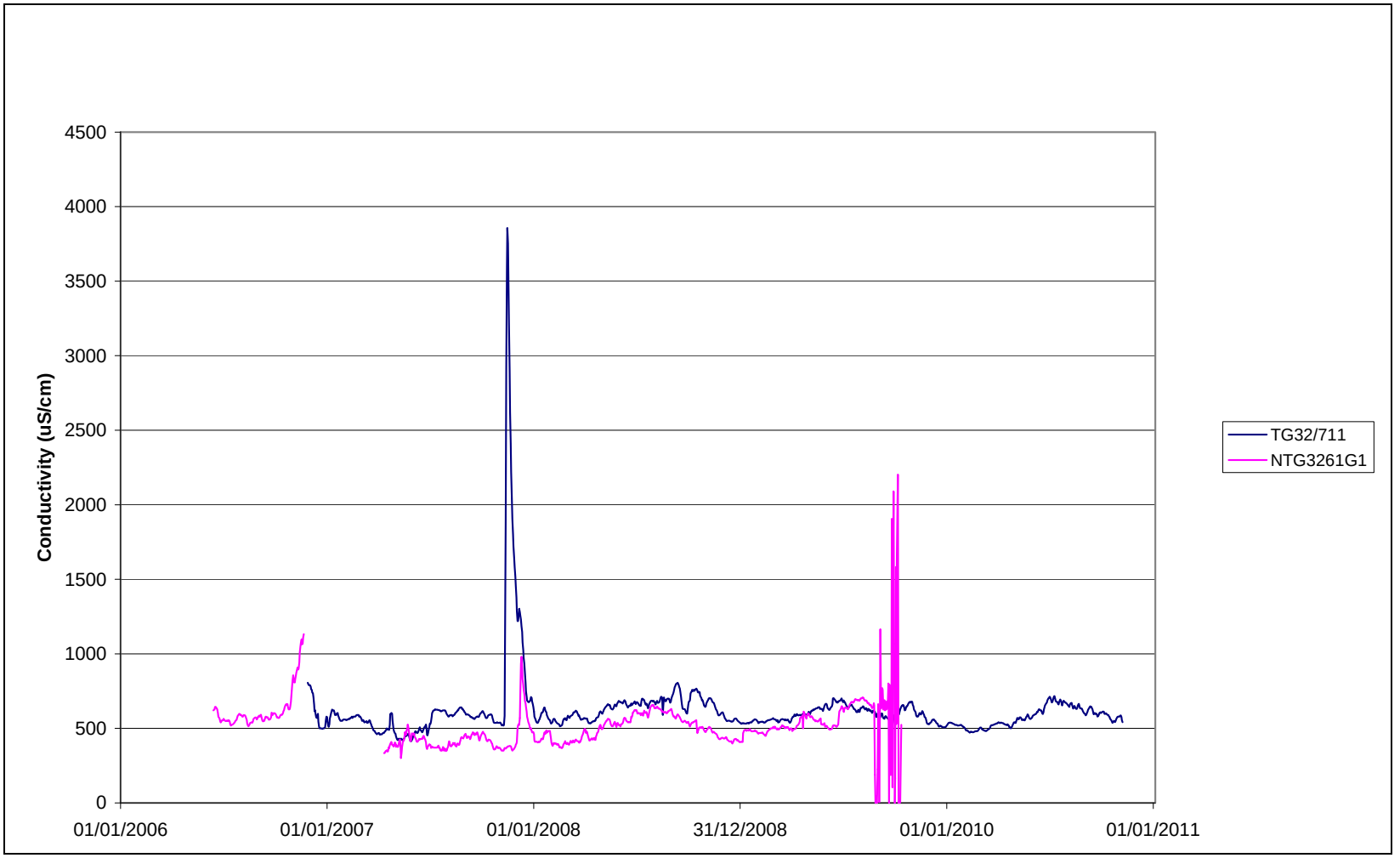


Figure F1 **Water Electrical Conductivity Variations at Two Gaugeboards in the Internal System**

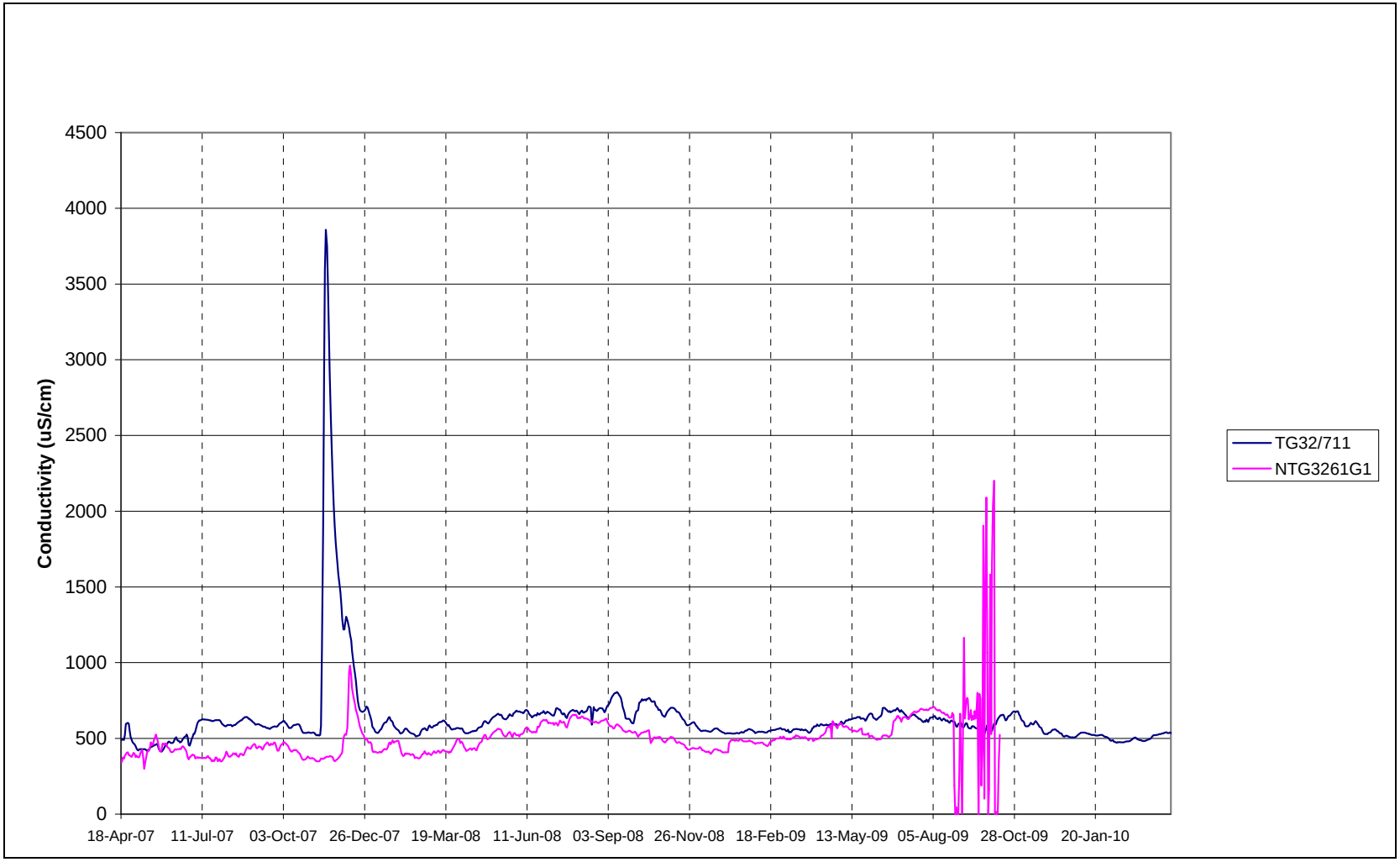


Figure F2 **Water Electrical Conductivity Variations at Two Gaugeboards in the Internal System at Scale for Comparison with TG32/687c (see Figure F3)**

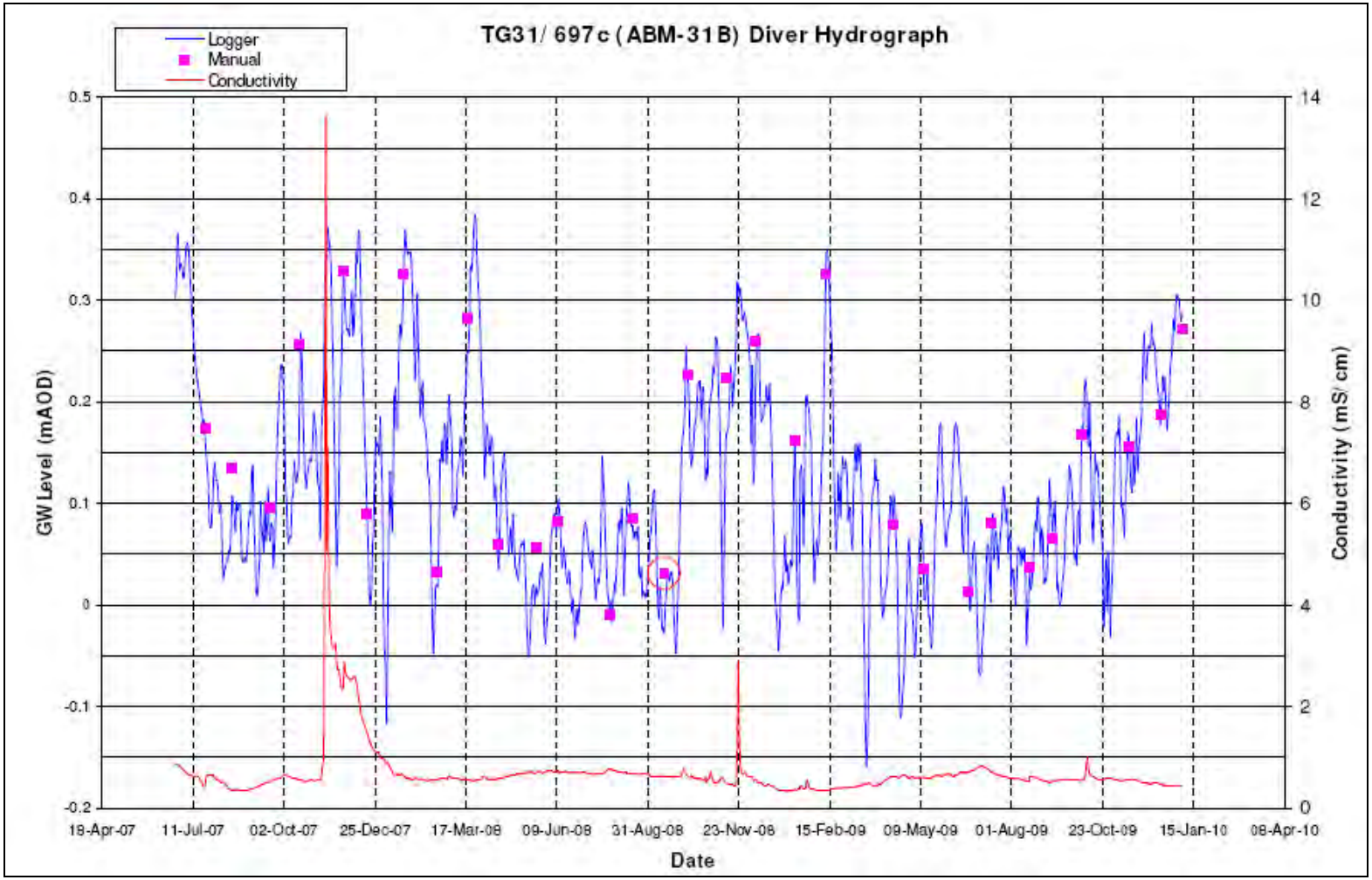


Figure F3 **Water Electrical Conductivity (and water level) Variations at Gaugeboard TG32/697c, which is on the Edge of Reepham Marshes and Connected to the River Ant to the South of Catfield Fen**

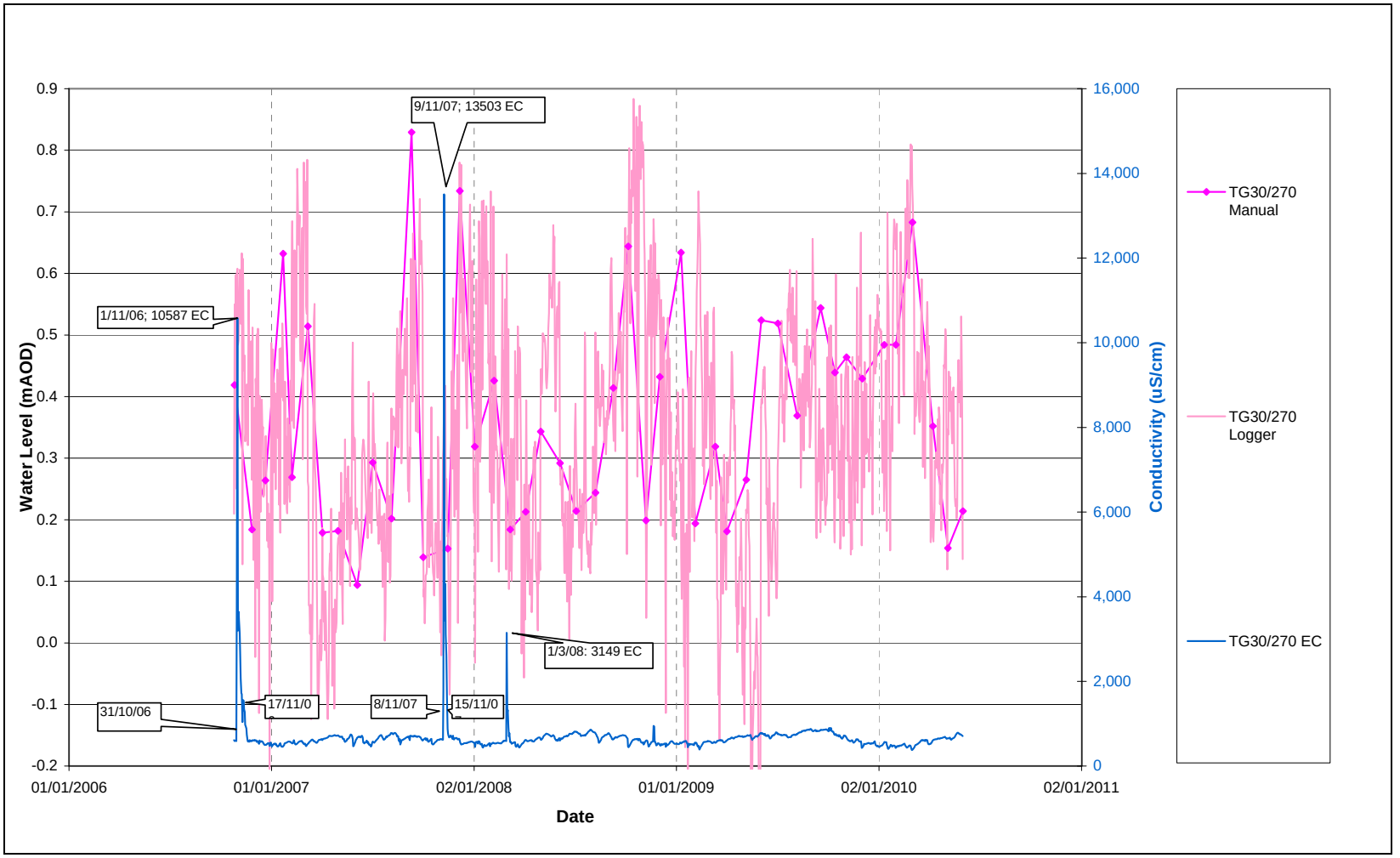


Figure F4 EC Peaks **Water Electrical Conductivity (and water level) Variations at Gaugeboard TG30/270 on the River Yare near Brundall Marina, showing well defined**

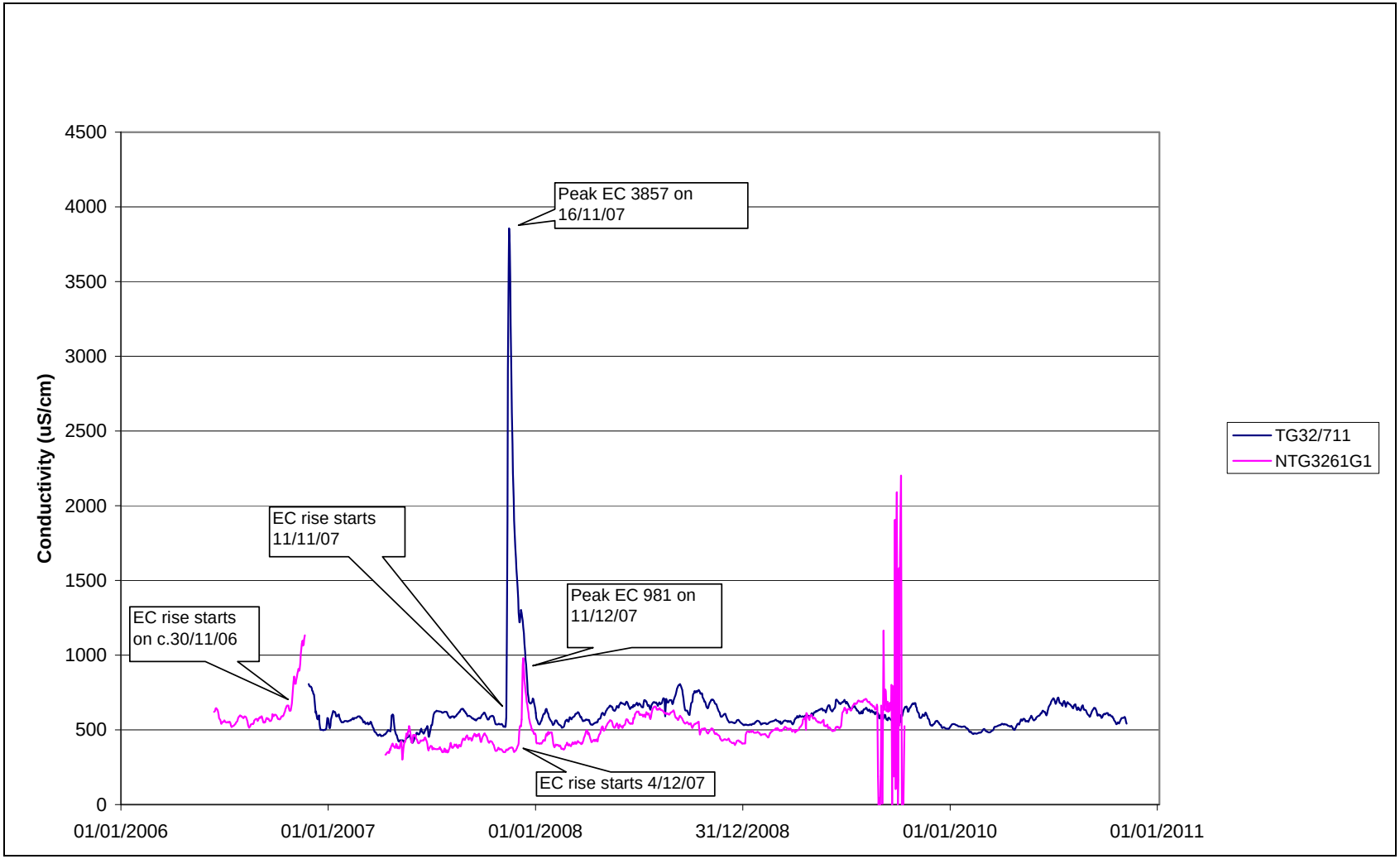


Figure F5 **Water Electrical Conductivity Variations at Two Gaugeboards in the Internal System with Dates of EC Rises and Peaks**

