

Appendix F Water Quality Monitoring Data

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PORT OF AIRLIE MARINA DEVELOPMENT

Appendix F Water Quality Monitoring Data

F.1 FRC Monitoring Data (1998-2001)

The following water quality monitoring results are from a Whitsunday Shire Council monitoring program undertaken by FRC Environmental.

■ **Table F-1 Water quality sampling sites for Boat Haven, Pioneer and Charlies Bays.**

Bay	Site	AMG Co-ordinates	
Boat Haven Bay	Inshore	6 79 81 E	77 57 27 N
	Over coral	6 79 20 E	77 58 16 N
Pioneer Bay	Inshore	6 75 53 E	77 56 74 N
	Offshore	6 77 71 E	77 59 20 N
	Over corals	6 77 10 E	77 58 10 N
Charlies Bay	Inshore	6 74 16 E	77 60 54 N
	Over corals	6 75 19 E	77 61 80 N

■ **Table F-2 Water quality parameters: physicochemical and biological.**

Event	Location	DO mg/L	Chl mg/L	pH	Salinity g/L	Temp. °C	TSS mg/L	Secchi m	
June 98	B/Haven Bay	In	8.4	<1	8.3	34.2	24	106	bot.
		Off	9.6	<1	8.4	33.8	22	44	1.35
	Pioneer Bay	In	8.6	<1	8.2	32.0	23	150	0.35
		Off	8.5	<1	8.2	33.2	22	58	1.01
	Charlies Bay	In	9.5	<1	8.1	32.7	23	46	0.72
		Off	8.0	<1	8.2	33.5	22	126	1.63
Nov 98	B/Haven Bay	In	<1		34.7	27	116	0.12	
		Off	<1		34.1	25	12	0.60	
		Cor	<1		34.6	26	12	0.27	
	Pioneer Bay	In	<1		34.6	26	284	0.06	
		Off	<1		35.2	24	3	0.90	
		Cor	<1		35.2	24	31	0.72	
	Charlies Bay	In	<1		34.4	27	119	0.20	
		Off	<1		35.0	24	<1	0.82	
		Cor	<1		35.0	24	12	0.56	
	May 99	Funnel Bay	Cor	<1		35.1	24	4	1.10
			In	<0.1		29	24	157	0.65
		B/Haven Bay	Off	<0.1		29	23	145	0.90
Cor			<0.4		29	23	132	0.60	
In			0.2		29	24	196	0.80	
Pioneer Bay		Off	<0.1		30	23	147	1.25	
		Cor	0.2		29	24	232	1.30	
		In	<0.1		29	24	103	1.10	
Charlies Bay		Off	<0.2		29	23	127	1.75	
		Cor	<0.1		30	23	89	1.45	
		In	<0.1		29	23	121	0.85	
Nov 99		B/Haven Bay	In	<0.1		33.6	26.8	40	0.35
			Cor	7		35.2	25.3	37	0.80
		Pioneer Bay	In	6		31.6	26.5	92	0.30
			Off	2		35.6	24.6	24	0.65
			Cor	7		37.6	25.2	24	0.90
		Charlies Bay	In	4		36.4	27.2	36.4	0.25
			Cor	<0.1		34.8	25.7	34.8	1.30

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Event	Location		DO mg/L	Chl amg/L	pH	Salinity g/L	Temp. °C	TSS mg/L	Secchi m
June 00	B./Haven Bay	In		<1		36.9	22	27	> 0.35
		Cor		<1		37.1	22	24	1.40
	Pioneer Bay	In		<1		37.0	22	27	> 0.55
		Cor				36.5	22	28	1.25
		Off		<1		37.0	22	24	1.65
	Charlies Bay	In		<1		36.6	22	26	< 0.65
		Cor		<1		37.1	22	28	1.55
Funnel Bay	Cor		<1		36.5	22	26	1.55	
Nov 00	B./Haven Bay	In		<1		32.3	24.5	59	> 1.15
		Cor		<1		34.1	23.5	72	1.40
	Pioneer Bay	In		<1		26.3	25.0	29	> 0.25
		Cor		<1		28.9	23.5	36	1.45
		Off		1		33.2	23.5	77	1.05
	Charlies Bay	In		1		30.6	25.0	84	> 1.05
Cor			<1		31.4	24.0	97	1.35	
Jun 01	B./Haven Bay	In		<1		34	22	112	> 0.25
		Cor		<1		30	22	116	0.45
	Pioneer Bay	Cor		5		35	22	195	1.25
		Off		1		37	21	109	2.80
	Charlies Bay	In		2		32	21	192	0.60
		Cor		<1		59	21	102	1.30
Funnel Bay	Cor		<1		31	21	126	2.15	
Nov 01	B./Haven Bay	In		1		38	26	99	0.20
		Cor		<1		31	26	15	n.a.
	Pioneer Bay	In		2		35	26	35	> 0.40
		Cor		<1		36	26	7	1.35
		Off		<1		36	25	1	1.35
	Charlies Bay	In		<1		37	26	8	> 1.20
		Cor		<1		37	25	2	3.40

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■ **Table F-3 Water quality parameters – nutrients (µg/L)**

