

**Table A2.1. Summary of primary and secondary data from short-term cadmium toxicity tests. Only LC<sub>50</sub> and EC<sub>50</sub> values were included because they were the only endpoints used for the acute guideline derivation.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident?	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Primary Data</b>																
<b>Amphibian</b>																
<i>Ambystoma gracile</i>	Northwestern salamander	Yes	3 month old larvae	96-h	LC <sub>50</sub>	Mortality	468.4	522	499 - 546	45	6.8	NR but FT	20 ± 1	FT	Nebeker <i>et al.</i> 1995	Met all criteria
<b>Fish</b>																
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Newly hatched	96-h	LC <sub>50</sub>	Mortality	2.9	1.38	1.02 - 1.87	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2); Estimated by linear interpolation.
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	96-h	LC <sub>50</sub>	Mortality	7.9	3.75	2.77 - 5.08	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2); Estimated by linear interpolation.
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	17	8.08	5.96 - 10.9	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	23	10.9	8.07 - 14.8	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Yearling	96-h	LC <sub>50</sub>	Mortality	>67	NC <sup>3</sup>	NC <sup>3</sup>	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus confusus</i>	Shorthead sculpin	Yes	Adult; 30-60 mm	96-h	LC <sub>50</sub>	Mortality	0.93	2.27	1.58 - 3.27	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	48-h	LC <sub>50</sub>	Mortality	8.9	27	17.2 - 42.5	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<b>Fish - Salmonid</b>																
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	Yes	YOY; 15-50 mm; 0.08-1.1 g	96-h	LC <sub>50</sub>	Mortality	1.2	2	1.62 - 2.46	30.5	7.11	>8	11.9	R	Mebane <i>et al.</i> 2012	Met all criteria. From broodstock.
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	Yes	YOY; 15-50 mm; 0.08-1.1 g	96-h	LC <sub>50</sub>	Mortality	0.94	2.3	1.6 - 3.31	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria. Field-collected.

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Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident?	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	Yes	YOY; 15-50 mm; 0.08-1.1 g	96-h	LC <sub>50</sub>	Mortality	1.5	2.38	1.97 - 2.87	32	6.97	>8	12.1	R	Mebane <i>et al.</i> 2012	Met all criteria. From broodstock.
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	96-h	LC <sub>50</sub>	Mortality	3.7	1.76	1.3 - 2.38	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	5.2	2.47	1.82 - 3.35	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported that test was conducted at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Parr	96-h	LC <sub>50</sub>	Mortality	1	2.23	1.61 - 3.08	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Swim-up	96-h	LC <sub>50</sub>	Mortality	1.3	2.89	2.09 - 4.01	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Alevin	96-h	LC <sub>50</sub>	Mortality	>27	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	<0.5	NC <sup>3</sup>	NC <sup>3</sup>	9.2 (8-11)	6.96	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	0.7	4	1.97 - 8.15	9.2 (8-11)	5.68	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	28	160	78.6 - 326	9.2 (8-11)	4.67	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	0.36	0.576	0.475 - 0.697	31.7	7.53	92-100% sat.	8.1	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	0.35	0.588	0.476 - 0.727	30.2	7.56	92-100% sat.	12.1	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	0.35	0.607	0.485 - 0.76	29.3	7.5	92-100% sat.	8	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	0.53	0.876	0.714 - 1.08	30.7	7.43	92-100% sat.	7.6	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	2.07	1.14	0.893 - 1.45	89.3	7.49	92-100% sat.	7.9	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 263-1600mg	120-h	LC <sub>50</sub>	Mortality	0.84	1.42	1.15 - 1.76	30	6.52	92-100% sat.	7.8	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.34	0.831	0.577 - 1.2	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria. Kootenai strain of trout.

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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.93	1.47	1.22 - 1.78	32	7.45	>8	9.5	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.83	1.48	1.17 - 1.88	28.5	7.35	>8	11.1	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.8	1.95	1.36 - 2.81	21	6.59	>8	8.9	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	1.3	2.77	2.03 - 3.77	24	6.67	>8	10	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.48	3.64	1.59 - 8.31	7	6.45	>8	9.8	R	Mebane <i>et al.</i> 2012	Met all criteria. No partial mortality; LC50 estimate is the midpoint of a linear interpolation between the bracketing exposures.
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	0.99	3.96	2.25 - 6.98	13	6.7	>8	10	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 20-40 mm; 0.1-0.5 g	96-h	LC <sub>50</sub>	Mortality	<2.9	NC <sup>3</sup>	NC <sup>3</sup>	30	6.6	>8	10	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Swim-up	96-h	LC <sub>50</sub>	Mortality	1.8	4.01	2.89 - 5.55	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Parr	96-h	LC <sub>50</sub>	Mortality	3.5	7.79	5.62 - 10.8	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Alevin	96-h	LC <sub>50</sub>	Mortality	>26	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	4.7	4.92	4.83 - 5.02	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	1.23	2.14	1.71 - 2.68	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	3.9	2.86	2.52 - 3.24	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	96-h	LC <sub>50</sub>	Mortality	10.1	3.24	2.03 - 5.15	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	0.83	1.37	1.12 - 1.68	30.7	7.43	92-100% sat.	7.6	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	0.83	1.4	1.13 - 1.72	30.2	7.56	92-100% sat.	12.1	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	0.88	1.41	1.16 - 1.7	31.7	7.53	92-100% sat.	8.1	FT	Hansen <i>et al.</i> 2002a	Met all criteria

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<b>Fish - Salmonid (cont.)</b>																
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	0.83	1.44	1.15 - 1.8	29.3	7.5	92-100% sat.	8	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	5.23	2.88	2.26 - 3.67	89.3	7.49	92-100% sat.	7.9	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 76-341mg	120-h	LC <sub>50</sub>	Mortality	2.41	4.08	3.29 - 5.05	30	6.52	92-100% sat.	7.8	FT	Hansen <i>et al.</i> 2002a	Met all criteria
<b>Invertebrate - ALS insect</b>																
<i>Arctopsyche</i> sp.	Caddisfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>458	NC <sup>3</sup>	NC <sup>3</sup>	28	7.1	>8	10.7	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Baetis tricaudatus</i>	Mayfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	16	13.5	12.6 - 14.5	59	7.1	>8	9.7	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Baetis tricaudatus</i>	Mayfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	74	181	126 - 260	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Baetis tricaudatus</i>	Mayfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>444	NC <sup>3</sup>	NC <sup>3</sup>	24	6.9	>8	10	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Chironomus riparius</i>	Midge	Yes	2nd instar larvae	96-h	LC <sub>50</sub>	Mortality	1760	753	533 - 1060	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Chironomus riparius</i>	Midge	Yes	2nd instar larvae	48-h	LC <sub>50</sub>	Mortality	2620	1120	793 - 1580	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	48-h	LC <sub>50</sub>	Mortality	29560	89800	57100 - 141000	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	2nd instar larvae	96-h	LC <sub>50</sub>	Mortality	1680	719	509 - 1020	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	2nd instar larvae	48-h	LC <sub>50</sub>	Mortality	9340	4000	2830 - 5650	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Rhithrogena</i> sp.	Mayfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>50	NC <sup>3</sup>	NC <sup>3</sup>	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Rhithrogena</i> sp.	Mayfly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	157	321	240 - 429	25	7.2	>8	10.4	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Rhithrogena hageni</i>	Mayfly	Yes	Nymphs	96-h	LC <sub>50</sub>	Mortality	10500	11000	10800 - 11100	48 ± 2	7.66 ± 0.1	9.07 ± 0.15	12 ± 0.3	FT	Brinkman and Johnston 2008	Met all criteria
<i>Sweltsa</i> sp.	Stonefly	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>5239	NC <sup>3</sup>	NC <sup>3</sup>	26	7.11	>8	9.2	R	Mebane <i>et al.</i> 2012	Met all criteria

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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod</b>																
<i>Gammarus pulex</i>	Amphipod	Yes	NR	96-h	LC <sub>50</sub>	Mortality	82.1	15.7	7.96 - 30.8	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	48-h	LC <sub>50</sub>	Mortality	494	94.2	47.9 - 185	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	96-h	LC <sub>50</sub>	Mortality	2.8	8.51	5.41 - 13.4	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	48-h	LC <sub>50</sub>	Mortality	5.6	17	10.8 - 26.8	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<b>Invertebrate - Cladoceran</b>																
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	48-h	LC <sub>50</sub>	Mortality	60.6	37.3	30.7 - 45.5	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	48-h	LC <sub>50</sub>	Mortality	63.9	39.4	32.3 - 48	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	48-h	LC <sub>50</sub>	Mortality	68.3	42.1	34.5 - 51.3	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	24-h	LC <sub>50</sub>	Mortality	77	47.5	39 - 57.8	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	24-h	LC <sub>50</sub>	Mortality	78	48.1	39.5 - 58.6	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	< 24-h old	24-h	LC <sub>50</sub>	Mortality	85.9	52.9	43.5 - 64.5	80	8.48	7.92	25	S	Black 2001	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	31.47	39.6	36.1 - 43.5	40	7.4 ± 0.07	91.4 ± 2.4 % sat.	20 ± 1	S	Shaw <i>et al.</i> 2006	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	96-h	LC <sub>50</sub>	Mortality	16.9	51.3	32.6 - 80.8	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	48-h	LC <sub>50</sub>	Mortality	63.1	192	122 - 302	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia ambigua</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	10.12	12.7	11.6 - 14	40	7.4 ± 0.07	91.4 ± 2.4 % sat.	20 ± 1	S	Shaw <i>et al.</i> 2006	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	36	73.5	54.9 - 98.4	25	7.8	7.5-9.0	20 ± 0.5	R	Schuytema <i>et al.</i> 1984	Met all criteria. The renewal beaker was considered to have a "recirculating device."
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	62	127	94.6 - 169	25	7.5	7.5-9.0	20 ± 0.5	R	Schuytema <i>et al.</i> 1984	Met all criteria. The renewal beaker was considered to have a "recirculating device."
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	101.16	127	116 - 140	40	7.4 ± 0.07	91.4 ± 2.4 % sat.	20 ± 1	S	Shaw <i>et al.</i> 2006	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	96-h	LC <sub>50</sub>	Mortality	12.7	8.03	6.66 - 9.68	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	48-h	LC <sub>50</sub>	Mortality	26.4	16.7	13.9 - 20.1	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria

**Table A2.1. Summary of primary and secondary data from short-term cadmium toxicity tests. Only LC<sub>50</sub> and EC<sub>50</sub> values were included because they were the only endpoints used for the acute guideline derivation.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident?	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia pulex</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	44.96	56.6	51.5 - 62.1	40	7.4 ± 0.07	91.4 ± 2.4 % sat.	20 ± 1	S	Shaw <i>et al.</i> 2006	Met all criteria
<i>Simocephalus serrulatus</i>	Water flea	Yes	Adult	96-h	LC <sub>50</sub>	Mortality	7	33	17.5 - 62.1	11.1	6.5	>80% sat.	22 ± 2	S	Giesy <i>et al.</i> 1977	Met all criteria. Well water used.
<i>Simocephalus serrulatus</i>	Water flea	Yes	Adult	96-h	LC <sub>50</sub>	Mortality	35	184	93.4 - 361	10	5.6	>80% sat.	22 ± 2	S	Giesy <i>et al.</i> 1977	Met all criteria. Water from Skinface pond used. Hypothesis that more DOC in this water reduced Cd toxicity (Cd binds to DOC).
<b>Invertebrate - Decapod</b>																
<i>Orconectes virilis</i>	Crayfish	Yes	Intermolt (adult)	96-h	LC <sub>50</sub>	Mortality	6100	12000	9090 - 15700	26 (24-28)	6.9 (6.7-7.0)	8.4 (8.1-8.6)	20 (19-21)	FT	Mirenda 1986	Met all criteria
<b>Invertebrate - Mussel</b>																
<i>Lampsilis rafinesqueana</i>	Neosho mucket	No	Juvenile (5-d old)	96-h	LC <sub>50</sub>	Mortality	20	23.9	22.2 - 25.8	42 ± 1.8	7.8 ± 0.1	>7.0	20 ± 1	R	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (5-d old)	96-h	LC <sub>50</sub>	Mortality	16	19.1	17.8 - 20.6	42 ± 3.2	8.1 ± 0.1	>7.0	20 ± 1	R	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Glochidia	48-h	LC <sub>50</sub>	Mortality	>33	NC <sup>3</sup>	NC <sup>3</sup>	48 ± 4	8.0 ± 0.2	>7.0	20 ± 1	S	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (5-d old)	96-h	LC <sub>50</sub>	Mortality	>34	NC <sup>3</sup>	NC <sup>3</sup>	40	7.9	>7.0	20 ± 1	R	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	96-h	LC <sub>50</sub>	Mortality	>62	NC <sup>3</sup>	NC <sup>3</sup>	40 ± 2.2	8.0 ± 0.1	>7.0	20 ± 1	R	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (6 month old)	96-h	LC <sub>50</sub>	Mortality	199	232	218 - 248	43 ± 1.2	7.8 ± 0.1	>7.0	20 ± 1	R	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Glochidia	48-h	LC <sub>50</sub>	Mortality	>227	NC <sup>3</sup>	NC <sup>3</sup>	46 ± 5.2	7.9 ± 0.1	>7.0	20 ± 1	S	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	96-h	EC <sub>50</sub>	Dead and stressed	72	24	15.4 - 37.6	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	96-h	LC <sub>50</sub>	Mortality	82	27.4	17.5 - 42.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	48-h	EC <sub>50</sub>	Dead and stressed	91	29.6	18.7 - 46.7	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (7-d old)	48-h	EC <sub>50</sub>	Dead and stressed	107	34.7	22 - 55	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria

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Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident?	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Mussel (cont.)</b>																
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	48-h	LC <sub>50</sub>	Mortality	141	45.8	28.9 - 72.4	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (7-d old)	48-h	LC <sub>50</sub>	Mortality	166	53.9	34.1 - 85.3	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (14-d old)	48-h	EC <sub>50</sub>	Dead and stressed	291	94.5	59.7 - 149	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (14-d old)	48-h	LC <sub>50</sub>	Mortality	345	112	70.8 - 177	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Glochidia	48-h	LC <sub>50</sub>	Mortality	>1000	NC <sup>3</sup>	NC <sup>3</sup>	149 ± 6.3	8.4 ± 0.1	8.4 ± 0.1	21.4 ± 0.5	S	Lasee 1991	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	96-h	LC <sub>50</sub>	Mortality	50.8	29.8	23.9 - 37	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	96-h	LC <sub>50</sub>	Mortality	55.5	32.5	26.2 - 40.4	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	96-h	LC <sub>50</sub>	Mortality	67	39.3	31.6 - 48.8	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	94.9	55.6	44.7 - 69.2	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	104	60.9	49 - 75.8	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Lasmigona subviridis</i>	Mussel	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	123	72.1	58 - 89.6	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Ligumia subrostrata</i>	Mussel	No	Glochidia	24-h	LC <sub>50</sub>	Mortality	720	393	307 - 503	80-100	7.6 - 7.8	7.0 - 8.0	23 ± 2	S	Clem 1998	Met all criteria
<i>Ptychobranthus occidentalis</i>	Mussel	No	Glochidia	24-h	LC <sub>50</sub>	Mortality	339	185	145 - 237	80-100	7.6 - 7.8	7.0 - 8.0	23 ± 2	S	Clem 1998	Met all criteria
<i>Utterbackia imbecillis</i>	Paper	No	Juvenile	96-h	LC <sub>50</sub>	Mortality	19.1	11.2	9 - 13.9	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Utterbackia imbecillis</i>	Paper	No	Juvenile	96-h	LC <sub>50</sub>	Mortality	21.7	12.7	10.2 - 15.8	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Utterbackia imbecillis</i>	Paper	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	63.8	37.4	30.1 - 46.5	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Utterbackia imbecillis</i>	Paper	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	66.5	39	31.3 - 48.5	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<i>Utterbackia imbecillis</i>	Paper	No	Juvenile	48-h	LC <sub>50</sub>	Mortality	82.7	48.5	39 - 60.3	84	8.03	7.98	24.9	R	Black 2001	Met all criteria
<b>Invertebrate - Snail</b>																
<i>Gyraulus</i> sp.	Snail	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>73	NC <sup>3</sup>	NC <sup>3</sup>	21	7.15	>8	10.8	R	Mebane <i>et al.</i> 2012	Met all criteria
<i>Gyraulus</i> sp.	Snail	Yes	NR	96-h	LC <sub>50</sub>	Mortality	>455	NC <sup>3</sup>	NC <sup>3</sup>	24	7.1	>8	8.8	R	Mebane <i>et al.</i> 2012	Met all criteria

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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Secondary Data</b>																
<b>Fish</b>																
<i>Morone saxatilis</i>	Striped bass	Yes	63-d old	96-h	LC <sub>50</sub>	Mortality	10	1.67	0.802 - 3.46	285	7.9	Aerated	20 ± 2	S	Palawski 1985	Nominal concentrations used and possibly pseudoreplication (replication was unclear - could have had multiple tanks as they said they followed standard methods).
<i>Morone saxatilis</i>	Striped bass	Yes	63-d old	96-h	LC <sub>50</sub>	Mortality	4	5.03	4.58 - 5.53	40	8.1	Aerated	20 ± 2	S	Palawski 1985	Nominal concentrations used and possibly pseudoreplication (replication was unclear - could have had multiple tanks as they said they followed standard methods).
<i>Morone saxatilis</i>	Striped bass	Yes	63-d old	96-h	LC <sub>50</sub>	Mortality	75	7.71	3.05 - 19.5	455	7.9	Aerated	20 ± 2	S	Palawski 1985	Nominal concentrations used and possibly pseudoreplication (replication was unclear - could have had multiple tanks as they said they followed standard methods).
<b>Fish - Salmonid</b>																
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	3.4	4.17	3.84 - 4.53	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	Alevin	96-h	LC <sub>50</sub>	Mortality	6	7.36	6.77 - 8	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	1.5	1.84	1.69 - 2	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Alevin	96-h	LC <sub>50</sub>	Mortality	37.9	46.5	42.8 - 50.5	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	96-h	LC <sub>50</sub>	Mortality	5.92	0.658	0.269 - 1.61	422	6.96	8.1	13.3	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	96-h	LC <sub>50</sub>	Mortality	6.57	1.4	0.747 - 2.63	224	7.03	8.3	13.4	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals).