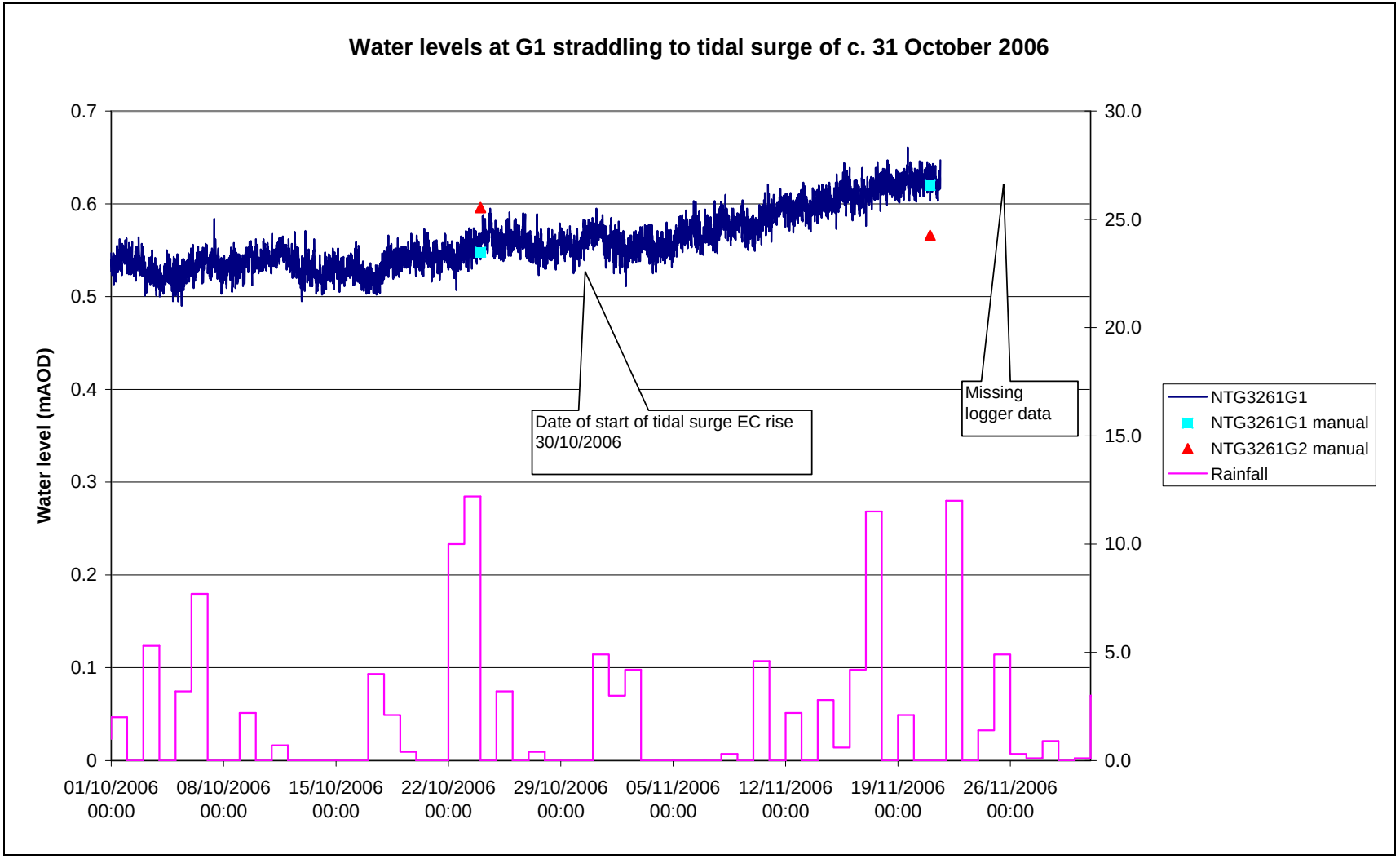


Figure F6 **Water Level Variations at Gaugeboard NTG3261G1 (15 minute logger data) and Rainfall at the time of the October/November 2006 Tidal Surge**

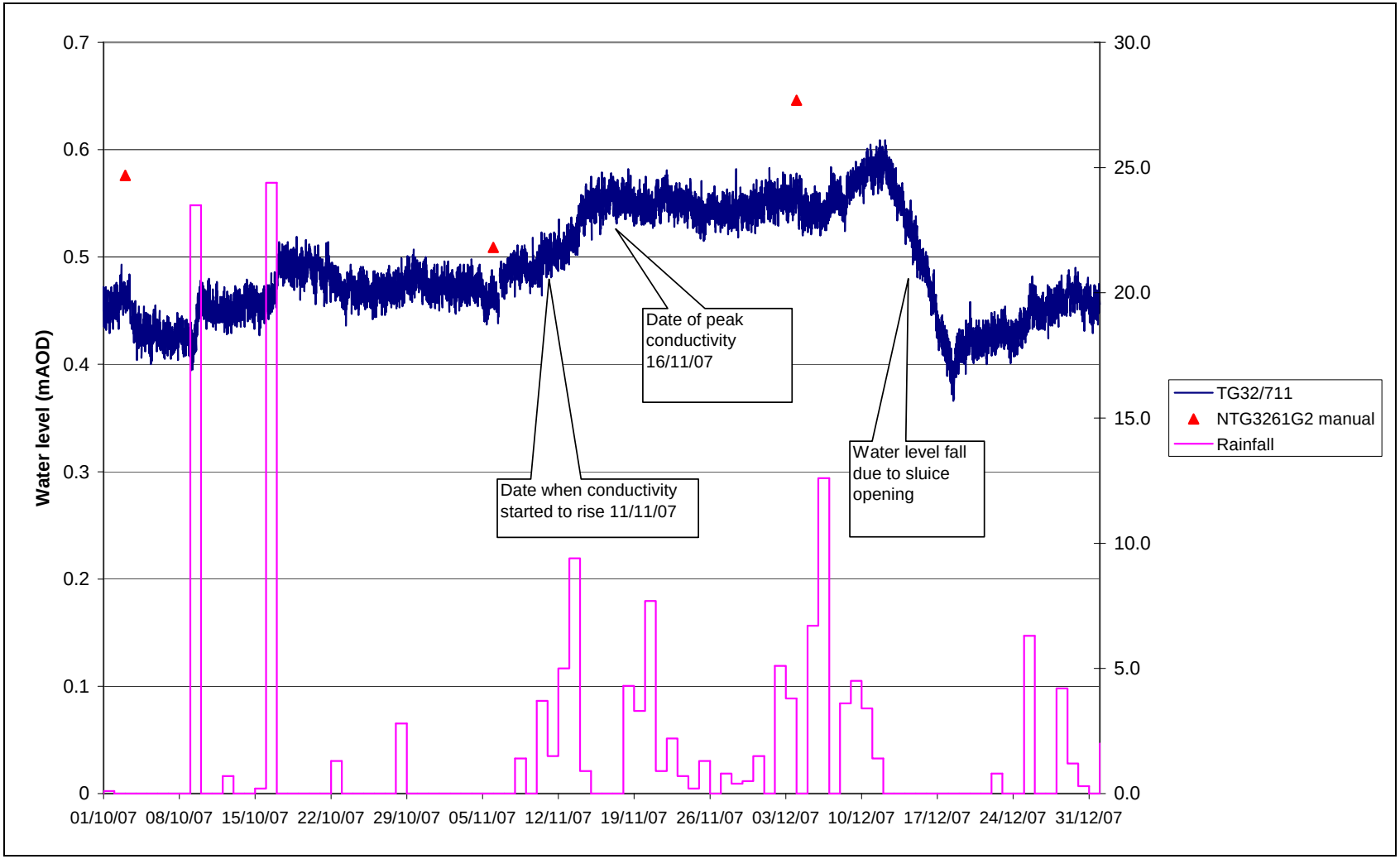


Figure F7 **Water Level Variations at Gaugeboard TG32/711 (15 minute logger data) and Rainfall at the time of the November 2007 Tidal Surge**

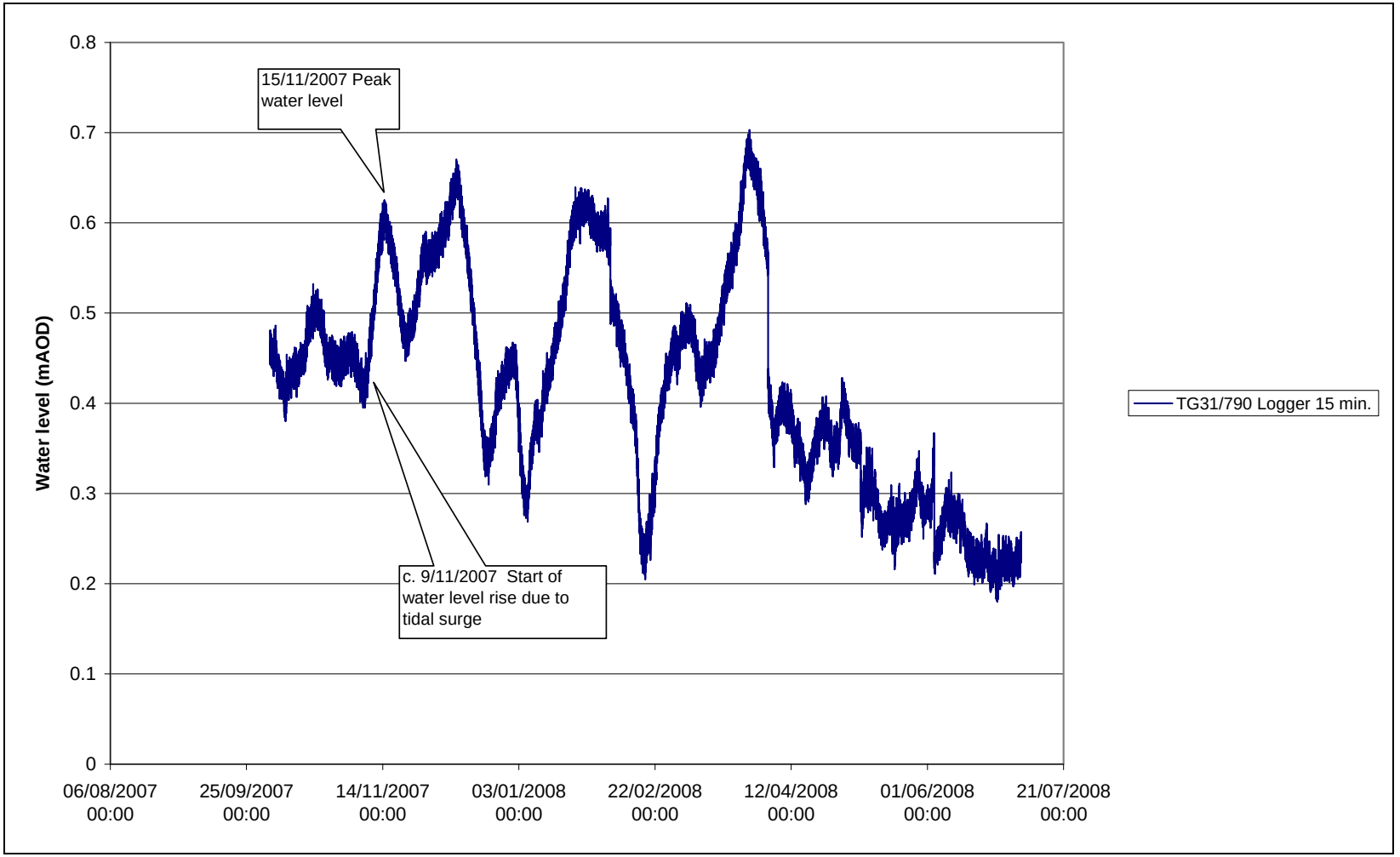


Figure F8 **Water Level Variations at Gaugeboard TG31/790 (15 minute logger data) Covering the Period of the November 2007 Tidal Surge. It is located in Sharp Street Fens to the South of the Low Bund which forms Part of the Southern Boundary of the Internal System**

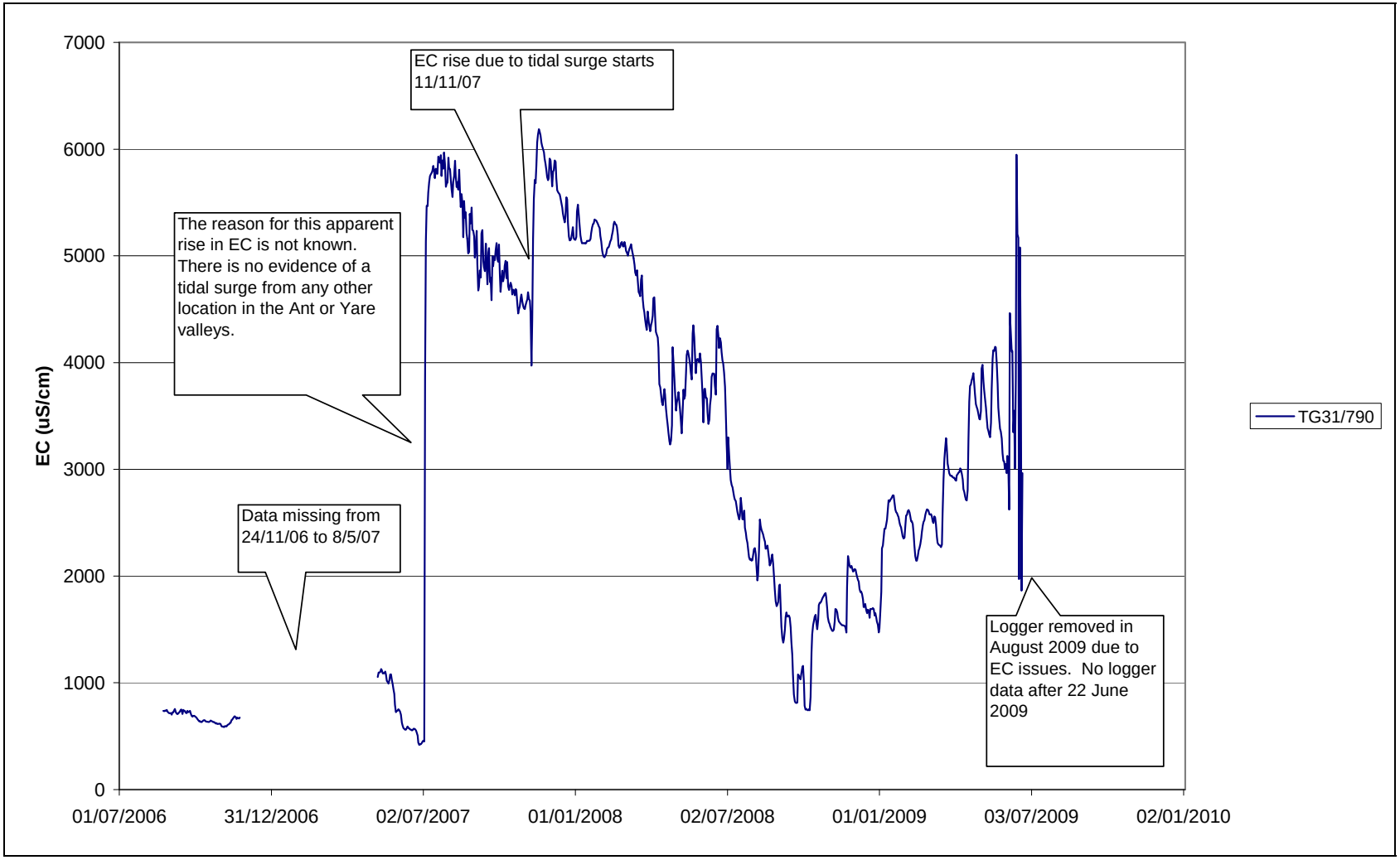


Figure F9 **Water Electrical Conductivity Variations at Gaugeboard TG31/790 in Sharp Street Fens to the South of Catfield Fen**

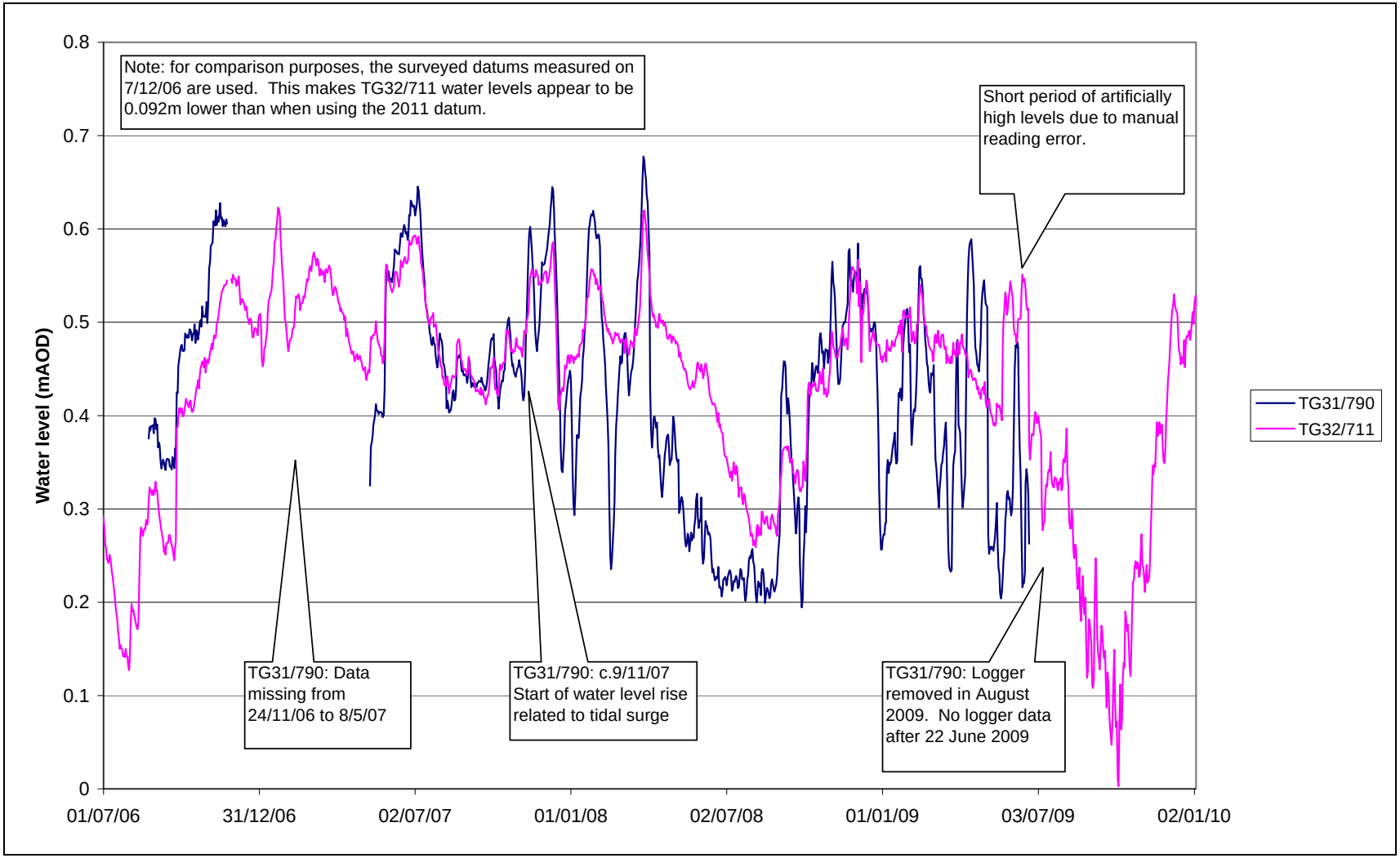


Figure F10 Comparison of Water Levels in Sharp Street Fens at Gaugeboard TG31/790 with those in the Internal System at Gaugeboard TG32/711

Table F1 Water chemistry analyses from Collins (1988)

