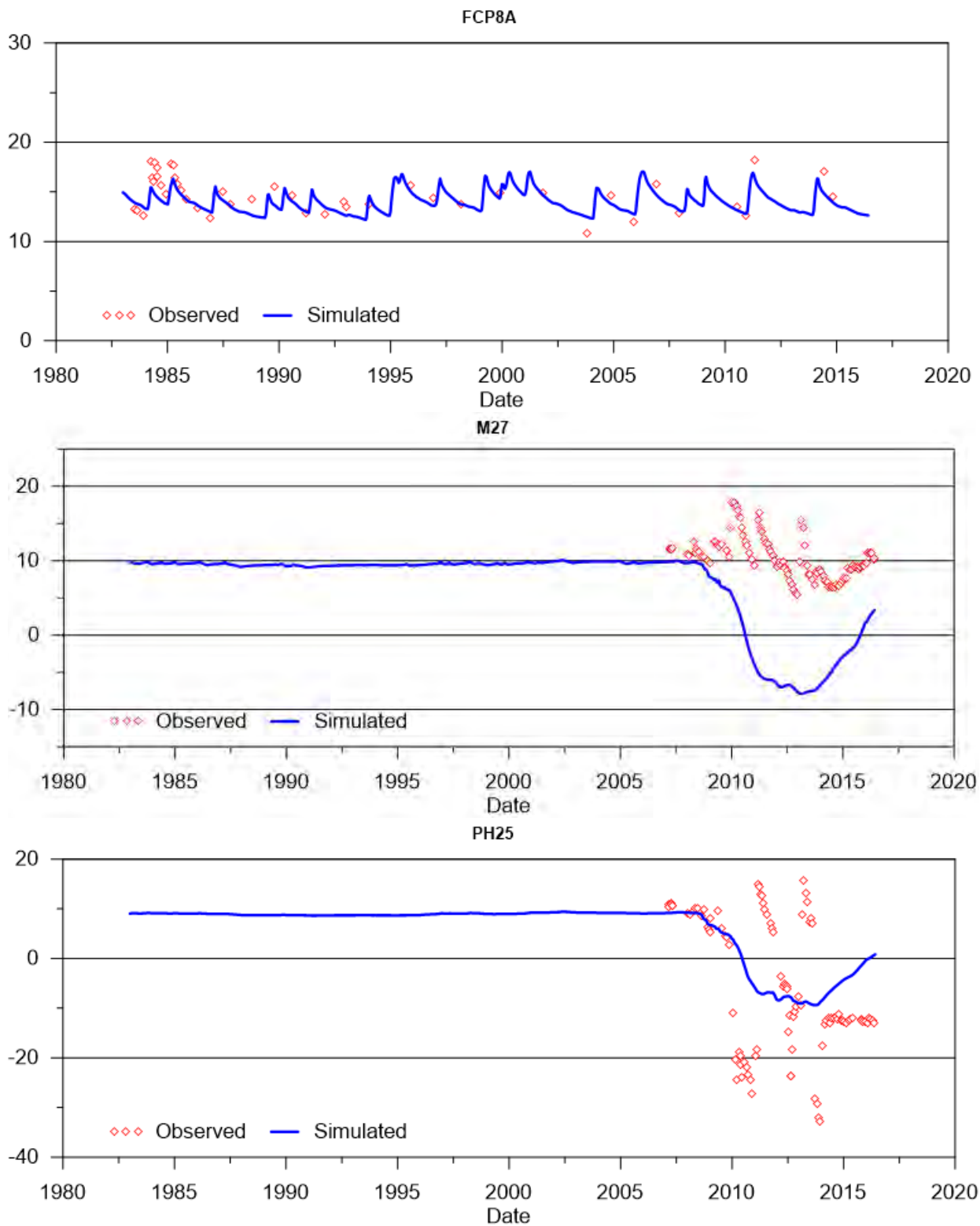
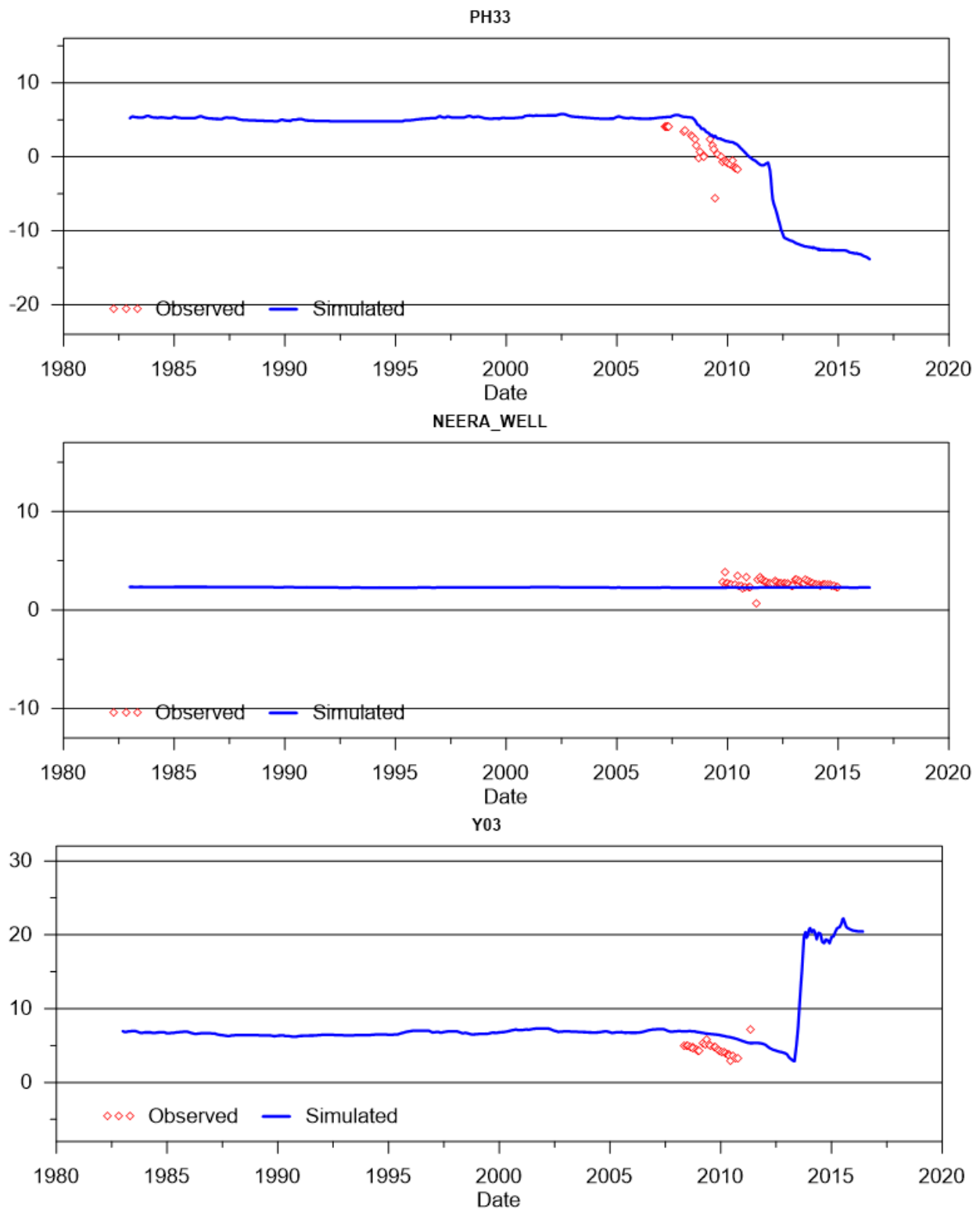
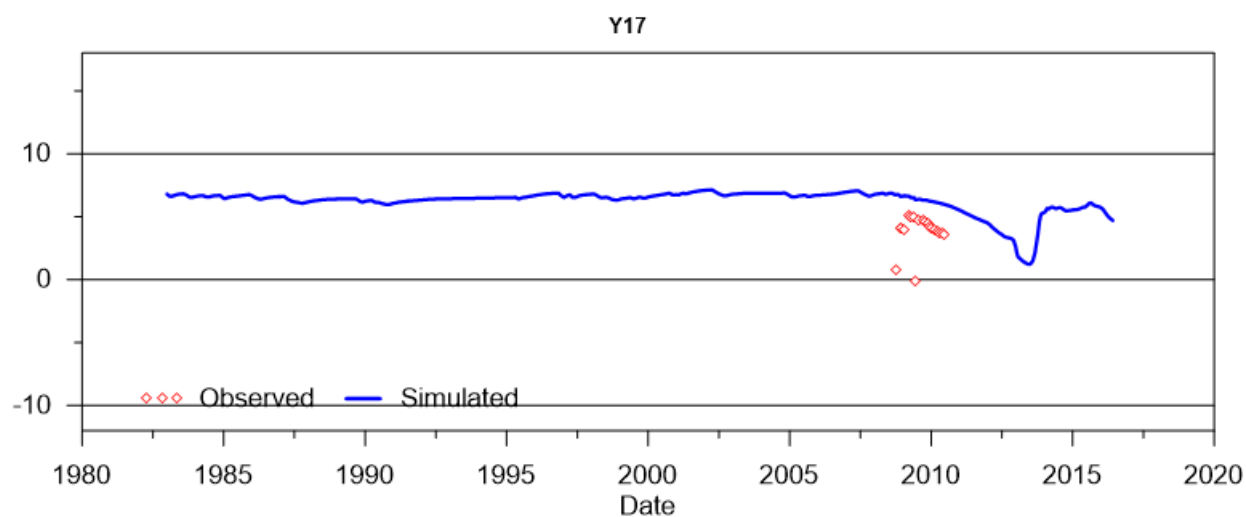
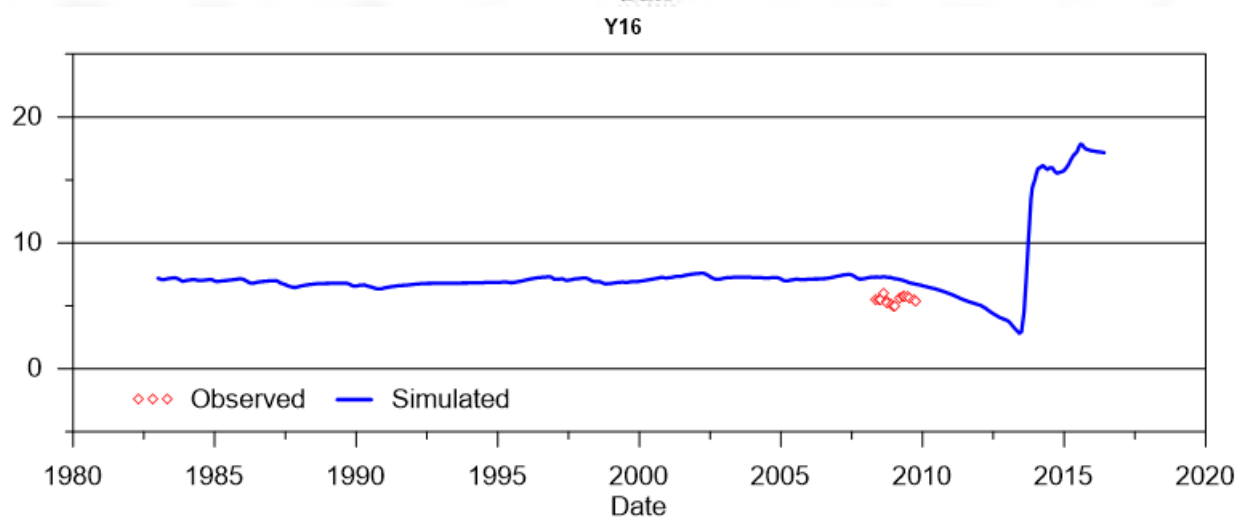
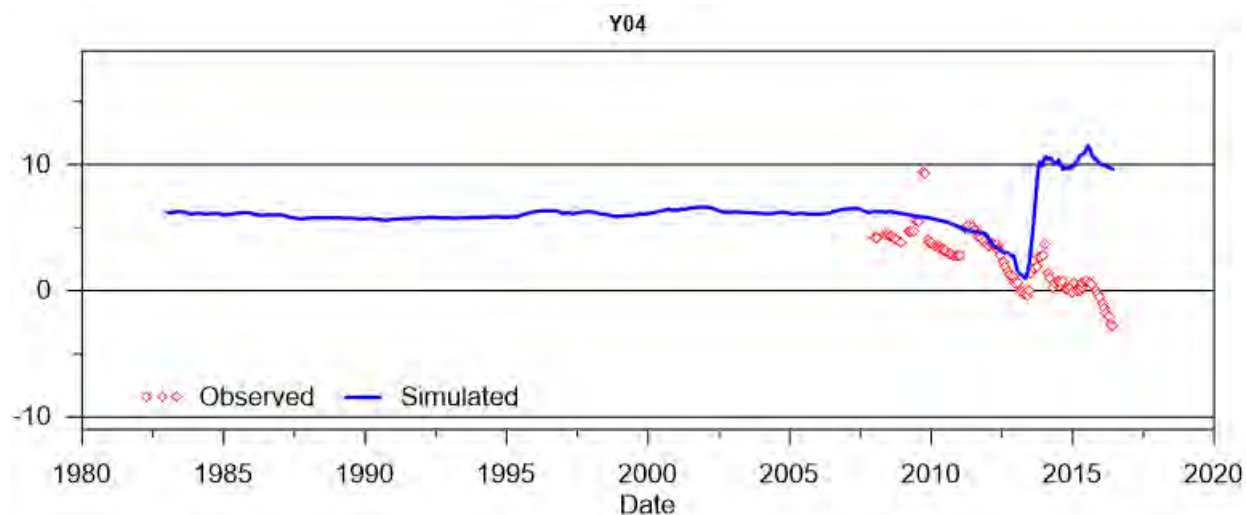


SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL
APPENDIX E –Calibrated standpipe groundwater levels

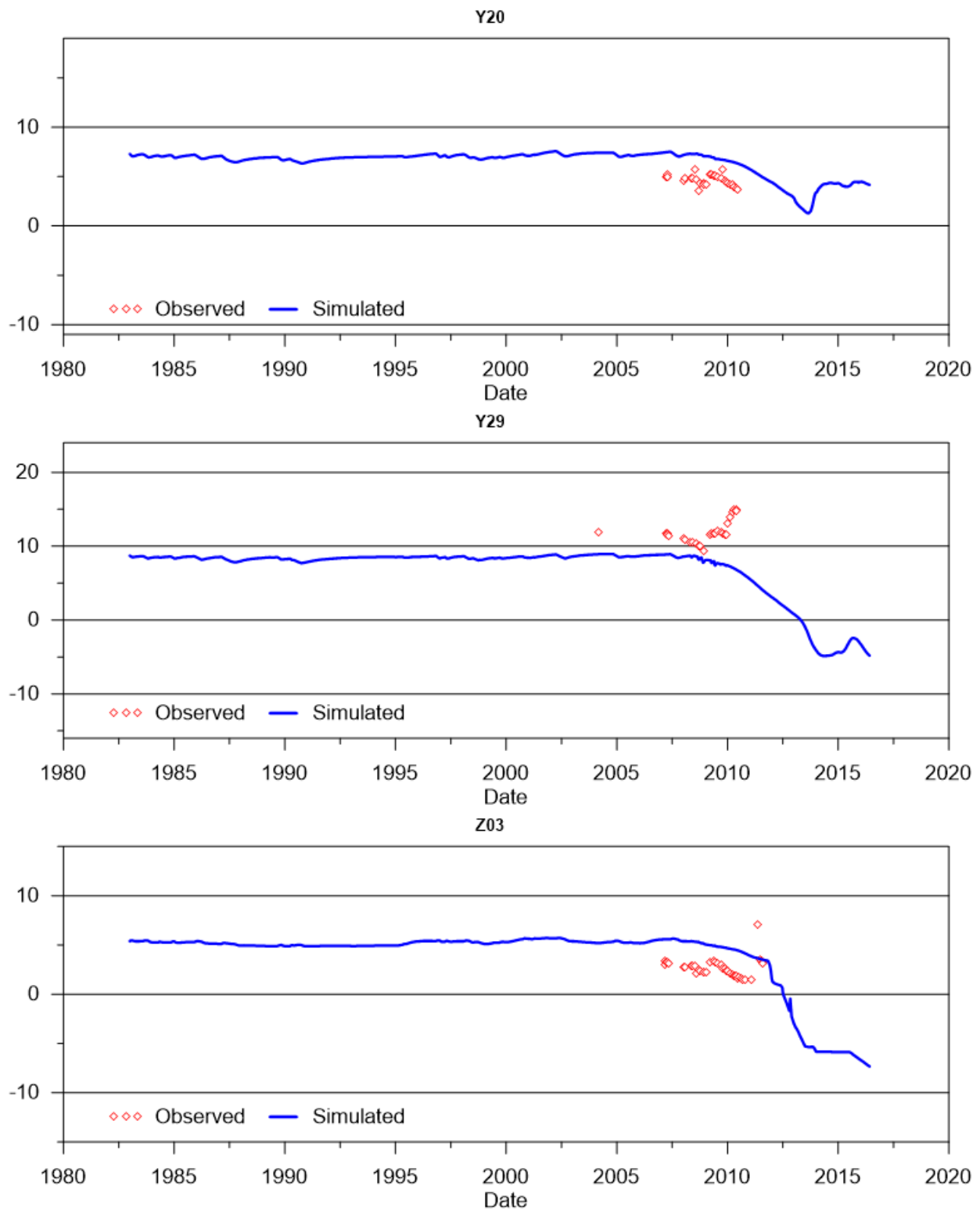


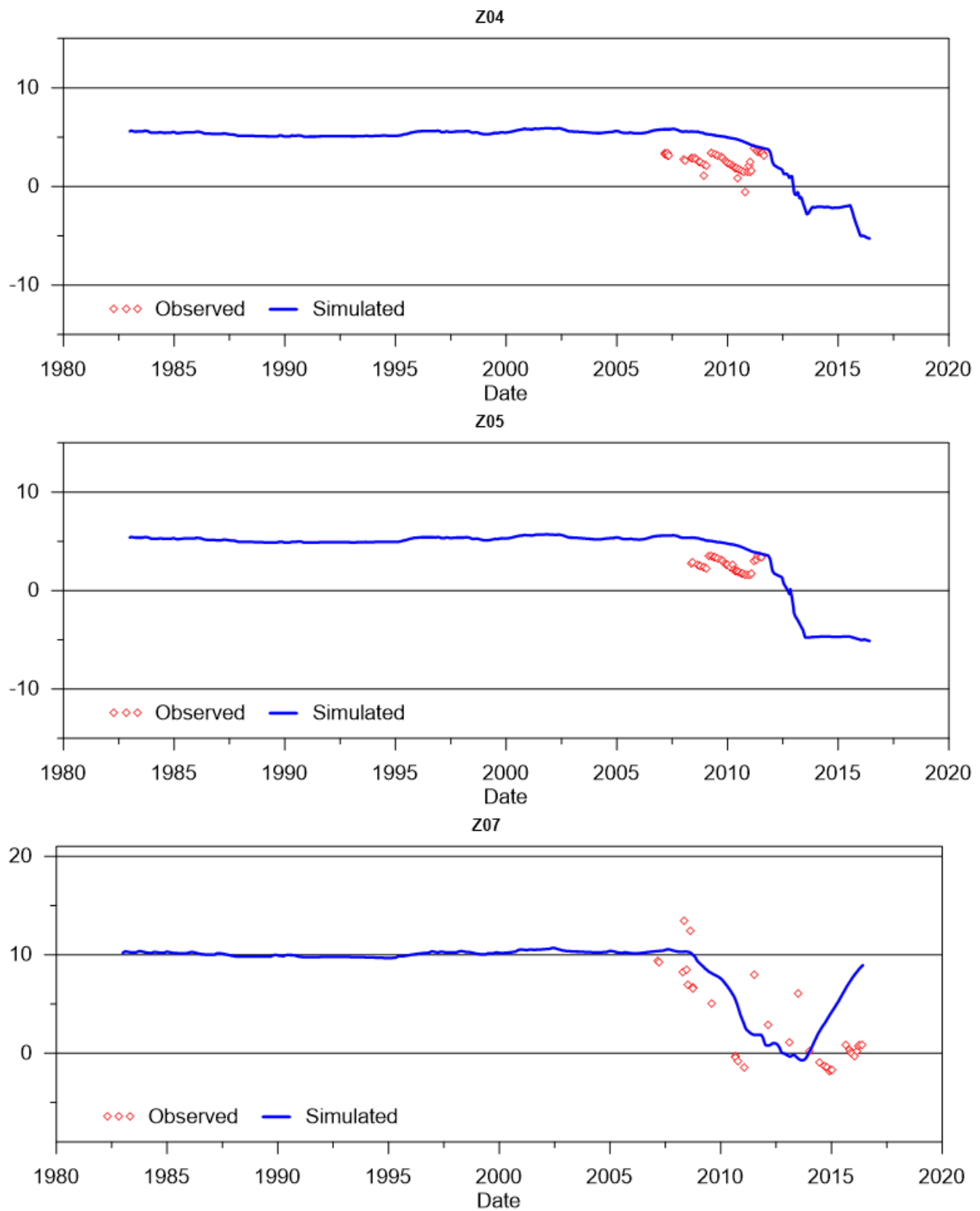


SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL
APPENDIX E –Calibrated standpipe groundwater levels

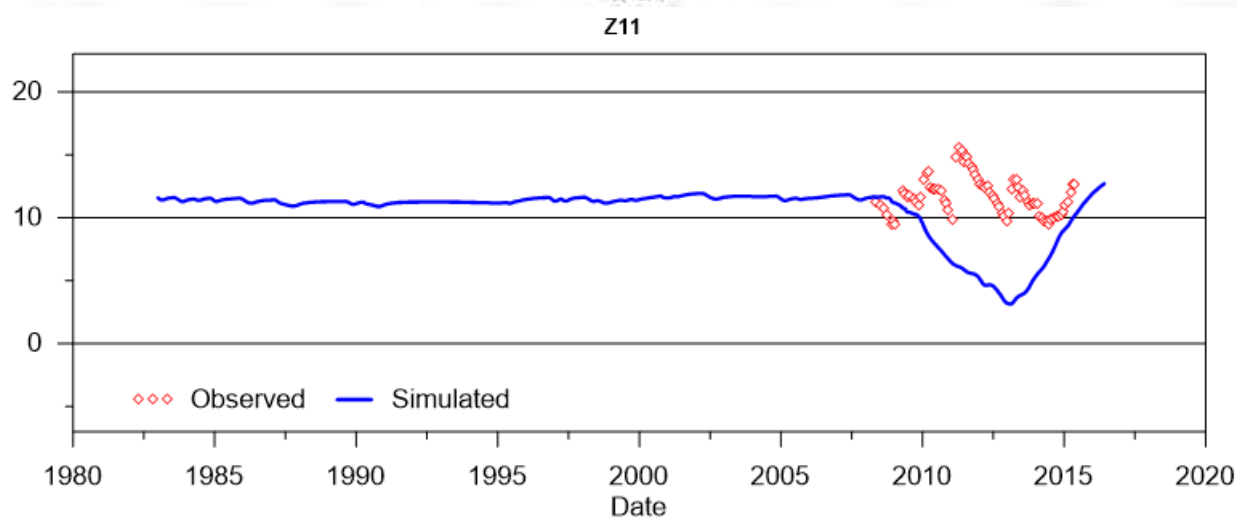
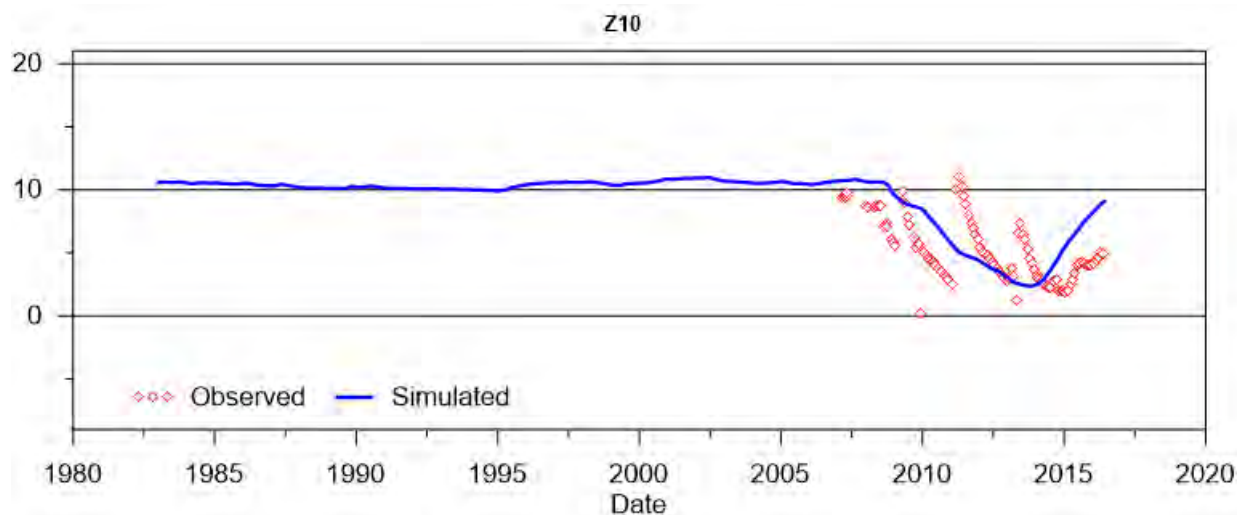


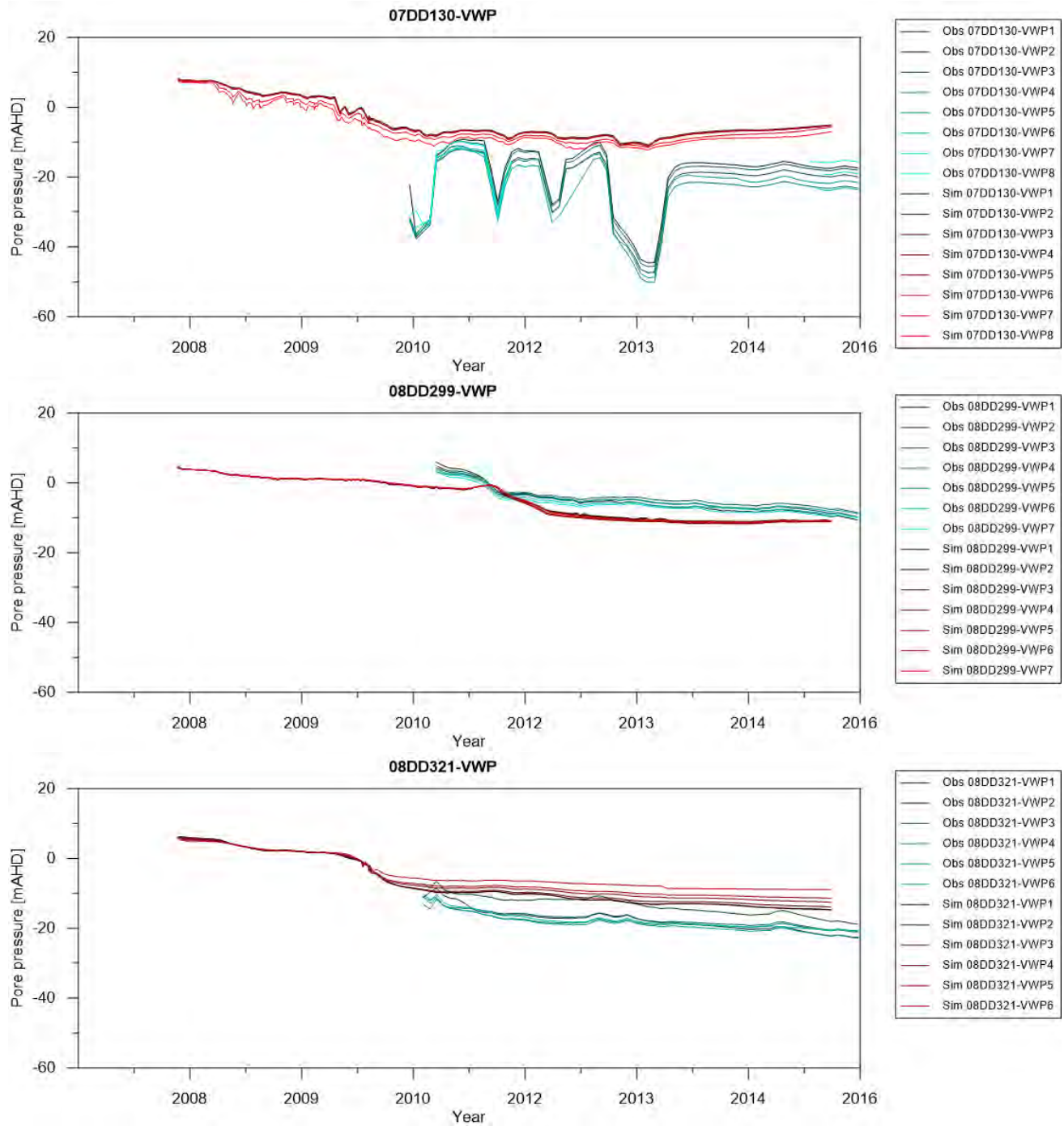
SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL
APPENDIX E –Calibrated standpipe groundwater levels

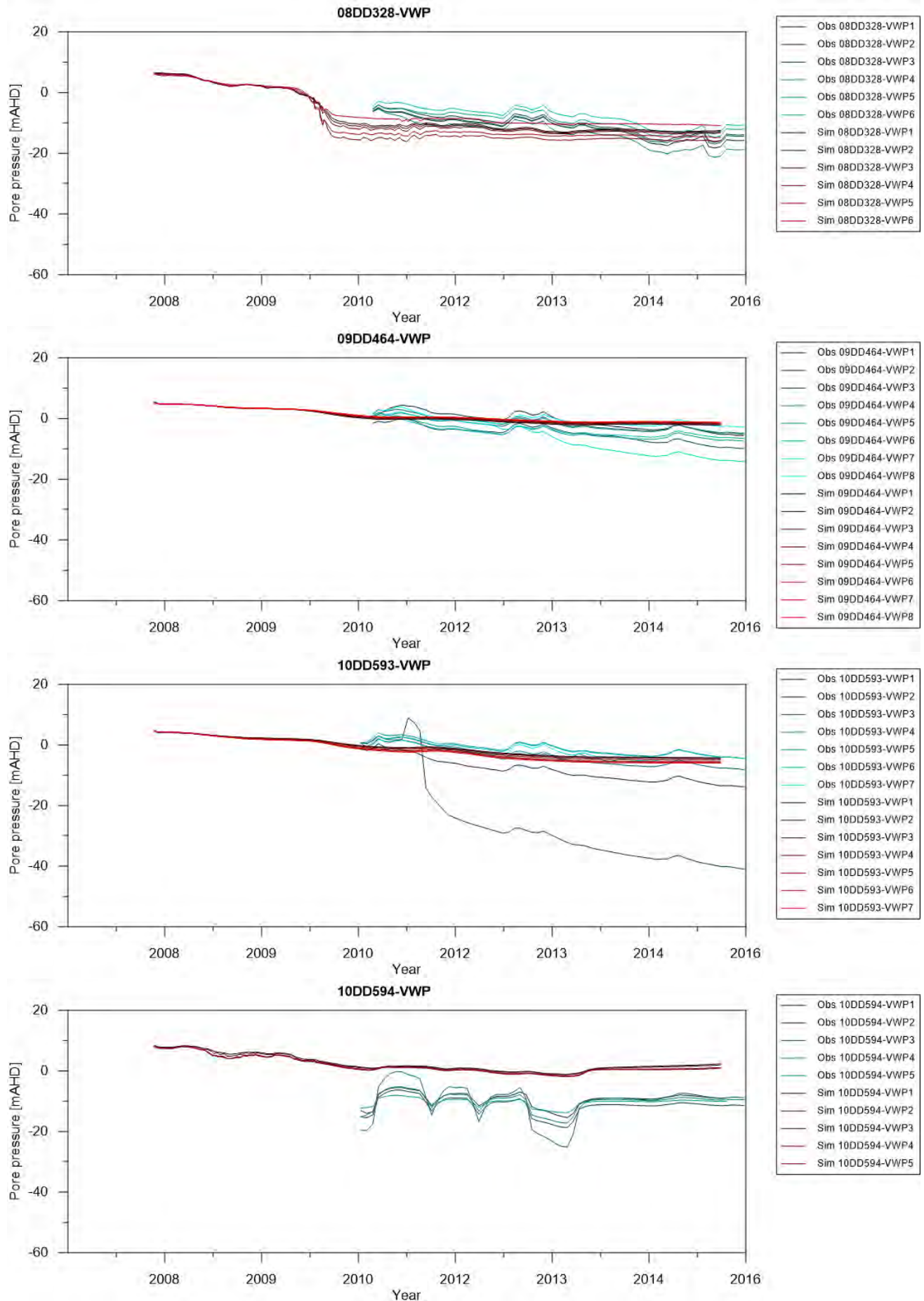


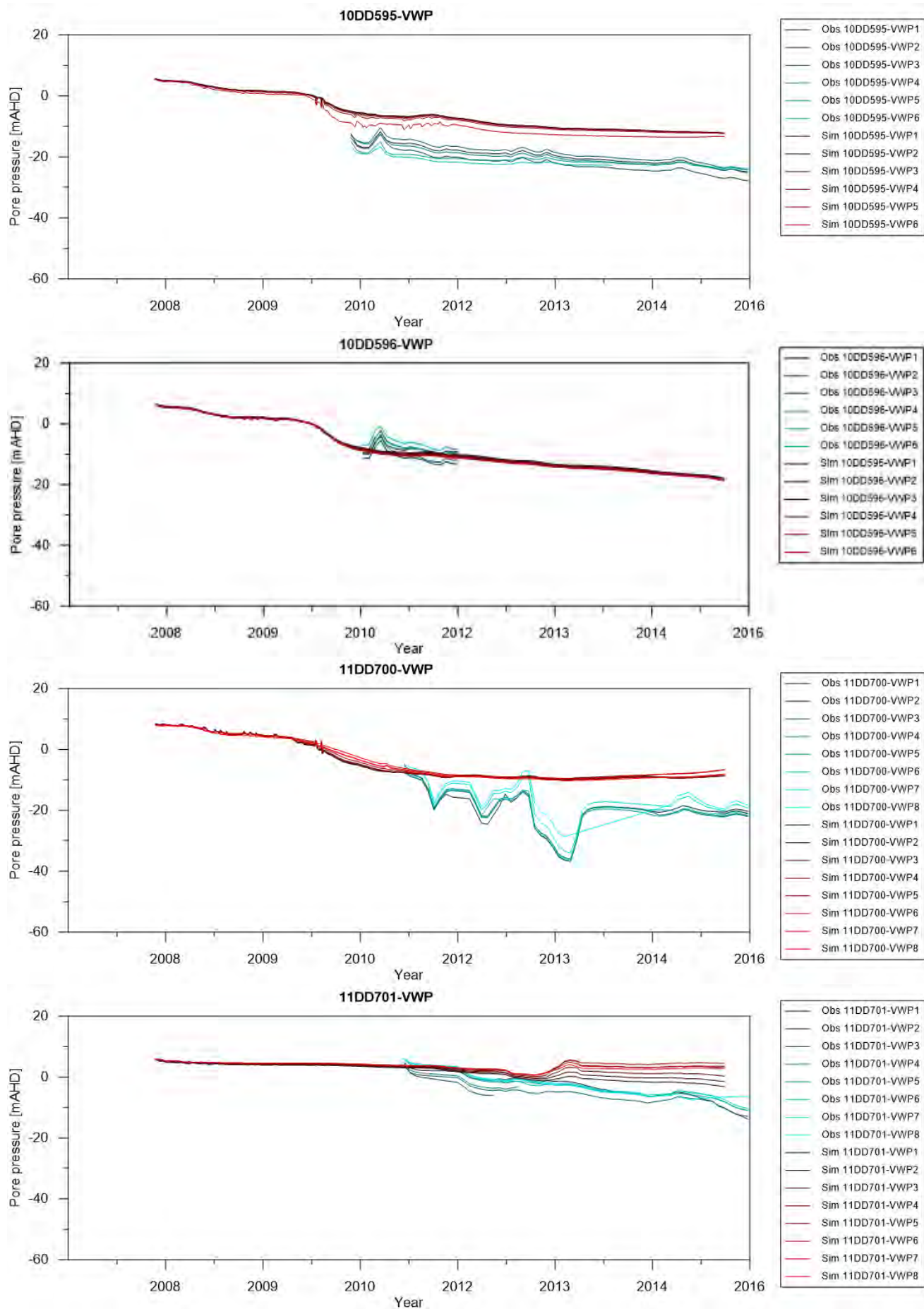


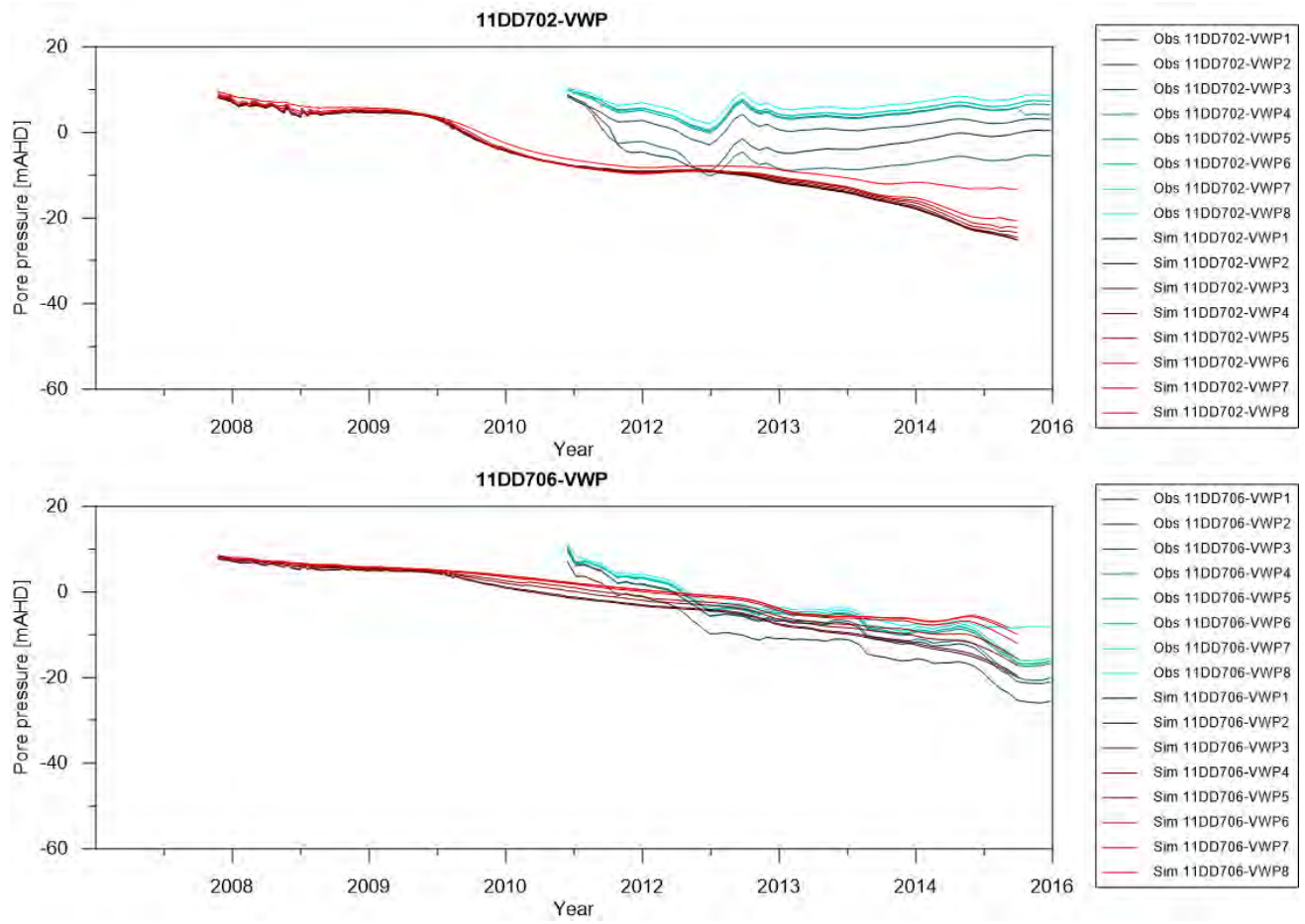
SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL
APPENDIX E –Calibrated standpipe groundwater levels











Contributions to groundwater level component of the objective function

Sum of squared weighted residuals (ie phi)	1.44E+06	m
Number of residuals with non-zero weight	14403	m
Root mean square of all observations	10.01	m
Contribution to phi from observation group "e_dewater"	16631	m
Contribution to phi from observation group "s_dewater"	341378	m
Contribution to phi from observation group "se_dewater"	506116	m
Contribution to phi from observation group "ne_dewater"	20459	m
Contribution to phi from observation group "pit_dewat"	30242	m
Contribution to phi from observation group "east_pit"	51587	m
Contribution to phi from observation group "west_pit"	3309.3	m
Contribution to phi from observation group "e_mine"	37109	m
Contribution to phi from observation group "n_mine"	34.237	m
Contribution to phi from observation group "s_mine"	713.08	m
Contribution to phi from observation group "e_alluv"	2442.4	m
Contribution to phi from observation group "n_alluv"	7.4618	m
Contribution to phi from observation group "s_alluv"	2530.9	m
Contribution to phi from observation group "fcp"	110.76	m
Contribution to phi from observation group "ex_mine"	7554.3	m
Contribution to phi from observation group "tsf"	21344	m
Contribution to phi from observation group "vwp"	400856	m

Individual observation group performance statistics

Residuals for observation group "e_dewater":-

Number of residuals with non-zero weight	353	
Mean value of non-zero weighted residuals	-3.85	m
Maximum weighted residual [observation "08nc280_003"]	10.03	m
Minimum weighted residual [observation "10nc586_004"]	-59.48	m
"Variance" of weighted residuals	47.11	m
"Standard error" of weighted residuals	6.864	m

Residuals for observation group "s_dewater":-

Number of residuals with non-zero weight	551	
Mean value of non-zero weighted residuals	-7.703	m
Maximum weighted residual [observation "08nc265_001"]	96.52	m
Minimum weighted residual [observation "08nc266_006"]	-72.63	m
"Variance" of weighted residuals	619.6	m
"Standard error" of weighted residuals	24.89	m

Residuals for observation group "se_dewater":-

Number of residuals with non-zero weight	708	
Mean value of non-zero weighted residuals	-13.08	m
Maximum weighted residual [observation "10nc590_096"]	13.96	m
Minimum weighted residual [observation "08nc273_002"]	-118	m

APPENDIX G – Groundwater level observation group calibration statistics

"Variance" of weighted residuals	714.9	m
"Standard error" of weighted residuals	26.74	m
Residuals for observation group "ne_dewater":-		
Number of residuals with non-zero weight	209	
Mean value of non-zero weighted residuals	-4.502	m
Maximum weighted residual [observation "09nc412_012"]	3.104	m
Minimum weighted residual [observation "09nc412_002"]	-48.72	m
"Variance" of weighted residuals	97.89	m
"Standard error" of weighted residuals	9.894	m
Residuals for observation group "pit_dewat":-		
Number of residuals with non-zero weight	51	
Mean value of non-zero weighted residuals	-23.08	m
Maximum weighted residual [observation "08nc268_013"]	-1.22	m
Minimum weighted residual [observation "08nc268_002"]	-36.1	m
"Variance" of weighted residuals	593	m
"Standard error" of weighted residuals	24.35	m
Residuals for observation group "east_pit":-		
Number of residuals with non-zero weight	861	
Mean value of non-zero weighted residuals	-0.1847	m
Maximum weighted residual [observation "07rc170_004"]	32.28	m
Minimum weighted residual [observation "ph25_019"]	-27.86	m
"Variance" of weighted residuals	59.92	m
"Standard error" of weighted residuals	7.74	m
Residuals for observation group "west_pit":-		
Number of residuals with non-zero weight	545	
Mean value of non-zero weighted residuals	1.693	m
Maximum weighted residual [observation "07rc135_057"]	8.668	m
Minimum weighted residual [observation "09nc411_001"]	-4.95	m
"Variance" of weighted residuals	6.072	m
"Standard error" of weighted residuals	2.464	m
Residuals for observation group "e_mine":-		
Number of residuals with non-zero weight	1435	
Mean value of non-zero weighted residuals	-1.073	m
Maximum weighted residual [observation "09nc563_006"]	21.02	m
Minimum weighted residual [observation "09nc566_017"]	-27.77	m
"Variance" of weighted residuals	25.86	m
"Standard error" of weighted residuals	5.085	m
Residuals for observation group "n_mine":-		
Number of residuals with non-zero weight	19	
Mean value of non-zero weighted residuals	-1.072	m
Maximum weighted residual [observation "12dd721_002"]	0.1488	m
Minimum weighted residual [observation "12dd721_001"]	-2.328	m
"Variance" of weighted residuals	1.802	m

"Standard error" of weighted residuals	1.342	m
Residuals for observation group "s_mine":-		
Number of residuals with non-zero weight	137	
Mean value of non-zero weighted residuals	1.086	m
Maximum weighted residual [observation "11dd712_004"]	9.822	m
Minimum weighted residual [observation "11dd712_011"]	-2.631	m
"Variance" of weighted residuals	5.205	m
"Standard error" of weighted residuals	2.281	m
Residuals for observation group "e_alluv":-		
Number of residuals with non-zero weight	3880	
Mean value of non-zero weighted residuals	0.2736	m
Maximum weighted residual [observation "09nc541_065"]	3.007	m
Minimum weighted residual [observation "09nc500_041"]	-12.81	m
"Variance" of weighted residuals	0.6295	m
"Standard error" of weighted residuals	0.7934	m
Residuals for observation group "n_alluv":-		
Number of residuals with non-zero weight	28	
Mean value of non-zero weighted residuals	-0.3316	m
Maximum weighted residual [observation "08nc630_001"]	0.5274	m
Minimum weighted residual [observation "08nc633_007"]	-1.066	m
"Variance" of weighted residuals	0.2665	m
"Standard error" of weighted residuals	0.5162	m
Residuals for observation group "s_alluv":-		
Number of residuals with non-zero weight	368	
Mean value of non-zero weighted residuals	-0.5827	m
Maximum weighted residual [observation "08nc379_003"]	5.942	m
Minimum weighted residual [observation "08nc382_049"]	-10.23	m
"Variance" of weighted residuals	6.877	m
"Standard error" of weighted residuals	2.622	m
Residuals for observation group "fcp":-		
Number of residuals with non-zero weight	146	
Mean value of non-zero weighted residuals	0.3812	m
Maximum weighted residual [observation "fcp32b_005"]	3.068	m
Minimum weighted residual [observation "fcp2b_002"]	-1.899	m
"Variance" of weighted residuals	0.7586	m
"Standard error" of weighted residuals	0.871	m
Residuals for observation group "ex_mine":-		
Number of residuals with non-zero weight	267	
Mean value of non-zero weighted residuals	3.462	m
Maximum weighted residual [observation "09nc430_018"]	10.85	m
Minimum weighted residual [observation "09nc427_002"]	-21.48	m
"Variance" of weighted residuals	28.29	m
"Standard error" of weighted residuals	5.319	m

Residuals for observation group "tsf":-

Number of residuals with non-zero weight	664	
Mean value of non-zero weighted residuals	2.524	m
Maximum weighted residual [observation "09dd604_008"]	16.31	m
Minimum weighted residual [observation "09nc426_007"]	-48.65	m
"Variance" of weighted residuals	32.14	m
"Standard error" of weighted residuals	5.67	m

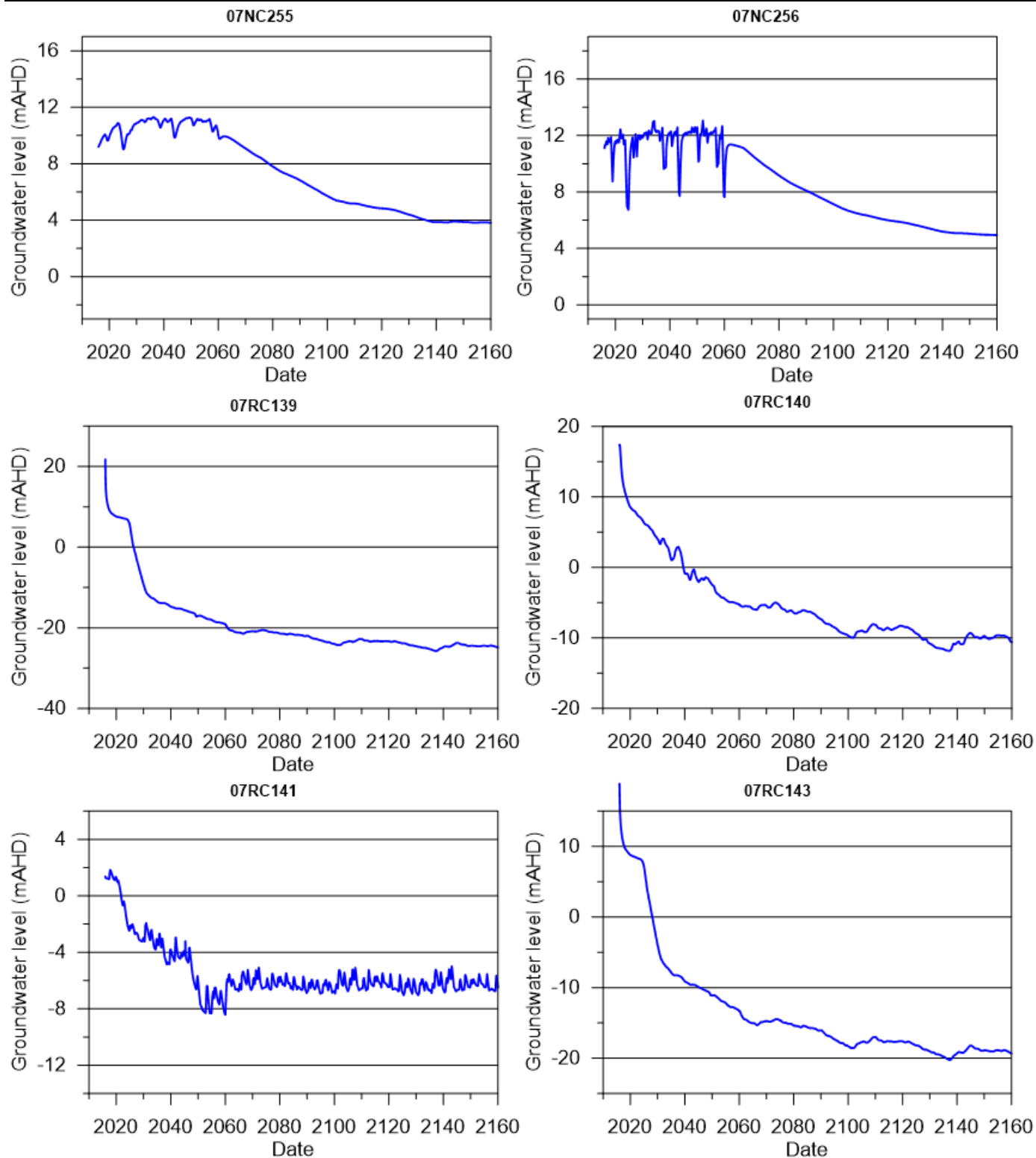
Residuals for observation group "vwp":-

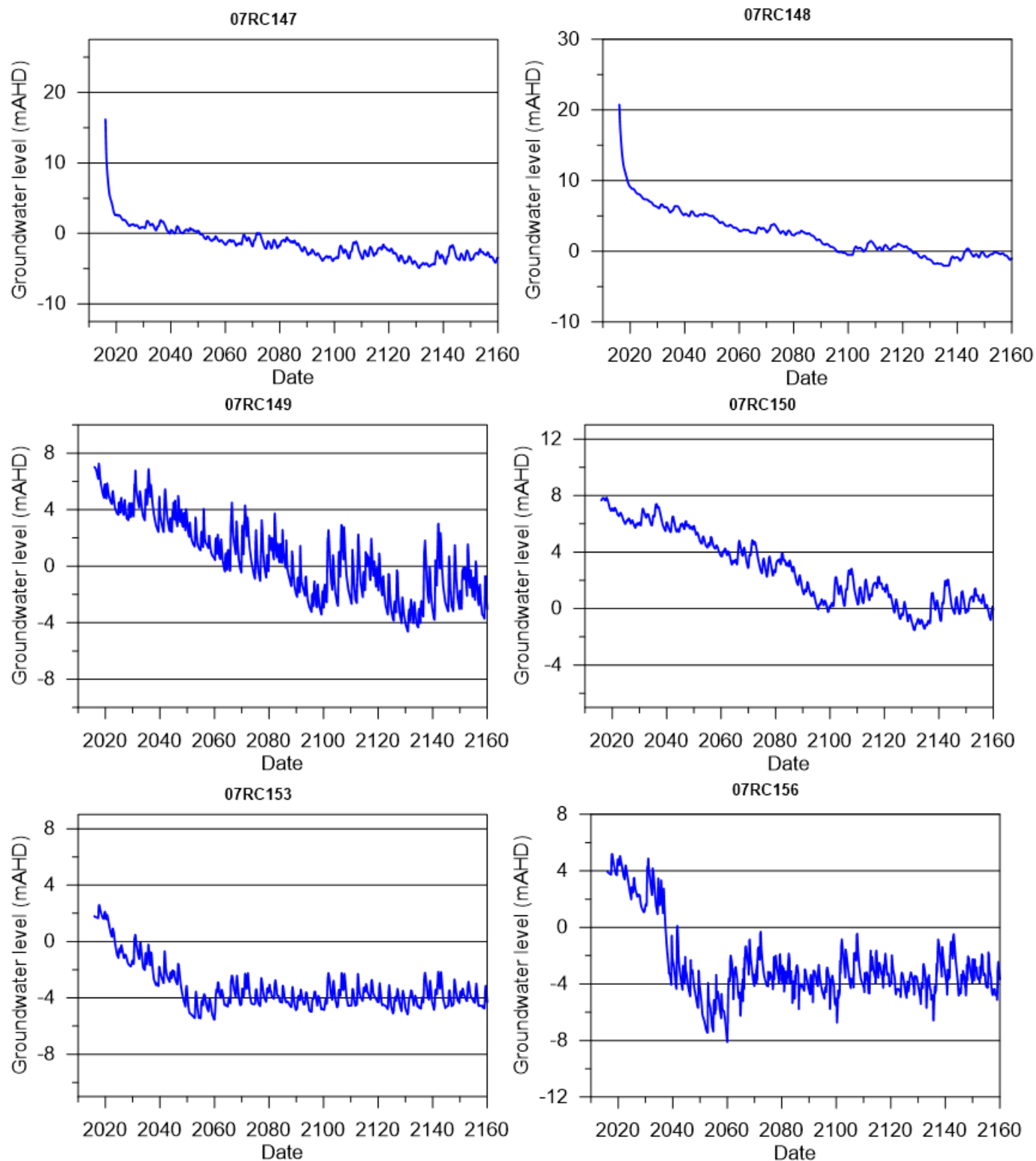
Number of residuals with non-zero weight	4181	
Mean value of non-zero weighted residuals	-2.242	m
Maximum weighted residual [observation "596-vwp1_001"]	44.11	m
Minimum weighted residual [observation "130-vwp4_035"]	-40.24	m
"Variance" of weighted residuals	95.88	m
"Standard error" of weighted residuals	9.792	m

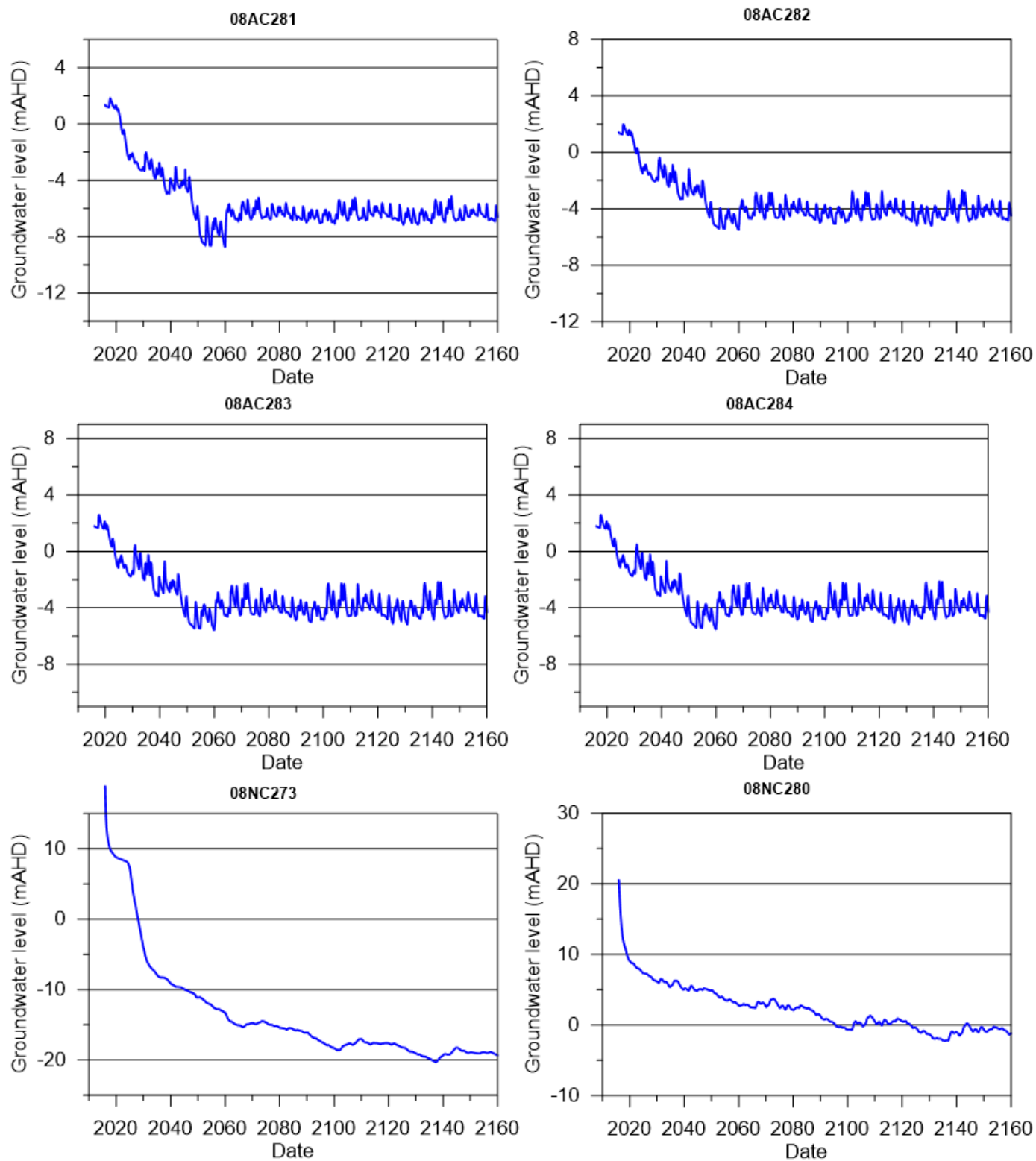
SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

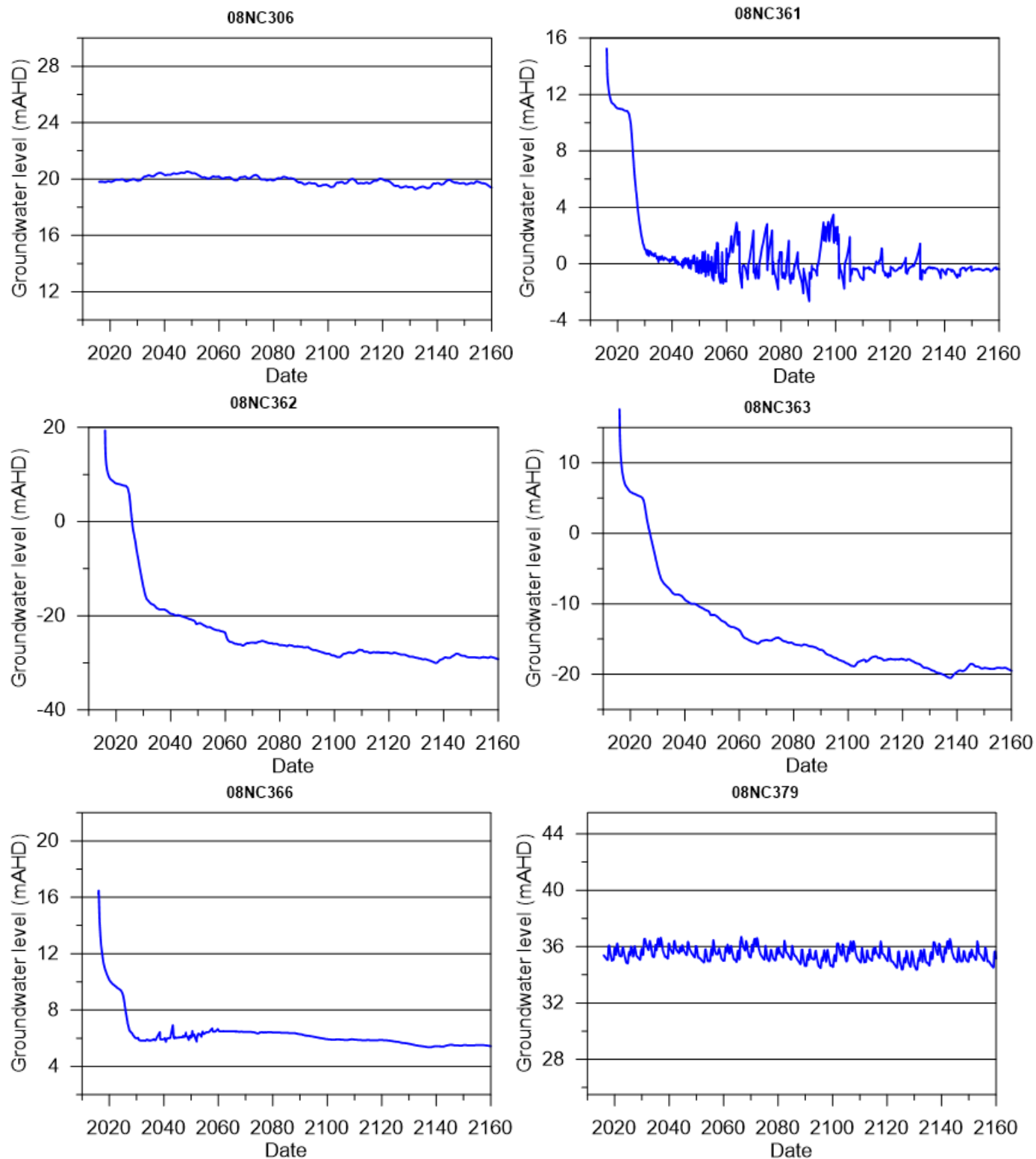
APPENDIX H – Calibrated model water balances (1983 – 2016)

