

Supplementary material

Diatom–water quality thresholds in South Australian streams indicate a need for more stringent water quality guidelines

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Table S1. Water quality data and site codes for Tibby *et al.* study sites

Sample	Region	Year	Season	EPA Code	Code on Fig. 1	Sample number in Fig. 2	TP ($\mu\text{g L}^{-1}$)	Conductivity ($\mu\text{S cm}^{-1}$)	TN (mg L^{-1})	TKN (mg L^{-1})	NO_x ($\mu\text{g L}^{-1}$)	Temperature ($^{\circ}\text{C}$)	Dissolved oxygen (mg L^{-1})	pH
1	south-east	2014	Autumn	13123a	26	120	62	1316	1.677	1.63	47	13	9.8	8.77
2	south-east	2014	Spring	13123s	26	95	46	1924	2.58	2.58	1.5	21	9.5	8.8
3	south-east	2014	Autumn	13124a	19	42	20	1537	0.75	0.75	1.5	12.7	11.5	8.85
4	south-east	2014	Spring	13124s	19	79	35	2627	1.31	1.31	1.5	24	11.5	9.12
5	south-east	2014	Autumn	13128a	17	66	29	1312	1.74	1.17	570	12.2	8.6	8.27
6	south-east	2014	Spring	13128s	17	43	20	1242	0.873	0.87	1.5	24.5	11.9	8.12
7	south-east	2014	Autumn	13132a	35	121	63	642	1.886	1.88	6	14.4	9.8	7.59
8	south-east	2014	Spring	13132s	35	76	33	361	2.017	2.01	7	18.2	12.5	9.14
9	south-east	2014	Autumn	13133a	11	90	42	6060	1.595	1.13	465	14.4	7.9	8.25
10	south-east	2014	Spring	13133s	11	80	35	9167	1.225	1.21	15	24.5	16	8.44
11	south-east	2014	Spring	13212s	28	65	28	880	0.548	0.54	8	20.1	13.3	8.51
12	south-east	2014	Autumn	13213a	9	161	176	3530	3.76	3.75	10	14.8	11	9.14
13	south-east	2014	Spring	13213s	9	118	60	8276	2.91	2.91	1.5	27.7	11.7	9.21
14	south-east	2014	Autumn	13214a	2	27	15	4034	0.428	0.42	8	11.6	7.1	8.2
15	south-east	2014	Spring	13214s	2	82	37	5902	1.133	1.13	3	22.8	5.6	7.8
16	south-east	2014	Autumn	3005a	16	107	52	2793	1.774	1.55	224	8.9	7.1	8.26
17	south-east	2014	Spring	3005s	16	71	30	3119	1.386	1.16	226	16	4	8.7
18	south-east	2014	Spring	30072s	1	40	19	18977	1.525	0.8	725	24.6	11	8.12
19	south-east	2014	Autumn	30076a	10	16	12	2203	1.476	0.89	586	11.3	9.8	7.13
20	south-east	2014	Spring	30076s	10	51	22	2871	1.05	0.77	280	21	9.8	8.01
21	south-east	2014	Autumn	30078a	36	28	15	1171	4.55	0.78	3770	11.5	10	7.67
22	south-east	2014	Spring	30078s	36	21	14	1004	5.04	0.22	4820	15.5	16.6	8.34
23	south-east	2014	Autumn	30079a	21	147	107	1761	1.42	1.42	1.5	9.6	6.9	8.37
24	south-east	2014	Spring	30079s	21	91	42	2024	1.24	1.24	1.5	17.4	3.9	7.34
25	south-east	2014	Autumn	3007a	7	34	16	8149	0.576	0.57	6	13.3	11.7	9.1
26	south-east	2014	Spring	3007s	7	67	29	19144	1.43	1.43	1.5	26.7	10.4	9.04
27	south-east	2014	Autumn	30080a	22	55	24	1166	1.498	1.44	58	12	6.3	8.32
28	south-east	2014	Spring	30080s	22	29	15	1471	1.094	1.09	4	20.1	9.1	8.12
29	south-east	2014	Autumn	30081a	39	10	11	670	2.33	0.56	1770	11.2	6.9	7.67
30	south-east	2014	Spring	30081s	39	3	10	686	1.78	0.38	1400	13.8	11.1	8
31	south-east	2014	Autumn	30083a	20	22	14	1653	0.527	0.52	7	12.3	12.4	9.16
32	south-east	2014	Spring	30083s	20	68	29	1575	0.971	0.95	21	24.3	13.5	9.37
33	south-east	2014	Autumn	3008a	31	35	16	1667	3.8	0.12	3680	12.5	7.7	7.72
34	south-east	2014	Spring	3008s	31	36	17	1673	3.28	0.14	3140	17.7	12.3	8.01
35	south-east	2014	Autumn	3009a	34	37	17	1267	6.17	0.19	5980	12.2	8.7	7.7
36	south-east	2014	Spring	3009s	34	18	13	1095	5.39	0.025	5390	16.9	12.2	8.09
37	south-east	2014	Autumn	3010a	38	11	11	1239	2.04	0.2	1840	10.7	7.4	7.24
38	south-east	2014	Spring	3010s	38	4	10	1205	0.22	0.22	1.5	13.6	8.3	7.94