Site ID	Site Location	Sample Type	GW or SW	Date	Ionic Balance greater than 10% Error (according to Collins)	Internal or External System	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	NO3	SR	Fe	TDS	ALK	PH	Temp	EC
6	Sluice	Dyke	Surface water	17/05/1988	Yes	Internal	66.00	11.40	34.00	4.10	272.80	0.14	36.00	83.00	0.20	0.07	0.59	370.89	224.00	7.20	15.00	620.00
7	Corner	Dyke	Surface water	17/05/1988	No	Internal	66.00	11.00	34.00	4.10	170.54	0.07	43.00	84.00	1.10	0.26	0.09	380.92	140.00	7.10	16.70	580.00
8		Dyke	Surface water	17/05/1988	No	Internal	73.00	12.80	39.00	4.60	176.68	0.04	52.00	82.00	1.60	0.22	0.09	389.88	145.00	6.90	15.00	500.00
9		Dyke	Surface water	17/05/1988	No	Internal	65.00	11.10	33.00	4.10	159.57	0.06	37.00	83.00	0.20	0.19	0.08	381.64	131.00	7.10	15.10	620.00
12	North Marsh	Pond	Surface water	16/05/1988	No	Internal	122.00	18.80	32.50	2.40	243.31	0.25	129.00	88.00	22.80	0.41	0.03	424.07	200.00	7.50	18.50	920.00
10		Pond	Surface water	29/06/1988	No	Internal	40.00	28.00	49.80	6.40	158.35	0.06	6.00	105.00	2.70	0.30	0.20	323.82	130.00	7.10	20.50	580.00
11		Dyke	Surface water	25/05/1988	No	Internal	54.00	25.20	74.50	7.50	129.19	0.02	79.00	114.00	5.30	0.10	0.91	514.89	106.00	6.70	13.10	680.00
13		Dyke	Surface water	06/06/1988	Yes	Internal	133.00	52.20	35.80	5.80	311.69	0.20	117.00	274.00	12.04	0.10	0.01	438.76	256.00	7.30	15.00	900.00
14		Dyke	Surface water	14/06/1988	No	Internal	77.00	27.90	35.30	4.30	236.42	0.05	52.00	101.00	2.49	0.10	0.29	477.08	194.00	6.80	16.80	580.00
15	Middle Marsh	Pond	Surface water	05/06/1988	Yes	Internal	3.00	1.40	5.40	0.80	62.14	0.02	72.00	128.00	0.10	0.01	0.12	414.95	51.00	6.90	17.50	210.00
15	Middle Marsh	Pond	Surface water	13/08/1988	No	Internal	14.09	11.21	21.50	2.30	66.99	0.03	5.50	32.82	0.62	0.10	0.12	404.44	55.00	7.10	19.00	200.00
2a 2m	2m piezometer	Piezometer	Groundwater	06/06/1988	Yes	Internal	61.00	535.00	59.00	6.00	560.67	0.07	11.00	116.00	0.10	0.20	0.05	432.57	460.00	6.60	13.00	1000.00
2a 2m	2m piezometer	Piezometer	Groundwater	18/08/1988	Yes	Internal	46.00	96.64	44.00	2.90	438.71	0.09	4.21	88.01	0.63	0.40	0.05	448.07	360.00	6.80	18.00	630.00
2b 6m	6m piezometer	Piezometer	Groundwater	06/06/1988	Yes	Internal	28.00	30.00	29.40	4.10	182.25	0.29	27.00	109.00	0.10	0.10	0.64	446.37	150.00	7.70	11.20	310.00
17		Pond	Surface water	06/06/1988	No	Internal	34.00	7.30	45.50	5.30	103.48	0.07	22.00	67.00	0.22	0.10	0.09	431.13	85.00	7.30	15.90	500.00
18		Pond	Surface water	07/06/1988	Yes	Internal	73.00	5.60	18.90	0.40	247.87	0.40	157.00	86.30	0.21	0.10	0.18	444.72	204.00	7.70	22.50	450.00
16	Middle Marsh	Peat surface water	Surface water	07/07/1988	Yes	Internal	3.00	4.20	10.10	0.70	12.19		70.00	85.10	1.70	0.10	0.14	520.42	10.00	6.20	14.50	110.00
16	Middle Marsh	Peat surface water	Surface water	18/08/1988	Yes	Internal	6.26	5.30	15.00	0.40	12.19		4.93	21.55	0.59	0.10	0.14	979.50	10.00	5.50	15.00	90.00
19	Middle Marsh	Dyke	Surface water	18/06/1988	Yes	Internal	8.00	14.90	37.20	5.10	221.74	0.07	69.00	97.50	0.10	0.10	0.20	871.97	182.00	7.00	15.50	700.00
20		Peat surface water	Surface water	18/08/1988	No	Internal	42.05	18.08	65.00	7.30	140.11	0.04	6.10	139.62	0.74	0.20	0.26	366.98	115.00	7.00	23.20	620.00
21	Hubbards Cottage	Dyke	Surface water	19/06/1988	Yes	Internal	128.10	44.70	36.30	3.20	191.28	0.06	104.00	91.00	9.30	0.20	0.02	294.15	157.00	7.00	16.60	820.00
22	Drakes Cottage well	Crag groundwater	Groundwater	19/06/1988	No	Internal	68.20	2.70	17.30	11.70	120.56	0.06	80.00	40.00	10.22	0.10	0.02	421.25	99.00	7.20	12.77	800.00
23	Drakes Cottage	Dyke	Surface water	19/06/1988	Yes	Internal	59.70	10.00	31.70	5.80	394.35	0.32	52.00	97.00	3.68	0.10	0.10	391.47	324.00	7.40	13.88	820.00
24	Green Shutters	Dyke	Surface water	19/06/1988	No	Internal	72.60	29.60	43.30	4.10	193.71	0.06	63.00	93.00	0.55	0.10	0.17	516.28	159.00	7.00	17.22	700.00
25	Bull Bridge	Dyke	Surface water	19/06/1988	No	Internal	101.50	14.70	36.20	3.00	187.59	0.08	97.00	89.00	9.16	0.10	0.13	393.77	154.00	7.10	17.22	780.00
26		Dyke	Surface water	19/06/1988	Yes	Internal	75.20	58.50	43.40	4.00	219.26	0.09	72.00	93.00	0.73	0.10	0.02	460.76	180.00	7.10	18.88	650.00
27		Peat surface water	Surface water	19/06/1988	No	Internal	40.00	20.10	44.60	1.80	109.65	0.04	54.00	97.00	0.18	0.10	0.01	315.70	90.00	7.00	22.22	560.00
28		Peat surface water	Surface water	19/06/1988	No	Internal	31.00	6.00	38.00	0.30	48.75		43.00	84.00	0.01	0.20	0.04	227.09	40.00	6.50	14.44	450.00
29		Dyke	Surface water	19/06/1988	No	Internal	54.00	19.90	41.70	3.40	175.48	0.04	38.00	89.00	0.09	1.70	0.27	397.53	144.00	6.80	17.77	610.00
30	Fenside	Dyke	Surface water	29/06/1988	No	Internal	110.00	32.00	52.10	50.60	565.22	0.23	21.00	125.00	6.20	0.40	2.86	691.66	464.00	7.10	10.80	1100.00
31	North Marsh	Peat surface water	Surface water	30/06/1988	Yes	Internal	100.00	15.00	35.00	1.30	427.81	0.05	82.00	86.00	0.10	0.60	0.32	532.13	351.00	6.60	16.00	850.00
32	North Marsh	Dyke	Surface water	30/06/1988	No	Internal	130.00	28.00	42.00	0.80	427.03	0.43	22.00	104.00	0.50	0.60	0.61	542.64	351.00	7.50	12.00	850.00
33		Peat surface water	Surface water	30/06/1988	No	Internal	20.00	5.00	41.80	5.90	48.75		6.00	89.00	0.90	0.40	0.18	196.49	40.00	6.50	12.00	400.00
34	River Ant	River	Surface water	25/05/1988	No	External	84.00	19.50	57.70	6.20	187.69	0.60	111.00	66.30	3.90	0.40	0.04	442.57	155.00	8.00	11.80	750.00
5 3m	3m piezometer	Piezometer	Groundwater	18/06/1988	Yes	External	114.90	14.70	94.70	2.50	481.37	0.10	5.00	288.00	0.01	0.60	0.01	764.90	395.00	6.80	15.00	1200.00
4 4.9m	4.9m piezometer	Piezometer	Groundwater	18/06/1988	No	External	90.50	50.80	83.70	6.70	255.95	0.03	17.00	308.00	0.57	1.70	0.01	689.38	210.00	6.60	16.00	640.00
4 3m	3m piezometer	Piezometer	Groundwater	18/06/1988	Yes	External	105.00	4.00	91.70	2.90	280.03	0.18	23.00	296.00	0.10	3.60	0.01	673.13	230.00	7.30	16.80	720.00
3 3m	3m piezometer	Piezometer	Groundwater	06/06/1988	Yes	External	204.00	401.00	315.00	4.90	816.41	0.21	12.00	63.30	0.10	1.30	0.06	1416.89	670.00	6.90	11.90	2100.00
3 3m	3m piezometer	Piezometer	Groundwater	18/06/1988	Yes	External	218.30	146.93	319.00	2.40	735.89	0.24	2.00	622.01	0.56	1.30		1688.49	604.00	7.00	15.70	2000.00
3 8m	8m piezometer	Piezometer	Groundwater	18/06/1988	Yes	External	137.60	151.00	86.40	6.80	547.48	0.55	9.00	132.00	0.22	0.90	0.19	806.02	450.00	7.50	11.90	950.00

Table F1 (continued) Water chemistry analyses from Collins (1988)

Site ID	Site Location	Sample Type	GW or SW	Date	Ionic Balance greater than 10% Error (according to Collins)	Internal or External System	Ca	Mg	Na	K	HCO3	CO3	SO4	Cl	NO3	SR	Fe	TDS	ALK	PH	Temp	EC
35		Peat surface water	Surface water	17/05/1988	No	External	68.00	13.20	49.00	3.50	170.62	0.03	30.00	112.00	0.20	0.30	0.05	364.35	140.00	6.70	16.20	600.00
36		Dyke	Surface water	06/06/1988	No	External	60.00	20.80	39.50	4.00	231.44	0.09	46.00	54.10	0.99	0.20	0.22	341.75	190.00	7.10	17.00	840.00
43	Spring	Peat surface water	Surface water	08/06/1988	No	External	110.00	81.70	37.70	7.40	350.53	0.28	149.00	94.50	5.58	0.30	0.01	663.80	288.00	7.40	14.00	760.00
37	Great Fen	Peat surface water	Surface water	29/06/1988	No	External	55.00	12.00	48.30	9.50	170.62	0.03	9.00	131.00	3.00	0.40	0.13	356.91	140.00	6.70	18.30	600.00
38	Great Fen	Peat surface water	Surface water	18/08/1988	No	External	63.57	20.33	45.50	1.40	146.14	0.07	62.61	99.88	0.56	0.30		369.17	120.00	7.20	20.00	660.00
39	Barton Broad	Broad	Surface water	29/06/1988	No	External	100.00	14.00	50.60	8.70	194.02	0.49	94.00	122.00	2.90	0.80	0.30	493.70	160.00	7.90	15.50	810.00
40		Dyke	Surface water	14/06/1988	Yes	Internal	125.00	31.00	37.70	10.00	177.88	0.06	95.00	97.50	5.12	0.20	0.03	490.17	146.00	7.00	14.00	900.00
41		Dyke	Surface water	18/06/1988	Yes	Internal	89.50	65.60	33.50	5.60	175.60	1.12	68.00	94.00	2.27	0.20	0.10	446.79	146.00	8.30	18.33	670.00
42	Catfield Broad	Broad	Surface water	08/06/1988	No	Internal	88.00	29.30	35.50	4.50	234.50	0.38	76.00	94.80	0.25	0.20	0.05	449.17	193.00	7.70	15.50	690.00
44	Ludham PWS	Crag groundwater	Groundwater	18/08/1988	No	External	76.11	9.38	33.50	3.40	258.35	0.05	33.06	46.19	0.56	0.30		338.10	212.00	6.80	11.00	480.00

Table F2 Water Chemistry Analyses from AMP Studies (Atkins/HSI, 2005)

Site id	Site Location	GW or SW	Date	Ca	Mg	Na	K	Alk	SO4	Cl	NO3 as N	Fe	pH (field)	pH (lab)	EC (field)	EC (lab)	Total Alk (field)	Total Alk (lab)
Point 1 Catfield Fen	Dyke	Surface water	23/08/2001	73	14	45	4.4	147.7	47.8	70	0.075	0.039						
Point 1 Catfield Fen	Dyke	Surface water	25/09/2002	99.4	22.5	66.9	11.2	19.3	96.8	10.6	< 0.069	0.021						
Point 1 Catfield Fen	Dyke	Surface water	09/09/2003	97.8	15.7	54	7.88	236	81.2	103	0.137	0.579						
Point 1 Catfield Fen	Dyke	Surface water	21/09/2004	86.7	18.9	39.4	5.71	200	63.4	60	0.07	0.15						
Point 2 Middle Marsh	Dyke	Surface water	23/08/2001	135	21	49.9	8.8	298.4	82	80.3	0.75	0.126						
Point 2 Middle Marsh	Dyke	Surface water	25/09/2002	123	22.6	53.8	13	278	84.4	84.3	0.139	0.056						
Point 2 Middle Marsh	Dyke	Surface water	09/09/2003	124	25	42.9	4.29	274	92.5	80.8	0.2	0.426						
Point 2 Middle Marsh	Dyke	Surface water	21/09/2004	124	20.8	38.6	7.64	319	69.1	38.8	< 0.069	0.143						
Point 4 Church Wood	Dyke	Surface water	23/08/2001	115	14.2	45.6	5.5	284.2	90.6	49.6	< 0.069	0.249						
Point 4 Church Wood	Dyke	Surface water	25/09/2002	86.7	14.1	54.2	8.79	270	5.12	40.7	< 0.069	0.983						
Point 4 Church Wood	Dyke	Surface water	21/09/2004	102	7.46	28.3	1.28	323	5.84	14.4	0.24	0.521						
Point N Snipe Marsh	Dyke	Surface water	23/08/2001	108	13.8	40.6	8.3	197.1	51.3	66.4	11.5	0.098						
Point N Snipe Marsh	Dyke	Surface water	25/09/2002	108	18.5	54.4	12.8	192	78.9	82	8.47	11.11						
Point N Snipe Marsh	Dyke	Surface water	08/09/2003	100	18.3	46.1	8.96	182	75.8	82	4.85	10.6						
Point N Snipe Marsh	Dyke	Surface water	20/09/2004	103	18.2	34.3	7.34	184	81.2	74.3	7.12	0.453						
NTG3261P1	Shallow Crag	Groundwater	23/08/2001	73.1	42.4	74.2	5.9	35	230	91	22	0.12	5.74	5.88	880	872	260	217
HDP17	Shallow Crag	Groundwater	20/09/2004	101	61.5	44.5	2.75	130	165	162	20.38	3.82	6.37	6.38	994	1039	180	130
TG32/815D	Shallow Crag	Groundwater	20/09/2004	3.96	4.13	28.6	1.98	4.5	18.9	48.1	0.1	43.6	6.15	6.02	320	265	80	4.5
TG32/815A	Shallow Crag	Groundwater	21/09/2004	178	13	31.7	0.96	315	96.1	66.7	12.09	3.21	6.9	6.82	918	916	340	315
NTG3261P2	Shallow Sand	Groundwater	23/08/2001	56.6	8.5	19.9	57.3	199.8	30.4	15.7	2.7	1.15	6.6	6.77	464	494		199.8
NTG3261P2	Shallow Sand ("Alluvial")	Groundwater	25/09/2002	87.3	12	30.9	56.5	217	37.5	55.8	9.18	4.48	6.98	7.28	711	661	260	
NTG3261P2	Shallow Sand ("Alluvial")	Groundwater	09/09/2003	102	11.4	18.2	49.9	201	39	46.5	12	1.14	7.24	7.54	709	641	260	201
NTG3261P2	Shallow Sand ("Alluvial")	Groundwater	20/09/2004	54.7	7.47	16.4	43.4	174	30.3	17.1	2.73	1.03	6.82	6.92	485	435	200	174
NTG3261P3	Peat	Groundwater	23/08/2001	75.6	36.1	199	4	180.2	4.3	377	< 0.069	2.76	5.75	6.27	1417	1348		180.3
NTG3261P3	Peat	Groundwater	25/09/2002	73.5	36.8	186	6.96	165	4.17	387	0.071	4.41	5.82	6.09	1483	1346	200	165
NTG3261P3	Peat	Groundwater	09/09/2003	64.7	33.2	178	0.823	156	3.37	356	0.152	5.82	5.88	6.07	1378	1273	220	156
NTG3270P4	Crag	Groundwater	23/08/2001	87.1	60.8	56.1	8.6	14.5	154	155	46.7	2.91	4.75	5.28	1045	1041		
NTG3270P5	Shallow gravel ("Alluvial")	Groundwater	23/08/2001	68.3	26.5	41.5	10.4	252	3.6	81.2	< 0.69	37.53	6.41	6.57	700			
Sharp Street P1	Middle Crag	Groundwater	23/08/2001	122	18.7	97.5	14.5	250.6	169	72	0.1	1.5	6.93	7.06	925	912	260	250.6
Sharp Street P1	Middle Crag	Groundwater	25/09/2002	135	21.5	61.8	11	212	176	78.8	0.5	5.07	6.63	6.93	938	892		212
Sharp Street P1	Middle Crag	Groundwater	08/09/2003	113	7.51	49.6	12.3	96	69.4	93.2	9.39	0.618	12.01	11.4	877	761	140	96
Sharp Street P1	Middle Crag	Groundwater	20/09/2004	81.3	2.41	52.3	38	17	165	87.3	10.57	0.798	9.81	9.45	671	669	40	17
Sharp Street P2	Deep Crag	Groundwater	25/08/2002	116	7.94	32.4	2.36	234	80.4	45.7	< 0.069	3.72	7.42	7.38	708	643	290	234
Sharp Street P2	Deep Crag	Groundwater	08/09/2003	88.3	6.55	36.6	2.59	183	66	42.9	0.251	1.99	7.58	7.64	585	557	260	183
Sharp Street P2	Deep Crag	Groundwater	20/09/2004	101	6.11	29.1	2.03	204	69.9	39.1	0.19	2.4	7.58	7.58	586	562	240	204
Sharp Street P3	Shallow Crag	Groundwater	23/08/2001	73.2	28.3	44.4	6.6	57.4	109	114	13.8	0.67	5.75	5.89	645	654		57.4
Sharp Street P3	Shallow Crag	Groundwater	25/09/2002	72.8	31.16	51.1	8.16	56.4	131	86.9	17.3	67.6	5.64	5.95	742	702	220	56
Sharp Street P3	Shallow Crag	Groundwater	08/09/2003	68.5	25.4	34.7	3.66	50	107	84.1	17.7	2.02	5.69	5.92	712	675	100	50
Sharp Street P3	Shallow Crag	Groundwater	20/09/2004	62	23.2	33.2	3.61	50	105	77.5	16.58	0.378	5.92	5.89	595	603	100	50
Ludham PS P5	Deep Crag	Groundwater	23/08/2001	61.7	16.7	43.3	3.3	52.6	127	82.5	1.34	23.02						
Ludham PS P5	Deep Crag	Groundwater	25/09/2002	107	4.82	30.6	2.01	231	57.2	39.2	< 0.069	1.66	7.41	7.71	624	572	280	231
Ludham PS P5	Deep Crag	Groundwater	08/09/2003	125	2.51	33.5	3.56	135	106	68	7	1.31	12.35	11.6	984	867	180	135
Ludham PS P5	Deep Crag	Groundwater	20/09/2004	66.7	32	34.1	3.61	44	126	107	14.3	< 0.052	8.95	5.73	474	699	80	44
Ludham PS Raw	Deep Crag	Groundwater	23/08/2001	91.4	6.3	32.9	2.9	204.5	45.9	46.6	< 0.069	1.21		7.43		563		204.5
Ludham BH1	Deep Crag	Groundwater	25/09/2002	75.2	6.19	40.4	4.54	183	26.3	64.2	< 0.069	0.193	8.51	8.73	568	524	240	230
Ludham BH1	Deep Crag	Groundwater	08/09/2003	92.7	5.78	34.3	3.02	196	48.2	47.7	0.228	0.476	8.11	7.62	608	541	240	196

Table F2 (continued) **Water Chemistry Analyses from AMP Studies (Atkins/HSI, 2005)**

Site ID	Site Location	GW or SW	Date	Ca	Mg	Na	K	Alk	SO4	Cl	NO3 as N	Fe	pH (field)	pH (lab)	EC (field)	EC (lab)	Total Alk (field)	Total Alk (lab)
Ludham BH1	Deep Crag	Groundwater	20/09/2004	89.9	6.35	33.2	2.84	203	54.8	48.6	0.295	2.11	7.47	6.36	567	1035	220	203
Ludham BH2	Deep Crag	Groundwater	25/09/2002	93	8.3	32.5	4.38	199	50.3	64.2	< 0.069	1.19						

Table F3 Water Chemistry Analyses from Ewan (2005) (All determinand analyses in mg/l)

Site ID	Easting	Northing	Site Location	GW or SW	Date	Ca	Mg	Na	K	Alk	SO4	Cl	NO3 as N	Fe	Mn	Al	NH4	Be	Bo	Br	F	P	pH	EC
A39	636640	320940	Dyke	Surface water	29/09/2005	35	6.9	33	3.2	100	15	60	1	0.051	0.031	0.0029	0.082	0	0.096	0.120	0.098	0.000	7.22	360
A40	636640	321350	Dyke	Surface water	29/09/2005	81	13	43	7.6	200	66	82	1.1	0.160	0.150	0.0032	0.14	0	0.095	0.200	0.12	0.120	7.32	640
A42	636960	321400	Dyke	Surface water	29/09/2005	50	11	51	18	190	24	85	0.99	1.200	0.330	0.041	0.74	0	0.15	0.290	0.14	0.940	6.96	550
A43	636650	321120	Dyke	Surface water	29/09/2005	57	13	38	3	150	50	72	1	0.012	0.007	0	0.036	0	0.065	0.150	0.11	0	7.68	520
A49	637260	321530	Dyke	Surface water	29/09/2005	130	23	35	4.6	270	120	79	12	0.190	0.520	0	0.093	0	0	0.220	0.15	0.014	7.32	830
A72	636800	321250	Dyke	Surface water	29/09/2005	67	14	39	3.1	190	47	76	1	0.028	0.020	0	0.061	0	0.095	0.190	0.11	0	7.61	570

Table F4 **Summary of Water Chemistry Analyses, with Subdivision into Different Chemical Groupings**