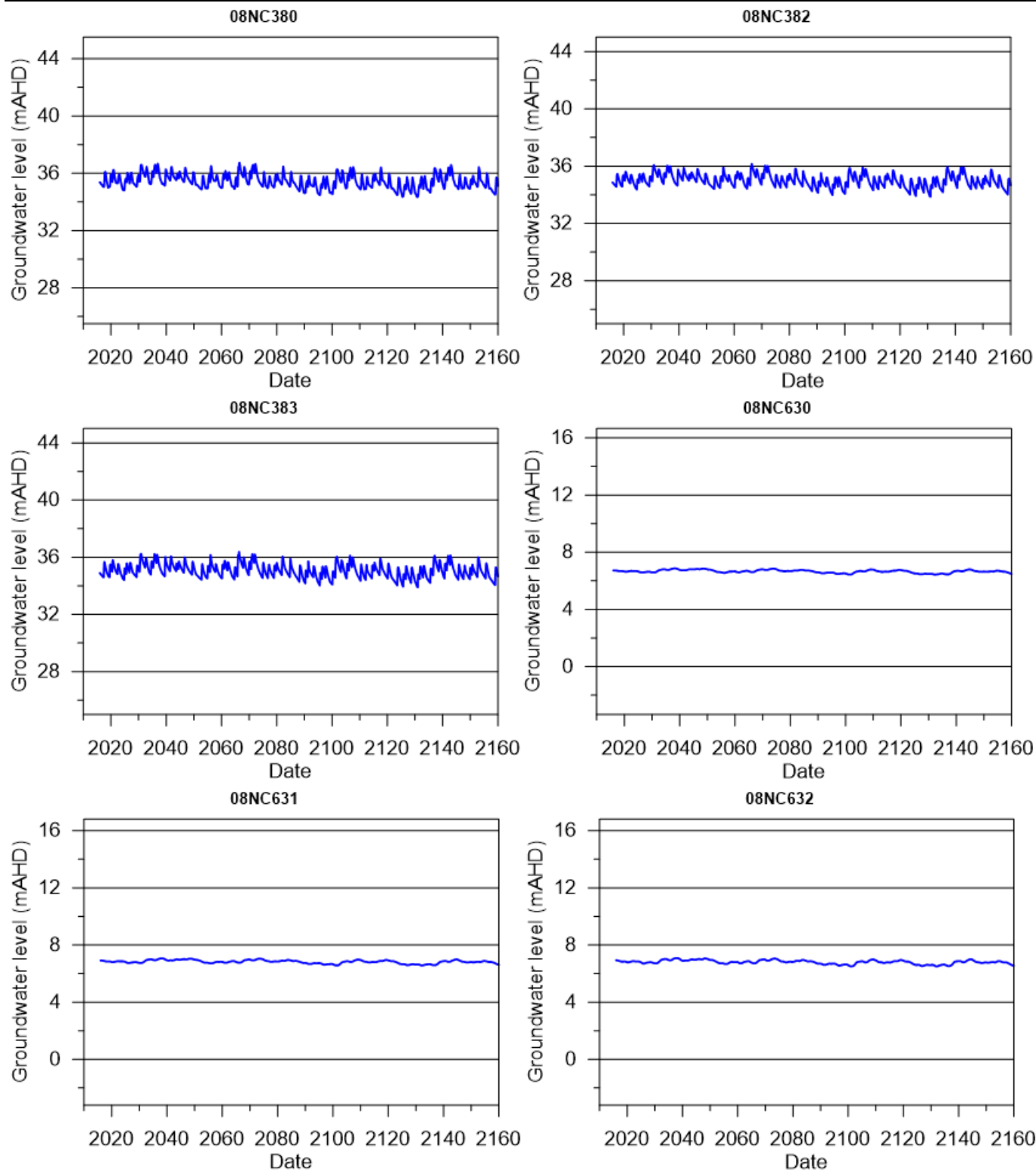
Date	Year	river_vol	coast_vol	tidal_vol	in_vol	out_vol
01/01/1984	1983	0.00	-1.90	-0.73	4.31	-21.47
01/01/1985	1984	11.37	-3.71	-1.60	19.86	-19.16
01/01/1986	1985	18.05	-2.04	-1.03	6.61	-21.92
01/01/1987	1986	0.53	-2.10	-0.80	10.48	-16.77
01/01/1988	1987	12.22	-1.93	-0.93	8.75	-17.86
01/01/1989	1988	0.00	-2.16	-0.76	13.98	-15.05
01/01/1990	1989	12.45	-1.97	-0.83	8.91	-15.89
01/01/1991	1990	11.81	-1.69	-0.95	6.93	-17.73
01/01/1992	1991	11.51	-1.59	-0.78	8.57	-15.49
01/01/1993	1992	0.00	-2.29	-0.83	11.95	-13.88
01/01/1994	1993	10.02	-2.67	-0.90	13.23	-14.95
01/01/1995	1994	5.38	-1.24	-0.46	6.70	-15.26
01/01/1996	1995	29.81	-5.56	-2.71	33.24	-24.39
01/01/1997	1996	0.00	-3.52	-1.33	16.56	-18.58
01/01/1998	1997	15.24	-3.62	-1.68	12.99	-21.57
01/01/1999	1998	0.00	-2.80	-1.07	12.95	-16.51
01/01/2000	1999	28.15	-4.67	-2.04	20.43	-20.62
01/01/2001	2000	15.64	-4.12	-2.08	19.37	-23.66
01/01/2002	2001	15.12	-3.75	-1.78	10.75	-25.49
01/01/2003	2002	0.00	-1.65	-0.65	4.49	-18.44
01/01/2004	2003	0.00	-1.22	-0.35	4.85	-15.28
01/01/2005	2004	21.34	-2.80	-1.32	15.14	-18.30
01/01/2006	2005	2.86	-2.36	-0.92	13.47	-14.45
01/01/2007	2006	27.47	-5.13	-2.47	22.91	-24.02
01/01/2008	2007	0.00	-1.33	-0.53	2.12	-18.64
01/01/2009	2008	12.26	-2.77	-1.24	16.10	-16.64
01/01/2010	2009	12.89	-4.67	-1.95	22.01	-21.90
01/01/2011	2010	2.00	-1.52	-0.46	8.52	-16.23
01/01/2012	2011	21.93	-5.72	-2.38	25.85	-22.21
01/01/2013	2012	0.25	-2.47	-0.74	8.92	-17.71
01/01/2014	2013	6.89	-3.20	-0.94	18.59	-16.13
01/01/2015	2014	15.33	-1.99	-0.91	9.93	-20.38
01/01/2016	2015	0.19	-2.80	-0.85	19.38	-15.71