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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	96-h	LC <sub>50</sub>	Mortality	3.08	3.14	3.12 - 3.17	49	6.98	8.2	13.5	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals).
<i>Thymallus arcticus</i>	Arctic grayling	Yes	Juvenile	96-h	LC <sub>50</sub>	Mortality	4	4.91	4.51 - 5.33	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<i>Thymallus arcticus</i>	Arctic grayling	Yes	Alevin	96-h	LC <sub>50</sub>	Mortality	6.1	7.48	6.88 - 8.13	41 (40-43)	7.1-8.0	>40% sat.	12 ± 1	S	Buhl and Hamilton 1991	Pseudoreplication
<b>Invertebrate - Amphipod</b>																
<i>Gammarus pulex</i>	Amphipod	Yes	Females with empty brood pouches, carrying unfertilized or stage 1 eggs	48-h	LC <sub>50</sub>	Mortality	21	10.9	8.33 - 14.2	94.6 ± 7.2	7.7 ± 0.8	9.81 ± 0.8	11 ± 0.2	R	McCahon and Pascoe 1988	Assumed pseudoreplication because it wasn't clear about the number of replicates.
<i>Gammarus pulex</i>	Amphipod	Yes	Sexually mature males	96-h	LC <sub>50</sub>	Mortality	30	15.6	11.9 - 20.3	94.6 ± 7.2	7.7 ± 0.8	9.81 ± 0.8	11 ± 0.2	R	McCahon and Pascoe 1988	Assumed pseudoreplication because it wasn't clear about the number of replicates.
<i>Gammarus pulex</i>	Amphipod	Yes	Females with empty brood pouches, carrying unfertilized or stage 1 eggs	24-h	LC <sub>50</sub>	Mortality	100	51.9	39.7 - 67.8	94.6 ± 7.2	7.7 ± 0.8	9.81 ± 0.8	11 ± 0.2	R	McCahon and Pascoe 1988	Assumed pseudoreplication because it wasn't clear about the number of replicates.
<i>Gammarus pulex</i>	Amphipod	Yes	Females carrying eggs in stages 2-6 or embryos	48-h	LC <sub>50</sub>	Mortality	140	72.6	55.5 - 94.9	94.6 ± 7.2	7.7 ± 0.8	9.81 ± 0.8	11 ± 0.2	R	McCahon and Pascoe 1988	Assumed pseudoreplication because it wasn't clear about the number of replicates.
<i>Gammarus pulex</i>	Amphipod	Yes	Sexually mature males	48-h	LC <sub>50</sub>	Mortality	210	109	83.3 - 142	94.6 ± 7.2	7.7 ± 0.8	9.81 ± 0.8	11 ± 0.2	R	McCahon and Pascoe 1988	Assumed pseudoreplication because it wasn't clear about the number of replicates.

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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran</b>																
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	>36	NC <sup>3</sup>	NC <sup>3</sup>	25	7.8	7.5-9.0	20 ± 0.5	S	Schuytema <i>et al.</i> 1984	A static test and Cd concentrations and water quality weren't measured at beginning and end.
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	24	49	36.6 - 65.6	25	6.6	7.5-9.0	20 ± 0.5	S	Schuytema <i>et al.</i> 1984	Static test; Cd concentrations and water quality weren't measured at beginning and end. Beaker had "poor Cd precision due to chemical or matrix interference."
<i>Daphnia magna</i>	Water flea	Yes	≤ 24-h old	48-h	LC <sub>50</sub>	Mortality	40	81.7	61.1 - 109	25	6.7	7.5-9.0	20 ± 0.5	S	Schuytema <i>et al.</i> 1984	A static test and Cd concentrations and water quality weren't measured at beginning and end. Beaker had "poor Cd precision due to chemical or matrix interference."
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	26	7.37	4.41 - 12.3	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	35	9.92	5.94 - 16.6	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	40	11.3	6.78 - 19	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	50	14.2	8.48 - 23.7	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.

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							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	55	15.6	9.33 - 26.1	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	63	17.9	10.7 - 29.9	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	100	28.4	17 - 47.4	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<i>Daphnia magna</i>	Water flea	Yes	Neonates	48-h	LC <sub>50</sub>	Mortality	>120	NC <sup>3</sup>	NC <sup>3</sup>	160-180	<8	NR	18-22	S	Ward and Robinson 2005	O <sub>2</sub> not reported, but everything else was done well; stated ASTM and EPA methods were followed, so O <sub>2</sub> levels were probably ok. Study ran 8 tests with 8 genetic strains.
<b>Invertebrate - Hydra</b>																
<i>Hydra viridissima</i>	Hydra (green)	Yes	Nonbudding hydra	96-h	LC <sub>50</sub>	Mortality	3	7.91	5.33 - 11.8	19-20	7.25-7.53	7.73-9.44	22.5-24.5	S	Holdway <i>et al.</i> 2001	Nominal concentrations used.
<i>Hydra vulgaris</i>	Hydra (pink)	Yes	Nonbudding hydra	96-h	LC <sub>50</sub>	Mortality	82.5	218	147 - 323	19-20	7.25-7.53	7.73-9.44	22.5-24.5	S	Holdway <i>et al.</i> 2001	Nominal concentrations used.
<b>Invertebrate - Mussel</b>																
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Glochidia	48-h	LC <sub>50</sub>	Mortality	>8	NC <sup>3</sup>	NC <sup>3</sup>	56 ± 0.6	7.9 ± 0.1	>7.0	20 ± 1	S	Wang <i>et al.</i> 2010	Cd concentrations not measured (nominal values used).

ALS = aquatic life stage; B.C. = British Columbia; d = day; DO = dissolved oxygen; dph = days post-hatch; EC = effect concentration; FT = flow-through; h = hour; LC = lethal concentration; LOEC = Lowest Observed Effect Concentration; NA = not applicable; NC = not calculable; NR = not reported; R = renewal; S = static; Sat = saturation; Temp = temperature; YOY = young-of-year.

<sup>1</sup> Effect concentration normalized to a hardness of 50 mg CaCO<sub>3</sub>/L using the equation  $EC_x = e^{((\ln 50 - \ln(\text{original hardness})) * 1.03) + \ln(EC_x \text{ original})}$

<sup>2</sup> 95% confidence limits of the predicted range of the effect concentrations based on the derived confidence interval of the estimated slope.

<sup>3</sup> Only effect values that were defined numbers (i.e., not a > or < value) were normalized to a hardness of 50 mg CaCO<sub>3</sub>/L.

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Primary Data</b>																
<b>Algae</b>																
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>10</sub>	Growth Rate	6	6.36	6.26 - 6.46	46.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>10</sub>	Growth Rate	8.5	19.5	15.7 - 24.1	16.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>10</sub>	Growth Rate	2.8	20.3	12.2 - 33.7	3.4	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>20</sub>	Growth Rate	22	23.3	23 - 23.7	46.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>20</sub>	Growth Rate	4.3	31.1	18.7 - 51.9	3.4	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>10</sub>	Growth Rate	7.5	34.9	23.4 - 51.8	6.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>20</sub>	Growth Rate	16.2	37.1	30 - 46	16.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>20</sub>	Growth Rate	12.8	59.5	40 - 88.5	6.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>50</sub>	Growth Rate	9.4	68	40.8 - 113	3.4	6.5	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>50</sub>	Growth Rate	43	98.6	79.6 - 122	16.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>50</sub>	Growth Rate	29	135	90.6 - 200	6.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<i>Pseudokirchneriella subcapitata</i>	Green algae	Yes	NA	72-h	EC <sub>50</sub>	Growth Rate	199	211	208 - 214	46.2	6.7	NR (plant)	21 ± 1	S	Källqvist	Met all criteria
<b>Amphibian</b>																
<i>Ambystoma gracile</i>	Northwestern salamander	Yes	3 month old larvae	24-d	NOEC	Growth (weight & weight)	48.9	52.8	51.8 - 53.9	45	6.8	NR but FT	20 ± 1	FT	Nebeker <i>et al.</i> 1995	Met all criteria
<i>Ambystoma gracile</i>	Northwestern salamander	Yes	3 month old larvae	10-d	NOEC	Growth (weight)	106.3	115	113 - 117	45	6.8	NR but FT	20 ± 1	FT	Nebeker <i>et al.</i> 1995	Met all criteria
<i>Ambystoma gracile</i>	Northwestern salamander	Yes	3 month old larvae	24-d	LOEC	Growth (weight & weight)	193.1	209	205 - 213	45	6.8	NR but FT	20 ± 1	FT	Nebeker <i>et al.</i> 1995	Met all criteria
<i>Ambystoma gracile</i>	Northwestern salamander	Yes	3 month old larvae	10-d	LOEC	Growth (weight)	227.3	246	241 - 251	45	6.8	NR but FT	20 ± 1	FT	Nebeker <i>et al.</i> 1995	Met all criteria
<b>Aquatic Plant</b>																
<i>Lemna minor</i>	Duckweed	Yes	NA	7-d	EC <sub>50</sub>	Growth Rate	214	88.5	70.4 - 111	166	5.5 ± 0.2	NR (plant)	25 ± 2	S	Drost <i>et al.</i> 2007	Met all criteria
<i>Lemna minor</i>	Duckweed	Yes	NA	72-h	EC <sub>50</sub>	Growth Rate	393	162	129 - 204	166	5.5 ± 0.2	NR (plant)	25 ± 2	S	Drost <i>et al.</i> 2007	Met all criteria
<b>Fish</b>																
<i>Acipenser transmontanus</i>	White sturgeon	Yes	ELS (embryo/ larvae)	27-d (19 dph)	LC <sub>20</sub>	Mortality	8.7	6.79	6.37 - 7.24	70 ± 9.8	7.9 ± 0.2	8.9 ± 0.9	15 ± 0.5	FT	Vardy <i>et al.</i> 2011	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish (cont.)</b>																
<i>Acipenser transmontanus</i>	White sturgeon	Yes	ELS (embryo/larvae)	27-d (19 dph)	LC <sub>50</sub>	Mortality	21.4	16.7	15.7 - 17.8	70 ± 9.8	7.9 ± 0.2	8.9 ± 0.9	15 ± 0.5	FT	Vardy <i>et al.</i> 2011	Met all criteria
<i>Catostomus commersoni</i>	White sucker	Yes	ELS (embryo/larvae)	40-d	NOEC	Biomass	4.2	4.54	4.45 - 4.63	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	18.1 (13.1-21.0)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Catostomus commersoni</i>	White sucker	Yes	ELS (embryo/larvae)	40-d	LOEC	Biomass	12	13	12.7 - 13.2	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	18.1 (13.1-21.0)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	NOEC	Biomass	0.59	0.347	0.302 - 0.398	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	NOEC	Mortality	0.59	0.347	0.302 - 0.398	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	14-d	NOEC	Mortality	1.3	0.764	0.666 - 0.876	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	LOEC	Biomass	1.3	0.764	0.666 - 0.876	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	LOEC	Mortality	1.3	0.764	0.666 - 0.876	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	NOEC	Mortality	1.4	0.822	0.717 - 0.944	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	LC <sub>50</sub>	Mortality	1.73	1.02	0.886 - 1.17	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	21-d	EC <sub>50</sub>	Biomass	1.77	1.04	0.906 - 1.19	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	14-d	LC <sub>50</sub>	Mortality	2.02	1.19	1.03 - 1.36	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish (cont.)</b>																
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	EC <sub>50</sub>	Biomass	2.4	1.41	1.23 - 1.62	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	LOEC	Mortality	2.6	1.53	1.33 - 1.75	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	NOEC	Biomass	2.6	1.53	1.33 - 1.75	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	14-d	LOEC	Mortality	2.7	1.59	1.38 - 1.82	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	LC <sub>50</sub>	Mortality	2.9	1.7	1.49 - 1.95	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Cottus bairdi</i>	Mottled sculpin	Yes	Swim-up	28-d	LOEC	Biomass	5.3	3.11	2.71 - 3.57	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Esox lucius</i>	Northern pike	Yes	ELS (embryo/larvae)	35-d	NOEC	Biomass	4.2	4.54	4.45 - 4.63	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	15.9 (15.0-16.7)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Esox lucius</i>	Northern pike	Yes	ELS (embryo/larvae)	35-d	LOEC	Biomass	12.9	13.9	13.7 - 14.2	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	15.9 (15.0-16.7)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Growth	NC	NC	NC	261	8.37 - 8.56	6.9 - 8.7	19.2 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Growth	NC	NC	NC	272	8.36 - 8.50	7.3 - 8.7	20.8 - 24.2	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Growth	NC	NC	NC	273	8.19 - 8.48	7.3 - 8.3	21.5 - 25	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Growth	NC	NC	NC	285	8.35 - 8.55	7.6 - 8.9	20.1 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Survival	NC	NC	NC	273	8.19 - 8.48	7.3 - 8.3	21.5 - 25	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Survival	NC	NC	NC	292	8.39 - 8.60	7.3 - 8.6	20.8 - 24.4	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Growth	NC	NC	NC	272	8.36 - 8.50	7.3 - 8.7	20.8 - 24.2	R	Castillo and Longley 2001	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish (cont.)</b>																
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Growth	6.9	1.88	1.35 - 2.63	292	8.39 - 8.60	7.3 - 8.6	20.8 - 24.4	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Growth	8	2.18	1.56 - 3.05	292	8.39 - 8.60	7.3 - 8.6	20.8 - 24.4	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Survival	>8.0	NC <sup>3</sup>	NC <sup>3</sup>	292	8.39 - 8.60	7.3 - 8.6	20.8 - 24.4	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Survival	11.3	3.14	2.25 - 4.37	285	8.35 - 8.55	7.6 - 8.9	20.1 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Survival	11.5	3.41	2.49 - 4.66	261	8.37 - 8.56	6.9 - 8.7	19.2 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Survival	12.2	3.51	2.54 - 4.84	272	8.36 - 8.50	7.3 - 8.7	20.8 - 24.2	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LC <sub>50</sub>	Mortality	15.43	4.29	3.08 - 5.97	285	8.35 - 8.55	7.6 - 8.9	20.1 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Survival	16.5	4.58	3.29 - 6.38	285	8.35 - 8.55	7.6 - 8.9	20.1 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Growth	>16.5	NC <sup>3</sup>	NC <sup>3</sup>	285	8.35 - 8.55	7.6 - 8.9	20.1 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LC <sub>50</sub>	Mortality	16.99	4.88	3.54 - 6.74	272	8.36 - 8.50	7.3 - 8.7	20.8 - 24.2	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Survival	17.9	5.15	3.73 - 7.1	272	8.36 - 8.50	7.3 - 8.7	20.8 - 24.2	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Growth	>21.9	NC <sup>3</sup>	NC <sup>3</sup>	273	8.19 - 8.48	7.3 - 8.3	21.5 - 25	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Survival	>21.9	NC <sup>3</sup>	NC <sup>3</sup>	273	8.19 - 8.48	7.3 - 8.3	21.5 - 25	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	LOEC	Survival	21.3	6.31	4.61 - 8.64	261	8.37 - 8.56	6.9 - 8.7	19.2 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	Larvae (4-6 days old)	7-d	NOEC	Growth	>21.3	NC <sup>3</sup>	NC <sup>3</sup>	261	8.37 - 8.56	6.9 - 8.7	19.2 - 24.1	R	Castillo and Longley 2001	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	10-d	NOEC	Survival	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	10-d	LC <sub>50</sub>	Mortality	1.6	3.54	2.88 - 4.34	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	10-d	LOEC	Growth	>2	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	10-d	LOEC	Survival	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish (cont.)</b>																
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	10-d	NOEC	Growth	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	14-d	NOEC	Survival	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	14-d	LC <sub>50</sub>	Mortality	2.3	5.09	4.15 - 6.25	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	14-d	LOEC	Growth	>3	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	14-d	LOEC	Survival	3	6.64	5.41 - 8.15	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	14-d	NOEC	Growth	3	6.64	5.41 - 8.15	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	7-d	NOEC	Survival	4	8.85	7.21 - 10.9	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	7-d	LC <sub>50</sub>	Mortality	4.4	9.73	7.93 - 11.9	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Pimephales promelas</i>	Fathead minnow	Yes	NR	7-d	LOEC	Survival	6	13.3	10.8 - 16.3	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<b>Fish - Salmonid</b>																
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	27-d	NOEC	Biomass	1.3	1.4	1.38 - 1.43	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.1 (8.5-10.7)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Lake Superior strain.
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	27-d	LOEC	Biomass	3.4	3.67	3.6 - 3.75	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.1 (8.5-10.7)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Lake Superior strain.
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	47-d	NOEC	Biomass	4.1	4.43	4.34 - 4.52	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria. West coast strain.
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	82-d	NOEC	Biomass	4.1	4.43	4.34 - 4.52	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria. West coast strain.
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	47-d	LOEC	Biomass	12.5	13.5	13.2 - 13.8	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria. West coast strain.
<i>Oncorhynchus kisutch</i>	Coho salmon	Yes	ELS (embryo/larvae)	82-d	LOEC	Biomass	12.5	13.5	13.2 - 13.8	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria. West coast strain.