Group	General Description	n	Parameter median (values in square brackets are the observed range)										Typical Equivalent Ratios		Calcite Saturation Index (median)
			Ca mg/l	Na mg/l	K mg/l	Mg mg/l	Cl mg/l	SO_4 mg/l	HCO_3 mg/l	Fe mg/L	Nitrate as N mg/L	pH	Ca/Mg	Na/Cl	
River and Broads	Ca-HCO3 water type from rivers / broads surrounding the site. Higher pH than other surface waters; calcite saturated.	3	88 [84 - 100]	51 [36 - 58]	6.2 [4.5 - 8.7]	19.5 [14 - 29.3]	95 [66 - 122]	94 [76 - 111]	194 [188 - 235]	0.05 [0.04 - 0.3]	2.9 [0.3 - 3.9]	7.9 [7.7 - 8]	2.71	0.82	0.5
Dyke Type 1	Dilute water type from surface waters. Low concentrations of Ca, Mg, HCO3 and SO4.	8	35 [14 - 42]	43 [22 - 65]	4.3 [0.3 - 7.3]	9.3 [5 - 28]	87 [33 - 140]	11 [6 - 54]	107 [49 - 158]	0.11 [0.01 - 0.26]	0.7 [0 - 2.7]	7.1 [6.5 - 7.3]	2.23	0.77	-0.8
Dyke Type 2	Surface waters with ionic compositions intermediate between Type 1 and Type 3. Understaturated wrt Calcite.	25	73 [50 - 108]	42 [28 - 75]	4.4 [1.3 - 18]	14.1 [7.5 - 29.6]	82 [14 - 131]	51 [5 - 97]	220 [129 - 391]	0.17 [0.01 - 11.1]	1.0 [0 - 11.5]	7.1 [6.7 - 7.7]	3.11	0.78	-0.4
Dyke Type 3	Ca-Mg-HCO3-SO4 water type from surface waters. High Ca and HCO3; saturated wrt calcite; occasionally high nitrate.	8	124 [115 - 135]	43 [33 - 54]	5.1 [0.8 - 13]	21.8 [14.2 - 28]	81 [39 - 104]	88 [22 - 129]	340 [243 - 427]	0.17 [0.03 - 0.61]	0.4 [0 - 22.8]	7.5 [7.3 - 7.5]	3.41	0.81	0.1
Dyke Type 4	Dyke waters showing evidence of pollution (elevated nitrate, SO4, Mg, and K).	2	110 [110 - 110]	45 [38 - 52]	29.0 [7.4 - 50.6]	56.9 [32 - 81.7]	110 [95 - 125]	85 [21 - 149]	458 [351 - 565]	1.44 [0.01 - 2.86]	5.9 [5.6 - 6.2]	7.3 [7.1 - 7.4]	1.16	0.63	-0.3
Deep Crag	Ca-HCO3 water type from Deep Crag boreholes. High Ca/Mg ratio, moderate Fe concentration, very low nitrate.	9	91 [75 - 116]	33 [29 - 40]	2.9 [2 - 4.5]	6.4 [5.8 - 9.4]	47 [39 - 64]	50 [26 - 80]	246 [221 - 283]	1.60 [0.19 - 3.72]	0.2 [0 - 0.6]	7.6 [6.8 - 8.5]	8.64	1.10	0.3
Shallow Crag	Ca-Mg-SO4 water type from Shallow Crag boreholes. High Mg, SO4, Fe and nitrate concentrations. Low HCO3 and pH.	7	73 [62 - 101]	45 [33 - 74]	5.9 [2.8 - 8.6]	31.2 [23.2 - 61.5]	91 [78 - 162]	131 [105 - 230]	61 [18 - 157]	2.02 [0.12 - 67.6]	17.7 [13.8 - 46.7]	5.7 [4.8 - 6.4]	1.41	0.75	-2.3
Crag: Ludham PS P5	Deep Crag source exhibiting characteristics of both Deep Crag and Shallow Crag groups.	4	87 [62 - 125]	34 [31 - 43]	3.4 [2 - 3.6]	10.8 [2.5 - 32]	75 [39 - 107]	116 [57 - 127]	114 [53 - 280]	1.49 [0.03 - 23]	4.2 [0 - 14.3]	9.0 [7.4 - 12.4]	4.83	0.69	-0.3
Other Crag	Ca-HCO3-SO4 type from shallow / mid depth Crag boreholes. Composition between Shallow and Deep Crag Groups.	5	122 [68 - 178]	52 [17 - 98]	11.7 [1 - 38]	13.0 [2.4 - 21.5]	72 [40 - 87]	165 [80 - 176]	257 [21 - 381]	1.50 [0.02 - 5.07]	10.2 [0.1 - 12.1]	6.9 [6.6 - 9.8]	5.63	1.12	-0.1
Shallow groundwater	Ca-HCO3 water type from superficial deposits. High nitrate concentrations, very high K at one location, low SO4.	6	78 [55 - 102]	25 [16 - 84]	46.7 [6.7 - 57.3]	11.7 [7.5 - 50.8]	51 [16 - 308]	30 [4 - 39]	250 [211 - 305]	1.15 [0.01 - 37.5]	2.7 [0.3 - 12]	6.7 [6.4 - 7.2]	3.99	0.77	-0.7
Peat	Na-Cl type groundwater from a single peat observation borehole (NTG3261P3). High Na and Cl concentrations suggest limited flushing of salt, probably from saline incursions sourced from the sea	3	74 [65 - 76]	186 [178 - 199]	4.0 [0.8 - 7]	36.1 [33.2 - 36.8]	377 [356 - 387]	4 [3 - 4]	200 [189 - 218]	4.40 [2.76 - 5.8]	0.1 [0 - 0.2]	5.8 [5.8 - 5.9]	1.22	0.76	-1.6
Rainwater	[mean]	2	1.4 [0.5 - 2.3]	2.5 [1.3 - 3.8]	0.29 [0.21 - 0.36]	0.59 [0.37 - 0.81]	4.2 [1.7 - 6.6]	5.6 [4.5 - 6.8]	-	-	-	-	1.42	0.94	

Rainwater data from Hiscock, 2005 (Hydrogeology: Principles and Practice) and Met Office Stoke Ferry.

Table F5 Identification of Analyses Assigned to Different Chemical Groupings

Hydrochemical Group	Station ID	Data Source
River & Broads	34 River Ant	Collins
	39 Barton Broad	Collins
	42 Catfield Broad	Collins
Dyke Type 1	10	Collins
	17	Collins
	20	Collins
	27	Collins
	28	Collins
	33	Collins
	15 Middle Marsh	Collins
	A39	Ewan
Dyke Type 2	8	Collins
	9	Collins
	11	Collins
	14	Collins
	29	Collins
	35	Collins
	36	Collins
	24 Green Shutters	Collins
	25 Bull Bridge	Collins
	37 Great Fen	Collins
	38 Great Fen	Collins
	7 Corner	Collins
	A40	Ewan
	A42	Ewan
	A43	Ewan
	A72	Ewan
	Point 1 Catfield Fen	Atkins/HSI (AMP)
	Point 4 Church Wood (2002 & 2004 samples, Atkins/HSI (AMP))	Atkins/HSI (AMP)
	Point N Snipe Marsh	Atkins/HSI (AMP)
Dyke Type 3	12 North Marsh	Collins
	32 North Marsh	Collins
	A49	Ewan
	Point 2 Middle Marsh	Atkins/HSI (AMP)
	Point 4 Church Wood (2001 & 2003 samples, Atkins/HSI (AMP))	Atkins/HSI (AMP)
Dyke Type 4	30 Fenside	Collins
	43 Spring	Collins

Hydrochemical Group	Station ID	Data Source
Deep Crag	44 Ludham PWS	Collins
	Ludham BH1	Atkins/HSI (AMP)
	Ludham BH2	Atkins/HSI (AMP)
	Ludham PS Raw	Atkins/HSI (AMP)
	Sharp Street P2	Atkins/HSI (AMP)
Shallow Crag	HDP17	Atkins/HSI (AMP)
	NTG3261P1	Atkins/HSI (AMP)
	NTG3270P4	Atkins/HSI (AMP)
	Sharp Street P3	Atkins/HSI (AMP)
Other Crag	22 Drakes Cottage well	Collins
	Sharp Street P1	Atkins/HSI (AMP)
	TG32/815A	Atkins/HSI (AMP)
Crag: Ludham PS P5	Ludham PS P5	Atkins/HSI (AMP)
Shallow groundwater	4 4.9m piezometer	Collins
	NTG3261P2	Atkins/HSI (AMP)
	NTG3270P5	Atkins/HSI (AMP)
Peat	NTG3261P3	Atkins/HSI (AMP)
Poor Ion Balance	13	Collins
	18	Collins
	26	Collins
	40	Collins
	41	Collins
	15 Middle Marsh	Collins
	16 Middle Marsh	Collins
	19 Middle Marsh	Collins
	21 Hubbards Cottage	Collins
	23 Drakes Cottage	Collins
	2a 2m 2m piezometer	Collins
	2b 6m 6m piezometer	Collins
	3 3m piezometer	Collins
	3 8m piezometer	Collins
	31 North Marsh	Collins
	4 3m piezometer	Collins
	5 3m piezometer	Collins
	6 Sluice	Collins
	Point 1 Catfield Fen	Atkins/HSI (AMP)
	Sharp Street P1	Atkins/HSI (AMP)
	TG32/815D	Atkins/HSI (AMP)

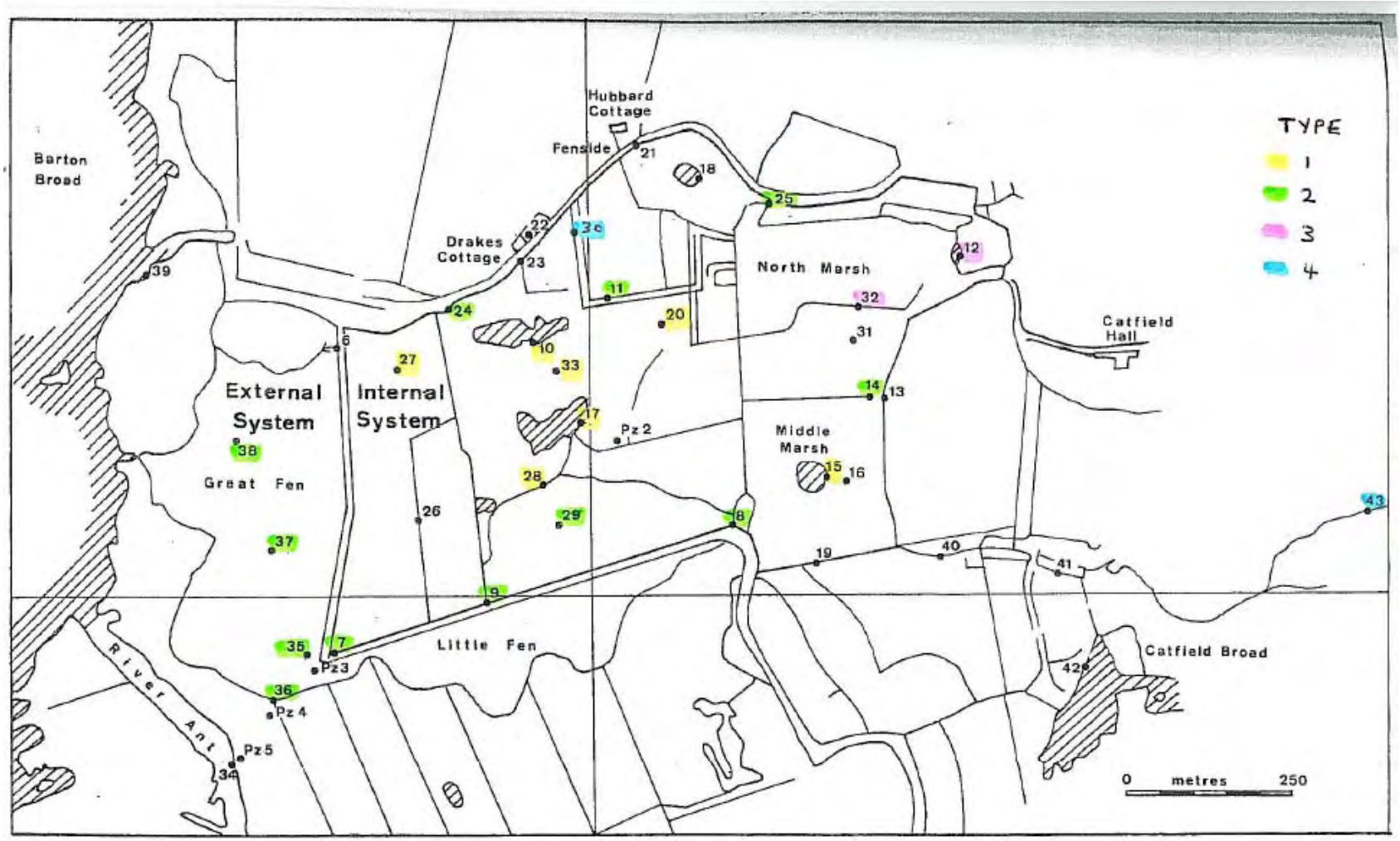


Figure F11 Locations Sampled by Collins (1988) with Surface Water Chemical Typing (from Ingram, this investigation)

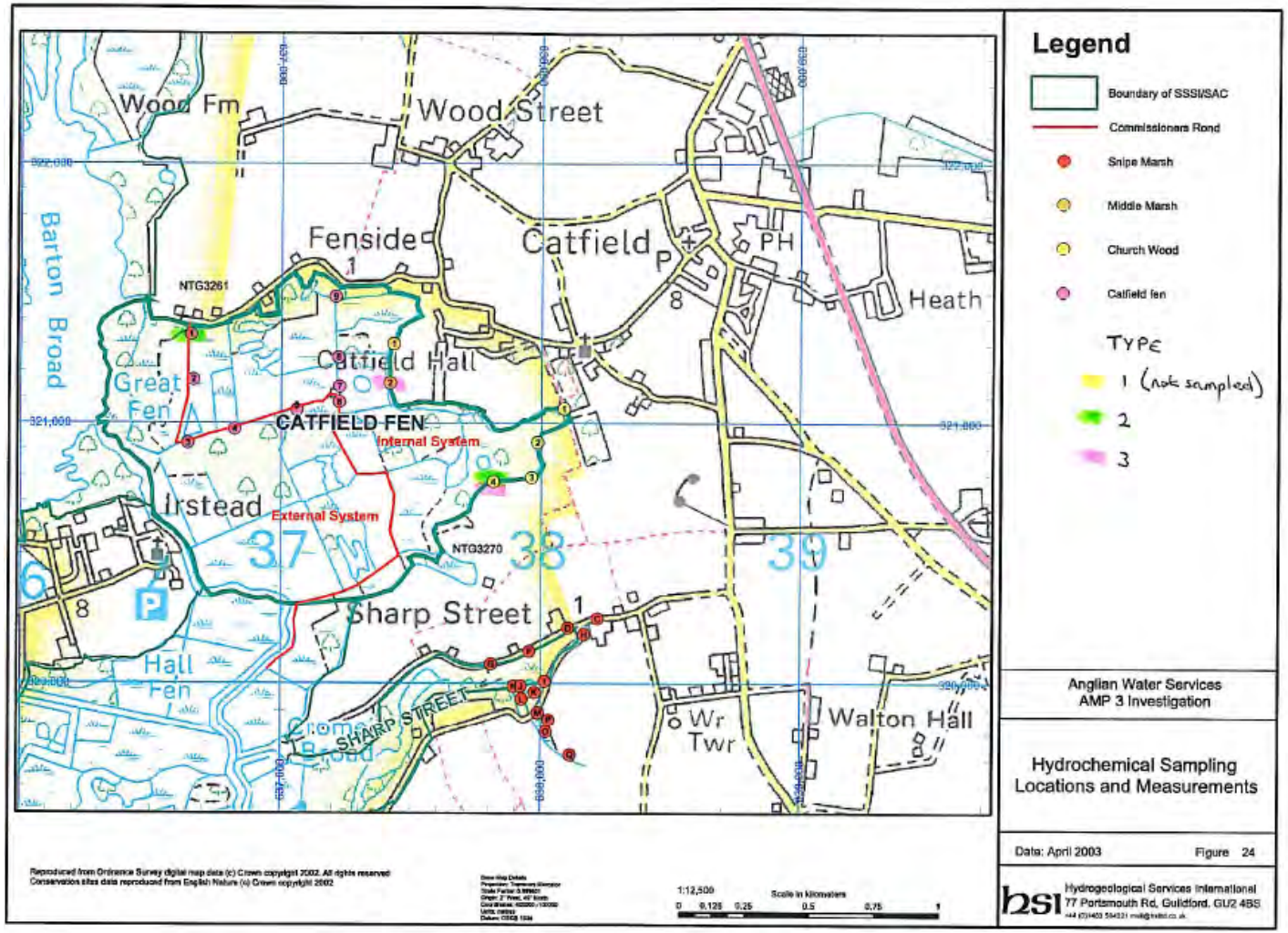


Figure F12 **Locations Sampled for AMP Studies (after Atkins/HSI, 2003) with Surface Water Chemical Typing (from Ingram, this investigation)**

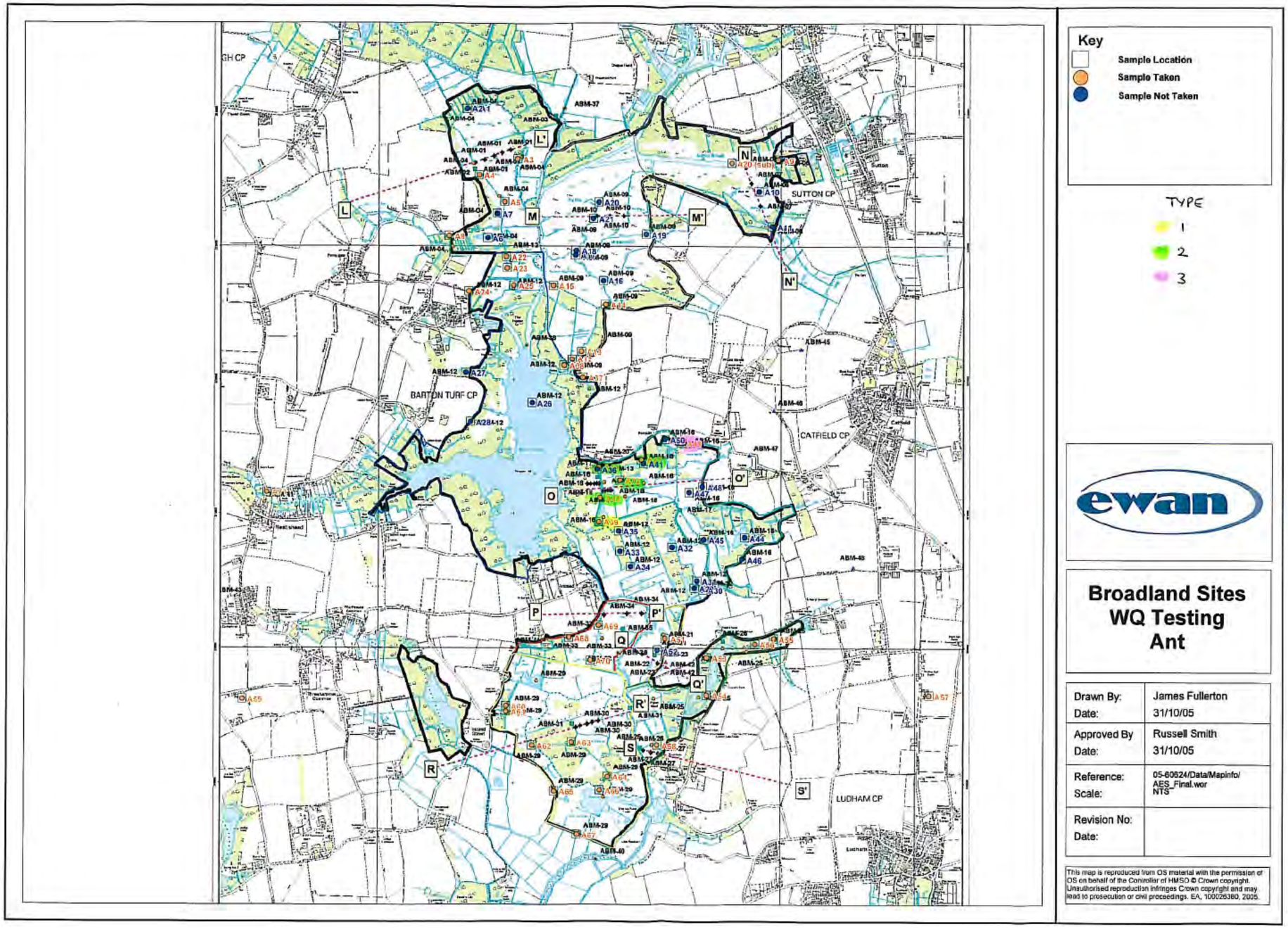


Figure F13 Locations Sampled by Ewan (2005) with Surface Water Chemical Typing (from Ingram, this investigation)