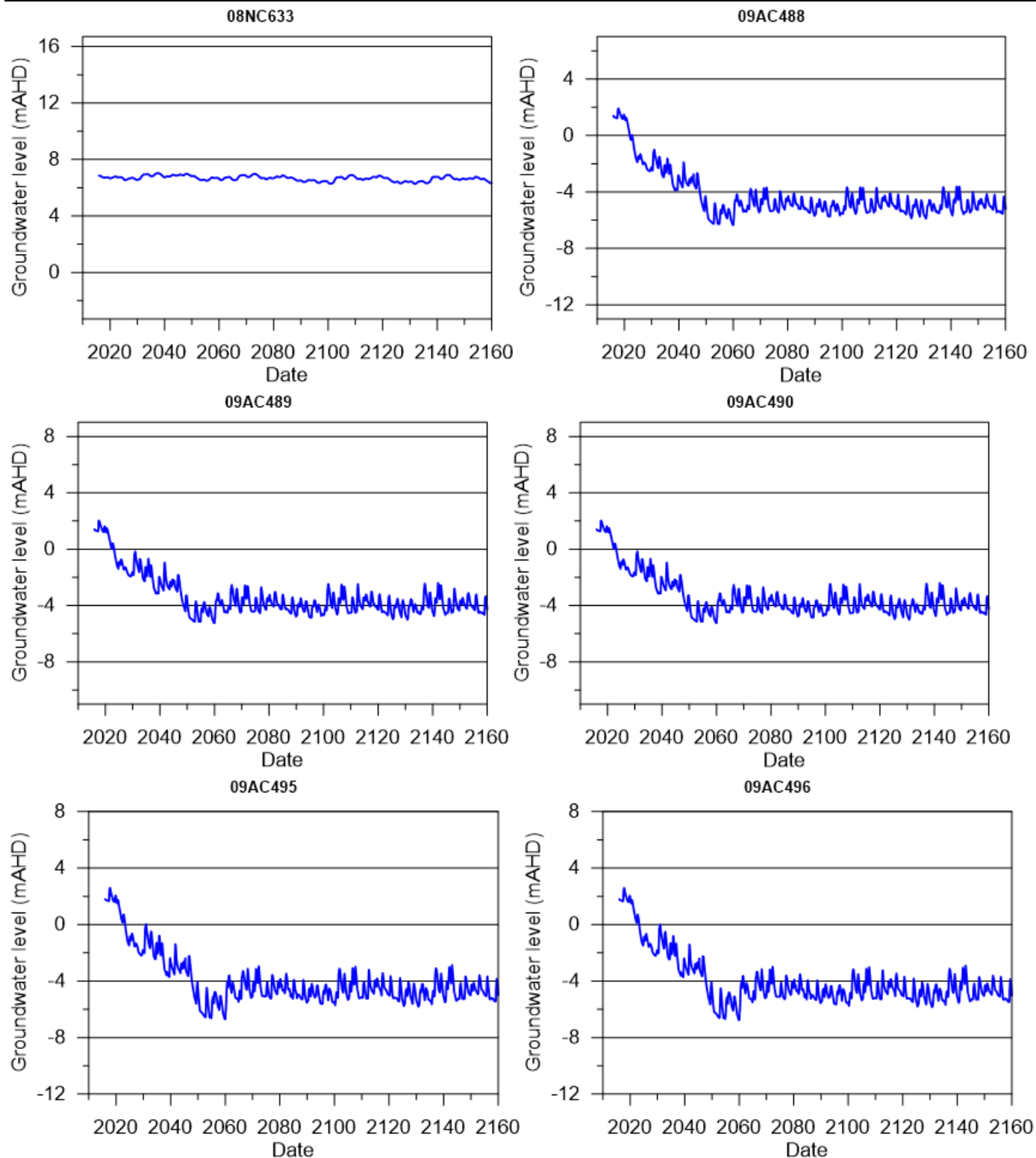


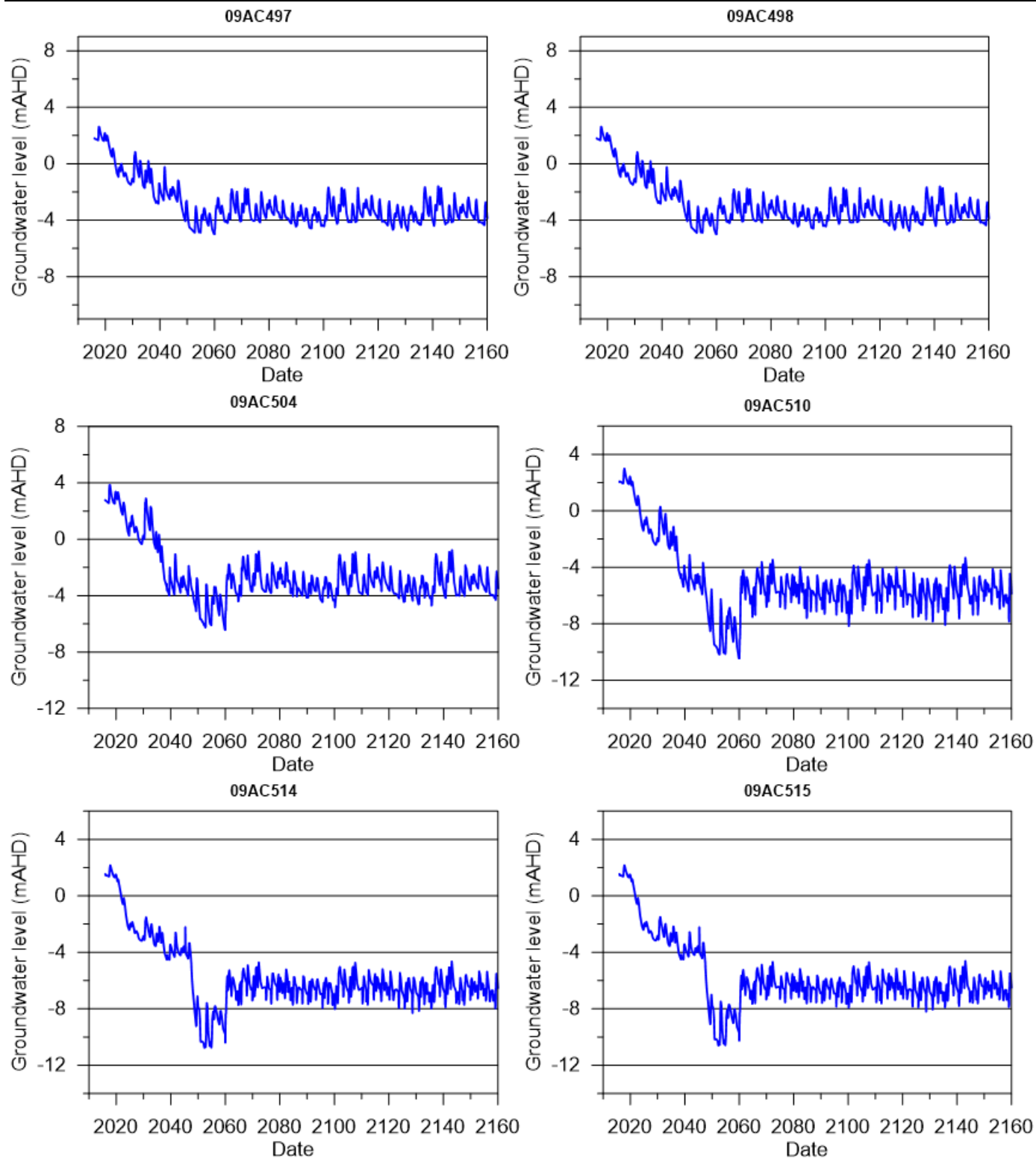


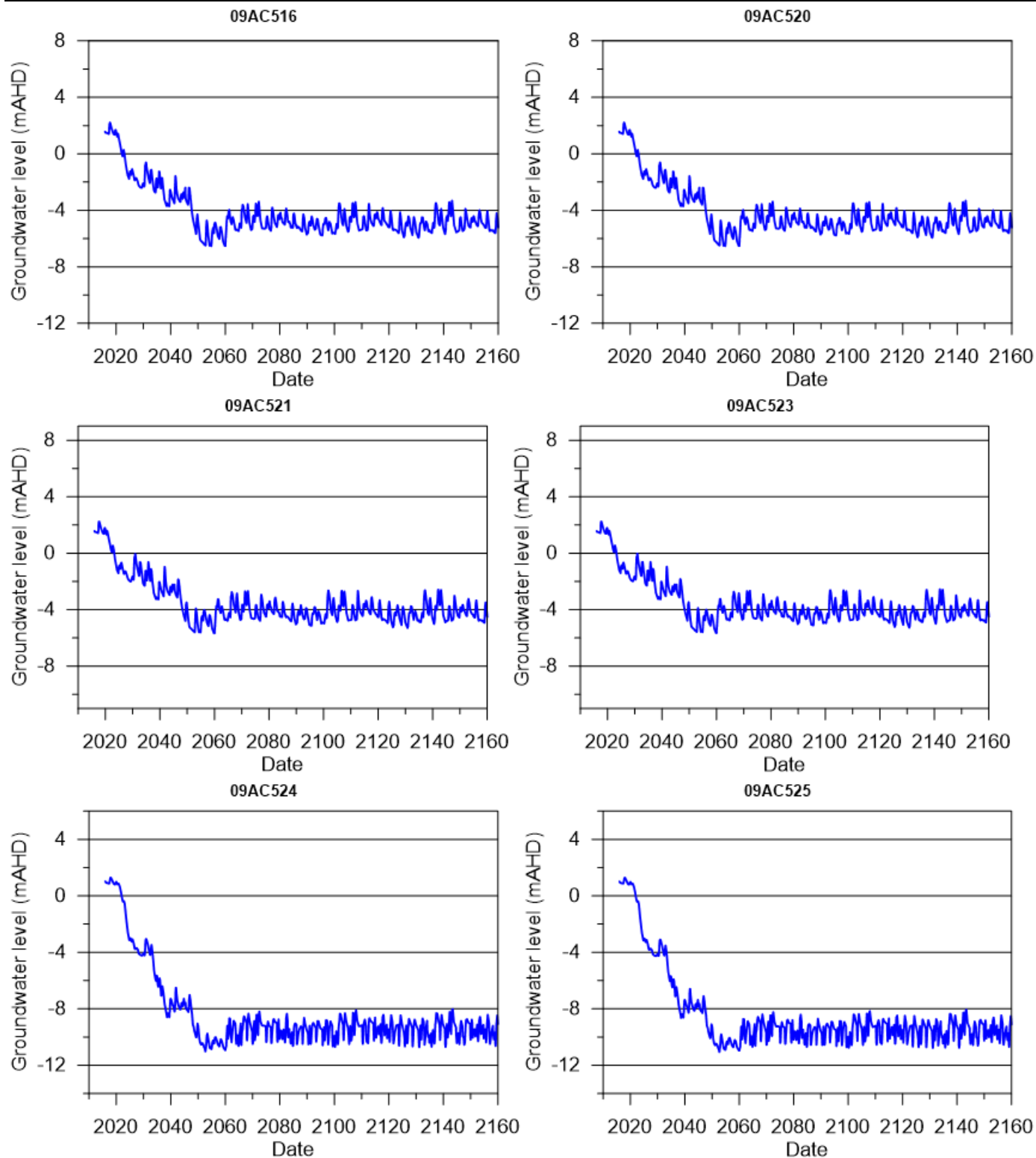


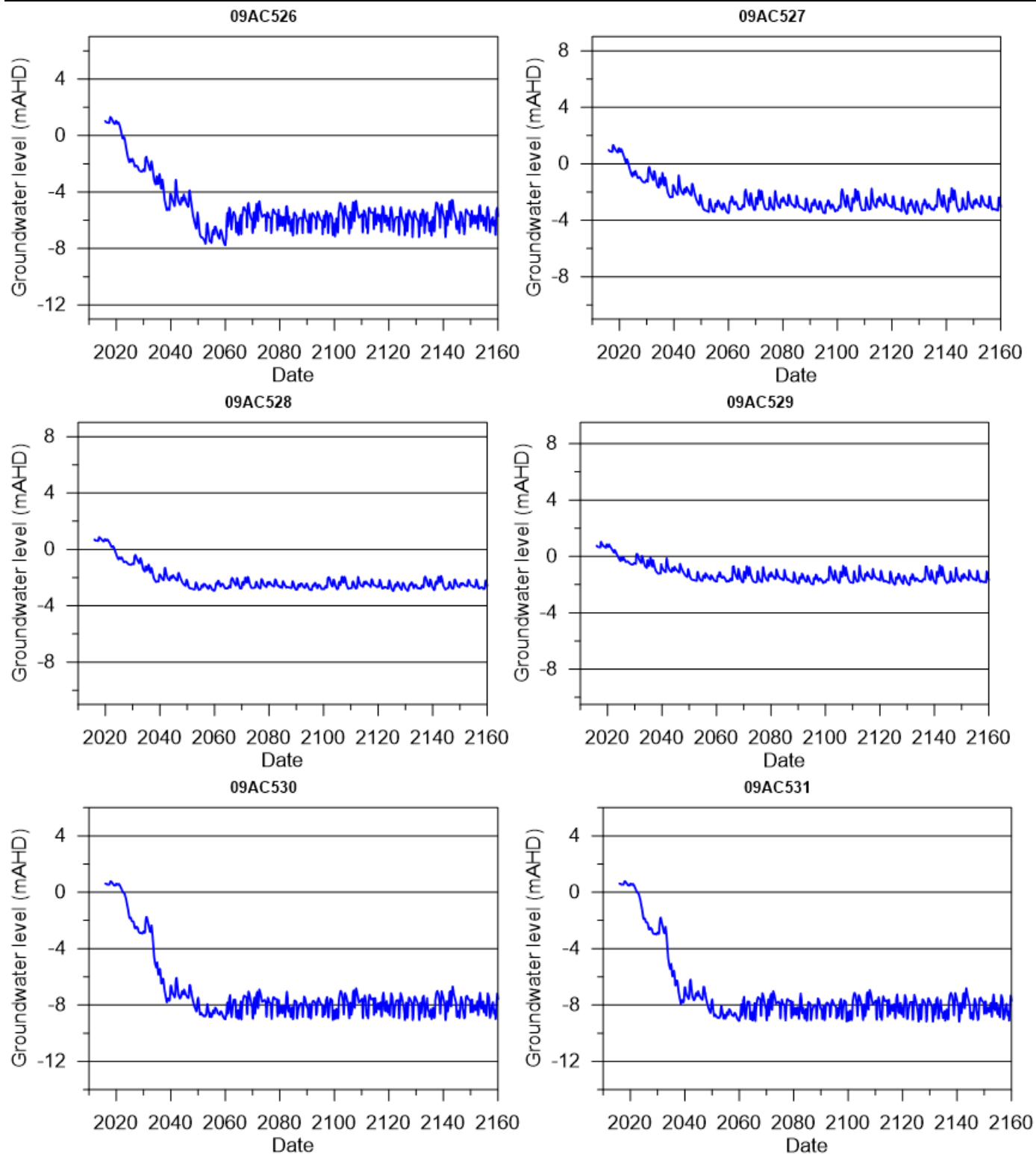


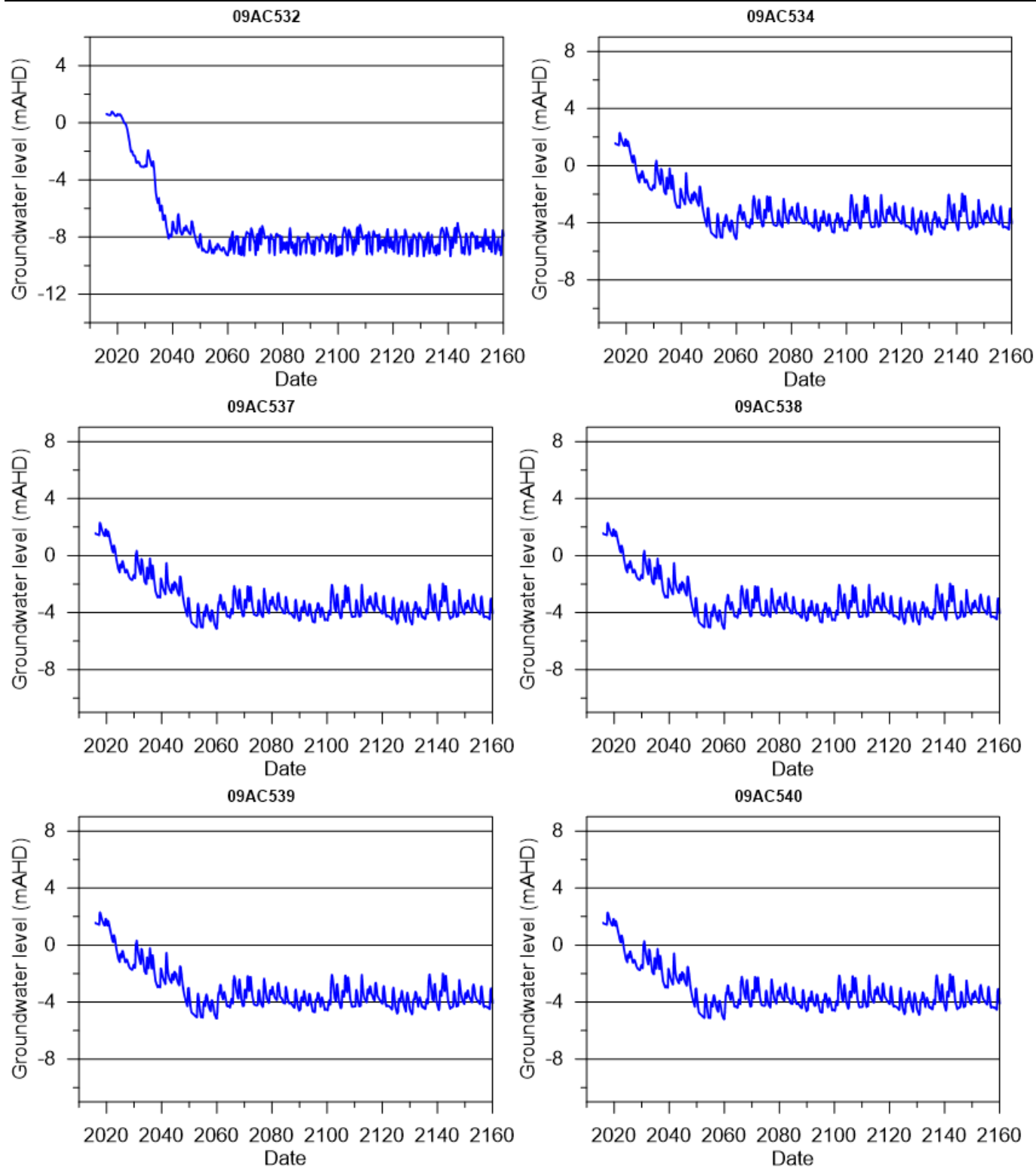


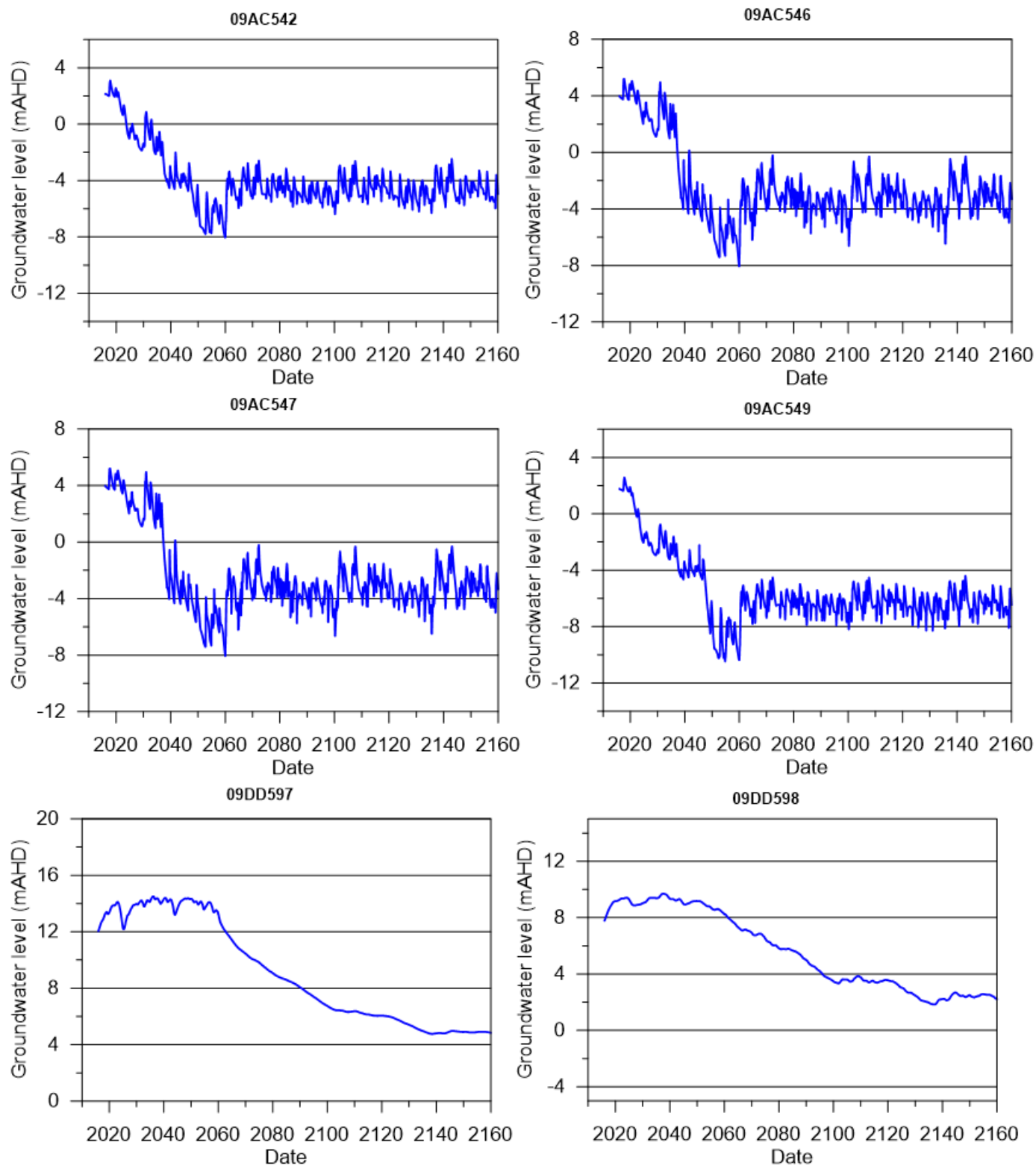


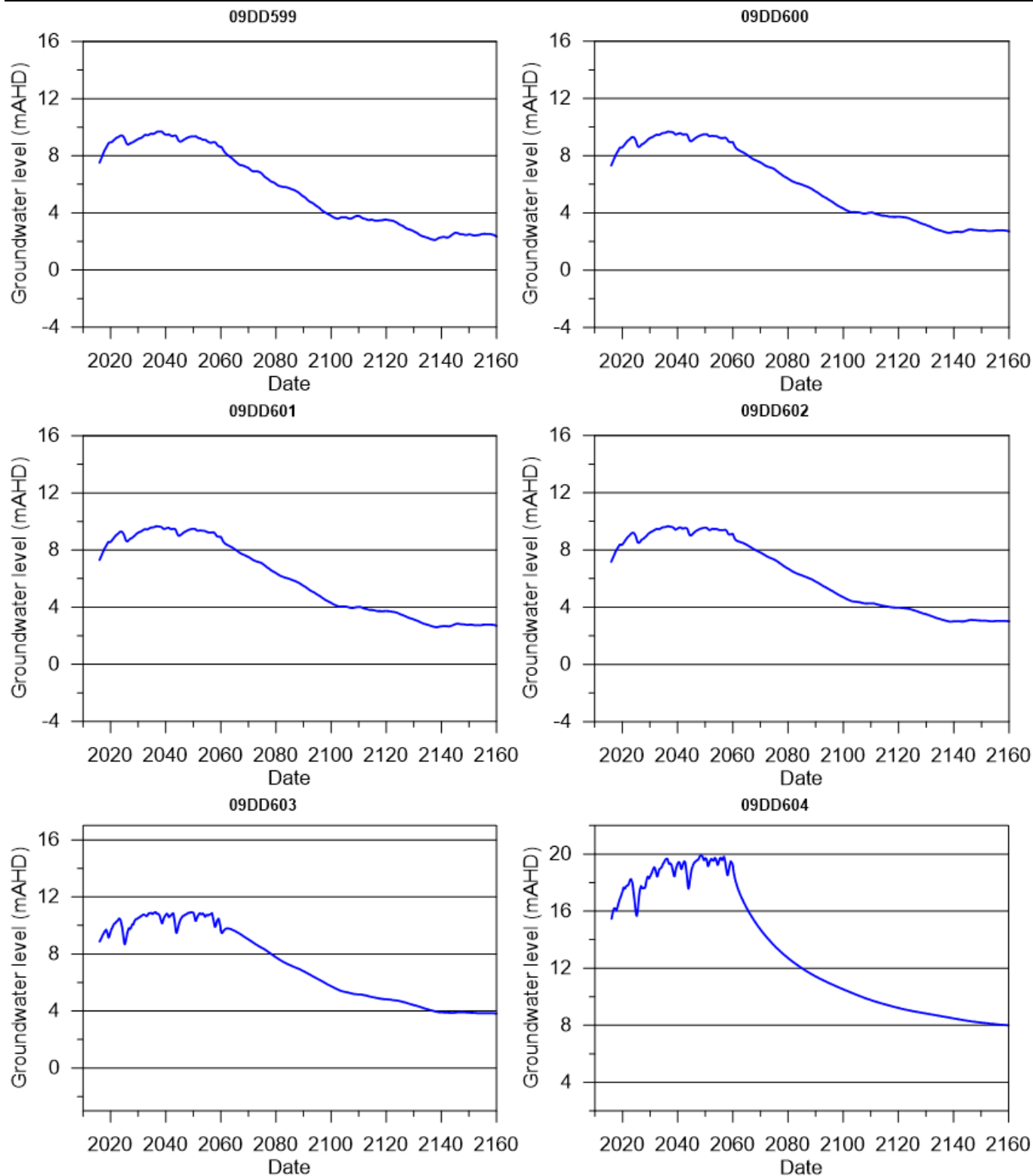


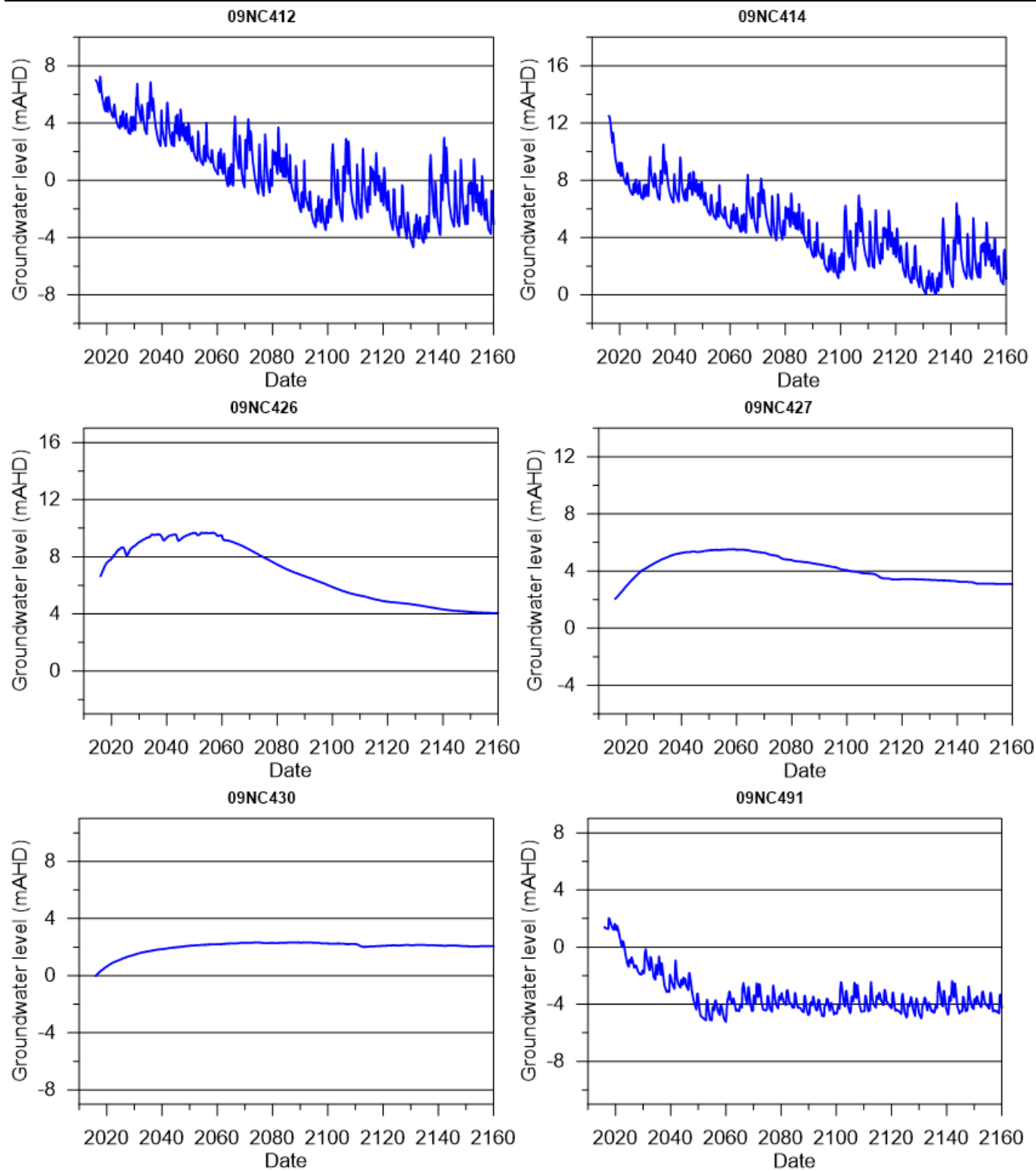


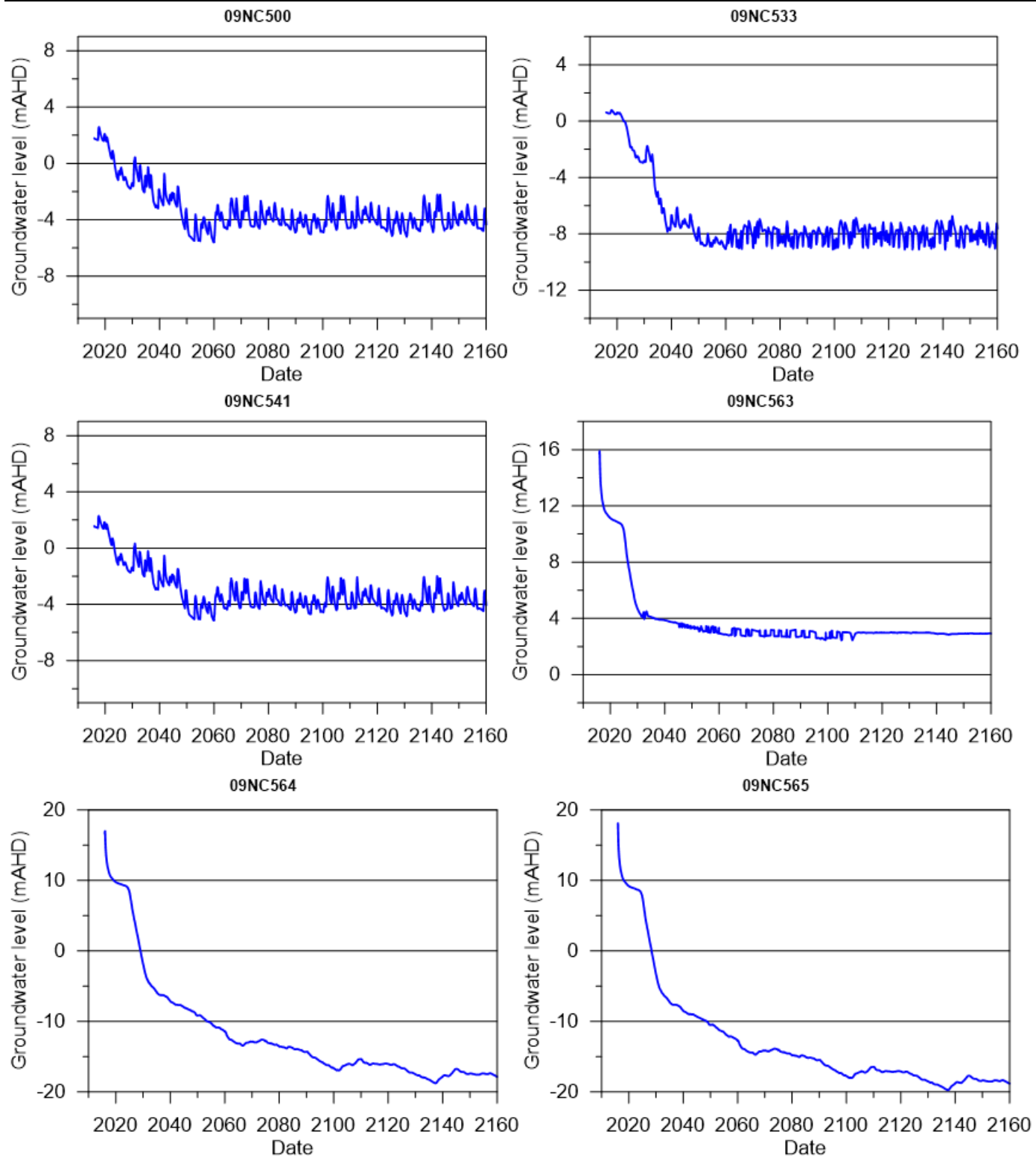


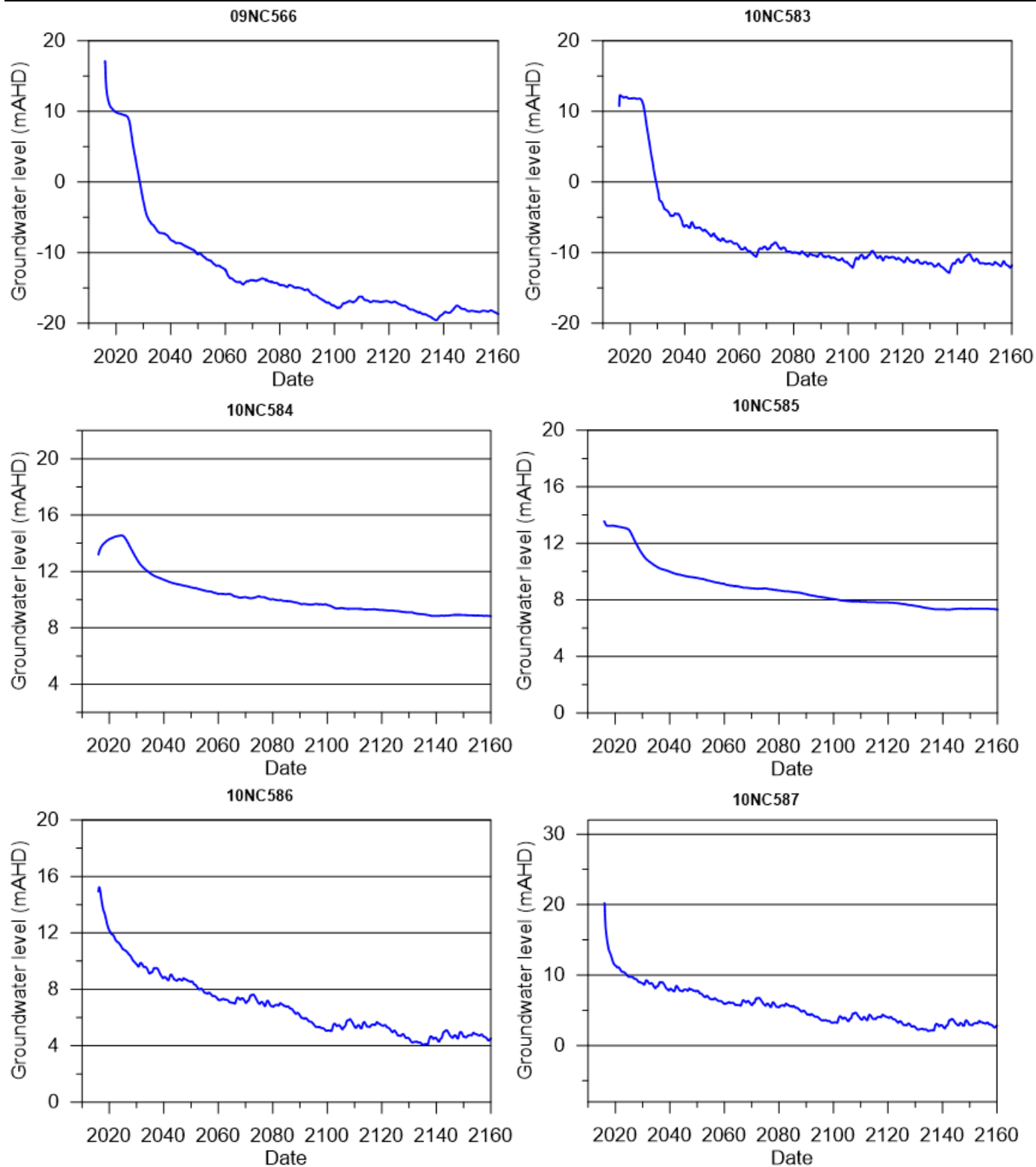


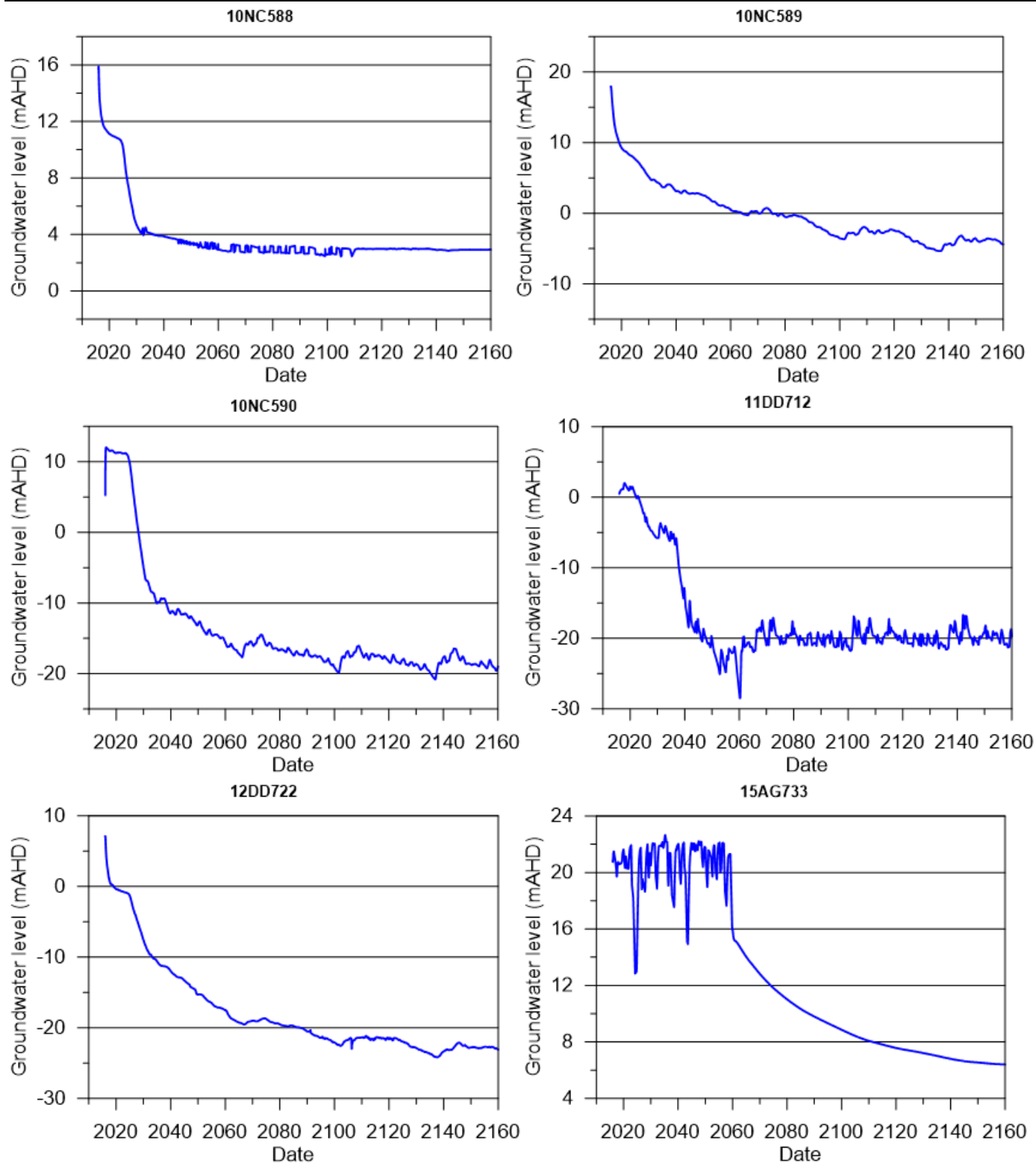


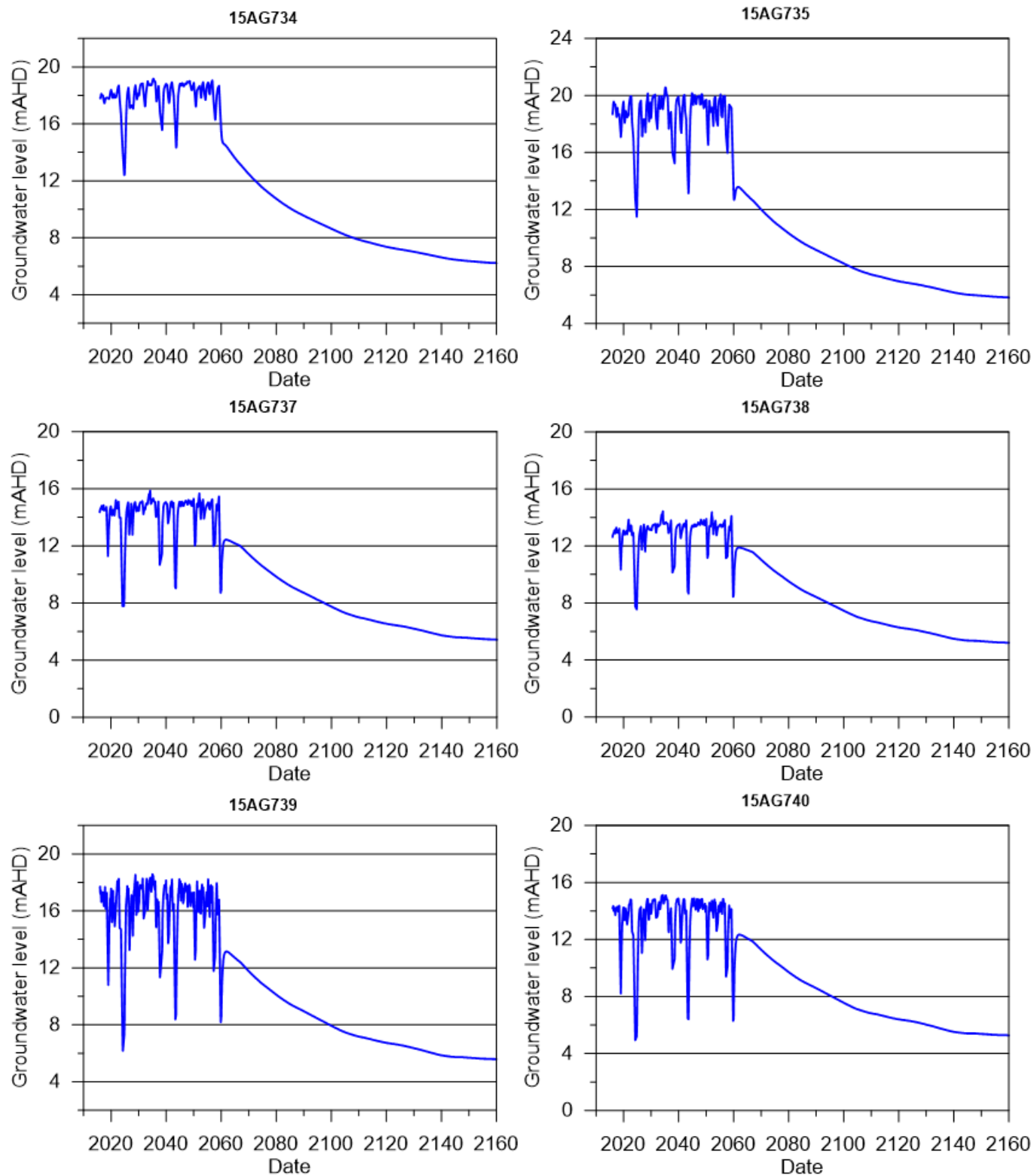


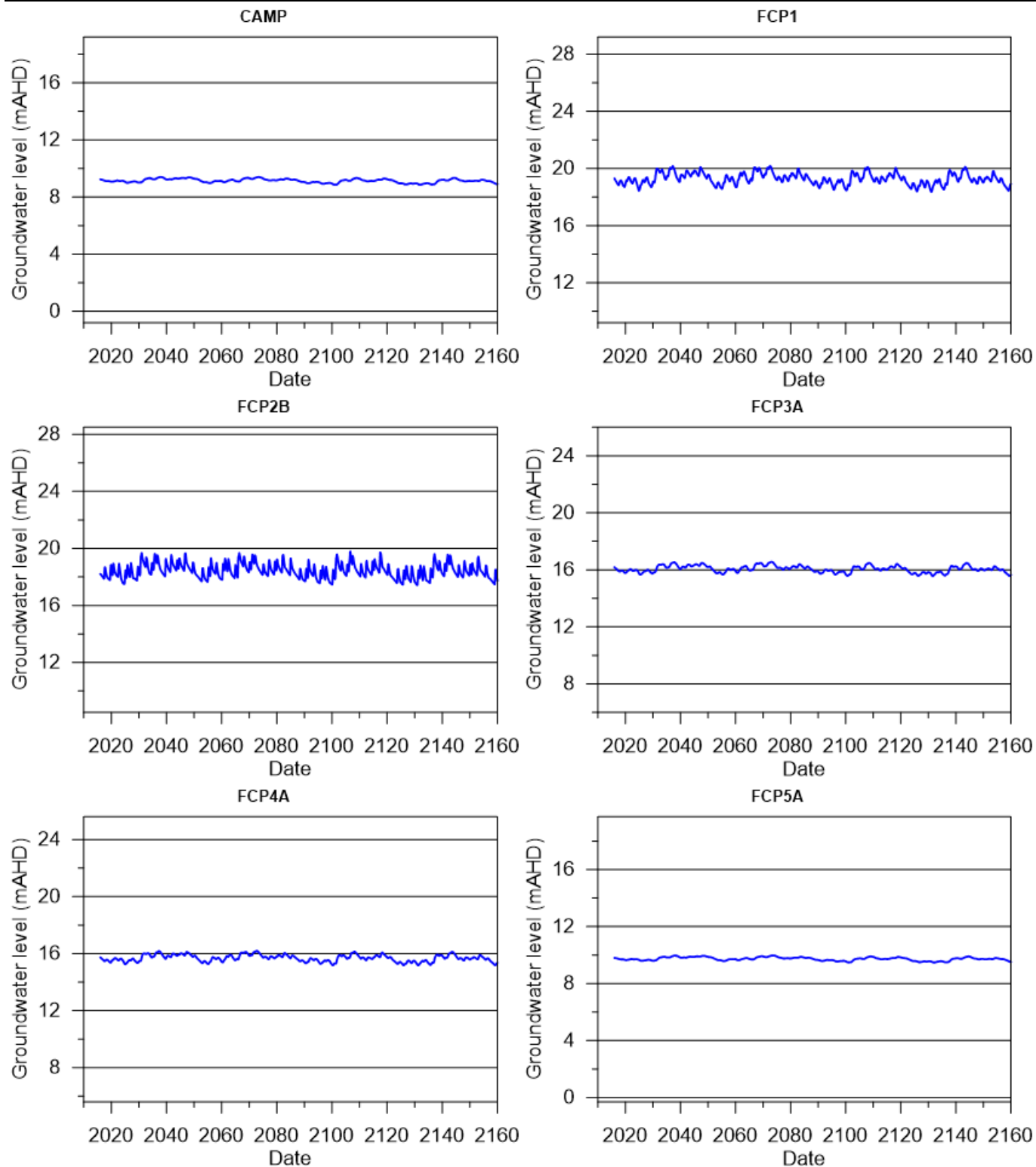


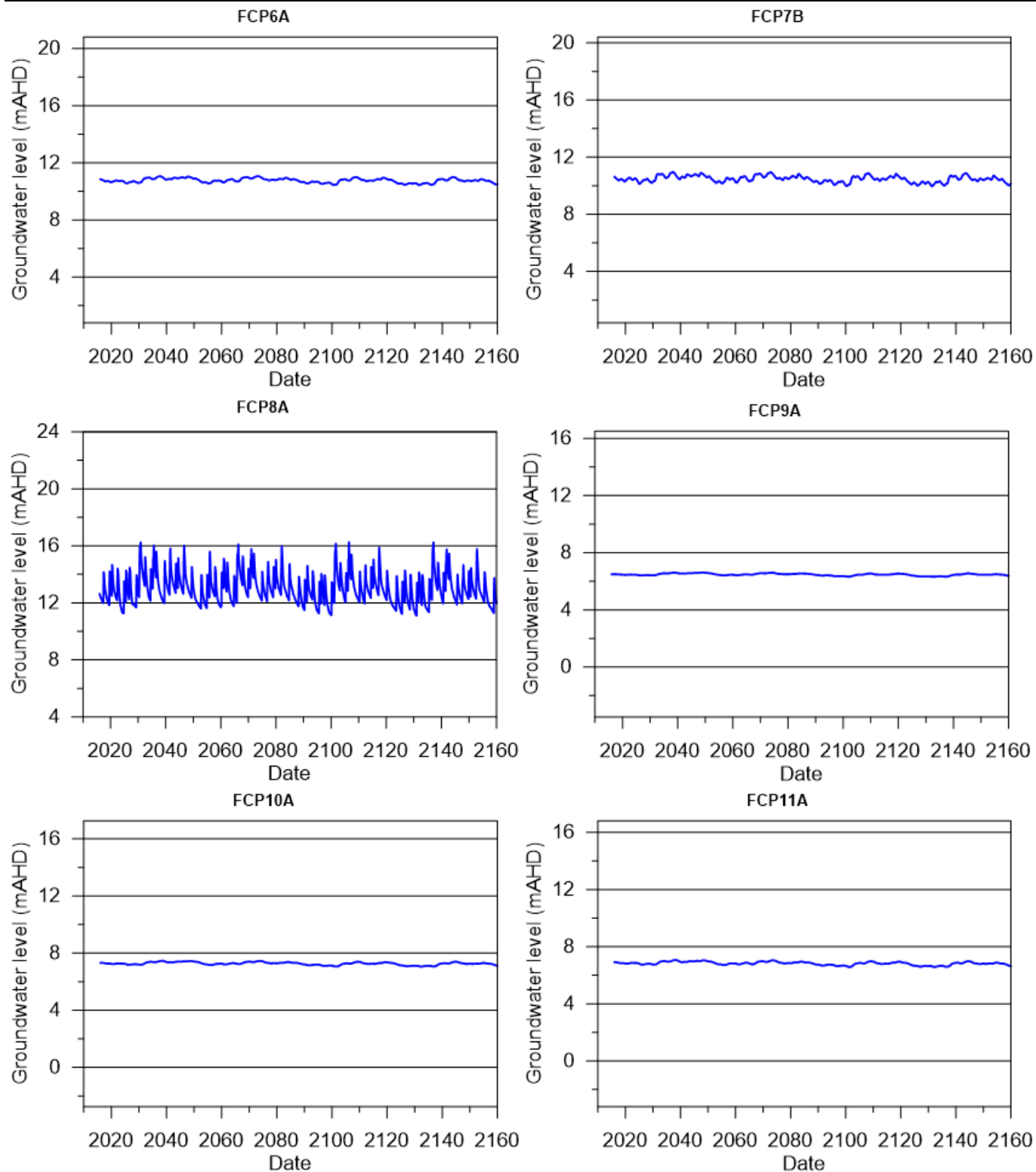


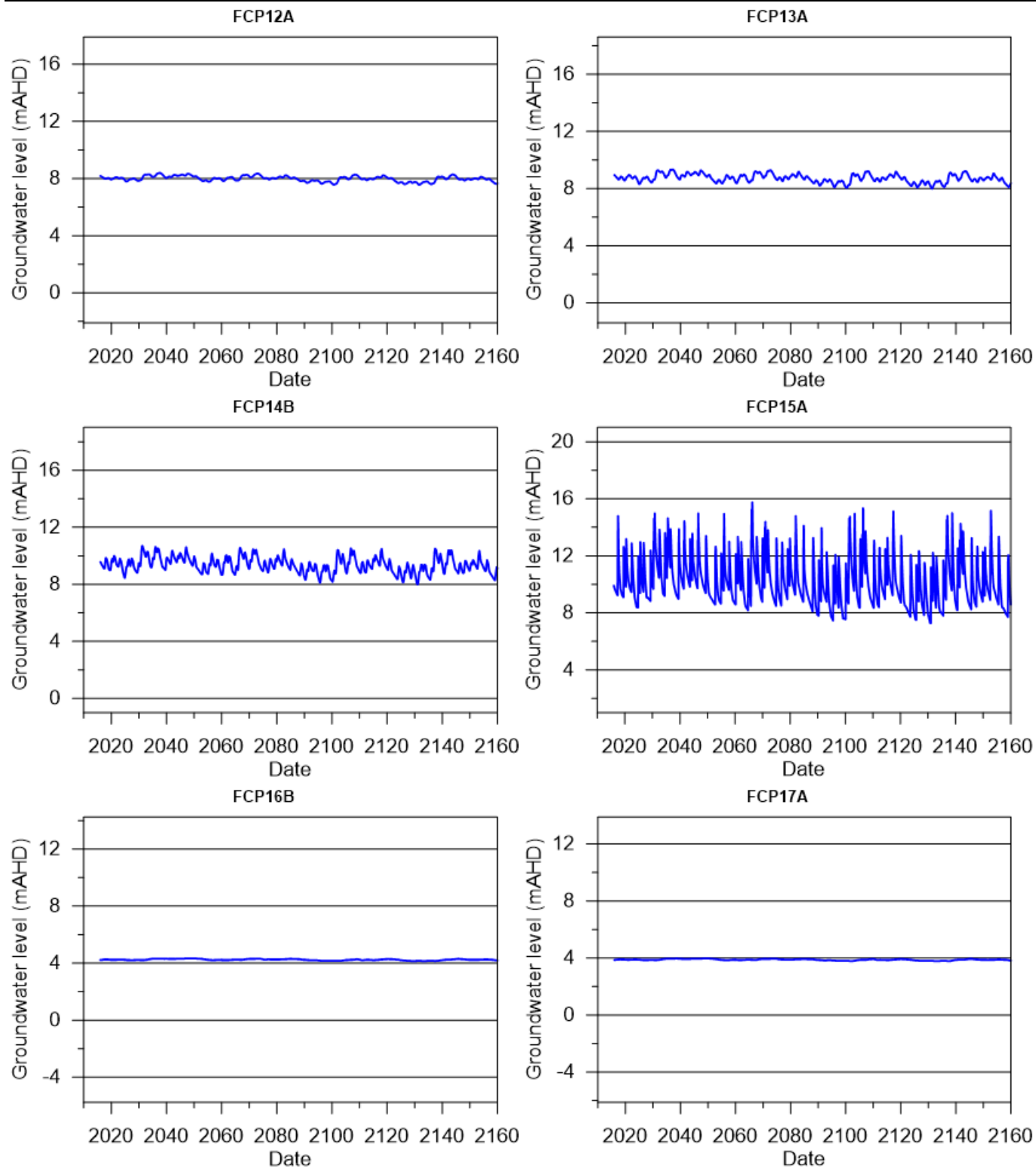


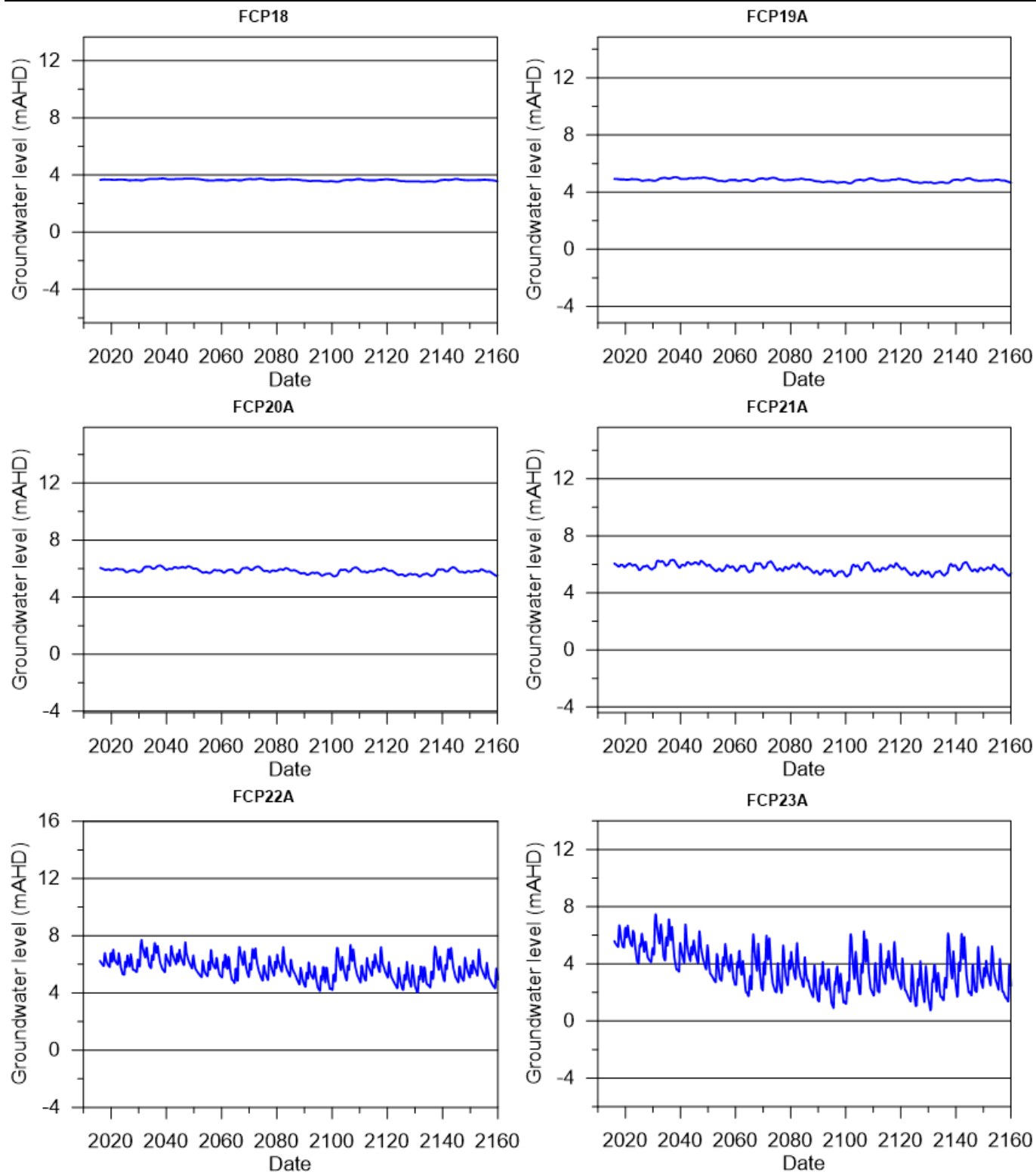


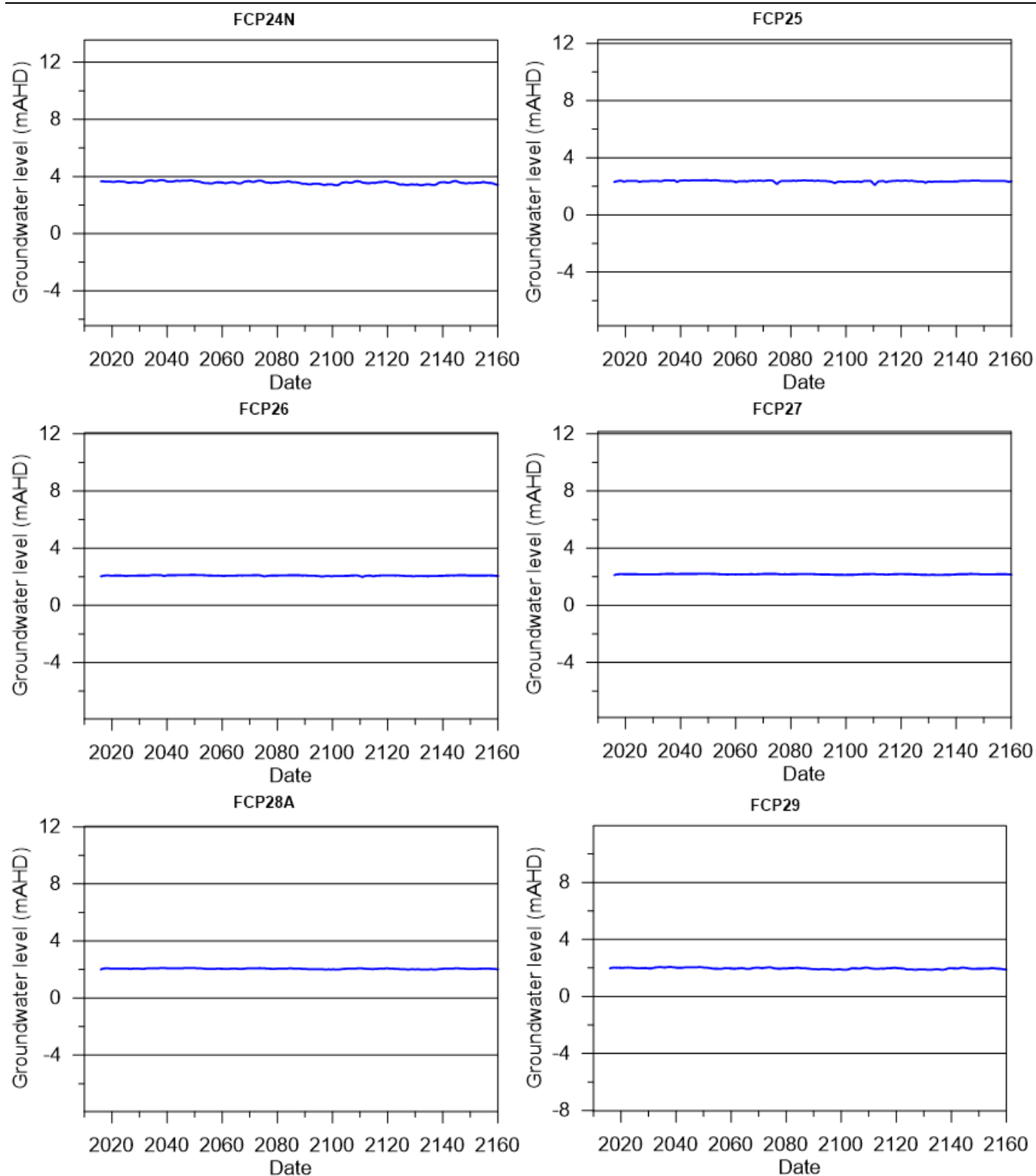


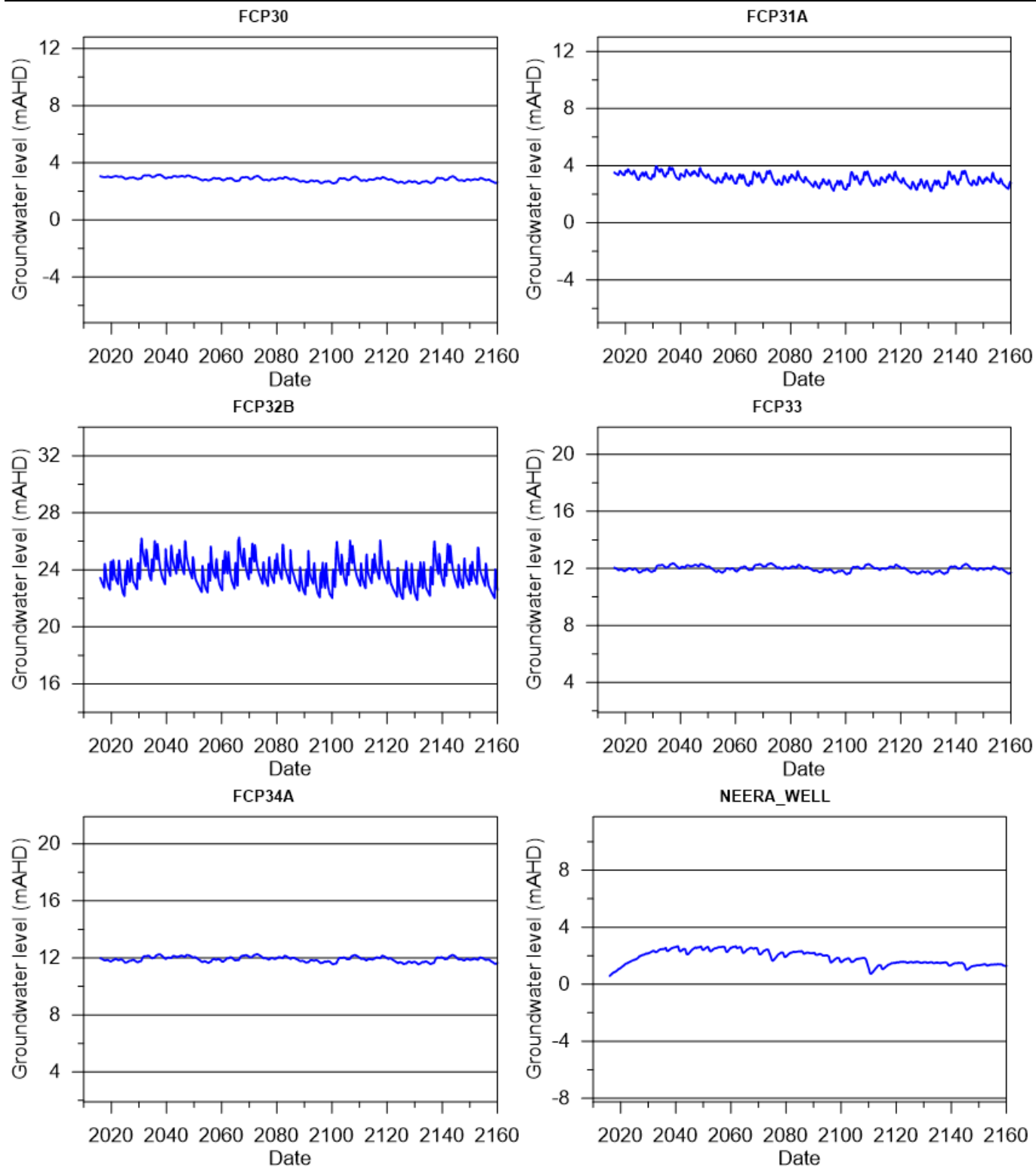


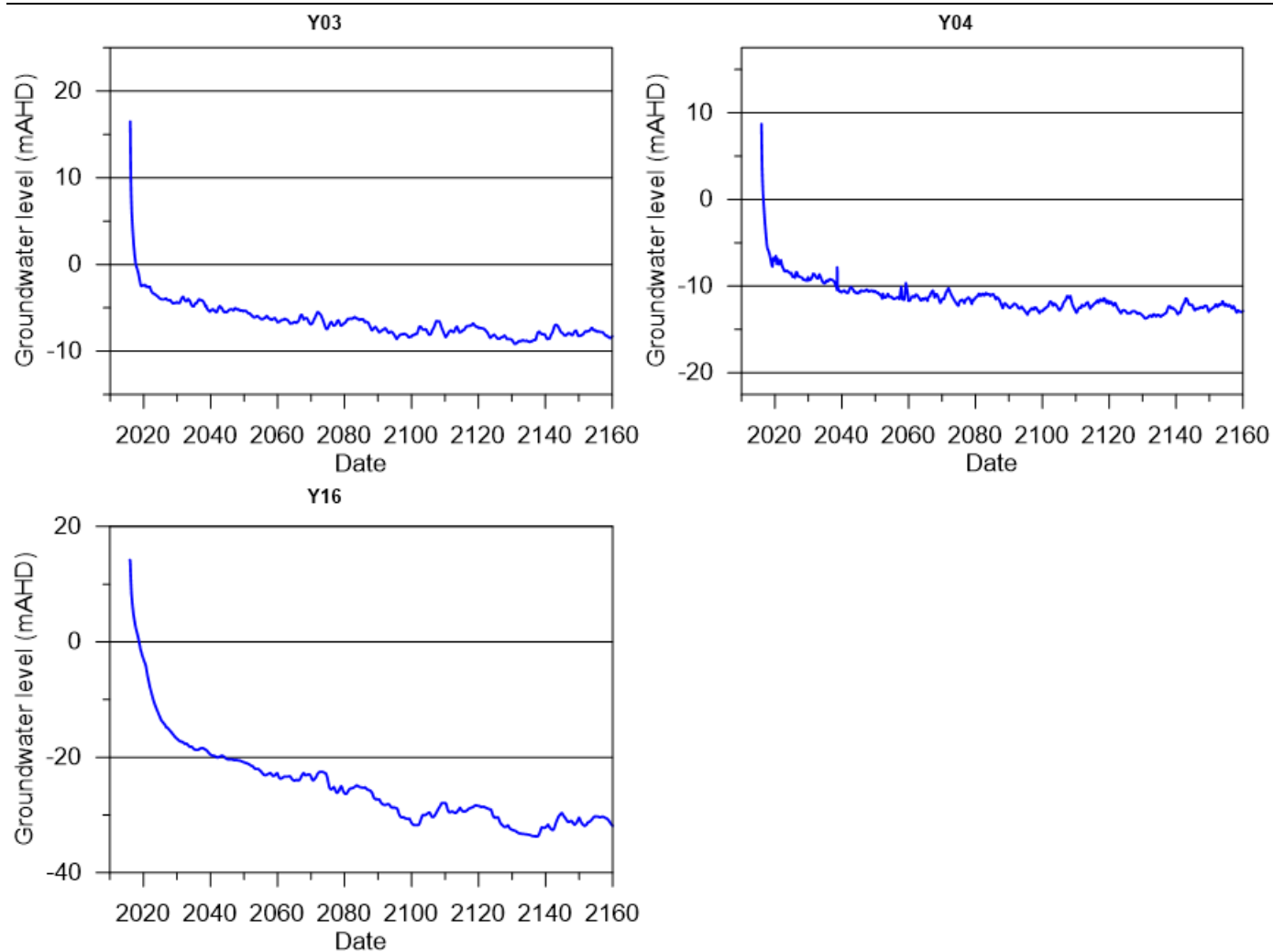












SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

APPENDIX J – LoM and post closure forecast water balance components

Sino Iron LoM (2016 – 2060) in / out flow water balance components

Sino Iron post closure in / out flow water balance components						
Year	river_vol	coast_vol	tidal_vol	flux_in	flux_out	pit_vol
	[GL]	[GL]	[GL]	[GL]	[GL]	[GL]
2017	0.00	-2.21	-0.76	14.89	-13.13	-1.93
2018	16.34	-2.42	-0.91	15.22	-14.71	-1.75
2019	0.00	-2.49	-0.73	15.57	-13.55	-1.64
2020	14.58	-2.33	-0.81	15.23	-14.32	-1.75
2021	14.16	-2.47	-0.94	14.84	-15.44	-2.61
2022	0.00	-2.53	-0.57	15.62	-13.02	-2.87
2023	14.29	-2.51	-0.57	14.85	-13.33	-3.33
2024	0.00	-2.52	-0.15	15.60	-12.46	-4.08
2025	15.54	-2.39	0.08	16.16	-11.52	-4.42
2026	14.44	-2.34	-0.17	15.14	-13.69	-4.98
2027	11.66	-2.40	0.11	15.63	-13.51	-5.01
2028	0.00	-2.47	0.28	15.02	-13.09	-4.68
2029	0.27	-2.43	0.48	16.18	-11.65	-4.77
2030	13.60	-2.46	0.29	15.36	-12.50	-4.80
2031	38.25	-2.51	-0.22	14.95	-14.51	-5.33
2032	0.00	-2.57	-0.08	14.67	-14.75	-5.51
2033	15.31	-2.56	-0.02	14.85	-14.81	-5.43
2034	0.00	-2.55	0.42	15.68	-12.58	-5.45
2035	16.01	-2.38	0.30	14.97	-13.33	-6.00
2036	27.79	-2.52	-0.08	13.87	-16.53	-7.33
2037	14.07	-2.66	0.08	14.28	-16.20	-7.61
2038	0.00	-2.54	0.76	15.65	-13.28	-6.78
2039	0.00	-2.16	1.11	16.21	-11.51	-6.06
2040	16.85	-2.23	0.77	14.99	-12.74	-6.74
2041	0.00	-2.23	0.98	15.78	-12.19	-6.75
2042	36.46	-2.34	0.35	14.98	-13.61	-7.61
2043	0.00	-2.50	0.64	15.48	-12.73	-7.23
2044	14.32	-2.47	0.82	15.66	-12.06	-6.65
2045	14.57	-2.53	0.66	14.43	-14.36	-7.07
2046	0.26	-2.55	0.94	14.44	-13.66	-6.76
2047	28.56	-2.52	0.60	14.31	-15.35	-7.33
2048	0.26	-2.58	0.89	15.08	-13.37	-7.61
2049	0.26	-2.51	1.29	15.13	-12.43	-7.36
2050	16.72	-2.47	0.99	15.33	-12.83	-7.70
2051	0.27	-2.45	1.41	15.62	-11.77	-7.50
2052	0.00	-2.40	1.62	15.76	-11.45	-6.97
2053	18.18	-2.27	1.55	16.45	-11.05	-6.90
2054	0.05	-2.29	1.28	15.43	-11.68	-7.38
2055	9.61	-2.26	1.61	16.23	-10.92	-6.95
2056	26.61	-2.28	1.15	15.03	-12.17	-7.33
2057	2.52	-2.41	1.04	15.23	-12.78	-7.64
2058	14.88	-2.35	1.34	16.12	-11.26	-7.35
2059	0.00	-2.38	1.27	15.59	-11.48	-7.57
2060	0.00	-2.37	1.64	16.35	-10.07	-7.05

Sino Iron post closure (2060 – 20160) in / out flow water balance components

Sino Iron post closure in / out flow water balance components						
Year	river_vol	coast_vol	tidal_vol	flux_in	areal_out	pit_vol
2061	24.58	-2.18	1.47	13.44	-11.63	-1.84
2062	4.93	-2.33	1.39	13.22	-12.22	-2.17
2063	12.12	-2.37	1.43	13.17	-12.70	-2.32
2064	0.26	-2.34	1.92	13.39	-11.39	-2.44
2065	12.49	-2.30	1.80	13.45	-11.62	-2.58
2066	24.91	-2.32	1.57	13.27	-12.42	-2.66
2067	14.46	-2.45	0.49	12.53	-16.79	-2.83
2068	15.45	-2.49	1.37	12.98	-13.45	-2.97
2069	0.29	-2.52	1.24	13.01	-13.26	-3.10
2070	15.20	-2.42	1.80	13.30	-11.88	-3.24
2071	20.26	-2.42	0.92	13.02	-13.50	-3.41
2072	29.02	-2.56	0.45	12.42	-17.79	-3.54
2073	3.78	-2.64	0.84	12.41	-17.60	-3.73

SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

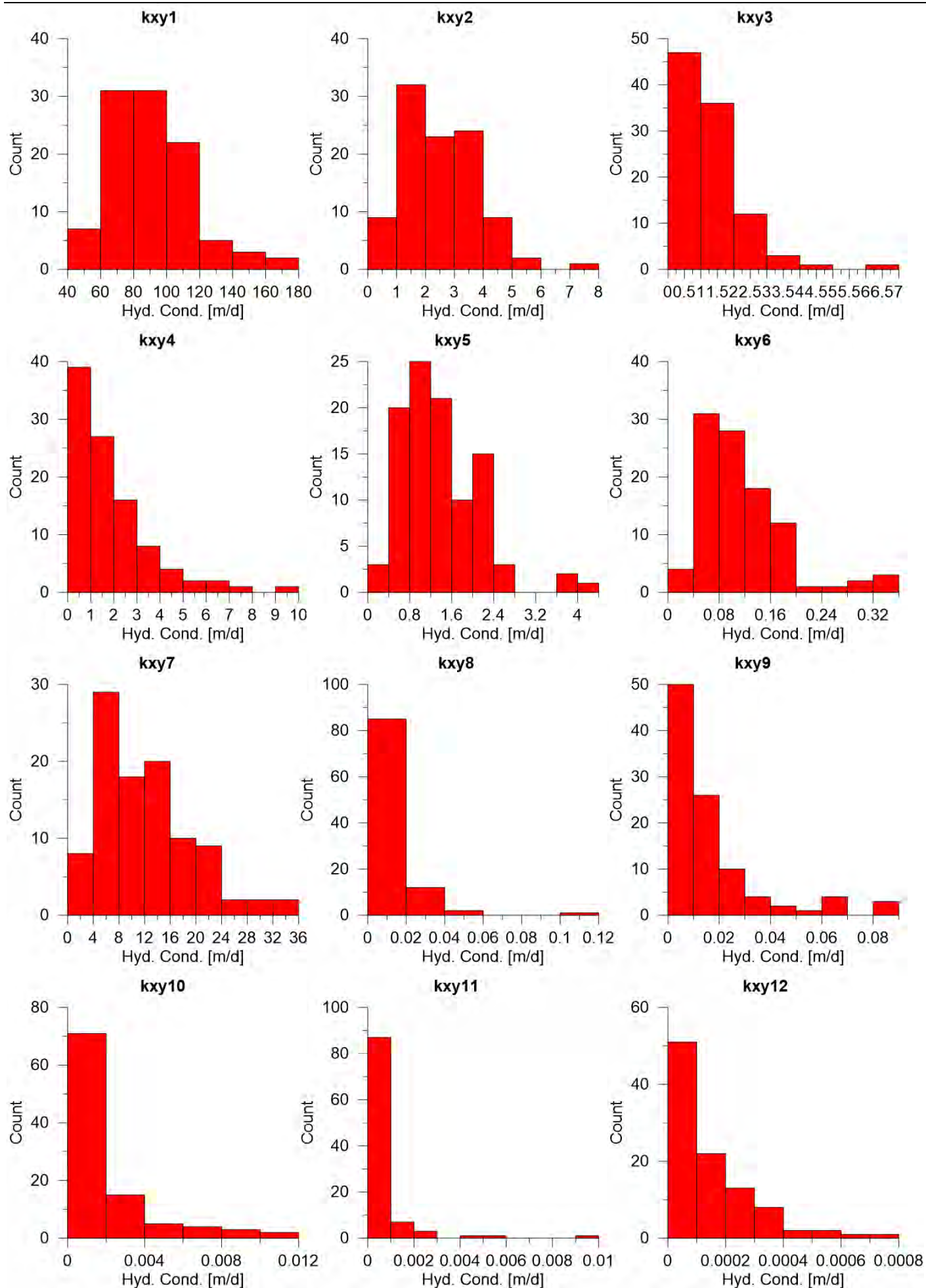
APPENDIX J – LoM and post closure forecast water balance components

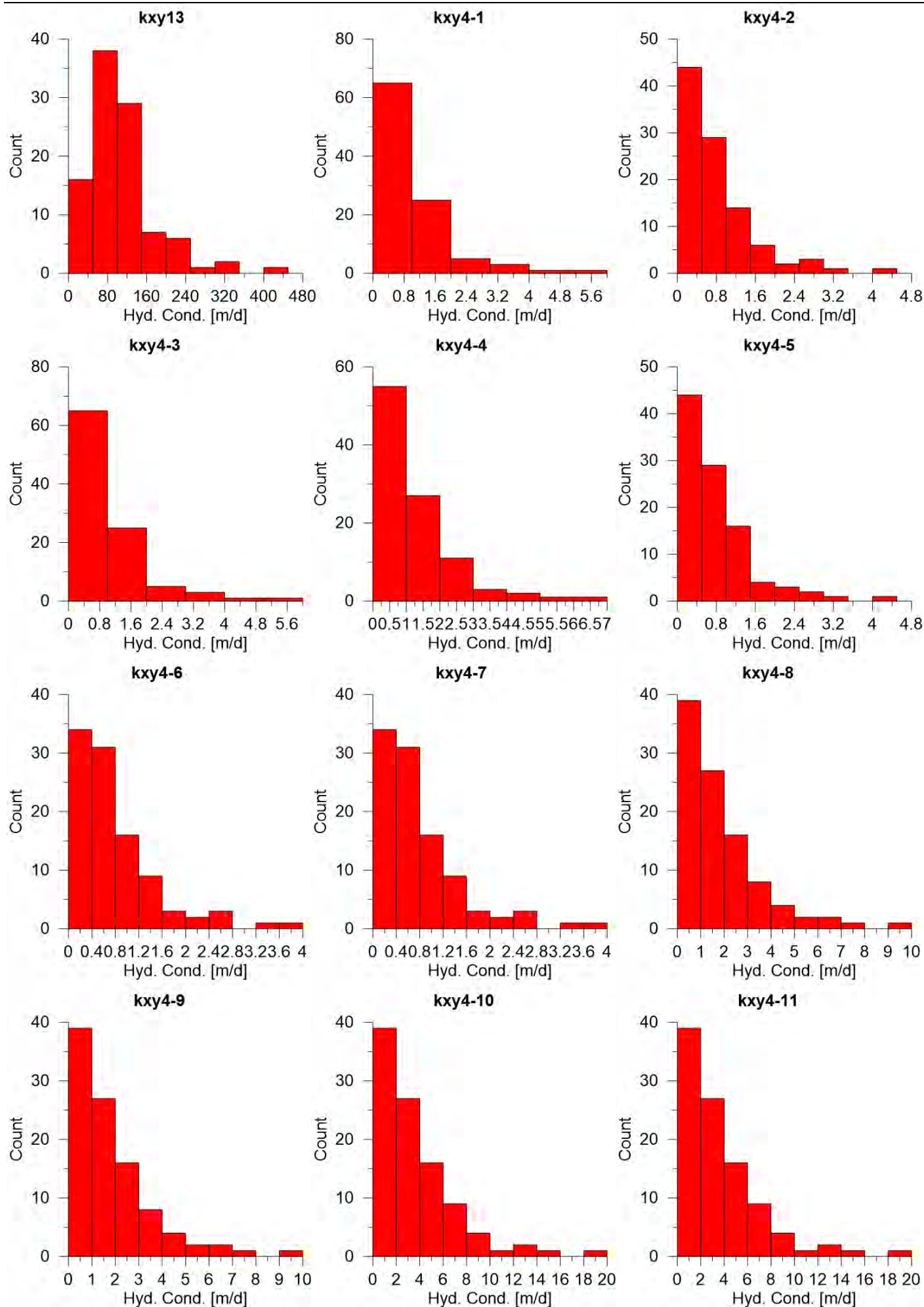
Sino Iron post closure in / out flow water balance components						
Year	river_vol	coast_vol	tidal_vol	flux_in	areal_out	pit_vol
2074	0.00	-2.59	1.74	13.01	-13.62	-3.90
2075	14.48	-2.51	1.90	13.26	-12.58	-4.03
2076	2.50	-2.49	1.25	13.11	-12.84	-4.15
2077	25.35	-2.43	1.60	13.31	-12.47	-4.26
2078	12.08	-2.52	0.57	12.55	-16.76	-4.36
2079	1.13	-2.51	1.67	13.09	-12.70	-4.55
2080	25.24	-2.48	1.13	12.91	-14.04	-4.63
2081	0.62	-2.55	1.20	12.88	-14.07	-4.69
2082	20.04	-2.51	1.52	13.11	-13.32	-4.72
2083	6.34	-2.56	1.06	12.78	-14.65	-4.83
2084	0.27	-2.51	1.69	13.19	-12.24	-4.88
2085	17.35	-2.45	1.63	13.34	-12.25	-4.91
2086	0.00	-2.46	1.52	13.22	-12.15	-4.93
2087	0.28	-2.37	1.89	13.43	-11.27	-4.96
2088	0.00	-2.30	2.18	13.57	-10.78	-5.00
2089	19.09	-2.22	1.56	13.48	-11.24	-5.04
2090	0.00	-2.25	2.01	13.52	-10.83	-5.06
2091	15.89	-2.18	1.65	13.46	-11.07	-5.10
2092	18.99	-2.31	1.22	13.10	-13.00	-5.14
2093	0.00	-2.36	1.80	13.32	-11.76	-5.21
2094	15.11	-2.36	1.46	13.22	-12.25	-5.23
2095	0.00	-2.35	1.97	13.43	-11.03	-5.28
2096	15.82	-2.21	1.83	13.49	-11.04	-5.32
2097	13.92	-2.28	1.34	13.25	-12.48	-5.42
2098	13.16	-2.34	1.52	13.19	-12.38	-5.46
2099	0.00	-2.38	1.84	13.28	-11.70	-5.49
2100	0.30	-2.29	2.02	13.50	-10.92	-5.55
2101	13.93	-2.31	1.68	13.35	-11.78	-5.61
2102	42.98	-2.38	0.58	12.71	-16.93	-5.68
2103	0.00	-2.52	1.28	12.78	-14.18	-5.74
2104	15.72	-2.50	1.11	12.89	-13.80	-5.78
2105	0.00	-2.49	1.78	13.26	-12.11	-5.84
2106	23.89	-2.42	1.12	12.99	-13.83	-5.82
2107	26.93	-2.55	0.53	12.49	-16.84	-5.82
2108	14.69	-2.61	0.86	12.59	-15.41	-5.89
2109	0.00	-2.58	1.69	13.10	-12.91	-5.96
2110	0.00	-2.37	2.08	13.36	-11.54	-6.01
2111	18.43	-2.21	1.49	13.29	-11.96	-6.04
2112	0.00	-2.26	1.90	13.37	-11.42	-6.06
2113	35.45	-2.32	0.72	12.97	-14.72	-6.11
2114	0.00	-2.44	1.46	13.03	-12.89	-6.14
2115	14.93	-2.37	1.47	13.16	-12.43	-6.17
2116	14.90	-2.46	1.18	12.97	-13.53	-6.17
2117	0.31	-2.48	1.61	13.20	-12.63	-6.18
2118	29.53	-2.48	0.94	12.74	-15.87	-6.19
2119	0.30	-2.54	1.49	12.94	-13.51	-6.23
2120	0.30	-2.48	1.84	13.27	-12.21	-6.25
2121	22.51	-2.47	1.16	13.03	-13.79	-6.30
2122	0.30	-2.46	1.70	13.18	-12.23	-6.33
2123	0.00	-2.40	2.05	13.41	-11.46	-6.34
2124	17.47	-2.26	1.76	13.45	-11.33	-6.36
2125	0.00	-2.30	1.75	13.42	-11.49	-6.38
2126	15.81	-2.25	1.81	13.49	-11.16	-6.37
2127	15.86	-2.31	1.37	13.24	-12.22	-6.37
2128	0.00	-2.37	1.71	13.30	-11.63	-6.40
2129	15.64	-2.28	1.72	13.43	-11.49	-6.44
2130	0.00	-2.29	1.81	13.34	-11.51	-6.46
2131	1.18	-2.18	2.18	13.56	-10.50	-6.49
2132	28.67	-2.18	1.34	13.31	-11.93	-6.48
2133	3.70	-2.33	1.65	13.27	-12.02	-6.51
2134	9.47	-2.37	1.58	13.17	-12.38	-6.52
2135	0.30	-2.32	2.00	13.45	-10.97	-6.52
2136	14.07	-2.29	1.79	13.42	-11.54	-6.50
2137	32.95	-2.33	1.37	13.27	-12.52	-6.54

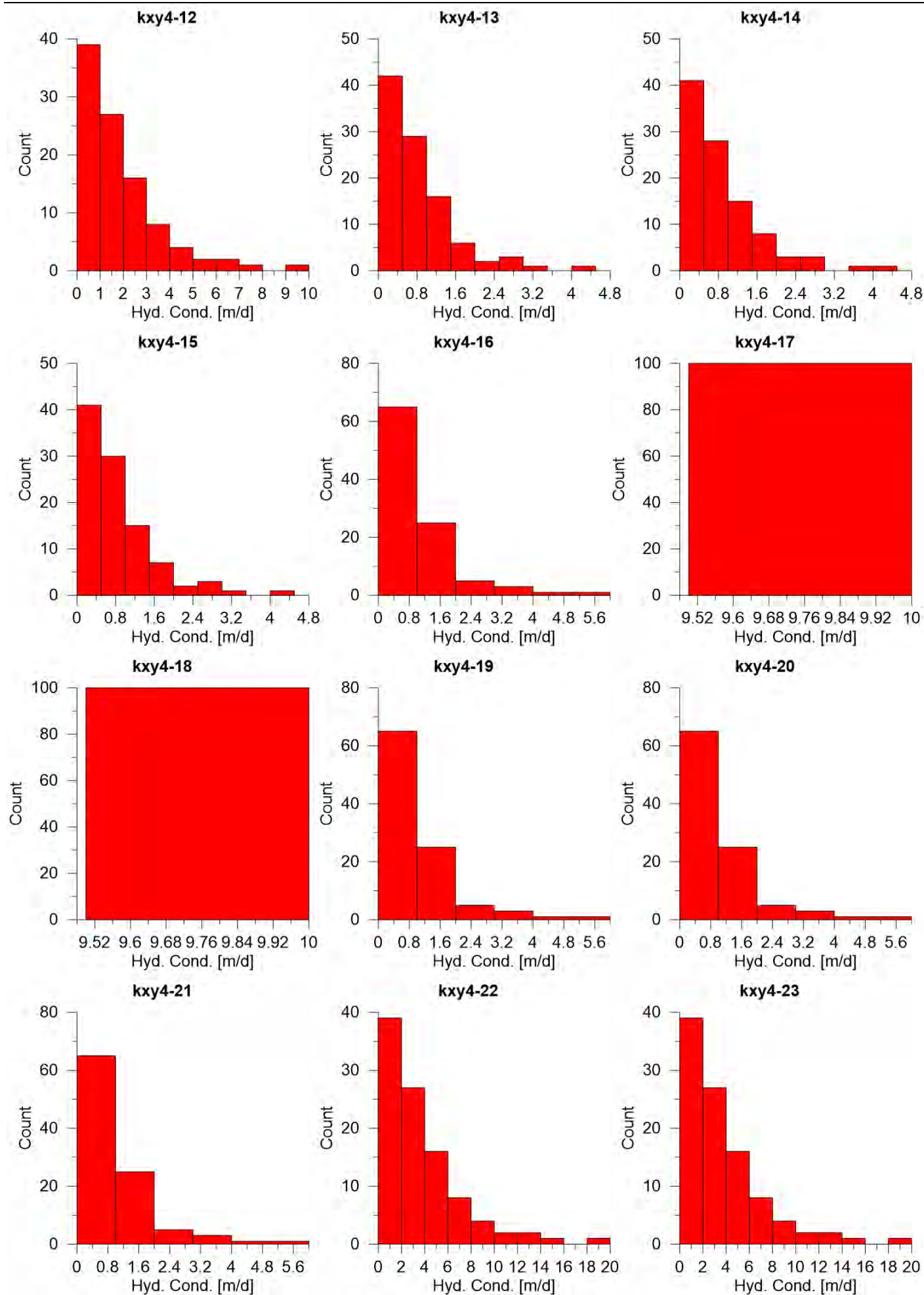
SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

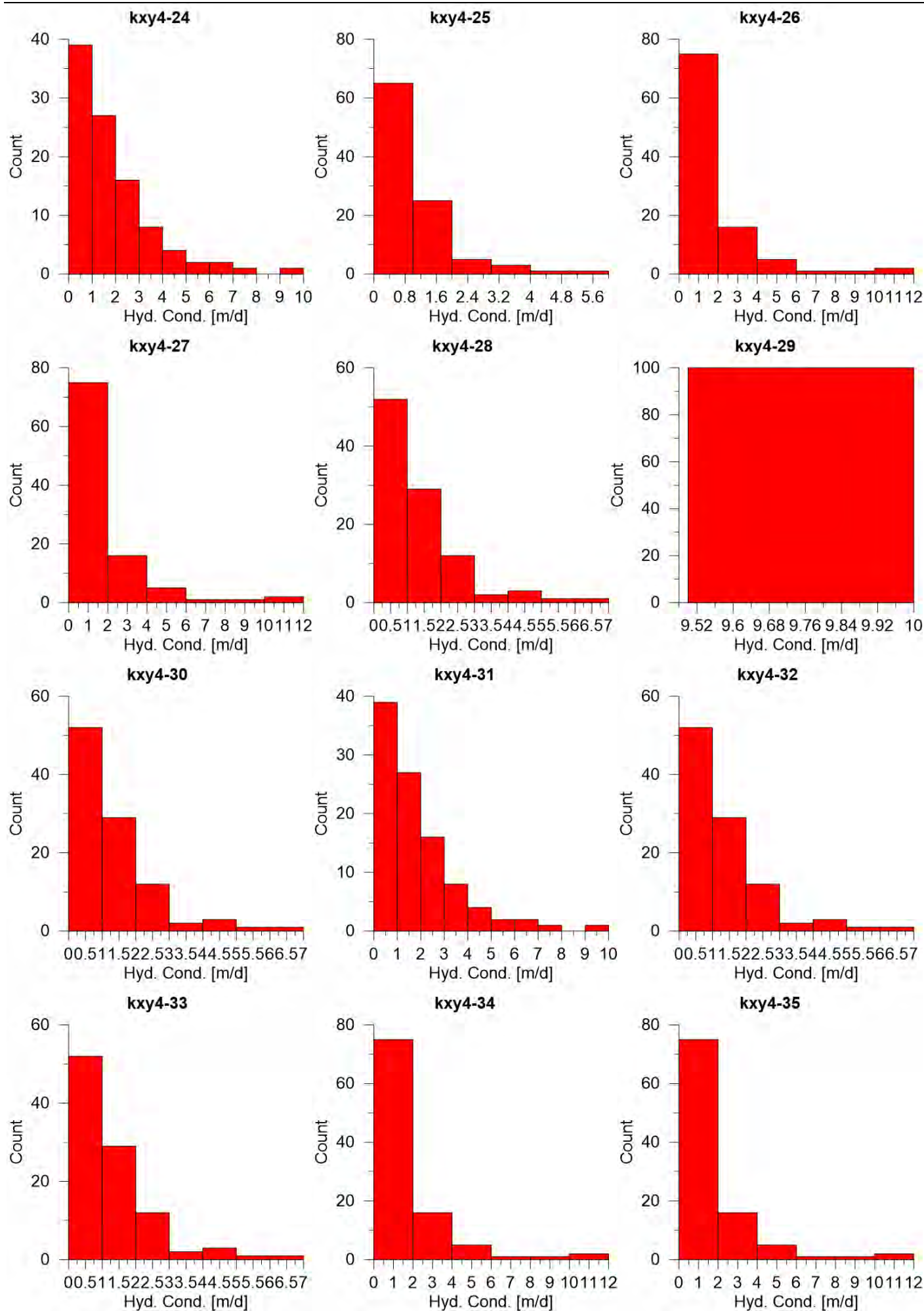
APPENDIX J – LoM and post closure forecast water balance components

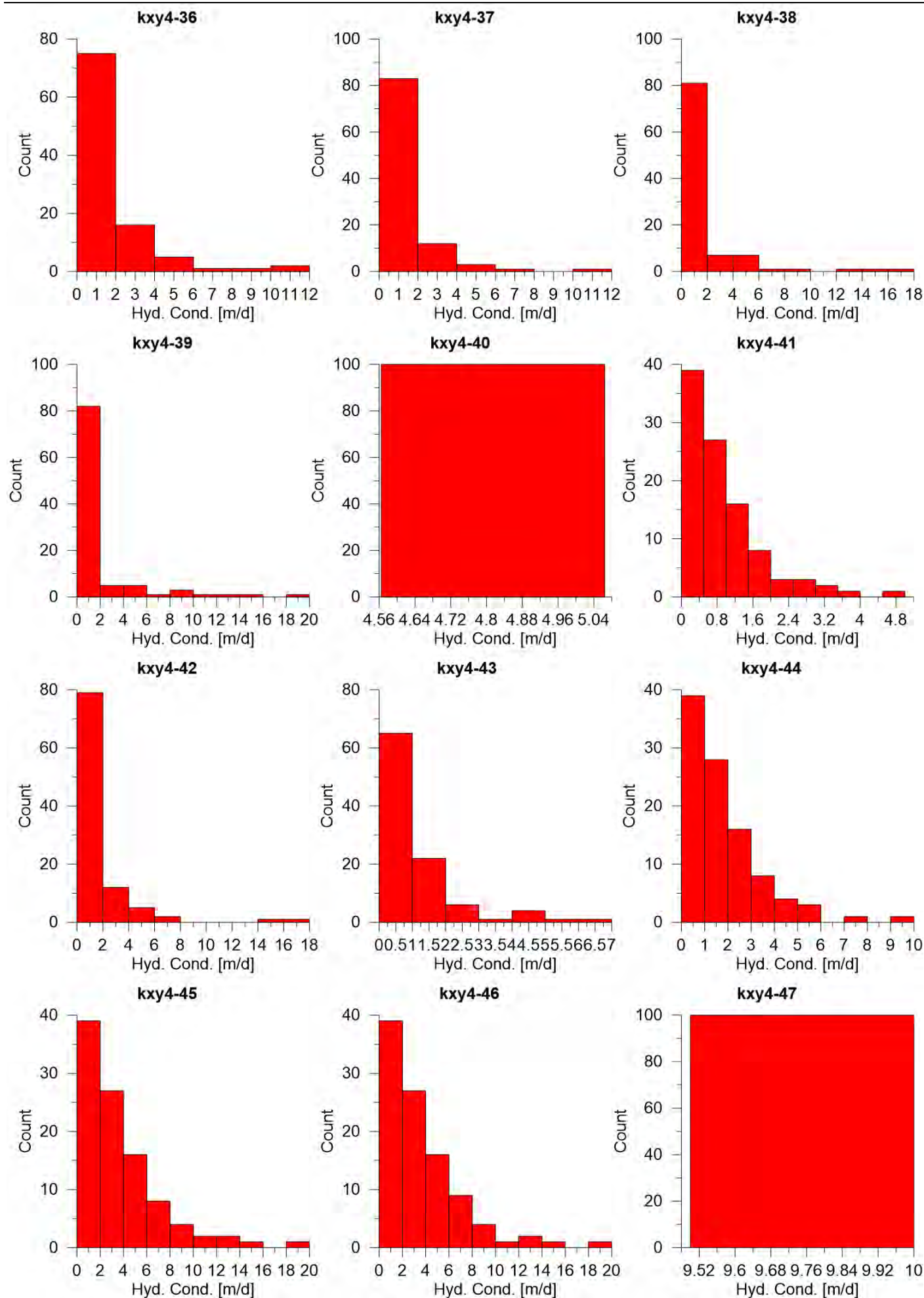
Sino Iron post closure in / out flow water balance components						
Year	river_vol	coast_vol	tidal_vol	flux_in	areal_out	pit_vol
2138	11.43	-2.44	0.92	12.83	-14.21	-6.58
2139	22.08	-2.36	1.28	13.05	-13.40	-6.60
2140	0.00	-2.48	1.43	12.94	-13.27	-6.58
2141	21.04	-2.40	1.54	13.19	-12.74	-6.61
2142	27.04	-2.46	0.74	12.64	-15.77	-6.60
2143	19.87	-2.58	0.64	12.47	-16.76	-6.65
2144	0.00	-2.63	1.24	12.63	-15.10	-6.69
2145	0.00	-2.50	1.90	13.17	-12.46	-6.78
2146	17.37	-2.40	1.64	13.25	-12.38	-6.81
2147	0.00	-2.44	1.55	13.19	-12.27	-6.80
2148	35.46	-2.38	1.24	13.11	-13.93	-6.83
2149	0.32	-2.53	0.95	12.75	-14.71	-6.89
2150	14.61	-2.45	1.66	13.15	-12.46	-6.93
2151	14.19	-2.45	1.24	12.98	-13.56	-6.94
2152	0.58	-2.50	1.47	13.03	-13.10	-6.95
2153	30.51	-2.46	1.30	13.06	-14.54	-6.98
2154	0.30	-2.54	1.24	12.72	-14.64	-7.01
2155	0.30	-2.50	1.73	13.16	-12.46	-7.02
2156	16.99	-2.45	1.46	13.19	-12.65	-7.00
2157	0.14	-2.47	1.70	13.28	-12.08	-7.06
2158	0.17	-2.39	1.98	13.42	-11.39	-7.04
2159	0.66	-2.28	2.17	13.57	-10.84	-7.08
2160	17.53	-2.30	1.42	13.34	-11.67	-7.08