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39	south-east	2014	Autumn	3014a	23	23	14	1355	0.584	0.58	4	10.2	6.6	8.26
40	south-east	2014	Spring	3014s	23	60	26	1802	0.51	0.5	11	18.8	4.9	7.55
41	south-east	2014	Autumn	3020a	14	173	695	949	6.96	6.96	1.5	8.9	5.7	8.81
42	south-east	2014	Spring	3020s	14	169	333	1005	3.65	3.6	46	16.4	5.1	7.49
43	south-east	2014	Autumn	3024a	40	19	13	676	1.43	0.41	1020	10.9	6.8	8.09
44	south-east	2014	Spring	3024s	40	24	14	1043	1.365	0.6	765	15.4	6.3	7.74
45	south-east	2014	Autumn	3033a	32	177	1050	1060	6.46	5.17	1290	11.6	5.8	8.23
46	south-east	2014	Spring	3033s	32	170	368	1161	1.25	1	250	18.8	11.9	8.45
47	south-east	2014	Autumn	3047a	15	111	54	2268	1.762	1.6	162	10.2	5.9	8.37
48	south-east	2014	Spring	3047s	15	178	3817	1188	0.154	3.8	17	20.2	2.4	7.66
49	south-east	2014	Autumn	3067a	30	112	55	734	1.503	1.48	23	10.8	4.9	7.47
50	south-east	2014	Spring	3067s	30	149	114	960	2.83	2.78	50	11.2	2.5	7.72
51	south-east	2014	Autumn	7516a	8	69	29	9571	0.818	0.76	58	14.4	17.6	9.12
52	south-east	2014	Spring	7516s	8	54	23	20590	0.945	0.94	5	27.3	10.2	8.76
53	south-east	2014	Autumn	7517a	18	41	19	2048	0.729	0.48	249	10.3	7.4	8.35
54	south-east	2014	Spring	7517s	18	44	20	3550	0.746	0.72	26	17.8	5.6	8.12
55	south-east	2014	Autumn	7519a	33	159	162	819	3.346	3.06	286	11.7	7	8.44
56	south-east	2014	Spring	7519s	33	150	116	930	2.824	2.66	164	16.3	8.8	8.77
57	south-east	2014	Autumn	7523a	37	5	10	626	2.65	0.36	2290	12	12.9	8.15
58	south-east	2014	Spring	7523s	37	83	37	733	2.79	0.61	2180	21.9	12.5	8.68
59	south-east	2014	Autumn	99999a	25	49	21	1401	0.89	0.89	1.5	10.7	11.5	8.6
60	south-east	2014	Spring	99999s	25	62	27	1514	0.7	0.69	5	20.8	9.6	8.12
61	MLR	2015	Autumn	EMLR01a	E01	131	76	4356	0.723	0.71	13	12.1	8.6	7.63
62	MLR	2015	Autumn	ELMR02a	E02	77	34	6091	0.809	0.68	129	13.8	5.7	7.3
63	MLR	2015	Autumn	EMLR03a	E03	70	29	1900	0.51	0.5	10	11.9	7.1	7.84
64	MLR	2015	Autumn	EMLR04a	E04	174	758	1223	0.54	0.54	1.5	10.6	9	8.15
65	MLR	2015	Autumn	EMLR05a	E05	84	37	1613	0.779	0.72	59	12.2	7.5	8.12
66	MLR	2015	Autumn	EMLR07a	E07	98	49	1201	0.922	0.86	62	12.2	8.1	8.07
67	MLR	2015	Autumn	EMLR08a	E08	129	73	1570	1.023	1.02	3	12.5	4.8	8.03
68	MLR	2015	Autumn	EMLR10a	E10	127	68	6143	1.49	1.49	1.5	12.8	5.3	7.81
69	MLR	2015	Autumn	EMLR11a	E11	50	21	1881	0.818	0.8	18	12.2	8.4	7.9
70	MLR	2015	Autumn	EMLR12a	E12	116	59	1186	0.54	0.47	70	12.1	7.7	6.87
71	MLR	2015	Autumn	EMLR13a	E13	108	52	2003	0.6	0.6	1.5	12.1	8.6	7.97
72	MLR	2015	Autumn	EMLR14a	E14	38	17	1923	0.698	0.64	58	12.3	7.8	8
73	EP	2015	Autumn	EP01a	1	130	73	10549	0.89	0.89	1.5	10.3	5.7	7.86
74	EP	2015	Autumn	EP02a	2	45	20	11510	0.879	0.87	9	12.5	8.2	8.27
75	EP	2015	Autumn	EP03a	3	119	60	11773	1.255	1.25	5	14.6	7.2	7.84
76	EP	2015	Autumn	EP04a	4	132	76	13999	1.13	1.13	1.5	14.8	8.5	8.24
77	EP	2015	Autumn	EP05a	5	88	40	12714	0.996	0.99	6	13.3	7.2	8.3