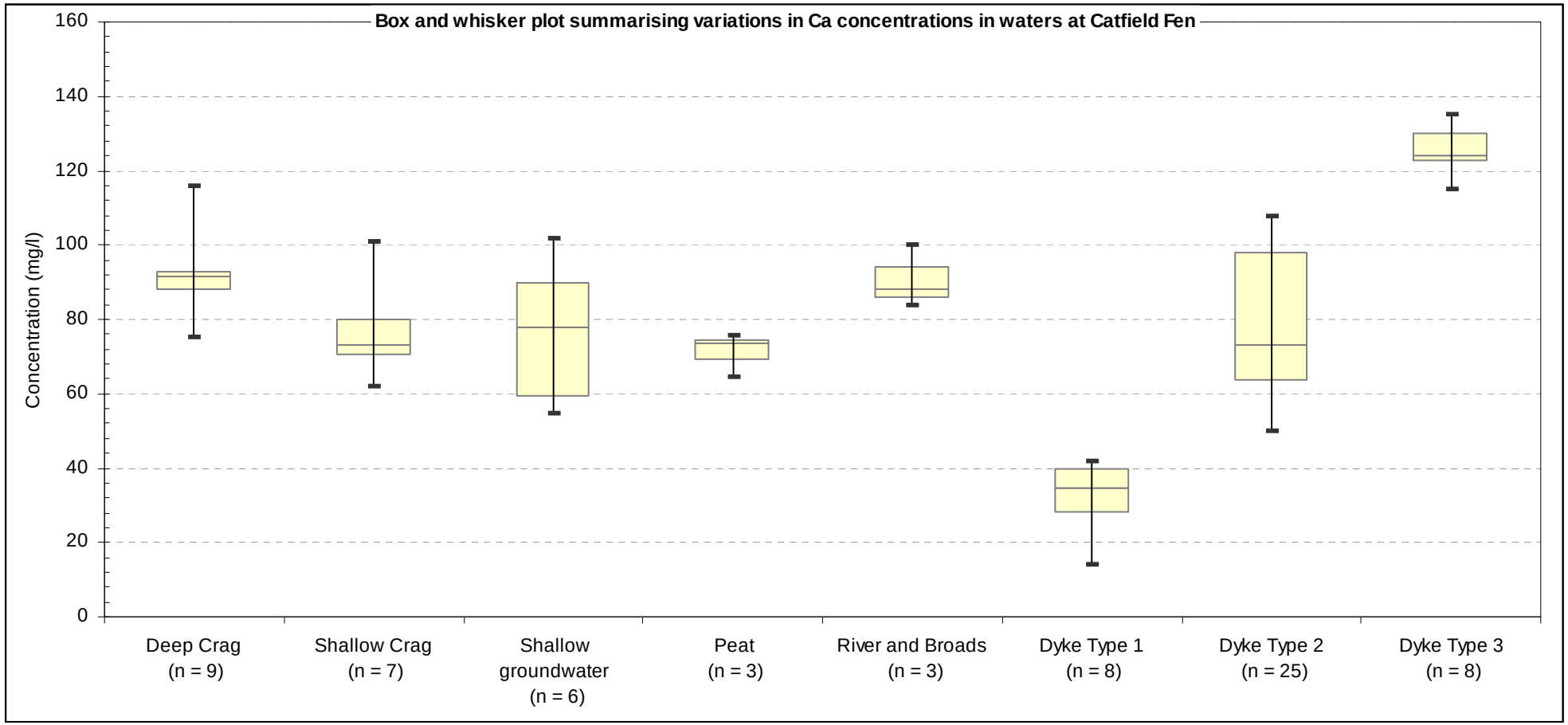


Figure F14 **Box and Whisker Plot Summarising Variations in Ca Concentrations in Waters at and near Catfield Fen**

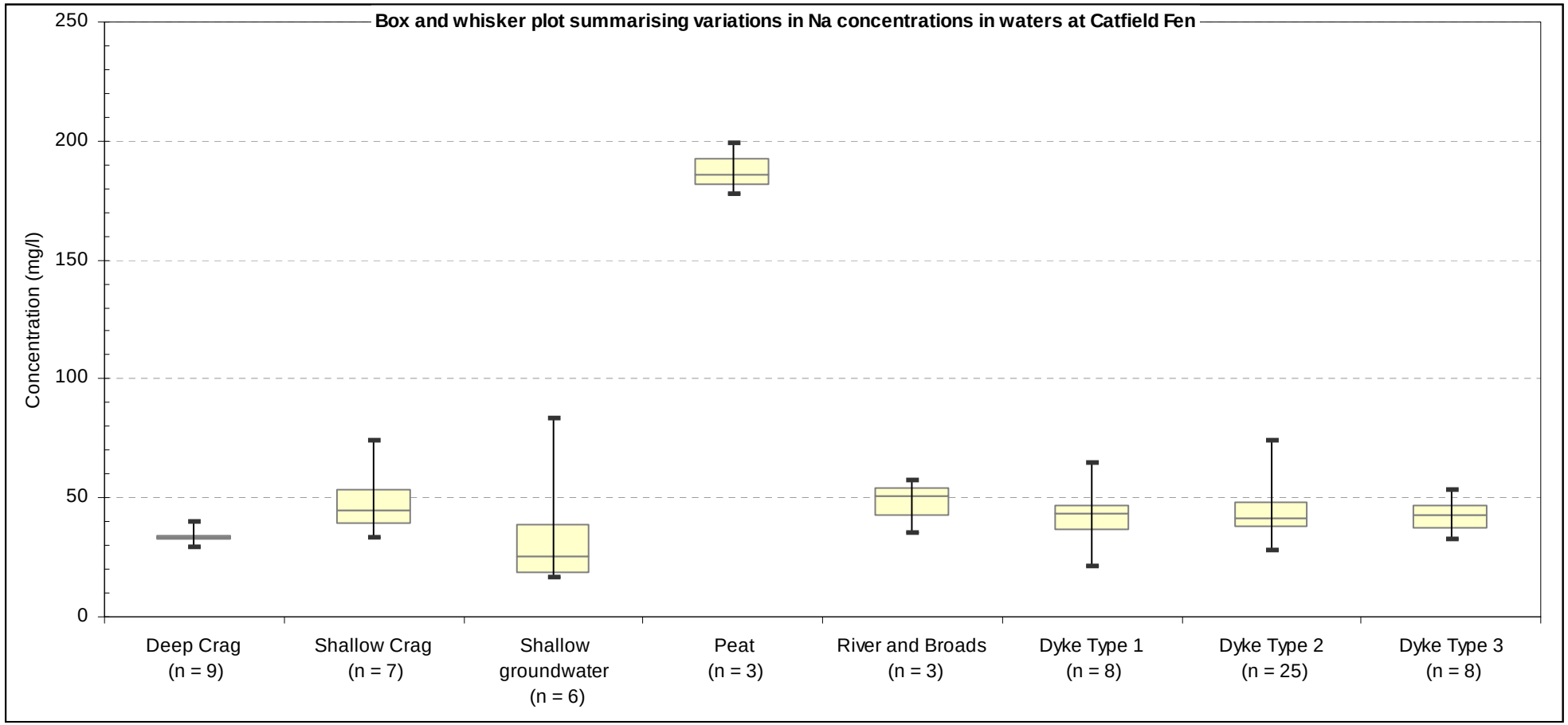


Figure F15 **Box and Whisker Plot Summarising Variations in Na Concentrations in Waters at and near Catfield Fen**

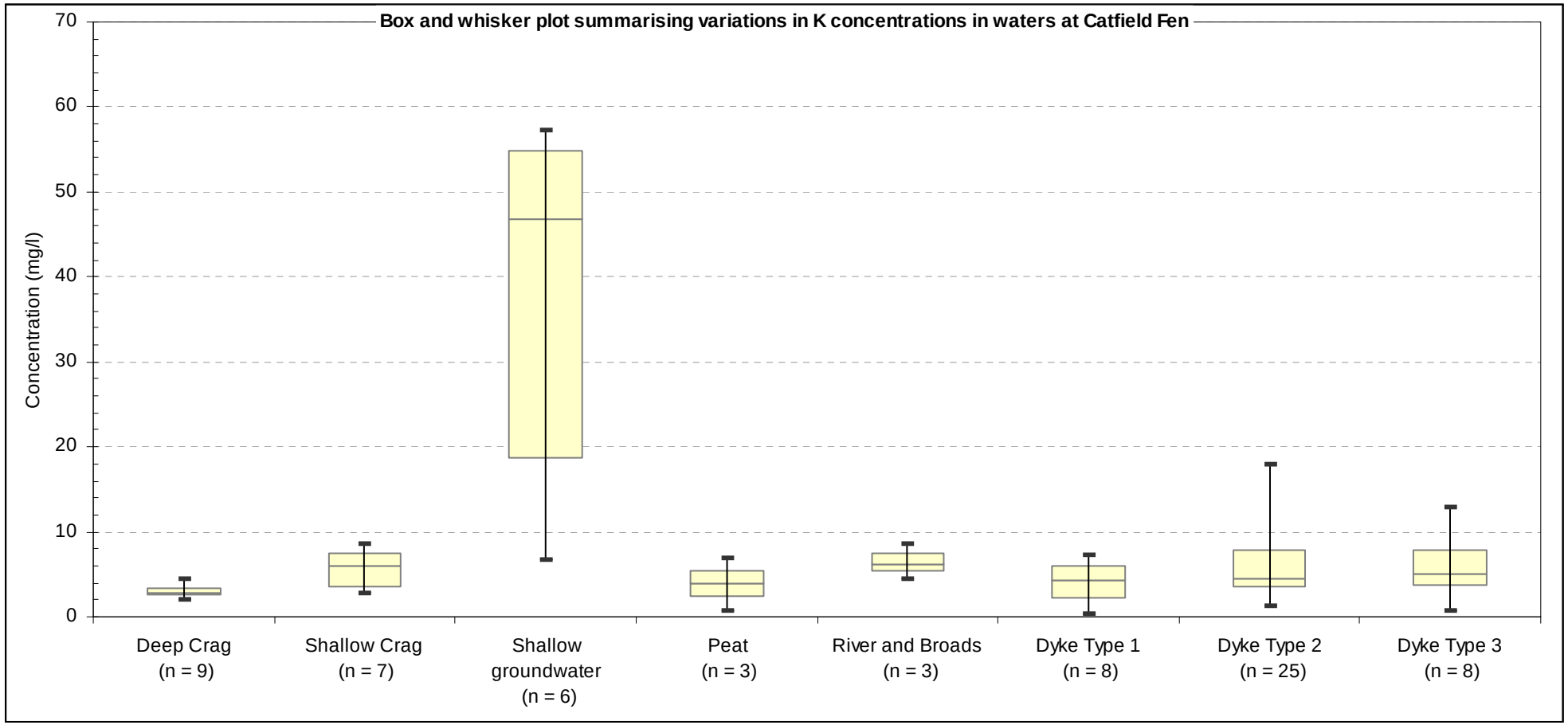


Figure F16 **Box and Whisker Plot Summarising Variations in K Concentrations in Waters at and near Catfield Fen**

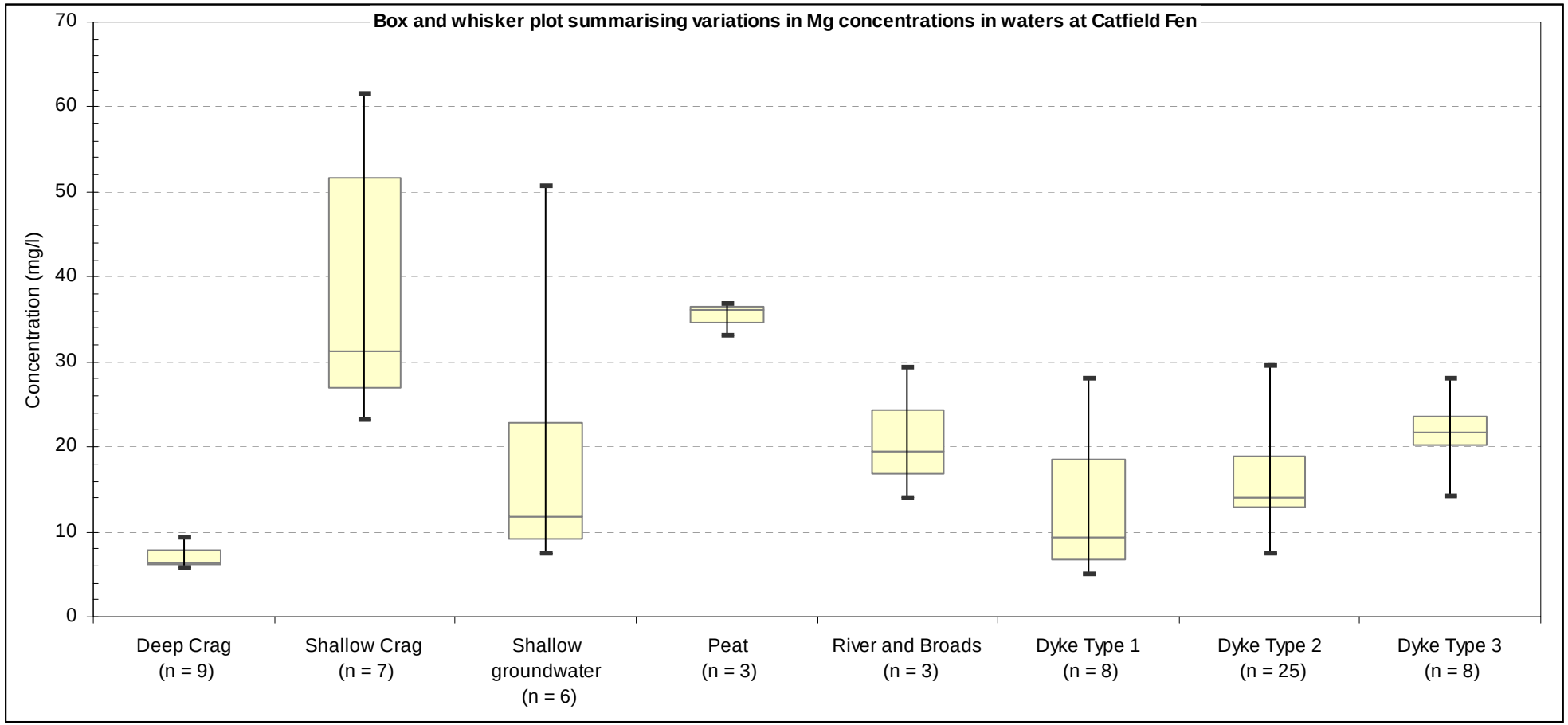


Figure F17 **Box and Whisker Plot Summarising Variations in Mg Concentrations in Waters at and near Catfield Fen**

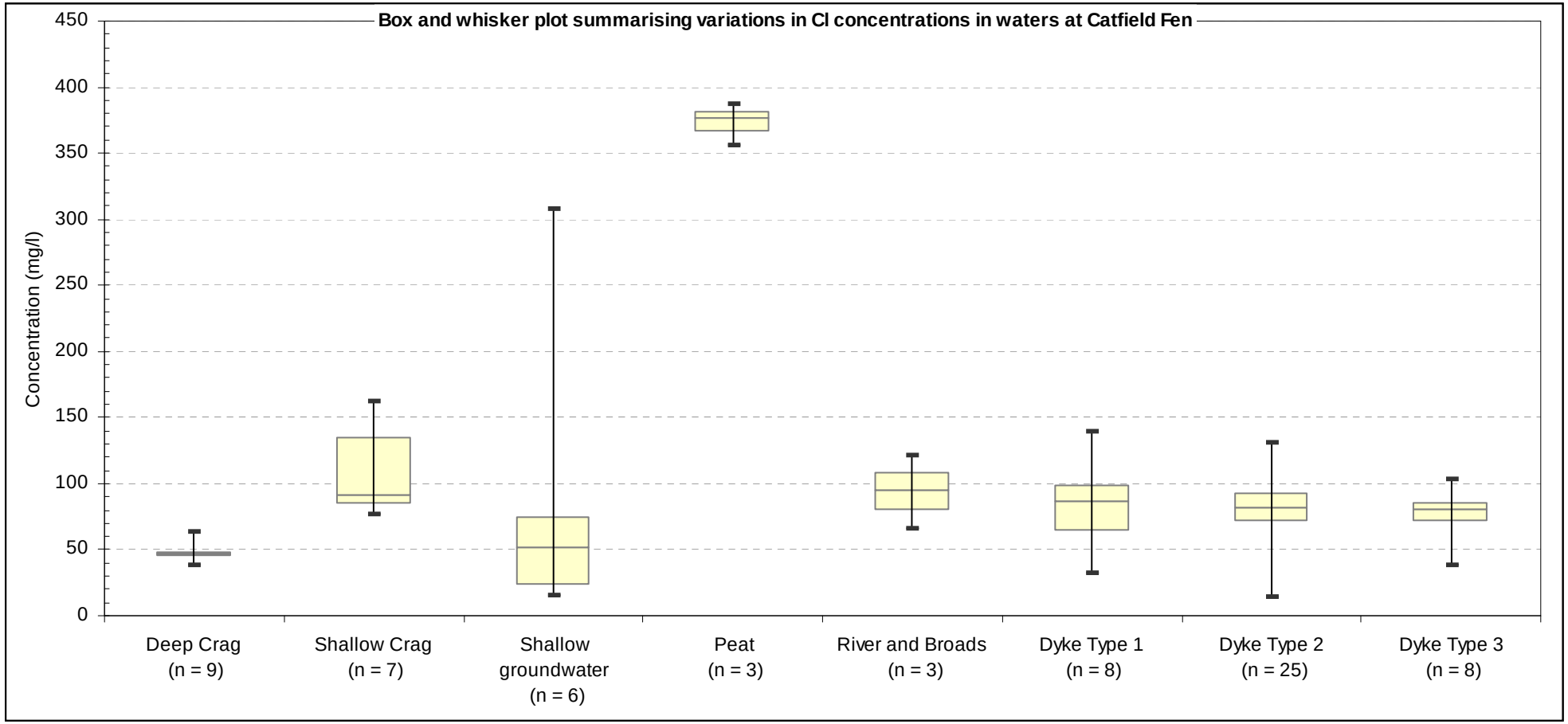


Figure F18 **Box and Whisker Plot Summarising Variations in Cl Concentrations in Waters at and near Catfield Fen**

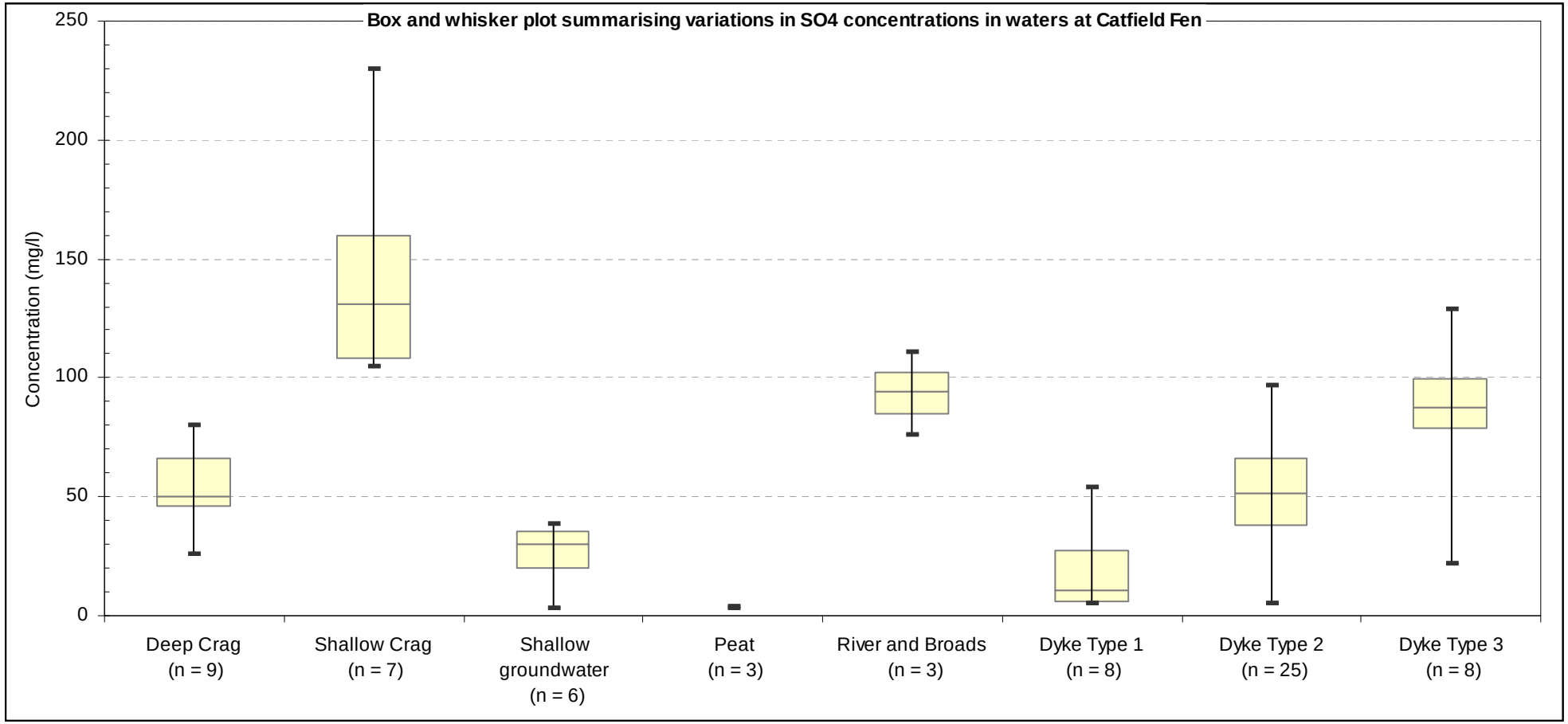


Figure F19 Box and Whisker Plot Summarising Variations in SO_4 Concentrations in Waters at and near Catfield Fen