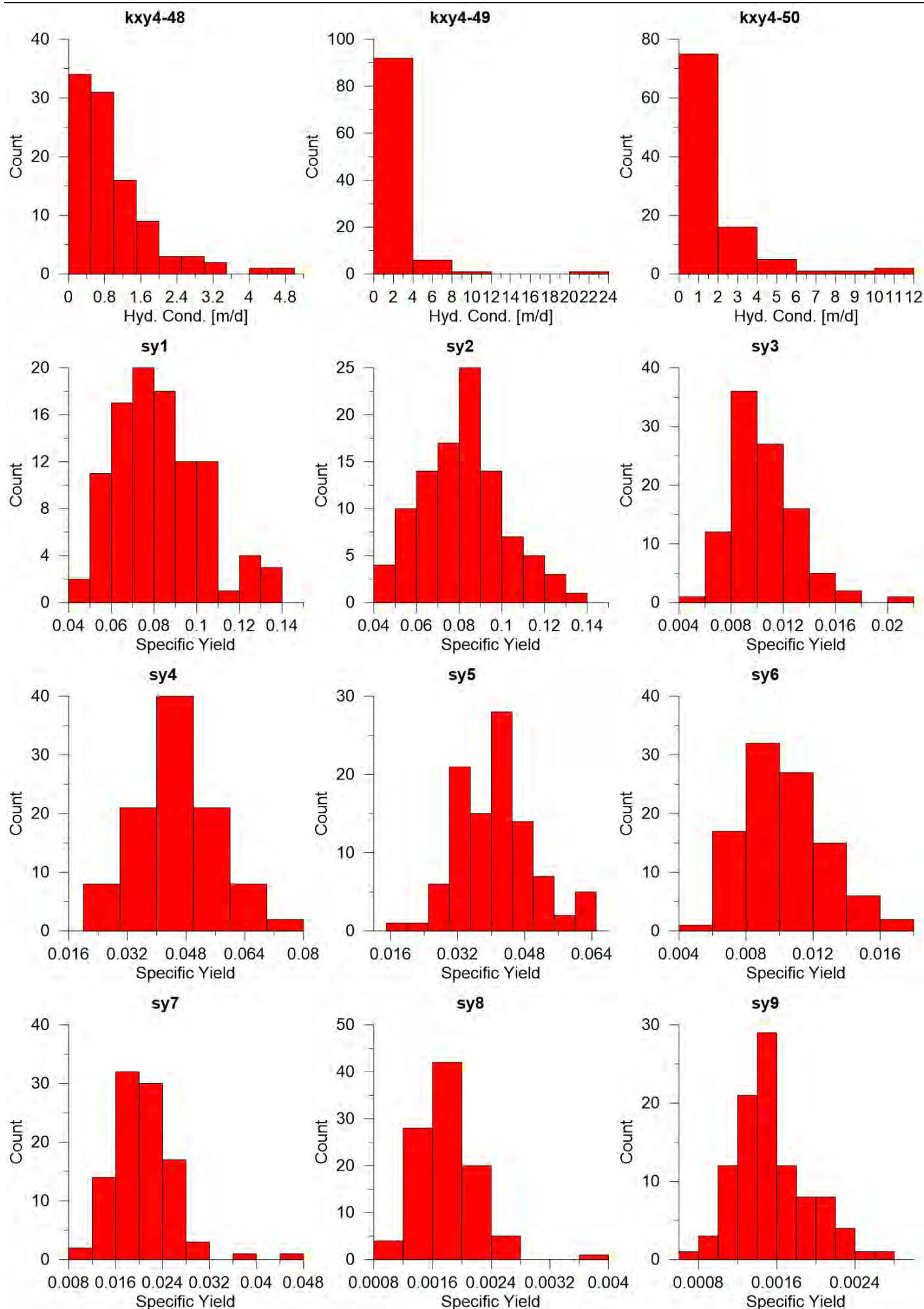


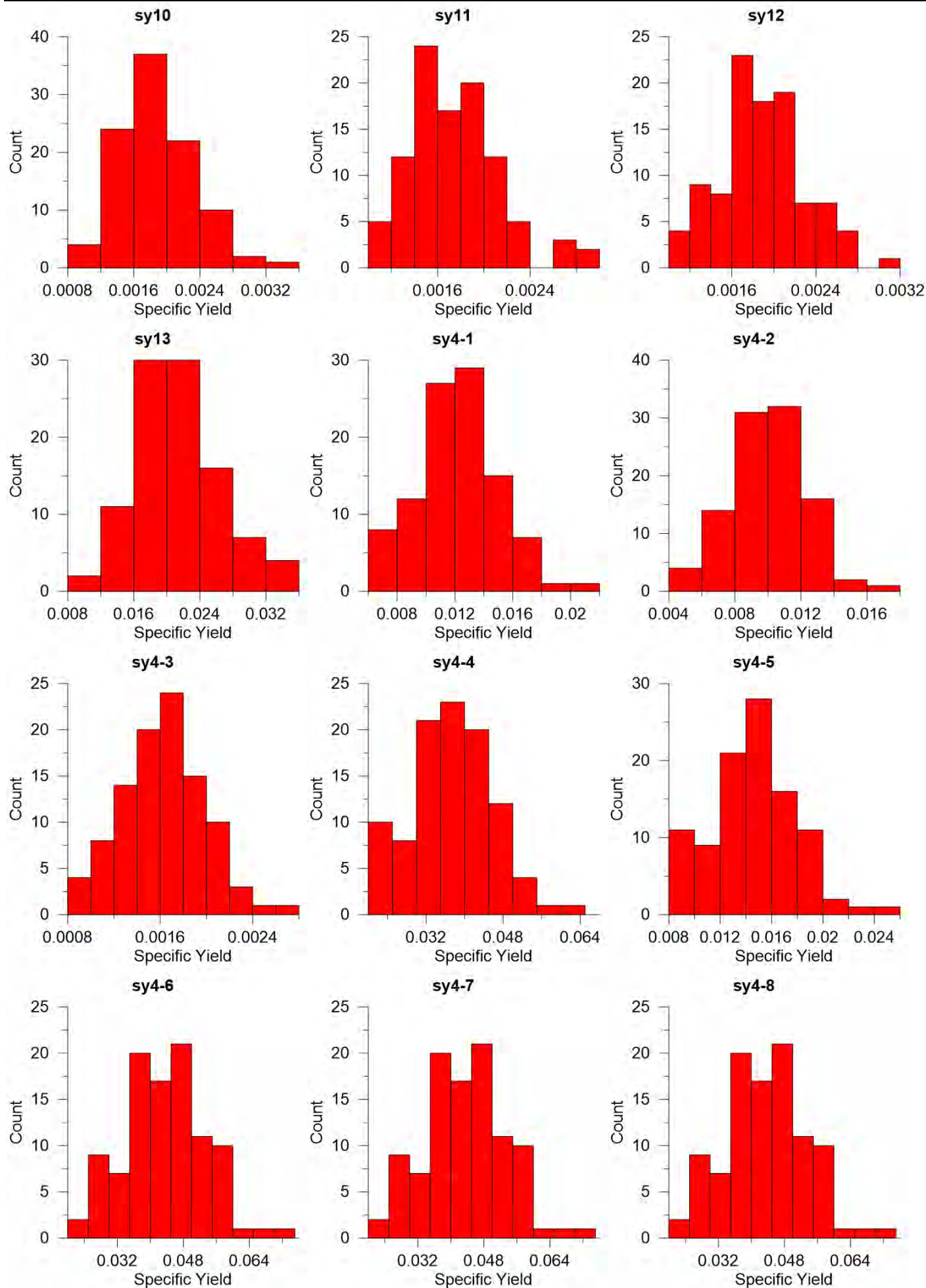


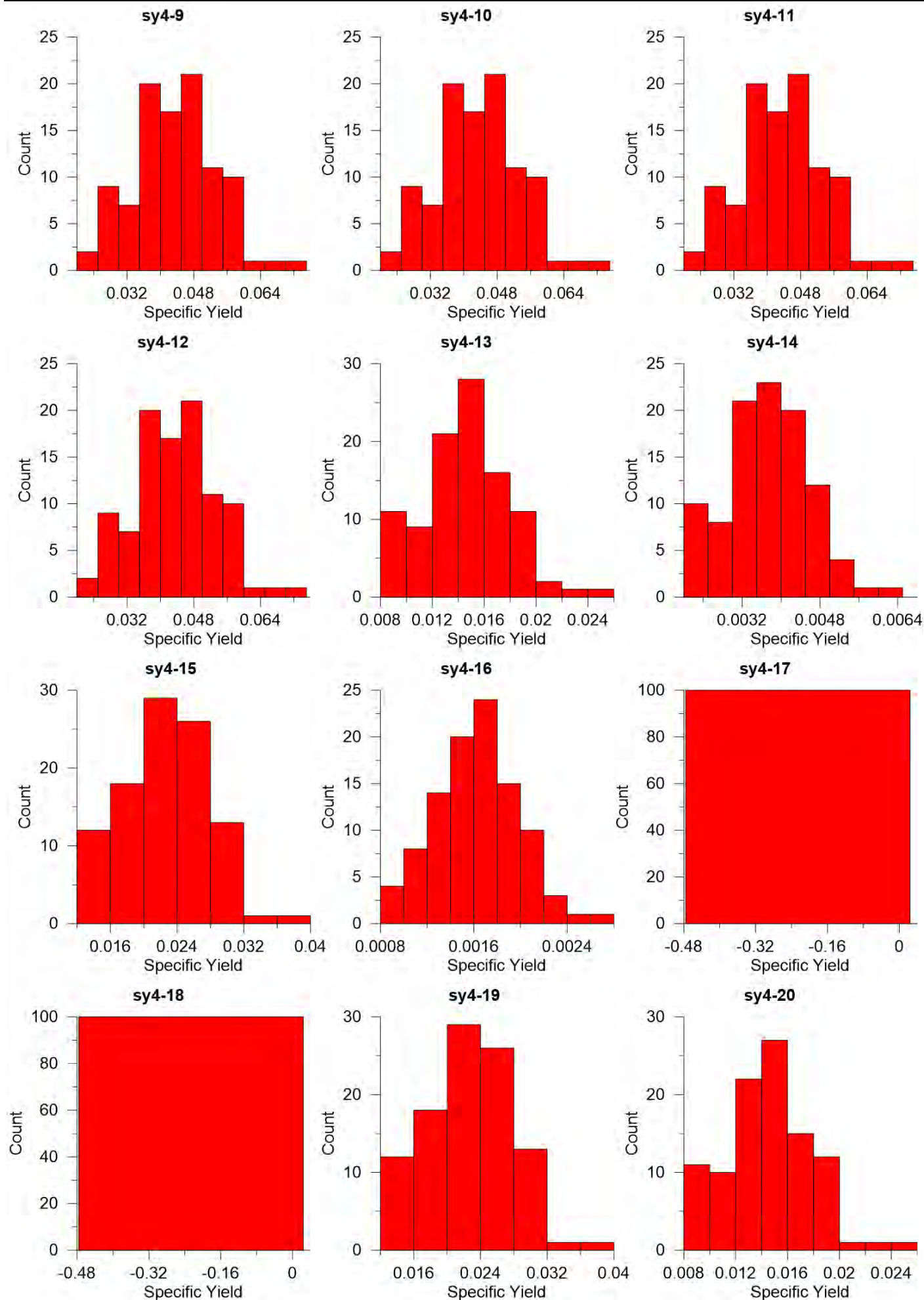


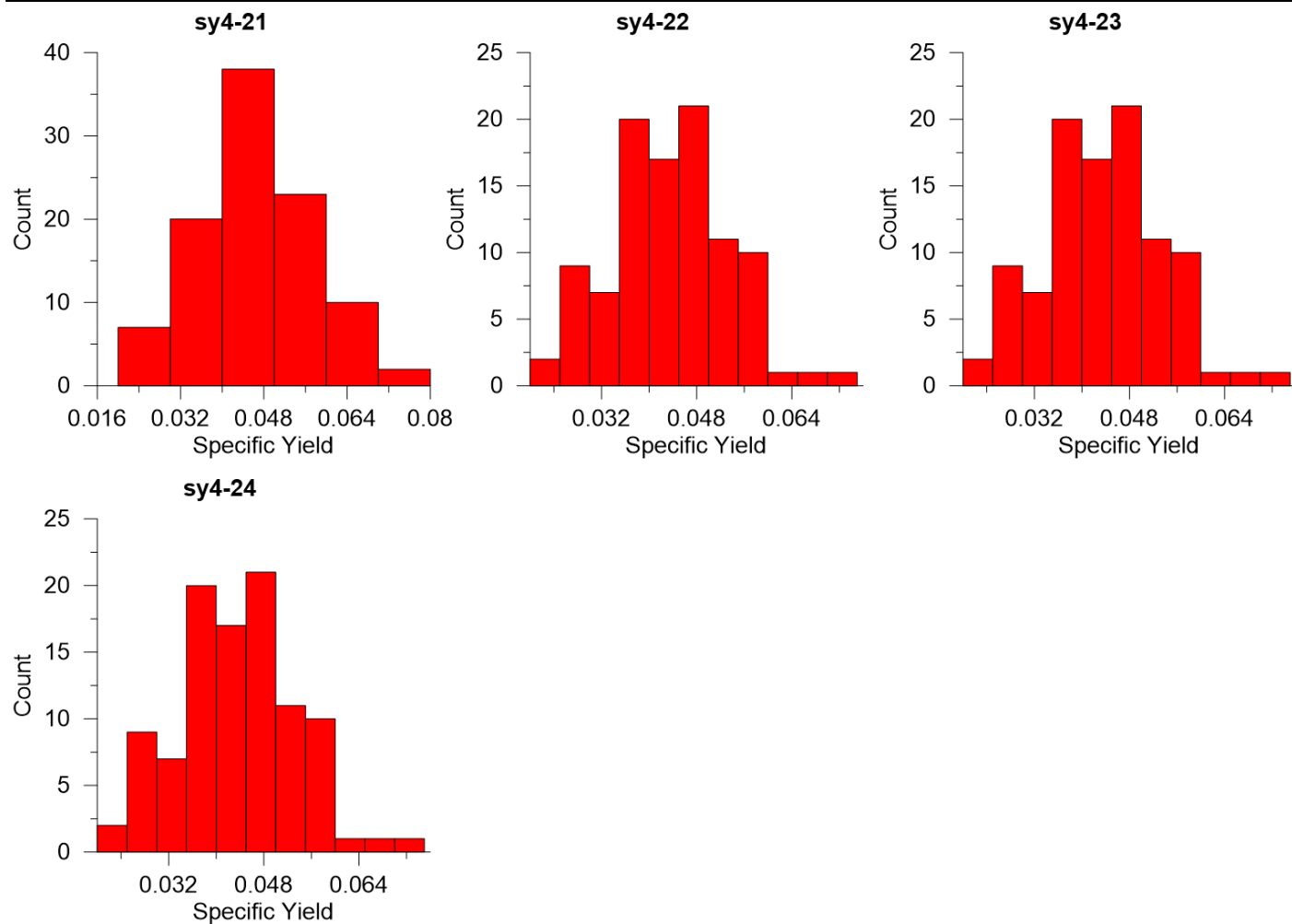


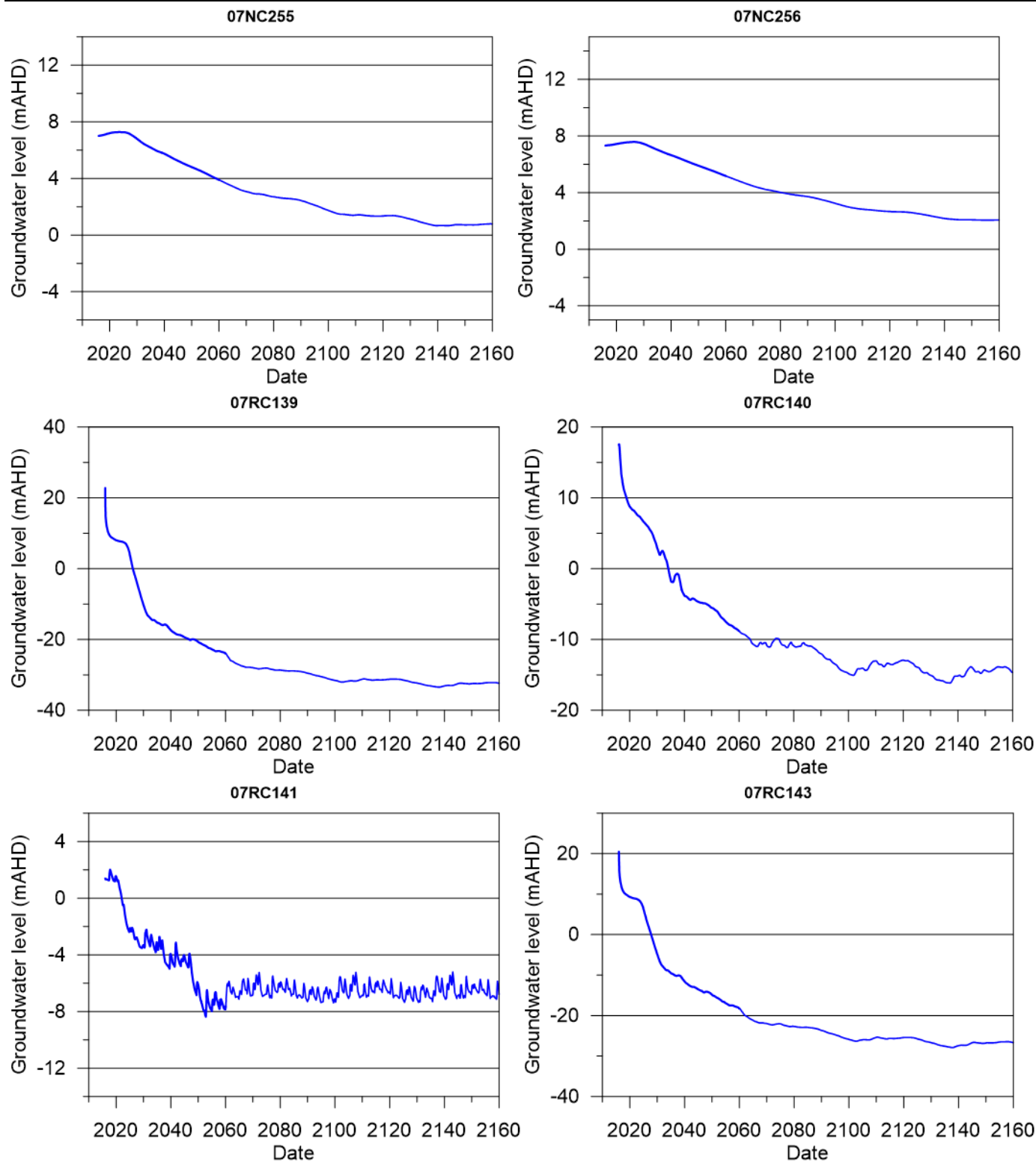


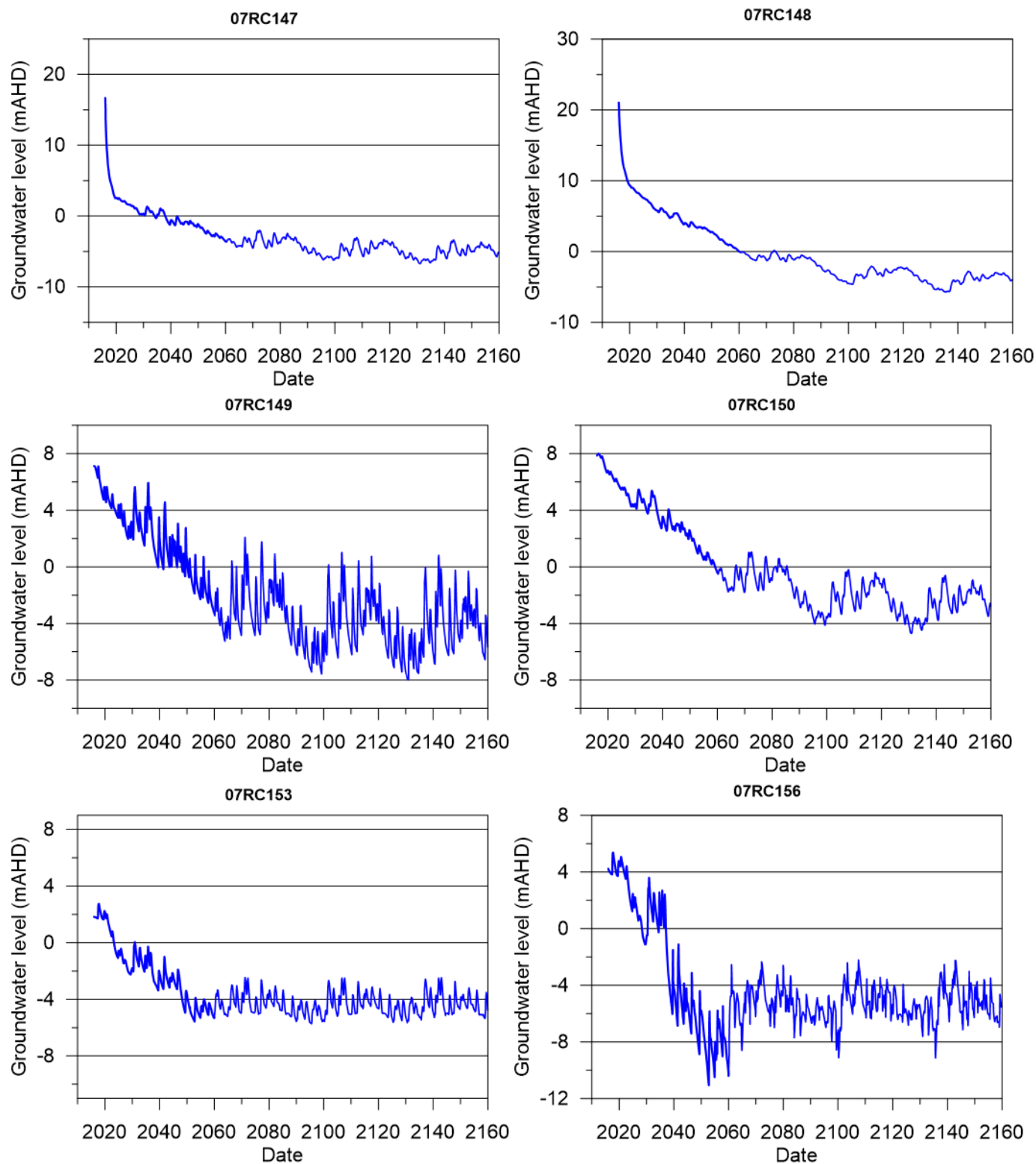


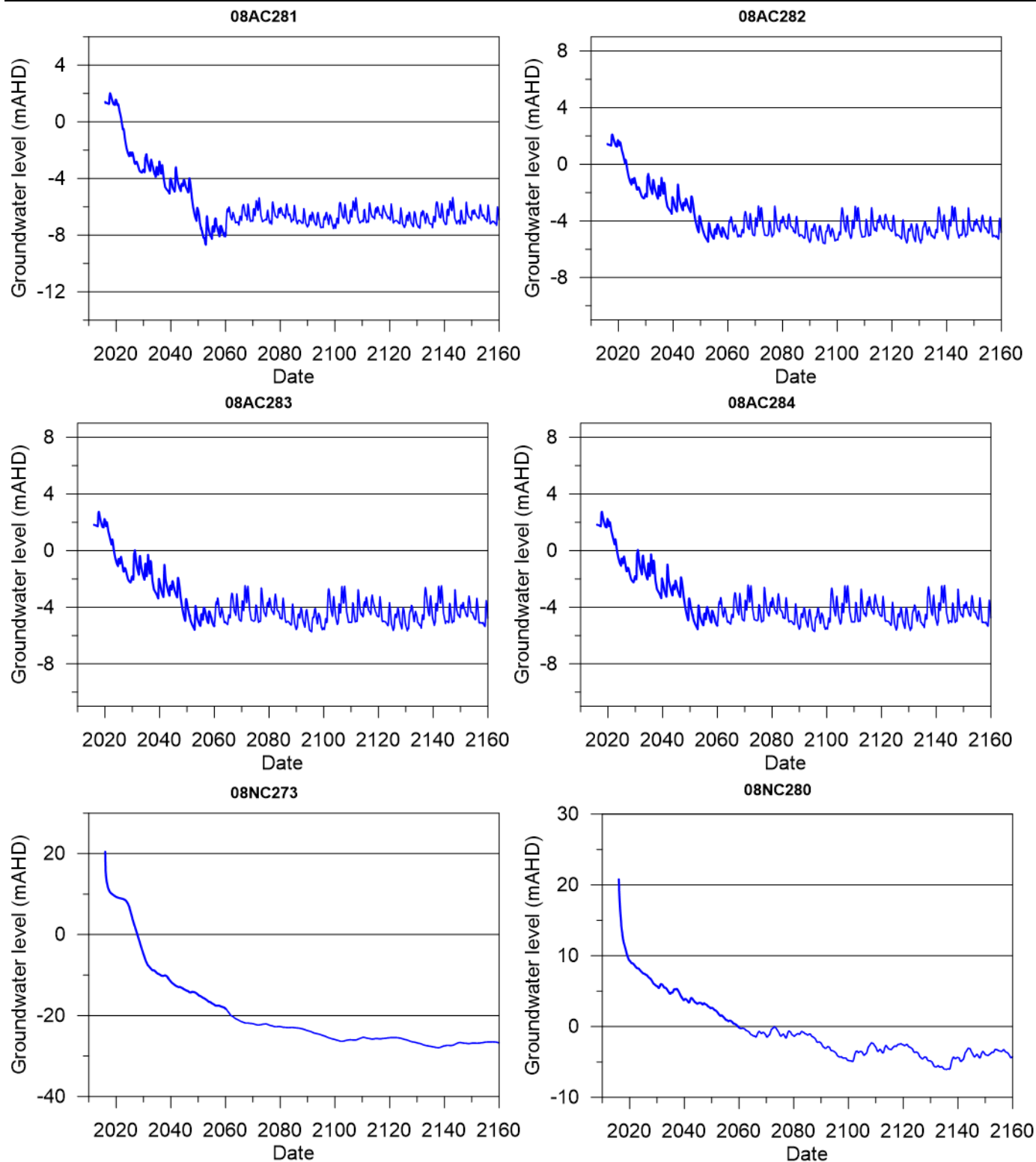


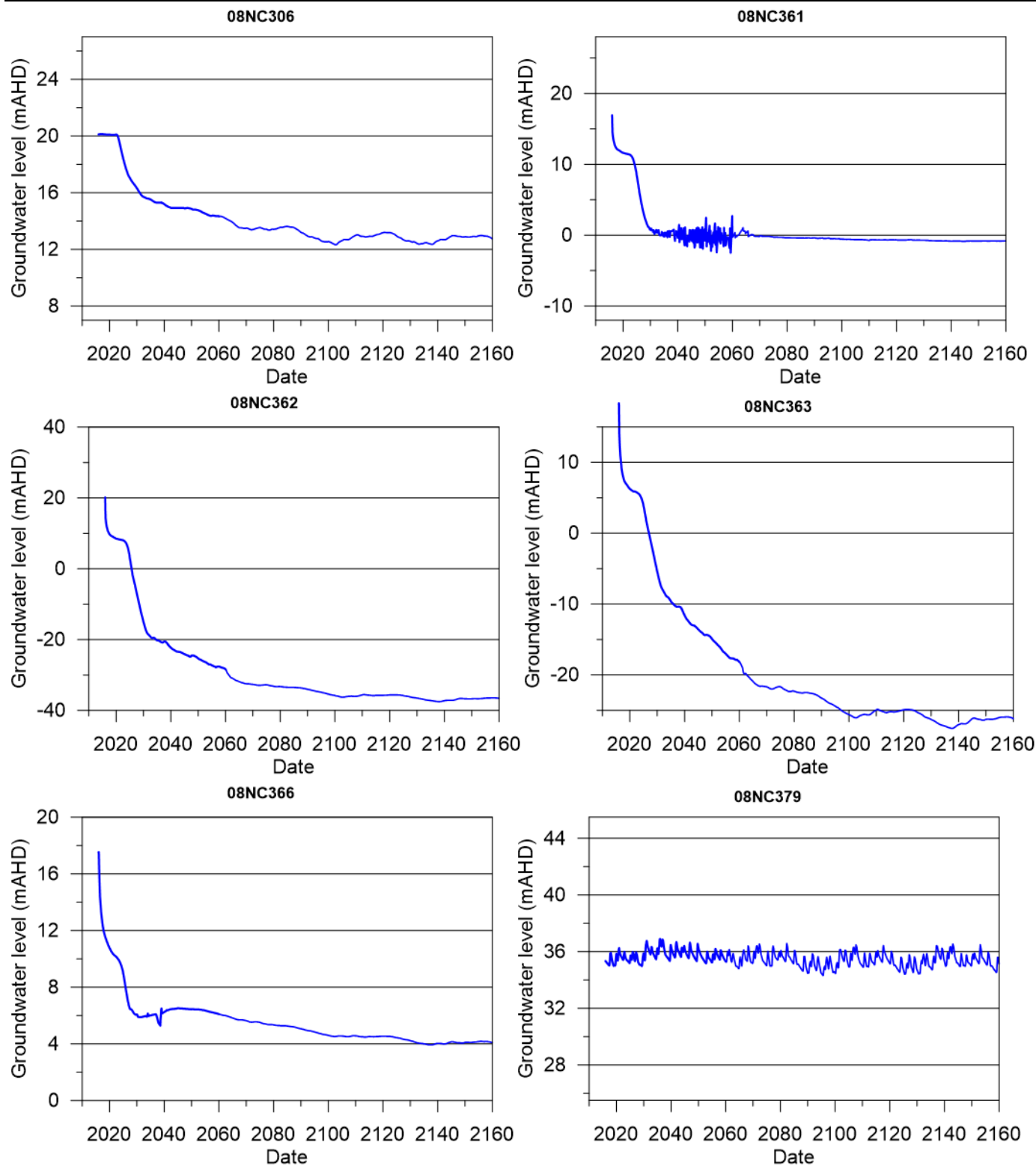


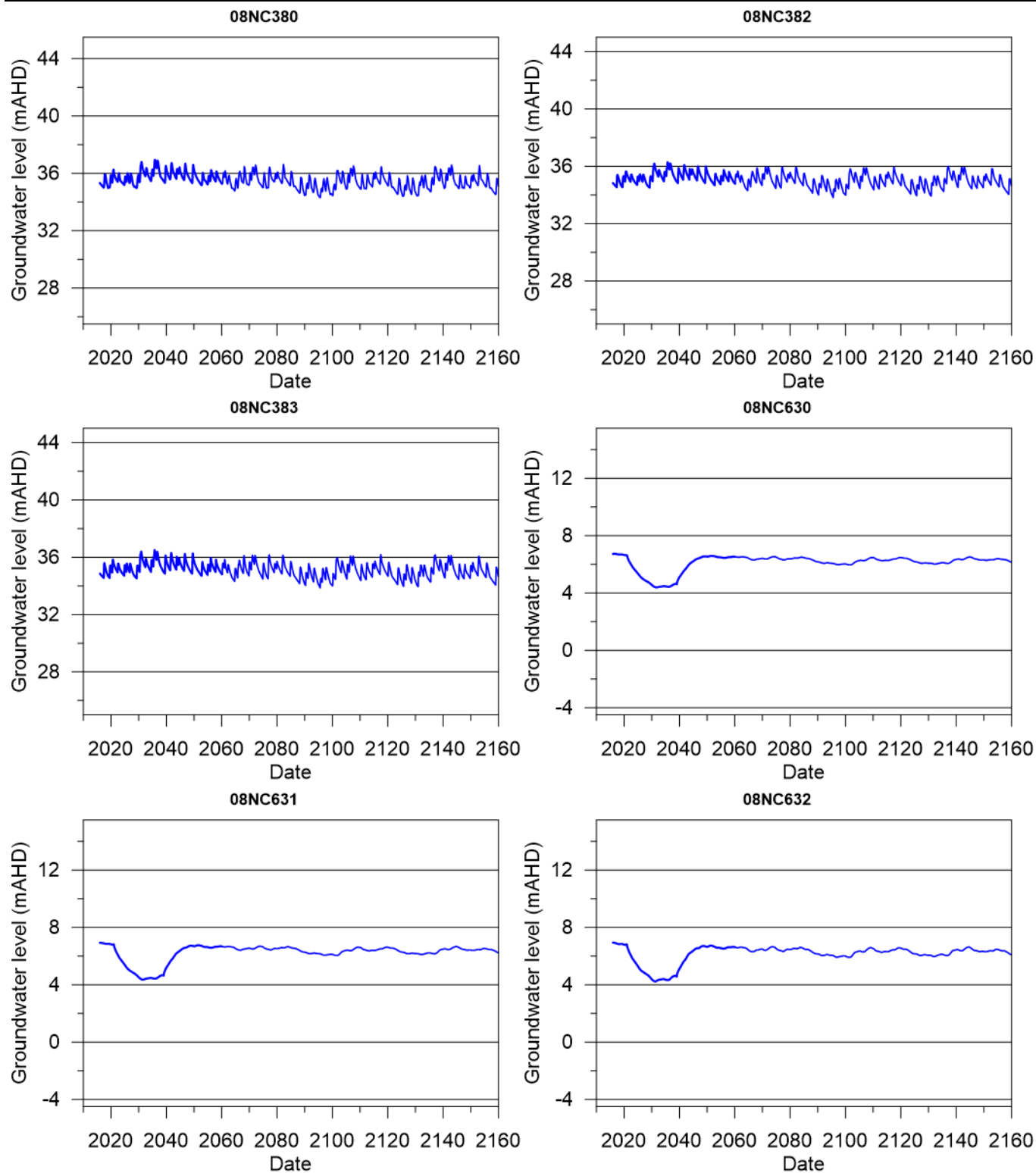


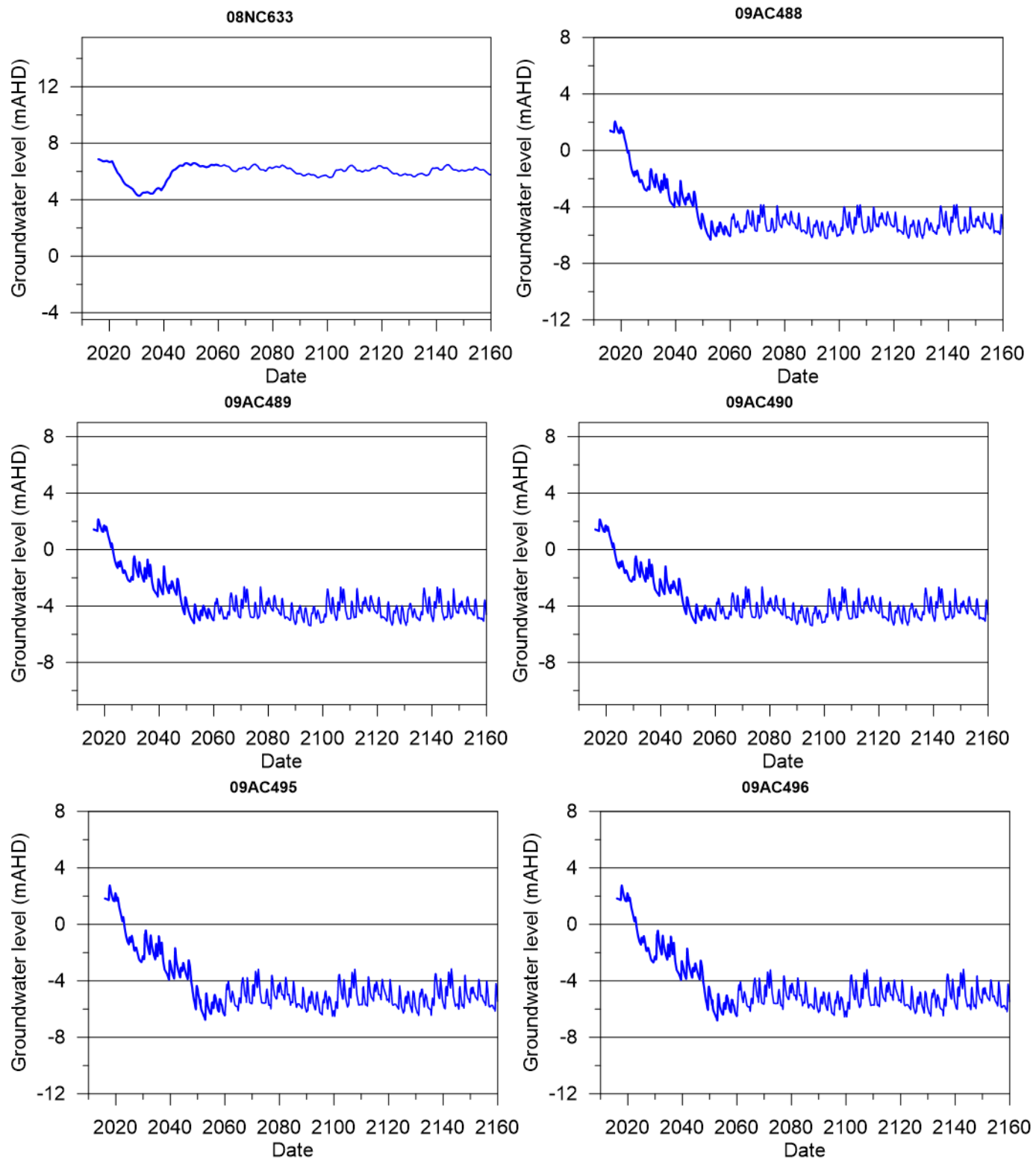


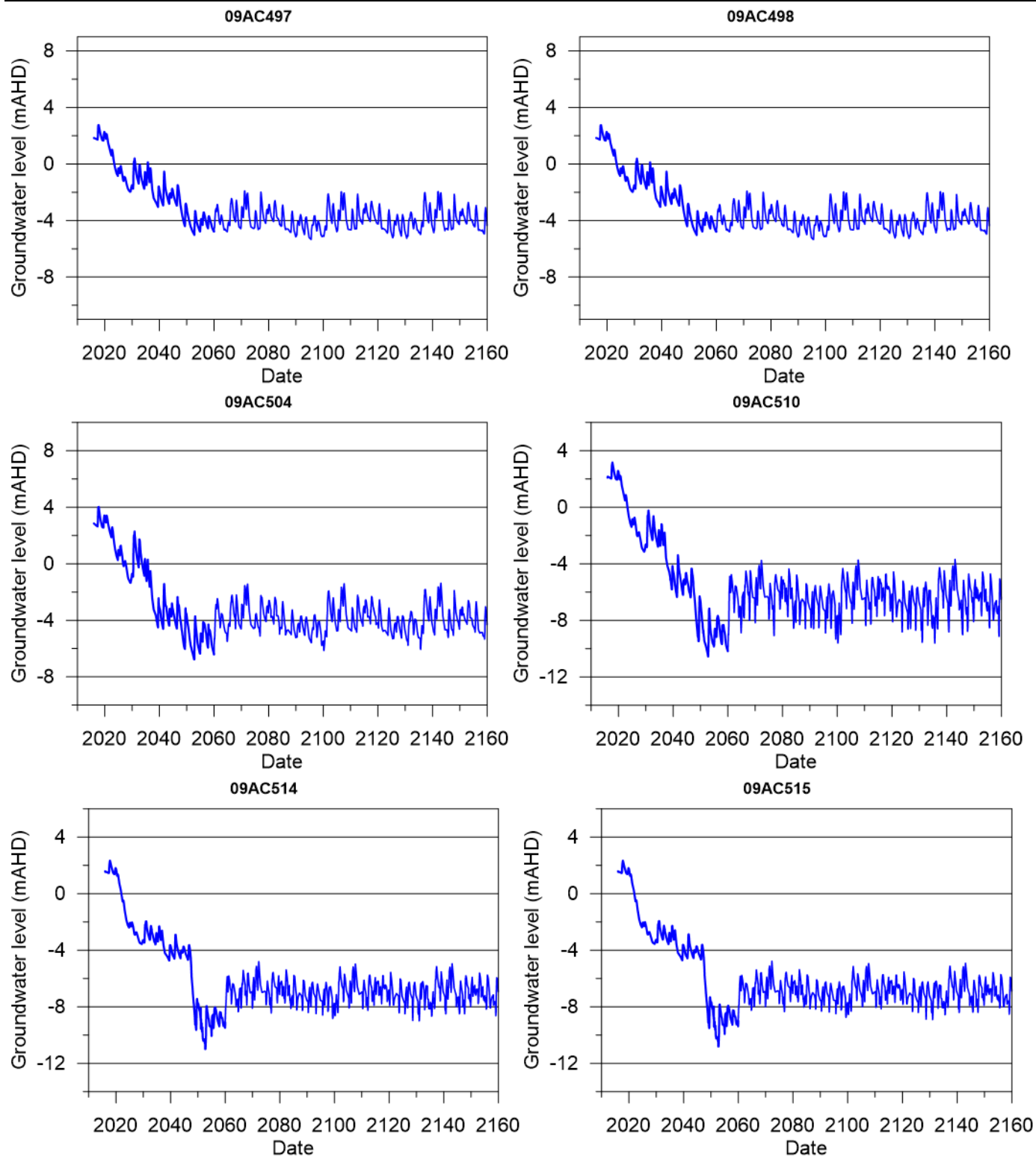


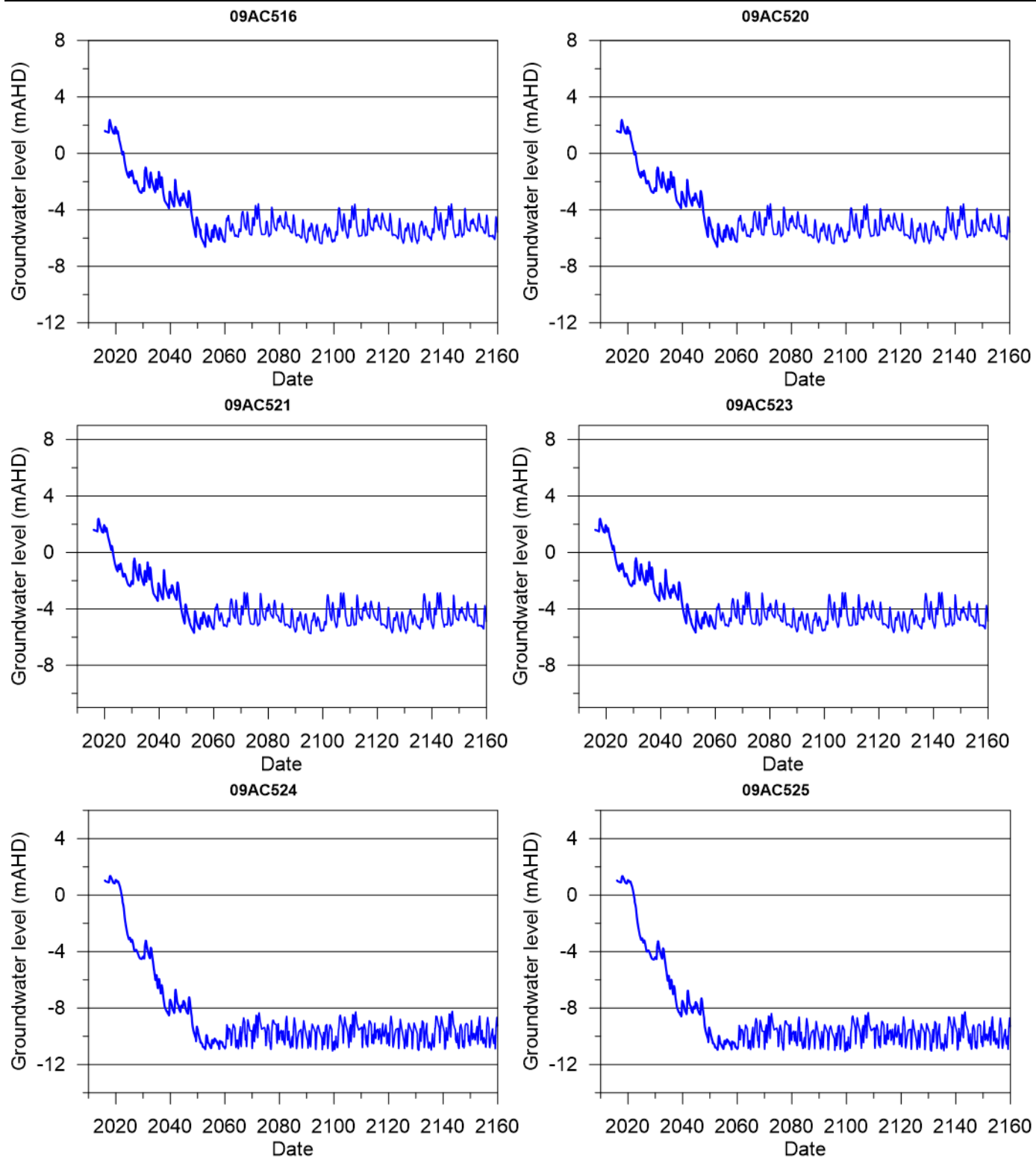


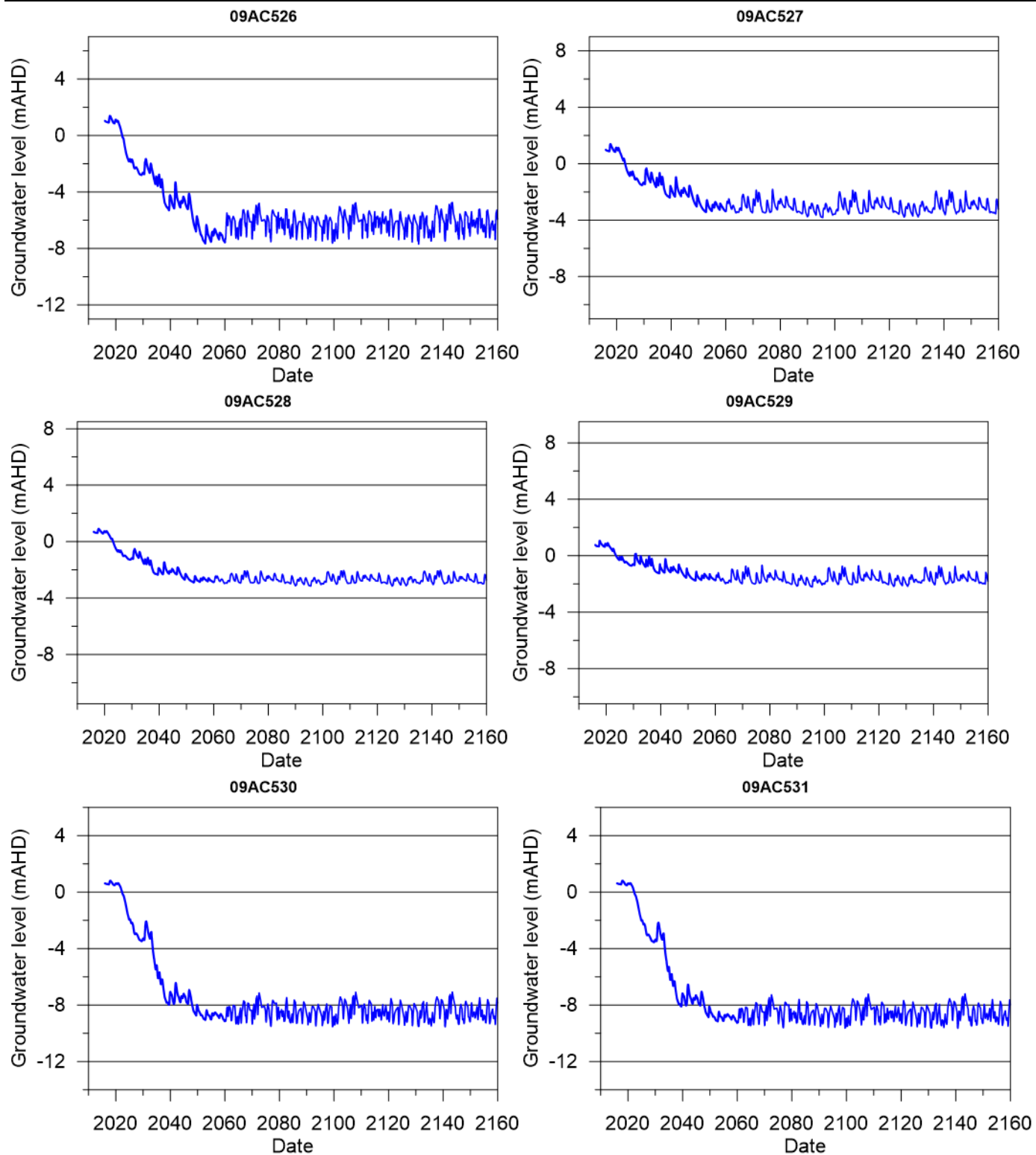


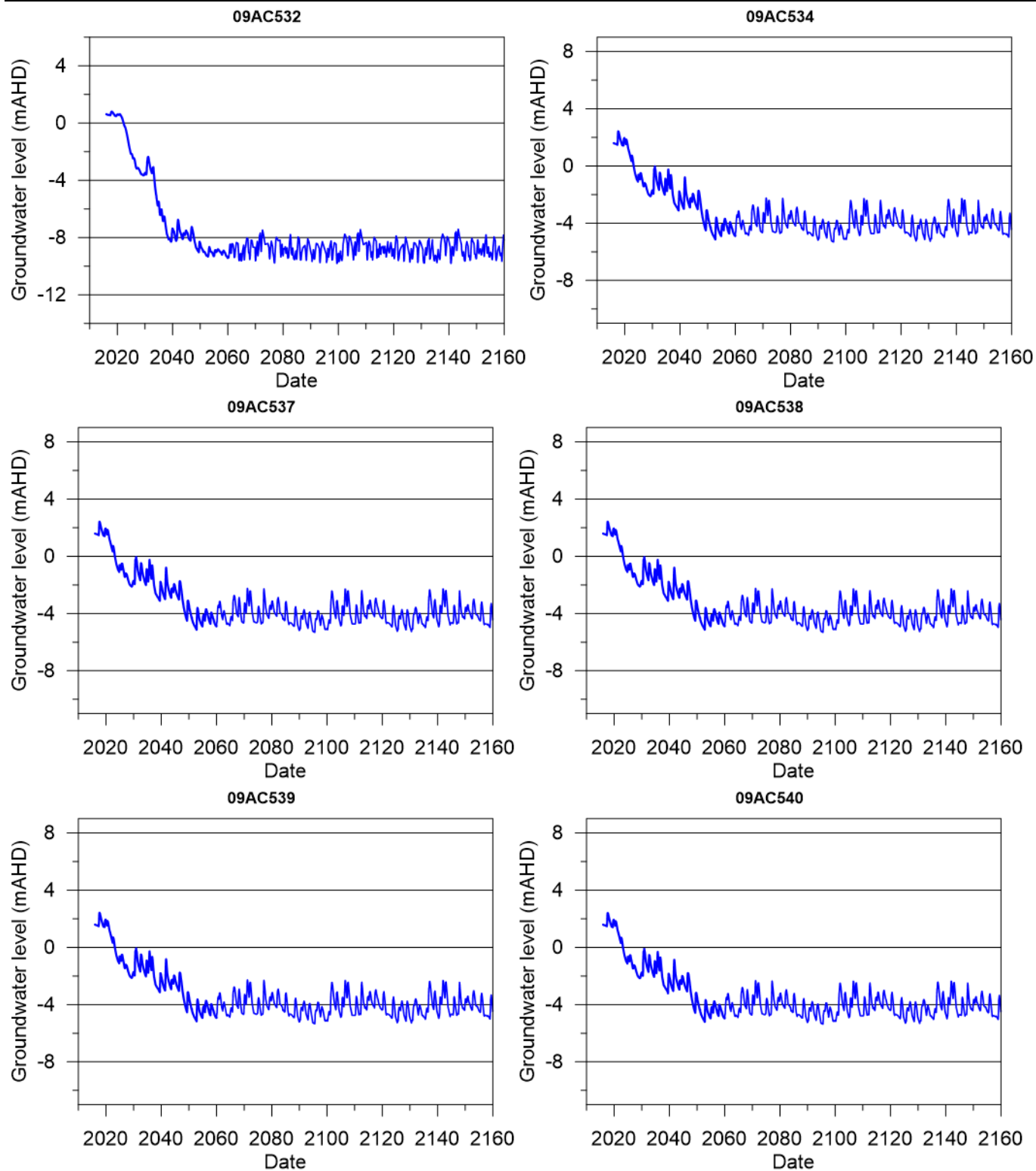


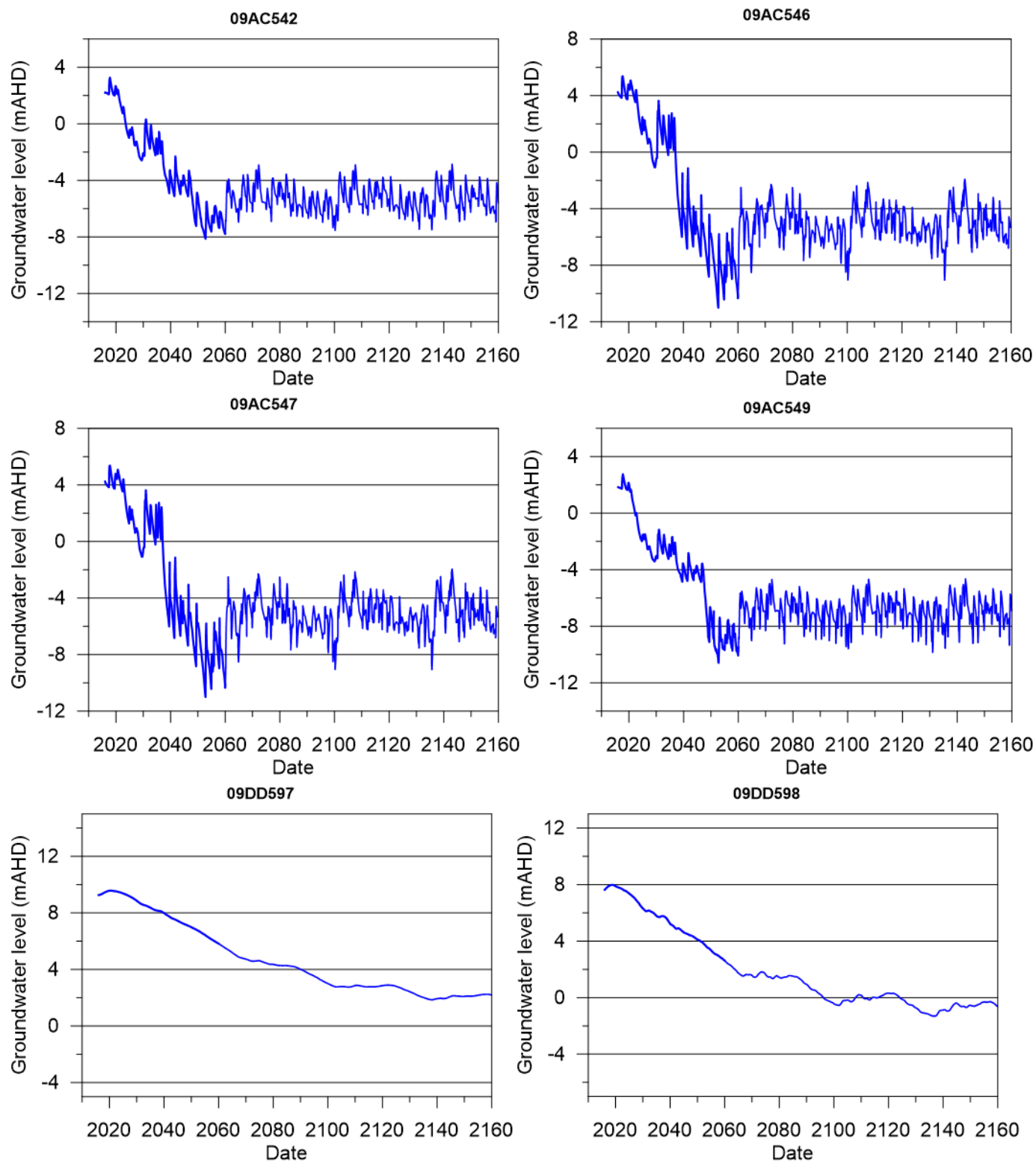


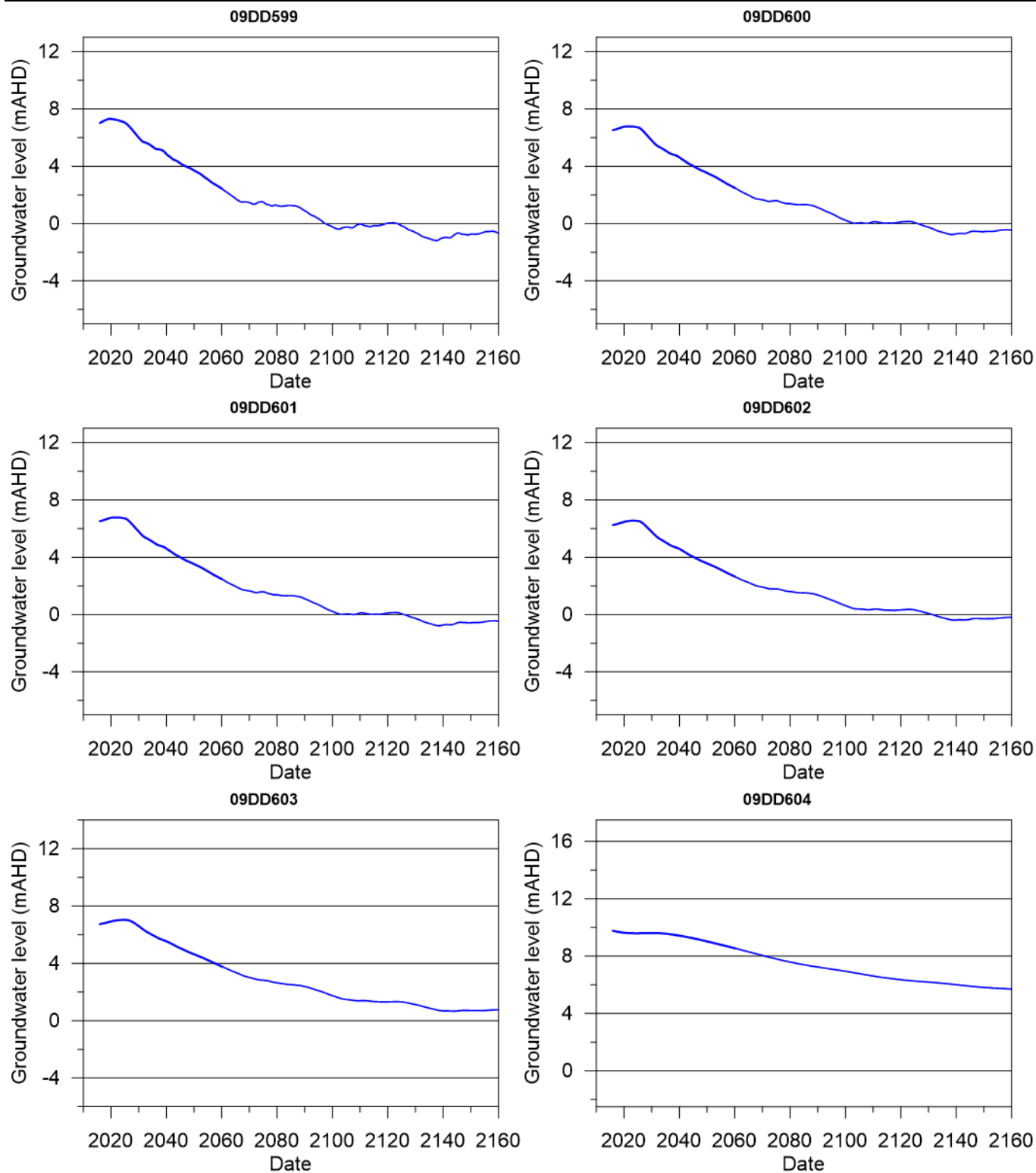


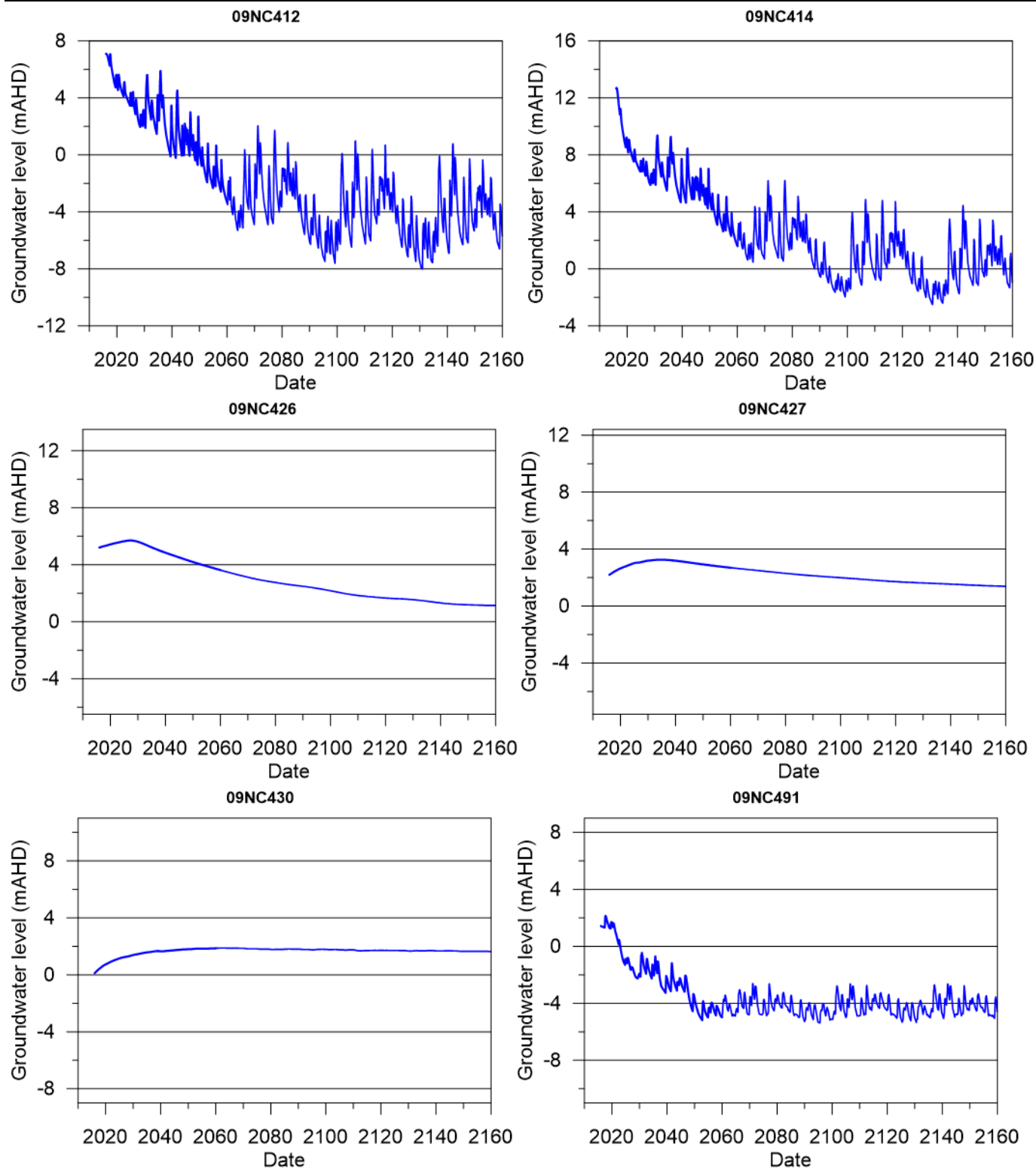


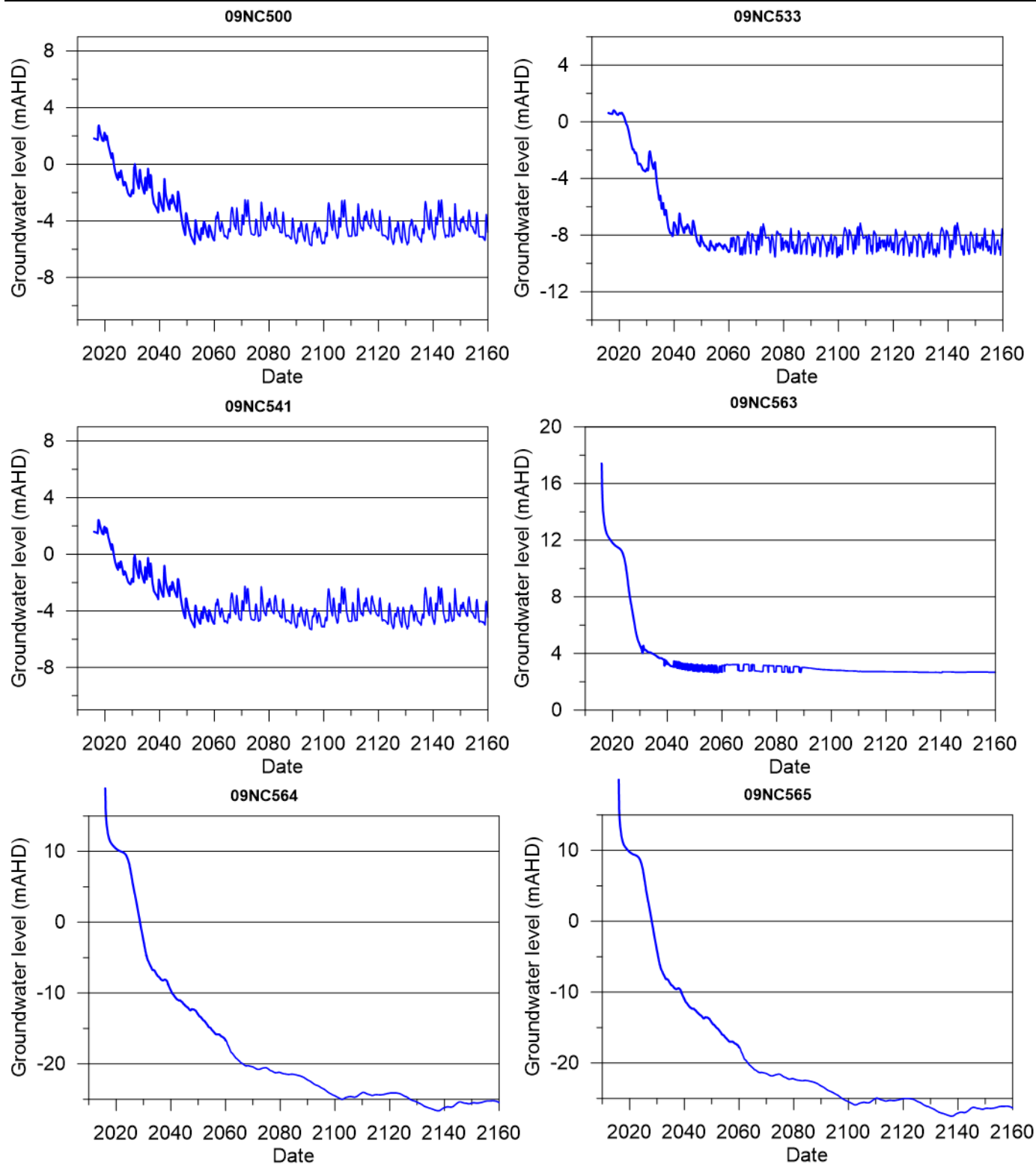


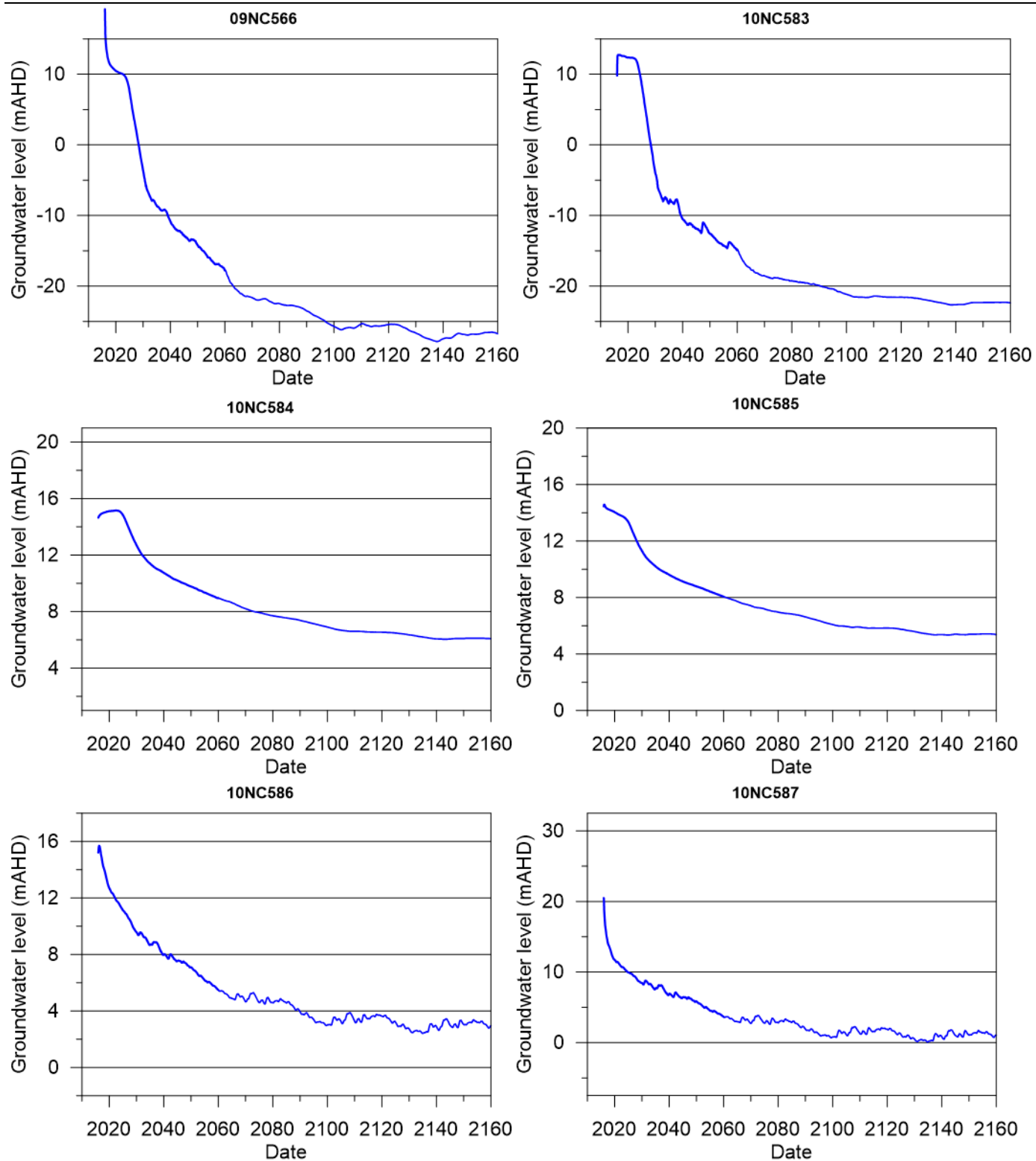


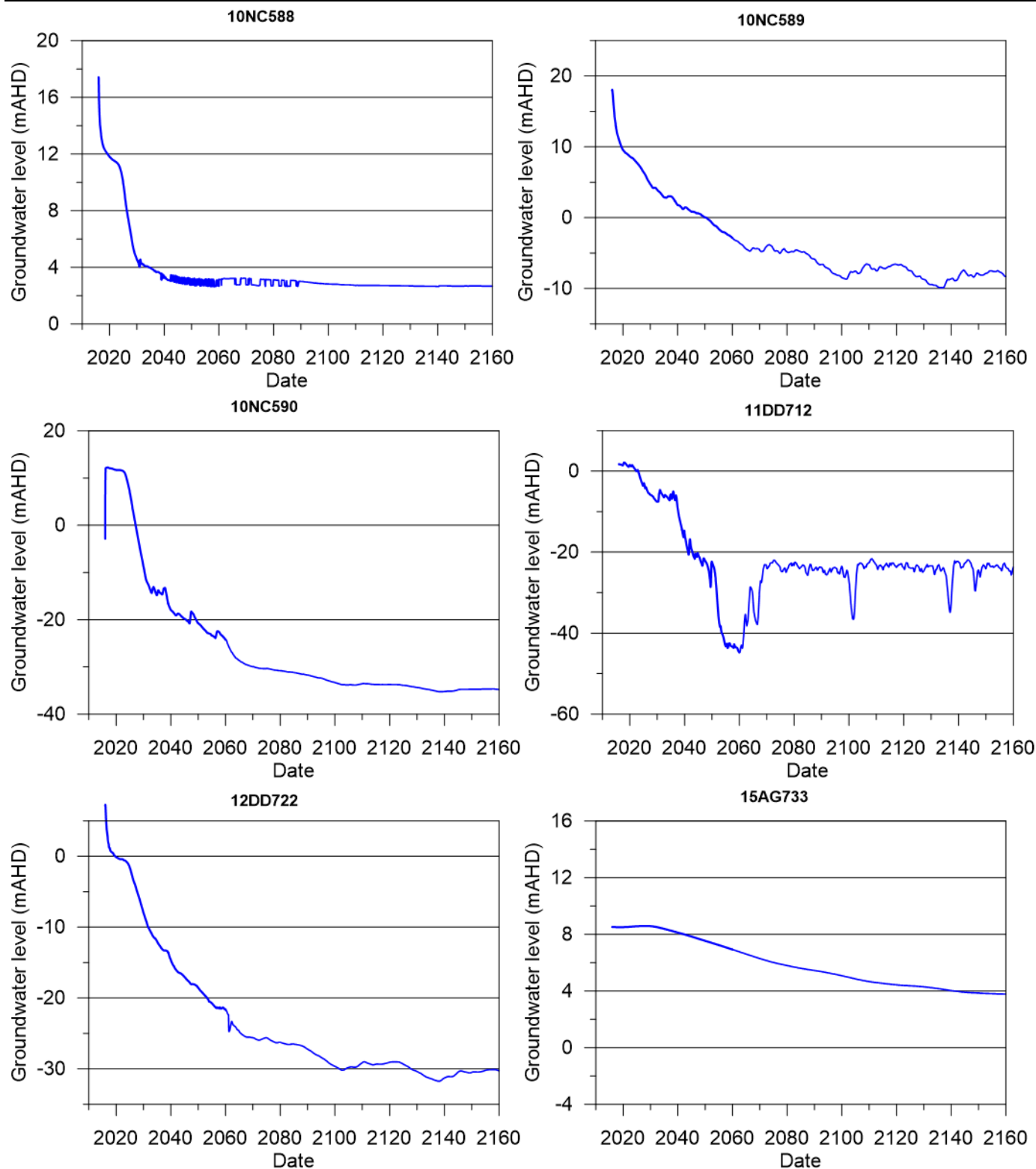


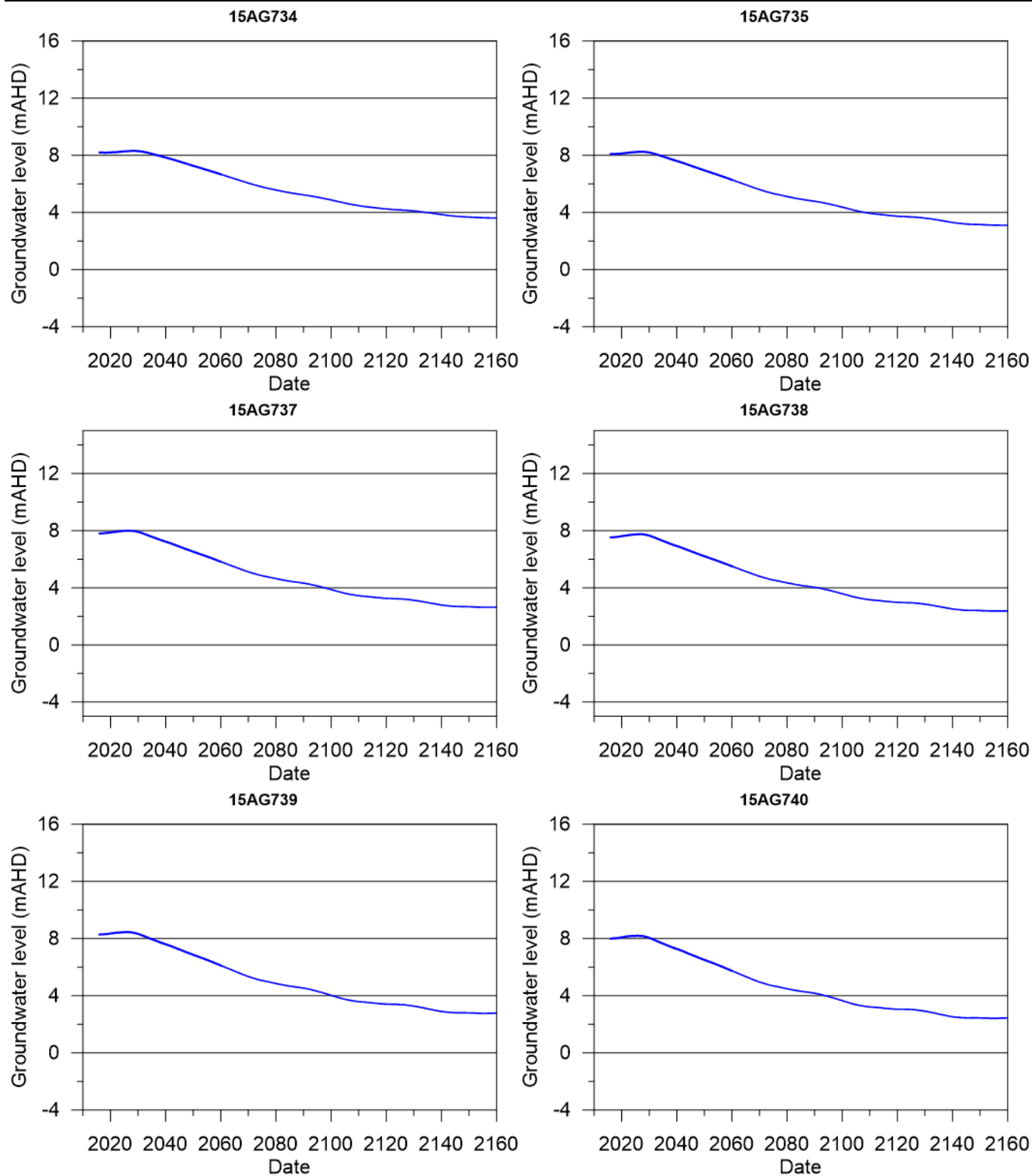


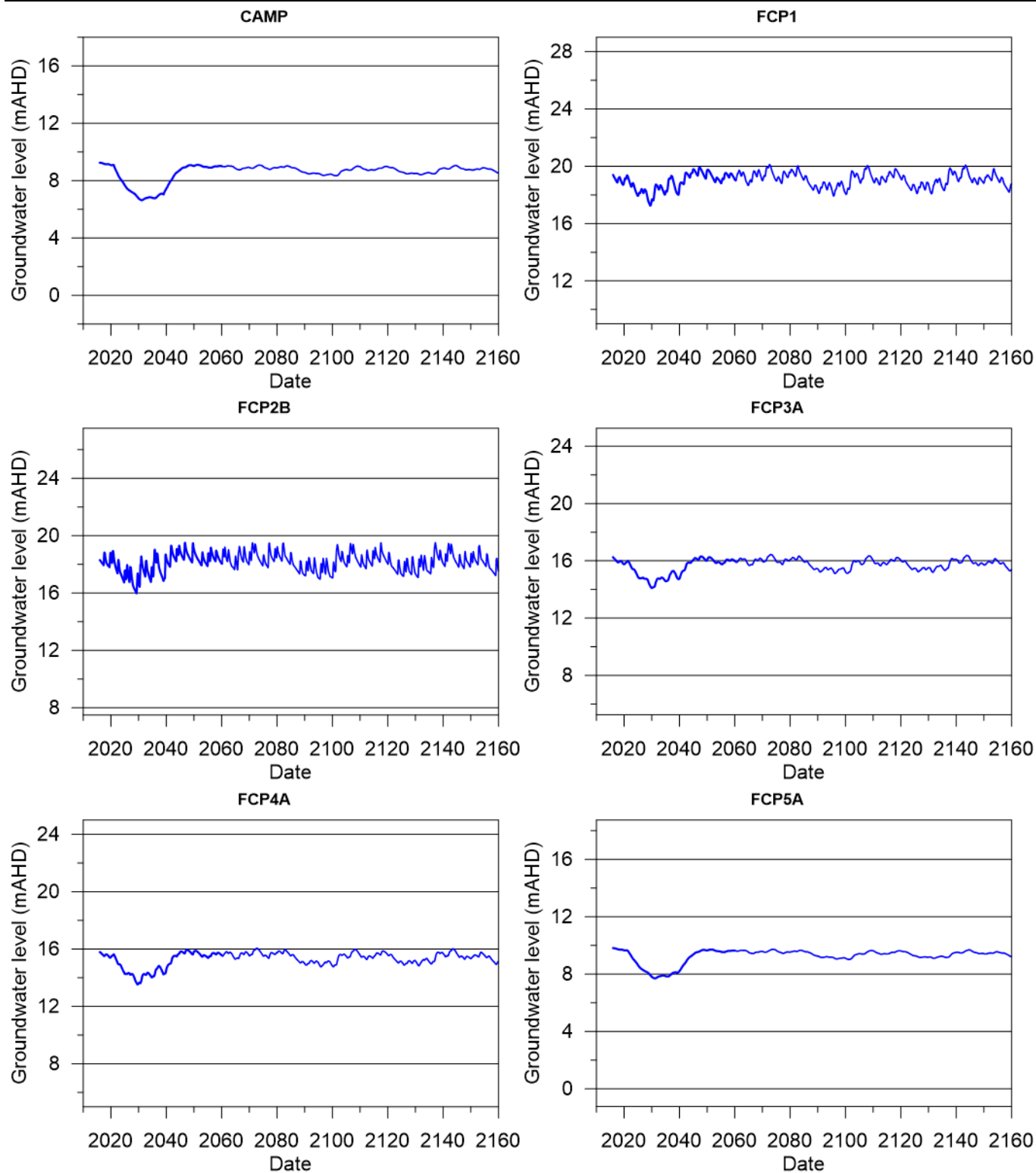


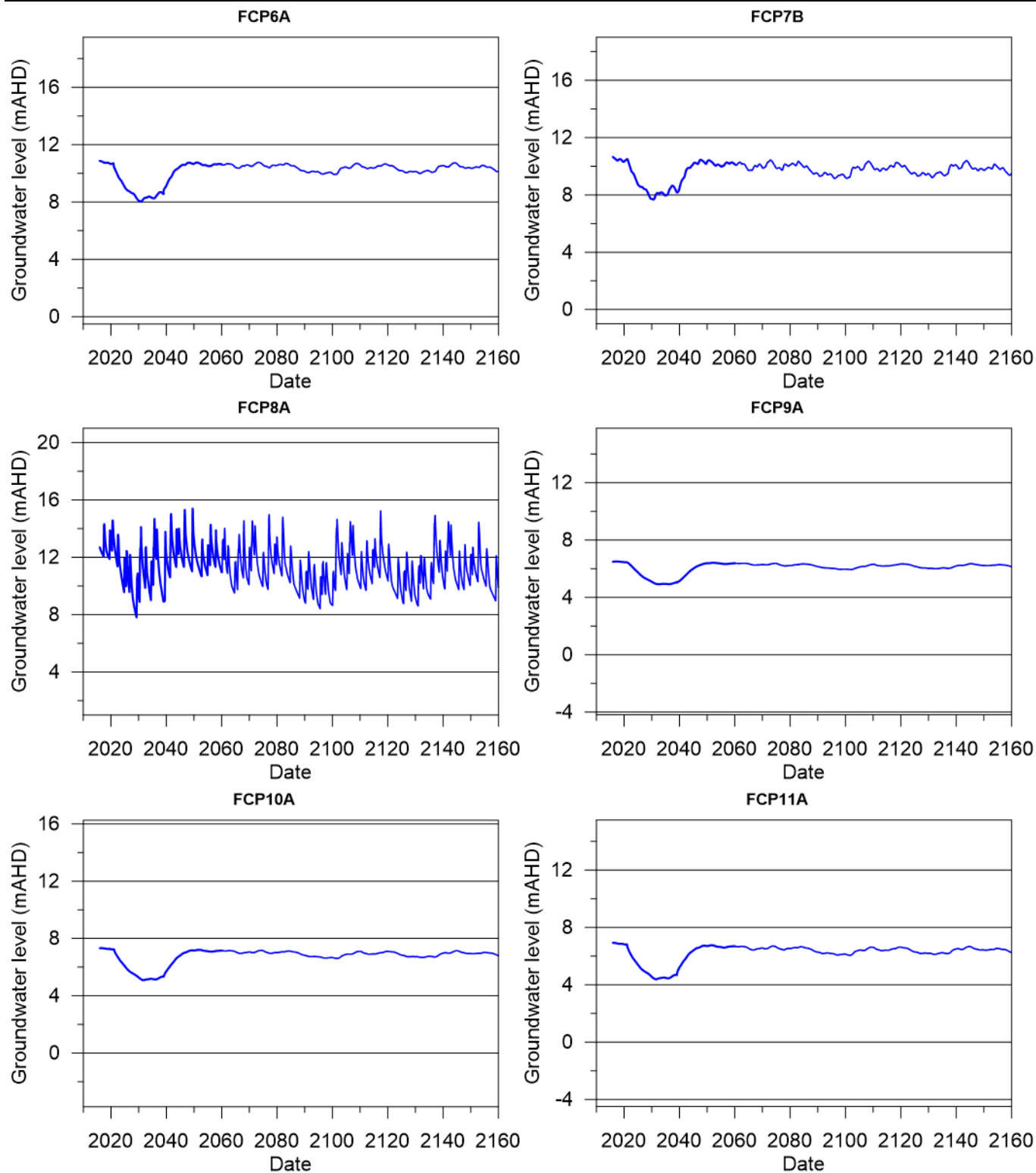


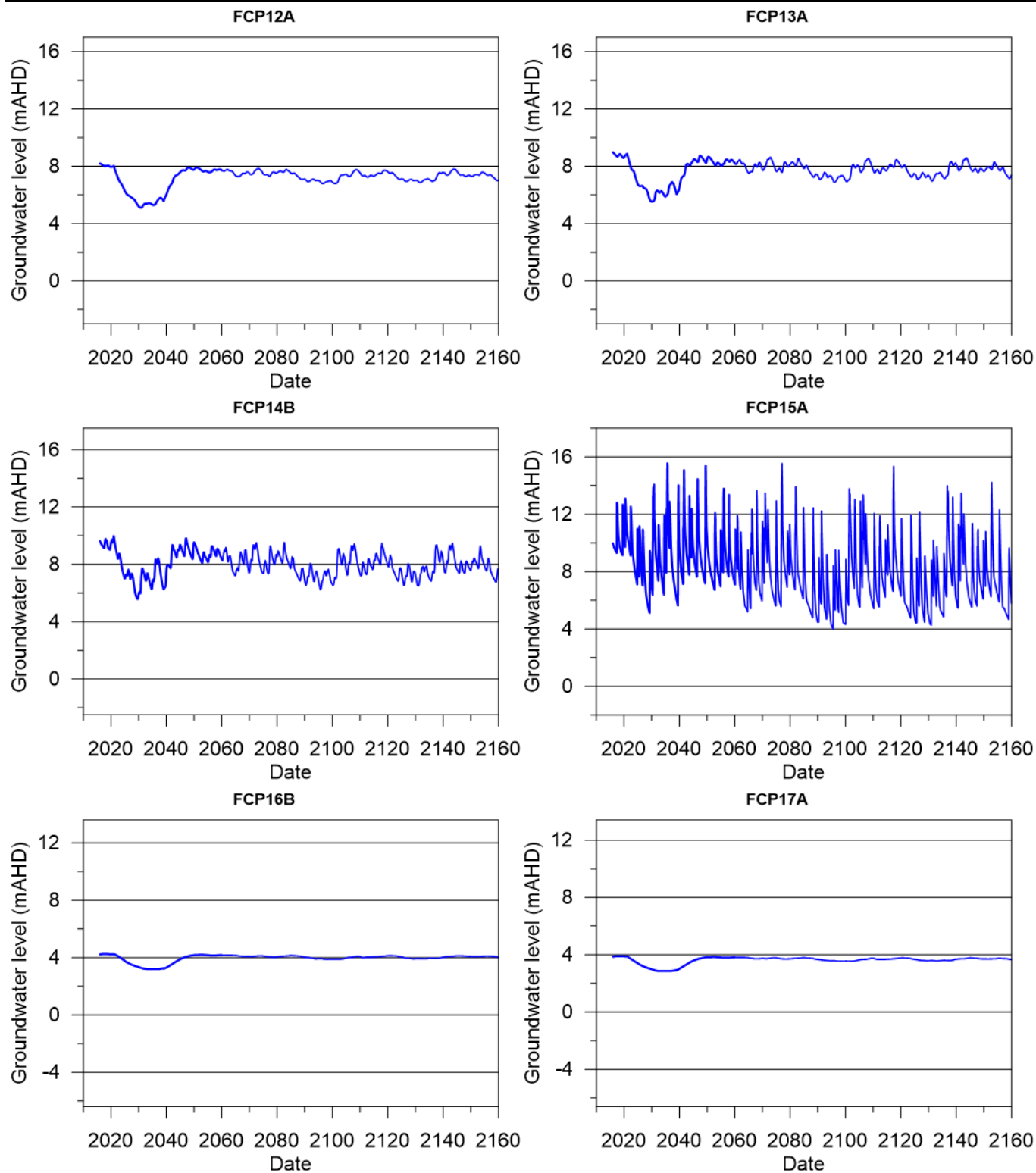
APPENDIX L – Cumulative impact LoM and post closure forecast groundwater levels

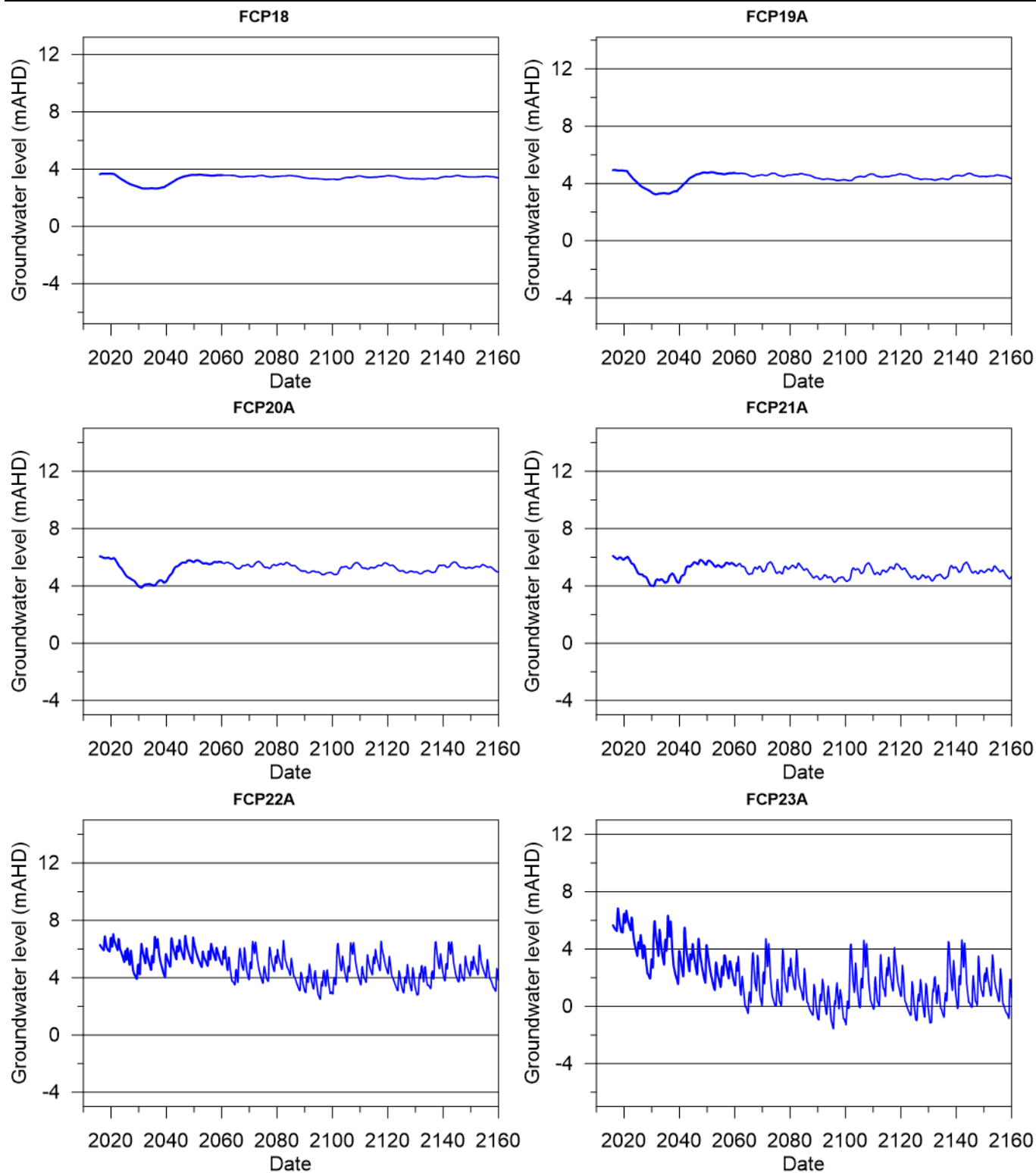


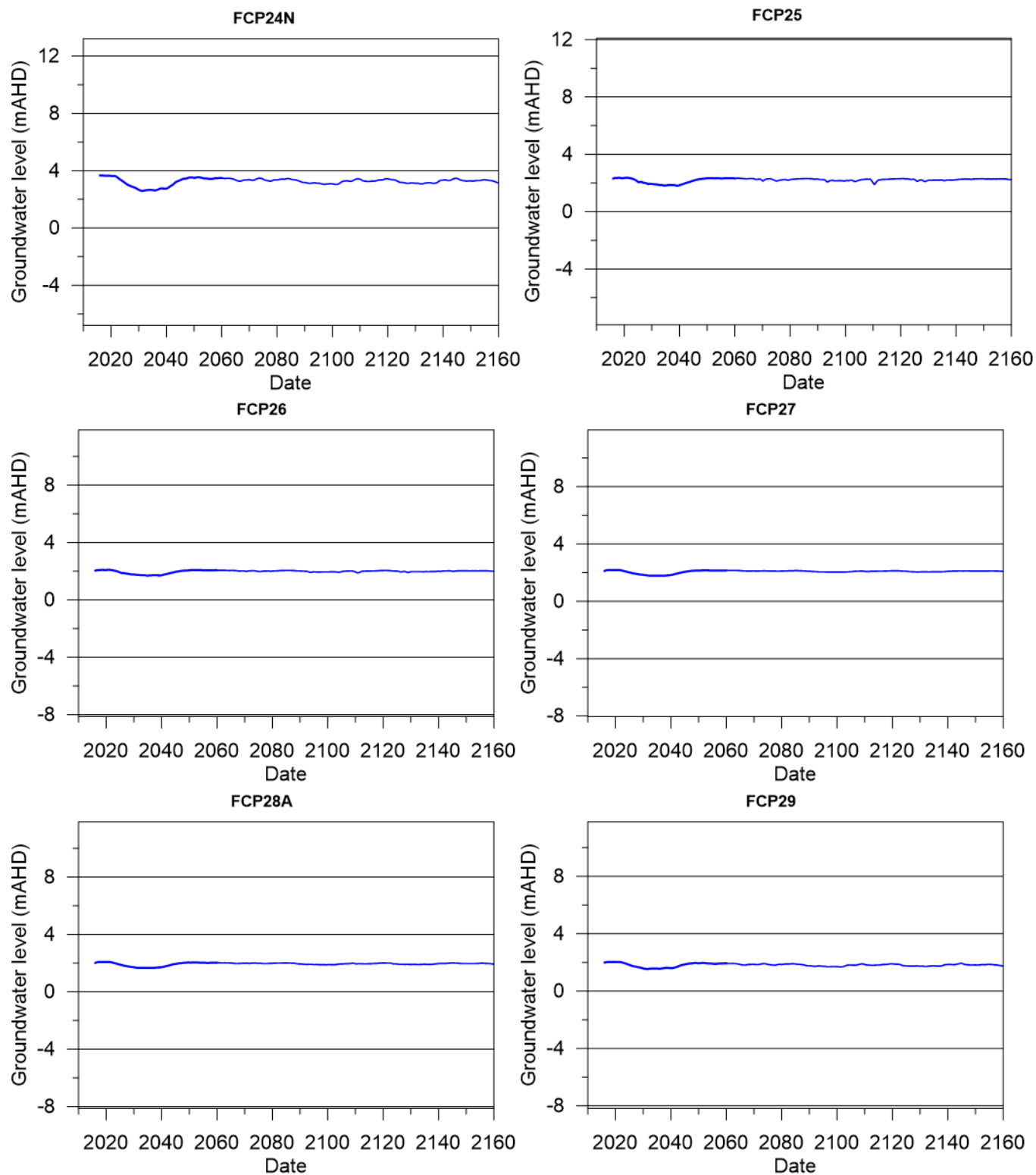


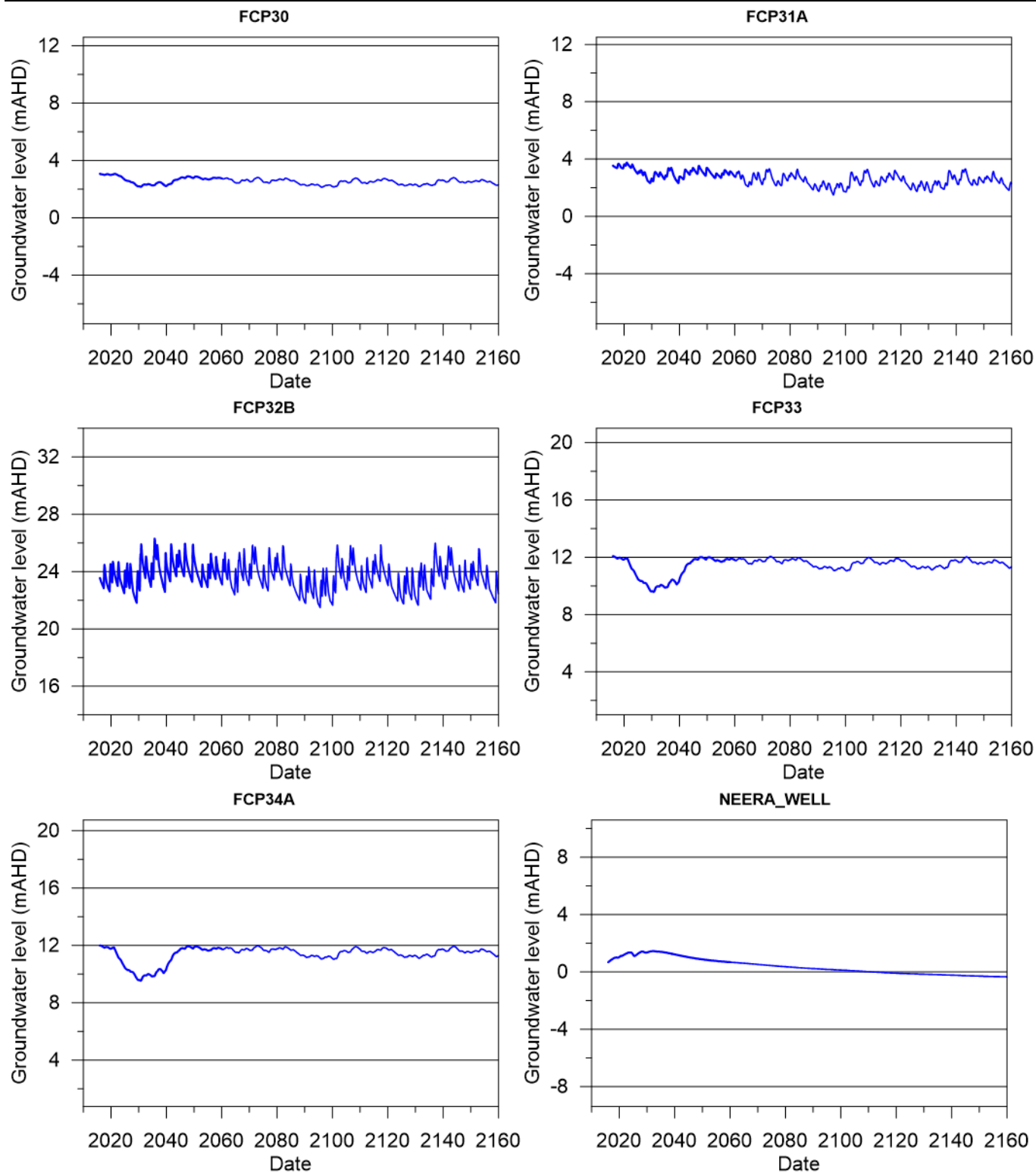


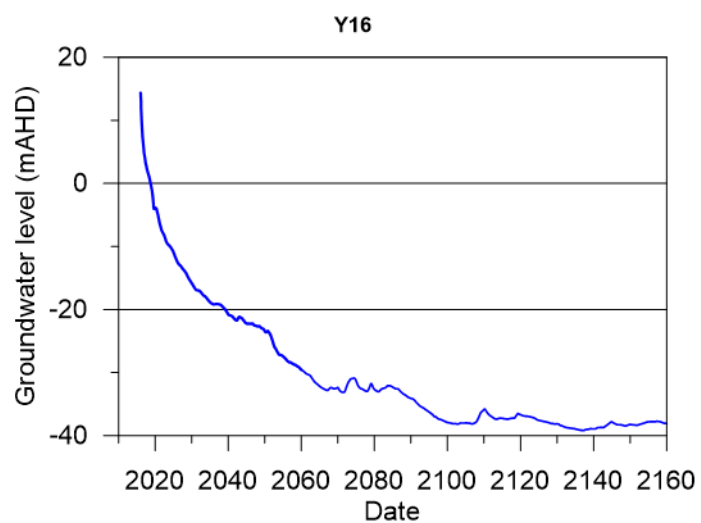
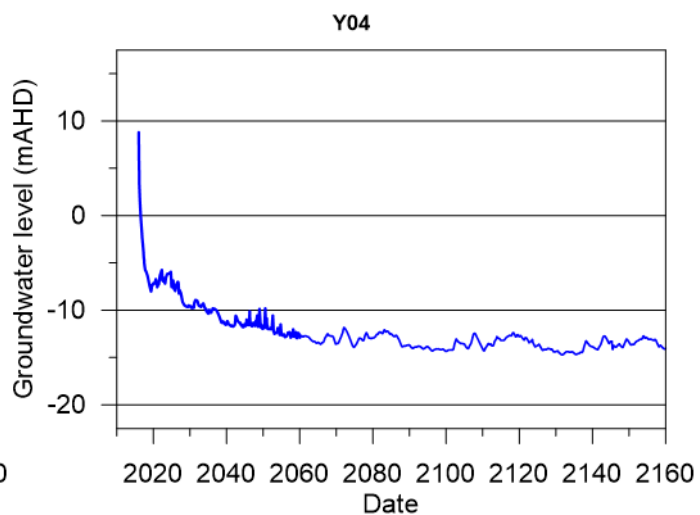
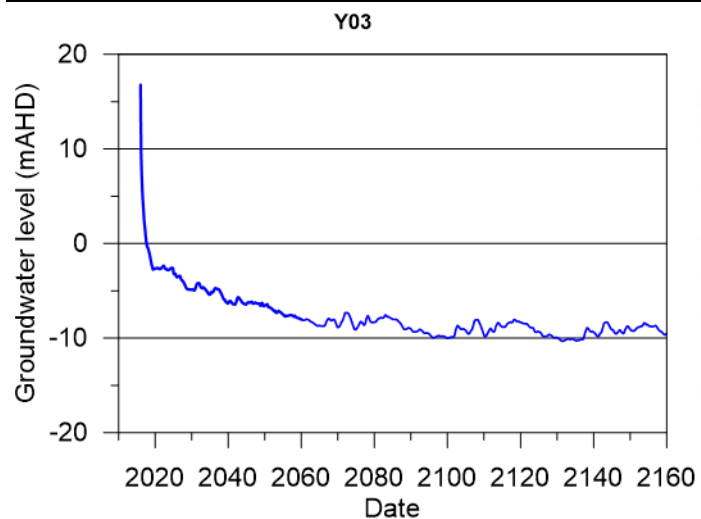












Cumulative impact LoM (2016 – 2060) regional water budget components including individual pit inflows.

Cumulative impact LoM (2016 – 2060) regional water budget components including individual pit inflows.											
Date	river_vol	coast_vol	tidal_vol	flux_in	areal_vol	pit_vol	austeel	bal_sth	mineral	totpit_vol	borefield
01/01/2017	0.00	-2.10	-0.81	13.17	-12.84	-1.95	0.00	0.00	0.00	-1.95	0.00
01/01/2018	16.09	-2.04	-0.94	13.03	-14.11	-1.71	0.00	0.00	0.00	-1.71	0.00
01/01/2019	0.00	-2.32	-0.72	13.10	-13.21	-1.62	0.00	0.00	0.00	-1.62	0.00
01/01/2020	14.89	-2.40	-0.79	13.10	-13.66	-1.43	0.00	0.00	0.00	-1.43	0.00
01/01/2021	14.46	-2.51	-0.94	12.93	-14.79	-2.22	0.00	0.00	0.00	-2.22	-0.01
01/01/2022	0.00	-2.49	-0.60	13.07	-13.24	-2.67	0.00	-0.32	-1.69	-4.67	-6.00
01/01/2023	14.70	-2.24	-0.57	13.17	-12.98	-3.72	0.00	-5.43	-4.22	-13.37	-6.00
01/01/2024	0.00	-2.33	-0.04	13.44	-11.23	-4.04	-0.95	-2.67	-2.10	-9.76	-6.00
01/01/2025	15.86	-1.43	1.82	13.70	-9.73	-4.23	-10.98	-1.91	-1.72	-18.84	-6.02
01/01/2026	15.25	-1.10	3.06	13.52	-10.50	-4.66	-5.79	-1.72	-1.58	-13.76	-6.00
01/01/2027	13.78	-0.88	3.46	13.64	-9.77	-4.49	-5.51	-1.57	-1.54	-13.10	-6.00
01/01/2028	0.00	-0.93	3.68	13.70	-9.54	-4.36	-5.21	-1.39	-1.47	-12.43	-6.00
01/01/2029	0.27	-0.83	3.97	13.91	-8.76	-4.30	-5.19	-1.24	-1.36	-12.09	-6.02
01/01/2030	15.29	-0.63	3.77	13.83	-8.98	-4.36	-5.14	-1.13	-1.33	-11.96	-6.00
01/01/2031	45.24	-0.72	3.28	13.63	-10.40	-5.00	-4.99	-1.31	-1.42	-12.72	-6.00
01/01/2032	0.00	-0.94	3.35	13.59	-10.14	-5.14	-4.85	-1.29	-1.40	-12.69	-6.00
01/01/2033	16.62	-0.88	3.43	13.71	-9.94	-4.89	-4.85	-1.44	-1.33	-12.51	-6.02
01/01/2034	0.00	-0.85	3.77	13.76	-9.02	-5.15	-4.73	-1.33	-1.37	-12.58	-6.00
01/01/2035	18.88	-0.66	3.70	13.78	-9.18	-5.44	-4.81	-1.49	-1.33	-13.07	-6.00
01/01/2036	36.31	-0.86	3.23	13.48	-11.51	-6.59	-4.65	-1.31	-1.33	-13.88	-6.00
01/01/2037	15.41	-0.92	3.41	13.41	-11.21	-7.05	-4.70	-1.72	-1.40	-14.87	-6.02
01/01/2038	0.00	-0.94	4.09	13.71	-9.30	-6.31	-4.76	-1.20	-1.39	-13.66	-6.00
01/01/2039	0.00	-0.61	4.47	13.89	-8.28	-5.61	-4.68	-0.99	-1.31	-12.58	-5.98
01/01/2040	24.88	-0.38	3.87	13.75	-9.12	-6.10	-1.59	-1.32	-0.56	-9.58	0.00
01/01/2041	0.00	-0.63	4.21	13.75	-8.95	-6.17	-2.04	-1.44	-0.69	-10.34	0.00
01/01/2042	34.40	-0.74	3.75	13.46	-10.91	-6.62	-2.38	-1.47	-0.78	-11.25	0.00
01/01/2043	0.00	-0.85	4.05	13.45	-10.16	-6.45	-2.51	-1.57	-0.95	-11.48	0.00
01/01/2044	15.27	-0.82	4.17	13.52	-10.40	-6.07	-2.76	-1.69	-0.98	-11.50	0.00
01/01/2045	14.56	-1.05	3.95	13.34	-11.51	-6.34	-2.93	-1.72	-1.02	-12.01	0.00
01/01/2046	0.27	-1.09	4.27	13.44	-10.77	-5.99	-3.19	-1.76	-1.10	-12.04	0.00
01/01/2047	26.90	-1.10	3.90	13.25	-12.40	-6.35	-3.22	-1.78	-1.12	-12.47	0.00
01/01/2048	0.27	-1.21	4.20	13.30	-11.44	-6.76	-3.22	-1.76	-1.15	-12.89	0.00
01/01/2049	0.28	-1.10	4.62	13.56	-10.68	-6.57	-3.22	-1.76	-1.19	-12.74	0.00
01/01/2050	26.46	-1.18	4.20	13.28	-12.41	-7.00	-3.30	-1.73	-1.21	-13.25	0.00
01/01/2051	0.29	-1.16	4.54	13.38	-11.24	-6.92	-3.33	-1.71	-1.24	-13.19	0.00
01/01/2052	0.00	-1.17	4.84	13.55	-10.74	-6.57	-3.38	-1.67	-1.27	-12.89	0.00
01/01/2053	18.68	-0.99	4.82	13.64	-10.52	-6.13	-3.39	-1.64	-1.27	-12.43	0.00
01/01/2054	0.06	-1.10	4.55	13.51	-10.73	-6.61	-3.39	-1.58	-1.24	-12.83	0.00
01/01/2055	9.86	-0.97	4.88	13.63	-10.19	-6.27	-3.41	-1.56	-1.23	-12.49	0.00
01/01/2056	23.89	-1.05	4.45	13.48	-11.14	-6.47	-3.47	-1.54	-1.24	-12.71	0.00
01/01/2057	3.18	-1.18	4.45	13.39	-11.59	-6.83	-3.51	-1.46	-1.24	-13.04	0.00
01/01/2058	14.04	-1.14	4.72	13.50	-10.99	-6.60	-3.49	-1.43	-1.23	-12.76	0.00
01/01/2059	0.00	-1.20	4.66	13.43	-11.15	-6.56	-3.55	-1.41	-1.23	-12.75	0.00
01/01/2060	0.00	-0.96	4.92	13.53	-10.40	-6.37	-3.57	-1.38	-1.23	-12.56	0.00
	10.60	-1.20	3.16	13.49	-10.90	-5.29	-3.33	-1.43	-1.19	-11.24	-2.46

Cumulative impact post closure (2060 – 2160) regional water budget components including individual pit inflows.										
Year	river_vol	coast_vol	tidal_vol	flux_in	flux_out	pit_vol	austeel	bal_sth	mineral	totpit_vol
2061	25.70	-0.54	5.08	13.68	-10.03	-2.07	-4.18	-1.25	-1.65	-9.15
2062	4.44	-0.69	5.43	13.53	-10.66	-2.38	-4.19	-1.24	-1.65	-9.46
2063	13.86	-0.63	5.55	13.59	-10.64	-2.47	-4.29	-1.23	-1.64	-9.64
2064	0.27	-0.44	6.19	13.76	-9.55	-2.65	-4.25	-1.19	-1.64	-9.72
2065	14.92	-0.36	5.92	13.81	-9.56	-2.73	-4.24	-1.19	-1.65	-9.81
2066	26.37	-0.38	5.74	13.68	-9.64	-2.77	-4.27	-1.17	-1.66	-9.87
2067	22.64	-0.47	4.72	13.44	-12.26	-2.88	-4.29	-1.14	-1.67	-9.99

SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

APPENDIX M – Cumulative impact LoM and post closure water balances

Cumulative impact post closure (2060 – 2160) regional water budget components including individual pit inflows.										
Year	river_vol	coast_vol	tidal_vol	flux_in	flux_out	pit_vol	austeel	bal_sth	mineral	totpit_vol
2068	22.71	-0.42	5.57	13.66	-10.34	-3.02	-4.28	-1.16	-1.68	-10.14
2069	2.58	-0.54	5.42	13.66	-10.12	-3.10	-4.35	-1.17	-1.68	-10.30
2070	16.04	-0.31	6.07	13.86	-9.25	-3.19	-4.34	-1.17	-1.67	-10.37
2071	23.98	-0.31	5.07	13.62	-10.21	-3.31	-4.33	-1.16	-1.68	-10.48
2072	25.64	-0.52	4.69	13.40	-11.53	-3.45	-4.30	-1.17	-1.71	-10.62
2073	0.88	-0.56	5.15	13.44	-11.54	-3.61	-4.32	-1.14	-1.71	-10.79
2074	0.00	-0.12	6.11	13.69	-9.93	-3.79	-4.32	-1.17	-1.69	-10.98
2075	15.50	0.94	6.25	13.78	-9.25	-3.87	-4.37	-1.16	-1.67	-11.06
2076	5.01	0.40	5.52	13.66	-10.43	-3.95	-4.43	-1.17	-1.68	-11.23
2077	28.16	0.07	5.83	13.77	-9.71	-4.10	-4.51	-1.17	-1.68	-11.47
2078	14.98	-0.37	4.76	13.48	-11.04	-4.17	-4.69	-1.14	-1.68	-11.67
2079	0.78	-0.33	5.93	13.71	-9.79	-4.28	-4.65	-1.16	-1.69	-11.78
2080	30.07	-0.39	5.16	13.62	-11.17	-4.29	-4.72	-1.15	-1.70	-11.85
2081	0.62	-0.55	5.28	13.59	-11.27	-4.36	-4.68	-1.17	-1.70	-11.90
2082	21.67	-0.52	5.50	13.63	-10.79	-4.41	-4.80	-1.16	-1.67	-12.04
2083	6.91	-0.54	5.07	13.34	-12.09	-4.48	-4.82	-1.17	-1.73	-12.20
2084	0.30	-0.45	5.71	13.59	-10.81	-4.52	-4.78	-1.16	-1.72	-12.17
2085	18.75	-0.54	5.62	13.67	-10.87	-4.52	-4.90	-1.16	-1.65	-12.23
2086	0.00	-0.54	5.65	13.57	-11.67	-4.60	-5.01	-1.16	-1.67	-12.44
2087	0.28	-0.32	6.10	13.69	-10.38	-4.59	-5.05	-1.16	-1.67	-12.47
2088	0.00	-0.33	6.37	13.81	-9.68	-4.63	-5.05	-1.11	-1.63	-12.42
2089	20.63	-0.29	5.63	13.76	-10.51	-4.66	-5.06	-1.15	-1.64	-12.51
2090	0.00	-0.01	6.38	13.80	-10.24	-4.71	-5.04	-1.13	-1.65	-12.53
2091	16.86	0.37	5.91	13.79	-10.40	-4.71	-5.07	-1.15	-1.61	-12.54
2092	17.68	-0.02	5.47	13.64	-10.80	-4.71	-5.10	-1.12	-1.63	-12.57
2093	0.00	-0.04	6.30	13.88	-9.66	-4.81	-5.06	-1.11	-1.64	-12.63
2094	16.82	0.05	5.74	13.94	-8.67	-4.83	-4.99	-1.15	-1.63	-12.60
2095	0.00	0.27	6.47	14.03	-7.95	-4.88	-4.99	-1.13	-1.66	-12.65
2096	17.21	1.00	6.25	14.09	-7.59	-4.89	-4.98	-1.15	-1.62	-12.65
2097	16.90	0.46	5.59	14.01	-9.13	-4.97	-5.01	-1.13	-1.60	-12.70
2098	15.04	0.02	5.88	13.96	-9.05	-5.04	-5.00	-1.11	-1.61	-12.76
2099	0.00	-0.04	6.23	13.96	-9.10	-5.07	-4.98	-1.10	-1.64	-12.79
2100	0.28	0.18	6.35	14.02	-8.70	-5.12	-5.03	-1.12	-1.63	-12.90
2101	15.34	-0.08	5.88	13.92	-9.08	-5.16	-5.06	-1.10	-1.61	-12.93
2102	44.89	-0.23	4.63	13.65	-10.94	-5.19	-5.12	-1.08	-1.61	-13.00
2103	0.00	-0.10	5.54	13.73	-9.84	-5.30	-5.17	-1.10	-1.66	-13.23
2104	19.08	0.39	5.38	13.77	-9.19	-5.30	-5.17	-1.13	-1.70	-13.30
2105	0.00	0.07	6.18	13.95	-9.02	-5.38	-5.18	-1.13	-1.72	-13.41
2106	20.48	-0.13	5.61	13.93	-8.94	-5.36	-5.17	-1.14	-1.70	-13.36
2107	31.87	-0.45	4.72	13.57	-10.72	-5.34	-5.17	-1.13	-1.70	-13.35
2108	16.28	-0.51	4.93	13.54	-10.98	-5.40	-5.17	-1.11	-1.73	-13.42
2109	0.00	-0.40	5.95	13.76	-10.03	-5.50	-5.18	-1.14	-1.74	-13.56
2110	0.00	0.57	6.39	13.96	-8.72	-5.51	-5.17	-1.16	-1.69	-13.53
2111	19.65	0.94	5.61	13.95	-8.93	-5.50	-5.21	-1.14	-1.70	-13.54
2112	0.00	0.15	6.09	13.92	-9.73	-5.52	-5.22	-1.13	-1.70	-13.57
2113	36.17	-0.19	4.97	13.73	-10.80	-5.55	-5.22	-1.14	-1.70	-13.62
2114	0.00	-0.11	5.75	13.74	-10.51	-5.66	-5.23	-1.12	-1.69	-13.69
2115	15.77	-0.23	5.43	13.73	-10.45	-5.59	-5.22	-1.13	-1.67	-13.61
2116	15.62	-0.48	5.10	13.58	-10.74	-5.61	-5.24	-1.14	-1.72	-13.71
2117	0.29	-0.43	5.67	13.68	-10.57	-5.66	-5.21	-1.14	-1.70	-13.70
2118	32.99	-0.45	5.00	13.44	-12.49	-5.68	-5.26	-1.13	-1.70	-13.78
2119	0.30	-0.48	5.57	13.58	-11.72	-5.70	-5.25	-1.14	-1.72	-13.81
2120	0.27	-0.16	5.90	13.68	-10.82	-5.72	-5.26	-1.15	-1.71	-13.83
2121	18.49	-0.44	5.32	13.65	-10.89	-5.74	-5.27	-1.14	-1.73	-13.88
2122	0.28	-0.29	6.12	13.77	-10.11	-5.75	-5.23	-1.11	-1.72	-13.81
2123	0.00	-0.16	6.31	13.85	-9.87	-5.77	-5.23	-1.13	-1.71	-13.85
2124	20.20	0.41	5.95	13.88	-9.46	-5.80	-5.28	-1.12	-1.67	-13.87
2125	0.00	-0.13	6.07	13.88	-9.61	-5.82	-5.29	-1.11	-1.71	-13.93
2126	16.95	0.13	6.28	13.93	-9.62	-5.84	-5.26	-1.13	-1.68	-13.92
2127	17.93	0.03	5.56	13.86	-9.98	-5.80	-5.27	-1.14	-1.63	-13.83

SINO EXPANSION LIFE OF MINE GROUNDWATER MODEL

APPENDIX M – Cumulative impact LoM and post closure water balances

Cumulative impact post closure (2060 – 2160) regional water budget components including individual pit inflows.										
Year	river_vol	coast_vol	tidal_vol	flux_in	flux_out	pit_vol	austeel	bal_sth	mineral	totpit_vol
2128	0.00	-0.18	6.01	13.84	-9.86	-5.83	-5.25	-1.10	-1.67	-13.84
2129	16.99	0.33	6.05	13.98	-8.77	-5.89	-5.30	-1.13	-1.65	-13.97
2130	0.00	0.10	6.08	13.89	-9.18	-5.88	-5.26	-1.11	-1.66	-13.92
2131	1.25	0.37	6.51	14.04	-8.34	-5.87	-5.27	-1.12	-1.65	-13.91
2132	31.60	0.19	5.38	13.96	-8.93	-5.82	-5.27	-1.11	-1.62	-13.82
2133	4.04	-0.11	5.85	13.99	-9.47	-5.91	-5.29	-1.10	-1.65	-13.95
2134	10.31	-0.21	5.79	13.93	-9.05	-5.90	-5.26	-1.11	-1.66	-13.93
2135	0.29	0.01	6.18	14.05	-8.16	-5.89	-5.27	-1.13	-1.65	-13.93