**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	28-d	NOEC	Biomass	1.3	0.764	0.666 - 0.876	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	28-d	NOEC	Mortality	1.3	0.764	0.666 - 0.876	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	28-d	LOEC	Biomass	2.7	1.59	1.38 - 1.82	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	28-d	LOEC	Mortality	2.7	1.59	1.38 - 1.82	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Swim-up	28-d	LC <sub>50</sub>	Mortality	5.5	3.23	2.82 - 3.71	103	8.24	9.2	18.5	FT	Besser <i>et al.</i> 2007	Met all criteria. Reported test was run at 12°C but water temp was measured to have mean = 18.5°C (Table S-2).
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Parr	200-h	LC <sub>10</sub>	Mortality	0.7	1.24	1.07 - 1.44	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Parr	200-h	LC <sub>50</sub>	Mortality	0.9	1.59	1.38 - 1.85	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Swim-up	200-h	LC <sub>10</sub>	Mortality	1	1.77	1.53 - 2.05	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Swim-up	200-h	LC <sub>50</sub>	Mortality	1.3	2.3	1.99 - 2.67	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Alevin	186-h	LC <sub>10</sub>	Mortality	>6	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Alevin	186-h	LC <sub>50</sub>	Mortality	>27	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	7-d	LC <sub>50</sub>	Mortality	<0.5	NC <sup>3</sup>	NC <sup>3</sup>	9.2 (8-11)	6.96	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	7-d	LC <sub>50</sub>	Mortality	0.7	2.43	1.76 - 3.36	9.2 (8-11)	5.68	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Steelhead	Yes	Fry	7-d	LC <sub>50</sub>	Mortality	6.3	21.9	15.9 - 30.2	9.2 (8-11)	4.67	>90% sat.	14.5-17	FT	Cusimano <i>et al.</i> 1986	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (1.4g)	30-d	NOEC	Mortality	3	1.41	1.16 - 1.71	140	8	Aerated	14	FT	Hollis <i>et al.</i> 1999	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (1.4g)	30-d	LOEC	Mortality	10	4.69	3.85 - 5.7	140	8	Aerated	14	FT	Hollis <i>et al.</i> 1999	Met all criteria. All mortality occurred in first 3 days and then ceased.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (1.4g)	30-d	NOEC	Growth	10	4.69	3.85 - 5.7	140	8	Aerated	14	FT	Hollis <i>et al.</i> 1999	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (5.6g)	30-d	NOEC	Growth Rate	0.11	0.216	0.181 - 0.257	20	7.2	Aerated	17	FT	Hollis <i>et al.</i> 2000a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (5.6g)	30-d	NOEC	Mortality	0.11	0.216	0.181 - 0.257	20	7.2	Aerated	17	FT	Hollis <i>et al.</i> 2000a	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	30-d	NOEC	Mortality	1.6	0.83	0.7 - 0.983	122	7.2	Aerated	13	FT	Hollis <i>et al.</i> 2000b	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	30-d	NOEC	Mortality	1.6	1.39	1.34 - 1.44	60.4	7.2	Aerated	13	FT	Hollis <i>et al.</i> 2000b	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	30-d	LOEC	Mortality	3.2	3.19	3.18 - 3.19	50.3	7.2	Aerated	13	FT	Hollis <i>et al.</i> 2000b	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile	30-d	LOEC	Mortality	3	4.71	4.19 - 5.29	27.1	7.2	Aerated	13	FT	Hollis <i>et al.</i> 2000b	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	EC <sub>10</sub>	Weight	0.15	0.222	0.2 - 0.245	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	LOEC	Length	0.16	0.237	0.214 - 0.262	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	LOEC	Weight	0.16	0.237	0.214 - 0.262	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	MATC	Length	<0.16	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	MATC	Weight	<0.16	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	NOEC	Length	<0.16	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	NOEC	Weight	<0.16	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	53-d	NOEC	Mortality	0.6	1.19	0.998 - 1.42	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	NOEC	Mortality	1	1.48	1.34 - 1.64	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	53-d	LC <sub>10</sub>	Mortality	0.82	1.63	1.36 - 1.94	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	53-d	MATC	Mortality	0.88	1.75	1.46 - 2.08	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	LC <sub>10</sub>	Mortality	0.89	1.77	1.48 - 2.11	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	LC <sub>10</sub>	Mortality	1.6	2.37	2.14 - 2.62	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	MATC	Mortality	1.6	2.37	2.14 - 2.62	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	53-d	LC <sub>20</sub>	Mortality	1.2	2.38	2 - 2.84	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	LC <sub>20</sub>	Mortality	1.2	2.38	2 - 2.84	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	53-d	LOEC	Mortality	1.3	2.58	2.16 - 3.08	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	EC <sub>10</sub>	Weight	1.3	2.58	2.16 - 3.08	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	LOEC	Mortality	1.3	2.58	2.16 - 3.08	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	MATC	Mortality	<1.3	NC <sup>3</sup>	NC <sup>3</sup>	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	NOEC	Mortality	<1.3	NC <sup>3</sup>	NC <sup>3</sup>	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	NOEC	Weight	1.3	2.58	2.16 - 3.08	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	LC <sub>20</sub>	Mortality	2.2	3.25	2.94 - 3.6	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	EC <sub>20</sub>	Weight	1.8	3.57	2.99 - 4.26	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	EC <sub>10</sub>	Length	>2.5	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	EC <sub>20</sub>	Length	>2.5	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	EC <sub>20</sub>	Weight	>2.5	NC <sup>3</sup>	NC <sup>3</sup>	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	62-d	LOEC	Mortality	2.5	3.7	3.34 - 4.09	29.4 ± 3.6	7.19 ± 0.3	9.2 ± 0.9	12.5 ± 0.9	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	MATC	Weight	1.9	3.77	3.16 - 4.5	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	EC <sub>10</sub>	Length	2.6	5.16	4.32 - 6.16	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	LOEC	Weight	2.9	5.76	4.82 - 6.87	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	NOEC	Length	2.9	5.76	4.82 - 6.87	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	MATC	Length	4.4	8.73	7.32 - 10.4	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	EC <sub>20</sub>	Length	6.8	13.5	11.3 - 16.1	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	ELS	69-d	LOEC	Length	6.9	13.7	11.5 - 16.3	19.7 ± 1.5	6.75 ± 0.4	10.2 ± 0.7	9.8 ± 0.6	FT	Mebane <i>et al.</i> 2008	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Alevin	200-h	LC <sub>10</sub>	Mortality	18-26	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Swim-up	200-h	LC <sub>10</sub>	Mortality	1.2	2.13	1.83 - 2.46	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Parr	200-h	LC <sub>10</sub>	Mortality	1.3	2.3	1.99 - 2.67	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Swim-up	200-h	LC <sub>50</sub>	Mortality	1.6	2.83	2.44 - 3.28	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Parr	200-h	LC <sub>50</sub>	Mortality	2	3.54	3.06 - 4.11	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	Alevin	200-h	LC <sub>50</sub>	Mortality	>26	NC <sup>3</sup>	NC <sup>3</sup>	23 ± 1	~ 7.1	10.2 ± 0.3	12.2 ± 0.4	FT	Chapman 1978	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	ELS	120-d	NOEC	Mortality	1.3	2.14	1.88 - 2.43	25.4 ± 3.9	7.32 ± 0.07	10.15 ± 0.32	12.2 ± 0.4	NR	Chapman 1982	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	ELS	120-d	Chronic value	Mortality	1.57	2.58	2.27 - 2.94	25.4 ± 3.9	7.32 ± 0.07	10.15 ± 0.32	12.2 ± 0.4	NR	Chapman 1982	Met all criteria
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Yes	ELS	120-d	LOEC	Mortality	1.9	3.13	2.75 - 3.56	25.4 ± 3.9	7.32 ± 0.07	10.15 ± 0.32	12.2 ± 0.4	NR	Chapman 1982	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	ELS (embryo/fry)	90-d	NOEC	Biomass	0.92	0.951	0.943 - 0.959	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	ELS (embryo/fry)	90-d	IC <sub>20</sub>	Biomass	1.29	1.33	1.32 - 1.34	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	ELS (embryo/fry)	90-d	LOEC	Biomass	1.71	1.77	1.75 - 1.78	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	ELS (embryo/fry)	90-d	NOEC	Survival	1.71	1.77	1.75 - 1.78	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	30-d	NOEC	Biomass	2.41	2.49	2.47 - 2.51	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	30-d	NOEC	Survival	2.41	2.49	2.47 - 2.51	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	30-d	IC <sub>20</sub>	Biomass	3.02	3.12	3.1 - 3.15	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	ELS (embryo/fry)	90-d	LOEC	Survival	3.4	3.51	3.48 - 3.54	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	30-d	LOEC	Biomass	4.32	4.47	4.43 - 4.5	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Prosopium williamsoni</i>	Mountain whitefish	Yes	Fry	30-d	LOEC	Survival	4.32	4.47	4.43 - 4.5	47.8 ± 6.2	6.81 ± 0.18	9.2 ± 0.6	9.5 ± 0.3	FT	Brinkman and Vieira 2008	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Weight	NC	NC	NC	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Weight	NC	NC	NC	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Weight	NC	NC	NC	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Weight	NC	NC	NC	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Survival	1.3	1.04	0.983 - 1.1	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Survival	0.74	1.1	0.993 - 1.22	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	IC <sub>20</sub>	Biomass	0.87	1.29	1.17 - 1.43	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Survival	1.83	1.47	1.38 - 1.55	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Survival	1.02	1.52	1.37 - 1.68	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	IC <sub>20</sub>	Biomass	2.18	1.75	1.65 - 1.85	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Survival	2.58	2.07	1.95 - 2.19	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Weight	2.58	2.07	1.95 - 2.19	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Survival	4.81	2.13	1.73 - 2.63	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Survival	1.4	2.08	1.88 - 2.3	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Weight	1.4	2.08	1.88 - 2.3	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Weight	3.4	2.72	2.57 - 2.88	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Survival	6.54	2.9	2.35 - 3.58	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	IC <sub>20</sub>	Biomass	6.62	2.93	2.38 - 3.62	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Weight	1.95	2.9	2.62 - 3.21	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	IC <sub>20</sub>	Biomass	4.01	3.09	2.89 - 3.3	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	IC <sub>20</sub>	Biomass	2.22	3.19	2.9 - 3.5	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Weight	4.49	3.6	3.4 - 3.81	67.6 ± 1.5	7.60 ± 0.10	8.88 ± 0.17	11.4 ± 0.2	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Survival	4.68	3.6	3.37 - 3.86	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Survival	2.54	3.65	3.32 - 4	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Survival	8.88	3.94	3.19 - 4.86	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	LOEC	Weight	2.72	4.04	3.65 - 4.48	29.2 ± 0.9	7.54 ± 0.13	8.61 ± 0.22	11.7 ± 0.1	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Survival	9.62	4.31	3.5 - 5.3	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Survival	6.36	4.9	4.58 - 5.24	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Survival	3.52	5.05	4.6 - 5.55	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Survival	13.6	6.09	4.95 - 7.49	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	IC <sub>20</sub>	Biomass	13.6	6.09	4.95 - 7.49	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Weight	>8.64	NC <sup>3</sup>	NC <sup>3</sup>	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Survival	8.64	6.65	6.22 - 7.12	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Weight	8.64	6.65	6.22 - 7.12	71.3 ± 2.7	7.75 ± 0.14	8.61 ± 0.67	12.0 ± 0.3	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	Chronic value	Weight	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	Fry	30-d	NOEC	Weight	16.4	7.27	5.89 - 8.97	151 ± 2	7.51 ± 0.12	8.58 ± 0.14	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Weight	>4.87	NC <sup>3</sup>	NC <sup>3</sup>	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Survival	4.87	6.99	6.37 - 7.67	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Weight	4.87	6.99	6.37 - 7.67	30.6 ± 2.1	7.72 ± 0.12	8.49 ± 0.58	11.6 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	Chronic value	Weight	>19.1	NC <sup>3</sup>	NC <sup>3</sup>	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b> <i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	LOEC	Survival	19.1	8.55	6.95 - 10.5	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/fry)	55-d	NOEC	Weight	19.1	8.55	6.95 - 10.5	149 ± 7	7.83 ± 0.14	8.32 ± 0.64	11.8 ± 0.4	FT	Brinkman and Hansen 2007	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	63-d	NOEC	Biomass	1.1	1.19	1.17 - 1.21	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.0 (9.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Started test as late eyed eggs.
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	31-d	NOEC	Biomass	3.7	4	3.92 - 4.08	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.0 (9.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Started test as late eyed eggs.
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	63-d	LOEC	Biomass	3.7	4	3.92 - 4.08	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.0 (9.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Started test as late eyed eggs.
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	110-d	NOEC	Biomass	3.8	4.11	4.03 - 4.19	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-10.8)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	83-d	NOEC	Biomass	3.8	4.11	4.03 - 4.19	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-10.8)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	31-d	LOEC	Biomass	11.2	12.1	11.9 - 12.3	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	10.0 (9.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria. Started test as late eyed eggs.
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	110-d	LOEC	Biomass	11.7	12.6	12.4 - 12.9	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-10.8)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salmo trutta</i>	Brown trout	Yes	ELS (embryo/larvae)	83-d	LOEC	Biomass	11.7	12.6	12.4 - 12.9	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-10.8)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 212mg & 30.5mm	55-d	NOEC	Growth	0.37	0.531	0.484 - 0.583	30.6 ± 1.90	7.55 ± 0.12	8.69 ± 0.26	8.1 ± 0.28	FT	Hansen <i>et al.</i> 2002b	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 212mg & 30.5mm	55-d	NOEC	Mortality	0.37	0.531	0.484 - 0.583	30.6 ± 1.90	7.55 ± 0.12	8.69 ± 0.26	8.1 ± 0.28	FT	Hansen <i>et al.</i> 2002b	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 212mg & 30.5mm	55-d	LOEC	Growth	0.787	1.13	1.03 - 1.24	30.6 ± 1.90	7.55 ± 0.12	8.69 ± 0.26	8.1 ± 0.28	FT	Hansen <i>et al.</i> 2002b	Met all criteria
<i>Salvelinus confluentus</i>	Bull trout	Yes	Fry; 212mg & 30.5mm	55-d	LOEC	Mortality	0.787	1.13	1.03 - 1.24	30.6 ± 1.90	7.55 ± 0.12	8.69 ± 0.26	8.1 ± 0.28	FT	Hansen <i>et al.</i> 2002b	Met all criteria. Most mortality occurred in first 5 days.