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78	EP	2015	Autumn	EP06a	6	20	13	11000	0.12	0.12	1.5	11.2	9.3	8.26
79	EP	2015	Autumn	EP07a	7	128	70	23951	2.833	2.83	3	13.5	8.4	8.42
80	EP	2015	Autumn	EP10a	10	148	113	27637	2.953	2.82	133	18.9	8.3	4.57
81	MLR	2015	Autumn	WMLR01a	1	30	15	305	0.531	0.52	11	12.2	9.4	8.34
82	MLR	2015	Autumn	WMLR02a	2	72	30	775	0.445	0.44	5	11.5	9.7	7.98
83	MLR	2015	Autumn	WMLR04a	4	126	66	516	2.54	0.47	2070	14.2	8.6	7.85
84	MLR	2015	Autumn	WMLR05a	5	85	37	3479	0.811	0.78	31	9.4	7.7	8.02
85	MLR	2015	Autumn	WMLR06a	6	12	11	303	0.315	0.31	5	12.7	9.6	7.9
86	MLR	2015	Autumn	WMLR07a	7	46	20	693	0.378	0.37	8	13.7	6.9	7.85
87	MLR	2015	Autumn	WMLR08a	8	73	30	575	0.789	0.74	49	11.1	8.8	7.25
88	MLR	2015	Autumn	WMLR09a	9	1	8	427	0.442	0.43	12	7.8	10.9	8.55
89	MLR	2015	Autumn	WMLR10a	10	171	477	1663	3.154	3.09	64	12.1	6.5	7.26
90	MLR	2015	Autumn	WMLR11a	11	74	30	360	0.512	0.5	12	12	8.1	7.88
91	MLR	2015	Autumn	WMLR14a	14	78	34	1976	0.74	0.74	1.5	11.9	9.3	7.78
92	MLR	2015	Autumn	WMLR15a	15	61	26	1046	0.933	0.81	123	10.1	9.3	8.05
93	MLR	2015	Autumn	WMLR16a	16	47	20	735	0.444	0.44	4	10.4	4.3	7.93
94	MLR	2015	Spring	EMLR03s	E03	153	118	2504	1.592	1.43	162	19.6	2.2	7.34
95	MLR	2015	Spring	EMLR07s	E07	89	40	1272	0.604	0.59	14	15	4.3	7.26
96	MLR	2015	Spring	EMLR08s	E08	125	65	3532	0.609	0.53	79	14	3.3	7.23
97	MLR	2015	Spring	EMLR10s	E10	158	133	6108	1.65	1.65	1.5	19.6	5.4	7.76
98	MLR	2015	Spring	EMLR11s	E11	133	79	2271	0.903	0.81	93	14.5	4.8	7.29
99	MLR	2015	Spring	EMLR12s	E12	154	121	2460	1.302	1.17	132	17.9	4.4	7.47
100	MLR	2015	Spring	EMLR13s	E13	124	64	2043	1.135	1.07	65	20.6	3.2	7.5
101	MLR	2015	Spring	EMLR14s	E14	87	38	2272	0.545	0.4	145	13.6	3.1	6.85
102	EP	2015	Spring	EP01s	1	155	130	16053	2.952	2.93	22	27.2	16.1	8.84
103	EP	2015	Spring	EP02s	2	75	32	7814	0.855	0.61	245	16.4	7	7.79
104	EP	2015	Spring	EP03s	3	86	37	9377	0.834	0.72	114	20	7.5	8.07
105	EP	2015	Spring	EP05s	5	101	50	11347	1.057	1.02	37	18.3	5	7.78
106	EP	2015	Spring	EP06s	6	113	55	9508	0.91	0.91	1.5	22	9.9	8.31
107	EP	2015	Spring	EP07s	7	160	174	41973	3.918	3.88	38	22.3	8.7	8.78
108	EP	2015	Spring	EP08s	8	105	51	20369	2.845	2.8	45	16.8	7.5	8.69
109	EP	2015	Spring	EP09s	9	122	63	14723	1.941	1.91	31	17.6	9.3	8.15
110	MLR	2015	Spring	EP10s	10	138	87	66641	1.982	1.13	852	20.5	5.6	3.58
111	MLR	2015	Spring	WMLR01s	1	2	9	345	0.332	0.21	122	21.7	7.7	7.88
112	MLR	2015	Spring	WMLR02s	2	59	25	1312	0.326	0.28	46	16	9.8	7.95
113	MLR	2015	Spring	WMLR05s	5	146	99	3995	0.723	0.68	43	17.3	3.5	7.78
114	MLR	2015	Spring	WMLR06s	6	13	11	314	0.207	0.2	7	17.4	9.4	8.17
115	MLR	2015	Spring	WMLR07s	7	117	59	929	0.354	0.31	44	17.9	2.9	7.42
116	MLR	2015	Spring	WMLR08s	8	102	50	748	0.965	0.93	35	17.9	10.6	7.98