Event	Location		NH ₄	NO ₃	TN (TKN +NO ₃)	PO ₄	TP
June 98	B/Haven Bay	In	<5	35	130	30	38
		Off	10	37	100	14	25
	Pioneer Bay	In	<5	39	120	10	85
		Off	100	39	260	150	16
	Charlies Bay	In	<5	45	50	20	35
		Off	<5	35	70	7	20
Nov 98	B/Haven Bay	In	<10	<5	40	<10	30
		Off	<10	<5	<10	<10	10
	Pioneer Bay	Cor	10	<5	40	<10	10
		In	<10	<5	24	80	120
	Charlies Bay	Off	<10	<5	20	<10	<10
		Cor	10	<5	70	<10	70
May 99	B/Haven Bay	In	15	<1	85	10	22
		Off	19	113	208	3	24
	Pioneer Bay	Cor	13	1	130	<1	23
		In	17	16	247	9	25
	Charlies Bay	Off	19	9	191	<1	48
		Cor	15	194	191	7	18
Nov 99	B/Haven Bay	In	19	<1	602	6	22
		Off	20	<1	306	10	19
	Pioneer Bay	Cor	19	1	306	3	29
		In	16	<1	136	8	12
	Charlies Bay	Cor	16	<1	136	8	12
		In	9	47	245	20	51
June 00	B/Haven Bay	Cor	9	13	154	17	44
		In	6	12	315	43	43
	Pioneer Bay	Off	7	10	117	56	61
		Cor	8	13	227	43	45
	Charlies Bay	In	11	12	267	45	59
		Cor	6	15	91	53	45
Nov 00	B/Haven Bay	In	<5	17	129	<10	19
		Cor	<5	1	209	<10	36
	Pioneer Bay	In	<5	<1	127	<10	32
		Cor	<5	1	303	<10	23
	Charlies Bay	Off	<5	14	140	<10	19
		In	<5	8	836	<10	15
Nov 01	B/Haven Bay	Cor	<5	7	89	<10	21
		In	<5	23	218	<10	19
	Pioneer Bay	Cor	<5	24	869	15	116
		In	<5	16	652	<10	66
	Charlies Bay	In	19	23	94	12	72
		Cor	<5	72	142	<10	59
June 01	B/Haven Bay	Off	<5	24	617	<10	62
		In	7	18	1029	15	108
	Pioneer Bay	Cor	<5	16	990	<10	121
		In	6	53	<100	<10	<10
	Charlies Bay	In	7	52	<100	<10	30
		Cor	5	20	400	<10	<10
Nov 01	B/Haven Bay	Off	4	32	<100	<10	<10
		In	5	64	<100	<10	20
	Pioneer Bay	Cor	10	60	<100	<10	<10
		In	10	34	<100	<10	<10
	Charlies Bay	Cor	10	34	<100	<10	<10
		In	<10	33	199	7	127
Nov 01	B/Haven Bay	Cor	<10	32	95	3	12
		In	<10	39	112	7	27
	Pioneer Bay	Cor	<10	29	66	6	19
		Off	<10	25	65	5	9
	Charlies Bay	In	<10	28	113	2	10
		Cor	<10	24	97	1	10

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F.2 Department of Environmental and Heritage Data (1988-89)

■ **Table F-4 DEH Average Physical Water Quality Monitoring Data Summary (with standard variations)**

Location (sites)	Temperature (°C)	pH (0-14)	Cond. (mS/cm)	Turbidity (NTU)	Secchi Depth (m)
All sites (1-14)	25.0 (3.6)	8.3 (0.2)	57.1 (2.3)	4.8 (5.3)	1.4 (0.8)
Pioneer Bay (2 & 9)	24.9 (3.4)	8.3 (0.2)	56.7 (3.0)	2.5 (1.0)	1.5 (0.6)
Shute Harbour (12-14)	23.9 (3.5)	8.4 (.02)	58.7 (2.2)	2.1 (5.2)	3.5 (0.5)
ANZECC	<2°C increase	<0.2 change		<10% change in seasonal mean	

■ **Table F-5 DEH Average Chemical Water Quality Monitoring Data Summary (with standard variations)**

Location (sites)	TSS (mg/L)	Org N. (mgN/L)	Ammonia (mgN/L)	Ox. N (mgN/L)	TN (mgN/L)	Reactive P. (mgP/L)	TP (mgP/L)
All sites (1-14)	9.7 (10.2)	0.2 (0.2)	0.010 (0.012)	0.014 (0.026)	0.25 (0.19)	0.006 (0.006)	0.03 (0.03)
Pioneer Bay (2 & 9)	6.6 (4.4)	0.3 (0.3)	0.014 (0.018)	0.022 (0.052)	0.29 (0.33)	0.005 (<0.001)	0.04 (0.05)
Shute Harbour	5.6 (1.6)	0.2 (0.1)	0.004 (0.002)	0.004 (0.006)	0.20 (0.14)	0.005 (0.001)	0.02 (<0.01)
Boathaven Bay (10 & 11)	10.4 (11.8)	0.2 (0.1)	0.014 (0.013)	0.015 (0.011)	0.26 (0.15)	0.005 (<0.001)	0.03 (0.02)
ANZECC (embayment)			<0.005	<0.100		<0.015	