**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b> <i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	150-d	NOEC	Biomass	1.1	1.19	1.17 - 1.21	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	89-d	NOEC	Biomass	1.1	1.19	1.17 - 1.21	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	150-d	LOEC	Biomass	3.8	4.11	4.03 - 4.19	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	55-d	NOEC	Biomass	3.8	4.11	4.03 - 4.19	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	89-d	LOEC	Biomass	3.8	4.11	4.03 - 4.19	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	ELS (embryo/larvae)	55-d	LOEC	Biomass	11.7	12.6	12.4 - 12.9	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.7 (8.0-11.1)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	NOEC	Growth	7	2.64	2.05 - 3.4	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	NOEC	Survival	7	2.64	2.05 - 3.4	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	NOEC	Growth	3	3.74	3.54 - 3.96	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	NOEC	Survival	3	3.74	3.54 - 3.96	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	NOEC	Growth	12	4.53	3.52 - 5.82	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	LOEC	Growth	12	4.53	3.52 - 5.82	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	LOEC	Survival	12	4.53	3.52 - 5.82	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	NOEC	Growth	6	7.49	7.07 - 7.93	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	LOEC	Growth	6	7.49	7.07 - 7.93	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	60-d	LOEC	Survival	6	7.49	7.07 - 7.93	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	LOEC	Growth	21	7.92	6.16 - 10.2	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	LOEC	Growth	10	12.5	11.8 - 13.2	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	NOEC	Survival	>91	NC <sup>3</sup>	NC <sup>3</sup>	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	35-d	NOEC	Percent Hatch	>91	NC <sup>3</sup>	NC <sup>3</sup>	188 ± 27	6.7-7.1	10.6 ± 1.5	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	30-d	NOEC	Survival	>47	NC <sup>3</sup>	NC <sup>3</sup>	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Fry	35-d	NOEC	Percent Hatch	>47	NC <sup>3</sup>	NC <sup>3</sup>	37 ± 7.2	6.5-7.2	10.0 ± 0.8	10	FT	Sauter <i>et al.</i> 1976 (USEPA)	Met all criteria
<i>Salvelinus namaycush</i>	Lake trout	Yes	ELS (embryo/larvae)	41-d	NOEC	Biomass	4.4	4.75	4.66 - 4.85	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.6 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus namaycush</i>	Lake trout	Yes	ELS (embryo/larvae)	74-d	NOEC	Biomass	4.4	4.75	4.66 - 4.85	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.6 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salvelinus namaycush</i>	Lake trout	Yes	ELS (embryo/larvae)	41-d	LOEC	Biomass	12.3	13.3	13 - 13.6	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.6 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<i>Salvelinus namaycush</i>	Lake trout	Yes	ELS (embryo/larvae)	74-d	LOEC	Biomass	12.3	13.3	13 - 13.6	45 (44-46)	7.6 (7.2-7.8)	10.3 (8-12.2)	9.6 (8.0-11.2)	FT	Eaton <i>et al.</i> 1978	Met all criteria
<b>Invertebrate - ALS insect</b>																
<i>Baetis rhodani</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	1000	1000	NA <sup>4</sup>	50	5	Aerated	9.5-11.5	FT	Gerhardt	Met all criteria
<i>Baetis rhodani</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	2300	2300	NA <sup>4</sup>	50	7	Aerated	9.5-11.5	S	Gerhardt	Met all criteria
<i>Baetis rhodani</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	2500	2500	NA <sup>4</sup>	50	7	Aerated	9.5-11.5	FT	Gerhardt	Met all criteria
<i>Baetis rhodani</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	3000	3000	NA <sup>4</sup>	50	5	Aerated	9.5-11.5	S	Gerhardt	Met all criteria
<i>Chironomus riparius</i>	Midge	Yes	2nd instar larvae	10-d	LC <sub>50</sub>	Mortality	700	382	326 - 446	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	14-d	LOEC	Growth	100	221	180 - 272	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	14-d	NOEC	Growth	<100	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	10-d	LOEC	Growth	500	1110	901 - 1360	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	10-d	NOEC	Growth	<500	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	10-d	NOEC	Survival	500	1110	901 - 1360	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	14-d	NOEC	Survival	500	1110	901 - 1360	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	7-d	LOEC	Growth	500	1110	901 - 1360	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	7-d	NOEC	Growth	<500	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	7-d	NOEC	Survival	500	1110	901 - 1360	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	14-d	LC <sub>50</sub>	Mortality	635	1400	1140 - 1720	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	10-d	LC <sub>50</sub>	Mortality	963	2130	1740 - 2620	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - ALS insect (cont.)</b>																
<i>Chironomus dilutus</i>	Midge	Yes	NR	10-d	LOEC	Survival	1000	2210	1800 - 2720	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	14-d	LOEC	Survival	1000	2210	1800 - 2720	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	7-d	LOEC	Survival	1000	2210	1800 - 2720	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	NR	7-d	LC <sub>50</sub>	Mortality	1700	3760	3060 - 4620	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Chironomus dilutus</i>	Midge	Yes	2nd instar larvae	10-d	LC <sub>50</sub>	Mortality	740	403	345 - 472	114	7.2	≥ 80% sat.	22 ± 1	R	Watts and Pascoe 2000	Met all criteria
<i>Leptophlebia marginata</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	3600	3600	NA <sup>4</sup>	50	5	Aerated	9.5-11.5	FT	Gerhardt	Met all criteria
<i>Leptophlebia marginata</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	4400	4400	NA <sup>4</sup>	50	7	Aerated	9.5-11.5	FT	Gerhardt	Met all criteria
<i>Leptophlebia marginata</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	>5000	NC <sup>3</sup>	NC <sup>3</sup>	50	5	Aerated	9.5-11.5	S	Gerhardt	Met all criteria
<i>Leptophlebia marginata</i>	Mayfly	Yes	NR	120-h	LC <sub>50</sub>	Mortality	>5000	NC <sup>3</sup>	NC <sup>3</sup>	50	7	Aerated	9.5-11.5	S	Gerhardt	Met all criteria
<i>Rhithrogena hageni</i>	Mayfly	Yes	Nymphs	10-d	NOEC	Mortality	1880	1940	1920 - 1950	48 ± 2	7.66 ± 0.1	9.07 ± 0.15	12 ± 0.3	FT	Brinkman and Johnston 2008	Met all criteria
<i>Rhithrogena hageni</i>	Mayfly	Yes	Nymphs	10-d	LOEC	Mortality	3520	3630	3600 - 3660	48 ± 2	7.66 ± 0.1	9.07 ± 0.15	12 ± 0.3	FT	Brinkman and Johnston 2008	Met all criteria
<b>Invertebrate - Amphipod</b>																
<i>Gammarus pulex</i>	Amphipod	Yes	NR	120-h	LOEC	Mortality	7.5	2.29	1.69 - 3.12	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	168-h	NOEC	Mortality	7.5	2.29	1.69 - 3.12	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	264-h	LC <sub>50</sub>	Mortality	10.5	3.21	2.37 - 4.36	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	168-h	LOEC	Mortality	15	4.59	3.38 - 6.23	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	168-h	LC <sub>50</sub>	Mortality	21.6	6.61	4.87 - 8.97	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria
<i>Gammarus pulex</i>	Amphipod	Yes	NR	120-h	LC <sub>50</sub>	Mortality	37.1	11.4	8.36 - 15.4	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>20</sub>	Biomass	0.5	0.253	0.212 - 0.302	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Survival	0.5	0.253	0.212 - 0.302	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>20</sub>	Survival	0.52	0.263	0.221 - 0.314	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>20</sub>	Biomass	0.76	0.334	0.27 - 0.413	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Survival	0.8	0.351	0.284 - 0.434	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	Chronic value	Survival	0.74	0.375	0.314 - 0.447	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>20</sub>	Survival	0.91	0.4	0.323 - 0.494	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	Chronic value	Survival	1.02	0.448	0.362 - 0.554	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Survival	1.1	0.557	0.467 - 0.664	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Survival	1.3	0.571	0.461 - 0.706	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Biomass	1.3	0.571	0.461 - 0.706	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	Chronic value	Biomass	1.69	0.742	0.6 - 0.918	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Biomass	2.2	0.966	0.781 - 1.19	153	7.40 - 7.94	5.5 - 7.1	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	Chronic value	Biomass	>4.5	NC <sup>3</sup>	NC <sup>3</sup>	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Biomass	>4.5	NC <sup>3</sup>	NC <sup>3</sup>	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Biomass	4.5	2.28	1.91 - 2.72	126	7.44 - 8.16	5.5 - 7.6	23 ± 1	FT	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	14-d	NOEC	Survival	0.1	0.221	0.18 - 0.272	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	14-d	LOEC	Survival	0.25	0.553	0.451 - 0.679	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	14-d	LC <sub>50</sub>	Mortality	0.65	1.44	1.17 - 1.77	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	10-d	NOEC	Survival	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	7-d	NOEC	Survival	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	NR	10-d	LC <sub>50</sub>	Mortality	1.2	2.65	2.16 - 3.26	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	7-d	LC <sub>50</sub>	Mortality	1.7	3.76	3.06 - 4.62	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	10-d	LOEC	Survival	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	14-d	LOEC	Growth	>2	NC <sup>3</sup>	NC <sup>3</sup>	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	14-d	NOEC	Growth	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Hyalella azteca</i>	Amphipod	Yes	NR	7-d	LOEC	Survival	2	4.42	3.6 - 5.43	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<b>Invertebrate - Cladoceran</b>																
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	10-d	NOEC	Reproduction (# young/female)	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	14-d	NOEC	Reproduction (# young/female)	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	7-d	NOEC	Reproduction (# young/female)	1	2.21	1.8 - 2.72	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	10-d	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	14-d	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	7-d	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	10-d	NOEC	Survival	10	22.1	18 - 27.2	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	14-d	NOEC	Survival	10	22.1	18 - 27.2	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	7-d	NOEC	Survival	10	22.1	18 - 27.2	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	14-d	LC <sub>50</sub>	Mortality	10.1	22.3	18.2 - 27.4	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	10-d	LC <sub>50</sub>	Mortality	10.6	23.4	19.1 - 28.8	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	7-d	LC <sub>50</sub>	Mortality	11.6	25.7	20.9 - 31.5	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	10-d	LOEC	Survival	13	28.8	23.4 - 35.3	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	14-d	LOEC	Survival	13	28.8	23.4 - 35.3	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Ceriodaphnia dubia</i>	Water flea	Yes	NR	7-d	LOEC	Survival	13	28.8	23.4 - 35.3	6-28	5.5-7.7	4.2-9.3 (>40% sat)	19.2-24.8	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	NOEC	Reproduction	1.67	1.01	0.887 - 1.15	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	IC <sub>20</sub>	Reproduction	2.23	1.35	1.18 - 1.54	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	IC <sub>20</sub>	Survival	2.29	1.39	1.22 - 1.58	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	Chronic value	Reproduction	2.39	1.45	1.27 - 1.65	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	NOEC	Reproduction	1.97	1.94	1.93 - 1.95	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	LOEC	Reproduction	3.43	2.07	1.82 - 2.36	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria



**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	NOEC	Survival	3.43	2.07	1.82 - 2.36	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	IC <sub>20</sub>	Reproduction	2.07	2.04	2.03 - 2.05	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	Chronic value	Reproduction	2.6	2.56	2.55 - 2.57	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	Chronic value	Survival	4.85	2.93	2.58 - 3.34	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	Chronic value	Survival	>3.43	NC <sup>3</sup>	NC <sup>3</sup>	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	IC <sub>20</sub>	Survival	>3.43	NC <sup>3</sup>	NC <sup>3</sup>	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	LOEC	Reproduction	3.43	3.38	3.37 - 3.39	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	LOEC	Survival	>3.43	NC <sup>3</sup>	NC <sup>3</sup>	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	NOEC	Survival	3.43	3.38	3.37 - 3.39	51	7.24 - 8.50	5.1 - 7.6	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	LOEC	Survival	6.85	4.14	3.64 - 4.72	99	7.48 - 8.50	5.4 - 7.2	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	10-d	NOEC	Survival	5	3.6	3.31 - 3.92	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	14-d	NOEC	Survival	5	3.6	3.31 - 3.92	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	7-d	NOEC	Survival	5	3.6	3.31 - 3.92	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	14-d	LC <sub>50</sub>	Mortality	8.6	6.2	5.7 - 6.75	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	10-d	LC <sub>50</sub>	Mortality	9	6.49	5.96 - 7.06	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	7-d	LC <sub>50</sub>	Mortality	9.9	7.14	6.56 - 7.77	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	10-d	LOEC	Survival	10	7.21	6.62 - 7.84	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	14-d	LOEC	Survival	10	7.21	6.62 - 7.84	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia magna</i>	Water flea	Yes	NR	7-d	LOEC	Survival	10	7.21	6.62 - 7.84	69-87	6.9-8.3	7.7-9.0	19.6-24.0	NR	Suedel <i>et al.</i> 1997	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	IC <sub>20</sub>	Survival	1.45	1.41	1.4 - 1.42	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	IC <sub>20</sub>	Reproduction	2.17	2.11	2.09 - 2.12	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	Chronic value	Reproduction	>14.6	NC <sup>3</sup>	NC <sup>3</sup>	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	Chronic value	Survival	>14.6	NC <sup>3</sup>	NC <sup>3</sup>	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	LOEC	Reproduction	>14.6	NC <sup>3</sup>	NC <sup>3</sup>	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	LOEC	Survival	>14.6	NC <sup>3</sup>	NC <sup>3</sup>	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	NOEC	Reproduction	14.6	14.2	14.1 - 14.3	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	18-d	NOEC	Survival	14.6	14.2	14.1 - 14.3	52	7.61 - 8.66	5.2 - 7.1	20 ± 1	R	Chadwick Ecological Consultants, Inc. 2004	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	60-d	NOEC	Mortality	5	2.88	2.49 - 3.32	106	8.49 - 8.61	Aerated	20	R	Ingersoll and Winner 1982	Met all criteria
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	60-d	LOEC	Mortality	10	5.75	4.99 - 6.63	106	8.49 - 8.61	Aerated	20	R	Ingersoll and Winner 1982	Met all criteria
<b>Invertebrate - Decapod</b>																
<i>Orconectes virilis</i>	Crayfish	Yes	Intermolt (adult)	14-d	LC <sub>50</sub>	Mortality	700	1130	1000 - 1280	26 (24-28)	6.9 (6.7-7.0)	8.4 (8.1-8.6)	20 (19-21)	FT	Mirenda 1986	Met all criteria
<i>Orconectes virilis</i>	Crayfish	Yes	Intermolt (adult)	10-d	LC <sub>50</sub>	Mortality	1000	1620	1430 - 1830	26 (24-28)	6.9 (6.7-7.0)	8.4 (8.1-8.6)	20 (19-21)	FT	Mirenda 1986	Met all criteria
<i>Orconectes virilis</i>	Crayfish	Yes	Intermolt (adult)	7-d	LC <sub>50</sub>	Mortality	1800	2910	2570 - 3300	26 (24-28)	6.9 (6.7-7.0)	8.4 (8.1-8.6)	20 (19-21)	FT	Mirenda 1986	Met all criteria
<b>Invertebrate - Mussel</b>																
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	NOEC	Growth (length)	4.4	4.61	4.55 - 4.66	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	NOEC	Survival	4.4	4.61	4.55 - 4.66	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria

Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Mussel (cont.)</b>																
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	IC <sub>10</sub>	Growth (length)	4.6	4.81	4.76 - 4.87	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	IC <sub>10</sub>	Survival	4.8	5.02	4.96 - 5.08	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	IC <sub>20</sub>	Growth (length)	5	5.23	5.17 - 5.29	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	IC <sub>20</sub>	Survival	5.7	5.97	5.9 - 6.04	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	Chronic value	Growth (length)	6	6.28	6.21 - 6.35	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	Chronic value	Survival	6	6.28	6.21 - 6.35	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	LC <sub>50</sub>	Mortality	8.1	8.48	8.38 - 8.58	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	LOEC	Growth (length)	8.2	8.58	8.48 - 8.68	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	28-d	LOEC	Survival	8.2	8.58	8.48 - 8.68	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	21-d	LC <sub>50</sub>	Mortality	12	12.6	12.4 - 12.7	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis siliquoidea</i>	Fatmucket	No	Juvenile (2 month old)	10-d	LC <sub>50</sub>	Mortality	>22	NC <sup>3</sup>	NC <sup>3</sup>	47 ± 12	8.0 ± 0.2	>7.0	20 ± 1	FT	Wang <i>et al.</i> 2010	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LOEC	Anterior shell length	10	4.57	3.73 - 5.59	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	NOEC	Anterior shell length	<10	NC <sup>3</sup>	NC <sup>3</sup>	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	NOEC	Length	10	4.57	3.73 - 5.59	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	NOEC	Percent Growth	10	4.57	3.73 - 5.59	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	EC <sub>50</sub>	Dead and stressed	24	11	8.95 - 13.4	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Glochidia	7-d	NOEC	Height	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Glochidia	7-d	NOEC	Length	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LOEC	Length	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LOEC	Percent Growth	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Mussel (cont.)</b>																
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	NOEC	Height	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	NOEC	Posterior shell length	30	13.7	11.2 - 16.8	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LC <sub>50</sub>	Mortality	38	17.4	14.2 - 21.2	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Glochidia	7-d	LOEC	Height	50	22.8	18.7 - 28	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Glochidia	7-d	LOEC	Length	50	22.8	18.7 - 28	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LOEC	Height	50	22.8	18.7 - 28	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Lampsilis ventricosa</i>	Mussel	No	Juvenile (0-d old)	7-d	LOEC	Posterior shell length	50	22.8	18.7 - 28	145 ± 4.0	8.3 ± 0.2	8.3 ± 0.1	21.7 ± 0.4	R	Lasee 1991	Met all criteria
<i>Pisidium</i> sp.	Mussel	Unknown	NR	120-h	NOEC	Mortality	5000	5000	NA <sup>4</sup>	50	7	Aerated	9.5-11.5	S	Gerhardt 1992	Met all criteria. No mortality observed at any concentration in any experiment.
<b>Secondary Data</b>																
<b>Fish</b>																
<i>Pimephales promelas</i>	Fathead minnow	Yes	3 week old fry; 12mm ave. length	30-d	NOEC	Egg Hatchability	27	9.59	7.34 - 12.5	204 ± 8.4	7.6 ± 0.14	6.6 ± 1.2	19-25	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	3 week old fry; 12mm ave. length	30-d	LOEC	Egg Hatchability	57	20.3	15.5 - 26.5	204 ± 8.4	7.6 ± 0.14	6.6 ± 1.2	19-25	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	3 week old fry; 12mm ave. length	30-d	NOEC	Survival	57	20.3	15.5 - 26.5	204 ± 8.4	7.6 ± 0.14	6.6 ± 1.2	19-25	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	Fry; ave. 0.23g at start	9 months	LC <sub>50</sub>	Mortality	68	24.4	18.7 - 31.8	201 ± 6.1	7.7 ± 0.2	6.5 ± 1.5	16-27	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	Fry; ave. 0.23g at start	63-d	LC <sub>50</sub>	Mortality	89	32	24.5 - 41.6	201 ± 6.1	7.7 ± 0.2	6.5 ± 1.5	16-27	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	3 week old fry; 12mm ave. length	30-d	LOEC	Survival	110	39.1	29.9 - 51	204 ± 8.4	7.6 ± 0.14	6.6 ± 1.2	19-25	FT	Pickering and Gast 1972	Pseudoreplication
<i>Pimephales promelas</i>	Fathead minnow	Yes	Fry; ave. 0.23g at start	35-d	LC <sub>50</sub>	Mortality	150	53.9	41.4 - 70.2	201 ± 6.1	7.7 ± 0.2	6.5 ± 1.5	16-27	FT	Pickering and Gast 1972	Pseudoreplication

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid</b>																
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	NOEC	Mortality	2.57	0.535	0.357 - 0.802	422	6.96	8.1	13.3	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	NOEC	Mortality	2.55	0.846	0.636 - 1.12	224	7.03	8.3	13.4	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	LOEC	Mortality	5.16	1.07	0.716 - 1.61	422	6.96	8.1	13.3	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	NOEC	Mortality	1.25	1.27	1.26 - 1.27	49	6.98	8.2	13.5	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	LOEC	Mortality	5.03	1.67	1.25 - 2.22	224	7.03	8.3	13.4	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Fry; 45mm length	100-d	LOEC	Mortality	1.74	1.77	1.76 - 1.77	49	6.98	8.2	13.5	FT	Davies <i>et al.</i> 1993	MgSO <sub>4</sub> was used to adjust hardness (plays a minor role relative to Ca in terms of reducing toxicity of metals)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (1.4g)	30-d	NOEC	Oxygen Consumption	10	4.69	3.85 - 5.7	140	8	Aerated	14	FT	Hollis <i>et al.</i> 1999	Secondary endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (1.4g)	30-d	NOEC	Time to Fatigue	10	4.69	3.85 - 5.7	140	8	Aerated	14	FT	Hollis <i>et al.</i> 1999	Secondary endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (5.6g)	30-d	NOEC	Oxygen Consumption	0.11	0.216	0.181 - 0.257	20	7.2	Aerated	17	FT	Hollis <i>et al.</i> 2000a	Secondary (physiological) endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile (5.6g)	30-d	NOEC	Swimming Performance	0.11	0.216	0.181 - 0.257	20	7.2	Aerated	17	FT	Hollis <i>et al.</i> 2000a	Secondary (physiological) endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	YOY; total length = 5-6 cm	246-277 d Cd exposure; Pred/prey test lasted 5 d	NOEC	Predator avoidance	5	3.24	2.9 - 3.63	90	7.8	>85% sat.	10.9 - 12.5	FT	Scherer <i>et al.</i> 1997	Secondary (behavioural) endpoint. Not specified how many reps, but they calculated means and medians, so assume at least 3. Three predators & 5 prey fish per tank.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b> <i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile; 2.5 ± 0.1 g (mean ± SEM)	7-d	NOEC	Predator avoidance (line crossings & feeding bites)	0.5	0.263	0.222 - 0.31	120	8	Aerated	12	FT	Scott <i>et al.</i> 2003	Secondary (behavioural) endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile; 2.5 ± 0.1 g (mean ± SEM)	7-d	LOEC	Predator avoidance (line crossings & feeding bites)	2	1.05	0.889 - 1.24	120	8	Aerated	12	FT	Scott <i>et al.</i> 2003	Secondary (behavioural) endpoint
<i>Oncorhynchus mykiss</i>	Rainbow trout	Yes	Juvenile; 2.5 ± 0.1 g (mean ± SEM)	7-d	NOEC	Plasma cortisol response	2	1.05	0.889 - 1.24	120	8	Aerated	12	FT	Scott <i>et al.</i> 2003	Secondary (physiological) endpoint & pseudoreplication. Control mortality not stated, but assume low because not testing for mortality here.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~47-d post-hatch	NOEC	Biomass	0.32	0.49	0.439 - 0.547	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~47-d post-hatch	LOEC	Biomass	1	1.53	1.37 - 1.71	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	92-d	NOEC	Survival post-hatch	2.5	3.83	3.43 - 4.28	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~44-d post-hatch	LOEC	Biomass	3.2	4.9	4.39 - 5.47	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~44-d post-hatch	NOEC	Biomass	<3.2	NC <sup>3</sup>	NC <sup>3</sup>	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~61-d post-hatch	NOEC	Biomass	3.2	6.52	5.43 - 7.84	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	92-d	LOEC	Survival post-hatch	8.2	12.6	11.3 - 14	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization to alevin	~61-d post-hatch	LOEC	Biomass	10	20.4	17 - 24.5	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from stage 4 egg	78-d	NOEC	Percent Hatch	29	59.1	49.2 - 71	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	158-d	NOEC	Survival post-hatch	90	183	153 - 220	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	96-d	NOEC	Percent Hatch	90	183	153 - 220	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from stage 14 egg	78-d	NOEC	Percent Hatch	90	183	153 - 220	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	45-d	NOEC	Percent Hatch	300	460	412 - 513	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	48-d	NOEC	Percent Hatch	300	460	412 - 513	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	92-d	NOEC	Survival post-hatch	300	460	412 - 513	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	158-d	LOEC	Survival post-hatch	270	550	458 - 661	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	96-d	LOEC	Percent Hatch	270	550	458 - 661	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from stage 14 egg	78-d	LOEC	Percent Hatch	270	550	458 - 661	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication



**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Fish - Salmonid (cont.)</b>																
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from stage 4 egg	78-d	LOEC	Percent Hatch	270	550	458 - 661	19	6.5	12.5	5.1 ± 0.9	FT	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	45-d	LOEC	Percent Hatch	800	1230	1100 - 1370	28	7.3	11.1	9.6 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	48-d	LOEC	Percent Hatch	800	1230	1100 - 1370	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salmo salar</i>	Atlantic salmon	No	Exposed from fertilization	92-d	LOEC	Survival post-hatch	800	1230	1100 - 1370	28	7.3	11.1	8.9 ± 0.3	R	Rombough and Garside 1982	Pseudoreplication. In one place said mean temp was 8.0 ± 0.3, but then referred to test as being at 8.9°C.
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Juvenile - from hatch	12 weeks	NOEC	Growth (weight)	1.7	1.87	1.82 - 1.91	44 (42-47)	7-8	7 (4-12)	9 ± 1	FT	Benoit <i>et al.</i> 1976	Additional stressor: third generation fish after the first and second generations were also exposed to Cd
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Juvenile - from hatch	16 weeks	NOEC	Growth (weight)	1.7	1.87	1.82 - 1.91	44 (42-47)	7-8	7 (4-12)	9 ± 1	FT	Benoit <i>et al.</i> 1976	Additional stressor: second generation fish after the first generation was also exposed to Cd
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Juvenile - from hatch	12 weeks	LOEC	Growth (weight)	3.4	3.74	3.65 - 3.83	44 (42-47)	7-8	7 (4-12)	9 ± 1	FT	Benoit <i>et al.</i> 1976	Additional stressor: third generation fish after the first and second generations were also exposed to Cd
<i>Salvelinus fontinalis</i>	Brook trout	Yes	Juvenile - from hatch	16 weeks	LOEC	Growth (weight)	3.4	3.74	3.65 - 3.83	44 (42-47)	7-8	7 (4-12)	9 ± 1	FT	Benoit <i>et al.</i> 1976	Additional stressor: second generation fish after the first generation was also exposed to Cd
<b>Invertebrate - ALS insect</b>																
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Percent Hatch	4	1.13	0.811 - 1.56	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Biomass	5.8	1.63	1.18 - 2.26	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Percent Emergence	5.8	1.63	1.18 - 2.26	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Percent Hatch	5.8	1.63	1.18 - 2.26	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - ALS insect (cont.)</b>																
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Weight	5.8	1.63	1.18 - 2.26	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Percent Emergence	8.1	2.28	1.64 - 3.16	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Weight	9.9	2.79	2.01 - 3.86	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Biomass	10.3	2.9	2.09 - 4.02	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Number of Eggs	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Survival	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	IC <sub>25</sub>	Time to Death	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Biomass	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Number of Eggs	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Percent Emergence	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Percent Hatch	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Survival	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - ALS insect (cont.)</b>																
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Time to Death	>16.4	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	LOEC	Weight	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Number of Eggs	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Survival	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Chironomus dilutus</i>	Midge	Yes	< 24-h old larvae	60-d	NOEC	Time to Death	16.4	4.62	3.33 - 6.4	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Rhithrogena hageni</i>	Mayfly	Yes	Nymphs	10-d	NOEC	Moulting	1880	1940	1920 - 1950	48 ± 2	7.66 ± 0.1	9.07 ± 0.15	12 ± 0.3	FT	Brinkman and Johnston 2008	Secondary endpoint
<i>Rhithrogena hageni</i>	Mayfly	Yes	Nymphs	10-d	LOEC	Moulting	3520	3630	3600 - 3660	48 ± 2	7.66 ± 0.1	9.07 ± 0.15	12 ± 0.3	FT	Brinkman and Johnston 2008	Secondary endpoint
<b>Invertebrate - Amphipod</b>																
<i>Echinogammarus meridionalis</i>	Amphipod	Yes	Adult males	6-d	NOEC	Feeding Rate	4.2	1.24	0.903 - 1.7	263.43 ± 12.15	7.92 ± 0.02	>90% sat.	20 ± 1	S	Pestana <i>et al.</i> 2007	Static test and water quality not measured at end of test
<i>Echinogammarus meridionalis</i>	Amphipod	Yes	Adult males	6-d	LOEC	Feeding Rate	6.53	1.92	1.4 - 2.64	263.43 ± 12.15	7.92 ± 0.02	>90% sat.	20 ± 1	S	Pestana <i>et al.</i> 2007	Static test and water quality not measured at end of test
<i>Gammarus pulex</i>	Amphipod	Yes	NR	168-h	NOEC	Feeding Rate	7.5	2.29	1.69 - 3.12	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Secondary endpoint. Paper also has endpoints of ventilatory activity and locomotor activity
<i>Gammarus pulex</i>	Amphipod	Yes	NR	168-h	LOEC	Feeding Rate	15	4.59	3.38 - 6.23	249.9	7.19 ± 0.02	NR but FT	12	FT	Felten <i>et al.</i> 2008	Secondary endpoint. Paper also has endpoints of ventilatory activity and locomotor activity
<i>Hyalella azteca</i>	Amphipod	Yes	1 to 11 - d old	7-d	LC <sub>50</sub>	Mortality	0.15	0.318	0.262 - 0.386	18	7.39	7-10	24.7	S	Borgmann <i>et al.</i> 2005	Static test without multiple measurements
<i>Hyalella azteca</i>	Amphipod	Yes	1 to 11 - d old	7-d	LC <sub>50</sub>	Mortality	1.6	0.82	0.69 - 0.974	124	8.21	7-10	24.7	S	Borgmann <i>et al.</i> 2005	Static test without multiple measurements
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>25</sub>	Biomass	0.51	0.144	0.103 - 0.199	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Survival	0.51	0.144	0.103 - 0.199	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	NOEC	Survival	0.51	0.144	0.103 - 0.199	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>25</sub>	Weight	0.74	0.208	0.15 - 0.289	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	Day 28 - 42	IC <sub>25</sub>	Reproduction	1.4	0.394	0.284 - 0.547	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	NOEC	Length	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	NOEC	Survival	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Survival	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Biomass	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Length	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	NOEC	Weight	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	35-d	NOEC	Survival	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	IC <sub>25</sub>	Biomass	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	IC <sub>25</sub>	Survival	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	LOEC	Survival	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	Day 28 - 42	NOEC	Reproduction	1.9	0.535	0.385 - 0.742	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	35-d	IC <sub>25</sub>	Survival	2	0.563	0.406 - 0.781	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>25</sub>	Survival	2.1	0.591	0.426 - 0.82	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	IC <sub>25</sub>	Biomass	2.4	0.675	0.487 - 0.937	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	IC <sub>25</sub>	Length	2.6	0.732	0.527 - 1.01	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	IC <sub>25</sub>	Survival	2.7	0.76	0.548 - 1.05	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	IC <sub>25</sub>	Weight	2.8	0.788	0.568 - 1.09	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	IC <sub>25</sub>	Length	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	IC <sub>25</sub>	Weight	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	LOEC	Biomass	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	LOEC	Length	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	LOEC	Survival	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	LOEC	Weight	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	NOEC	Biomass	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	10-d	NOEC	Weight	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Biomass	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Length	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	28-d	LOEC	Weight	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	35-d	LOEC	Survival	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	IC <sub>25</sub>	Length	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	LOEC	Biomass	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	LOEC	Length	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Amphipod (cont.)</b>																
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	LOEC	Weight	>3.2	NC <sup>3</sup>	NC <sup>3</sup>	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	NOEC	Biomass	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	NOEC	Length	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	42-d	NOEC	Weight	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<i>Hyalella azteca</i>	Amphipod	Yes	7-8 d old	Day 28 - 42	LOEC	Reproduction	3.2	0.9	0.649 - 1.25	280	7.8	>2.5	23	FT	Ingersoll and Kemble 2001	Effect level derived by linear interpolation using smoothed means due to lack of monotonic dose-response curve.
<b>Invertebrate - Cladoceran</b>																
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	EC <sub>16</sub>	Reproduction	0.214	0.0675	0.0501 - 0.0909	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	NOEC	Reproduction	0.153	0.0482	0.0358 - 0.065	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	MATC	Reproduction	0.265	0.0835	0.062 - 0.113	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	EC <sub>50</sub>	Reproduction	>15.3	NC <sup>3</sup>	NC <sup>3</sup>	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	LC <sub>50</sub>	Mortality	>15.3	NC <sup>3</sup>	NC <sup>3</sup>	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Ceriodaphnia reticulata</i>	Water flea	Yes	< 24-h old	7-d	LOEC	Reproduction	0.460	0.145	0.108 - 0.195	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	EC <sub>16</sub>	Reproduction	0.987	0.311	0.231 - 0.419	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.