2136	15.16	-0.04	5.86	13.97	-8.74	-5.85	-5.27	-1.10	-1.60	-13.82
2137	32.52	-0.19	5.32	13.92	-9.57	-5.88	-5.30	-1.07	-1.64	-13.89
2138	11.29	-0.40	4.88	13.60	-10.89	-5.94	-5.34	-1.07	-1.68	-14.03
2139	19.17	0.05	5.56	13.80	-9.51	-6.01	-5.34	-1.12	-1.72	-14.19
2140	0.00	-0.12	5.82	13.79	-9.75	-6.06	-5.33	-1.12	-1.70	-14.22
2141	19.23	-0.16	5.93	13.90	-9.66	-6.06	-5.35	-1.13	-1.72	-14.26
2142	31.54	-0.35	4.98	13.60	-10.80	-6.02	-5.37	-1.12	-1.70	-14.20
2143	16.28	-0.54	4.81	13.47	-11.81	-6.06	-5.38	-1.11	-1.71	-14.27
2144	0.00	-0.45	5.50	13.54	-11.51	-6.14	-5.33	-1.11	-1.76	-14.34
2145	0.00	0.28	6.26	13.87	-9.92	-6.12	-5.37	-1.10	-1.76	-14.36
2146	19.29	0.73	5.82	13.94	-8.86	-6.21	-5.35	-1.14	-1.72	-14.42
2147	0.00	-0.05	5.81	13.88	-9.57	-6.08	-5.35	-1.13	-1.72	-14.29
2148	36.12	-0.16	5.51	13.82	-10.10	-6.12	-5.37	-1.13	-1.71	-14.33
2149	0.32	-0.38	5.43	13.72	-10.14	-6.18	-5.44	-1.11	-1.67	-14.39
2150	15.74	-0.28	5.76	13.81	-9.36	-6.17	-5.40	-1.13	-1.68	-14.38
2151	15.97	-0.42	5.29	13.73	-10.12	-6.18	-5.36	-1.13	-1.72	-14.40
2152	0.57	-0.48	5.52	13.68	-10.01	-6.22	-5.43	-1.13	-1.72	-14.50
2153	29.89	-0.12	5.44	13.62	-11.03	-6.28	-5.39	-1.13	-1.70	-14.51
2154	0.27	-0.37	5.44	13.56	-11.00	-6.30	-5.36	-1.12	-1.70	-14.49
2155	0.28	-0.42	5.86	13.69	-10.16	-6.29	-5.36	-1.12	-1.72	-14.50
2156	18.84	-0.30	5.53	13.67	-10.63	-6.29	-5.36	-1.13	-1.70	-14.49
2157	0.13	-0.35	5.99	13.75	-10.86	-6.41	-5.38	-1.10	-1.73	-14.62
2158	0.16	-0.20	6.23	13.86	-9.35	-6.35	-5.36	-1.10	-1.70	-14.50
2159	0.68	0.48	6.38	14.00	-8.67	-6.40	-5.37	-1.12	-1.66	-14.55
2160	18.40	0.40	5.46	13.85	-9.00	-6.39	-5.42	-1.11	-1.66	-14.57

Consolidated species list 2016

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
ACANTHACEAE		<i>Avicennia marina</i>	1	1	1				
		<i>Avicennia marina</i> subsp. <i>marina</i>					1		
		<i>Dicladanthera forrestii</i>	1	1				1	
		<i>Rostellularia adscendens</i> var. <i>clementii</i>	1	1	1	1	1	1	
AIZOACEAE		<i>Trianthema</i> aff. <i>kimberleyi</i>		1	1				
		<i>Trianthema triquetrum</i>		1	1		1	1	
		<i>Trianthema turgidifolium</i>		1		1	1		
		<i>Zaleya galericulata</i>		1		1			
AMARANTHACEAE		<i>Achyranthes aspera</i>	1	1			1		1
	*	<i>Aerva javanica</i>	1	1	1		1	1	
		<i>Alternanthera angustifolia</i>	1	1		1	1		
		<i>Alternanthera nana</i>	1	1	1		1	1	
		<i>Alternanthera nodiflora</i>	1	1			1	1	1
		<i>Amaranthus mitchellii</i>	1	1					
		<i>Amaranthus undulatus</i>	1	1	1	1	1	1	1
		<i>Gomphrena canescens</i>	1	1				1	
		<i>Gomphrena canescens</i> subsp. <i>canescens</i>	1				1		
		<i>Gomphrena cunninghamii</i>	1	1			1	1	1
		<i>Gomphrena kanisii</i>						1	
		<i>Gomphrena sordida</i>	1	1					
		<i>Ptilotus ?auriculifolius/macrocephalus</i>	1			1			
		<i>Ptilotus aervoides</i>	1	1			1		
		<i>Ptilotus astrolasius</i>	1	1					
		<i>Ptilotus auriculifolius</i>	1	1	1	1			
		<i>Ptilotus axillaris</i>	1	1					1
		<i>Ptilotus calostachyus</i>	1	1			1		1
		<i>Ptilotus carinatus</i>	1	1			1		
		<i>Ptilotus clementii</i>	1	1			1		
		<i>Ptilotus fusiformis</i>	1	1			1		
		<i>Ptilotus gaudichaudii</i>						1	
		<i>Ptilotus gomphrenoides</i>						1	

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Ptilotus gomphrenoides</i> var. <i>conglomeratus</i>	1				1		
		<i>Ptilotus gomphrenoides</i> var. <i>gomphrenoides</i>	1	1			1		
		<i>Ptilotus helipteroides</i>	1	1			1	1	
		<i>Ptilotus incanus</i>							1
		<i>Ptilotus macrocephalus</i>						1	
		<i>Ptilotus murrayi</i>	1	1			1	1	
		<i>Ptilotus nobilis</i>	1	1			1	1	1
		<i>Ptilotus obovatus</i>	1	1				1	1
		<i>Ptilotus obovatus</i> var. <i>obovatus</i>					1		
		<i>Ptilotus polystachyus</i>	1	1					
		<i>Ptilotus roei</i>	1			1			
		<i>Ptilotus villosiflorus</i>	1	1	1				
		<i>Surreya diandra</i>	1	1	1	1			
APOCYNACEAE		<i>Wrightia saligna</i>		1		1			
ARALIACEAE		<i>Trachymene oleracea</i>		1		1			1
ARALIACEAE		<i>Trachymene oleracea</i> subsp. <i>oleracea</i>					1	1	1
ASCLEPIADACEAE		<i>Cynanchum floribundum</i>	1	1				1	
		<i>Sarcostemma viminale</i> subsp. <i>australe</i>	1	1		1	1		
ASPHODELACEAE	*	<i>Asphodelus fistulosus</i>						1	
ASTERACEAE	*	<i>Bidens bipinnata</i>	1	1					1
		<i>Blumea tenella</i>	1	1				1	
		<i>Brachyscome ciliaris</i>					1		
		<i>Calotis porphyroglossa</i>						1	
		<i>Centipeda minima</i>	1	1					
		<i>Centipeda minima</i> subsp. <i>macrocephala</i>						1	
		<i>Flaveria trinervia</i>	1	1			1	1	
		<i>Helichrysum luteoalbum</i>						1	
		<i>Pentalepis trichodesmoides</i>	1	1	1				1
		<i>Peripleura</i> / <i>Minuria</i> sp.		1		1			
		<i>Peripleura obovata</i>		1	1				
		<i>Pluchea dentex</i>					1	1	
		<i>Pluchea dunlopia</i>	1						
		<i>Pluchea ferdinandi-muelleri</i>	1	1					
		<i>Pluchea rubelliflora</i>	1	1			1	1	1

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Pterocaulon</i> sp.						1	
		<i>Pterocaulon sphacelatum</i>	1	1	1	1	1	1	1
		<i>Pterocaulon sphaeranthoides</i>	1	1		1	1		
		<i>Rhodanthe floribunda</i>					1		
	*	<i>Sonchus oleraceus</i>						1	
		<i>Streptoglossa adscendens</i>					1		
		<i>Streptoglossa bubakii</i>						1	
		<i>Streptoglossa decurrens</i>		1		1	1	1	
		<i>Streptoglossa liatroides</i>		1		1	1		
		<i>Streptoglossa odora</i>						1	
		<i>Streptoglossa</i> sp.		1	1				
		<i>Streptoglossa tenuiflora</i>					1		
BIGNONIACEAE		<i>Dolichandrone heterophylla</i>	1	1	1	1			
BORAGINACEAE		<i>Ehretia saligna</i>	1	1		1			1
		<i>Ehretia saligna</i> var. <i>saligna</i>						1	
		<i>Heliotropium chrysocarpum</i>	1						
		<i>Heliotropium crispatum</i>	1	1				1	
		<i>Heliotropium cunninghamii</i>	1	1			1		
		<i>Heliotropium curassavicum</i>					1	1	
		<i>Heliotropium foliatum</i>	1	1					
		<i>Heliotropium heteranthum</i>	1	1			1		
		<i>Heliotropium inexplicitum</i>	1	1					
		<i>Heliotropium ovalifolium</i>	1	1		1			
		<i>Heliotropium tanythrix</i>							1
		<i>Heliotropium</i> sp.	1	1		1		1	
		<i>Trichodesma zeylanicum</i>		1		1	1	1	1
		<i>Trichodesma zeylanicum</i> subsp. <i>zeylanicum</i>			1				
		<i>Trichodesma zeylanicum</i> var. <i>grandiflorum</i>			1				
BRASSICACEAE		<i>Lepidium pedicellosum</i>					1		
CAMPANULACEAE		<i>Wahlenbergia</i> sp.						1	
		<i>Wahlenbergia tumidifructa</i>						1	
CAPPARACEAE		<i>Capparis lasiantha</i>					1		
		<i>Capparis spinosa</i> var. <i>nummularia</i>	1	1			1		1
		<i>Capparis umbonata</i>	1	1					

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
CARYOPHYLLACEAE		<i>Polycarpaea corymbosa</i>						1	1
		<i>Polycarpaea corymbosa</i> var. <i>corymbosa</i>	1	1					
		<i>Polycarpaea holtzei</i>	1	1			1		
		<i>Polycarpaea longiflora</i>	1	1	1		1		1
CELASTRACEAE		<i>Stackhousia intermedia</i>		1				1	
CHENOPODIACEAE		<i>Atriplex bunburyana</i>	1	1	1		1		
		<i>Atriplex codonocarpa</i>	1	1			1		
		<i>Atriplex isatidea</i>	1	1	1	1			
		<i>Atriplex semilunaris</i>	1						
		<i>Dissocarpus paradoxus</i>	1	1	1	1			
		<i>Dysphania melanocarpa</i> forma <i>leucocarpa</i>	1	1				1	
		<i>Dysphania plantaginella</i>	1	1					
		<i>Dysphania rhadinostachya</i>	1	1	1			1	
		<i>Enchylaena tomentosa</i>	1	1					
		<i>Enchylaena tomentosa</i> var. <i>tomentosa</i>					1		
		<i>Maireana georgei</i>	1				1		
		<i>Maireana melanocoma</i>	1	1					
		<i>Maireana planifolia</i>	1				1		
		<i>Maireana tomentosa</i>	1	1					
		<i>Maireana tomentosa</i> subsp. <i>tomentosa</i>					1		
		<i>Neobassia astrocarpa</i>	1	1					
		<i>Rhagodia eremaea</i>	1	1			1		
		<i>Rhagodia preissii</i> subsp. <i>obovata</i>	1	1					
		<i>Salsola australis</i>	1	1			1	1	1
	*	<i>Salsola</i> sp.					1		
		<i>Sclerolaena bicornis</i>	1				1		
		<i>Sclerolaena bicornis</i> var. <i>bicornis</i>					1		
		<i>Sclerolaena cornishiana</i>	1	1	1				
		<i>Sclerolaena costata</i>	1	1			1	1	
		<i>Sclerolaena densiflora</i>					1		
		<i>Sclerolaena eriacantha</i>	1	1					
		<i>Sclerolaena glabra</i>	1	1			1		
		<i>Sclerolaena hostilis</i>	1	1	1				
		<i>Sclerolaena uniflora</i>	1	1					

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Tecticornia halocnemoides</i>					1		
		<i>Tecticornia halocnemoides</i> subsp. <i>tenuis</i>	1	1		1			
		<i>Tecticornia halocnemoides</i> subsp. <i>tenuis</i>					1		
		<i>Tecticornia indica</i> subsp. <i>bidens</i>					1		
		<i>Tecticornia indica</i> subsp. <i>leiostachya</i>	1	1					
		<i>Tecticornia pruinosa</i>	1	1					
		<i>Tecticornia pterygosperma</i> subsp. <i>denticulata</i>	1	1					
		<i>Tecticornia pterygosperma</i> subsp. <i>denticulata</i>					1		
		<i>Threlkeldia diffusa</i>		1	1				
CLEOMACEAE		<i>Cleome oxalidea</i>	1	1	1				
		<i>Cleome viscosa</i>	1	1			1	1	1
		<i>Bonamia media</i>	1	1			1	1	1
CONVOLVULACEAE		<i>Bonamia pannosa</i>	1	1					
		<i>Bonamia rosea</i>							1
		<i>Convolvulus angustissimus</i> subsp. <i>angustissimus</i>						1	
		<i>Convolvulus remotus</i>	1	1					
		<i>Duperreya commixta</i>	1	1	1	1	1	1	
		<i>Evolvulus alsinoides</i>	1	1	1	1			
		<i>Evolvulus alsinoides</i> var. <i>decumbens</i>							1
		<i>Evolvulus alsinoides</i> var. <i>villosicalyx</i>	1	1			1	1	1
		<i>Evolvulus</i> sp.	1	1	1				
		<i>Ipomoea optica</i>	1	1					
		<i>Ipomoea costata</i>	1	1			1		
		<i>Ipomoea muelleri</i>	1	1	1		1	1	1
		<i>Ipomoea pes-caprae</i>	1						
		<i>Ipomoea polymorpha</i>	1	1					
		<i>Operculina aequisepala</i>	1	1	1	1			
		<i>Polymeria ambigua</i>	1	1			1	1	
		<i>Polymeria calycina</i>	1				1		
		<i>Cuscuta victoriana</i>	1	1	1				
CUCURBITACEAE		<i>Trichosanthes cucumerina</i>		1		1			
		<i>Austrobryonia pilbarensis</i>					1		
	*	<i>Citrullus colocynthis</i>					1	1	
	*	<i>Citrullus lanatus</i>	1	1			1		

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	*	<i>Cucumis melo</i>	1	1	1	1		1	1
		<i>Cucumis</i> sp.	1	1	1	1		1	
CYPERACEAE		<i>Bulbostylis barbata</i>	1	1				1	
		<i>Cyperus bifax</i>	1	1					
		<i>Cyperus blakeanus</i>	1	1	1				
		<i>Cyperus bulbosus</i>	1	1					
		<i>Cyperus iria</i>	1	1					
		<i>Cyperus squarrosus</i>	1	1					
		<i>Cyperus vaginatus</i>	1	1			1	1	
		<i>Eleocharis geniculata</i>						1	
		<i>Fimbristylis depauperata</i>	1	1					
		<i>Fimbristylis dichotoma</i>	1	1				1	
		<i>Fimbristylis microcarya</i>	1	1	1				
		<i>Schoenoplectus laevis</i>	1	1					
		<i>Schoenoplectus subulatus</i>	1	1				1	
ELATINACEAE		<i>Bergia pedicellaris</i>	1	1					
EUPHORBIACEAE		<i>Adriana tomentosa</i>	1	1	1				
		<i>Adriana tomentosa</i> var. <i>hookeri</i>	1		1		1		
		<i>Euphorbia australis</i>	1	1	1		1	1	1
		<i>Euphorbia boophthona</i>	1	1			1	1	
		<i>Euphorbia coghlanii</i>	1	1				1	
		<i>Euphorbia drummondii</i>	1	1	1	1	1		
		<i>Euphorbia myrtoides</i>							1
		<i>Euphorbia schultzei</i>	1	1	1	1	1		
		<i>Euphorbia tannensis</i>					1		
		<i>Euphorbia tannensis</i> subsp. <i>eremophila</i>	1	1		1			
		<i>Flueggea virosa</i> subsp. <i>melanthesoides</i>	1	1					
		<i>Notoleptopus decaisnei</i>	1	1			1	1	
		<i>Notoleptopus decaisnei</i> var. <i>orbicularis</i>							1
		<i>Phyllanthus aridus</i>	1	1		1			
		<i>Phyllanthus erwinii</i>	1	1					
		<i>Phyllanthus maderaspatensis</i>	1	1				1	1
		<i>Phyllanthus</i> sp.					1		
FABACEAE		<i>Acacia ampliceps</i>	1	1	1			1	