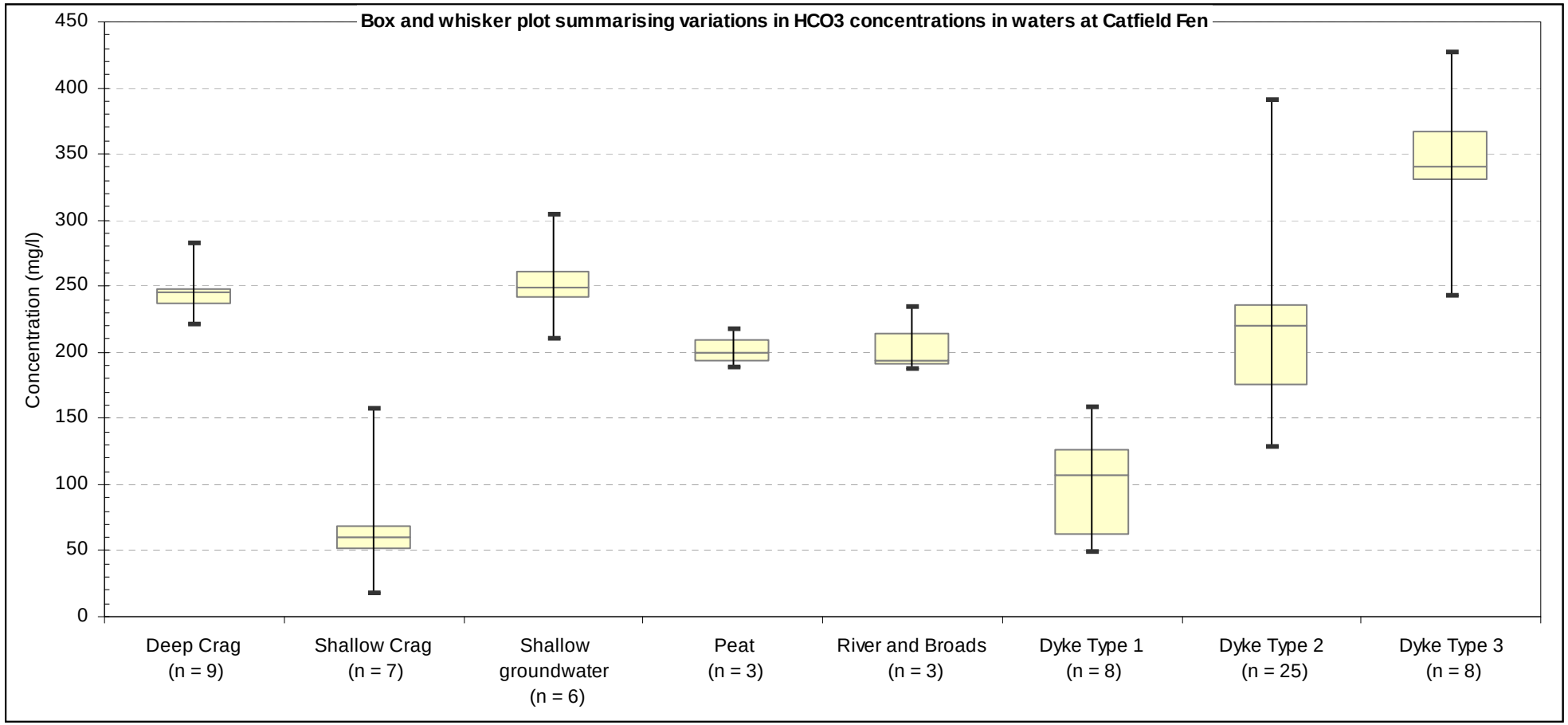


Figure F20 Box and Whisker Plot Summarising Variations in HCO_3 Concentrations in Waters at and near Catfield Fen

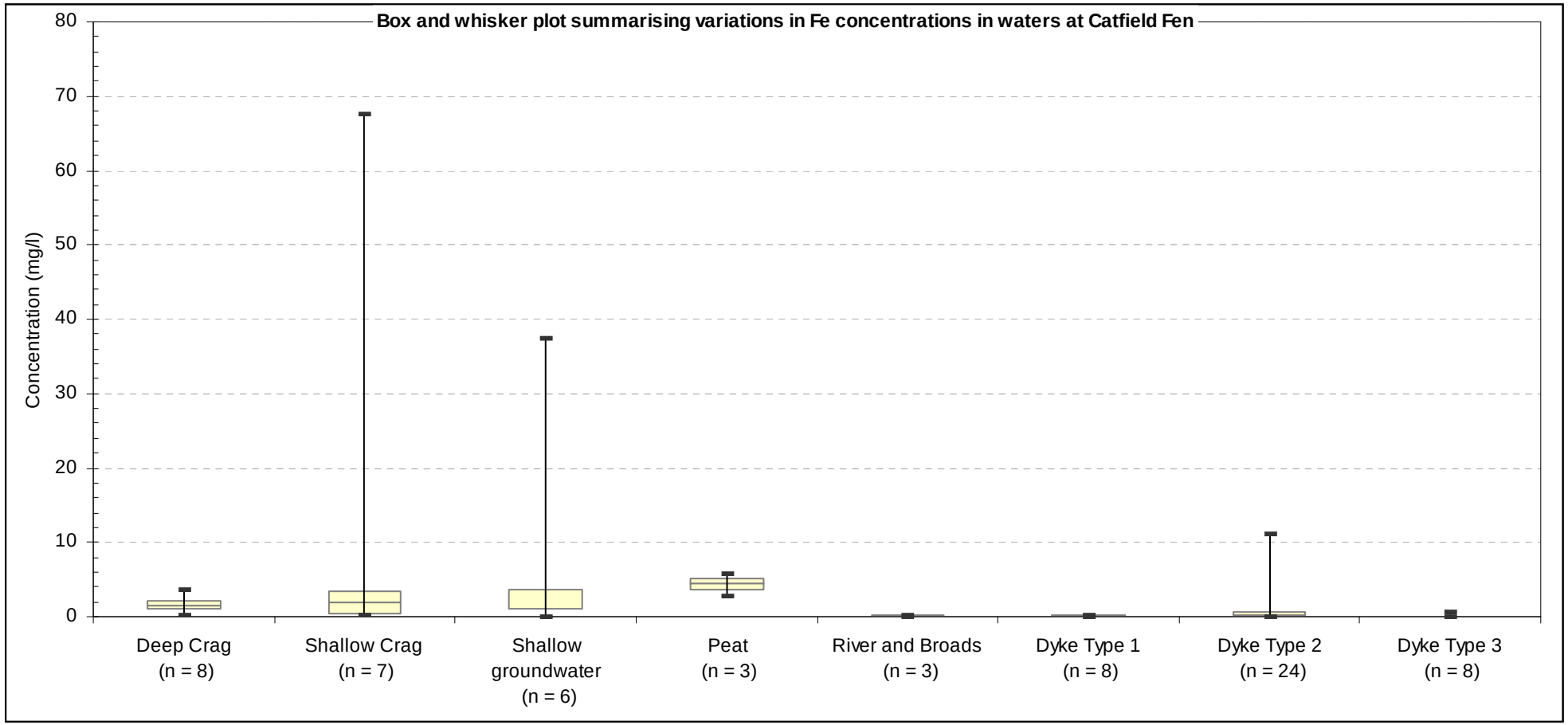


Figure F21 **Box and Whisker Plot Summarising Variations in Fe Concentrations in Waters at and near Catfield Fen**

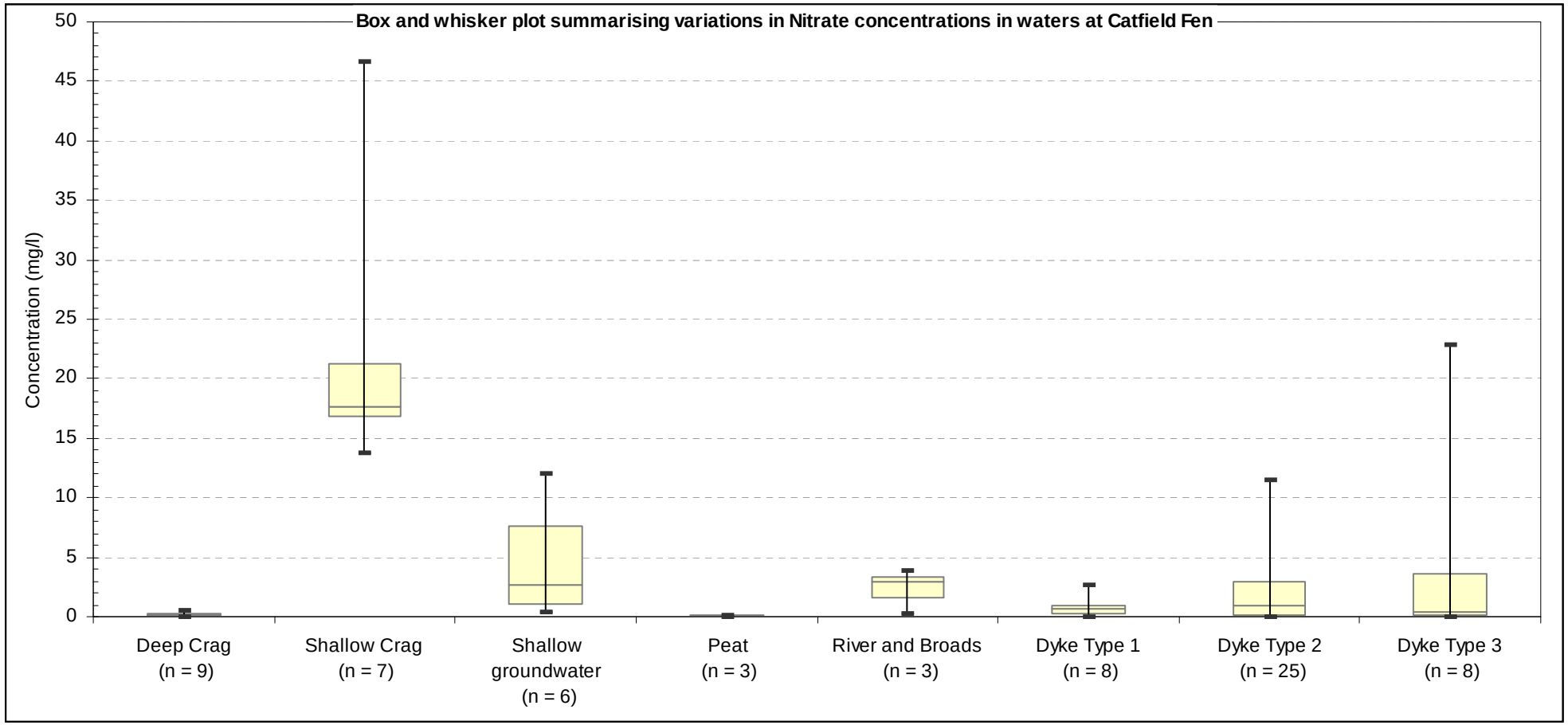


Figure F22 **Box and Whisker Plot Summarising Variations in Nitrate (as N) Concentrations in Waters at and near Catfield Fen**

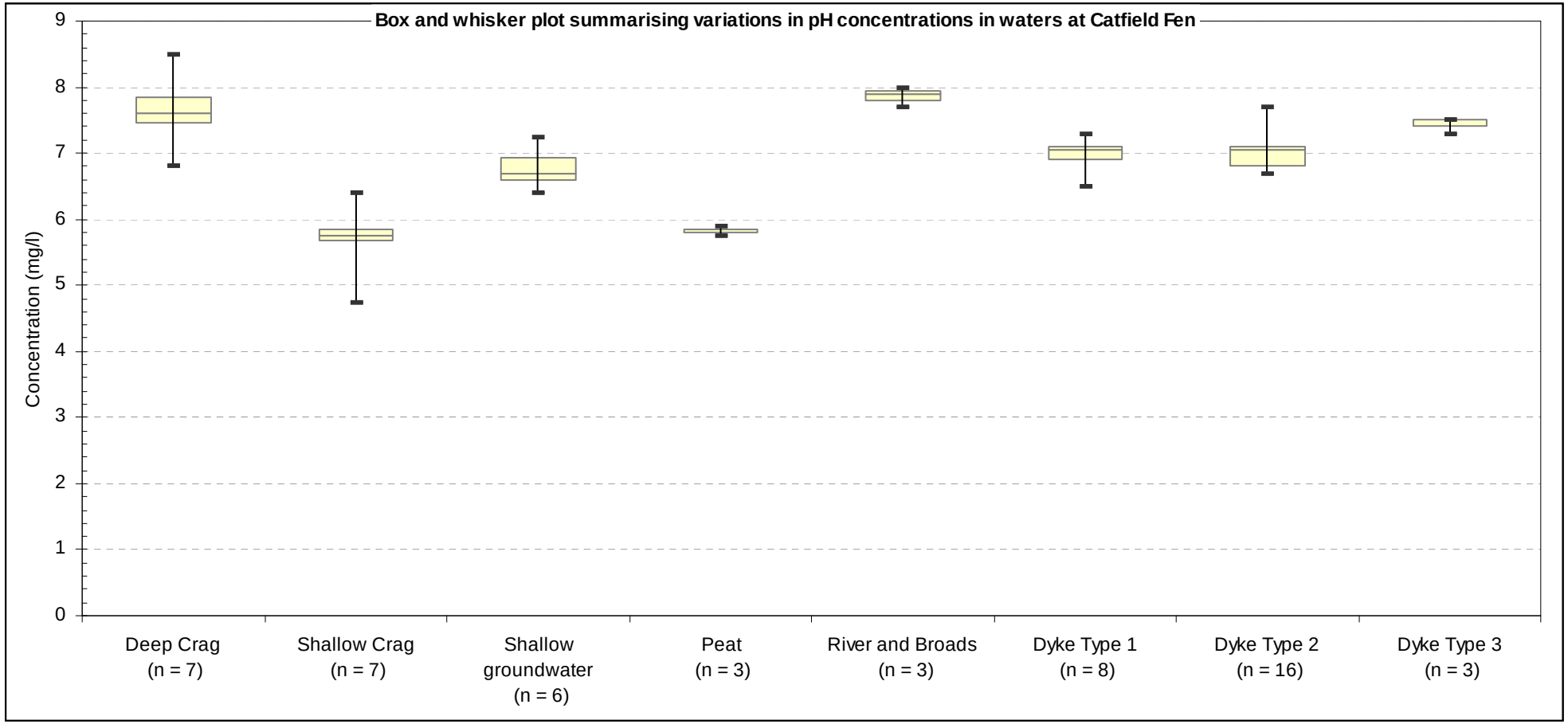


Figure F23 Box and Whisker Plot Summarising Variations in pH Concentrations in Waters at and near Catfield Fen

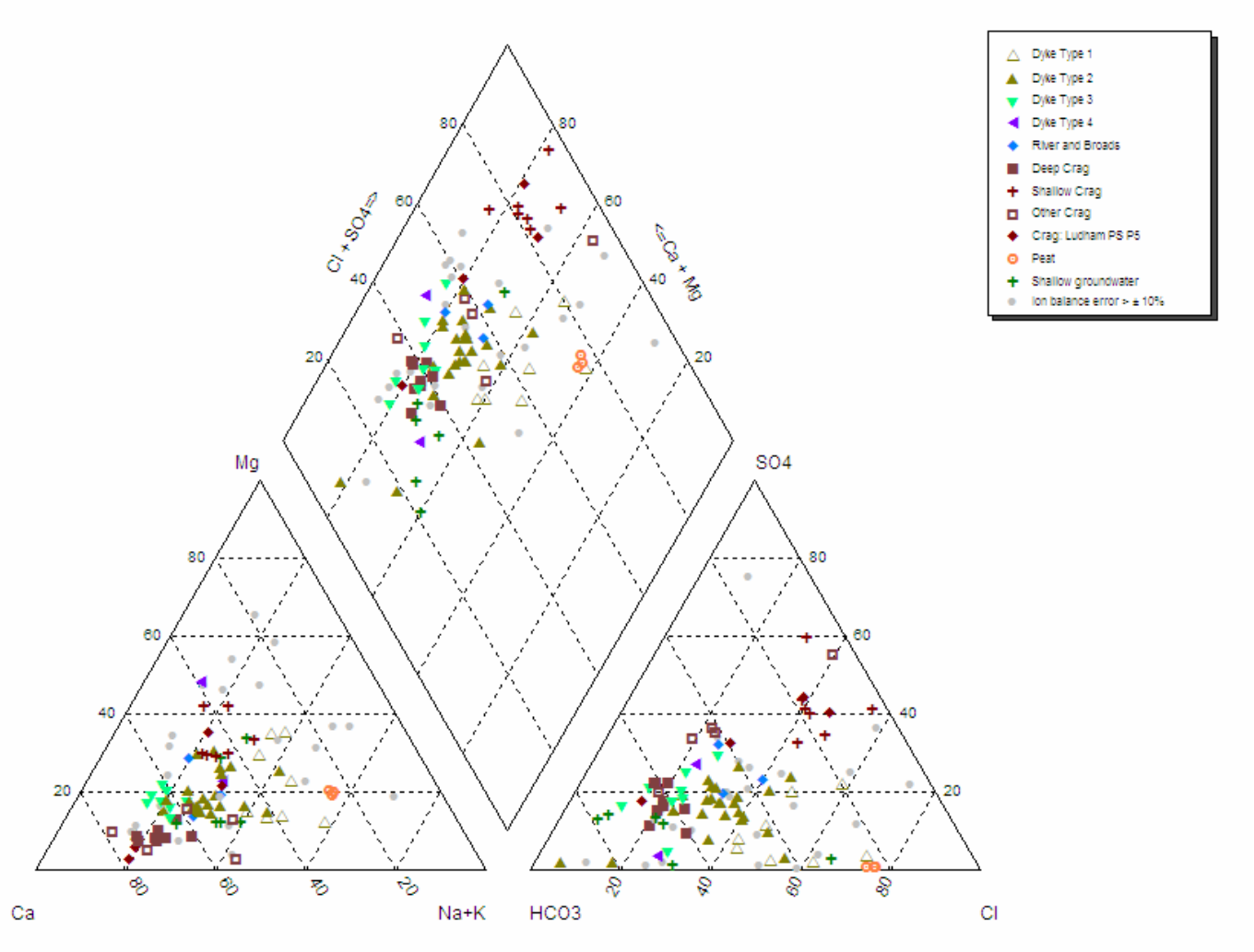


Figure F24 Piper Plot Showing General Chemical Characteristics

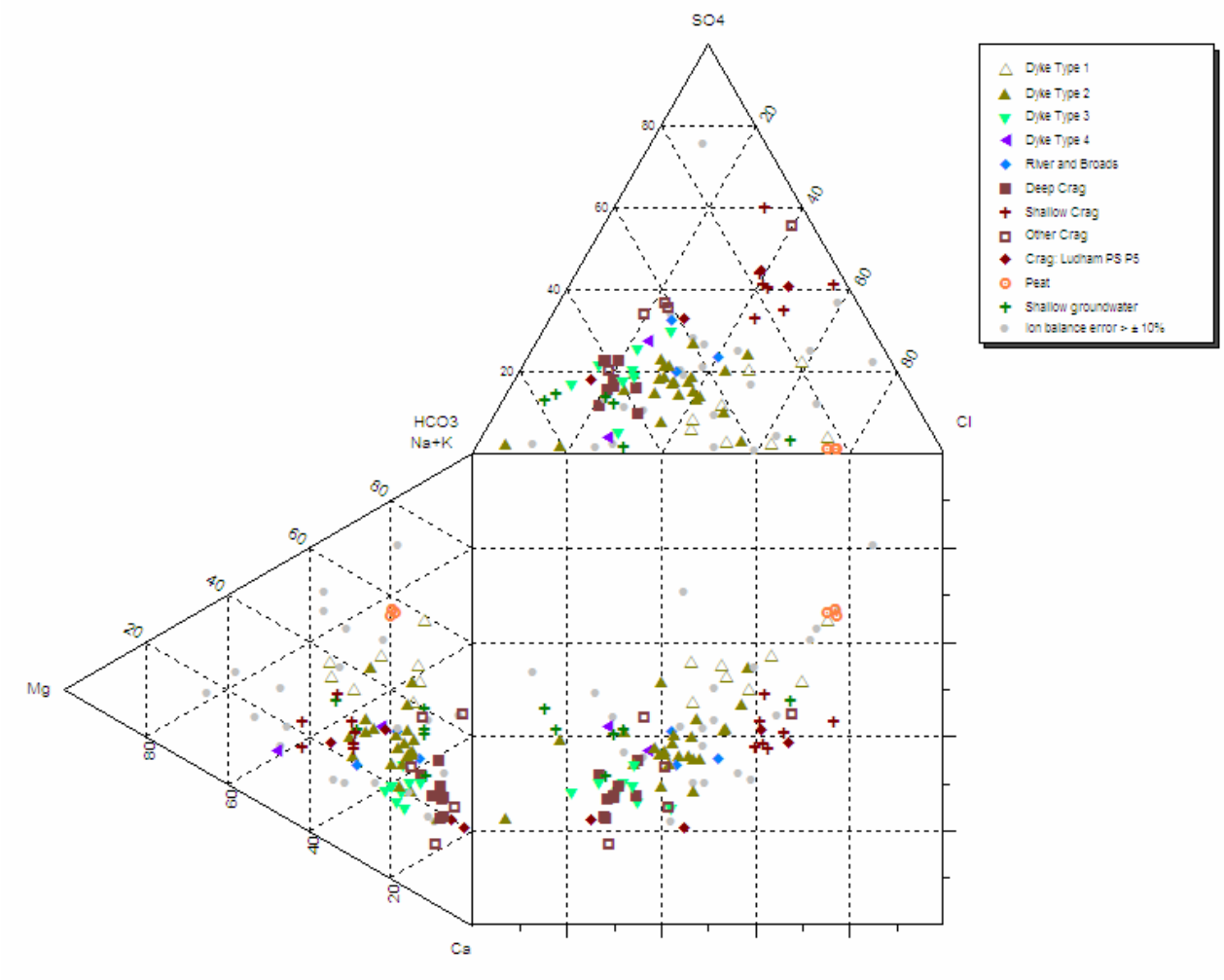
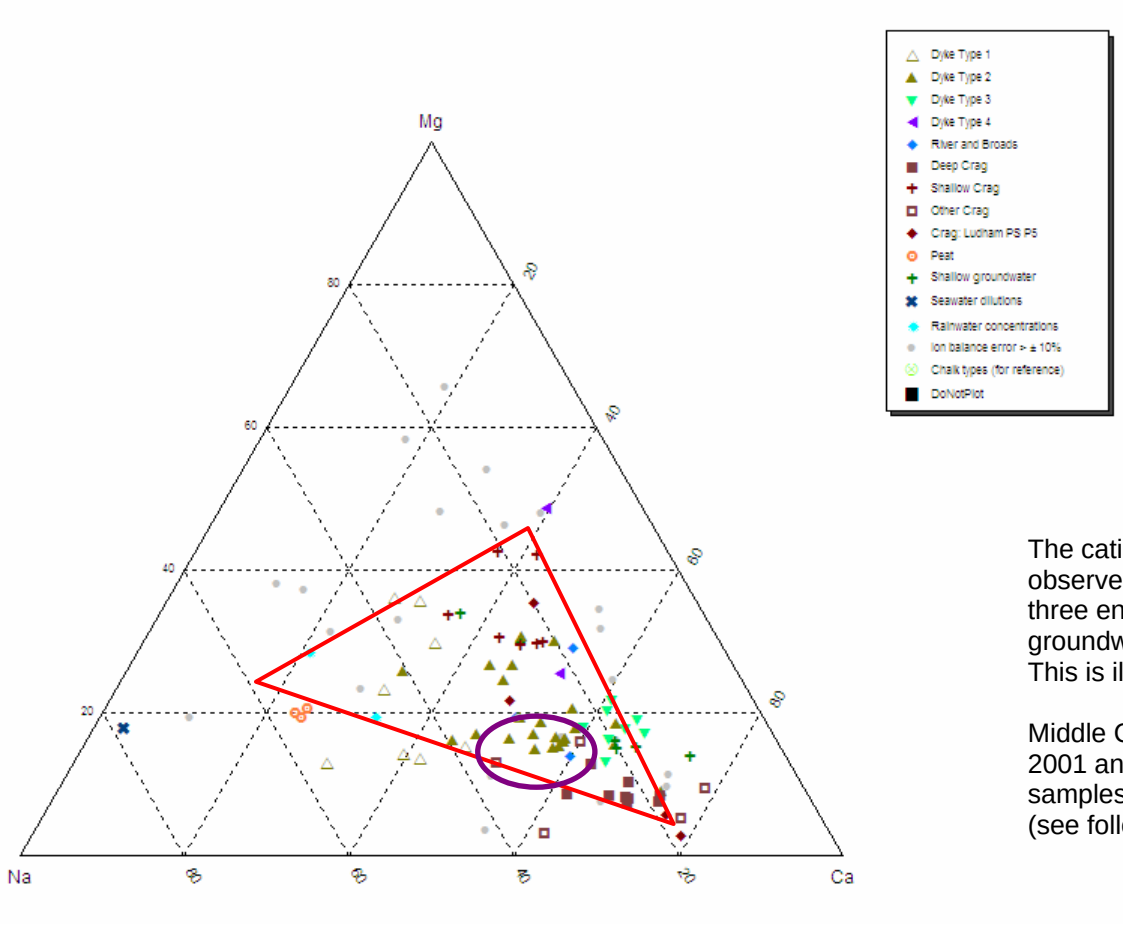