**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Cladoceran (cont.)</b>																
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	NOEC	Reproduction	1.53	0.482	0.358 - 0.65	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	EC <sub>50</sub>	Reproduction	3.5	1.1	0.819 - 1.49	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	MATC	Reproduction	2.65	0.835	0.62 - 1.13	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	LOEC	Reproduction	4.6	1.45	1.08 - 1.95	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	14-d	LC <sub>50</sub>	Mortality	>15.3	NC <sup>3</sup>	NC <sup>3</sup>	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Daphnia magna</i>	Water flea	Yes	< 24-h old	21-d	NOEC	Reproduction Rate	1	0.306	0.225 - 0.415	250	8.0 ± 0.2	≥ 69% sat.	25 ± 1	R	Kuhn <i>et al.</i> 1989	Nominal concentrations used
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	EC <sub>16</sub>	Reproduction	0.388	0.122	0.0908 - 0.165	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	NOEC	Reproduction	4.60	1.45	1.08 - 1.95	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	MATC	Reproduction	8.39	2.64	1.96 - 3.56	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	EC <sub>50</sub>	Reproduction	>15.3	NC <sup>3</sup>	NC <sup>3</sup>	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	LC <sub>50</sub>	Mortality	>15.3	NC <sup>3</sup>	NC <sup>3</sup>	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used
<i>Daphnia pulex</i>	Water flea	Yes	< 24-h old	14-d	LOEC	Reproduction	15.3	4.82	3.58 - 6.5	240 ± 10	8.0 ± 0.3	>5	23 ± 1	R	Elnabaraway <i>et al.</i> 1986	Nominal concentrations used. Effect concentrations updated after a re-evaluation of the study in October 2014.
<b>Invertebrate - Decapod</b>																
<i>Atyaephyra desmarestii</i>	Decapod	No	Adult; >14mm total length	6-d	NOEC	Feeding Rate	4.2	1.24	0.903 - 1.7	263.43 ± 12.15	7.92 ± 0.02	>90% sat.	20 ± 1	S	Pestana <i>et al.</i> 2007	Static test and water quality not measured at end of test



**Table A2.2. Summary of primary and secondary data from long-term cadmium toxicity tests.**

Data Type / Receptor Group / Scientific Name	Common Name	B.C. Resident	Life Stage	Test Duration	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)			Hardness (mg CaCO <sub>3</sub> /L)	pH	DO (mg/L unless noted)	Temp (°C)	Test Type	Reference	Explanation of Rank / Comments
							Original Effect	Hardness-Normalized <sup>1</sup>	Predicted Effect Range <sup>2</sup>							
<b>Invertebrate - Decapod (cont.)</b> <i>Atyaephyra desmarestii</i>	Decapod	No	Adult; >14mm total length	6-d	LOEC	Feeding Rate	6.53	1.92	1.4 - 2.64	263.43 ± 12.15	7.92 ± 0.02	>90% sat.	20 ± 1	S	Pestana <i>et al.</i> 2007	Static test and water quality not measured at end of test
<b>Invertebrate - Hydra</b> <i>Hydra viridissima</i>	Hydra (green)	Yes	Budding hydra	7-d	NOEC	Population growth	0.4	0.8	0.669 - 0.957	19-20	7.25-7.53	7.73-9.44	22.5-24.5	R	Holdway <i>et al.</i> 2001	Nominal concentrations used
<i>Hydra viridissima</i>	Hydra (green)	Yes	Budding hydra	7-d	LOEC	Population growth	0.8	1.6	1.34 - 1.91	19-20	7.25-7.53	7.73-9.44	22.5-24.5	R	Holdway <i>et al.</i> 2001	Nominal concentrations used
<i>Hydra vulgaris</i>	Hydra (pink)	Yes	Budding hydra	7-d	LOEC	Population growth	12.5	25	20.9 - 29.9	19-20	7.25-7.53	7.73-9.44	22.5-24.5	R	Holdway <i>et al.</i> 2001	Nominal concentrations used
<i>Hydra vulgaris</i>	Hydra (pink)	Yes	Budding hydra	7-d	NOEC	Population growth	<12.5	NC <sup>3</sup>	NC <sup>3</sup>	19-20	7.25-7.53	7.73-9.44	22.5-24.5	R	Holdway <i>et al.</i> 2001	Nominal concentrations used

ALS = aquatic life stage; B.C. = British Columbia; EC = effect concentration; d = day; DO = dissolved oxygen; dph = days post-hatch; ELS = early life stage; FT = flow-through; h = hour; IC = inhibition concentration; LC = lethal concentration; LOEC = Lowest Observed Effect Concentration; MATC = Maximum Acceptable Toxicant Concentration; NA = not applicable; NC = not calculable; NOEC = No Observed Effect Concentration; NR = not reported; R = renewal; S = static; sat = saturation; Temp = temperature; YOY = young-of-year.

<sup>1</sup> Effect concentration normalized to a hardness of 50 mg CaCO<sub>3</sub>/L using the equation  $EC_x = e^{((\ln 50 - \ln(\text{original hardness})) * 0.736) + \ln(EC_{x, \text{original}})}$

<sup>2</sup> 95% confidence limits of the predicted range of the effect concentrations based on the derived confidence interval of the estimated slope.

<sup>3</sup> Only effect values that were defined numbers (i.e., not a > or < value) were normalized to a hardness of 50 mg CaCO<sub>3</sub>/L.

<sup>4</sup> Tests were performed at a hardness of 50 mg CaCO<sub>3</sub>/L so confidence levels were not calculated.

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Algae</b>			
<i>Ankistrodesmus falcatus</i>	Green algae	Baer <i>et al.</i> 1999	Water quality and replicates not reported; did not specify endpoints
<i>Chlorella vulgaris</i>	Algae	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Selenastrum capricornutum</i>	Green algae	Baer <i>et al.</i> 1999	Water quality and replicates not reported; did not specify endpoints
<i>Selenastrum capricornutum</i>	Green algae	Benhra <i>et al.</i> 1997	Water quality not reported
<b>Amphibian</b>			
<i>Bufo arenarum</i>	Toad	Ferrari <i>et al.</i> 1993	Water quality not reported
<i>Xenopus laevis</i>	African clawed frog	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<b>Fish</b>			
<i>Acipenser transmontanus</i>	White sturgeon	Vardy <i>et al.</i> 2011	High control mortality after 19 days post-hatch when fish transitioned to exogenous feeding
<i>Brachydanio rerio</i>	Leopard danio	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Carassius auratus</i>	Goldfish	McCarty <i>et al.</i> 1978	pH not reported
<i>Carassius auratus</i>	Goldfish	Phipps and Holcombe 1985	Control mortality not reported
<i>Carassius auratus</i>	Goldfish	Pickering and Henderson 1966	Control mortality not reported
<i>Catostomus commersoni</i>	White sucker	Duncan and Klaverkamp 1983	Control mortality not reported
<i>Ctenopharyngodon idellus</i>	Grass carp	Yorulmazlar and Gul 2003	Hardness not reported
<i>Danio rerio</i>	Zebrafish	Alsop and Wood 2011	Control mortality not reported
<i>Gambusia affinis</i>	Western mosquitofish	Giesy <i>et al.</i> 1977	Control mortality not reported
<i>Ictalurus punctatus</i>	Channel catfish	Phipps and Holcombe 1985	Control mortality not reported
<i>Ictalurus punctatus</i>	Channel catfish	Sauter <i>et al.</i> 1976 (USEPA)	High control mortality
<i>Ictalurus punctatus</i>	Channel catfish	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Lebistes reticulatus</i>	Guppy	Pickering and Henderson 1966	Control mortality not reported
<i>Lepomis cyanellus</i>	Green sunfish	Carrier and Beitinger 1988	pH not reported; mortality never reached 50%, so the estimated LC <sub>50</sub> (above the highest concentration) is not very reliable
<i>Lepomis cyanellus</i>	Green sunfish	Pickering and Henderson 1966	Control mortality not reported
<i>Lepomis macrochirus</i>	Bluegill	Bishop and McIntosh 1981	Control mortality not reported

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Fish (cont.)</b>			
<i>Lepomis macrochirus</i>	Bluegill	Phipps and Holcombe 1985	Control mortality not reported
<i>Lepomis macrochirus</i>	Bluegill	Pickering and Henderson 1966	Control mortality not reported
<i>Lepomis macrochirus</i>	Bluegill	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Micropterus dolomieu</i>	Smallmouth bass	Eaton <i>et al.</i> 1978	High control mortality
<i>Morone saxatilis</i>	Striped bass	Hughes 1973	Control mortality, water quality, and statistical methods not reported
<i>Oreochromis niloticus</i>	Nile tilapia	Garcia-Santos <i>et al.</i> 2006	Control mortality not reported
<i>Oryzias latipes</i>	Japanese medaka	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Perca flavescens</i>	Yellow perch	Niyogi <i>et al.</i> 2004	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Baer <i>et al.</i> 1999	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Birge <i>et al.</i> 1983	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Diamond <i>et al.</i> 1997	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Gauthier <i>et al.</i> 2006	Study used lake water in lab exposures (contained mixture of metals)
<i>Pimephales promelas</i>	Fathead minnow	Hall <i>et al.</i> 1986	Control mortality and O <sub>2</sub> not reported
<i>Pimephales promelas</i>	Fathead minnow	Phipps and Holcombe 1985	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Pickering and Gast 1972	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Pickering and Henderson 1966	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Schubauer-Berigan <i>et al.</i> 1993	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Sherman <i>et al.</i> 1987	Control mortality not reported
<i>Pimephales promelas</i>	Fathead minnow	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Pimephales promelas</i>	Fathead minnow	Spehar and Fiandt 1986	Control mortality not reported
<i>Poecilia reticulata</i>	Guppy	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Rutilus frisii</i>	Black Sea roach	Gholami <i>et al.</i> 2010	Control mortality, water quality, and toxicant concentrations not reported
<i>Stizostedion vitreum</i>	Walleye	Sauter <i>et al.</i> 1976 (USEPA)	High control mortality
<i>Tinca tinca</i>	Tench	Sikorska and Wolnicki 2010	Hardness not reported
<b>Fish - Salmonid</b>			
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	Mebane <i>et al.</i> 2012	High control mortality
<i>Oncorhynchus mykiss</i>	Rainbow trout	Birge <i>et al.</i> 1983	Control mortality not reported

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Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Fish - Salmonid (cont.)</b>			
<i>Oncorhynchus mykiss</i>	Rainbow trout	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Oncorhynchus mykiss</i>	Steelhead	Chapman 1978	Inadequate replication
<i>Oncorhynchus mykiss</i>	Rainbow trout	Hollis <i>et al.</i> 1999	Need at least 20 fish for a flow-through test; control mortality not reported
<i>Oncorhynchus mykiss</i>	Rainbow trout	Hollis <i>et al.</i> 2000a	Control mortality not reported
<i>Oncorhynchus mykiss</i>	Rainbow trout	Hollis <i>et al.</i> 2000b	Not enough fish (only 8 fish in 1 tank; need 20 for flow-through)
<i>Oncorhynchus mykiss</i>	Rainbow trout	Mebane <i>et al.</i> 2008	High control mortality and no water quality reported for acute test
<i>Oncorhynchus mykiss</i>	Rainbow trout	Niyogi <i>et al.</i> 2004	Control mortality not reported
<i>Oncorhynchus mykiss</i>	Rainbow trout	Phipps and Holcombe 1985	Control mortality not reported
<i>Oncorhynchus mykiss</i>	Rainbow trout	Sloman <i>et al.</i> 2003	Specific growth rate not a relevant endpoint in relation to Cd exposure b/c of experimental design
<i>Oncorhynchus mykiss</i>	Rainbow trout	Sloman <i>et al.</i> 2003	Group dominance hierarchy not a relevant endpoint in relation to Cd exposure
<i>Oncorhynchus mykiss</i>	Rainbow trout	Sloman <i>et al.</i> 2003	Time to achieve dominance not a relevant endpoint in relation to Cd exposure
<i>Oncorhynchus mykiss</i>	Rainbow trout	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Chapman 1982	Control mortality and water quality not reported
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Chapman 1978	Inadequate replication
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Finlayson and Verrue 1982	Control mortality not reported
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	Hamilton and Buhl 1990	Control mortality and O <sub>2</sub> not reported
<i>Salmo trutta</i>	Brown trout	Brown <i>et al.</i> 1994	No statistics presented
<i>Salmo trutta</i>	Brown trout	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Salvelinus fontinalis</i>	Brook trout	Benoit <i>et al.</i> 1976	No statistics were done for 1 <sup>st</sup> generation fish (other generations were used)

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Fish - Salmonid (cont.)</b>			
<i>Salvelinus namaycush</i>	Lake trout	Scherer <i>et al.</i> 1997	Statistics not reported in enough detail to obtain NOEC/LOEC for the situation with the predator (lake trout) exposed to Cd matched with unexposed prey
<b>Invertebrate - ALS insect</b>			
<i>Baetis tricaudatus</i>	Mayfly	Irving <i>et al.</i> 2003	Control mortality >10%; hardness not reported
<i>Chironomus plumosus</i>	Midge	Vedamanikam and Shazilli 2008a	Water quality not reported
<i>Chironomus plumosus</i>	Midge	Vedamanikam and Shazilli 2008b	Control mortality and water quality not reported
<i>Chironomus plumosus</i>	Midge	Vedamanikam and Shazilli 2009	Control mortality and water quality not reported
<i>Chironomus riparius</i>	Midge	Bechard <i>et al.</i> 2008	Control mortality too high (~18%)
<i>Chironomus riparius</i>	Midge	Pascoe <i>et al.</i> 1989	Inappropriate statistics used
<i>Chironomus dilutus</i>	Midge	Ha and Choi 2008	Control mortality and water quality not reported
<i>Culicoides furens</i>	Midge	Vedamanikam and Shazilli 2008a	Water quality not reported
<i>Culicoides furens</i>	Midge	Vedamanikam and Shazilli 2008b	Control mortality and water quality not reported
<i>Enallagma</i> sp.	Damselfly	Mackie 1989	No methods presented
<i>Erythemis simplicicollis</i>	Dragonfly	Tollett <i>et al.</i> 2009	Control mortality and O <sub>2</sub> not reported
<i>Pachydiplax longipennis</i>	Dragonfly	Tollett <i>et al.</i> 2009	Control mortality and O <sub>2</sub> not reported
<i>Paraleptophlebia praepedita</i>	Mayfly	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Rhithrogena</i> sp.	Mayfly	Mebane <i>et al.</i> 2012	High control mortality
<b>Invertebrate - Amphipod</b>			
<i>Echinogammarus meridionalis</i>	Amphipod	Pestana <i>et al.</i> 2007	Control mortality not reported
<i>Gammarus fasciatus</i>	Amphipod	Borgmann <i>et al.</i> 1989	High control mortality and O <sub>2</sub> not reported
<i>Gammarus fossarum</i>	Amphipod	Alonso <i>et al.</i> 2010	Hardness not reported
<i>Gammarus pseudolimnaeus</i>	Amphipod	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Gammarus pulex</i>	Amphipod	Alonso <i>et al.</i> 2010	Hardness not reported
<i>Hyalella azteca</i>	Amphipod	Borgmann <i>et al.</i> 1989	High control mortality and O <sub>2</sub> not reported
<i>Hyalella azteca</i>	Amphipod	Borgmann <i>et al.</i> 1991	O <sub>2</sub> not reported
<i>Hyalella azteca</i>	Amphipod	Jackson <i>et al.</i> 2000	Control mortality and O <sub>2</sub> not reported

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Invertebrate - Amphipod (cont.)</b>			
<i>Hyalella azteca</i>	Amphipod	Mackie 1989	No methods presented
<i>Hyalella azteca</i>	Amphipod	Schubauer-Berigan <i>et al.</i> 1993	Control mortality not reported
<i>Hyalella azteca</i>	Amphipod	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Hyalella azteca</i>	Amphipod	Stanley <i>et al.</i> 2005	Stream and effluent (lab) water contained too many other things to make this comparable to normal lab
<b>Invertebrate - Cladoceran</b>			
<i>Ceriodaphnia dubia</i>	Water flea	Castillo and Longley 2001	Water quality not reported
<i>Ceriodaphnia dubia</i>	Water flea	Diamond <i>et al.</i> 1997	Control mortality not reported
<i>Ceriodaphnia dubia</i>	Water flea	Schubauer-Berigan <i>et al.</i> 1993	Control mortality not reported
<i>Ceriodaphnia dubia</i>	Water flea	Spehar and Fiandt 1986	Control mortality not reported
<i>Ceriodaphnia dubia</i>	Water flea	Winner 1988	O <sub>2</sub> and pH not reported
<i>Ceriodaphnia reticulata</i>	Water flea	Elnabaraway <i>et al.</i> 1986	Control mortality not reported
<i>Ceriodaphnia reticulata</i>	Water flea	Hall <i>et al.</i> 1986	Control mortality and O <sub>2</sub> not reported
<i>Ceriodaphnia reticulata</i>	Water flea	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Daphnia magna</i>	Water flea	Baer <i>et al.</i> 1999	Control mortality not reported
<i>Daphnia magna</i>	Water flea	Barata and Baird 2000	Control mortality and water quality not reported
<i>Daphnia magna</i>	Water flea	Barata <i>et al.</i> 2000	Control mortality not reported; didn't specify hardness
<i>Daphnia magna</i>	Water flea	Biesinger and Christensen 1972	Control mortality not reported
<i>Daphnia magna</i>	Water flea	Bodar <i>et al.</i> 1988	O <sub>2</sub> not reported; inappropriate statistics used
<i>Daphnia magna</i>	Water flea	Borgmann <i>et al.</i> 1989	O <sub>2</sub> not reported
<i>Daphnia magna</i>	Water flea	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<i>Daphnia magna</i>	Water flea	Chapman <i>et al.</i> 1980	Control mortality not reported
<i>Daphnia magna</i>	Water flea	Elnabaraway <i>et al.</i> 1986	Control mortality not reported
<i>Daphnia magna</i>	Water flea	Ferreira <i>et al.</i> 2008	Control mortality and water quality not reported
<i>Daphnia magna</i>	Water flea	Hall <i>et al.</i> 1986	Control mortality and O <sub>2</sub> not reported
<i>Daphnia magna</i>	Water flea	Heugens <i>et al.</i> 2003	Hardness and pH not reported
<i>Daphnia magna</i>	Water flea	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Daphnia magna</i>	Water flea	Winner 1988	O <sub>2</sub> and pH not reported