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Acacia amplexa x bivenosa</i>					1		
		<i>Acacia ancistrocarpa</i>	1	1	1		1	1	1
		<i>Acacia arida</i>	1	1			1		1
		<i>Acacia bivenosa</i>	1	1	1	1	1	1	1
		<i>Acacia citrinoviridis</i>						1	
		<i>Acacia coriacea</i>	1		1				1
		<i>Acacia coriacea</i> subsp. <i>coriacea</i>	1	1	1		1		1
		<i>Acacia coriacea</i> subsp. <i>pendens</i>	1	1				1	1
		<i>Acacia elachantha</i>	1	1			1		1
		<i>Acacia inaequilatera</i>	1	1	1		1	1	1
		<i>Acacia marramamba</i>	1	1	1				
		<i>Acacia monticola</i>	1	1		1			
		<i>Acacia pyrifolia</i>	1	1				1	1
		<i>Acacia pyrifolia</i> var. <i>pyrifolia</i>					1		
		<i>Acacia sclerosperma</i>	1	1				1	
		<i>Acacia sclerosperma</i> subsp. <i>sclerosperma</i>	1			1	1	1	
		<i>Acacia sericophylla</i>					1		
		<i>Acacia synchronicia</i>	1			1	1	1	1
		<i>Acacia tenuissima</i>	1	1	1		1	1	
		<i>Acacia trachycarpa</i>	1	1	1	1	1	1	1
		<i>Acacia tumida</i>	1	1	1		1		
		<i>Acacia victoriae</i>	1	1					
		<i>Acacia xiphophylla</i>	1	1			1		1
		<i>Alysicarpus muelleri</i>	1	1			1	1	
		<i>Canavalia rosea</i>	1	1					
		<i>Crotalaria cunninghamii</i>	1	1					
		<i>Crotalaria dissitiflora</i> subsp. <i>benthamiana</i>	1	1	1				
		<i>Crotalaria medicaginea</i>	1	1			1	1	1
		<i>Crotalaria medicaginea</i> var. <i>neglecta</i>					1		
		<i>Crotalaria novae-hollandiae</i>	1	1					1
		<i>Crotalaria novae-hollandiae</i> subsp. <i>crassipes</i>	1						
		<i>Crotalaria ramosissima</i>	1	1					
		<i>Crotalaria</i> sp.					1		
		<i>Cullen cinereum</i>					1		

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Cullen graveolens</i>	1	1	1				
		<i>Cullen lachnostachys</i>	1		1				
		<i>Cullen leucanthum</i>	1	1	1		1		
		<i>Cullen leucochaites</i>						1	
		<i>Cullen pogonocarpum</i>	1	1					
		<i>Desmodium filiforme</i>	1	1					
		<i>Desmodium muelleri</i>	1	1					1
		<i>Dichrostachys spicata</i>						1	
		<i>Erythrina vespertilio</i>	1	1				1	
		<i>Glycine canescens</i>	1	1			1		
		<i>Glycine ?tomentella</i>	1						
		<i>Indigastrium parviflorum</i>	1	1					
		<i>Indigofera bovipерda</i>							1
		<i>Indigofera bovipерda</i> subsp. <i>bovipерda</i>						1	
		<i>Indigofera colutea</i>	1	1			1		1
		<i>Indigofera linifolia</i>	1	1			1	1	1
		<i>Indigofera linnaei</i>						1	
		<i>Indigofera monophylla</i>	1	1			1	1	1
		<i>Indigofera sessiliflora</i>	1	1		1			
		<i>Indigofera trita</i>	1	1			1	1	
		<i>Isotropis atropurpurea</i>	1	1				1	1
		<i>Lotus australis</i>	1	1	1	1			
		<i>Lotus cruentus</i>						1	
		<i>Neptunia dimorphantha</i>	1	1	1	1			
		<i>Neptunia monosperma</i>					1		
		<i>Petalostylis labicheoides</i>	1	1				1	
	*, DP	<i>Prosopis pallida</i>	1	1			1	1	
		<i>Rhynchosia minima</i>	1	1	1	1	1	1	1
		<i>Senna artemisioides</i> subsp. <i>oligophylla</i>	1	1	1		1	1	1
		<i>Senna artemisioides</i> subsp. <i>oligophylla</i> x <i>helmsii</i>	1						1
		<i>Senna ferraria</i>					1		
		<i>Senna glaucifolia</i>	1			1			
		<i>Senna glutinosa</i>						1	
		<i>Senna glutinosa</i> subsp. <i>chatelainiana</i>	1	1	1		1		

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Senna glutinosa</i> subsp. <i>glutinosa</i>	1	1	1	1			1
		<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x ? <i>pruinosa</i>	1				1		
		<i>Senna glutinosa</i> subsp. <i>glutinosa</i> x <i>luerssenii</i>	1	1		1	1		1
		<i>Senna glutinosa</i> subsp. <i>pruinosa</i>	1						1
		<i>Senna glutinosa</i> subsp. <i>pruinosa</i> x ? <i>glutinosa</i>	1	1					
		<i>Senna glutinosa</i> subsp. x <i>luerssenii</i>	1	1					1
		<i>Senna hamersleyensis</i>	1	1			1		
		<i>Senna notabilis</i>	1	1		1	1	1	1
		<i>Senna</i> sp.	1		1				
		<i>Senna</i> sp. <i>Karajini</i> (M.E.Trudgen 10392)	1	1					
		<i>Senna venusta</i>	1	1					
		<i>Seringia nephrosperma</i>	1	1	1				
		<i>Sesbania cannabina</i>	1	1	1		1	1	
		<i>Swainsona canescens</i>		1		1			
		<i>Swainsona colutoides</i>		1	1				
		<i>Swainsona formosa</i>		1	1		1	1	1
		<i>Swainsona kingii</i>		1	1				
		<i>Swainsona leeana</i>		1	1	1			
		<i>Tephrosia clementii</i>		1		1			
		<i>Tephrosia</i> aff. <i>densa</i>		1	1				
		<i>Tephrosia flammea</i>					1		
		<i>Templetonia</i> aff. <i>hookeri</i>			1	1			
		<i>Tephrosia leptoclada</i>					1		
		<i>Tephrosia rosea</i>			1				
		<i>Tephrosia rosea</i> var. <i>clementii</i>		1	1				
		<i>Tephrosia supina</i>		1	1			1	1
		<i>Tephrosia uniovulata</i>				1			
	*	<i>Vachellia farnesiana</i>	1	1	1	1	1	1	1
		<i>Vigna lanceolata</i>						1	
		<i>Vigna lanceolata</i> var. <i>lanceolata</i>		1	1	1			
		<i>Zornia muelleriana</i>		1		1			
FRANKENIACEAE		<i>Frankenia ambita</i>	1	1			1		
		<i>Frankenia pauciflora</i>	1	1					
GENTIANACEAE		<i>Schenkia clementii</i>						1	

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GERANIACEAE		<i>Erodium</i> sp.	1						
GOODENIACEAE		<i>Goodenia forrestii</i>	1	1			1		
		<i>Goodenia heterochila</i>					1		
		<i>Goodenia lamprosperma</i>	1	1			1	1	
		<i>Goodenia microptera</i>	1	1	1	1		1	
		<i>Goodenia muelleriana</i>							1
	P4	<i>Goodenia nuda</i>						1	
		<i>Goodenia pascua</i>	1		1				
		<i>Goodenia stobbsiana</i>		1					1
		<i>Goodenia</i> sp.	1	1	1	1			
	P3	<i>Goodenia</i> sp. East Pilbara (AA Mitchell PRP 727)	1	1					
		<i>Goodenia stobbsiana</i>	1			1	1		
		<i>Scaevola acacioides</i>	1		1	1			
		<i>Scaevola spinescens</i>	1	1	1	1		1	1
		<i>Scaevola thesioides</i> subsp. <i>thesioides</i>	1	1	1	1			
GYROSTEMONACEAE		<i>Codonocarpus cotinifolius</i>	1	1	1				
HALORAGACEAE		<i>Haloragis gossei</i>	1	1					
		<i>Haloragis gossei</i> var. <i>gossei</i>					1		
HYDROCHARITACEAE		<i>Vallisneria</i> sp.		1		1			
LAMIACEAE		<i>Basilicum polystachyon</i>	1	1	1			1	
		<i>Clerodendrum floribundum</i> var. <i>angustifolium</i>	1	1					
		<i>Clerodendrum tomentosum</i>	1	1					
		<i>Teucrium pilbaranum</i>						1	
LAURACEAE		<i>Cassytha capillaris</i>	1	1	1	1	1		
LOBELIACEAE		<i>Lobelia arnhemiaca</i>						1	
LORANTHACEAE		<i>Lysiana casuarinae</i>						1	
LYTHRACEAE		<i>Ammannia baccifera</i>	1	1	1		1	1	1
		<i>Ammannia multiflora</i>	1	1		1			
MALVACEAE		<i>Abutilon amplum</i>	1	1				1	
		<i>Abutilon cryptopetalum</i>	1	1	1				
		<i>Abutilon cunninghamii</i>	1	1					
		<i>Abutilon dioicum</i>	1	1					
		<i>Abutilon fraseri</i>	1	1					
		<i>Abutilon lepidum</i>	1	1	1	1	1	1	1

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Abutilon macrum</i>	1	1					
		<i>Abutilon malvifolium</i>	1	1					
		<i>Abutilon otocarpum</i>	1	1		1			1
		<i>Abutilon oxycarpum</i>	1			1			
		<i>Abutilon oxycarpum</i> subsp. Prostrate (A.A. Mitchell PRP 1266)							
		<i>Abutilon</i> sp.						1	
		<i>Abutilon</i> sp. <i>Pilbara</i> (W.R. Barker 2025)	1	1					
		<i>Corchorus carnarvonensis</i>	1						
		<i>Corchorus incanus</i> subsp. <i>incanus</i>					1		
		<i>Corchorus laniflorus</i>	1	1			1		1
		<i>Corchorus lasiocarpus</i>	1						1
		<i>Corchorus lasiocarpus</i> subsp. <i>parvus</i>						1	
		<i>Corchorus parviflorus</i>	1				1	1	
		<i>Corchorus tectus</i>					1		
		<i>Corchorus tridens</i>	1	1				1	
		<i>Corchorus trilocularis</i>					1		
		<i>Corchorus walcottii</i>	1	1		1			
		<i>Gossypium australe</i>	1	1			1	1	1
		<i>Gossypium robinsonii</i>	1		1	1		1	
		<i>Hibiscus</i> aff. <i>platychlamys</i>	1		1	1		1	
	*	<i>Hibiscus austrinus</i>	1		1				
		<i>Hibiscus austrinus</i> var. <i>austrinus</i>						1	
		<i>Hibiscus brachysiphonius</i>	1	1					
		<i>Hibiscus coatesii</i>	1	1					1
		<i>Hibiscus leptocladus</i>	1	1					
	P3	<i>Hibiscus panduriformis</i>	1	1					
		<i>Hibiscus</i> sp.					1		
		<i>Hibiscus sturtii</i>					1		
		<i>Hibiscus sturtii</i> var. <i>campylochlamys</i>							1
		<i>Hibiscus sturtii</i> var. <i>grandiflorus</i>							1
		<i>Hibiscus sturtii</i> var. <i>platychlamys</i>	1	1					1
		<i>Lawrencia viridigrisea</i>	1	1	1	1			
	*	<i>Malvastrum americanum</i>	1	1			1	1	1

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Melhania oblongifolia</i>	1	1				1	1
	*	<i>Melochia pyramidata</i>	1	1					
		<i>Sida arsiniata</i>	1	1					
		<i>Sida brownii</i>							1
		<i>Sida cardiophylla</i>	1	1	1	1			1
		<i>Sida clementii</i>	1	1					
		<i>Sida echinocarpa</i>	1	1	1		1	1	1
		<i>Sida fibulifera</i>	1	1	1	1		1	1
		<i>Sida rohlenae</i>	1	1					1
		<i>Sida rohlenae</i> subsp. <i>rohlenae</i>					1		
		<i>Sida</i> sp.	1	1					
		<i>Sida</i> sp. dark green fruits (S. van Leeuwen 2260)	1						
		<i>Sida</i> sp. Excedentifolia (J.L. Egan 1925)							1
		<i>Sida</i> sp. Pilbara (A.A. Mitchell PRP 1543)	1				1		1
		<i>Sida</i> sp. Pindan (B.G. Thomson 3398)							1
		<i>Sida</i> sp. spiciform panicles (E. Leyland s.n. 14/8/1990)							1
		<i>Triumfetta appendiculata</i>		1	1	1		1	1
		<i>Triumfetta chaetocarpa</i>			1				
		<i>Triumfetta clementii</i>		1		1	1	1	1
		<i>Triumfetta deserticola</i>					1		
		<i>Triumfetta maconochieana</i>		1	1				
		<i>Triumfetta propinqua</i>						1	
		<i>Waltheria indica</i>		1		1		1	1
MARSILEACEAE		<i>Marsilea drummondii</i>	1				1		
		<i>Marsilea hirsuta</i>	1						
MENISPERMACEAE		<i>Tinospora smilacina</i>		1	1				1
MOLLUGINACEAE		<i>Glinus lotoides</i>	1	1			1	1	
		<i>Glinus oppositifolius</i>						1	
		<i>Mollugo molluginea</i>	1	1			1		1
MORACEAE		<i>Ficus aculeata</i>	1	1					1
		<i>Ficus aculeata</i> var. <i>indecora</i>	1	1					1
		<i>Ficus brachypoda</i>	1	1					
MYRTACEAE		<i>Corymbia aspera</i>	1						

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Corymbia candida</i> subsp. <i>candida</i>						1	
		<i>Corymbia hamersleyana</i>	1	1		1	1	1	1
		<i>Eucalyptus camaldulensis</i>	1	1			1	1	
		<i>Eucalyptus</i> sp.	1						
		<i>Eucalyptus victrix</i>	1	1			1	1	1
		<i>Eucalyptus xerothermica</i>						1	
		<i>Melaleuca argentea</i>	1	1				1	
		<i>Melaleuca glomerata</i>	1	1	1		1	1	
		<i>Melaleuca linophylla</i>	1	1	1				
NYCTAGINACEAE		<i>Boerhavia burbridgeana</i>	1	1					
		<i>Boerhavia coccinea</i>	1	1		1			
		<i>Boerhavia gardneri</i>	1	1					
		<i>Boerhavia paludosa</i>	1	1			1	1	
		<i>Boerhavia repleta</i>	1	1	1				
		<i>Boerhavia schomburgkiana</i>						1	
		<i>Boerhavia</i> sp.	1	1		1			
		<i>Commicarpus australis</i>	1	1		1			
OLEACEAE		<i>Jasminum didymum</i>						1	
		<i>Jasminum didymum</i> subsp. <i>lineare</i>	1	1					
PAPAVERACEAE	*	<i>Argemone ochroleuca</i>	1	1				1	
	*	<i>Argemone ochroleuca</i> subsp. <i>ochroleuca</i>					1		
PASSIFLORACEAE		<i>Passiflora foetida</i> var. <i>hispida</i>						1	
	*	<i>Passiflora foetida</i>	1	1			1		
PHRYMACEAE		<i>Mimulus gracilis</i>	1	1	1		1	1	
		<i>Peplidium</i> sp. E Evol. Fl. Fauna Arid Australia (A.S. Weston 12768)	1	1		1		1	
PLANTAGINACEAE		<i>Aegialitis annulata</i>	1	1					
		<i>Muellerolimon salicorniaceum</i>	1	1			1		
		<i>Plumbago zeylanica</i>	1	1		1			
		<i>Stemodia grossa</i>		1		1	1	1	1
		<i>Stemodia kingii</i>		1		1	1	1	
		<i>Striga squamigera</i>		1		1		1	
POACEAE		<i>Aristida ?holathera</i>	1						
		<i>Aristida contorta</i>	1	1			1	1	1

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Aristida holathera</i>	1	1					
		<i>Aristida inaequiglumis</i>	1		1				
		<i>Aristida latifolia</i>	1				1		
		<i>Aristida</i> sp.	1						
		<i>Astrebla pectinata</i>					1		
		<i>Bothriochloa ewartiana</i>	1	1	1	1	1		
	*	<i>Cenchrus ciliaris</i>	1	1	1		1	1	1
	*	<i>Cenchrus setiger</i>	1	1				1	1
	*	<i>Cenchrus</i> sp.	1						
		<i>Chloris pectinata</i>	1	1			1		
		<i>Chloris</i> sp.						1	
		<i>Chrysopogon fallax</i>	1	1	1		1		
		<i>Cymbopogon ambiguus</i>	1	1	1				1
		<i>Cymbopogon bombycinus</i>	1	1					
		<i>Cymbopogon obtectus</i>	1	1					
		<i>Cymbopogon procerus</i>	1				1		
		<i>Cynodon convergens</i>	1	1	1	1	1		
	*	<i>Cynodon dactylon</i>						1	
		<i>Cynodon prostratus</i>	1	1			1		
		<i>Dactyloctenium radulans</i>	1	1			1	1	1
		<i>Dichanthium fecundum</i>	1	1				1	
		<i>Dichanthium sericeum</i> subsp. <i>humilius</i>	1	1			1	1	1
		<i>Dichanthium sericeum</i> subsp. <i>sericeum</i>	1	1					
		<i>Digitaria brownii</i>	1	1	1				
		<i>Digitaria ctenantha</i>	1	1	1				
		<i>Enneapogon avenaceus</i>	1		1		1		
		<i>Enneapogon caeruleus</i>	1	1	1		1		
		<i>Enneapogon lindleyanus</i>	1	1	1	1			
		<i>Enteropogon ramosus</i>	1		1	1			
		<i>Enteropogon</i> sp.						1	
		<i>Eragrostis cumingii</i>	1	1	1			1	
		<i>Eragrostis dielsii</i>	1	1					
		<i>Eragrostis eriopoda</i>	1	1					
		<i>Eragrostis falcata</i>	1	1			1		

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Eragrostis setifolia</i>	1	1	1	1	1		
		<i>Eragrostis tenellula</i>	1	1	1			1	
		<i>Eragrostis xerophila</i>	1	1	1		1	1	
		<i>Eriachne aristidea</i>	1	1					
		<i>Eriachne benthamii</i>	1	1				1	
		<i>Eriachne helmsii</i>	1				1		
		<i>Eriachne mucronata</i>	1	1			1	1	1
		<i>Eriachne obtusa</i>					1		
		<i>Eriachne ovata</i>	1	1					
		<i>Eriachne pulchella</i>	1					1	
		<i>Eriachne pulchella</i> subsp. <i>dominii</i> (Hartley) Lazarides	1	1			1		1
		<i>Eriachne tenuiculmis</i>	1	1	1				
		<i>Eulalia aurea</i>	1	1	1	1		1	
		<i>Iseilema dolichotrichum</i>	1	1	1		1	1	
		<i>Iseilema eremaeum</i>	1	1					
		<i>Iseilema membranaceum</i>	1	1					
		<i>Panicum decompositum</i>	1	1			1	1	
		<i>Paraneurachne muelleri</i>	1	1	1				1
		<i>Paspalidium clementii</i>	1	1					1
		<i>Paspalidium tabulatum</i>	1	1		1			
		<i>Perotis rara</i>	1	1					
		<i>Schizachyrium fragile</i>	1	1	1				
		<i>Setaria dielsii</i>						1	
		<i>Setaria surgens</i>	1	1					
	*	<i>Setaria verticillata</i>	1	1			1		
		<i>Sorghum plumosum</i>	1	1				1	
		<i>Sorghum timorense</i>					1		
		<i>Spinifex longifolius</i>		1		1	1		
		<i>Sporobolus australasicus</i>		1	1	1	1	1	1
		<i>Sporobolus virginicus</i>		1	1	1			
		<i>Themeda triandra</i>		1	1		1	1	1
		<i>Tragus australianus</i>		1		1			
		<i>Triodia angusta</i>		1		1	1	1	1

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
		<i>Triodia epactia</i>		1	1	1	1	1	1
		<i>Triodia pungens</i>		1		1			
		<i>Triodia wiseana</i>		1	1		1	1	1
		<i>Tripogon loliiformis</i>		1	1				
		<i>Triraphis mollis</i>		1		1			
		<i>Urochloa holosericea</i> subsp. <i>velutina</i>		1		1			
		<i>Urochloa occidentalis</i>		1	1				
		<i>Urochloa</i> sp.		1	1	1			
		<i>Whiteochloa airoides</i>		1		1			
		<i>Xerochloa imberbis</i>		1	1		1		
		<i>Xerochloa laniflora</i>						1	
		<i>Yakirra australiensis</i>		1	1			1	
POLYGALACEAE		<i>Polygala isingii</i>	1	1	1	1		1	1
		<i>Polygala</i> sp.	1	1					
POLYGONACEAE	*	<i>Rumex vesicarius</i>	1				1	1	
PORTULACACEAE		<i>Portulaca oleracea</i>	1	1			1	1	
		<i>Portulaca pilosa</i>	1	1					1
PRIMULACEAE		<i>Aegiceras corniculatum</i>	1	1		1			
		<i>Samolus repens</i>	1	1	1	1			
PROTEACEAE		<i>Grevillea pyramidalis</i>	1	1			1		1
		<i>Grevillea wickhamii</i>							1
		<i>Hakea lorea</i>	1						1
		<i>Hakea lorea</i> subsp. <i>lorea</i>						1	
		<i>Hakea suberea</i>	1	1	1	1			
		<i>Hakea chordophylla</i>					1		
PTERIDACEAE		<i>Cheilanthes sieberi</i> subsp. <i>sieberi</i>	1	1					
RHAMNACEAE		<i>Ventilago viminalis</i>			1	1			
RHIZOPHORACEAE		<i>Bruguiera exaristata</i>	1	1	1				
		<i>Rhizophora stylosa</i>	1	1	1	1			
RUBIACEAE		<i>Oldenlandia crouchiana</i>	1	1	1				
		<i>Oldenlandia</i> sp.	1						
		<i>Synaptantha tillaeacea</i>						1	
		<i>Synaptantha tillaeacea</i> var. <i>tillaeacea</i>		1	1				
SANTALACEAE		<i>Santalum lanceolatum</i>	1	1			1		

Family	Species notes^	Species	HGM (2000)	Biota (2001)	Maunsell (2006)	Mattiske (2007)	Aecom (2009)	Astron (2008)	Astron (2009)
SAPINDACEAE		<i>Alectryon oleifolius</i>	1	1					
		<i>Alectryon oleifolius</i> subsp. <i>oleifolius</i>						1	
		<i>Dodonaea coriacea</i>	1	1	1				1
		<i>Dodonaea</i> sp.					1		
SCROPHULARIACEAE		<i>Eremophila forrestii</i>	1		1	1			
		<i>Eremophila forrestii</i> subsp. <i>forrestii</i>	1	1			1		
		<i>Eremophila longifolia</i>	1	1		1	1	1	1
		<i>Eremophila maculata</i>	1		1				
		<i>Myoporum montanum</i>	1	1					
SOLANACEAE	*	<i>Datura leichhardtii</i>	1	1			1	1	
		<i>Nicotiana benthamiana</i>	1	1					
		<i>Nicotiana occidentalis</i>						1	
		<i>Nicotiana rosulata</i>					1		
		<i>Nicotiana rosulata</i> subsp. <i>ingulba</i>						1	
		<i>Nicotiana rosulata</i> subsp. <i>rosulata</i>	1	1	1				
		<i>Nicotiana</i> sp.						1	
		<i>Solanum diversiflorum</i>	1	1	1		1	1	1
		<i>Solanum gabrielae</i>	1	1		1			
		<i>Solanum horridum</i>	1	1					1
		<i>Solanum lasiophyllum</i>	1	1			1	1	1
	*	<i>Solanum nigrum</i>						1	
STYLIDIACEAE		<i>Stylidium fluminense</i>						1	
		<i>Stylidium spathulatum</i>					1		
SURIANACEAE		<i>Stylobasium spathulatum</i>		1		1			
THYMELEACEAE		<i>Pimelea ammodarid</i>	1	1					
TYPHACEAE		<i>Typha domingensis</i>		1	1			1	
VIOLACEAE		<i>Hybanthus aurantiacus</i>	1	1			1	1	1
ZYGOPHYLLACEAE		<i>Tribulopsis angustifolia</i>						1	
		<i>Tribulus astrocarpus</i>				1			
		<i>Tribulus hirsutus</i>		1		1			
		<i>Tribulus occidentalis</i>		1		1			
		<i>Tribulus platypterus</i>		1		1			
		<i>Tribulus suberosus</i>		1	1				1

^ * - introduced species, P – priority species, DP – declared pest plant under BAM Act

Table notes:

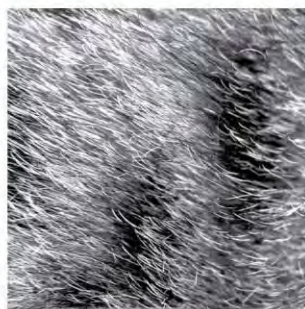
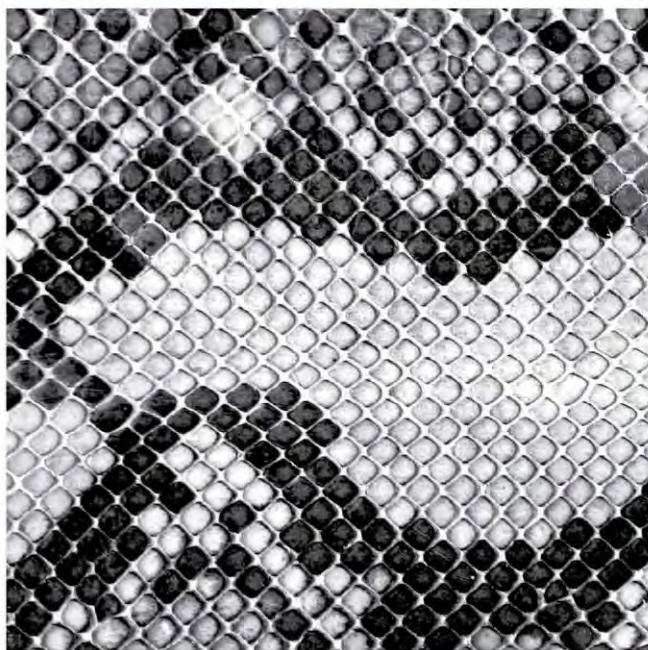
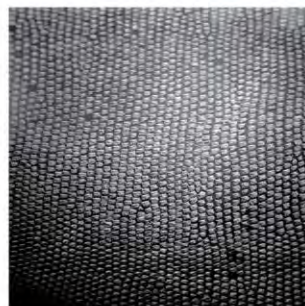
- a 'species affinis' (aff.) notation indicates a very close affinity with the species named, and could potentially be recognised as a separate species. Species recorded in the reports consolidated above that have this notation are not currently recognised as separate species by the WA Herbarium; as such, for the purpose of this document, they have been included with the confirmed species, where present, e.g. *Tephrosia* aff. *supina* is included with *Tephrosia supina*
- a 'confer' (cf.) or '?' notation implies the best possible identification given the available material. For the purpose of this document, species with these notations have been included with the confirmed species, e.g. *Senna ?notabilis* included with *Senna notabilis*, *Rhynchosia* cf. *minima* included with *Rhynchosia minima*
- records of species with multiple 'species affinis' (aff.) records have been collapsed into one record
- species that have been excluded by the WA Herbarium have been removed from the species list, where no alternative name is provided by Florabase
- species that are considered out of range by the WA Herbarium have been removed from the species list, where no alternative name is provided by Florabase
- where a species name has been deemed to have been misapplied against multiple species, the species name has been replaced with genus only, e.g. *Mukia maderaspatana* / *Cucumis maderaspatanus* has been deemed to have been misapplied against *Cucumis argenteus*, *C. althaeoides* and *C. variabilis*, therefore has been replaced with *Cucumis* sp.



Sino Iron Project Vertebrate Fauna Desktop Review

CITIC Pacific Mining Management

ecoscape



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EXECUTIVE SUMMARY

CITIC Pacific Mining Management (CPMM) has developed the Sino Iron Project at Cape Preston. This project is the largest magnetite mining and processing operation in Australia.

CPMM commissioned Ecoscape to review the suitability of previously completed vertebrate fauna surveys and assessments in relation to CPMM's current development plans. Vertebrate fauna assessments for the Sino Iron Project have been completed over three survey periods. The first Phase survey was completed 16 years ago (Halpern Glick Maunsell *et al.* 2001), the second phase, ten years ago (Maunsell AECOM Australia Pty Ltd 2008) and a third survey was completed eight years prior to this assessment, (Phoenix 2009).

An additional four surveys were identified as relevant to the study area (Bennelongia 2008, Pendoley 2009, Phoenix 2008 and Ecoscape 2016a, b). The findings of these surveys were reviewed with a specific focus on the occurrence of conservation significant species and their potential to occur in the vicinity of the study area.

In addition to the review of previous surveys, a database search was undertaken to determine the fauna species that could potentially occur within the study area. An emphasis was also placed on species of conservation significance. Updates on the status of both State and Commonwealth listed species were incorporated into the database search results to reflect current listings.

A total of 57 species of conservation significance (three mammals, 50 birds, four reptiles) have been recorded during previous surveys at Cape Preston and surrounding area. An additional 15 species (three mammals, six birds and six reptiles) have a medium to high likelihood of occurrence based on habitat, database searches and previous records.

Methodology and timing of the baseline survey completed in 2000 (HGM *et al.* 2001) and 2008 (Maunsell 2008 and Phoenix 2009) were assessed as suitable and followed the guidelines for vertebrate fauna assessments (EPA 2002 and EPA and DEC 2010).

1 INTRODUCTION

1.1 PROJECT BACKGROUND

CITIC Pacific Mining Management (CPMM) has developed the Sino Iron Project at Cape Preston. This project is the largest magnetite mining and processing operation in Australia.

1.2 SCOPE OF WORKS

CPMM commissioned Ecoscape to undertake a desktop review and determine the suitability of previously completed vertebrate fauna assessments in relation to the current development plans. Vertebrate fauna assessments for the Sino Iron Project were completed over three survey periods. The first Phase survey was completed 16 years ago (Halpern Glick Maunsell *et al.* 2001), the second phase was completed ten years ago (Maunsell AECOM Australia Pty Ltd 2008) and a third survey was completed eight years prior to this assessment (Phoenix 2009).

The objectives of the review were:

- review the suitability of the previous vertebrate fauna assessments in line with current development plans
- updated assessment of the conservation significant fauna taking into account recent changes to the conservation status of several species since the completion of previous surveys
- assessment of the terrestrial vertebrate fauna that includes any updated impact areas, and
- inclusion of recent vertebrate fauna survey results from the local region to provide additional context to the assessment.

The review provides a concise up to date report detailing the terrestrial vertebrate fauna associated with the ongoing development of the Sino Iron project. It also identifies potential gaps with regard to current legislation.

1.3 STUDY AREA

This desktop assessment covers the tenements associated with the Sino Iron project including G08/52, G08/74, G08/123, G08/126, G08/53, P08/658, E08/2036 and P08/650.

1.4 STATUTORY FRAMEWORK

This environmental assessment was conducted in accordance with Commonwealth and State legislation and guidelines:

- Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act)
- Western Australian *Wildlife Conservation Act 1950* (WC Act)
- Western Australian *Environmental Protection Act 1986* (EP Act)
- Western Australian *Biodiversity Conservation Act 2016* (BC Act)
- Position Statement No. 3: Terrestrial Biological Surveys as an Element of Biodiversity Protection (EPA 2002)
- Guidance Statement No. 56: Terrestrial Fauna Surveys for Environmental Impact Assessment in Western Australia (EPA 2004)
- Matters of National Environmental Significance. Significant impact guidelines 1.1 - Environment Protection and Biodiversity Conservation Act 1999 (DEWHA 2009)
- Technical Guide - Terrestrial Vertebrate Fauna Surveys for Environmental Impact Assessment (EPA & DEC 2010)
- Department of the Environment (2016) EPBC Act Referral guideline for the Northern Quoll, *Dasyurus hallucatus*

1.4.1 THREATENED AND PRIORITY FAUNA

Commonwealth Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)

On behalf of the Minister for Environment, the Department of Environment and Energy (DoEE) publishes a list of fauna and flora species regarded as threatened, rare, likely to become extinct, or presumed extinct. These taxa are protected under the EPBC Act and are listed in specific categories such as Critically Endangered, Endangered, Vulnerable, Conservation Dependent, Extinct, or Extinct in the Wild (**Table 8 in Appendix One**).

Migratory species are categorised under the EPBC Act as Matters of National Environmental Significance (MNES). Recognised migratory species include any native species identified in an international agreement approved by the Minister and those listed under:

- The Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention)
- The China-Australia Migratory Bird Agreement (CAMBA)
- The Japan-Australia Migratory Bird Agreement (JAMBA).
- The Republic of Korea-Australia Migratory Bird Agreement (ROKAMBA)

Western Australian Biodiversity Conservation Act 2016

The Western Australian *Biodiversity Conservation Act 2016* (BC Act, the Act), parts of which were enacted on 21 September 2016, provides for the conservation, protection and ecologically sustainable use of biodiversity and biodiversity components in Western Australia. The BC Act replaces the *Wildlife Conservation Act 1950*.

Threatened species (both flora and fauna) that meet the categories listed within the Act are highly protected and require authorisation by the Ministerial to take or disturb. Seven categories have been devised that include Threatened Fauna conservation categories of critically endangered, endangered, vulnerable and presumed extinct have been aligned with those detailed in the EPBC Act (Schedule 1-4). Additional categories (Schedule 5-7) cover migratory species, conservation dependent species and other specially protected species (**Table 9 in Appendix One**).

Flora and fauna species may be listed as being of special conservation interest if they have a naturally low population, restricted natural range, are subject to or recovering from a significant population decline or reduction of range or are of special interest, and the Minister considers that 'taking' may result in depletion of the species. Migratory species and those subject to international agreement are also listed under the Act. These are known as specially protected species. Threatened Ecological Communities (TECs) are also protected under the Act and are categorised using the same criteria as threatened species.

At the time of writing this report, some sections of the BC Act had not yet been proclaimed, including those relating to species of conservation interest (Specially Protected Species) and TECs. During this transition period the WC Act is still in effect where relevant. The current listings were published in the *Government Gazette* on 3 November 2015 (Western Australian Government 2015).

Department of Parks and Wildlife (DPaW) Priority Species

In addition to these statutory listings, DPaW maintains a list of 'Priority' species (P1-P5) that are also of conservation interest (**Table 9 in Appendix One**). Any fauna survey conducted for the purposes of environmental impact assessment (EIA) must include an assessment of presence/absence potential for these species. There is also a requirement for an impact assessment (due to the proposed action) and an expectation all appropriate sources of information are investigated.

2 LITERATURE REVIEW

2.1 DATABASE SEARCHES

Database searches were undertaken to determine fauna species that could potentially occur within the study area. Particular emphasis was placed on species of conservation significance. Updates on the status of listed species were incorporated into the below database search results to reflect current listings. **Table 1** lists the database searches performed.

Table 1: Details of Database searches

Field	Database Title	Custodian	Search Details
Conservation Significant Vertebrate Fauna	Commonwealth Protected Matters Search Tool (PMST)	Department of the Environment and Energy (DoEE)	Date: 29 Nov 2016 Buffer: 40 km Lat: -21.061633° Long: 116.176266°
Conservation Significant Vertebrate Fauna	DPaW database	Department of Parks and Wildlife (DPaW)	Date: 22 Nov 2016 Buffer: 50 km around Project footprint
Vertebrate Fauna	NatureMap	DPaW	Date: 28 Nov 2016 Buffer: 40 km Lat: 21° 05' 02" S Long: 116° 10' 38"E
Birds	Birdata	BirdLife Australia	Date: 29 Nov 2016 Buffer 20 km Lat: -21.061633° Long: 116.176266°
Vertebrate Fauna	Atlas of Living Australia		Date: 30 Nov 2016 Buffer 10 km Search Area 1 Lat: -21.061633° Long: 116.176266° Search Area 2 Lat: -20.006647° Long: 116.222740°

2.1.1 COMMONWEALTH PROTECTED MATTERS SEARCH

A DoEE online PMST database search (DoEE 2016a) was conducted and Commonwealth *Species Profile and Threats Database* (DoEE 2016c) lists were reviewed to identify threatened or specially protected fauna previously recorded nearby.

The PMST search identified 35 species (or its habitat) as being likely to occur within the study area **Table 2**. Nineteen species are listed as Threatened fauna, 19 species are listed as Migratory species and 25 species are listed as Marine species. Species can be listed as Threatened, Migratory and Marine concurrently (or any combination of) and the numbers of species in each category includes replicated species. Entirely Marine species including Sea Snakes, Cetaceans and Fish were excluded with the exception of marine turtles due to their reliance on beaches for breeding.

Twelve fauna species listed as Invasive Species were also identified from the PMST.

Table 2: PMST vertebrate fauna database results

Species name	Common name	Threatened	Migratory	Marine	Type of Presence
SPECIES OF NATIONAL ENVIRONMENTAL SIGNIFICANCE (NES)					
Mammals					
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered			Species or species habitat known to occur within area
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable			Species or species habitat likely to occur within area
<i>Rhinonictes aurantia</i> (Pilbara form)	Pilbara Leaf-nosed Bat	Vulnerable			Species or species habitat likely to occur within area
<i>Macroderma gigas</i>	Ghost Bat	Vulnerable			Species or species habitat likely to occur within area
Birds					
<i>Limosa lapponica menzbieri</i>	Bar-tailed Godwit (Northern Siberian)	Critically Endangered			Species or species habitat may to occur within area
<i>Numenius madagascariensis</i>	Eastern Curlew	Critically Endangered	•	•	Species or species habitat known to occur within area
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered	•	•	Species or species habitat known to occur within area
<i>Macronectes giganteus</i>	Southern Giant-Petrel	Endangered	•	•	Species or species habitat may to occur within area
<i>Rostratula australis</i>	Australian Painted Snipe	Endangered		•	Species or species habitat may to occur within area
<i>Pezoporus occidentalis</i>	Night Parrot	Endangered			Species or species habitat may to occur within area
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit (Western Alaskan)	Vulnerable			Species or species habitat likely to occur within area
<i>Sternula nereis nereis</i>	Australian Fairy Tern	Vulnerable			Breeding known to occur within area
<i>Puffinus pacificus</i>	Wedge-tailed Shearwater		•	•	Breeding known to occur within area
<i>Charadrius veredus</i>	Oriental Plover		•	•	Species or species habitat may occur within area
<i>Limosa lapponica</i>	Bar-tailed Godwit		•	•	Species or species habitat known to occur within area
<i>Tringa nebularia</i>	Common Greenshank		•	•	Species or species habitat likely to occur within area
<i>Glareola maldivarum</i>	Oriental Pratincole		•	•	Species or species habitat may occur within area
<i>Sterna dougallii</i>	Roseate Tern		•	•	Foraging, feeding or related behaviour likely to occur within area
<i>Apus pacificus</i>	Fork-tailed Swift		•	•	Species or species habitat likely to occur within area
<i>Pandion haliaetus</i>	Eastern Osprey		•	•	Breeding known to occur within area
<i>Hirundo rustica</i>	Barn Swallow		•	•	Species or species habitat may occur within area
<i>Motacilla flava</i>	Yellow Wagtail		•	•	Species or species habitat may occur within area
<i>Motacilla cinerea</i>	Grey Wagtail		•	•	Species or species habitat may occur within area
<i>Ardea ibis</i>	Cattle Egret			•	Species or species habitat may occur within area
<i>Ardea modesta</i>	Eastern Great Egret			•	Species or species habitat known to occur within area

LITERATURE REVIEW

Species name	Common name	Threatened	Migratory	Marine	Type of Presence
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle			•	Species or species habitat known to occur within area
<i>Chroicocephalus novaehollandiae</i>	Silver Gull			•	Breeding known to occur within area
<i>Merops ornatus</i>	Rainbow Bee-eater			•	Species or species habitat may occur within area
Reptiles					
<i>Caretta caretta</i>	Loggerhead Turtle	Endangered	•	•	Foraging, feeding or related behaviour known to occur within area
<i>Dermochelys coriacea</i>	Leatherback Turtle	Endangered	•	•	Breeding likely to occur within area
<i>Chelonia mydas</i>	Green Turtle	Vulnerable	•	•	Breeding known to occur within area
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Vulnerable	•	•	Breeding known to occur within area
<i>Natator depressus</i>	Flatback Turtle	Vulnerable	•	•	Breeding known to occur within area
<i>Ctenotus angusticeps</i>	Airlie Island Ctenotus	Vulnerable			Species or species habitat likely to occur within area
<i>Liasis olivaceus barroni</i>	Olive Python (Pilbara subspecies)	Vulnerable			Species or species habitat likely to occur within area
INVASIVE SPECIES					
Mammals					
<i>Mus musculus</i>	House Mouse				Species or species habitat likely to occur within area
<i>Rattus rattus</i>	Black Rat				Species or species habitat likely to occur within area
<i>Oryctolagus cuniculus</i>	Rabbit				Species or species habitat likely to occur within area
<i>Vulpes vulpes</i>	Red Fox				Species or species habitat likely to occur within area
<i>Felis catus</i>	Cat				Species or species habitat likely to occur within area
<i>Equus asinus</i>	Donkey				Species or species habitat likely to occur within area
<i>Equus caballus</i>	Horse				Species or species habitat likely to occur within area
Birds					
<i>Columba livia</i>	Domestic Pigeon				Species or species habitat likely to occur within area
<i>Passer domesticus</i>	House Sparrow				Species or species habitat likely to occur within area
<i>Passer montanus</i>	Eurasian Tree Sparrow				Species or species habitat likely to occur within area
Reptiles					
<i>Hemidactylus frenatus</i>	Asian House Gecko				Species or species habitat likely to occur within area
<i>Ramphotyphlops braminus</i>	Flowerpot Blind Snake				Species or species habitat likely to occur within area

2.1.2 DPAW THREATENED AND PRIORITY FAUNA DATABASE SEARCH

The search of DPaW's Threatened and Priority Fauna database resulted in a total of 43 species recorded from within 50 km of the study area: eight mammal, 28 bird, six reptile and one fish species (**Table 3**). Marine species such as Dugong and Humpback Whale where

Table 3: Threatened and Priority Fauna identified from DPaW database search

Species	Scientific name	EPBC Act Listing			BC Act / DPaW
		Threatened	Migratory	Marine	
Mammals					
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered	-	-	Schedule 2
Black-flanked Rock Wallaby	<i>Petrogale lateralis lateralis</i>	Endangered	-	-	Schedule 2
Pilbara Leaf-nosed Bat	<i>Rhinonictis aurantia</i>	Vulnerable	-	-	Schedule 3
Ghost Bat	<i>Macroderma gigas</i>	Vulnerable	-	-	Schedule 3
Little North-western Mastiff Bat	<i>Mormopterus loriae cobourgiana</i>	-	-	-	Priority 1
Spectacled Hare-wallaby (mainland)	<i>Lagorchestes conspicillatus leichardti</i>	-	-	-	Priority 3
Lakeland Downs Mouse, Kerakenga	<i>Leggadina lakedownensis</i>	-	-	-	Priority 4
Western Pebble-mound Mouse, Ngadji	<i>Pseudomys chapmani</i>	-	-	-	Priority 4
Birds					
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered	•	•	Schedule 3/ Schedule 5
Curlew Sandpiper	<i>Calidris ferruginea</i>	Critically Endangered,	•	•	Schedule 3 /Schedule 5
Great Knot	<i>Calidris tenuirostris</i>	Critically Endangered	•	•	Schedule 3 /Schedule 5
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered	•	•	Schedule 2 /Schedule 5
Australian Fairy Tern	<i>Sternula nereis nereis</i>	Vulnerable	-	-	Schedule 3
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable	•	•	Schedule 3 /Schedule 5
Hutton’s Shearwater	<i>Puffinus huttoni</i>	-		•	Schedule 2
Wedge-tailed Shearwater	<i>Puffinus pacificus</i>	-	•	•	Schedule 5
Pin-tailed Snipe	<i>Gallinago stenura</i>	-	•	•	Schedule 5
Bar-tailed Godwit	<i>Limosa lapponica</i>	-	•	•	Schedule 5
Common Greenshank	<i>Tringa nebularia</i>	-	•	•	Schedule 5
Oriental Pratincole	<i>Glareola maldivarum</i>	-	•	•	Schedule 5
Roseate Tern	<i>Sterna dougallii</i>	-	•	•	Schedule 5
Fork-tailed Swift	<i>Apus pacificus</i>	-	•	•	Schedule 5
Grey Plover	<i>Pluvialis squatarola</i>	-	•	•	Schedule 5
Pacific Golden Plover	<i>Pluvialis fulva</i>	-	•	•	Schedule 5
Glossy Ibis	<i>Plegadis falcinellus</i>	-	•	•	Schedule 5
White-winged Black tern	<i>Chlidonias leucopterus</i>	-	•	•	Schedule 5
Ruddy Turnstone	<i>Arenaria interpres</i>	-	•	•	Schedule 5
Red-necked Stint	<i>Calidris ruficollis</i>	-	•	•	Schedule 5
Whimbrel	<i>Numenius phaeopus</i>	-	•	•	Schedule 5
Wood Sandpiper	<i>Tringa glareola</i>	-	•	•	Schedule 5
Marsh Sandpiper	<i>Tringa stagnatilis</i>	-	•	•	Schedule 5

Species	Scientific name	EPBC Act Listing			BC Act / DPaW
Caspian Tern	<i>Sterna caspia</i>	-	•	•	Schedule 5
Common Tern	<i>Sterna hirundo</i>	-	•	•	Schedule 5
Eastern Great Egret	<i>Ardea modesta</i>	-	-	•	Schedule 5
Rainbow Bee-eater	<i>Merops ornatus</i>	-	-	•	Schedule 5
Peregrine Falcon	<i>Falco peregrinus</i>	-	-	-	Schedule 7
Reptiles					
Loggerhead Turtle	<i>Caretta caretta</i>	Endangered	•	•	Schedule 2
Green Turtle	<i>Chelonia mydas</i>	Vulnerable	•	•	Schedule 3
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Vulnerable	•	•	Schedule 3
Flatback Turtle	<i>Natator depressus</i>	Vulnerable	•	•	Schedule 3
Pilbara Olive Python	<i>Liasis olivaceus barroni</i>	Vulnerable	-	-	Schedule 3
Lined Soil-Crevise Skink	<i>Notoscincus butleri</i>	-	-	-	Priority 4
Fish					
Fortescue Grunter	<i>Leiopotherapon aheneua</i>	-	-	-	Priority 4

2.1.3 OTHER DATABASE SEARCHES

NatureMap (DPaW 2016a), Atlas of Living Australia (ALA 2016), and Birddata (Birdlife Australia 2016) databases was queried to identify fauna species that have been recorded from within and near the northern tenement study area (**Appendix Two**).

2.2 PREVIOUS SURVEYS

A literature review has identified eight previous vertebrate fauna assessments from the surrounding region.

Table 4: Previous surveys in the region

Project Name and Author	Level of Assessment	Distance from Study area
Austeel Biological Survey Phase 1 (HGM <i>et.al.</i> 2001)	Level 2 Vertebrate Fauna Survey (single phase)	0 km
Balmoral South Iron Ore Project Fauna Survey (Maunsell AECOM 2006)	Level 2 Vertebrate Fauna Survey (single phase)	0 km
Targeted Fauna Assessment (Mulgara and Pilbara Olive Python) – Balmoral South (Stage 1) Cape Preston Iron Ore Project (Phoenix 2008)	Targeted Fauna Survey (Mulgara and Pilbara Olive Python)	0 km
Cape Preston Mining Estate consolidated Vegetation, Flora and Fauna Assessment (Maunsell AECOM 2008)	Level 2 Vertebrate Fauna Assessment using data from previous assessments (HGM <i>et.al.</i> 2001; Maunsell AECOM 2006; Phoenix 2008))	0 km
Report on Shorebird Numbers and Shorebird Values at Cape Preston (Bennelongia 2008)	Targeted Shorebird assessment	0 km
Vertebrate Fauna survey of Mineralogy Cape Preston Iron Ore Project (Phoenix 2009)	Level 2 Vertebrate Fauna Survey (Phase 2 using (HGM <i>et.al.</i> 2001) data as Phase 1)	0 km
CPMM Sino Iron Project Cape Preston Marine Turtle Surveys January and March 2009 (Pendoley 2009)	Targeted Marine Turtle Survey	0 km
Reconnaissance and Targeted Northern Quoll survey Cape Preston (Ecoscape 2016a, b)	Reconnaissance and Targeted Northern Quoll Survey	0 km

2.2.1 LIKELIHOOD OF OCCURRENCE

The likelihood of occurrence for species of conservation significance within the immediate vicinity of the study area was assessed using the following criteria:

- suitability of habitats present within the study area
- distance between previous record of conservation significant species and the study area
- frequency and number of records in the region, and
- date of record of conservation significant species (recent or historical).

The sufficiency of information and behavioural and ecological characteristics, such as cryptic behaviours were also taken into account. Using the above criteria, the categories of likelihood of occurrence are shown in **Table 5**.

Table 5: Categories for likelihood of occurrence of conservation significant fauna

Likelihood	Categories
Recorded	Species recorded within the study area within a reasonable timeframe (0-15 years)
High	Species recorded in close proximity to the study area (<10 km) within the past 15 years; suitable habitat occurs within the study area
Medium	Species historically recorded in close proximity (<10 km) to the study area, more than 15 years ago; suitable habitat may exist within the study area
Low	Species not recorded in the proximity of the study area or rarely recorded within 20 km of the study area; suitable habitat unlikely to occur within the study area
Very Low	Species not recorded by multiple surveys/databases within 50 km of the study area and suitable habitat does not occur within the study area, however species or suitable habitat is listed as potentially occurring in the wider region

3 RESULTS

3.1 FAUNA HABITATS

Phase 1 of the baseline survey identified a total of ten habitat types from within the study area (HGM *et al.* 2001):

- Beach
- Mangroves
- Coastal Sand Dunes
- Samphire
- Stony Plain
- Low Stony Hill
- Rocky Hills and Outcrops
- Cracking Clays
- Creeklines
- Sandplain

During the second phase of surveying, a total of seven habitat types were described as present at the study area (Phoenix 2009). These comprise of:

- Cracking Clay
- Dune
- Hilltops, hillslopes and rocky outcrops
- Mangrove/beach
- Samphire
- Stony spinifex plain with or without low shrubs
- Major and minor drainage lines

None of the above habitat types were identified as unique to the locality or were assessed to be of regional significance (HGM *et al.* 2001).

3.2 FAUNA ASSEMBLAGE

The Phase 1 of the baseline survey conducted by HGM (2001) recorded a total of 174 species which comprise of 21 mammal species, 95 bird species, 55 reptiles and three amphibians. Phase 2 of the baseline survey recorded a total of 158 fauna species which included 18 mammal species, 76 bird species, 63 reptile species and one amphibian species. The species recorded from each survey and database search are summarised in

Table 6

Table 6: Database search results

Source	Mammals	Birds	Reptiles	Amphibians	Fish	Total
Austeel Biological Survey Ph1 (HGM <i>et al.</i> 2001)	21	95	55	3	-	174
Shorebird Survey Cape Preston (Hassell 2002)	-	82	-	-	-	82
Balmoral South (Maunsell 2008)	8	57	38	2	-	105
Cape Preston Shorebirds (Bennelongia 2008)	-	23	-	-	-	23
Cape Preston (Phoenix 2009)	18	76	63	1	-	158
Northern Quoll (Ecoscape 2016a,b)	11	62	11	-	-	84
NatureMap	30	134	75	5	3	247
Atlas of Living Australia	15	113	53	2	-	183

Source	Mammals	Birds	Reptiles	Amphibians	Fish	Total
Birdata	-	122	-	-	-	122
Total	46	180	95	6	3	330

3.3 CONSERVATION SIGNIFICANT SPECIES

A total of 57 species of conservation significance (three mammals, 50 birds, four reptiles) have been recorded during previous surveys at Cape Preston and surrounding area. An additional 15 species (three mammals, six birds and six reptiles) have a medium to high likelihood of occurrence based on habitat, database searches and previous records.

The below table summarises the species that are likely to be present or have been recorded from site. The details of each species, including preferred habitat, previous records and the likelihood of occurrence, is listed in **Table 15** in **Appendix Three**.

Table 7: Conservation Significant Species likely to occur

Species	Scientific name	EPBC Act Listing	BC Act	DPaW	Likelihood
Mammals					
Northern Quoll	<i>Dasyurus hallucatus</i>	Endangered	Schedule 2		Recorded
Pilbara Leaf-nosed Bat	<i>Rhinonicteris aurantia</i>	Vulnerable	Schedule 3		High
Ghost Bat	<i>Macroderma gigas</i>	Vulnerable	Schedule 3		Medium
Northern Coastal Free-tailed Bat	<i>Ozimops cobourgianus</i>	-	-	Priority 1	Recorded
Water-rat	<i>Hydromys chrysogaster</i>	-	-	Priority 4	High
Lakeland Downs Mouse, (Kerakenga)	<i>Leggadina lakedownensis</i>	-	-	Priority 4	Recorded
Birds					
Bar-tailed Godwit	<i>Limosa lapponica</i>	Migratory, Marine	Migratory (S5)	VU	Recorded
Bar-tailed Godwit (Northern Siberian)	<i>Limosa lapponica menzbieri</i>	Critically Endangered	-	VU	Recorded
Bar-tailed Godwit (Western Alaskan)	<i>Limosa lapponica baueri</i>	Vulnerable	-	VU	Recorded
Eastern Curlew	<i>Numenius madagascariensis</i>	Critically Endangered, Migratory, Marine	Schedule 3/ Schedule 5	VU	Recorded
Great Knot	<i>Calidris tenuirostris</i>	Critically Endangered Migratory, Marine	Schedule 3 /Schedule 5	VU	Recorded
Curlew Sandpiper	<i>Calidris ferruginea</i>	Critically Endangered, Migratory, Marine	Schedule 3 /Schedule 5	VU	Recorded
Lesser Sand Plover	<i>Charadrius mongolus</i>	Endangered	Schedule 2 /Schedule 5	EN	Recorded
Greater Sand Plover	<i>Charadrius leschenaultii</i>	Vulnerable, Migratory, Marine	Vulnerable (S3) Migratory (S5)	VU	Recorded
Australian Fairy Tern	<i>Sternula nereis nereis</i>	Vulnerable	Schedule 3	VU	High
Eastern Osprey	<i>Pandion haliaetus cristatus</i>	Migratory, Marine	Migratory (S5)	-	Recorded
Pacific Golden Plover	<i>Pluvialis fulva</i>	Migratory, Marine	Schedule 5	-	High
Grey Plover	<i>Pluvialis squatarola</i>	Migratory, Marine	Schedule 5	-	Recorded
Oriental Plover	<i>Charadrius veredus</i>	Migratory, Marine	Schedule 5	-	Recorded

Species	Scientific name	EPBC Act Listing	BC Act	DPaW	Likelihood
Whimbrel	<i>Numenius phaeopus</i>	Migratory, Marine	Schedule 5	-	Recorded
Marsh Sandpiper	<i>Tringa stagnatilis</i>	Migratory, Marine	Schedule 5		Recorded
Common Greenshank	<i>Tringa nebularia</i>	Migratory, Marine	Schedule 5	-	Recorded
Wood Sandpiper	<i>Tringa glareola</i>	Migratory, Marine	Schedule 5	-	Medium
Grey-tailed Tattler	<i>Tringa brevipes</i>	Migratory, Marine	Schedule 5	-	Recorded
Terek Sandpiper	<i>Tringa cinerea</i>	Migratory, Marine	Schedule 5		Recorded
Common Sandpiper	<i>Tringa hypoleucos</i>	Migratory, Marine	Schedule 5		Recorded
Ruddy Turnstone	<i>Arenaria interpres</i>	Migratory, Marine	Schedule 5		Recorded
Sanderling	<i>Calidris alba</i>	Migratory, Marine	Schedule 5	-	Recorded
Red-necked Stint	<i>Calidris ruficollis</i>	Migratory, Marine	Schedule 5	-	Recorded
Oriental Pratincole	<i>Glareola maldivarum</i>	Migratory, Marine	Schedule 5	-	Medium
Gull-billed Tern	<i>Sterna nilotica</i>	Migratory, Marine	Schedule 5	-	Recorded
Caspian Tern	<i>Sterna caspia</i>	Migratory, Marine	Schedule 5	-	Recorded
Bridled Tern	<i>Sterna anaethetus</i>	Migratory, Marine	Schedule 5	-	Recorded
Fork-tailed Swift	<i>Apus pacificus</i>	Migratory, Marine	Schedule 5	-	Medium
Eastern Great Egret	<i>Ardea modesta</i>	Marine	Schedule 5	-	Recorded
Crested Tern	<i>Sterna bergii</i>	Migratory, Marine	-	-	Recorded
Straw-necked Ibis	<i>Threskiornis spinicollis</i>	Marine	-	-	Recorded
Nankeen Night Heron	<i>Nycticorax caledonicus</i>	Marine	-	-	Recorded
Little Egret	<i>Ardea garzetta</i>	Marine	-	-	Recorded
Eastern Reef Heron	<i>Ardea sacra</i>	Marine	-	-	Recorded
Australian Pelican	<i>Pelecanus conspicillatus</i>	Marine	-	-	Recorded
Brown Goshawk	<i>Accipiter fasciatus</i>	Marine	-	-	Recorded
Swamp Harrier	<i>Circus approximans</i>	Marine	-	-	Recorded
Whistling Kite	<i>Haliastur sphenurus</i>	Marine	-	-	Recorded
Brahminy Kite	<i>Haliastur indus</i>	Marine	-	-	Recorded
White-bellied Sea-Eagle	<i>Haliaeetus leucogaster</i>	Marine	-	-	Recorded
Beach Stone-curlew	<i>Esacus magnirostris</i>	Marine	-	-	Recorded
Black-winged Stilt	<i>Himantopus himantopus</i>	Marine	-	-	Medium
Silver Gull	<i>Larus novaehollandiae</i>	Marine	-	-	Recorded
Lesser Crested Tern	<i>Sterna bengalensis</i>	Marine	-	-	Recorded
Horsfield's Bronze Cuckoo	<i>Chrysococcyx basalis</i>	Marine	-	-	Recorded
Black-eared Cuckoo	<i>Chrysococcyx osculans</i>	Marine	-	-	Recorded
Pallid Cuckoo	<i>Cacomantis pallidus</i>	Marine	-	-	Recorded
Southern Boobook	<i>Ninox boobook boobook</i>	Marine	-	-	Recorded
Spotted Nightjar	<i>Eurostopodus argus</i>	Marine	-	-	Recorded
Sacred Kingfisher	<i>Todiramphus sanctus</i>	Marine	-	-	Recorded
Rainbow Bee-eater	<i>Merops ornatus</i>	Marine	-	-	Recorded
Nankeen Kestrel	<i>Falco cenchroides</i>	Marine	-	-	Recorded
Black-faced Cuckoo-shrike	<i>Coracina novaehollandiae</i>	Marine	-	-	Recorded
Magpie-lark	<i>Grallina cyanoleuca</i>	Marine	-	-	Recorded
Welcome Swallow	<i>Hirundo neoxena</i>	Marine	-	-	Recorded

Species	Scientific name	EPBC Act Listing	BC Act	DPaW	Likelihood
Tree Martin	<i>Petrochelidon nigricans</i>	Marine	-	-	Recorded
Australian Pipit	<i>Anthus australis</i>	Marine	-	-	Recorded
Peregrine Falcon	<i>Falco peregrinus</i>		Schedule 7		Medium
Grey Falcon	<i>Falco hypoleucos</i>		Schedule 3		Recorded
Reptiles					
Loggerhead Turtle	<i>Caretta caretta</i>	Endangered Migratory, Marine	Schedule 2	VU	High
Green Turtle	<i>Chelonia mydas</i>	Vulnerable Migratory, Marine	Schedule 3	VU	Recorded
Hawksbill Turtle	<i>Eretmochelys imbricata</i>	Vulnerable Migratory, Marine	Schedule 3	VU	High
Flatback Turtle	<i>Natator depressus</i>	Vulnerable Migratory, Marine	Schedule 3	VU	High
Airlie Island Ctenotus	<i>Ctenotus angusticeps</i>	Vulnerable	Schedule 3	VU	Medium
Pilbara Olive Python	<i>Liasis olivaceus barroni</i>	Vulnerable	Schedule 3	VU	Medium
Olive Sea Snake	<i>Aipysurus laevis</i>	Marine	-	-	High
North-western Mangrove Sea Snake	<i>Ephalophis greyae</i>	Marine	-	-	Recorded
Black-ringed Sea Snake	<i>Hydrelaps darwiniensis</i>	Marine	-	-	Recorded
Lined Soil-Crevise Skink	<i>Notoscincus butleri</i>			Priority 4	Recorded

4 DISCUSSION

4.1.1 HABITAT TYPES

All habitat types identified during the previous surveys were assessed as relatively common and not unique to the study area (HGM *et al.* 2001).

They can be summarised, and when combining similar habitats between the two baseline surveys, identified as eight broad fauna habitat types:

- Mangroves
- Dunes
- Samphire
- Cracking Clay
- Stony spinifex plain and lower hills
- Hilltops/hillslopes and outcrops
- Drainage lines (major and minor)
- Sandplain

None of the above habitat types are unique to the study area and are found across the wider region.

4.1.2 SUITABILITY OF PREVIOUS SURVEYS

The previous survey were undertaken during optimal timing for fauna activity as per guidelines (EPA and DEC 2010). The baseline survey was completed in April 2000 (HGM *et al.* 2001) with the second phase conducted in September 2008 (Phoenix 2009).