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117	MLR	2015	Spring	WMLR09s	9	17	12	573	0.214	0.18	34	16.1	8.5	7.99
118	MLR	2015	Spring	WMLR10s	10	172	598	3307	1.855	1.77	85	21.5	4.8	7.27
119	MLR	2015	Spring	WMLR11s	11	106	51	450	0.926	0.86	66	20.4	2.6	7.2
120	MLR	2015	Spring	WMLR15s	15	92	42	844	0.86	0.76	100	21.6	7.1	7.89
121	MLR	2015	Spring	WMLR16s	16	31	15	753	0.252	0.21	42	17.3	2	7.56
122	MLR	2016	Autumn	WMLR01 First Creek	18	6	10	151	0.62	0.51	110	10.2	10	8.09
123	MLR	2016	Autumn	WMLR02 Scott Creek	20	151	116	599	1.04	0.93	110	10.8	8.8	8
124	MLR	2016	Autumn	WMLR03 Deep Creek	21	99	49	960	1.17	1.14	32	11.3	8.8	7.64
125	MLR	2016	Autumn	WMLR07 Sturt River	41	143	92	619	0.876	0.58	296	10.6	9.3	7.73
126	MLR	2016	Autumn	WMLR08 Cox Creek	4	167	326	276	3.02	1.01	2010	11.6	8.4	7.47
127	MLR	2016	Autumn	WMLR10 Walkers Creek	43	165	271	6660	1.56	1.56	1.5	17.2	7.8	8.47
128	MLR	2016	Autumn	WMLR11 Nth Para River	5	162	190	2421	0.64	0.64	1.5	14	7.3	7.74
130	MLR	2016	Autumn	WMLR13 First Creek	6	14	11	150	0.635	0.53	105	10.6	10.2	7.66
131	MLR	2016	Autumn	WMLR15 Callowonga Creek	8	103	50	391	1.158	0.99	168	11.8	9.4	7.57
132	MLR	2016	Autumn	WMLR16–1 Sixth Creek	9	56	24	477	0.438	0.31	128	12.4	9.9	7.76
133	MLR	2016	Autumn	WMLR17 Back Valley Creek,	10	175	1010	1287	3.7	3.7	1.5	12	7.8	7.96
134	MLR	2016	Autumn	WMLR18 Aldgate Creek	11	139	88	196	1.293	0.94	353	10.3	9.3	8.13
135	MLR	2016	Autumn	WMLR19 Millers Creek	19	156	131	303	0.585	0.43	155	12.2	6.9	7.73
136	MLR	2016	Autumn	WMLR20 R Torrens	12	163	248	1792	2.907	2.89	17	12.8	2.7	7.19
138	MLR	2016	Autumn	WMLR22 Boat Harbour	22	63	27	305	0.887	0.86	27	11.4	8.8	8.25