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Invertebrate - Cladoceran (cont.)</b>			
<i>Daphnia pulex</i>	Water flea	Bertram and Hart 1979	Control mortality, O <sub>2</sub> , and water temperature not reported
<i>Daphnia pulex</i>	Water flea	Elnabaraway <i>et al.</i> 1986	Control mortality not reported
<i>Daphnia pulex</i>	Water flea	Hall <i>et al.</i> 1986	Control mortality and O <sub>2</sub> not reported
<i>Daphnia pulex</i>	Water flea	Ingersoll and Winner 1982	Control mortality not reported
<i>Daphnia pulex</i>	Water flea	Roux <i>et al.</i> 1993	Water quality not reported
<i>Daphnia pulex</i>	Water flea	Stackhouse and Benson 1988	Not described in enough detail to capture the required information
<i>Daphnia pulex</i>	Water flea	Winner 1986	O <sub>2</sub> not reported and test was only renewed every 2 or 3 days
<i>Simocephalus serrulatus</i>	Water flea	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<i>Simocephalus vetulus</i>	Water flea	Spehar and Carlson 1984	Control mortality and O <sub>2</sub> not reported
<b>Invertebrate - Clam</b>			
<i>Pisidium casertanum</i>	Clam	Mackie 1989	No methods presented
<i>Pisidium compressum</i>	Clam	Mackie 1989	No methods presented
<b>Invertebrate - Decapod</b>			
<i>Neomysis integer</i>	Opossum shrimp	Wildgust and Jones 1998	Water quality not reported except temperature and high control mortality
<i>Orconectes immunis</i>	Crayfish	Phipps and Holcombe 1985	Control mortality not reported
<i>Orconectes juvenilis</i>	Crayfish	Wigginton and Birge 2007	pH not reported
<i>Orconectes placidus</i>	Crayfish	Wigginton and Birge 2007	pH not reported
<i>Orconectes virilis</i>	Crayfish	Wigginton and Birge 2007	pH not reported
<i>Procambarus acutus</i>	Crayfish	Wigginton and Birge 2007	pH not reported
<i>Procambarus alleni</i>	Crayfish	Wigginton and Birge 2007	pH not reported
<i>Procambarus clarkii</i>	Crayfish	Wigginton and Birge 2007	pH not reported

**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

Receptor Group / Scientific Name	Common Name	Reference	Explanation of Unacceptable Ranking
<b>Invertebrate - Hydra</b>			
<i>Hydra vulgaris</i>	Hydroid	Beach and Pascoe 1998	Control mortality not reported
<b>Invertebrate - Mussel</b>			
<i>Anodonta imbecillis</i>	Paper pondshell	Keller and Zam 1991	Control mortality and O <sub>2</sub> not reported
<i>Utterbackia imbecillis</i>	Paper pondshell	Black 2001	High control mortality
<i>Fusconaia masoni</i>	Mussel	Black 2001	High control mortality
<i>Lampsilis teres</i>	Mussel	Clem 1998	High control mortality
<i>Leptodea fragilis</i>	Mussel	Clem 1998	High control mortality
<i>Potamilis pupuratus</i>	Mussel	Clem 1998	High control mortality
<b>Invertebrate - Snail</b>			
<i>Amnicola limosa</i>	Snail	Mackie 1989	No methods presented
<i>Aplexa hypnorum</i>	Snail	Phipps and Holcombe 1985	Control mortality not reported
<i>Hydrobia ventrosa</i>	Snail	Moller <i>et al.</i> 1996	Water quality not reported
<i>Lymnaea palustris</i>	Pond snail	Coeurdassier <i>et al.</i> 2003	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Lymnaea stagnalis</i>	Pond snail	Coeurdassier <i>et al.</i> 2003	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Potamopyrgus antipodarum</i>	Snail	Moller <i>et al.</i> 1996	Water quality not reported
<b>Invertebrate - Worm</b>			
<i>Aeolosoma headleyi</i>	Oligochaete	Niederlehner <i>et al.</i> 1984	Control mortality and water quality not reported
<i>Capitella capitata</i>	Polychaete	Mendez and Green-Ruiz 2006	High control mortality and no water quality except temperature reported
<i>Limnodrilus hoffmeisteri</i>	Oligochaete	Chapman <i>et al.</i> 1982	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Lumbriculus variegatus</i>	Oligochaete	Schubauer-Berigan <i>et al.</i> 1993	Control mortality not reported
<i>Quistadrilus multisetosus</i>	Oligochaete	Chapman <i>et al.</i> 1982	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Stylodrilus heringianus</i>	Oligochaete	Chapman <i>et al.</i> 1982	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Tubifex tubifex</i>	Oligochaete	Chapman <i>et al.</i> 1982	Control mortality, O <sub>2</sub> , and hardness not reported
<i>Tubifex tubifex</i>	Oligochaete	Maestre <i>et al.</i> 2009	Hardness not reported
<i>Tubifex tubifex</i>	Oligochaete	Redeker and Blust 2004	Control mortality not reported
<i>Tubifex tubifex</i>	Oligochaete	Reynoldson <i>et al.</i> 1996	Control mortality and O <sub>2</sub> not reported



**Table A2.3. List of studies identified as unacceptable for the derivation of a water quality guideline for cadmium.**

<b>Receptor Group / Scientific Name</b>	<b>Common Name</b>	<b>Reference</b>	<b>Explanation of Unacceptable Ranking</b>
<b>Other</b>			
<i>Brachionus havanaensis</i>	Mexican brachionid rotifer	Juarez-Franco <i>et al.</i> 2007	Control mortality and water quality not reported
<i>Paramecium caudatum</i>	Ciliated protozoa	Madoni <i>et al.</i> 1992	Hardness not reported
<i>Salmonella typhimurium</i>	Bacteria	Canton and Sloof 1982	Control mortality and O <sub>2</sub> not reported
<b>No relevant data found</b>			
NA	NA	Windward Environmental 2002	No information reported
NA	NA	Mackay <i>et al.</i> 2001	This paper contains nothing about Cd toxicity

ALS = aquatic life stage; Cd = cadmium; LC = lethal concentration; LOEC = Lowest Observed Effect Concentration; NA = not applicable;  
 NOEC = No Observed Effect Concentration; O<sub>2</sub> = oxygen.

**Table A2.4. Summary of data used to determine the relationship between the short-term toxicity of cadmium and ambient water hardness.**

Receptor Group / Scientific Name	Common Name	Effect Concentration (µg/L) <sup>1</sup>	Hardness (mg CaCO <sub>3</sub> /L)	Reference <sup>2</sup>
<b>Fish</b>				
<i>Morone saxatilis</i>	Striped bass	4	40	Palawski 1985
<i>Morone saxatilis</i>	Striped bass	10	285	Palawski 1985
<i>Morone saxatilis</i>	Striped bass	75	455	Palawski 1985
<b>Fish - Salmonid</b>				
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	0.94	21	Mebane <i>et al.</i> 2012
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	1.2	30.5	Mebane <i>et al.</i> 2012
<i>Oncorhynchus clarkii lewisi</i>	Cutthroat trout	1.5	32	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	3.7	103	Besser <i>et al.</i> 2007
<i>Oncorhynchus mykiss</i>	Rainbow trout	5.2	103	Besser <i>et al.</i> 2007
<i>Oncorhynchus mykiss</i>	Rainbow trout	1.5	41	Buhl and Hamilton 1991
<i>Oncorhynchus mykiss</i>	Rainbow trout	37.9	41	Buhl and Hamilton 1991
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.35	29.3	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.35	30.2	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.36	31.7	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.53	30.7	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.84	30	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	2.07	89.3	Hansen <i>et al.</i> 2002a
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.34	21	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.48	7	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.8	21	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.83	28.5	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.93	32	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	0.99	13	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Rainbow trout	1.3	24	Mebane <i>et al.</i> 2012
<i>Oncorhynchus mykiss</i>	Steelhead	1	23	Chapman 1978
<i>Oncorhynchus mykiss</i>	Steelhead	1.3	23	Chapman 1978
<i>Salmo trutta</i>	Brown trout	1.23	29.2	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	3.9	67.6	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	10.1	151	Brinkman and Hansen 2007
<i>Salvelinus confluentus</i>	Bull trout	0.83	29.3	Hansen <i>et al.</i> 2002a
<i>Salvelinus confluentus</i>	Bull trout	0.83	30.2	Hansen <i>et al.</i> 2002a
<i>Salvelinus confluentus</i>	Bull trout	0.83	30.7	Hansen <i>et al.</i> 2002a
<i>Salvelinus confluentus</i>	Bull trout	0.88	31.7	Hansen <i>et al.</i> 2002a
<i>Salvelinus confluentus</i>	Bull trout	2.41	30	Hansen <i>et al.</i> 2002a
<i>Salvelinus confluentus</i>	Bull trout	5.23	89.3	Hansen <i>et al.</i> 2002a
<b>Invertebrate - Cladoceran<sup>3</sup></b>				
<i>Daphnia magna</i>	Water flea	9.9	51	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	33	104	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	34	105	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	63	197	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	49	209	Chapman <i>et al.</i> 1980

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**Table A2.4. Summary of data used to determine the relationship between the short-term toxicity of cadmium and ambient water hardness.**

<b>Receptor Group / Scientific Name</b>	<b>Common Name</b>	<b>Effect Concentration (µg/L)<sup>1</sup></b>	<b>Hardness (mg CaCO<sub>3</sub>/L)</b>	<b>Reference<sup>2</sup></b>
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<sup>1</sup> The LC<sub>50</sub> from individual toxicity tests was used in all cases.

<sup>2</sup> All values used in this evaluation were from primary and secondary sources except for Chapman *et al.* 1980, which was included because the study was designed to look at the effect of hardness on cadmium toxicity.

<sup>3</sup> Only the *Daphnia magna* study by Chapman *et al.* 1980 was included in the analysis to minimize variability in the data resulting from varying experimental conditions and genetic strains.

**Table A2.5. Summary of data used to determine the relationship between the long-term toxicity of cadmium and ambient water hardness.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)	Hardness (mg CaCO <sub>3</sub> /L)	Reference <sup>1</sup>
<b>Algae</b>						
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth rate	4.3	3.4	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth rate	12.8	6.2	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth rate	16.2	16.2	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth rate	22	46.2	Källqvist 2009
<b>Fish</b>						
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	13.7	285	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	14.8	272	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	15.7	261	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	79.2	204	Pickering and Gast 1972
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	1.41	17	Suedel <i>et al.</i> 1997
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	2.45	17	Suedel <i>et al.</i> 1997
<i>Pimephales promelas</i>	Fathead minnow	CV	Survival	4.9	17	Suedel <i>et al.</i> 1997
<b>Fish - Salmonid</b>						
<i>Oncorhynchus mykiss</i>	Rainbow trout	CV	Survival	1.87	103	Besser <i>et al.</i> 2007
<i>Oncorhynchus mykiss</i>	Rainbow trout	CV	Survival	5.48	140	Hollis <i>et al.</i> 1999
<i>Oncorhynchus mykiss</i>	Rainbow trout	MATC	Survival	0.88	19.7	Mebane <i>et al.</i> 2008
<i>Oncorhynchus mykiss</i>	Rainbow trout	EC <sub>20</sub>	Survival	1.2	19.7	Mebane <i>et al.</i> 2008
<i>Oncorhynchus mykiss</i>	Rainbow trout	MATC	Survival	1.6	29.4	Mebane <i>et al.</i> 2008
<i>Oncorhynchus mykiss</i>	Steelhead	LC <sub>10</sub>	Survival	0.7	23	Chapman 1978
<i>Oncorhynchus mykiss</i>	Steelhead	LC <sub>10</sub>	Survival	1	23	Chapman 1978
<i>Salmo trutta</i>	Brown trout	CV	Survival	1.02	29.2	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	CV	Survival	1.83	67.6	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	CV	Survival	3.52	30.6	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	CV	Survival	6.36	71.3	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	CV	Survival	6.54	151	Brinkman and Hansen 2007

**Table A2.5. Summary of data used to determine the relationship between the long-term toxicity of cadmium and ambient water hardness.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint	Effect Concentration (µg/L)	Hardness (mg CaCO <sub>3</sub> /L)	Reference <sup>1</sup>
<b>Fish - Salmonid (cont.)</b>						
<i>Salmo trutta</i>	Brown trout	CV	Survival	13.6	149	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	CV	Biomass	2.02	45	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	CV	Biomass	6.44	45	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	CV	Biomass	6.67	45	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	CV	Biomass	6.67	45	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	CV	Growth	2.4	44	Benoit <i>et al.</i> 1976
<i>Salvelinus fontinalis</i>	Brook trout	CV	Growth	2.4	44	Benoit <i>et al.</i> 1976
<i>Salvelinus fontinalis</i>	Brook trout	CV	Biomass	2.04	45	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	CV	Biomass	2.04	45	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	CV	Biomass	6.67	45	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	CV	Survival	4.24	37	Sauter <i>et al.</i> 1976 (USEPA)
<i>Salvelinus fontinalis</i>	Brook trout	CV	Survival	9.17	188	Sauter <i>et al.</i> 1976 (USEPA)
<b>Invertebrate - Amphipod</b>						
<i>Hyaella azteca</i>	Amphipod	CV	Survival	0.74	126	Chadwick Ecological Consultants 2004
<i>Hyaella azteca</i>	Amphipod	CV	Survival	1.02	153	Chadwick Ecological Consultants 2004
<i>Hyaella azteca</i>	Amphipod	CV	Survival	0.984	280	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	CV	Survival	0.984	280	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	CV	Survival	2.47	280	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	CV	Survival	0.158	17	Suedel <i>et al.</i> 1997
<b>Invertebrate - Cladoceran<sup>2</sup></b>						
<i>Daphnia magna</i>	Water flea	CV	Survival	0.15	53	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	CV	Survival	0.21	103	Chapman <i>et al.</i> 1980
<i>Daphnia magna</i>	Water flea	CV	Survival	0.44	209	Chapman <i>et al.</i> 1980

CV = chronic value\*; EC = effect concentration; LC = lethal concentration; MATC = Maximum Acceptable Toxicant Concentration

\* The CV and the MATC are both equal to the geometric mean of the NOEC (no observed effect concentration) and LOEC (lowest observed effect concentration).

<sup>1</sup> All values used in this evaluation were from primary and secondary sources except for Chapman *et al.* 1980, which was included because the study was designed to look at the effect of hardness on cadmium toxicity.

<sup>2</sup> Only the *Daphnia magna* study by Chapman *et al.* 1980 was included in the analysis to minimize variability in the data resulting from varying experimental conditions and genetic strains.