The methodology used during the baseline surveys was adequate with up to nine nights of trapping during the Balmoral South survey (Maunsell 2008) and up to 10 nights of trapping during the phase 2, Cape Preston survey (Phoenix 2009). Database searches completed during this assessment supported the findings of the baseline surveys and updates of species listings were captured.

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APPENDIX ONE CONSERVATION CATEGORIES

Table 8: EPBC Act categories for flora and fauna

EPBC ACT 1999 category	Definition
Extinct	A native species is eligible to be included in the extinct category at a particular time if, at that time, there is no reasonable doubt that the last member of the species has died.
Extinct in the wild	A native species is eligible to be included in the extinct in the wild category at a particular time if, at that time: (a) it is known only to survive in cultivation, in captivity or as a naturalised population well outside its past range; or (b) it has not been recorded in its known and/or expected habitat, at appropriate seasons, anywhere in its past range, despite exhaustive surveys over a time frame appropriate to its life cycle and form.
Critically Endangered (CE)	A native species is eligible to be included in the critically endangered category at a particular time if, at that time, it is facing an extremely high risk of extinction in the wild in the immediate future, as determined in accordance with the prescribed criteria.
Endangered (EN)	A native species is eligible to be included in the endangered category at a particular time if, at that time: (a) it is not critically endangered; and (b) it is facing a very high risk of extinction in the wild in the near future, as determined in accordance with the prescribed criteria.
Vulnerable (VU)	A native species is eligible to be included in the vulnerable category at a particular time if, at that time: (a) it is not critically endangered or endangered; and (b) it is facing a high risk of extinction in the wild in the medium term future, as determined in accordance with the prescribed criteria.
Conservation Dependent	A native species is eligible to be included in the conservation dependent category at a particular time if, at that time: (a) the species is the focus of a specific conservation program the cessation of which would result in the species becoming vulnerable, endangered or critically endangered; or (b) the following subparagraphs are satisfied: (i) the species is a species of fish; (ii) the species is the focus of a plan of management that provides for management actions necessary to stop the decline of, and support the recovery of, the species so that its chances of long term survival in nature are maximised; (iii) the plan of management is in force under a law of the Commonwealth or of a State or Territory; (iv) cessation of the plan of management would adversely affect the conservation status of the species.

Table 9: Conservation codes for Western Australian flora and fauna (DPaW 2015)

Conservation Codes for Western Australian Flora and Fauna	
T	Threatened species* Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i>, and listed under Schedules 1 to 4 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora (which may also be referred to as Declared Rare Flora). • Threatened fauna is that subset of 'Specially Protected Fauna' declared to be 'likely to become extinct' pursuant to section 14(4) of the Wildlife Conservation Act. • Threatened flora is flora that has been declared to be 'likely to become extinct or is rare, or is otherwise in need of special protection' pursuant to section 23F(2) of the Wildlife Conservation Act. The assessment of the conservation status of these species is based on their national extent and ranked according to their level of threat using IUCN Red List categories and criteria as detailed below.

Conservation Codes for Western Australian Flora and Fauna	
CR	Critically Endangered species Threatened species considered to be facing an extremely high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 1 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EN	Endangered species Threatened species considered to be facing a very high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 2 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
VU	Vulnerable species Threatened species considered to be facing a high risk of extinction in the wild. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 3 of the Wildlife Conservation (Specially Protected Fauna) Notice for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
EX	Presumed extinct species Species which have been adequately searched for and there is no reasonable doubt that the last individual has died. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 4 of the Wildlife Conservation (Specially Protected Fauna) for Threatened Fauna and Wildlife Conservation (Rare Flora) Notice for Threatened Flora.
IA	Migratory birds protected under an international agreement Birds that are subject to an agreement between the government of Australia and the governments of Japan (JAMBA), China (CAMBA) and The Republic of Korea (ROKAMBA), and the Bonn Convention, relating to the protection of migratory birds. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 5 of the Wildlife Conservation (Specially Protected Fauna) Notice.
CD	Conservation Dependent fauna Fauna of special conservation need being species dependent on ongoing conservation intervention to prevent it becoming eligible for listing as threatened. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 6 of the Wildlife Conservation (Specially Protected Fauna) Notice
OS	Other specially protected fauna Fauna otherwise in need of special protection to ensure their conservation. Published as Specially Protected under the <i>Wildlife Conservation Act 1950</i> , in Schedule 7 of the Wildlife Conservation (Specially Protected Fauna) Notice
P	Priority species - Possibly threatened species that do not meet survey criteria, or are otherwise data deficient, are added to the Priority Fauna or Priority Flora Lists under Priorities 1, 2 or 3. These three categories are ranked in order of priority for survey and evaluation of conservation status so that consideration can be given to their declaration as threatened flora or fauna. - Species that are adequately known, are rare but not threatened, or meet criteria for near threatened, or that have been recently removed from the threatened list for other than taxonomic reasons, are placed in Priority 4. These species require regular monitoring. - Assessment of Priority codes is based on the Western Australian distribution of the species, unless the distribution in WA is part of a contiguous population extending into adjacent States, as defined by the known spread of locations.
P1	Priority One: Poorly-known species Species that are known from one or a few locations (generally five or less) which are potentially at risk. All occurrences are either: very small; or on lands not managed for conservation, e.g. agricultural or pastoral lands, urban areas, road or rail reserves, gravel reserves and active mineral leases; or otherwise under threat of habitat destruction or degradation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under immediate threat from known threatening processes. Such species are in urgent need of further survey.
P2	Priority Two: Poorly-known species Species that are known from one or a few locations (generally five or less), some of which are on lands managed primarily for nature conservation, e.g. national parks, conservation parks, nature reserves and other lands with secure tenure being managed for conservation. Species may be included if they are comparatively well known from one or more localities but do not meet adequacy of survey requirements and appear to be under threat from known threatening processes. Such species are in urgent need of further survey.
P3	Priority Three: Poorly-known species Species that are known from several locations, and the species does not appear to be under imminent threat, or from few but widespread localities with either large population size or significant remaining areas of apparently suitable habitat, much of it not under imminent threat. Species may be included if they are comparatively well known from several localities but do not meet adequacy of survey requirements and known threatening processes exist that could affect them. Such species are in need of further survey.
P4	Priority Four: Rare, Near Threatened and other species in need of monitoring (a) Rare. Species that are considered to have been adequately surveyed, or for which sufficient knowledge is available, and that are considered not currently threatened or in need of special protection, but could be if present circumstances change. These species are usually represented on conservation lands. (b) Near Threatened. Species that are considered to have been adequately surveyed and that are close to qualifying for Vulnerable, but are not listed as Conservation Dependent. (c) Species that have been removed from the list of threatened species during the past five years for reasons other than taxonomy.
*Species includes all taxa (plural of taxon - a classificatory group of any taxonomic rank, e.g. a family, genus, species or any infraspecific category i.e. subspecies or variety, or a distinct population).	

APPENDIX TWO REGIONAL FAUNA LIST

Table 10: Regional Fauna Species List - Mammals

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
<i>Tachyglossidae</i>												
<i>Tachyglossus aculeatus</i>	Short-beaked Echidna				•	•		•	•			
<i>Dasyuridae</i>												
<i>Dasykaluta rosamondae</i>	Little Red Kaluta				•		•	•	•	•		
<i>Dasyurus hallucatus</i>	Northern Quoll	Endangered	Schedule 2					•	•		•	•
<i>Ningauï timealeyi</i>	Pilbara Ningauï				•				•	•		
<i>Planigale sp.</i>	Pilbara Planigale complex				•		•					
<i>Pseudantechinus woolleyae</i>	Woolley's Pseudantechinus								•			
<i>Sminthopsis macroura</i>	Stripe-faced Dunnart				•	•	•		•	•		
<i>Thylacomyidae</i>												
<i>Macrotis lagotis</i>	Greater Bilby	Vulnerable	Schedule 3									•
<i>Macropodidae</i>												
<i>Lagorchestes conspicillatus leichardti</i>	Spectacled Hare-wallaby			Priority 3					•		•	
<i>Osphranter robustus erubescens</i>	Euro, Biggada				•	•	•	•	•	•		
<i>Osphranter rufus</i>	Red Kangaroo, Malu				•	•	•	•	•			
<i>Petrogale lateralis lateralis</i>	Black-footed Rock-wallaby	Endangered	Schedule 2						•		•	
<i>Petrogale rothschildi</i>	Rothschild's Rock-wallaby							•	•			
<i>Muridae</i>												
<i>Hydromys chrysogaster</i>	Water-rat			Priority 4					•			
<i>Leggadina lakedownensis</i>	Short-tailed Mouse			Priority 4	•				•	•	•	
<i>*Mus musculus</i>	House Mouse				•	•			•	•		
<i>Notomys alexis alexis</i>	Spinifex Hopping-mouse								•			
<i>Pseudomys chapmani</i>	Western Pebble-mound Mouse				•			•	•	•	•	
<i>Pseudomys delicatulus</i>	Delicate Mouse				•				•	•		
<i>Pseudomys desertor</i>	Desert Mouse						•					
<i>Pseudomys hermannsburgensis</i>	Sandy Inland Mouse				•	•	•		•	•		
<i>Pseudomys nanus nanus</i>	Western Chestnut Mouse								•	•		
<i>Rattus rattus</i>	Black Rat							•	•			
<i>Rattus tunneyi tunneyi</i>	Pale Field-rat								•			
<i>Zyzomys argurus</i>	Common Rock-rat						•	•	•			
<i>Leporidae</i>												
<i>*Oryctolagus cuniculus</i>	Rabbit								•			
<i>Rhinonycteridae</i>												
<i>Rhinonicteris aurantia Pilbara form</i>	Pilbara Leaf-nosed Bat	Vulnerable	Schedule 3						•	•	•	•
<i>Megadermatidae</i>												
<i>Macroderma gigas</i>	Ghost Bat	Vulnerable	Schedule 3								•	•
<i>Emballonuridae</i>												
<i>Saccolaimus flaviventris</i>	Yellow-bellied Sheath-tailed Bat						•					
<i>Taphozous georgianus</i>	Common Sheath-tailed Bat						•					
<i>Molossidae</i>												
<i>Chaerephon jobensis colonicus</i>	Greater Northern Free-tailed Bat				•		•					
<i>Ozimops cobourgianus</i>	Northern Coastal Free-tailed Bat			Priority 1	•		•		•	•	•	

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
Vespertilionidae												
<i>Chalinolobus gouldii</i>	Gould's Wattled Bat						•					
<i>Nyctophilus arnhemensis</i>	Arnhem Long-eared Bat				•				•	•		
<i>Nyctophilus sp.</i>							•					
<i>Scotorepens greyii</i>	Little Broad-nosed Bat				•?		•		•	•		
<i>Vespadelus finlaysoni</i>	Finlayson's Cave-bat				•?		•					
Canidae												
<i>Canis dingo</i>	Dingo				•	•	•					
<i>*Vulpes vulpes</i>	Red Fox				•				•	•		
Felidae												
<i>*Felis catus</i>	Cat				•	•	•	•	•			
Bovidae												
<i>*Bos taurus</i>	European Cattle							•	•			
<i>*Ovis aries</i>	Sheep				•							

* Introduced species

?unconfirmed record

Table 11: Regional Fauna Species List - Birds

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et al. 2001)	Shorebird Survey Cape Preston (Hassell 2002)	Balmoral South (Maunsell 2008)	Cape Preston Shorebirds (Bennelongia 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	Birddata (2016)	ALA (2016)	DPaW Database	PMST (2016)
		EPBC Act	WC Act	DPaW											
Dromaiidae															
<i>Dromaius novaehollandiae</i>	Emu				•	•	•			•	•	•	•		
Anatidae															
<i>Cygnus atratus</i>	Black Swan										•				
<i>Tadorna tadornoides</i>	Australian Shelduck										•				
<i>Chenonetta jubata</i>	Australian Wood Duck										•				
<i>Anas superciliosa</i>	Pacific Black Duck				•		•		•		•	•	•		
<i>Anas gracilis</i>	Grey Teal						•				•	•	•		
<i>Aythya australis</i>	Hardhead										•				
Phasianidae															
<i>Coturnix ypsilophora</i>	Brown Quail				•	•	•		•		•	•			
Procellariidae															
<i>Macronectes giganteus</i>	Southern Giant Petrel	Endangered, Migratory, Marine	Schedule 5												•
<i>Puffinus pacificus</i>	Wedge-tailed Shearwater	Migratory, Marine	Schedule 5								•			•	•
<i>Puffinus huttoni</i>	Hutton's Shearwater	Marine	Schedule 2	EN										•	
Podicipedidae															
<i>Tachybaptus novaehollandiae</i>	Australasian Grebe (Black-throated Grebe)				•						•	•	•		
<i>Poliocephalus poliocephalus</i>	Hoary-headed Grebe										•	•	•		
Ciconiidae															
<i>Ephippiorhynchus asiaticus</i>	Black-necked Stork					•		•		•		•			
Threskiornithidae															
<i>Threskiornis spinicollis</i>	Straw-necked Ibis	Marine					•					•	•		
<i>Plegadis falcinellus</i>	Glossy Ibis	Migratory, Marine	Schedule 5											•	
<i>Platalea regia</i>	Royal Spoonbill											•			
Ardeidae															
<i>Nycticorax caledonicus</i>	Nankeen Night Heron (Rufous Night Heron)	Marine			•							•			
<i>Butorides striata</i>	Striated Heron (Mangrove Heron)				•	•					•	•			
<i>Ardea ibis</i>	Cattle Egret	Marine	Schedule 5												•
<i>Ardea pacifica</i>	White-necked Heron				•		•				•	•	•		
<i>Ardea modesta</i>	Eastern Great Egret	Marine	Schedule 5							•	•	•	•	•	•
<i>Ardea novaehollandiae</i>	White-faced Heron				•	•	•				•	•	•		
<i>Ardea garzetta</i>	Little Egret	Marine			•		•		•	•	•	•			
<i>Ardea sacra</i>	Eastern Reef Heron (Eastern Reef Egret)	Marine			•	•		•	•	•	•	•	•		
Pelecanidae															
<i>Pelecanus conspicillatus</i>	Australian Pelican	Marine				•	•		•		•	•	•		
Fregatidae															
<i>Fregata ariel</i>	Lesser Frigatebird	Migratory, Marine	Schedule 5									•			
Sulidae															
<i>Sula leucogaster</i>	Brown Booby	Migratory, Marine	Schedule 5								•				
Phalacrocoracidae															

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et al. 2001)	Shorebird Survey Cape Preston (Hassell 2002)	Balmoral South (Maunsell 2008)	Cape Preston Shorebirds (Bennelongia 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	Birddata (2016)	ALA (2016)	DPaW Database	PMST (2016)
		EPBC Act	WC Act	DPaW											
<i>Phalacrocorax melanoleucos</i>	Little Pied Cormorant										•	•	•		
<i>Phalacrocorax sulcirostris</i>	Little Black Cormorant						•	•			•				
<i>Phalacrocorax varius</i>	Pied Cormorant					•				•	•	•			
<i>Phalacrocorax carbo</i>	Great Cormorant										•				
Anhingidae															
<i>Anhinga novaehollandiae</i>	Australasian Darter										•	•	•		
Pandionidae															
<i>Pandion haliaetus cristatus</i>	Eastern Osprey	Migratory, Marine	Schedule 5		•	•			•	•	•	•	•		•
Accipitridae															
<i>Elanus caeruleus</i>	Black-shouldered Kite					•				•		•			
<i>Hieraaetus morphnoides</i>	Little Eagle						•				•				
<i>Aquila audax</i>	Wedge-tailed Eagle				•	•	•		•	•	•	•	•		
<i>Accipiter fasciatus</i>	Brown Goshawk	Marine			•		•				•				
<i>Circus approximans</i>	Swamp Harrier	Marine								•	•	•			
<i>Circus assimilis</i>	Spotted Harrier				•	•			•		•	•	•		
<i>Milvus migrans</i>	Black Kite						•		•		•	•	•		
<i>Haliastur sphenurus</i>	Whistling Kite	Marine			•		•		•	•	•	•	•		
<i>Haliastur indus</i>	Brahminy Kite	Marine			•	•			•	•	•	•	•		
<i>Haliaeetus leucogaster</i>	White-bellied Sea-Eagle	Marine			•	•	•		•	•	•	•	•		•
Otididae															
<i>Ardeotis australis</i>	Australian Bustard				•		•			•	•	•			
Rallidae															
<i>Porzana pusilla</i>	Baillon's Crake	Marine											•		
<i>Tribonyx ventralis</i>	Black-tailed Native-hen												•		
<i>Fulica atra</i>	Eurasian Coot										•				
Gruidae															
<i>Grus rubicunda</i>	Brolga						•		•	•					
Turnicidae															
<i>Turnix velox</i>	Little Button-quail				•		•		•	•	•	•			
Burhinidae															
<i>Burhinus grallarius</i>	Bush Stone-curlew (Bush Thick-knee)				•						•				
<i>Esacus magnirostris</i>	Beach Stone-curlew (Beach Thick-knee)	Marine			•	•		•			•	•	•		
Haematopodidae															
<i>Haematopus longirostris</i>	Pied Oystercatcher				•	•		•	•	•	•	•	•		
<i>Haematopus fuliginosus</i>	Sooty Oystercatcher							•		•	•	•			
Recurvirostridae															
<i>Himantopus himantopus</i>	Black-winged Stilt	Marine										•			
Charadriidae															
<i>Vanellus tricolor</i>	Banded Lapwing				•	•	•		•						
<i>Pluvialis fulva</i>	Pacific Golden Plover	Migratory, Marine	Schedule 5								•	•	•	•	
<i>Pluvialis squatarola</i>	Grey Plover	Migratory, Marine	Schedule 5			•		•			•	•	•	•	
<i>Charadrius ruficapillus</i>	Red-capped Plover				•	•		•	•	•	•	•	•		

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et al. 2001)	Shorebird Survey Cape Preston (Hassell 2002)	Balmoral South (Maunsell 2008)	Cape Preston Shorebirds (Bennelongia 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	Birddata (2016)	ALA (2016)	DPaW Database	PMST (2016)
		EPBC Act	WC Act	DPaW											
<i>Charadrius mongolus</i>	Lesser Sand Plover	Endangered, Migratory, Marine	Schedule 2, Schedule 5	EN		•		•			•	•	•	•	
<i>Charadrius leschenaultii</i>	Greater Sand Plover	Vulnerable, Migratory, Marine	Schedule 3, Schedule 5	VU	•	•		•	•		•	•	•	•	
<i>Charadrius veredus</i>	Oriental Plover	Migratory, Marine	Schedule 5			•							•		•
<i>Elseyornis melanops</i>	Black-fronted Dotterel				•	•	•		•		•	•	•		
Rostratulidae															
<i>Rostratula benghalensis australis</i>	Australian Painted Snipe	Endangered, Marine	Schedule 2	EN											•
Scolopacidae															
<i>Gallinago stenura</i>	Pin-tailed Snipe	Migratory, Marine	Schedule 5											•	
<i>Limosa lapponica</i>	Bar-tailed Godwit	Migratory, Marine	Schedule 5	VU											
<i>Limosa lapponica menzbieri</i>	Bar-tailed Godwit (Northern Siberian)	Critically Endangered		VU		•		•			•	•	•	•	•
<i>Limosa lapponica baueri</i>	Bar-tailed Godwit (Western Alaskan)	Vulnerable		VU											
<i>Numenius phaeopus</i>	Whimbrel	Migratory, Marine	Schedule 5			•		•	•	•	•	•	•	•	
<i>Numenius madagascariensis</i>	Eastern Curlew	Critically Endangered Migratory, Marine	Schedule 3, Schedule 5	VU	•	•		•	•	•	•	•	•	•	•
<i>Tringa stagnatilis</i>	Marsh Sandpiper	Migratory, Marine	Schedule 5			•		•	•			•	•	•	
<i>Tringa nebularia</i>	Common Greenshank	Migratory, Marine	Schedule 5			•		•		•	•	•	•	•	•
<i>Tringa glareola</i>	Wood Sandpiper	Migratory, Marine	Schedule 5								•			•	
<i>Tringa brevipes</i>	Grey-tailed Tattler	Migratory, Marine	Schedule 5		•	•		•	•			•	•		
<i>Tringa cinerea</i>	Terek Sandpiper	Migratory, Marine	Schedule 5			•						•	•		
<i>Tringa hypoleucos</i>	Common Sandpiper	Migratory, Marine	Schedule 5			•		•		•	•	•	•		
<i>Arenaria interpres</i>	Ruddy Turnstone	Migratory, Marine	Schedule 5		•	•		•			•	•	•	•	
<i>Calidris tenuirostris</i>	Great Knot	Critically Endangered Migratory, Marine	Schedule 3, Schedule 5	VU		•		•			•	•	•	•	
<i>Calidris alba</i>	Sanderling	Migratory, Marine	Schedule 5			•		•			•				
<i>Calidris ruficollis</i>	Red-necked Stint	Migratory, Marine	Schedule 5		•	•		•			•	•	•	•	
<i>Calidris ferruginea</i>	Curlew Sandpiper	Critically Endangered Migratory, Marine	Schedule 3, Schedule 5	VU				•			•	•		•	•
Glareolidae															
<i>Glareola maldivarum</i>	Oriental Pratincole	Migratory, Marine	Schedule 5								•	•	•	•	•
Laridae															
<i>Larus novaehollandiae</i>	Silver Gull	Marine			•	•		•	•	•	•	•	•		•
<i>Sterna nilotica</i>	Gull-billed Tern	Migratory, Marine	Schedule 5			•				•	•	•	•		
<i>Sterna caspia</i>	Caspian Tern	Migratory, Marine	Schedule 5		•	•	•			•	•	•	•	•	
<i>Sterna bergii</i>	Crested Tern	Migratory, Marine			•	•			•		•	•	•		
<i>Sterna bengalensis</i>	Lesser Crested Tern	Marine			•						•	•			
<i>Sterna albifrons</i>	White-shafted Little Tern (Little Tern)	Migratory, Marine	Schedule 5								•				
<i>Sterna nereis</i>	Fairy Tern	Vulnerable	Schedule 3	VU							•	•	•	•	•
<i>Sterna anaethetus</i>	Bridled Tern	Migratory, Marine	Schedule 5		•							•			
<i>Sterna fuscata</i>	Sooty Tern	Marine									•				
<i>Sterna dougallii</i>	Roseate Tern	Migratory, Marine	Schedule 5								•			•	•
<i>Sterna hirundo</i>	Common Tern	Migratory, Marine	Schedule 5								•			•	
<i>Sterna hybrida</i>	Whiskered Tern	Marine									•				
<i>Sterna leucoptera</i>	White-winged Black Tern	Migratory, Marine	Schedule 5									•	•	•	

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		EPBC Act	WC Act	DPaW											
Columbidae															
*Columba livia	Domestic Pigeon (Rock Dove)										•				
Phaps chalcoptera	Common Bronzewing										•	•			
Phaps histrionica	Flock Bronzewing (Flock Pigeon)										•				
Ocyphaps lophotes	Crested Pigeon				•	•	•		•	•	•	•	•		
Geophaps plumifera	Spinifex Pigeon				•	•	•		•	•	•	•	•		
Geopelia cuneata	Diamond Dove				•	•	•		•		•	•	•		
Geopelia striata placida	Peaceful Dove				•		•		•		•	•	•		
Geopelia humeralis	Bar-shouldered Dove				•						•	•	•		
Cuculidae															
Centropus phasianinus	Pheasant Coucal				•				•		•	•	•		
Chrysococcyx basalís	Horsfield's Bronze Cuckoo	Marine			•	•			•			•	•		
Chrysococcyx osculans	Black-eared Cuckoo	Marine			•	•									
Cacomantis pallidus	Pallid Cuckoo	Marine			•	•	•				•				
Strigidae															
Ninox boobook boobook	Southern Boobook	Marine			•								•		
Podargidae															
Podargus strigoides	Tawny Frogmouth				•		•		•		•	•	•		
Caprimulgidae															
Eurostopodus argus	Spotted Nightjar	Marine			•		•		•		•				
Aegothelidae															
Aegotheles cristatus	Australian Owlet-nightjar					•				•	•				
Apodidae															
Apus pacíficus	Pacific Swift (Fork-tailed Swift)	Migratory, Marine	Schedule 5										•	•	•
Alcedinidae															
Dacelo leachii	Blue-winged Kookaburra				•		•		•		•	•			
Todiramphus chloris	Collared Kingfisher				•				•		•	•			
Todiramphus sanctus	Sacred Kingfisher	Marine			•	•	•		•	•	•	•	•		
Todiramphus pyrrhopygius	Red-backed Kingfisher				•	•			•		•	•	•		
Meropidae															
Merops ornatus	Rainbow Bee-eater	Marine			•	•	•		•		•	•	•	•	•
Falconidae															
Falco cenchroides	Australian Kestrel (Nankeen Kestrel)	Marine			•	•	•		•	•	•	•	•		
Falco longipennis	Australian Hobby				•					•	•				
Falco berigora	Brown Falcon				•	•	•		•		•	•	•		
Falco peregrinus	Peregrine Falcon		Schedule 7											•	
Falco hypoleucos	Grey Falcon		Schedule 3	VU						•					
Cacatuidae															
Cacatua roseicapilla	Galah				•	•	•		•	•	•	•	•		
Cacatua sanguinea	Little Corella				•	•	•		•	•	•	•	•		
Nymphicus hollandicus	Cockatiel				•		•		•	•	•	•	•		
Psittacidae															
Platycercus zonarius	Australian Ringneck				•				•	•	•		•		

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et al. 2001)	Shorebird Survey Cape Preston (Hassell 2002)	Balmoral South (Maunsell 2008)	Cape Preston Shorebirds (Bennelongia 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	Birddata (2016)	ALA (2016)	DPaW Database	PMST (2016)
		EPBC Act	WC Act	DPaW											
<i>Melopsittacus undulatus</i>	Budgerigar						•		•		•	•	•		
<i>Pezoporus occidentalis</i>	Night Parrot	Endangered	Schedule 1	VU											•
Ptilonorhynchidae															
<i>Ptilonorhynchus maculatus guttatus</i>	Western Bowerbird									•			•		
Climacteridae															
<i>Climacteris melanurus</i>	Black-tailed Treecreeper												•		
Maluridae															
<i>Malurus lamberti</i>	Variegated Fairy-wren				•	•	•		•	•	•	•	•		
<i>Malurus leucopterus</i>	White-winged Fairy-wren				•	•	•		•	•	•	•	•		
<i>Stipiturus ruficeps</i>	Rufous-crowned Emu-wren				•	•							•		
<i>Amytornis striatus</i>	Striated Grasswren				•								•		
Meliphagidae															
<i>Sugomel niger</i>	Black Honeyeater											•			
<i>Lichmera indistincta</i>	Brown Honeyeater				•	•	•		•	•	•	•	•		
<i>Melithreptus gularis</i>	Black-chinned Honeyeater										•				
<i>Epthianura tricolor</i>	Crimson Chat									•	•	•			
<i>Epthianura crocea</i>	Yellow Chat										•				
<i>Acanthagenys rufogularis</i>	Spiny-cheeked Honeyeater								•						
<i>Manorina flavigula</i>	Yellow-throated Miner				•	•	•		•	•	•	•	•		
<i>Gavicalis virescens</i>	Singing Honeyeater				•	•	•		•	•		•	•		
<i>Ptilotula keartlandi</i>	Grey-headed Honeyeater												•		
<i>Ptilotula penicillata</i>	White-plumed Honeyeater				•				•	•		•	•		
Pardalotidae															
<i>Pardalotus rubricatus</i>	Red-browed Pardalote				•				•		•	•			
<i>Pardalotus striatus</i>	Striated Pardalote												•		
Acanthizidae															
<i>Pyrrholaemus brunneus</i>	Redthroat				•						•				
<i>Smicromis brevirostris</i>	Weebill										•	•			
<i>Gerygone levigaster</i>	Mangrove Gerygone					•							□		
<i>Gerygone fusca</i>	Western Gerygone												•		
<i>Gerygone tenebrosa</i>	Dusky Gerygone				•	•	•		•	•	•	•	•		
Pomatostomidae															
<i>Pomatostomus temporalis</i>	Grey-crowned Babbler				•				•	•	•		•		
Artamidae															
<i>Artamus leucorhynchus</i>	White-breasted Woodswallow				•	•			•		•	•	•		
<i>Artamus personatus</i>	Masked Woodswallow						•				•	•			
<i>Artamus cinereus</i>	Black-faced Woodswallow				•	•	•		•	•		•	•		
<i>Artamus minor</i>	Little Woodswallow						•								
Cracticidae															
<i>Cracticus nigrogularis</i>	Pied Butcherbird				•	•	•		•	•	•	•	•		
<i>Cracticus tibicen</i>	Australian Magpie				•	•	•			•	•				
Campephagidae															
<i>Coracina novaehollandiae</i>	Black-faced Cuckoo-shrike	Marine			•	•	•		•	•	•	•	•		

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		EPBC Act	WC Act	DPaW											
<i>Lalage tricolor</i>	White-winged Triller					•						•	•		
Oreoidae															
<i>Oreica gutturalis</i>	Crested Bellbird				•			•	•	•	•	•	•		
Pachycephalidae															
<i>Pachycephala melanura</i>	Mangrove Golden Whistler				•					•	•	•			
<i>Pachycephala rufiventris</i>	Rufous Whistler							•	•	•	•	•	•		
<i>Pachycephala lanioides</i>	White-breasted Whistler				•	•		•	•	•	•	•	•		
<i>Colluricincla harmonica</i>	Grey Shrike-thrush							•		•	•	•	•		
Rhipiduridae															
<i>Rhipidura leucophrys</i>	Willie Wagtail				•	•	•	•	•	•	•	•	•		
<i>Rhipidura albiscapa</i>	Grey Fantail											•	•		
<i>Rhipidura phasiana</i>	Mangrove Grey Fantail (Mangrove Fantail)				•	•		•	•	•	•	•	•		
<i>Motacilla flava</i>	Yellow Wagtail	Migratory, Marine													•
Monarchidae															
<i>Grallina cyanoleuca</i>	Magpie-lark	Marine			•	•	•	•	•	•	•	•	•		
<i>Myiagra rubecula</i>	Leaden Flycatcher				•										
Corvidae															
<i>Corvus orru</i>	Torresian Crow				•	•	•	•	•	•	•	•	•		
<i>Corvus bennetti</i>	Little Crow				•					•	•	•	•		
Petroicidae															
<i>Melanodryas cucullata</i>	Hooded Robin				•								•		
Alaudidae															
<i>Mirafra javanica</i>	Horsfield's Bushlark				•	•		•		•	•	•	•		
Hirundinidae															
<i>Hirundo rustica</i>	Barn Swallow	Marine													•
<i>Hirundo neoxena</i>	Welcome Swallow	Marine			•		•			•	•	•	•		
<i>Petrochelidon ariel</i>	Fairy Martin				•	•		•				•	•		
<i>Petrochelidon nigricans</i>	Tree Martin	Marine			•	•	•	•				•	•		
Acrocephalidae															
<i>Acrocephalus australis</i>	Australian Reed Warbler												•		
Locustellidae															
<i>Megalurus mathewsi</i>	Rufous Songlark					•		•	•	•	•	•	•		
<i>Megalurus cruralis</i>	Brown Songlark				•	•				•	•	•	•		
<i>Megalurus timoriensis</i>	Tawny Grassbird									•					
<i>Eremiornis carteri</i>	Spinifexbird				•	•		•	•	•			•		
Cisticolidae															
<i>Cisticola exilis</i>	Golden-headed Cisticola												•		
Zosteropidae															
<i>Zosterops luteus</i>	Yellow White-eye (Canary White-eye)				•	•		•		•	•	•	•		
Estrildidae															
<i>Emblema pictum</i>	Painted Finch				•	•		•	•	•	•	•	•		
<i>Neochmia ruficauda</i>	Star Finch									•					

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Shorebird Survey Cape Preston (Hassell 2002)	Balmoral South (Maunsell 2008)	Cape Preston Shorebirds (Bennelongia 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	Birddata (2016)	ALA (2016)	DPaW Database	PMST (2016)
		EPBC Act	WC Act	DPaW											
<i>Taeniopygia guttata</i>	Zebra Finch				•	•	•		•	•	•	•	•		
<i>Heteromunia pectoralis</i>	Pictorella Mannikin											•			
Motacillidae															
<i>Motacilla flava</i>	Yellow Wagtail	Marine													•
<i>Motacilla cinerea</i>	Grey Wagtail	Migratory, Marine													•
<i>Anthus australis</i>	Australian Pipit	Marine			•	•	•		•	•	•	•	•		

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Table 12: Regional Fauna Species List - Reptiles

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
Cheloniidae												
<i>Caretta caretta</i>	Loggerhead Turtle	Endangered Migratory, Marine	Schedule 2	EN					•		•	•
<i>Chelonia mydas</i>	Green Turtle	Vulnerable Migratory, Marine	Schedule 3	VU	•			•	•		•	•
<i>Eretmochelys imbricata</i>	Hawksbill Turtle	Vulnerable Migratory, Marine	Schedule 3	VU					•		•	•
<i>Natator depressus</i>	Flatback Turtle	Vulnerable Migratory, Marine	Schedule 3	VU					•	•	•	•
Dermochelyidae												
<i>Dermochelys coriacea</i>	Leatherback Turtle	Endangered Migratory, Marine	Schedule 3									•
Cheluidae												
<i>Chelodina steindachneri</i>	Flat-shelled Turtle							•				
Carphodactylidae												
<i>Nephurus levis pilbarensis</i>						•	•		•			
<i>Nephurus wheeleri cinctus</i>					•		•		•	•		
Diplodactylidae												
<i>Diplodactylus conspicillatus</i>	Variable Fat-tailed Gecko				•	•	•		•	•		
<i>Diplodactylus galaxias</i>	Northern Pilbara Beak-faced Gecko								•	•		
<i>Diplodactylus mitchelli</i>					•				•	•		
<i>Diplodactylus savagei</i>	Southern Pilbara Beak-faced Gecko				•	•	•					
<i>Lucasium stenodactylum</i>							•		•	•		
<i>Lucasium wombeyi</i>									•	•		
<i>Rhynchoedura ornata</i>	Western Beaked Gecko								•			
<i>Strophurus strophurus</i>							•		•			
Gekkonidae												
<i>Gehyra pilbara</i>					•	•			•	•		
<i>Gehyra punctata</i>					•		•		•	•		
<i>Gehyra purpurascens</i>									•			

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
<i>Gehyra variegata</i>					•	•	•	•	•	•		
<i>*Hemidactylus frenatus</i>	Asian House Gecko								•			
<i>Heteronotia binoei</i>	Bynoe's Gecko				•	•	•	•	•	•		
Pygopodidae												
<i>Delma nasuta</i>					•		•		•	•		
<i>Delma pax</i>					•		•		•	•		
<i>Lialis burtonis</i>					•	•	•		•	•		
<i>Pygopus nigriceps</i>					•	•	•		•	•		
Agamidae												
<i>Ctenophorus caudicinctus caudicinctus</i>					•	•	•	•	•	•		
<i>Ctenophorus isolepis isolepis</i>	Central Military Dragon				•	•	•		•	•		
<i>Ctenophorus nuchalis</i>	Central Netted Dragon				•	•	•		•	•		
<i>Ctenophorus reticulatus</i>	Western Netted Dragon								•			
<i>Gowidon longirostris</i>	Long-nosed Dragon				•	•	•	•	•			
<i>Lophognathus gilberti</i>	Ta-Ta or Gilbert's Dragon				•		•		•	•		
<i>Pogona minor</i>	Western Bearded Dragon				•	•	•		•	•		
<i>Tympanocryptis cephalus</i>	Coastal pebble-mimic dragons				•	•	•		•	•		
Scincidae												
<i>Carlia munda</i>					•		•		•	•		
<i>Carlia triacantha</i>					•		•		•	•		
<i>Cryptoblepharus plagiocephalus</i>					•							
<i>Cryptoblepharus ustulatus</i>							•					
<i>Ctenotus angusticeps</i>	Airlie Island Ctenotus	Vulnerable	Schedule 3									•
<i>Ctenotus duricola</i>					•	•	•		•	•		
<i>Ctenotus grandis titan</i>					•		•		•	•		
<i>Ctenotus hanloni</i>									•			
<i>Ctenotus helenae</i>					•	•	•		•	•		
<i>Ctenotus inornatus</i>								•		•		
<i>Ctenotus pantherinus ocellifer</i>					•	•	•		•	•		
<i>Ctenotus robustus</i>					•	•	•		•	•		
<i>Ctenotus rubicundus</i>							•		•	•		
<i>Ctenotus rufescens</i>						•						
<i>Ctenotus saxatilis</i>	Rock Ctenotus				•	•	•		•			
<i>Ctenotus schomburgkii</i>						•	•					
<i>Ctenotus serventyi</i>					•		•		•			
<i>Ctenotus uber</i>					•		•		•	•		
<i>Cyclodomorphus melanops melanops</i>					•		•		•	•		
<i>Egernia cygnitos</i>	Western Pilbara Spiny-tailed Skink				•		•		•	•		
<i>Eremiascincus isolepis</i>					•	•	•		•	•		
<i>Lerista bipes</i>					•	•	•	•	•	•		
<i>Lerista clara</i>									•			
<i>Lerista elegans</i>					•		•					
<i>Lerista muelleri</i>					•	•	•		•	•		

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
<i>Lerista verhmens</i>									•	•		
<i>Menetia greyii</i>					•	•	•		•	•		
<i>Menetia surda</i>					•				•	•		
<i>Morethia ruficauda exquisita</i>						•	•	•	•	•		
<i>Notoscincus butleri</i>	Lined Soil-Crevice Skink			P4			•				•	
<i>Notoscincus ornatus ornatus</i>						•			•			
<i>Proablepharus reginae</i>					•				•	•		
<i>Tiliqua multifasciata</i>	Central Blue-tongue				•				•	•		
<i>Tiliqua occipitalis</i>	Western Bluetongue								•			
Varanidae												
<i>Varanus acanthurus</i>	Spiny-tailed Goanna				•	•	•		•	•		
<i>Varanus brevicauda</i>	Short-tailed Pygmy Goanna					•	•		•	•		
<i>Varanus eremius</i>	Pygmy Desert Goanna						•		•			
<i>Varanus giganteus</i>	Perentie					•	•		•			
<i>Varanus gouldii</i>	Bungarra or Sand Goanna					•	•					
<i>Varanus panoptes</i>	Yellow-spotted Goanna				•	•	•	•	•			
Typhlopidae												
<i>Aniliios ammodytes</i>					•		•			•		
<i>Aniliios grypus</i>					•	•	•			•		
<i>Aniliios hamatus</i>					•					•		
Pythonidae												
<i>Antaresia perthensis</i>	Pygmy Python				•	•						
<i>Antaresia stimsoni</i>	Stimson's Python				•		•		•			
<i>Aspidites melanocephalus</i>	Black-headed Python				•			•				
<i>Liasis olivaceus barroni</i>	Pilbara Olive Python	Vulnerable	Schedule 3								•	•
Elapidae												
<i>Acanthophis wellsi</i>	Pilbara Death Adder				•	•	•		•	•		
<i>Brachyurophis approximans</i>							•		•	•		
<i>Demansia psammophis cupreiceps</i>					•		•		•	•		
<i>Demansia rufescens</i>	Rufous Whipsnake						•					
<i>Furina ornata</i>	Moon Snake					•	•		•			
<i>Parasuta monachus</i>					•		•		•	•		
<i>Pseudechis australis</i>	Mulga Snake				•	•	•		•			
<i>Pseudonaja mengdeni</i>	Western Brown Snake								•			
<i>Pseudonaja modesta</i>	Ringed Brown Snake						•		•	•		
<i>Pseudonaja nuchalis</i>	Gwardar; Northern Brown Snake				•	•	•					
<i>Suta fasciata</i>	Rosen's Snake						•		•			
<i>Suta punctata</i>	Spotted Snake				•		•		•	•		
<i>Aipysurus laevis</i>	Olive Sea Snake	Marine							•			
<i>Ephalophis greyae</i>	North-western Mangrove Sea Snake	Marine					•					
<i>Hydrelaps darwiniensis</i>	Black-ringed Sea Snake	Marine			•							

Table 13: Regional Fauna Species List - Amphibians

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
Hylidae												
Cyclorana maini	Sheep Frog				•	•		•		•		
Litoria rubella	Little Red Tree Frog				•	•	•	•		•		
Limnodynastidae												
Neobatrachus aquilonius	Northern Burrowing Frog							•	•			
Neobatrachus kunapalari	Kunapalari Frog							•	•			
Notaden nichollsi	Desert Spadefoot							•				
Myobatrachidae												
Uperoleia russelli	Northwest Toadlet				•					•		

Table 14: Regional Fauna Species List - Fish

Family/Genus/Species	Common Name	Conservation Status			Austeel Biological Survey Ph1 (HGM et.al. 2001)	Balmoral South (Maunsell 2008)	Cape Preston (Phoenix 2009)	Northern Quoll (Ecoscape 2016a,b)	NatureMap (2016)	ALA (2016)	DPaW Database (2016)	PMST (2016)
		EPBC Act	WC Act	DPaW								
Terapontidae												
Leiopotherapon aheneus	Fortescue Grunter			Priority 4					•		•	
Leiopotherapon unicolor	Spangled Grunter								•			
Melanotaeniidae												
Melanotaenia australis	Western Rainbowfish								•			

**APPENDIX THREE
SPECIES**

LIKELIHOOD OF CONSERVATION SIGNIFICANT

Table 15: Conservation Significant Fauna Summary

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
Mammals						
<i>Dasyurus hallucatus</i> Northern Quoll	Endangered	Endangered (S2)	-	Rocky areas with associated surface water, typically gorges and Cliffs/Escarpments. Major creeklines are considered suitable habitat however rarely confirmed in the Pilbara.	Record from near Mardie homestead (1957), Fortescue river adjacent to the Fortescue Roadhouse (2007) and further south along the Fortescue river (DPaW Database 2016c).	Recorded Recorded on four motion cameras in the Port area during initial reconnaissance survey (Ecoscape 2016a). Three individuals recorded from the breakwater area during following targeted survey (Ecoscape 2016b).
<i>Petrogale lateralis lateralis</i> Black-footed Rock-wallaby	Endangered	Endangered (S2)	-	Confined to boulder piles, rocky escarpments, gorges and cliff faces.	One record from east of the Fortescue River Roadhouse (1986) (DPaW Database 2016c).	Low Single record from 1986. Now considered to be locally extinct with several populations on nearby off shore islands including Barrow island.
<i>Macrotis lagotis</i> Greater Bilby	Vulnerable	Vulnerable (S3)	-	In the Pilbara often recorded from softer sandier soils with a combination of low <i>Acacia bivenosa</i> , <i>A. stellaticeps</i> and <i>A. trachycarpa</i> (Ecoscape 2016c). Can occur in harder soils associated with drainage lines.	No records from the surrounding region (DPaW 2016b). PMST results indicate that species or species habitat is likely to occur within area (DoEE 2016b).	Very Low No records in the surrounding region. Nearest records associated with the Abydos plain south of Port Hedland.
<i>Rhinonictoris aurantia Pilbara form</i> Pilbara Leaf-nosed Bat	Vulnerable	Vulnerable (S3)	-	Wide ranging forager over open plains and over surface water where available. Very specific roost cave requirements.	Recorded from Mardie station (1990) and two records from fauna surveys conducted in 2015 from 15 km east of the mine area (DPaW Database 2016c).	High Recorded from two locations within 15 km of the mine area. The mine area is likely to only be used as a foraging location due to habitat types that are present (HGM et.al. 2001; Phoenix 2009).
<i>Macroderma gigas</i> Ghost Bat	Vulnerable	Vulnerable (S3)	-	Wide ranging forager across multiple habitat types. Utilises cliff faces with cave structures as feeding roosts, day roost and maternity roosts.	Two records from 30-40 km east of the project in 1997 and 2006 (DPaW Database 2016c).	Medium Due to the wide ranging nature of this species and recent records from the surrounding region, Ghost Bats could be expected to utilise the study area to forage and may utilise feeding roosts and day roosts in the local area.
<i>Ozimops cobourgianus</i> Northern Coastal Free-tailed Bat	-	-	Priority 1	Mangrove areas where they prey on insects in the open air above the canopy.	Several records along the coast towards Karratha between 2000-2009 (DPaW 2016b).	Recorded Recorded from Mangrove habitats in the project area (HGM et.al. 2001; Phoenix 2009) and in similar habitats across the surrounding region.
<i>Lagorchestes conspicillatus leichardti</i> Spectacled Hare-wallaby	-	-	Priority 3	Typically prefers areas with large dense spinifex clumps associated with long unburnt habitats.	One record 20 km east of the project area (1979). Rarely recorded in the Pilbara however populations still persist.	Low No recent records from the regional area. No suitable habitats within the project area (HGM et.al. 2001; Phoenix 2009).
<i>Hydromys chrysogaster</i> Water-rat	-	-	Priority 4	Semi aquatic species that occurs in wetlands (fresh or brackish) and also Mangrove habitats.	One record from Regnard Island (1980) (DPaW 2016b) and several records from coastal areas near the Dampier Peninsular.	High Nearby records and suitable mangrove habitats in the project area (HGM et.al. 2001; Phoenix 2009).
<i>Leggadina lakedownensis</i> Short-tailed Mouse	-	-	Priority 4	In the Pilbara often associated with Cracking clay soils and open grass plains with cracking clay soils.	Recorded several times along the coastal plains adjacent to the project area (DPaW Database 2016c).	Recorded Recorded at three sites during the initial fauna survey (HGM et.al. 2001).
Birds						
<i>Limosa lapponica</i> Bar-tailed Godwit	Migratory, Marine	Migratory (S5)	VU	Breeds in the northern hemisphere. Found mainly in coastal habitats such as large intertidal sandflats, banks, mudflats, estuaries, inlets, harbours, coastal lagoons and bays. It is found often around beds of seagrass and, sometimes, in nearby saltmarsh.	Recorded by Hassell 2002, Bennelongia 2008 and records exist on NatureMap (within 50 km).	Recorded The species was recorded from the vicinity of the study area and habitat is present, however breeding does not occur in the area.
<i>Limosa lapponica menzbieri</i> Bar-tailed Godwit (Northern Siberian)	Critically Endangered	-	VU			
<i>Limosa lapponica baueri</i> Bar-tailed Godwit (Western Alaskan)	Vulnerable	-	VU			
<i>Numenius madagascariensis</i> Eastern Curlew	Critically Endangered Migratory, Marine	Schedule 3/ Schedule 5	VU	Sheltered coasts, estuaries, tidal flats, coastal wetlands, occasionally inland watercourses (Johnstone & Storr 2005).	Recorded during five previous surveys (HGM et al. 2002, Hassell 2002, Bennelongia 2008, Phoenix 2009 and Ecoscape 2016 a,b. The species was also included in the results of the database search result.	Recorded The species is known to occur in the vicinity of the study area and is likely to utilise the wetland habitats on a regular basis.
<i>Calidris tenuirostris</i> Great Knot	Critically Endangered Migratory, Marine	Schedule 3/ Schedule 5	VU	Mainly coastal, most common on northern coasts. Tidal mudflats; sandy ocean and bay shores; estuaries; shallow saline and freshwater wetlands. Breeds in northern hemisphere.	Recorded by Hassell 2002, Bennelongia 2008 and records exist on NatureMap (within 50 km), Birdata (2016) and ALA (2016).	Recorded The species is known to occur in the vicinity of the study area and is likely to utilise the coastal habitats on a regular basis.
<i>Calidris ferruginea</i> Curlew Sandpiper	Critically Endangered Migratory, Marine	Vulnerable (S3) Migratory (S5)	VU	Mainly intertidal mudflats in sheltered coastal areas, wetlands near the coast. Inland - ephemeral and permanent lakes, usually with bare edges of mud or sand.	Species was recorded by Bennelongia in 2008 from the study area and records also exist on NatureMap (2016) in the wider vicinity.	Recorded The species was recorded during one previous survey, records and habitat exist in the vicinity.
<i>Pezoporus occidentalis</i> Night Parrot	Endangered	Critically Endangered (S1)	CR	Mostly ground-dwelling; spinifex grasslands or samphire and chenopod shrublands near waterbodies.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Very Low Habitat is not present within the study area and no records exist in the wider area.
<i>Macronectes giganteus</i> Southern Giant Petrel	Endangered, Migratory, Marine	Migratory (S5)	-	Offshore seas; nests in open vegetation on islands.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Very low The species typically occurs offshore and may occasionally overfly the ocean in the vicinity of the study area.

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Charadrius mongolus</i> Lesser Sand Plover	Endangered, Migratory, Marine	Endangered (S2) Migratory (S5)	EN	Breeds in central and north-eastern Asia, and mostly winters in Australia. Widespread in coastal areas, in WA mainly along northern coasts. Usually occurs in coastal littoral and estuarine environments. Inhabits large intertidal sandflats or mudflats in sheltered bays, harbours and estuaries, and occasionally sandy ocean beaches, coral reefs, wave-cut rock platforms and rocky outcrops.	Species was recorded during the Shorebird survey at Cape Preston (Hassell 2002). Also recorded by Bennelongia (2008) and database searches returned records of the species.	Recorded The species was recorded previously and habitat exists along the coastal areas of the study area.
<i>Rostratula benghalensis australis</i> Australian Painted Snipe	Endangered, Marine	Endangered (S2)	EN	Swamps and permanent water bodies with surrounding vegetation.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Low The species has not been recorded from the study area despite several surveys. Some habitat may be present, however the species prefers dense vegetation cover which is very limited in the study area.
<i>Charadrius leschenaultii</i> Greater Sand Plover	Vulnerable, Migratory, Marine	Vulnerable (S3) Migratory (S5)	VU	Wide, sandy or shelly beaches, sand-spits, tidal mudflats, bare paddocks.	The Greater Sand Plover was recorded during the Austeel Biological Survey (HGM et al. 2001), the Shorebird survey at Cape Preston (Hassell 2002) and during the Balmoral South survey (Maunsell 2008). In addition, Phoenix reported this species as present at the study area.	Recorded Several records and habitat is present along the tidal mudflats and beaches. The species is expected to regularly visit these areas.
<i>Sterna nereis nereis</i> Australian Fairy Tern	Vulnerable	Vulnerable (S3)	VU	Sheltered seas, estuaries, and coastal lakes (Johnstone and Storr 1998).	Several database searches return records of this species in the vicinity (within 50 km of the study area).	High The species is likely to occur along sheltered areas of coastal beaches and estuaries at least on an occasional basis.
<i>Puffinus huttoni</i> Hutton's Shearwater	Marine	Endangered (S2)	EN	Breeds in alpine environments in New Zealand and spends the non-breeding season in Australia.	A few records exist from offshore island within 50 km of the study area (DPaW 2016).	Very Low The species is not likely to occur on the mainland .
<i>Puffinus pacificus</i> Wedge-tailed Shearwater	Migratory, Marine	Migratory (S5)	-	A pelagic, marine species known from tropical and subtropical waters. Breeds throughout its known range, mainly on vegetated islands, atolls and cays, but one colony is known on the Australian mainland. Usually excavates burrows on flat or flattish areas with dense grassy and tussocky vegetation.	Numerous records exist off the shore and on islands in the area. Habitat is present in the marine coastal areas, however the stud area is not expected to impact on those areas.	Low Species is not known to occur along the beaches and costal habitats and is restricted to islands and the open water.
<i>Plegadis falcinellus</i> Glossy Ibis	Migratory, Marine	Migratory (S5)	-	Shallows and adjacent flats of freshwater lakes and swamps; river pool; flooded samphire; sewage ponds. Nest in freshwater/brackish wetlands with tall, dense stands of emergent vegetation and low trees or bushes.	The species has been recorded within 50 km of the study area (DPaW 2016), however records are very sparse.	Low Some habitat exists in the study area, however the species is rarely observed.
<i>Fregata ariel</i> Lesser Frigatebird	Migratory, Marine	Migratory (S5)	-	Offshore seas.	The Birdata database search returned with a record of the species. However, no other records exist in the vicinity of the project.	Very Low The species does not occur on the mainland is very unlikely to occur in the study area.
<i>Sula leucogaster</i> Brown Booby	Migratory, Marine	Migratory (S5)	-	Offshore seas and coastal areas.	Records of the Brown Booby exist on NatureMap from islands around Dampier and Barrow Island.	Very Low The species is unlikely to occur in the study area due to its marine lifestyle.
<i>Pandion haliaetus cristatus</i> Eastern Osprey	Migratory, Marine	Migratory (S5)	-	Sheltered seas around coasts and offshore islands, estuaries, occasionally inland along larger rivers (Johnstone and Storr 1998).	The species is fairly commonly recorded along coastal areas. Records were made during the Austeel Biological Survey (HGM et al. 2001), Shorebird survey (Hassell 2002), baseline survey at Cape Preston (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b).	Recorded The species is known to occur in the study area and is likely to inhabit coastal areas in the vicinity on a permanent basis.
<i>Pluvialis fulva</i> Pacific Golden Plover	Migratory, Marine	Migratory (S5)	-	Coastal regions, sometimes inland, mostly along major river systems or inland wetlands. In WA mostly along north-western coasts. Usually occur on beaches, mudflats and sandflats in sheltered areas, including harbours, estuaries and lagoons, and also in evaporation ponds in saltworks. Also sometimes recorded on islands, sand and coral cays and exposed reefs and rocks.	The Pacific Golden Plover has been recorded along the coast in the wider vicinity (DPaW, ALA, Birdata) with one record from 2001 in the immediate surrounding (DPaW 2016).	High The species has been recorded in the surrounding and is likely to use the coastal habitats of the study areas at least on a occasional basis.
<i>Pluvialis squatarola</i> Grey Plover	Migratory, Marine	Migratory (S5)	-	Coastal areas, islands, near-coastal salt lakes.	The species has been recorded in the study area and surrounding (Hassell 2002, Bennelongia 2008, NatureMap 2016, ALA 2016, Birdata 2016)	Recorded The species has been recorded previously and is likely to regularly use the coastal habitats within the study area.

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Charadrius veredus</i> Oriental Plover	Migratory, Marine	Migratory (S5)	-	Open plains, including samphire; bare rolling country; bare claypans; open ground near inland swamps.	The Oriental Plover was recorded during the Shorebird survey (Hassell 2002).	Recorded The species has been recorded and suitable habitat exists along the coastal habitats within the study area.
<i>Gallinago stenura</i> Pin-tailed Snipe	Migratory, Marine	Migratory (S5)	-	Freshwater swamps, ponds, lakes with sparse to dense grass cover.	Only recorded from DPaW within 50 km of the study area. No other records exist.	Low Records of the species are rare in the region. Some habitat exists within the vicinity, however the species is not expected to occur on a regular basis.
<i>Numenius phaeopus</i> Whimbrel	Migratory, Marine	Migratory (S5)	-	Mainly along northern coasts but occurs in all states and sometimes inland. Often found on intertidal mudflats of sheltered coasts. Also in harbours, lagoons, estuaries and river deltas, often with mangroves, but also open, unvegetated mudflats. Occasionally on sandy/rocky beaches, on coral or rocky islets, or on intertidal reefs and platforms. Breeds in Alaska.	Recorded by Hassell (2002), Bennelongia (2008), Phoenix (2009) and Ecoscape (2016 a, b) from the vicinity of the study area.	Recorded The species is known to occur in the vicinity of the study area and suitable habitat is present.
<i>Tringa stagnatilis</i> Marsh Sandpiper	Migratory, Marine	Migratory (S5)	-	Coastal and inland freshwater and saline wetlands, mangroves, estuaries and sewage ponds. Avoid intertidal mudflats unless well protected.	The Marsh Sandpiper has been recorded from the study area (Hassell 2002, Bennelongia 2008, Phoenix 2009). In addition, database results from the region returned with records.	Recorded The Marsh Sandpiper has been recorded from the study area and suitable habitat is present within coastal habitats.
<i>Tringa nebularia</i> Common Greenshank	Migratory, Marine	Migratory (S5)	-	Intertidal mudflats, estuaries, freshwater and saline wetlands along the coast and inland.	Several records of the species exist from within the study area (Hassell 2002, Bennelongia 2008, Ecoscape 2016b).	Recorded The species is recorded regularly in the area and suitable habitat is present.
<i>Tringa glareola</i> Wood Sandpiper	Migratory, Marine	Migratory (S5)	-	Mainly shallow, fresh waters, river pools, claypans; occasionally brackish swamps; rarely salt lakes, estuaries and intertidal mudflats.	Records of the Wood Sandpiper exist in the region (NatureMap 2016, DPaW database), however records are generally scattered in the wider vicinity.	Medium The species has been recorded occasionally and some limited habitat is present in the brackish water habitats.
<i>Tringa brevipes</i> Grey-tailed Tattler	Migratory, Marine	Migratory (S5)	-	Most coastal regions, but mainly northern Australia. Sheltered coasts with reefs and rock platforms or with intertidal mudflats. Also intertidal rocky, coral or stony reefs, as well as platforms and islets that are exposed at low tide.	The Grey-tailed Tattler has been recorded during previous surveys (HGM et al. 2001, Hassell 2002, Bennelongia 2008 and Phoenix 2009) and database records exist in the area.	Recorded The species is known to occur in the study area and suitable habitat is present along the coast region.
<i>Tringa cinerea</i> Terek Sandpiper	Migratory, Marine	Migratory (S5)	-	Mainly coastal, occasionally inland. Occurs in tidal mudflats, estuaries; shores and reefs of islands; coastal swamps and commercial saltfields. Breeds in the northern hemisphere.	The species was recorded during the Shorebird survey (Hassell 2002) and some database records exist in the area (Karratha).	Recorded The species is known to occur, however the scattered records in the region indicate that the species may only occur infrequently.
<i>Tringa hypoleucos</i> Common Sandpiper	Migratory, Marine	Migratory (S5)	-	Coastal and inland wetlands, with varying levels of salinity; mostly found on muddy margins or rocky shores; rarely mudflats.	The species has been recorded during previous surveys (Hassell 2002, Bennelongia 2008 and Ecoscape 2016b). Some more database records are present.	Recorded The species is recorded regularly in the area and suitable habitat is present.
<i>Arenaria interpres</i> Ruddy Turnstone	Migratory, Marine	Migratory (S5)	-	Mostly coastal, sometimes inland. Strongly prefers rocky shores or beaches where there are large deposits of rotting seaweed. Breeds in the northern hemisphere.	Records exists from previous surveys (HGM et al. 2002, Hassell 2002, Bennelongia 2008 and database search results).	Recorded The species is recorded regularly in the area and suitable habitat is present along the rocky coastal habitats.
<i>Calidris alba</i> Sanderling	Migratory, Marine	Migratory (S5)	-	In WA, most frequently found on southern and south-western coasts. Broad ocean beaches of firm sand where waves ebb and flow, depositing strands and heaps of seaweed; often near river mouths; also inlets, tidal mudflats, lagoons. Breeds in northern hemisphere.	Records exists from previous surveys (Hassell 2002, Bennelongia 2008 and database search results.) in the area.	Recorded The species is recorded regularly in the area and suitable habitat is present along the coast.
<i>Calidris ruficollis</i> Red-necked Stint	Migratory, Marine	Migratory (S5)	-	Costal areas: sheltered inlets, bays, lagoons and estuaries with intertidal mudflats, often near spits, islets and banks; also saline and freshwater inland wetlands.	The species has been recorded during previous surveys (HGM et al. 2001, Hassell 2002, Bennelongia 2008). Some more database records are present.	Recorded The species is recorded regularly in the area and suitable habitat is present along waterways and the coast.
<i>Glareola maldivarum</i> Oriental Pratincole	Migratory, Marine	Migratory (S5)	-	Plains, shallow wet and dry edges in open bare wetlands, tidal mudflats, beaches.	Records of this species were returned during the database searches within 50 km of the study area. No other records exist with one record in the immediate surrounding (DPaW 2016).	Medium The species occurs in the wider area with some closeby records. Suitable habitats are present within the study area.
<i>Sterna nilotica</i> Gull-billed Tern	Migratory, Marine	Migratory (S5)	-	Salt lakes, beaches, estuarine mudflats, sewage farms and floodwater (Birdlife 2016).	The species has been recorded from the study area (Hassell 2002, Ecoscape 2016b) and additional records exist (DPaW 2016, Birdata 2016, ALA 2016).	Recorded The species is recorded regularly in the area and suitable habitat is present along waterways and the coast.

