	5792822.415	Primary	34	Phase 1	Yes	

Note 1	Sediment results reported in units of pg/g I-TEQ
Note 2	Highlighted blue concentrations indicate elevated dioxin concentration >60 pg/g which was used for the 95% UCL calculation
Note 3	Highlighted orange concentrations indicate sample has been excluded from UCL as the duplicate or primary (or redredged sample) concentration was higher and used for the 95% UCL calculation
Note 4	Highlighted green concentrations indicate elevated dioxin concentration >60 pg/g but result was not used for the 95% UCL calculation as additional redredging took place and Phase 2 or Phase 3 validation sampling occurred.

Sediment Dioxin UCL <sub>95</sub> (pg/g I-TEQ)	39
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	A	B	C	D	E	F	G	H	I	J	K	L	
1	<b>UCL Statistics for Uncensored Full Data Sets</b>												
2													
3	User Selected Options												
4	Date/Time of Computation			ProUCL 5.114-Nov-19 10:01:33 AM									
5	From File			WorkSheet.xls									
6	Full Precision			OFF									
7	Confidence Coefficient			95%									
8	Number of Bootstrap Operations			2000									
9													
10													
11	<b>Dioxin</b>												
12													
13	<b>General Statistics</b>												
14	Total Number of Observations				213		Number of Distinct Observations				53		
15									Number of Missing Observations				0
16	Minimum				20		Mean				36.94		
17	Maximum				160		Median				32		
18	SD				18.15		Std. Error of Mean				1.243		
19	Coefficient of Variation				0.491		Skewness				2.619		
20													
21	<b>Normal GOF Test</b>												
22	Shapiro Wilk Test Statistic				0.785		<b>Shapiro Wilk GOF Test</b>						
23	5% Shapiro Wilk P Value				0		Data Not Normal at 5% Significance Level						
24	Lilliefors Test Statistic				0.175		<b>Lilliefors GOF Test</b>						
25	5% Lilliefors Critical Value				0.0611		Data Not Normal at 5% Significance Level						
26	<b>Data Not Normal at 5% Significance Level</b>												
27													
28	<b>Assuming Normal Distribution</b>												
29	<b>95% Normal UCL</b>						<b>95% UCLs (Adjusted for Skewness)</b>						
30	95% Student's-t UCL				39		95% Adjusted-CLT UCL (Chen-1995)				39.23		
31									95% Modified-t UCL (Johnson-1978)				39.03
32													
33	<b>Gamma GOF Test</b>												
34	A-D Test Statistic				5.011		<b>Anderson-Darling Gamma GOF Test</b>						
35	5% A-D Critical Value				0.755		Data Not Gamma Distributed at 5% Significance Level						
36	K-S Test Statistic				0.125		<b>Kolmogorov-Smirnov Gamma GOF Test</b>						
37	5% K-S Critical Value				0.0622		Data Not Gamma Distributed at 5% Significance Level						
38	<b>Data Not Gamma Distributed at 5% Significance Level</b>												
39													
40	<b>Gamma Statistics</b>												
41	k hat (MLE)				5.882		k star (bias corrected MLE)				5.803		
42	Theta hat (MLE)				6.28		Theta star (bias corrected MLE)				6.367		
43	nu hat (MLE)				2506		nu star (bias corrected)				2472		
44	MLE Mean (bias corrected)				36.94		MLE Sd (bias corrected)				15.34		
45									Approximate Chi Square Value (0.05)				2357
46	Adjusted Level of Significance				0.0489						Adjusted Chi Square Value		2357
47													
48	<b>Assuming Gamma Distribution</b>												
49	95% Approximate Gamma UCL (use when n>=50))				38.74		95% Adjusted Gamma UCL (use when n<50)				38.75		
50													
51	<b>Lognormal GOF Test</b>												
52	Shapiro Wilk Test Statistic				0.924		<b>Shapiro Wilk Lognormal GOF Test</b>						
53	5% Shapiro Wilk P Value				1.110E-15		Data Not Lognormal at 5% Significance Level						
54	Lilliefors Test Statistic				0.102		<b>Lilliefors Lognormal GOF Test</b>						



	A	B	C	D	E	F	G	H	I	J	K	L
55	5% Lilliefors Critical Value				0.0611	Data Not Lognormal at 5% Significance Level						
56	<b>Data Not Lognormal at 5% Significance Level</b>											
57												
58	<b>Lognormal Statistics</b>											
59	Minimum of Logged Data				2.996	Mean of logged Data				3.522		
60	Maximum of Logged Data				5.075	SD of logged Data				0.396		
61												
62	<b>Assuming Lognormal Distribution</b>											
63	95% H-UCL				38.41	90% Chebyshev (MVUE) UCL				39.7		
64	95% Chebyshev (MVUE) UCL				41.1	97.5% Chebyshev (MVUE) UCL				43.04		
65	99% Chebyshev (MVUE) UCL				46.86							
66												
67	<b>Nonparametric Distribution Free UCL Statistics</b>											
68	<b>Data do not follow a Discernible Distribution (0.05)</b>											
69												
70	<b>Nonparametric Distribution Free UCLs</b>											
71	95% CLT UCL				38.99	95% Jackknife UCL				39		
72	95% Standard Bootstrap UCL				38.94	95% Bootstrap-t UCL				39.22		
73	95% Hall's Bootstrap UCL				39.37	95% Percentile Bootstrap UCL				38.96		
74	95% BCA Bootstrap UCL				39.1							
75	90% Chebyshev(Mean, Sd) UCL				40.67	95% Chebyshev(Mean, Sd) UCL				42.36		
76	97.5% Chebyshev(Mean, Sd) UCL				44.71	99% Chebyshev(Mean, Sd) UCL				49.31		
77												
78	<b>Suggested UCL to Use</b>											
79	95% Student's-t UCL				39	or 95% Modified-t UCL				39.03		
80												
81	Note: Suggestions regarding the selection of a 95% UCL are provided to help the user to select the most appropriate 95% UCL.											
82	Recommendations are based upon data size, data distribution, and skewness.											
83	These recommendations are based upon the results of the simulation studies summarized in Singh, Maichle, and Lee (2006).											
84	However, simulations results will not cover all Real World data sets; for additional insight the user may want to consult a statistician.											
85												