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Algae</b>							
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth Rate	22	23.3	23 - 23.7	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth Rate	4.3	31.1	18.7 - 51.9	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth Rate	16.2	37.1	30 - 46	Källqvist 2009
<i>Pseudokirchneriella subcapitata</i>	Green algae	EC <sub>20</sub>	Growth Rate	12.8	59.5	40 - 88.5	Källqvist 2009
<b>Amphibian</b>							
<i>Ambystoma gracile</i>	Northwestern salamander	LOEC	Growth (weight & length)	193	209	205 - 213	Nebeker <i>et al.</i> 1995
<i>Ambystoma gracile</i>	Northwestern salamander	LOEC	Growth (weight)	227	246	241 - 251	Nebeker <i>et al.</i> 1995
<b>Aquatic Plant</b>							
<i>Lemna minor</i>	Duckweed	EC <sub>50</sub>	Growth Rate	214	88.5	70.4 - 111	Drost <i>et al.</i> 2007
<i>Lemna minor</i>	Duckweed	EC <sub>50</sub>	Growth Rate	393	162	129 - 204	Drost <i>et al.</i> 2007
<b>Fish</b>							
<i>Acipenser transmontanus</i>	White sturgeon	LC <sub>20</sub>	Mortality	8.7	6.79	6.37 - 7.24	Vardy <i>et al.</i> 2011
<i>Catostomus commersoni</i>	White sucker	LOEC	Biomass	12	13	12.7 - 13.2	Eaton <i>et al.</i> 1978
<i>Cottus bairdi</i>	Mottled sculpin	EC <sub>50</sub>	Biomass	2.4	1.41	1.23 - 1.62	Besser <i>et al.</i> 2007
<i>Cottus bairdi</i>	Mottled sculpin	LC <sub>50</sub>	Mortality	2.02	1.19	1.03 - 1.36	Besser <i>et al.</i> 2007
<i>Cottus bairdi</i>	Mottled sculpin	LOEC	Biomass	1.3	0.764	0.666 - 0.876	Besser <i>et al.</i> 2007
<i>Esox lucius</i>	Northern pike	LOEC	Biomass	12.9	13.9	13.7 - 14.2	Eaton <i>et al.</i> 1978
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	15.4	4.29	3.08 - 5.97	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	17	4.88	3.54 - 6.74	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	LOEC	Growth	8	2.18	1.56 - 3.05	Castillo and Longley 2001

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Fish (cont.)</b>							
<i>Pimephales promelas</i>	Fathead minnow	LOEC	Survival	21.3	6.31	4.61 - 8.64	Castillo and Longley 2001
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	68	24.4	18.7 - 31.8	Pickering and Gast 1972
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	89	32	24.5 - 41.6	Pickering and Gast 1972
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	150	53.9	41.4 - 70.2	Pickering and Gast 1972
<i>Pimephales promelas</i>	Fathead minnow	LOEC	Egg Hatchability	57	20.3	15.5 - 26.5	Pickering and Gast 1972
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	1.6	3.54	2.88 - 4.34	Suedel <i>et al.</i> 1997
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	2.3	5.09	4.15 - 6.25	Suedel <i>et al.</i> 1997
<i>Pimephales promelas</i>	Fathead minnow	LC <sub>50</sub>	Mortality	4.4	9.73	7.93 - 11.9	Suedel <i>et al.</i> 1997
<b>Fish - Salmonid</b>							
<i>Oncorhynchus kisutch</i>	Coho salmon	LOEC	Biomass	3.4	3.67	3.6 - 3.75	Eaton <i>et al.</i> 1978
<i>Oncorhynchus kisutch</i>	Coho salmon	LOEC	Biomass	12.5	13.5	13.2 - 13.8	Eaton <i>et al.</i> 1978
<i>Oncorhynchus kisutch</i>	Coho salmon	LOEC	Biomass	12.5	13.5	13.2 - 13.8	Eaton <i>et al.</i> 1978
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Biomass	2.7	1.59	1.38 - 1.82	Besser <i>et al.</i> 2007
<i>Oncorhynchus mykiss</i>	Steelhead	LC <sub>10</sub>	Mortality	0.7	1.24	1.07 - 1.44	Chapman 1978
<i>Oncorhynchus mykiss</i>	Steelhead	LC <sub>10</sub>	Mortality	1	1.77	1.53 - 2.05	Chapman 1978
<i>Oncorhynchus mykiss</i>	Steelhead	LC <sub>50</sub>	Mortality	0.7	2.43	1.76 - 3.36	Cusimano <i>et al.</i> 1986
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	5.16	1.07	0.716 - 1.61	Davies <i>et al.</i> 1993
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	5.03	1.67	1.25 - 2.22	Davies <i>et al.</i> 1993
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	1.74	1.77	1.76 - 1.77	Davies <i>et al.</i> 1993
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	10	4.69	3.85 - 5.7	Hollis <i>et al.</i> 1999
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	3.2	3.19	3.18 - 3.19	Hollis <i>et al.</i> 2000b
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Mortality	3	4.71	4.19 - 5.29	Hollis <i>et al.</i> 2000b
<i>Oncorhynchus mykiss</i>	Rainbow trout	EC <sub>20</sub>	Mortality	1.2	2.38	2 - 2.84	Mebane <i>et al.</i> 2008
<i>Oncorhynchus mykiss</i>	Rainbow trout	EC <sub>20</sub>	Mortality	1.2	2.38	2 - 2.84	Mebane <i>et al.</i> 2008
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Weight	0.16	0.237	0.214 - 0.262	Mebane <i>et al.</i> 2008

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Fish - Salmonid (cont.)</b>							
<i>Oncorhynchus mykiss</i>	Rainbow trout	LOEC	Predator avoidance (line crossings & feeding bites)	2	1.05	0.889 - 1.24	Scott <i>et al.</i> 2003
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	LC <sub>10</sub>	Mortality	1.2	2.13	1.83 - 2.46	Chapman 1978
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	LC <sub>10</sub>	Mortality	1.3	2.3	1.99 - 2.67	Chapman 1978
<i>Oncorhynchus tshawytscha</i>	Chinook salmon	LOEC	Mortality	1.9	3.13	2.75 - 3.56	Chapman 1982
<i>Prosopium williamsoni</i>	Mountain whitefish	IC <sub>20</sub>	Biomass	1.29	1.33	1.32 - 1.34	Brinkman and Vieira 2008
<i>Prosopium williamsoni</i>	Mountain whitefish	IC <sub>20</sub>	Biomass	3.02	3.12	3.1 - 3.15	Brinkman and Vieira 2008
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	0.87	1.29	1.17 - 1.43	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	2.18	1.75	1.65 - 1.85	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	6.62	2.93	2.38 - 3.62	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	4.01	3.09	2.89 - 3.3	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	2.22	3.19	2.9 - 3.5	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	IC <sub>20</sub>	Biomass	13.6	6.09	4.95 - 7.49	Brinkman and Hansen 2007
<i>Salmo trutta</i>	Brown trout	LOEC	Biomass	3.7	4	3.92 - 4.08	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	LOEC	Biomass	11.2	12.1	11.9 - 12.3	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	LOEC	Biomass	11.7	12.6	12.4 - 12.9	Eaton <i>et al.</i> 1978
<i>Salmo trutta</i>	Brown trout	LOEC	Biomass	11.7	12.6	12.4 - 12.9	Eaton <i>et al.</i> 1978
<i>Salvelinus confluentus</i>	Bull trout	LOEC	Growth	0.787	1.13	1.03 - 1.24	Hansen <i>et al.</i> 2002b
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth (weight)	3.4	3.74	3.65 - 3.83	Benoit <i>et al.</i> 1976
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth (weight)	3.4	3.74	3.65 - 3.83	Benoit <i>et al.</i> 1976



**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Fish - Salmonid (cont.)</b>							
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Biomass	3.8	4.11	4.03 - 4.19	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Biomass	3.8	4.11	4.03 - 4.19	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Biomass	11.7	12.6	12.4 - 12.9	Eaton <i>et al.</i> 1978
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth	12	4.53	3.52 - 5.82	Sauter <i>et al.</i> 1976 (USEPA)
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth	6	7.49	7.07 - 7.93	Sauter <i>et al.</i> 1976 (USEPA)
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth	21	7.92	6.16 - 10.2	Sauter <i>et al.</i> 1976 (USEPA)
<i>Salvelinus fontinalis</i>	Brook trout	LOEC	Growth	10	12.5	11.8 - 13.2	Sauter <i>et al.</i> 1976 (USEPA)
<i>Salvelinus namaycush</i>	Lake trout	LOEC	Biomass	12.3	13.3	13 - 13.6	Eaton <i>et al.</i> 1978
<i>Salvelinus namaycush</i>	Lake trout	LOEC	Biomass	12.3	13.3	13 - 13.6	Eaton <i>et al.</i> 1978
<b>Invertebrate - ALS insect</b>							
<i>Baetis rhodani</i>	Mayfly	LC <sub>50</sub>	Mortality	1000	1000	NA <sup>5</sup>	Gerhardt 1992
<i>Baetis rhodani</i>	Mayfly	LC <sub>50</sub>	Mortality	2300	2300	NA <sup>5</sup>	Gerhardt 1992
<i>Baetis rhodani</i>	Mayfly	LC <sub>50</sub>	Mortality	2500	2500	NA <sup>5</sup>	Gerhardt 1992
<i>Baetis rhodani</i>	Mayfly	LC <sub>50</sub>	Mortality	3000	3000	NA <sup>5</sup>	Gerhardt 1992
<i>Chironomus riparius</i>	Midge	LC <sub>50</sub>	Mortality	700	382	326 - 446	Watts and Pascoe 2000
<i>Chironomus dilutus</i>	Midge	IC <sub>25</sub>	Percent Hatch	4	1.13	0.811 - 1.56	Ingersoll and Kemble 2001
<i>Chironomus dilutus</i>	Midge	LOEC	Growth	100	221	180 - 272	Suedel <i>et al.</i> 1997
<i>Chironomus dilutus</i>	Midge	LOEC	Growth	500	1110	901 - 1360	Suedel <i>et al.</i> 1997
<i>Chironomus dilutus</i>	Midge	LOEC	Growth	500	1110	901 - 1360	Suedel <i>et al.</i> 1997
<i>Chironomus dilutus</i>	Midge	LC <sub>50</sub>	Mortality	740	403	345 - 472	Watts and Pascoe 2000
<i>Leptophlebia marginata</i>	Mayfly	LC <sub>50</sub>	Mortality	3600	3600	NA <sup>5</sup>	Gerhardt 1992
<i>Leptophlebia marginata</i>	Mayfly	LC <sub>50</sub>	Mortality	4400	4400	NA <sup>5</sup>	Gerhardt 1992

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Invertebrate - ALS insect (cont.)</b>							
<i>Rhithrogena hageni</i>	Mayfly	LOEC	Mortality	3520	3630	3600 - 3660	Brinkman and Johnston 2008
<b>Invertebrate - Amphipod</b>							
<i>Echinogammarus meridionalis</i>	Amphipod	LOEC	Feeding Rate	6.53	1.92	1.4 - 2.64	Pestana <i>et al.</i> 2007
<i>Gammarus pulex</i>	Amphipod	LC <sub>50</sub>	Mortality	10.5	3.21	2.37 - 4.36	Felten <i>et al.</i> 2008
<i>Gammarus pulex</i>	Amphipod	LOEC	Feeding Rate	15	4.59	3.38 - 6.23	Felten <i>et al.</i> 2008
<i>Gammarus pulex</i>	Amphipod	LOEC	Mortality	7.5	2.29	1.69 - 3.12	Felten <i>et al.</i> 2008
<i>Hyaella azteca</i>	Amphipod	LC <sub>50</sub>	Mortality	0.15	0.318	0.262 - 0.386	Borgmann <i>et al.</i> 2005
<i>Hyaella azteca</i>	Amphipod	LC <sub>50</sub>	Mortality	1.6	0.82	0.69 - 0.974	Borgmann <i>et al.</i> 2005
<i>Hyaella azteca</i>	Amphipod	IC <sub>20</sub>	Biomass	0.5	0.253	0.212 - 0.302	Chadwick Ecological Consultants 2004
<i>Hyaella azteca</i>	Amphipod	IC <sub>20</sub>	Biomass	0.76	0.334	0.27 - 0.413	Chadwick Ecological Consultants 2004
<i>Hyaella azteca</i>	Amphipod	IC <sub>25</sub>	Biomass	0.51	0.144	0.103 - 0.199	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	IC <sub>25</sub>	Biomass	1.9	0.535	0.385 - 0.742	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	IC <sub>25</sub>	Biomass	2.4	0.675	0.487 - 0.937	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	IC <sub>25</sub>	Reproduction	1.4	0.394	0.284 - 0.547	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	IC <sub>25</sub>	Survival	2	0.563	0.406 - 0.781	Ingersoll and Kemble 2001
<i>Hyaella azteca</i>	Amphipod	LC <sub>50</sub>	Mortality	1.2	2.65	2.16 - 3.26	Suedel <i>et al.</i> 1997
<i>Hyaella azteca</i>	Amphipod	LC <sub>50</sub>	Mortality	1.7	3.76	3.06 - 4.62	Suedel <i>et al.</i> 1997
<i>Hyaella azteca</i>	Amphipod	LOEC	Survival	0.25	0.553	0.451 - 0.679	Suedel <i>et al.</i> 1997

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

Receptor Group / Scientific Name	Common Name	Effect Level	Toxicity Test Endpoint <sup>2</sup>	Effect Concentration (µg/L)			Reference
				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Invertebrate - Cladoceran</b>							
<i>Ceriodaphnia dubia</i>	Water flea	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	Suedel <i>et al.</i> 1997
<i>Ceriodaphnia dubia</i>	Water flea	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	Suedel <i>et al.</i> 1997
<i>Ceriodaphnia dubia</i>	Water flea	LOEC	Reproduction (# young/female)	4	8.85	7.21 - 10.9	Suedel <i>et al.</i> 1997
<i>Ceriodaphnia reticulata</i>	Water flea	EC <sub>16</sub>	Reproduction	0.214	0.0675	0.0501 - 0.0909	Elnabaraway <i>et al.</i> 1986
<i>Daphnia magna</i>	Water flea	IC <sub>20</sub>	Reproduction	2.23	1.35	1.18 - 1.54	Chadwick Ecological Consultants 2004
<i>Daphnia magna</i>	Water flea	IC <sub>20</sub>	Reproduction	2.07	2.04	2.03 - 2.05	Chadwick Ecological Consultants 2004
<i>Daphnia magna</i>	Water flea	EC <sub>16</sub>	Reproduction	0.987	0.311	0.231 - 0.419	Elnabaraway <i>et al.</i> 1986
<i>Daphnia magna</i>	Water flea	LC <sub>50</sub>	Mortality	8.6	6.2	5.7 - 6.75	Suedel <i>et al.</i> 1997
<i>Daphnia magna</i>	Water flea	LC <sub>50</sub>	Mortality	9	6.49	5.96 - 7.06	Suedel <i>et al.</i> 1997
<i>Daphnia magna</i>	Water flea	LC <sub>50</sub>	Mortality	9.9	7.14	6.56 - 7.77	Suedel <i>et al.</i> 1997
<i>Daphnia pulex</i>	Water flea	IC <sub>20</sub>	Survival	1.45	1.41	1.4 - 1.42	Chadwick Ecological Consultants 2004
<i>Daphnia pulex</i>	Water flea	EC <sub>16</sub>	Reproduction	0.388	0.122	0.0908 - 0.165	Elnabaraway <i>et al.</i> 1986
<i>Daphnia pulex</i>	Water flea	LOEC	Mortality	10	5.75	4.99 - 6.63	Ingersoll and Winner 1982
<b>Invertebrate - Decapod</b>							
<i>Orconectes virilis</i>	Crayfish	LC <sub>50</sub>	Mortality	700	1130	1000 - 1280	Mirenda 1986
<i>Orconectes virilis</i>	Crayfish	LC <sub>50</sub>	Mortality	1000	1620	1430 - 1830	Mirenda 1986
<i>Orconectes virilis</i>	Crayfish	LC <sub>50</sub>	Mortality	1800	2910	2570 - 3300	Mirenda 1986

**Table A2.6. Observed effect values (based on the most sensitive endpoint) in long-term toxicity tests from primary and secondary studies used to derive a water quality guideline for cadmium<sup>1</sup>.**

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				Original Effect	Hardness- Normalized <sup>3</sup>	Predicted Effect Range <sup>4</sup>	
<b>Invertebrate - Hydra</b>							
<i>Hydra viridissima</i>	Hydra (green)	LOEC	Population growth	0.8	1.6	1.34 - 1.91	Holdway <i>et al.</i> 2001
<i>Hydra vulgaris</i>	Hydra (pink)	LOEC	Population growth	12.5	25	20.9 - 29.9	Holdway <i>et al.</i> 2001

EC = effect concentration; IC = inhibition concentration; LC = lethal concentration; LOEC = Lowest Observed Effect Concentration; NA = not applicable.

<sup>1</sup> Additional information such as life stage, test duration, and test parameters are provided in Table A2.2.

<sup>2</sup> Most sensitive endpoint observed in the toxicity test.

<sup>3</sup> Effect concentration normalized to a hardness of 50 mg CaCO<sub>3</sub>/L using the equation  $EC_x = e^{((\ln 50 - \ln(\text{original hardness})) * 0.736) + \ln(EC_x \text{ original})}$

<sup>4</sup> 95% confidence limits of the predicted range of the effect concentrations based on the derived confidence interval of the estimated slope.

<sup>5</sup> Test was performed at a hardness of 50 mg CaCO<sub>3</sub>/L so confidence intervals were not calculated.