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Sterna caspia</i> Caspian Tern	Migratory, Marine	Migratory (S5)	-	Sheltered coasts, estuaries, tidal flats, coastal wetlands, occasionally inland watercourses (Johnstone and Storr 1998; Pizzey and Knight 2003).	The species has been recorded during previous surveys (HGM et al. 2001, Hassell 2002, Maunsell 2008, Ecoscape 2016b). Some more database records are present.	Recorded The species has been recorded regularly in the study area and suitable habitat is present along waterways and the coast.
<i>Sterna albifrons</i> White-shafted Little Tern (Little Tern)	Migratory, Marine	Migratory (S5)	-	Sheltered seas, estuaries and mangrove creeks.	The species has not been recorded in closeby areas with only two records returning from near Port Hedland (database searches).	Low The species is rarely recorded in the area, however some habitat is present and the species may occur infrequently.
<i>Sterna anaethetus</i> Bridled Tern	Migratory, Marine	Migratory (S5)	-	Offshore seas and coastlines.	The species was recorded during the Austeel survey (HGM et al 2001) and Birdata recorded the Bridled Tern in the region.	Recorded The species was recorded from the vicinity, however the species typically occurs offshore and is not likely to occur frequently in the study area.
<i>Sterna dougallii</i> Roseate Tern	Migratory, Marine	Migratory (S5)	-	Offshore seas.	The species was not recorded during surveys but some regional records exist on NatureMap and the DPaW database.	Very Low The species is rarely recorded in the area, however it is restricted to offshore seas and therefore not likely to occur.
<i>Sterna hirundo</i> Common Tern	Migratory, Marine	Migratory (S5)	-	Sheltered seas and estuaries.	The species was not recorded during surveys but some regional records exist on NatureMap and the DPaW database.	Low The species is rarely recorded in the area, however some habitat is present and the species may occur infrequently.
<i>Sterna leucoptera</i> White-winged Black Tern	Migratory, Marine	Migratory (S5)	-	Mainly estuaries and sheltered seas in north, freshwater lakes and swamps in south.	The species was not recorded during surveys but some regional records exist on NatureMap and the DPaW database. The closest record on NatureMap is from near Port Hedland.	Very Low The species is rarely recorded in the area, however some habitat is present and the species may occur infrequently.
<i>Apus pacificus</i> Pacific Swift (Fork-tailed Swift)	Migratory, Marine	Migratory (S5)	-	Aerial over a variety of habitat types, movements often associated with summer storm fronts (Johnstone and Storr 1998; Pizzey and Knight 2003)	The species was not recorded during surveys but some regional records exist on the Atlas of Living Australia (ALA 2016), DPaW database and PMST.	Medium Records of this species are generally scattered and are in association with storm fronts. The species may occur infrequently, however it is not expected to utilise the habitats of the study area due to its almost entirely lifestyle.
<i>Ardea ibis</i> Cattle Egret	Marine	Migratory (S5)	-	Grassy habitats, shallow wetlands and waterbodies, particularly damp pastures (Johnstone and Storr 1998).	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Low The species is rarely recorded in the area despite a number of surveys conducted previously.
<i>Ardea modesta</i> Eastern Great Egret	Marine	Migratory (S5)	-	Wide range of wetland habitats, including floodwaters, rivers, shallows of wetlands, intertidal mudflats (Johnstone and Storr 1998).	The Eastern Great Egret was recorded during the targeted Northern Quoll survey (Ecoscape 2016b). In addition, the database searches (DPaW, ALA, Birdata, PMST) have also recorded this species.	Recorded The species is known to occur and suitable habitat is present along water courses and wetland habitats.
<i>Sterna bergii</i> Crested Tern	Migratory, Marine	-	-	Strictly coastal, however there are occasional records in the arid interior of Australia (Birdlife 2016).	The species has been recorded during numerous previous surveys (HGM et al. 2001, Hassell 2002, Phoenix 2009). Additionally the database searches returned records of the species.	Recorded The species has been recorded from the study area and habitat is present along the beach and coastal area.
<i>Motacilla flava</i> Yellow Wagtail	Migratory, Marine	-	-	Breeds in Asia and migrates to North America and Alaska. Inhabits a variety of damp and wet habitats with low vegetation. Grassy tundra, hay fields, pastures and meadows, damp steppe.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Very Low Species has not been recorded in the area.
<i>Motacilla cinerea</i> Grey Wagtail	Migratory, Marine	-	-	Inhabits a variety of habitats, including farmlands, forested areas and plantations, fast-flowing mountain streams and forested areas.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Very Low Species has not been recorded in the area.
<i>Threskiornis spinicollis</i> Straw-necked Ibis	Marine	-	-	Variety of wet and dry grassland, pastures, croplands, swamps and lagoons (Birdlife 2016).	The species was recorded during one previous survey (Bennelongia 2008) and NatureMap states that the species is present around Karratha.	Recorded The species is known to occur in the study area and the surrounding. Suitable habitat is present within the study area and the species is likely to occur frequently.
<i>Nycticorax caledonicus</i> Nankeen Night Heron	Marine	-	-	Around permanent water (Birdlife 2016).	The species was recorded during the Austeel Biological Survey (HGM et al. 2001) and birdata included records.	Recorded The species has been recorded and habitat is present along waterways and other coastal habitats in the study area.
<i>Ardea garzetta</i> Little Egret	Marine	-	-	Mudflats, saltwater and freshwater wetlands and mangroves (Birdlife 2016).	The species was recorded during the Austeel Biological Survey (HGM et al. 2001), the Balmoral South survey (Maunsell 2008), Cape Preston survey (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b).	Recorded The species is present at the study area and habitat is suitable in the mangroves, waterways and coastal areas of the study area.
<i>Ardea sacra</i> Eastern Reef Heron	Marine	-	-	Rocky shorelines and coral islands with reefs (Birdlife 2016).	The species was recorded during the Austeel Biological Survey (HGM et al. 2001), Shorebird Survey at Cape Preston (Hassell 2002), Cape Preston survey (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b).	Recorded The species is present at the study area and habitat is suitable along the rocky shoreline of the study area.

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Pelecanus conspicillatus</i> Australian Pelican	Marine	-	-	Widespread on freshwater, estuarine and marine wetlands and waterways (Birdlife 2016).	The species was recorded during Shorebird Survey at Cape Preston (Hassell 2002), Barmoral South survey (Maunsell 2008) and the Cape Preston survey (Phoenix 2009).	Recorded The species is present at the study area and habitat is suitable along the waterways and estuarine, but also the beach front of the study area.
<i>Accipiter fasciatus</i> Brown Goshawk	Marine	-	-	Timbered habitats and forests.	The species was recorded the Austeel Biological Survey (HGM et al. 2001) and Barmoral South survey (Maunsell 2008), in addition to NatureMap records.	Recorded The species is present at the study area and suitable habitat exists within the study area.
<i>Circus approximans</i> Swamp Harrier	Marine	-	-	Terrestrial wetlands and open country.	The Swamp Harrier was recorded during the Northern Quoll survey at Cape Preston (Ecoscape 2016b). There are also NatureMap and Birdata records.	Recorded The species is present at the study area and suitable habitat exists within the study area.
<i>Haliastur sphenurus</i> Whistling Kite	Marine	-	-	Open country in particular around wetlands, also common around farmland and vineyards (Birdlife 2016).	The Whistling Kite is a common species in the Pilbara region and was recorded during the Northern Quoll survey at Cape Preston (Ecoscape 2016b). There are also NatureMap, ALA and Birdata records.	Recorded The Whistling Kite is a commonly seen species in the Pilbara and is expected to frequently visit the open inland habitats of the study area.
<i>Haliastur indus</i> Brahminy Kite	Marine	-	-	Coastal areas, particularly mangroves, swamps and estuaries (Birdlife 2016).	The species was recorded during the Austeel Biological Survey (HGM et al. 2001) and Shorebird Survey (Hassell 2002), Cape Preston survey (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b) in addition to NatureMap and ALA records.	Recorded The Brahminy Kite was recorded several times during surveys between 2002 and 2016 indicating that the species is a permanent resident in the area. Suitable habitat is present along the coastals area and mangroves.
<i>Haliaeetus leucogaster</i> White-bellied Sea-Eagle	Marine	-	-	Offshore islands, coasts, estuaries, coastal lakes. Occasionally inland along larger watercourses (Johnstone and Storr 1998).	The White-bellied Sea-Eagle was recorded during the Austeel Biological Survey (HGM et al. 2001), Shorebird Survey (Hassell 2002), Balmoral South (Maunsell 2008), Cape Preston survey (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b) in addition to NatureMap and ALA records.	Recorded The species is commonly recorded in the region and has been seen during several previous surveys. Suitable habitat is particularly present along waterways and estuaries.
<i>Porzana pusilla</i> Baillon's Crake	Marine	-	-	Wide variety of fresh water, saltwater habitats in both inland and coastal areas. Preference for shallow flooded areas, marshes, swamps, flooded meadows and artificial wetlands.	Records of the Baillon's Crake are very scattered and only one database search has returned this species (AL 2016). No other records exist in the area.	Low The species is rarely recorded in the area, some suitable habitat is present; however typical swamps with dense vegetation are lacking in the study area.
<i>Esacus magnirostris</i> Beach Stone-curlew	Marine	-	-	Undisturbed open beaches, exposed reeds and mangroves.	The Beach Stone-curlew was recorded during a number of previous records and database searches.	Recorded The species has been recorded during previous surveys and suitable habitat is present along the beach area.
<i>Himantopus himantopus</i> Black-winged Stilt	Marine	-	-	Variety of freshwater and saltwater habitats such as marshes, mudflats, shallow edges of lakes and rivers.	The only records of this species in the wider vicinity exist on birdata database. Some more record exist near Karratha and on Barrow Island (NatureMap 2016)	Medium Suitable habitat is present within the study area, however the records of the Black-winged Stilt are rare in the region and the species may only occasionally visit the study area.
<i>Larus novaehollandiae</i> Silver Gull	Marine	-	-	Breeds on offshore islands. Inhabits a variety of habitats including urban environments. Usually seen around saltwater habitats.	The species was recorded during the Austeel Biological Survey (HGM et al. 2001), Shorebird Survey (Hassell 2002), Cape Preston survey (Phoenix 2009) and the Northern Quoll survey (Ecoscape 2016b) in addition to numerous database searches	Recorded The species is a common species along the coast of Western Australia. Habitat is present along the beach and other saltwater habitats.
<i>Sterna bengalensis</i> Lesser Crested Tern	Marine	-	-	Variety of saltwater habitats.	Recorded during the Austeel Biological Survey (HGM et al. 2001) survey and some database records exist (NatureMap and Birdata)	Recorded The species occurs in the study area at least on an occasional basis. Suitable habitat is present along the coast, estuaries and mangrove habitats.
<i>Sterna fuscata</i> Sooty Tern	Marine	-	-	Tropical oceans, marshes and shores.	One database (NatureMap 2016) has recorded this species in the region. No other records exist and the species is generally very rarely seen in Western Australia.	Low Species is rarely recorded, with very scattered records in the area and habitat is not present.
<i>Sterna hybrida</i> Whiskered Tern	Marine	-	-	Shallow terrestrial wetlands, freshwater swamps, brackish and saline lakes.	One database (NatureMap 2016) has recorded this species in the region. No other records exist and the species is generally very rarely seen in Western Australia with a few records around Karratha.	Low Species is rarely recorded, with very scattered records in the area, some habitat may be present along the estuary.
<i>Chrysococcyx basalís</i> Horsfield's Bronze Cuckoo	Marine	-	-	Parasites bird species building dome nests. Variety of habitat, usually lightly wooded.	The Horsfield's Bronze Cuckoo is regularly seen in the region with records from previous surveys HGM et al. 2001, Hassell 2002 and Phoenix 2009. Birdata and ALA have also returned some records.	Recorded The species is known to occur and inhabits a variety of habitats in the study area.
<i>Chrysococcyx osculans</i> Black-eared Cuckoo	Marine	-	-	Drier country with mulga and mallee open woodlands and shrublands.	The species has been recorded in the region with records from HGM et al. 2001 and Hassell 2002. Birdata and ALA have also returned some records.	Recorded The species is known to occur and inhabits a variety of habitats in the study area.

Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Cacomantis pallidus</i> Pallid Cuckoo	Marine	-	-	Subtropical and tropical dry forests and mangrove forests.	The Pallid Cuckoo is common in Western Australia and has been recorded during previous surveys (HGM et al. 2001, Hassell 2002 and Maunsell 2008.	Recorded The species is known to occur in the area and the study area and habitat exists.
<i>Ninox boobook boobook</i> Southern Boobook	Marine	-	-	Wide range of habitats, from forest and open woodland to scrubland and semi-desert areas.	The species was recorded during one previous record (HGM et al. 2001) and was included in one database return (ALA 2016)	Recorded The species is known to occur and inhabits a variety of habitats in the study area.
<i>Eurostopodus argus</i> Spotted Nightjar	Marine	-	-	Variety of tree-studded areas with suitable hollows, also visits open country.	The Spotted Nightjar has been recorded from the study area and the region.	Recorded The species is known to occur and inhabits a variety of habitats in the study area.
<i>Todiramphus sanctus</i> Sacred Kingfisher	Marine	-	-	Paperbark forest, tall open eucalypt forest and melaleuca forest.	The species has been recorded from several previous surveys and databases.	Recorded The Sacred Kingfisher is known to occur and is likely a permanent resident of the study area. Suitable habitat is present along waterways and drainage lines.
<i>Merops ornatus</i> Rainbow Bee-eater	Marine	-	-	Range of woodlands and shrublands, open forests and cleared areas, prefers drainage lines and vicinity of water.	Recorded during several previous surveys and database searches.	Recorded The Rainbow Bee-eater is known to occur in the study area and inhabits a variety of habitats, in particular wooded areas and water ways, but also shrublands.
<i>Falco cenchroides</i> Australian Kestrel (Nankeen Kestrel)	Marine	-	-	Lightly wooded areas and open agricultural regions.	The species has been recorded from several previous surveys and databases.	Recorded The species is known to occur and inhabits a variety of habitats in the study area, in particular open grassland and lightly wooded areas.
<i>Coracina novaehollandiae</i> Black-faced Cuckoo-shrike	Marine	-	-	Lightly wooded areas, drainage lines and open woodland.	The species has been recorded from several previous surveys and databases.	Recorded The species occurs in the study area and surrounding and suitable habitat is present.
<i>Grallina cyanoleuca</i> Magpie-lark	Marine	-	-	Almost any habitat except rainforests.	The species has been recorded from several previous surveys and databases.	Recorded The species occurs in the study area and surrounding and suitable habitat is present.
<i>Hirundo rustica</i> Barn Swallow	Migratory, Marine	-	-	Often found in human-built artificial structures, great variety of habitats.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area.	Very Low Species has not been recorded in the area.
<i>Hirundo neoxena</i> Welcome Swallow	Marine	-	-	Almost all habitats. Common visitors to coastal and wetland areas.	Species has been recorded within the study area and is known to occur in the area (surveys and database searches)	Recorded The species is known to occur and suitable habitat is present in particular around wetland areas.
<i>Petrochelidon nigricans</i> Tree Martin	Marine	-	-	Open woodland near water, also human habitations including towns and cities.	The species has been recorded from several previous surveys in the area and databases searches within 50 km of the study area.	Recorded The species is known to occur at the study area and vicinity, suitable habitat is present.
<i>Anthus australis</i> Australian Pipit	Marine	-	-	Open country, range of wet heath habitats and dry shrublands.	The species has been recorded from several previous surveys in the area and databases searches within 50 km of the study area.	Recorded The species is known to occur at the study area and vicinity, suitable habitat is present.
<i>Falco peregrinus</i> Peregrine Falcon	-	Other Protected Fauna (S7)	-	Prefers wide-open spaces, in particular near coasts or drainage lines where birds are common.	One database search returned a record of the Peregrine Falcon (DPaW database), no other records exist.	Medium The species may use the study area occasionally as a hunting ground, however sightings in the area are rare and no breeding habitat exists.
<i>Falco hypoleucos</i> Grey Falcon	-	Vulnerable (S3)	VU	Lightly wooded coastal and riverine plains.	The species has been recorded from the study area and suitable hunting habitat is present. Three individuals recorded during the targeted Northern Quoll survey (Ecoscape 2016b). However no breeding habitat is expected to be impacted by the project.	Recorded The species is known to hunt within the study area and suitable habitat exists.
Reptiles	-		-			
<i>Caretta caretta</i> Loggerhead Turtle	Endangered, Migratory, Marine	Endangered (S2)	EN	In Australia they occur in coral reefs, bays and estuaries.	Three database search returned a record of this species (NatureMap 2016, DPaW search and PMST). Several records on NatureMap exist within the study area and surrounding.	High The species has been recorded frequently in the area and suitable habitat exists along the coast and in the estuary areas. In particular the sandy beaches may be used for nesting.
<i>Chelonia mydas</i> Green Turtle	Vulnerable Migratory, Marine	Vulnerable (S3)	VU	Shallow, coastal water with seagrass.	The species was recorded from one recent survey (Ecoscape 2016b) from the study area. NatureMap and DPaW database search also included some records.	Recorded The species has been recorded from the estuary/reef area of the study area and is likely to occasionally use the coastal areas. . In particular the sandy beaches may be used for nesting.

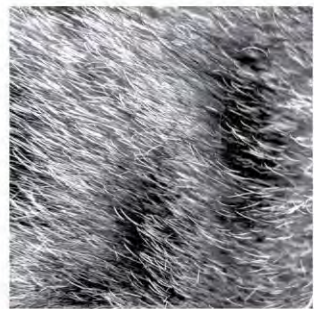
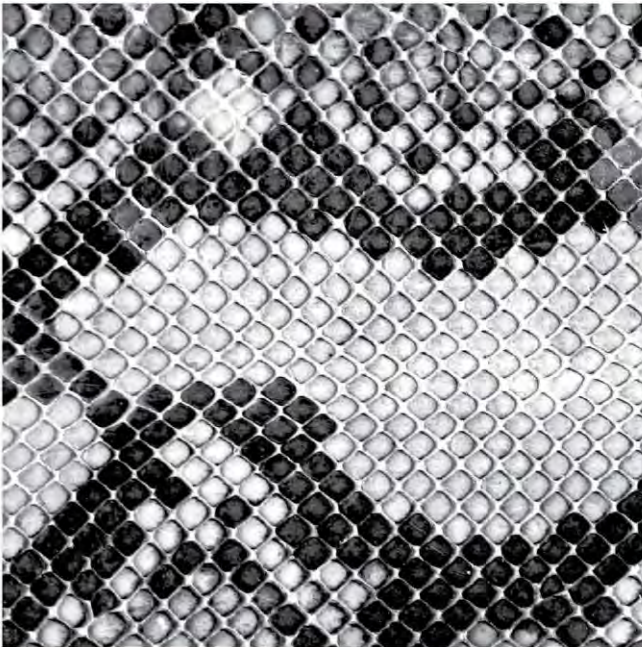
Species Name	Conservation Status			Habitat	Previous Records	Likelihood of Occurrence
	EPBC Act	WC Act	DPaW			
<i>Eretmochelys imbricata</i> Hawksbill Turtle	Vulnerable Migratory, Marine	Vulnerable (S3)	VU	Lagoons and mangrove swamps in estuaries.	Three database search returned a record of this species (NatureMap 2016, DPaW search and PMST). Several records on NatureMap exist within the study area and surrounding.	High The species has been recorded frequently in the area and suitable habitat exists along the coast and in the estuary areas. In particular the sandy beaches may be used for nesting.
<i>Natator depressus</i> Flatback Turtle	Vulnerable Migratory, Marine	Vulnerable (S3)	VU	Subtidal and soft-bottomed habitats, sandy beaches and shallow coastal waters.	All databases consulted returned with records of the species. Several records exist in the vicinity of the study area.	High The species has been recorded frequently in the area and suitable habitat exists along the coast and in the estuary areas. In particular the sandy beaches may be used for nesting.
<i>Dermochelys coriacea</i> Leatherback Turtle	Endangered Migratory, Marine	Vulnerable (S3)	VU	Highly pelagic, can be seen closer to shore during nesting season.	Protected Matter Search Tool (PMST) database return states that “species or species habitat may occur within area”. No other records known from the area. NatureMap states that one record was made from near Barrow Island.	Low Highly pelagic lifestyle, despite the lack of records still a potential for it to occur.
<i>Ctenotus angusticeps</i> Airlie Island Ctenotus	Vulnerable	Vulnerable (S3)	VU	Landward fringe of salt marsh communities in samphire shrubland or marine couch grassland in the intertidal zone along mangrove (Grey Mangrove (<i>Avicennia marina</i>) with occasional Red Mangrove (<i>Rhizophora stylosa</i>)) margins, however, subtle differences in vegetation/topography exist among sites where the species has been recorded (Maryan <i>et al.</i> 2013; Turpin & Ford 2011).	Recorded from along the Pilbara coast from Airlie Island, across to Broome. (Maryan <i>et al.</i> 2013; Turpin & Ford 2011).	Medium No records from recent projects however project area located within the current distribution and suitable habitat is present within the project area. Previous surveys predated recent increase in knowledge of distribution.
<i>Liasis olivaceus barroni</i> Pilbara Olive Python	Vulnerable	Vulnerable (S3)	VU	Watercourses and areas of permanent water in rocky gorges, escarpments and gullies.	Recorded from 2km south of Fortescue River Roadhouse (2015) (DPaW Database 2016c). The Dampier population has been the focus of previous work on the Pilbara Olive Python (Pearson 2006) and the species was recorded frequently in this area. However, no other records are known from the vicinity of the study area.	Medium The species has been recorded in the wider vicinity, however records are rare patchy and despite numerous surveys in the study area the species has not been recorded. Suitable habitat is limited within the study area.
<i>Aipysurus laevis</i> Olive Sea Snake	Marine	-	-	Lower reed edges and upper lagoon slopes.	Records exist from within 5 km of the study area (NatureMap 2016). Some more records exist around Dampier.	High The species has been recorded in the vicinity and suitable habitat is present.
<i>Ephalophis greyae</i> North-western Mangrove Sea Snake	Marine	-	-	Shallow flats, in mangroves and estuarine mudflats, also enters salt flats at low tide	Recorded during the Cape Preston survey (Phoenix 2009), however no other records are known from the vicinity.	Recorded The species was recorded during one previous survey, some habitat is present in the vicinity.
<i>Hydrelaps darwiniensis</i> Black-ringed Sea Snake	Marine	-	-	Shallow tropical marine environments, coral reefs and mangrove swamps up to 10m deep. They also inhabit sandy beaches, coral islands and occasionally low hanging trees.	Recorded during the Austeel Biological Survey (PHGM et al 2001), however no other records are known from the vicinity.	Recorded The species was recorded during one previous survey, some habitat is present in the vicinity.
Lined Soil-Crevice Skink <i>Notoscincus butleri</i>			Priority 4	Associated with stony/rocky, spinifex-dominated areas near creek and river margins, but also found on plains.	Recorded from three sites during the Baseline Cape Preston survey (Phoenix 2009), however the closest NatureMap records are 40 km from the study area.	Recorded The species was recorded during one previous survey, some habitat is present in the vicinity in the form of rocky plains adjacent to creeklines.
Fish						
<i>Leiopotherapon aheneus</i> Fortescue Grunter	-	-	Priority 4	Endemic species to the Pilbara region. Permanent water pools or streams.	The species is known to occur along the Fortescue River with the closest record from 25 km south-west of the study area (NatureMap 2016).	Low The species is associated with the Fortescue River. Some habitat may be occasionally present when conditions are suitable (very wet season), however the likelihood of the species to occur is low.



Cape Preston Northern Quoll Reconnaissance Survey

CITIC Pacific Mining Management

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- Site Environmental staff Daniel Statham, Harley Barron and Tom Wang (CITIC Pacific)
- Senior Environmental Adviser Brendan White (CITIC Pacific)
- Associated and Mining Lead Mat Brook (Strategen)

EXECUTIVE SUMMARY

CITIC Pacific Mining Management has developed the Sino Iron Project at Cape Preston. The Sino Iron project is the largest magnetite mining and processing operation in Australia. The project has developed via a staged approach and the work to which this proposal relates is the Stage 3 Sino Iron extension areas (study area).

Ecoscape was engaged to conduct a Northern Quoll reconnaissance survey of the Stage 3 extension of the Sino Iron project at Cape Preston. The scope of work includes a reconnaissance survey to determine the occurrence of Northern Quoll (*Dasyurus hallucatus*) and map all areas of suitable habitat.

The methodology for the Northern Quoll reconnaissance survey followed the Commonwealth Department of the Environment (DotE) EPBC Act Referral guideline for the Northern Quoll, *Dasyurus hallucatus* (DotE 2016).

The current guidelines state that Northern Quoll reconnaissance surveys can be conducted at any time of year and that the main objective of the survey is to both, detect the Northern Quoll and to assess the suitability of the habitats in the study area for Northern Quoll. Detection methods are recommended to include the use of baited motion cameras and active scat searches with additional techniques such as spot lighting included if required. Habitat assessments should also be conducted.

Ecoscape completed a preliminary desktop assessment to identify and map potential Northern Quoll habitat. Subsequently a reconnaissance survey was undertaken to ground-truth and refine any habitats identified during the desktop assessment. During this survey, scat searches were carried and a total of 60 motion cameras were set-up for approximately 20 days.

The reconnaissance survey identified 49.75 ha of potential habitat (including denning, foraging and dispersal). Of these, 2.57 ha are potential denning habitat (boulder piles), 34.26 ha were potential dispersal/foraging habitat (major creekline), 12.86 ha of habitat was assessed to be potential dispersal habitat (minor creeklines), 0.07 ha were assessed as potential foraging habitat (low laying boulders).

Northern Quolls were recorded from four locations in the northern sections of the study area (port area). Two locations were located in a water seep with associated denning habitat, which is adjacent to the dewatering facility and the remaining two were from along the breakwater, which is located north of the current study area.

The mine area was assessed to not contain critical populations as there are no high density populations located in this area and the area isn't considered to be refuge rich. The port area was assessed to contain critical populations as high density populations were recorded and there are areas of refuge rich habitat (man-made) located adjacent to the study area.

Although critical populations were recorded from the port area, the implications of the Northern Quoll habitat being man-made is currently not well understood.

1 INTRODUCTION

CITIC Pacific Mining Management (CPM) has developed the Sino Iron Project at Cape Preston. The Sino Iron project is the largest magnetite mining and processing operation in Australia. The project has been developed via a staged approach and the work to which this report relates is the Stage 3 Sino Iron extension areas (study area) (**Map 1**).

Ecoscape was engaged to conduct a Northern Quoll reconnaissance survey of the Stage 3 extension of the Sino Iron project at Cape Preston. The scope of work was to conduct a reconnaissance survey for the occurrence of Northern Quoll (*Dasyurus hallucatus*) and map all areas of suitable habitat.

The methodology for the Northern Quoll reconnaissance survey followed the methodology outlined in the Department of the Environment (DoE) EPBC Act Referral guideline for the Northern Quoll, *Dasyurus hallucatus* (Department of Environment 2016). The information below has been summarised from the current guidelines (DoE 2016) and provides the basis for the reconnaissance survey methodology used in .

The current guidelines (DoE 2016) state that Northern Quoll reconnaissance surveys can be conducted at any time of year and that the main objective of the survey is to both, detect the Northern Quoll and to assess the suitability of the habitats in the study area for Northern Quoll. Detection methods are recommended to include the use of baited motion cameras and active scat searches with additional techniques such as spot lighting included if required. Habitat assessments should also be conducted to include information on vegetation, potential sheltering sites, fire history, landscape connectivity and condition, presence of introduced predators and grazing history so that habitat quality can be assessed.

The aim of the reconnaissance survey is to determine if Northern Quoll are present within the study area and also whether there is any habitat critical to the survival of the Northern Quoll (critical habitat) present. Critical habitat is defined as:

- Offshore islands where the Northern Quoll is known to exist
- Rocky habitat such as ranges, escarpments, mesas, gorges, breakaways, boulder fields, major drainage lines or treed creek lines
- Structurally diverse woodlands or forest areas containing large diameter trees, termite mounds or hollow logs
- Dispersal and foraging habitat associated with or connecting populations important for the long-term survival of the Northern Quoll.

Populations important for the long-term survival of the Northern Quoll (critical populations) are defined as:

- high density Quoll populations, which occur in refuge-rich habitat critical to the survival of the species, including where cane toads are present
- occurring in habitat that is free of cane toads and unlikely to support cane toads upon arrival i.e. granite habitats in WA, populations surrounded by desert and without permanent water
- subject to ongoing conservation or research actions i.e. populations being monitored by government agencies or universities or subject to reintroductions or translocation.

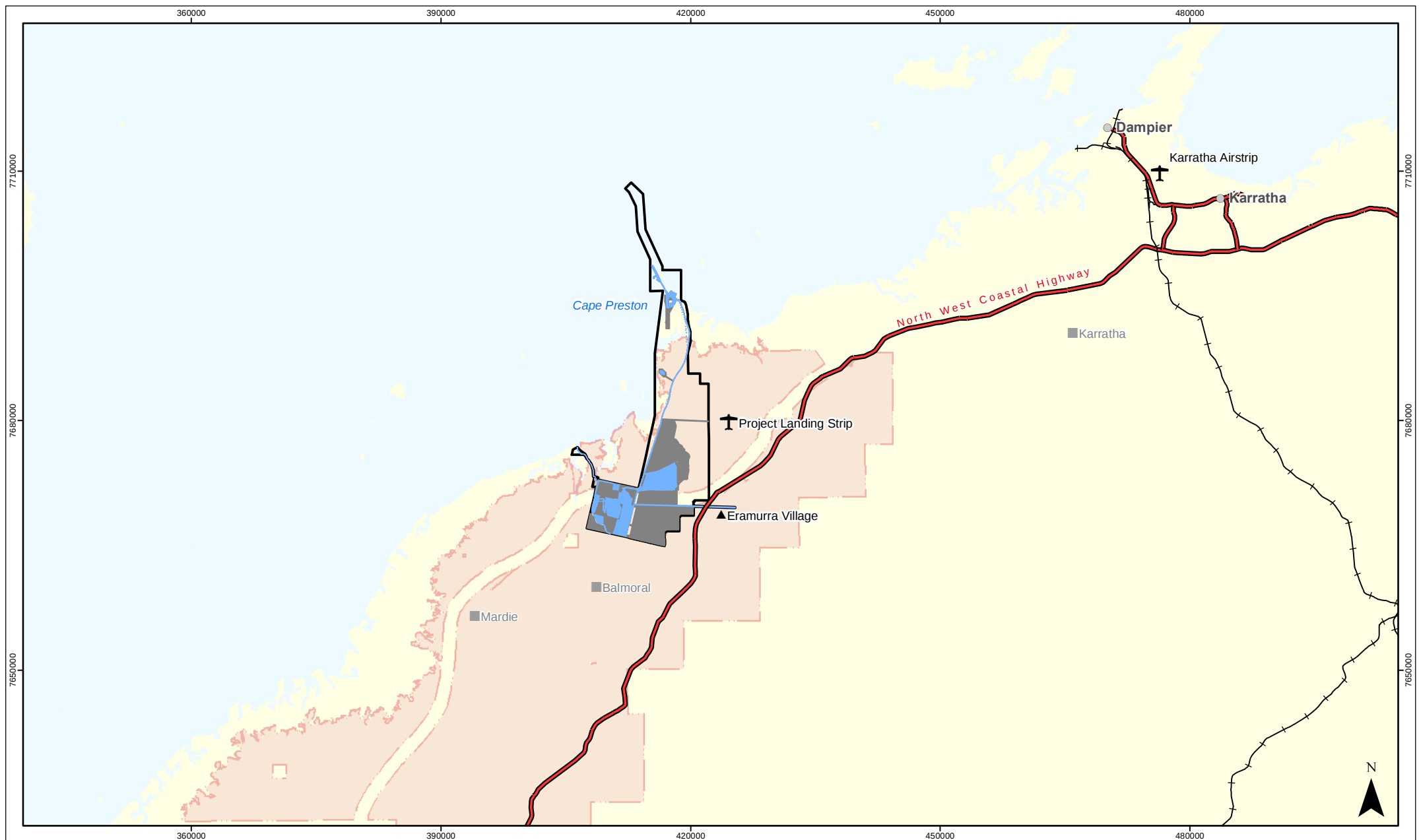
A high density population may be characterised by numerous camera triggers of multiple individuals across multiple cameras and or traps on the site. A low density population may be characterised by infrequent captures of one or two individuals confined to one or two traps or where no trapping has identified a Northern Quoll but latrine evidence remains. Detailed population modelling is not needed to make this assessment as appropriate survey effort will allow the determination of whether the population is of high or low density to be made (DoE 2016).

There are several survey considerations that are included in the referral guidelines with points edited so that only considerations that are relevant to this project (reconnaissance survey) are listed below. How these considerations were addressed by Ecoscape is also included in the below table.

Table 1: Considerations relevant to Northern Quoll reconnaissance surveys (adapted from DotE 2016)

CONSIDERATION	GUIDANCE	ECOSCAPE RESPONSE
Informed project siting and monitoring	Careful survey configuration to address project impact and non-impact zones.	Searches covered the entire Stage 3 extension study area, all of which is proposed to be impacted
Other state and territory guidelines	In WA, conformity with state survey guidelines, statements and operating procedures is recommended (EPA 2004: DEC 2011, EPA and DEC 2010).	All techniques used conform to relevant state guidelines as appropriate.
Timing	Remote cameras can be used at any time of the year but preferably when Northern Quolls are likely to be active and more detectable, i.e. before male die-off. This will depend on the location of your action.	The expected survey timing (April/May 2016) is considered optimal as males are currently beginning to roam in search of suitable females, which allow determination of maximum habitat use for this species.
Animal welfare	Surveys conducted by a suitably qualified person or group of persons with demonstrated skill in mammal surveys.	Ecoscope staff that completed this project are all qualified zoologists and highly experienced surveying for Northern Quoll. Fauna survey licences (SF010801) obtained prior to undertaking field survey.
	Remote cameras should not be baited with food rewards for longer than five consecutive nights to prevent impacts on normal animal behaviour. Scent lures with no associated food reward may be useful, for example burley oil.	All motion cameras were baited with non-food reward lures (burley oil soaked cloth ropes).
Detectability	Where possible, undertake repeat sampling in habitat critical to the survival of the Northern Quoll.	Single survey completed. Motion cameras remained in the field for an extended period (minimum 19 nights).
Site coverage	Cameras should cover all habitat types i.e. shelter and foraging and dispersal habitat. Targeted surveys should then be based on these results.	Motion camera sites were placed so that all habitat types are covered by some motion camera sites, or sections of the site.
Supplementary survey methods	Survey techniques such as latrine searches, employment of detection dogs or hair tubes are recommended for use with remote cameras or trapping to improve detection probability.	Latrine searches were conducted during the field survey. Use of detection dogs and hair-tubes is not considered cost or time effective for this project.
Survey design and effort	Cameras: Transects of ten baited remote motion sensor cameras spaced at least 100 m intervals for four nights is recommended. For linear habitat critical to the survival of the species (e.g. gorges, major drainage lines, breakaways less than 100 m wide), 1 camera per 100 linear metres is recommended	This survey design incorporated this motion camera density where possible however some areas of habitat are not expected to be large enough to allow all 10 cameras to be placed at one site. All cameras were set at 100 m intervals with the number of cameras used dictated by the size of the suitable habitat. A total of 60 cameras were deployed within the study area to maximise survey effort (minimum 1,140 detection nights).
Contribution to knowledge building	Where possible, samples and location data should be provided to institutes and individuals with ongoing research programs with the aim of increasing genetic and spatial knowledge of the Northern Quoll.	All data will be supplied to DPaW as per the requirements of the Regulation 17 permit (permit to take fauna).

CONSIDERATION	GUIDANCE	ECOSCAPE RESPONSE
	In WA, tissue samples (ear clippings) should be collected and sent to the WA Museum with the following details: Weight, sex, pes length (left hind foot measurement), tail diameter / circumference, crown length, reproductive condition, presence/absence of bite marks and parasites, locality (GPS coordinate in lat and long), collector's name and date.	No tissue samples were collected during this reconnaissance survey as no trapping was conducted.



Cape Preston Northern Quoll Reconnaissance Survey

Figure 1

Cape Preston Location Map

0 10 20
 Kilometres
 1:600,000
 Datum: GDA94
 Projection: MGA Zone 50

Department:	ENV	Date:	2/02/2017
Sheet Size:	A4	Status:	Final
Drawn by DS	Requested by MB, Strategen	Internal Reference 4475_00_2017_APP	

Legend

	Development Envelope		Homesteads
	Conceptual Footprint		Railway
	Statement 635 approval (MS635)		Principal Road
	Populated Place		Mardie Station
	Airport		
	Eramurra Village		

2 METHODS

The approach of this assessment consisted of a preliminary desktop habitat assessment based on aerial imagery, onsite reconnaissance survey with habitat assessments and the installation of motion cameras to identify the presence or absence of the Northern Quoll in the study area.

Preliminary desktop habitat assessments were completed using spatial information such as geology and land system maps as well as aerial imagery. Areas of potential habitat were selected based on the likelihood that habitats suitable for the Northern Quoll, as described in **Appendix One**, occurred in each section of the study area.

Based on the current DotE guidelines for Northern Quoll reconnaissance surveys, motion cameras should be established in a variety of Northern Quoll habitat (foraging, dispersal, denning). Motion cameras should also be set-up every 100 m along linear habitats such as breakaways, gorges and drainage lines, and left in place for a minimum of four consecutive nights.

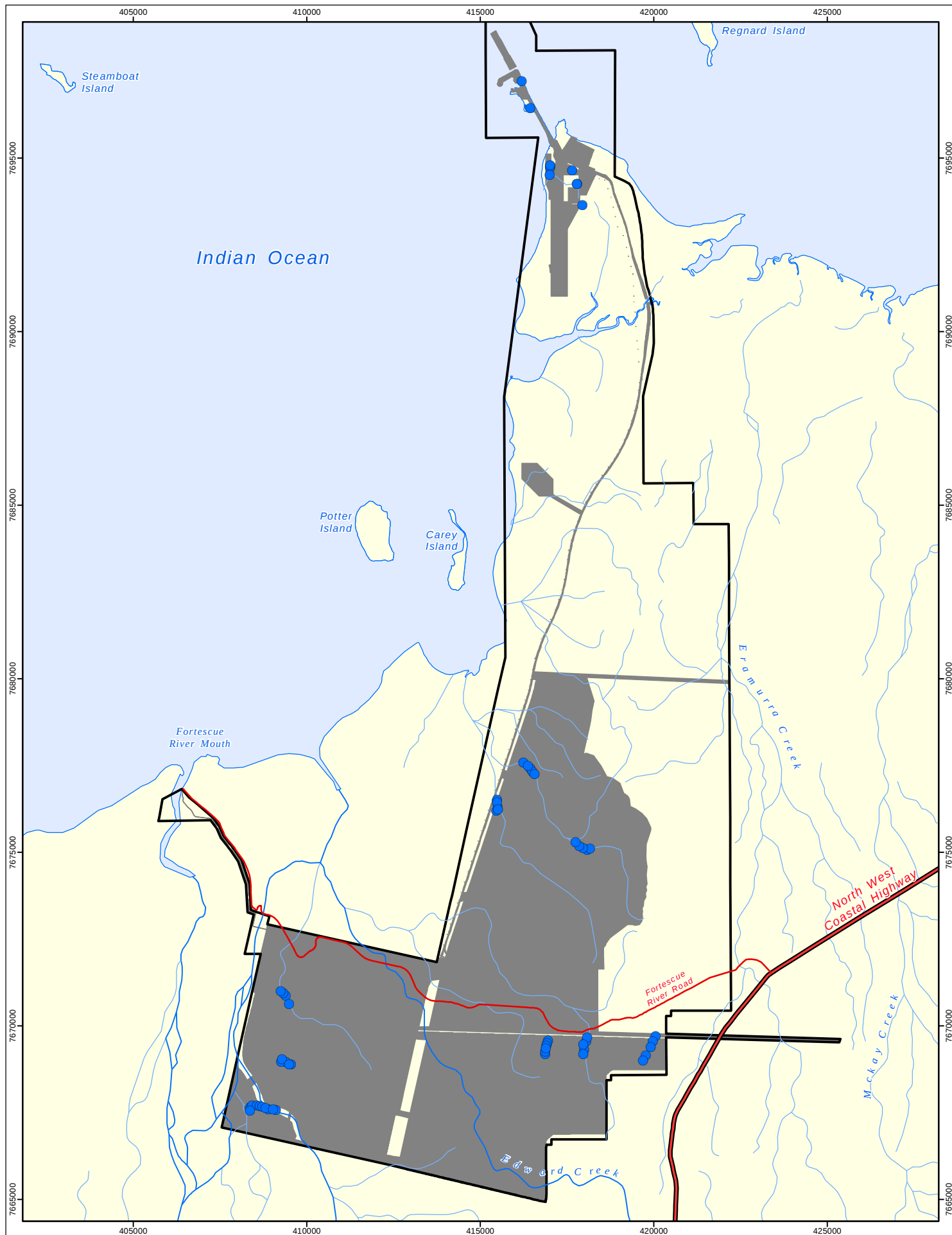
During the current reconnaissance survey a variety of habitats were identified and utilised for motion camera trapping, including potential denning, potential foraging and potential dispersal habitat. The key to describing the suitability of the habitat types is described in **Appendix One** and is based on the Trudgen scale for vegetation condition and the previous Northern Quoll referral guidelines (DSEWPaC 2011; Trudgen 1991).

A total of 60 motion cameras (Reconyx HC500) were established and left in place for between 19 and 21 nights (**Table 6**). Due to updates on the proposed footprint during the duration of the project some of the camera traps were placed in potential habitat outside the current footprint, however this data informs about the distribution of the Northern Quoll in the surrounding area. For each camera trap a scent lure (tuna oil soaked cotton rope) was used to attract fauna such as Northern Quoll (as outlined in the DotE guidelines) (**Plate 1**). At the request of site environment staff two motion cameras were setup along the breakwater at the Port as several staff had reported the presence of Northern Quoll from this area. After three weeks all motion cameras were collected and images analysed for evidence of Northern Quolls.

Habitat assessments were conducted at each motion camera site and also while travelling through the study area. Features such as rocky outcrops, large drainage lines and other features thought to be suitable as Northern Quoll habitat were noted and the preliminary habitat mapping updated in the field.



Plate 1: Motion camera trap setup



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Cape Preston Northern Quoll Reconnaissance Survey

Figure 2

Motion Camera Locations

0 2.5 5
Kilometres
1:140,000
Datum: GDA94
Projection: MGA Zone 50

Department: ENV Date: 2/02/2017

Sheet Size: A4 Status: Draft

Drawn by: CF Requested by: MC, Strategen Internal Reference: 4464_00_2017_APP

Legend

- Camera Locations
- Development Envelope
- Principal Road
- Conceptual Footprint
- Major Road
- Major Creek/River
- Minor Creek/River

3 RESULTS

3.1 HABITAT ASSESSMENT

Northern Quoll habitat was assessed using the categories and criteria as listed in Appendix One. The reconnaissance survey identified a total of 22.96 ha of potential Northern Quoll habitat (denning, foraging and dispersal) across the study area, however the suitability of the habitat was considered of moderate to low quality.

Based on the results of the Northern Quoll reconnaissance survey and habitat assessments, the study area can be separated into two areas; the mine area and the port area. The mine area is considered to be the stage 3 extension areas located south of Cape Preston and associated with the mine pit, processing facilities and waste and tailings storage facilities. The port area is considered to be the stage 3 extension areas located on Cape Preston and are associated with the dewatering facility, desalinisation plant and the port facility.

Potential denning habitat (moderate quality) in the form of rocky boulders was recorded from 2.57 ha of the study area with the majority identified in the mine area (2.45 ha) and a small area recorded from the port area (0.12 ha). Potential dispersal and foraging habitat (low to moderate quality) in the form of major creeklines with large eucalypt trees was the most common habitat, covering 34.26 ha (**Table 2, Plate 2**), of which all was recorded from the mine area. Potential dispersal habitat (low quality) was recorded from minor creeklines covering 12.86 ha of mine area only and covers an additional 0.07 ha (all **Table 2**).

Table 2: Northern Quoll habitat present in the study area

Habitat Type	Quality	Description	Total Extent (ha)	Mine area (ha)	Port area (ha)	Plate #
Potential denning habitat	Moderate	Rocky boulder	2.57	2.45	0.12	Plate 3
Potential dispersal habitat	Low	Minor creekline, no tree hollows and heavily grazed	12.86	12.86	-	Plate 4
Potential dispersal/foraging habitat	Low/Moderate	Major creekline with large eucalypt trees, some tree hollows but lack of understorey. Some grazing evident, water absent	34.26	34.26	-	Plate 2
Potential foraging habitat	Moderate	Boulder fields along rolling, rocky hills	0.07	0.07	-	Plate 5
Total			49.75	49.65	0.12	

The vast majority of the study area is not considered to be suitable Northern Quoll habitat consisting of low open shrubland over low spinifex on flat plains. Although Northern Quoll are capable of moving across this type of landscape, they are not commonly recorded utilising this habitat type and therefore Ecoscape does not consider it to be suitable Northern Quoll habitat.



Plate 2: Potential foraging and dispersal habitat (low to moderate quality)



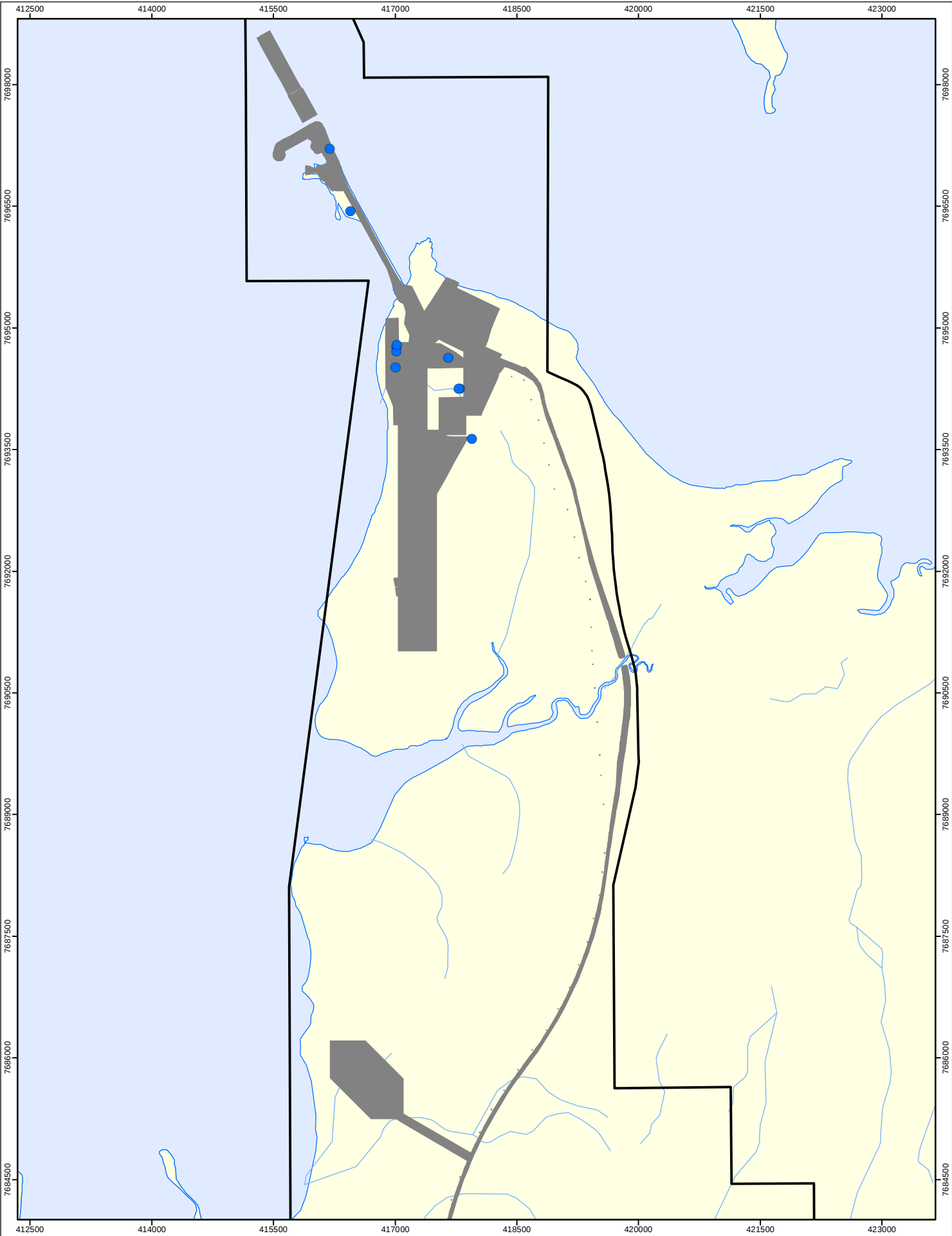
Plate 3: Potential denning habitat recorded in the study area (moderate quality)



Plate 4: Potential dispersal habitat recorded in the study area (low quality)



Plate 5: Potential foraging habitat recorded in the study area (low to moderate quality)





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Cape Preston Northern Quoll Reconnaissance Survey

Figure 3 - 1

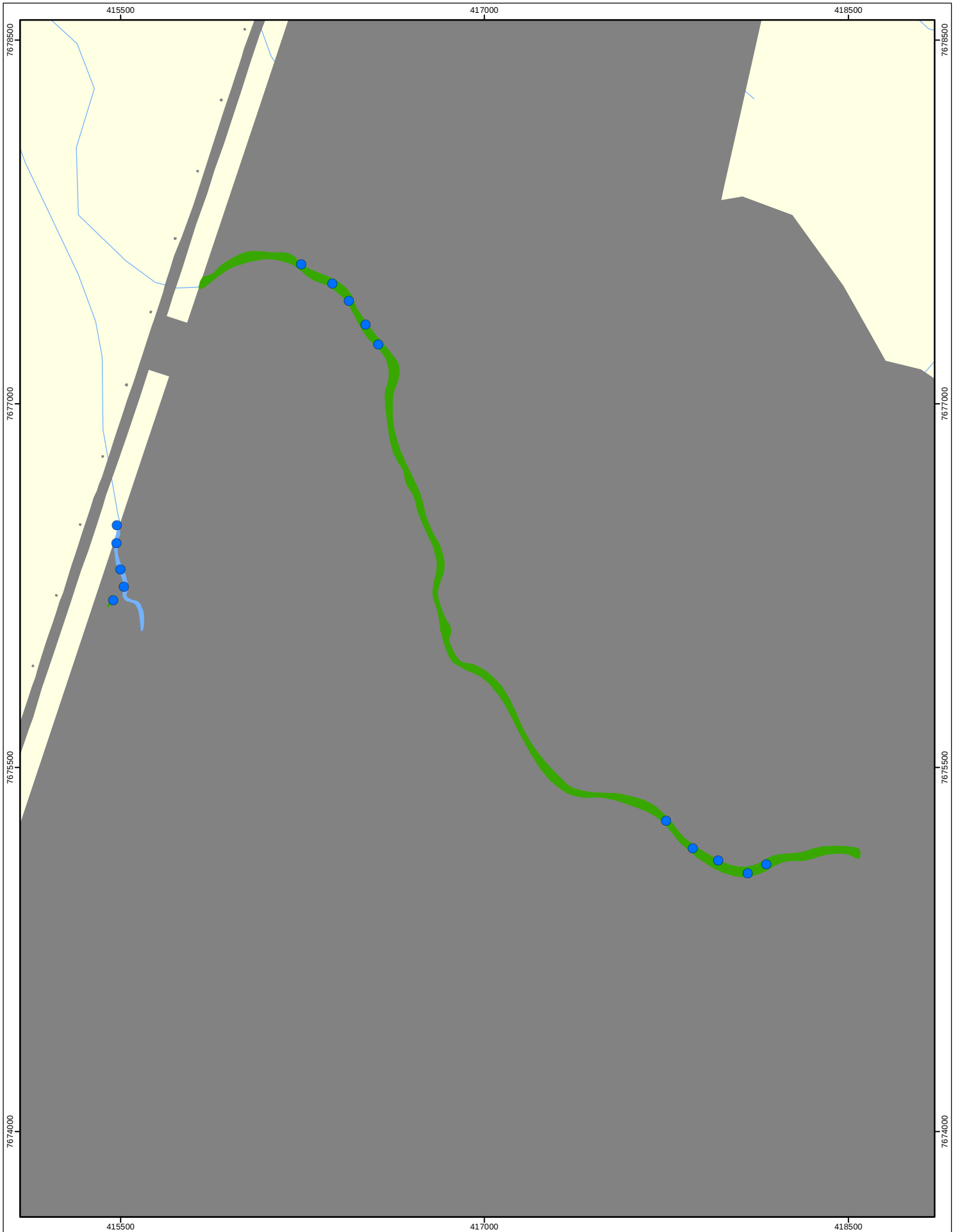
Northern Quoll Habitat

0 1 2
Kilometers
1:60,000
Datum: GDA94
Projection: MGA Zone 50

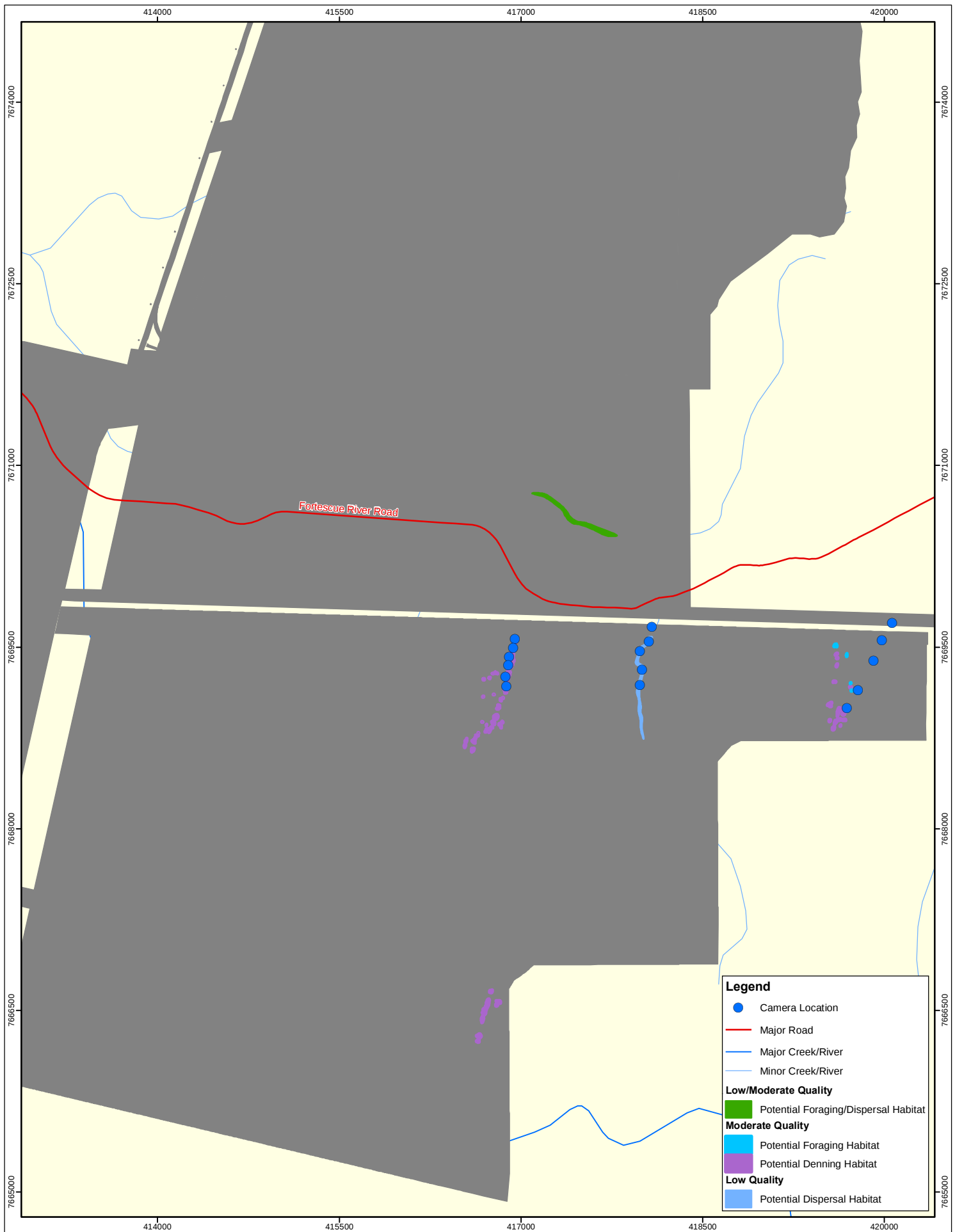
Department:	ENV	Date:	2/02/2017
Sheet Size:	A4	Status:	Final
Drawn by DS	Requested by MC, Strategen	Internal Reference 4469_00_2017_APP	

Legend

- Camera Location
- Development Envelope
- Conceptual Footprint
- Minor Creek/River
- Cape Preston Coast
- Moderate Quality**
- Potential Foraging Habitat
- Potential Denning Habitat



 CITIC PACIFIC MINING 中信泰富矿业	Cape Preston Northern Quoll Reconnaissance Survey Figure 3 - 2 Northern Quoll Habitat		0 250 500 Meters 1:20,000 Datum: GDA94 Projection: MGA Zone 50		Legend ● Camera Location — Minor Creek/River ■ Conceptual Footprint ■ Cape Preston Coast Low/Moderate Quality ■ Potential Foraging / Dispersal Habitat Low Quality ■ Potential Dispersal Habitat
			Department: ENV Date: 2/02/2017		
	Sheet Size: A4 Status: Final				
	Drawn by DS	Requested by MC, Strategen	Internal Reference 4470_00_2017_APP		



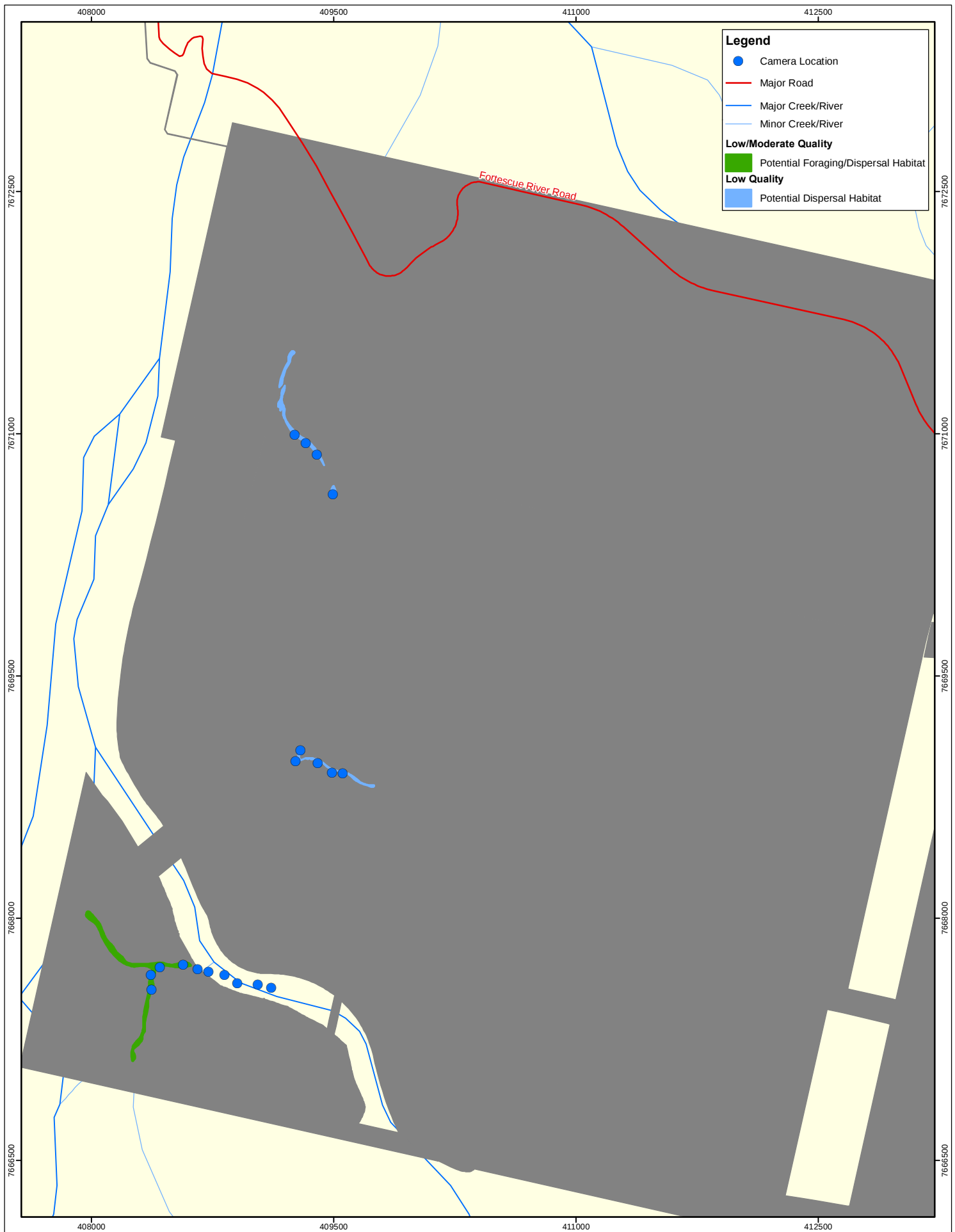
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Cape Preston Northern Quoll Reconnaissance Survey

Figure 3 - 3
Northern Quoll Habitat

0 500 1,000
Meters
1:40,000
Datum: GDA94
Projection: MGA Zone 50

Department:	ENV	Date:	2/02/2017
Sheet Size:	A4	Status:	Final
Drawn by DS	Requested by MC, Strategen	Internal Reference 4471_00_2017_APP	



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Cape Preston Northern Quoll Reconnaissance Survey

Figure 3 - 4
Northern Quoll Habitat

0 375 750
Meters
1:30,000
Datum: GDA94
Projection: MGA Zone 50

Department: ENV Date: 2/02/2017

Sheet Size: A4 Status: Final

Drawn by DS Requested by MC, Strategen Internal Reference 4472_00_2017_APP

3.2 ADDITIONAL NORTHERN QUOLL HABITAT

During the reconnaissance survey CPM environmental staff described several reports from fellow staff relating to Northern Quoll sightings in the vicinity of the Port facility. The Port facility consists of a constructed breakwater that extends for almost 1 km from the mainland and also includes several piles of surplus boulder material. These areas, although constructed by CPM, constitute high quality Northern Quoll denning habitat.



Plate 6: Breakwater wall located at the Port facility



Plate 7: Boulder piles located adjacent to the Port facility (located inside the study area)

3.3 MOTION CAMERA RECORDS

Northern Quolls were recorded from four motion cameras at three locations during the survey (**Map 4**). Two of these sites were located on the breakwater at the Port facility which is located north of the current study area. The remaining two records were made from one location around a small water seep located adjacent to the dewatering facility and is considered to be an area of potential denning habitat (**Plate 8**).



Plate 8: Water seep area located adjacent to the dewatering facility