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139	MLR	2016	Autumn	WMLR24 Deep Creek	5	81	35	7615	0.713	0.7	13	12.4	7	6.99
140	MLR	2016	Autumn	WMLR24 Little Para River	24	52	22	441	0.546	0.49	56	13.9	8.8	7.77
141	MLR	2016	Autumn	WMLR29 Tunkilla	29	109	53	236	1.302	0.89	412	11.3	8.6	7.73
142	MLR	2016	Autumn	WMLR30 Callawonga	30	141	89	242	1.685	1.36	325	11.3	7.4	7.75
143	MLR	2016	Autumn	WMLR32 Tunkalilla	32	25	14	202	0.711	0.56	151	10.8	9	8.03
144	MLR	2016	Autumn	WMLR33 Balaparudda Creek	33	114	55	520	1.441	1.43	11	12.1	8.9	7.44
145	MLR	2016	Autumn	WMLR34 Brownhill – Brownhill Creek Road	34	96	47	566	0.16	0.16	1.5	11.5	8.3	7.94
146	MLR	2016	Autumn	WMLR35 Brownhill downstream of Tilley's Hills Road	35	93	45	519	0.417	0.37	47	10.9	9.5	7.81
147	MLR	2016	Autumn	WMLR36 Jacobs Creek	36	7	10	1176	0.38	0.38	1.5	12.3	6.4	7.84
148	MLR	2016	Autumn	WMLR37 Myponga	37	32	15	2005	0.419	0.23	189	13.5	8	7.75
149	MLR	2016	Autumn	WMLR39 Light River Pinkerton Plains	39	136	83	10277	1.01	1.01	1.5	13.6	7.3	7.68
150	MLR	2016	Spring	WMLR01 First Creek, Waterfall Gully	18	8	10	151	0.62	0.51	110	10.2	10	8.09
151	MLR	2016	Spring	WMLR02 Scott Creek	20	152	116	599	1.04	0.93	110	10.8	8.8	8
152	MLR	2016	Spring	WMLR03 Deep Creek	21	100	49	960	1.17	1.14	32	11.3	8.8	7.64