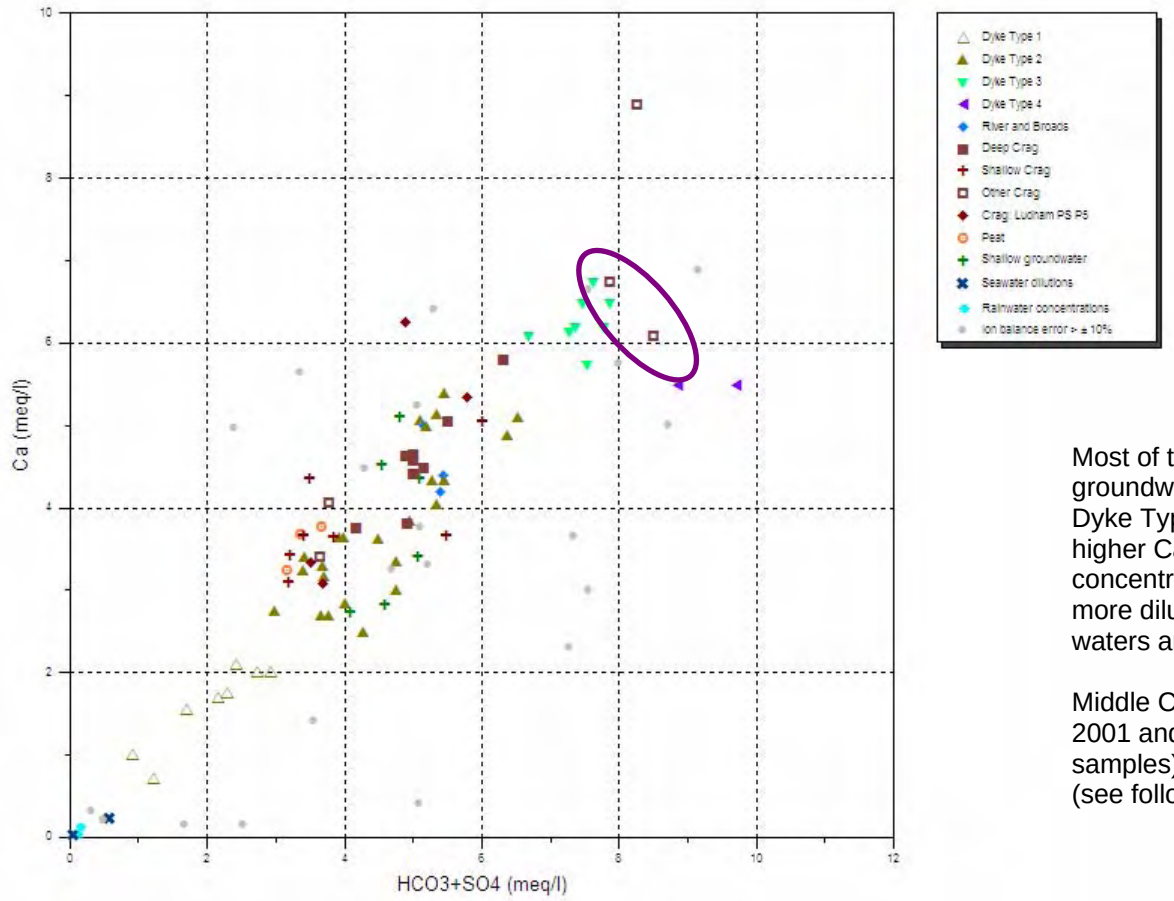
Figure F25 Durov Plot Showing General Chemical Characteristics



The cation ratios suggest that the water types observed could result from mixing between three end members: rain, shallow crag groundwater and deep crag groundwater. This is illustrated by the red triangle.

Middle Crag waters from Sharp Street P1 in 2001 and 2002 (N.B. not 2003 and 2004 samples) are highlighted by the purple ellipse (see following Figures)

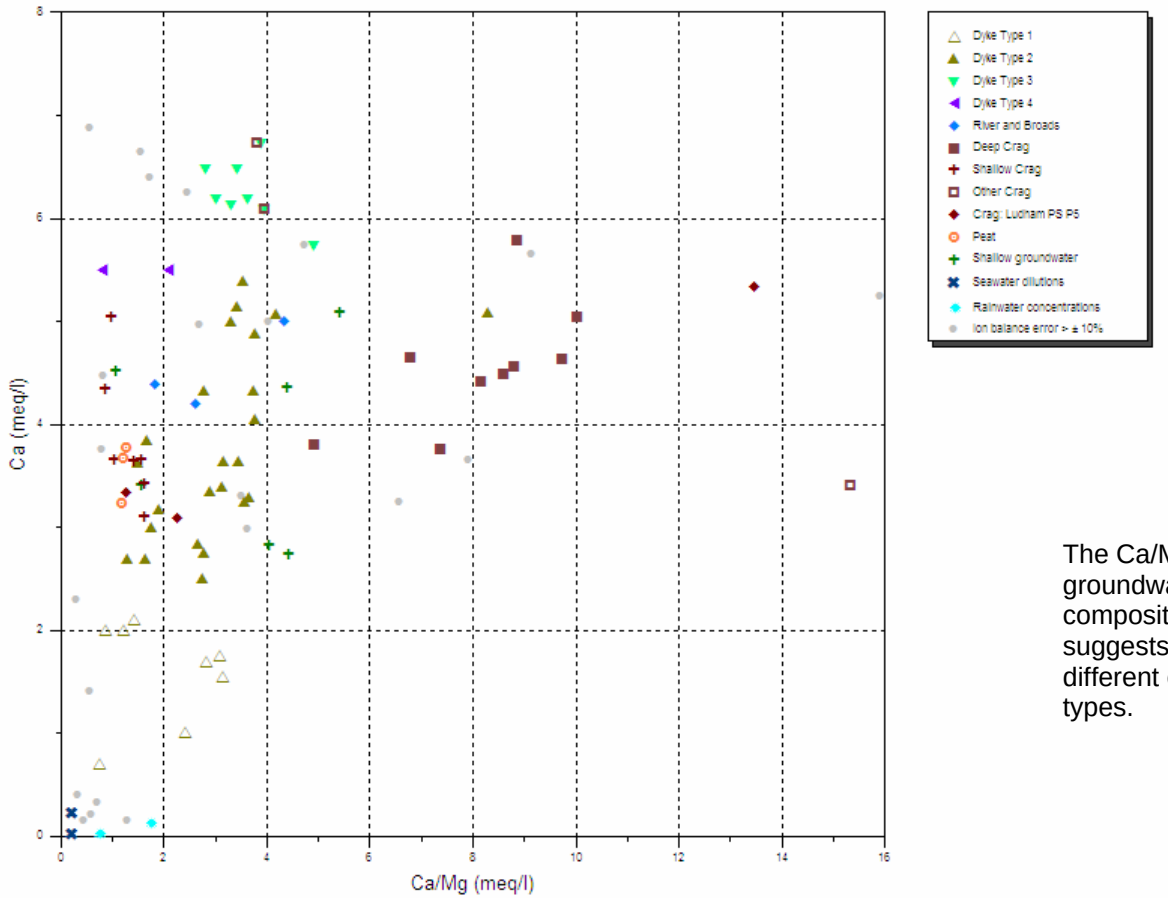
Figure F26 Ternary Plot for Major Cations (excluding K)



Most of the sampled waters (including groundwaters) have similar compositions to Dyke Type 2. Dyke Type 3 waters have higher Ca and HCO3 and SO4 concentrations. Dyke Type 1 waters have more dilute compositions. Type 4 Dyke waters are thought to be polluted.

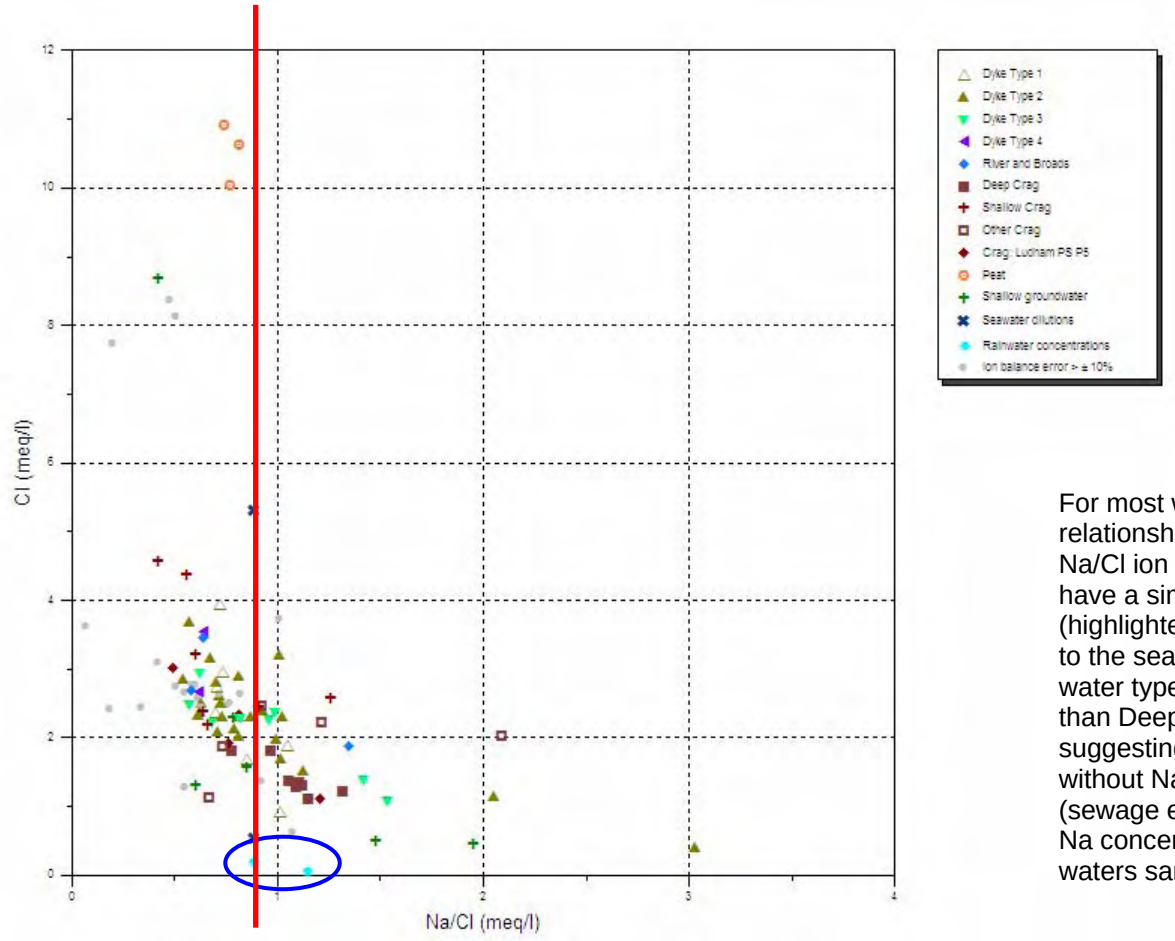
Middle Crag waters from Sharp Street P1 in 2001 and 2002 (N.B. not 2003 and 2004 samples) are highlighted by the purple ellipse (see following Figures)

Figure F27 Definition Diagram for Water Types (after Gilvear et al., 1997, Fig.8)



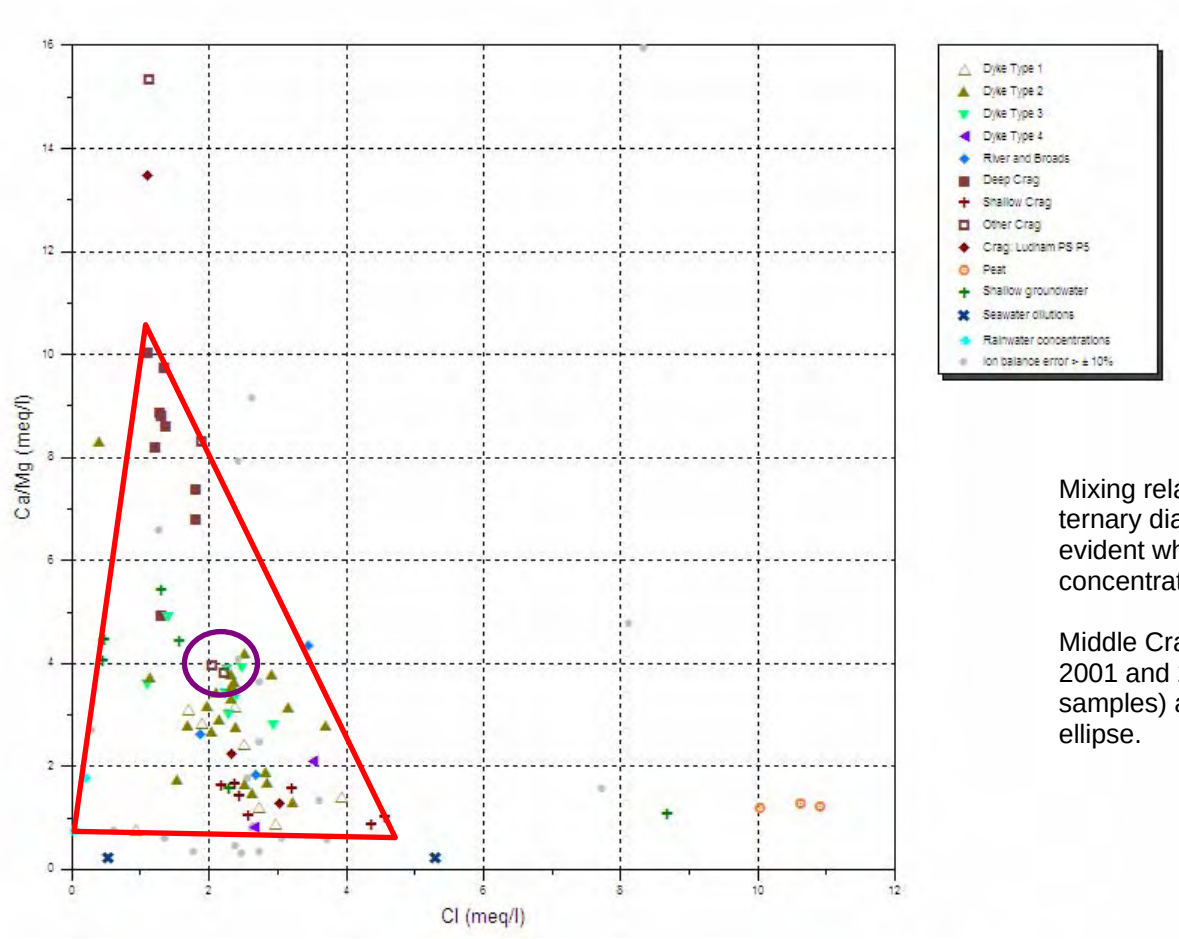
The Ca/Mg ion ratio indicates that Deep Crag groundwaters have a distinct hydrochemical composition from the other water types. This suggests that these groundwaters have a different chemical origin to the other water types.

Figure F28 Ca – Ca/Mg Plot



For most water samples there is an inverse relationship between Cl concentration and Na/Cl ion ratio. Deep Crag groundwaters have a similar Na/Cl ratio to rainwater (highlighted by the blue oval). This is similar to the seawater ratio (red vertical line). Other water types have higher Cl concentrations than Deep Crag and lower Na/Cl ratios suggesting that Cl is being contributed without Na, a possible indicator of pollution (sewage effluent or agricultural chemicals). Na concentrations are fairly constant in the waters sampled.

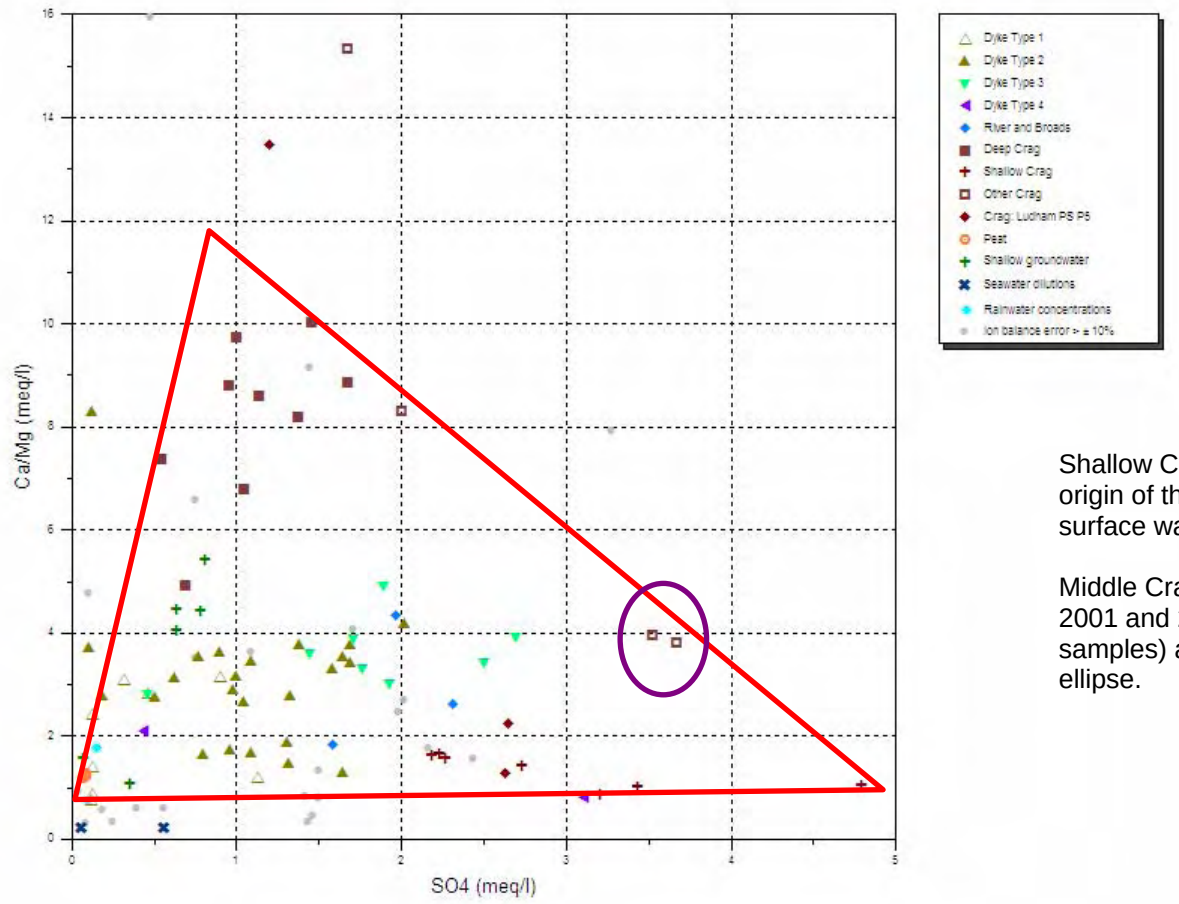
Figure F29 Cl - Na/Cl Plot



Mixing relationships identified from the cation ternary diagram (Figure F18 above) are also evident when Ca/Mg ratio is displayed with Cl concentration.