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F.3 University of Queensland Data (1995)

■ Table F-6 Average UQ Physical Water Quality Data Summary (1995) (with standard deviations)

Location	pH (0-14)	Salinity (g/L)	Temperature (°C)	DO (mg/L)	Turbidity (NTU)	Secchi Depth (m)	Kd (/m)
Charles Bay Average	8.30 (0.35)	34.2 (0.7)	25.6 (1.6)	6.50 (0.23)	2.5 (1.9)	2.3 (0.7)	0.7 (0.4)
Pioneer Bay Average	8.21 (0.47)	33.6 (2.2)	26.1 (2.7)	6.80 (0.64)	4.8 (3.5)	2.0 (0.8)	1.0 (0.3)
Boathaven Bay Average	8.32 (0.40)	34.6 (0.2)	25.4 (1.5)	6.49 (0.21)	3.7 (2.4)	1.5 (0.5)	1.2 (0.4)
ANZECC	<0.2 change		<2°C change	>6mg/L	10% change in seasonal mean		

■ Table F-7 Average UQ Chemical Water Quality Data Summary (1995) (with standard deviations)

Location	TSS (mg/L)	Ox. N (mgN/L)	NH ₃ (mg/L)	DIN (mg/L)	FRP (mg/L)	N:P (molar)	Chl a (µg/L)
Charles Bay							
Average (all sites)	18.19	0.008	0.020	0.029	0.004	17.1	0.52
SD (all sites)	(26.72)	(0.006)	(0.007)	(0.015)	(0.001)	(7.1)	(0.23)
Average (wet)	21.05	0.013	0.023	0.037	0.004	20.4	0.45
SD (wet)	(29.38)	(0.005)	(0.008)	(0.0013)	(0.001)	(6.8)	(0.08)
Max (wet)	113.80	0.020	0.030	0.050	0.004	27.6	0.55
Average (dry)	6.73	0.005	0.18	0.018	0.004	14.9	0.56
SD (dry)	(2.32)	(0.002)	(0.006)	(0.011)	(0.011)	(6.5)	(0.29)
Max (dry)	9.16	0.008	0.027	0.028	0.006	25.8	1.13
Pioneer Bay							
Average (all sites)	21.38	0.124	0.121	0.339	0.079	20.9	0.71
SD (all sites)	(10.85)	(0.320)	(0.290)	(0.734)	(0.218)	(11.6)	(0.30)
Average (wet)	24.58	0.417	0.403	0.817	0.294	12.3	0.91
SD (wet)	(11.78)	(0.514)	(0.508)	(1.025)	(0.367)	(7.5)	(0.38)
Max (wet)	37.92	1.300	1.300	2.600	0.908	22.3	1.50
Average (dry)	14.98	0.007	0.026	0.020	0.003	23.9	0.65
SD (dry)	(5.67)	(0.003)	(0.012)	(0.007)	(0.000)	(11.4)	(0.26)
Max (dry)	19.35	0.011	0.046	0.028	0.004	42.1	1.30
Boathaven Bay							
Average (all sites)	29.42	0.009	0.019	0.029	0.009	10.6	0.82
SD (all sites)	(12.51)	(0.010)	(0.008)	(0.015)	(0.009)	(5.9)	(0.30)
Average (wet)	35.74	0.030	0.027	0.050	0.006	17.9	0.93
SD (wet)	(3.55)	(0.000)	(0.006)	(0.010)	(0.000)	(2.7)	(0.13)
Max (wet)	38.13	0.030	0.030	0.060	0.006	20.0	1.03
Average (dry)	23.10	0.005	0.017	0.022	0.009	9.3	0.80
SD (dry)	(16.10)	(0.003)	(0.008)	(0.006)	(0.010)	(5.4)	(0.32)
Max (dry)	39.08	0.011	0.032	0.030	0.040	21.4	1.30
ANZECC		<0.1	<0.005		<0.015		<10

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F.4 WBM Sediment Chemistry Data

■ **Table F-8 Water Quality Testing Results – Metals & Bacteria**

Site	TPC (No/mL)	Cr (µg/L)	Cu (µg/L)	Ni (µg/L)	Pb (µg/L)	Zn (µg/L)	OCP (mg/L)
1	4	<50	<5	<15	13	36	ND
2	31.5	<50	<5	<15	<5	<20	ND
3	41	<50	<5	<15	<5	<20	ND
4	6	<50	<5	<15	<5	<20	ND
5	4	<50	<5	<15	<5	<20	ND
6	6.5	<50	<5	<15	<5	<20	ND
7	2	<50	<5	<15	<5	<20	ND
8	<1	<50	<5	<15	<5	<20	ND
9	2	<50	<5	<15	<5	<20	ND
10	13	<50	<5	<15	<5	<20	ND
11	8	<50	<5	<15	<5	<20	ND
12	13	<50	<5	<15	<5	20	ND
ANZECC	-	<50	<5	<15	<5	<50	-