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153	MLR	2016	Spring	WMLR04 Brownhill Creek, northern branch	25	48	20	980	0.253	0.25	1.5	18.9	8	7.67
154	MLR	2016	Spring	WMLR05 First Creek (Fleurieu)	2	145	97	566	1.03	1.03	1.5	12.5	8.9	7.48
155	MLR	2016	Spring	WMLR07 Sturt River	41	144	92	619	0.876	0.58	296	10.6	9.3	7.73
156	MLR	2016	Spring	WMLR08 Cox Creek	4	168	326	276	3.02	1.01	2010	11.6	8.4	7.47
157	MLR	2016	Spring	WMLR09 Inverbrackie Creek	42	134	82	850	0.632	0.54	92	10.6	7.3	7.11
158	MLR	2016	Spring	WMLR10 Walkers Creek	43	166	271	6660	1.56	1.56	1.5	17.2	7.8	8.47
160	MLR	2016	Spring	WMLR13 Wfall Gully	6	15	11	150	0.635	0.53	105	10.6	10.2	7.66
161	MLR	2016	Spring	WMLR14 Brownhill Creek, downstream caravan park	7	39	18	600	0.13	0.13	1.5	11.2	9.1	7.57
162	MLR	2016	Spring	WMLR15 Callawonga Creek	8	104	50	391	1.158	0.99	168	11.8	9.4	7.57
163	MLR	2016	Spring	WMLR16 Sixth Creek	9	57	24	477	0.438	0.31	128	12.4	9.9	7.76
164	MLR	2016	Spring	WMLR17 Back Valley Creek	10	176	1010	1287	3.7	3.7	1.5	12	7.8	7.96
165	MLR	2016	Spring	WMLR18 Aldgate Creek	11	140	88	196	1.293	0.94	353	10.3	9.3	8.13
166	MLR	2016	Spring	WMLR19 Millers Creek	19	157	131	303	0.585	0.43	155	12.2	6.9	7.73

Sample	Region	Year	Season	EPA Code	Code on Fig. 1	Sample number in Fig. 2	TP ($\mu\text{g L}^{-1}$)	Conductivity ($\mu\text{S cm}^{-1}$)	TN (mg L^{-1})	TKN (mg L^{-1})	NO _x ($\mu\text{g L}^{-1}$)	Temperature ($^{\circ}\text{C}$)	Dissolved oxygen (mg L^{-1})	pH
167	MLR	2016	Spring	WMLR20 Torrens River	12	164	248	1792	2.907	2.89	17	12.8	2.7	7.19
169	MLR	2016	Spring	WMLR22 Boat Harbour Creek	22	64	27	305	0.887	0.86	27	11.4	8.8	8.25
170	MLR	2016	Spring	WMLR24 Little Para River	24	53	22	441	0.546	0.49	56	13.9	8.8	7.77
171	MLR	2016	Spring	WMLR27 Deep Creek	27	135	82	426	1.29	1.26	30	13.2	7.9	7.66
172	MLR	2016	Spring	WMLR29 Tunkilla Creek	29	110	53	236	1.302	0.89	412	11.3	8.6	7.73
173	MLR	2016	Spring	WMLR30 Callawonga Creek	30	142	89	242	1.685	1.36	325	11.3	7.4	7.75
174	MLR	2016	Spring	WMLR32 Tunkallilla Creek	32	26	14	202	0.711	0.56	151	10.8	9	8.03
175	MLR	2016	Spring	WMLR33 Balapar Creek	33	115	55	520	1.441	1.43	11	12.1	8.9	7.44
176	MLR	2016	Spring	WMLR34 – Brownhill Creek Road (c0470)	34	97	47	566	0.16	0.16	1.5	11.5	8.3	7.94
177	MLR	2016	Spring	WMLR35 Brownhill Creek – downstream of Tilley's Hills Road (c0471)	35	94	45	519	0.417	0.37	47	10.9	9.5	7.81
178	MLR	2016	Spring	WMLR36 Jacobs Creek	36	9	10	1176	0.38	0.38	1.5	12.3	6.4	7.84
179	MLR	2016	Spring	WMLR37 Myponga Creek	37	33	15	2005	0.419	0.23	189	13.5	8	7.75
180	MLR	2016	Spring	WMLR39 Pinker Pl	39	137	83	10277	1.01	1.01	1.5	13.6	7.3	7.68

Sample	Region	Year	Season	EPA Code	Code on Fig. 1	Sample number in Fig. 2	TP ($\mu\text{g L}^{-1}$)	Conductivity ($\mu\text{S cm}^{-1}$)	TN (mg L^{-1})	TKN (mg L^{-1})	NO _x ($\mu\text{g L}^{-1}$)	Temperature ($^{\circ}\text{C}$)	Dissolved oxygen (mg L^{-1})	pH
181	MLR	2016	Spring	WMLR38 Light R Kapunda	38	58	24	8776	0.685	0.68	5	13.7	8.2	8.35
182	MLR	2016	Spring	WMLR39 Light R Linwood	39	123	63	11913	1.09	1.09	1.5	13.2	7.3	8.04