Middle Crag waters from Sharp Street P1 in 2001 and 2002 (N.B. not 2003 and 2004 samples) are highlighted by the purple ellipse.

Figure F30 Ca/Mg – Cl Plot



Shallow Crag groundwaters appear to be the origin of the high SO_4 concentrations in some surface waters.

Middle Crag waters from Sharp Street P1 in 2001 and 2002 (N.B. not 2003 and 2004 samples) are highlighted by the purple ellipse.

Figure F31 Ca/Mg –SO_4 Plot

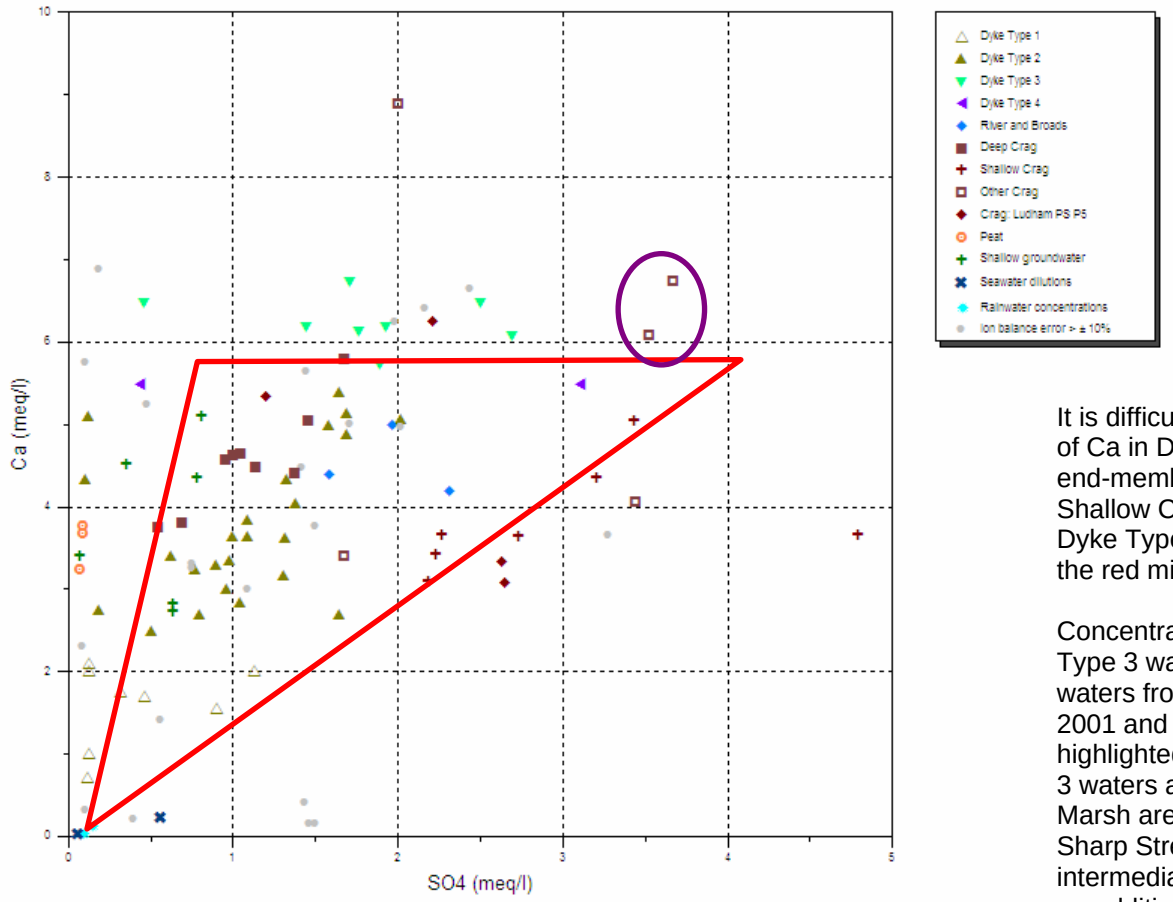
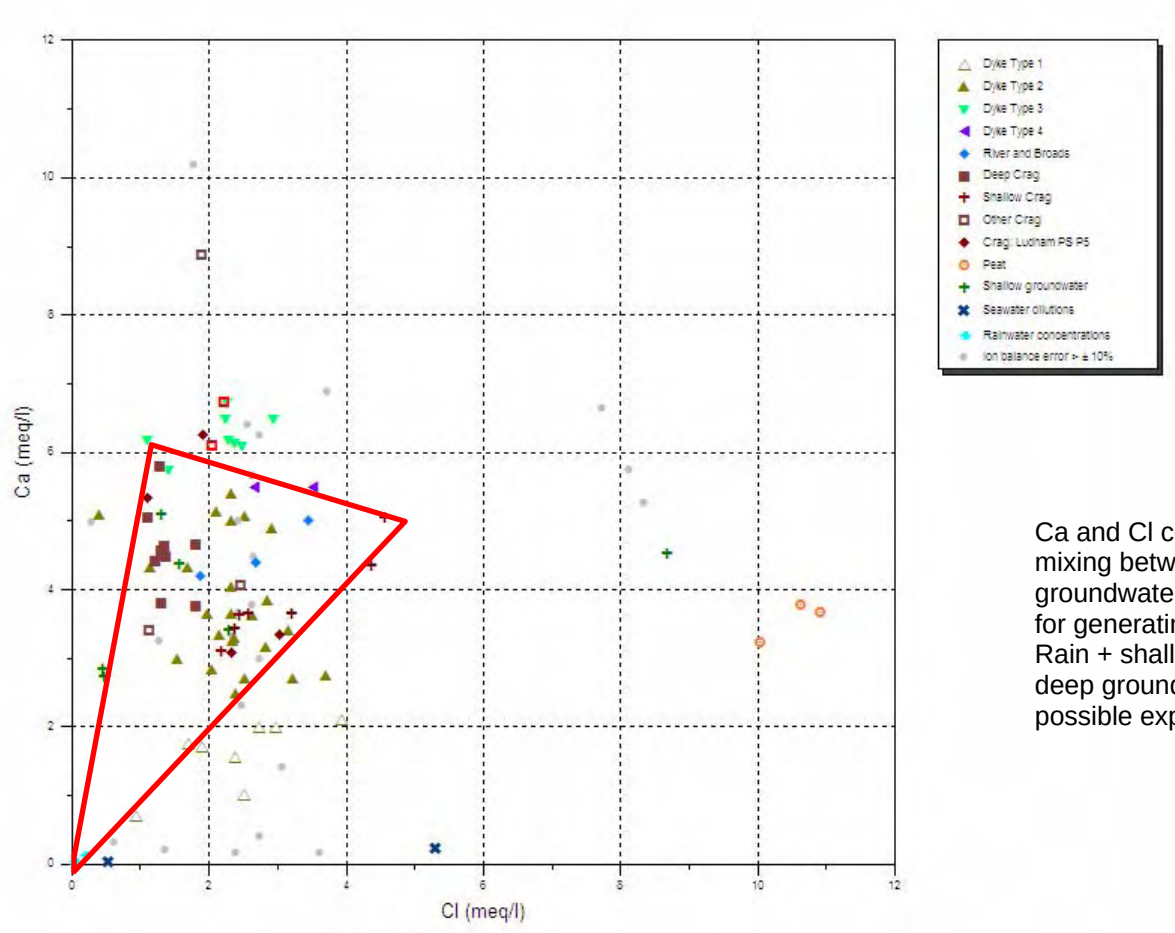


Figure F32 Ca –SO_4 Plot

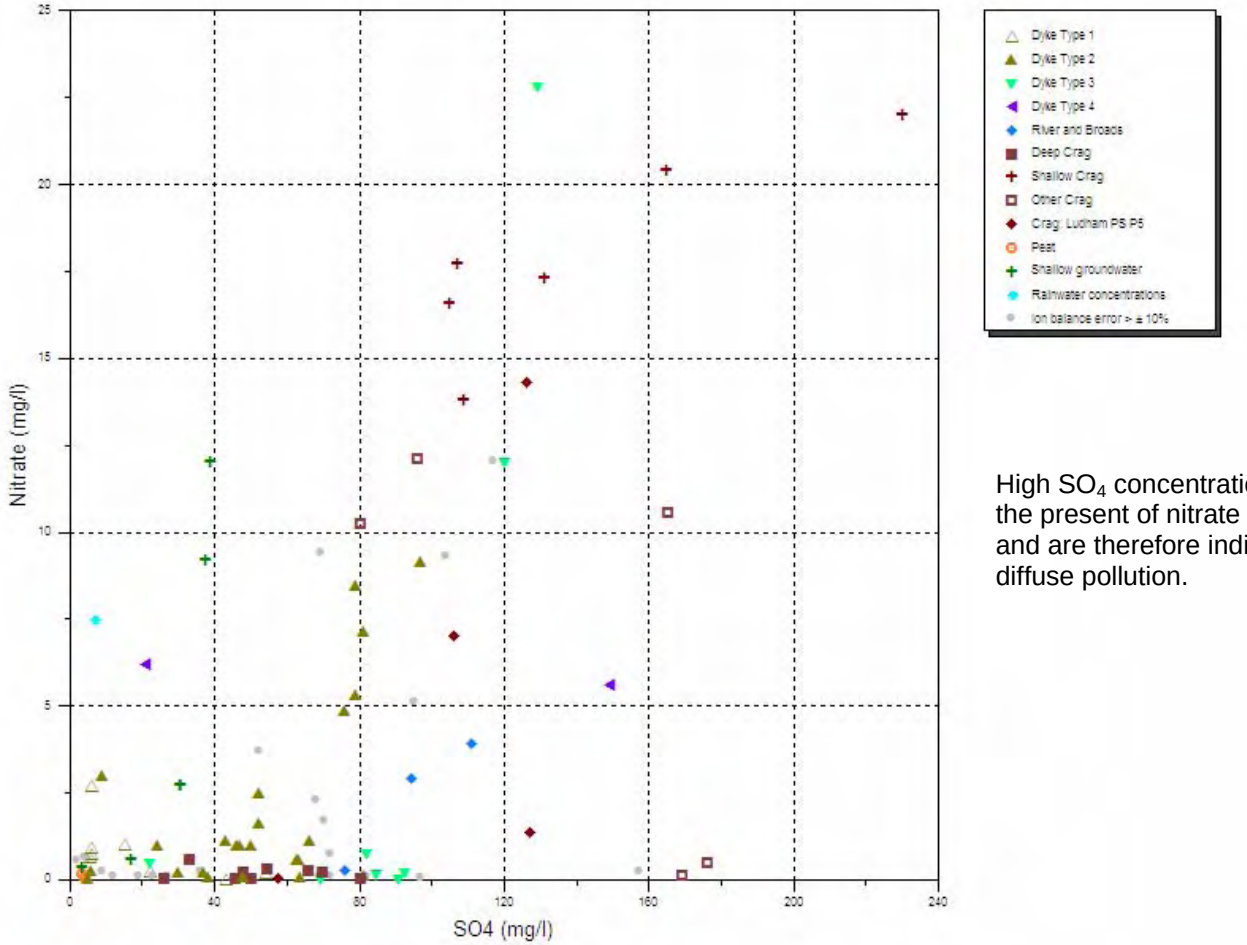
It is difficult to explain the high concentrations of Ca in Dyke Type 3 waters based on simple end-member mixing involving Deep Crag, Shallow Crag and rainwater alone, since Dyke Type 3 waters are positioned outside the red mixing triangle in the Figure.

Concentrations of Ca comparable to the Dyke Type 3 waters are found in the Middle Crag waters from Sharp Street P1 (samples from 2001 and 2002, not 2003 and 2004, highlighted by the purple ellipse). Dyke Type 3 waters are found in the North and Middle Marsh areas, in a comparable setting to Sharp Street. It therefore seems likely that intermediate (middle) Crag groundwaters are an additional, distinct end-member in the hypothesised mixing relationship.



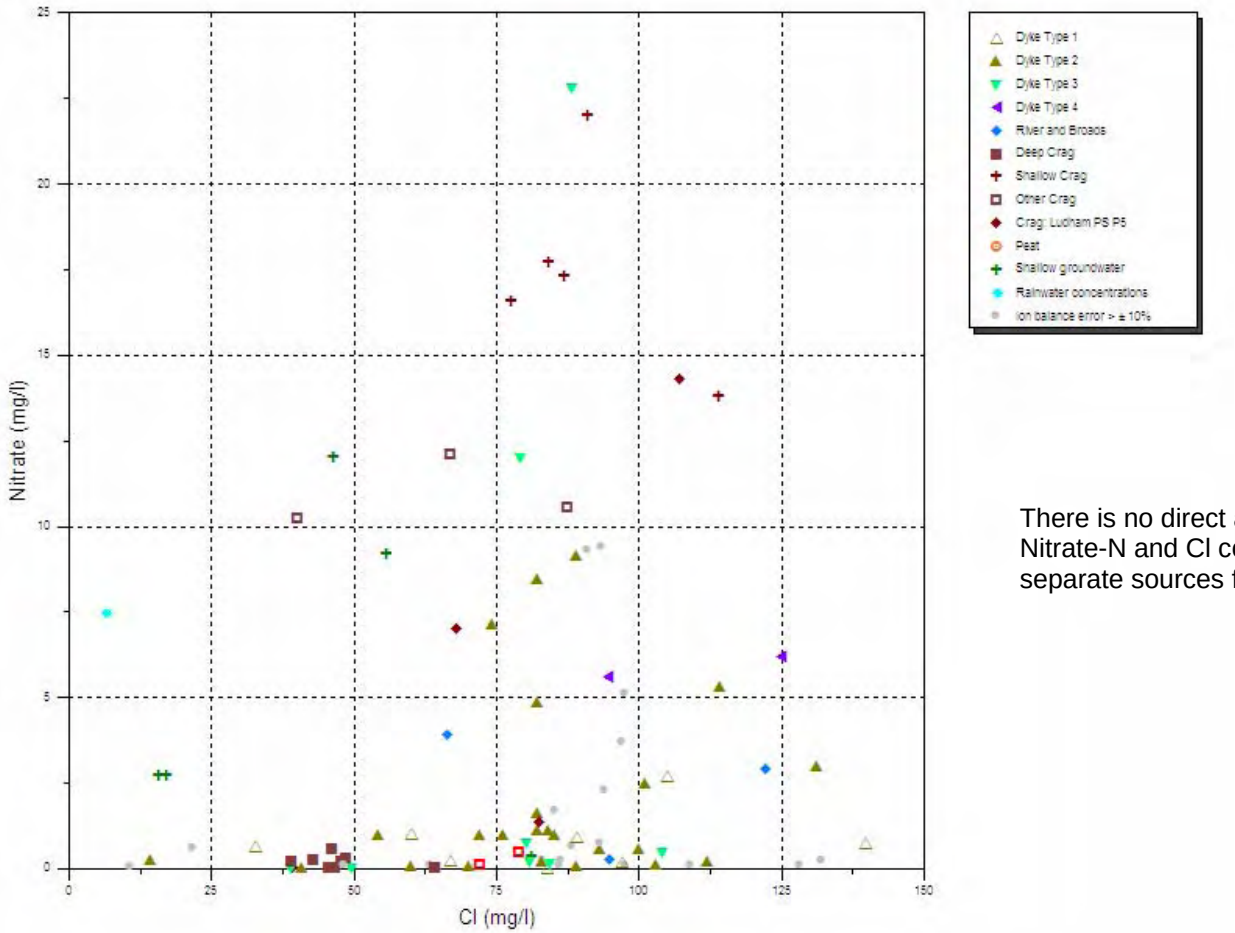
Ca and Cl concentrations suggest that direct mixing between rain water and deep groundwater is not an important mechanism for generating Dyke water types 1 and 2. Rain + shallow crag groundwater or rain + deep groundwater + broad or seawater are possible explanations.

Figure F33 Ca –Cl Plot



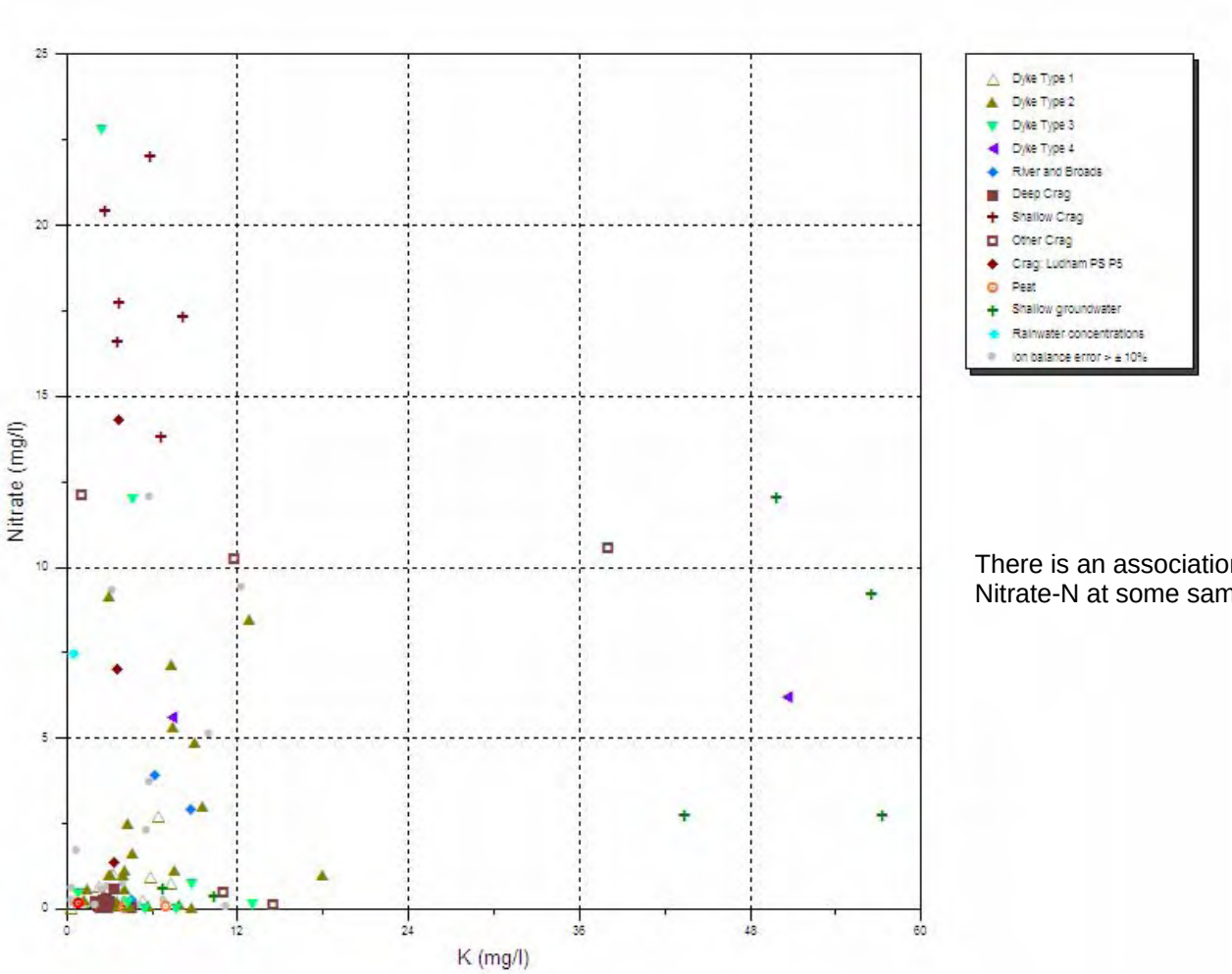
High SO_4 concentrations are associated with the present of nitrate (concentration as N) and are therefore indicative of agricultural diffuse pollution.

Figure F34 Nitrate - Sulphate Plot



There is no direct association between Nitrate-N and Cl concentrations suggesting separate sources for Nitrate and Cl

Figure F35 Nitrate - Chloride Plot



There is an association between K and Nitrate-N at some sampled locations.

Figure F36 Nitrate - K Plot