Hydraulics Research
Wallingford

ESTUARINE TRANSMISSION OF HEAVY METAL POLLUTANTS: Data collected from the River Conwy, North Wales

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This report describes work funded by the Department of the Environment under Research Contract PECD 7/7/049. It was carried out by Mr R J Jones and Mrs K A Turner under the direction of Mr T N Burt in the Tidal Engineering Department of Hydraulics Research, Wallingford, under the management of Mr M F C Thorn.

ABSTRACT

The United Kingdom has obligations under international conventions and the directives of the European Economic Community to control the pollution of the aquatic environment resulting from the discharge of dangerous substances. Legislative control of marine pollution from freshwater sources demands a more thorough understanding of the processes involved in the transmission of pollutants through a tidal estuary.

Hydraulics Research has been engaged in field studies of the estuarine transmission of heavy metal pollutants to determine to what extent metals entering an estuary from an outfall or freshwater source are trapped and stored within the estuarine sediments and how much passes out to sea. The present study was carried out over a two-year period in the tidal River Conwy, North Wales. This industrially unpolluted river was chosen as a contrast to those previously studied by HR to enable comparisons to be made.

The field program consisted of three main elements, the sampling of recently deposited bank sediments during the spring and autumn of both 1982 and 1983, continuous monitoring of the suspended solids concentration at one location from August 1982 to July 1983 and an intensive hydraulic survey carried out in the spring of 1983. The survey incorporated sampling of the estuary bed material throughout its length, sampling of the waters from both the estuary and its tributaries and continuous monitoring of water depth, velocity, direction of flow, suspended solids content, salinity and temperature at four selected positions, each one for the duration of a tidal cycle. Both types of sediment samples underwent size analysis prior to determination of the concentrations of Zn, Pb, Fe, Cu, Co and Mn. The water samples were analysed on collection for pH value and later for solids content and total metals concentration. This report details the methods of sample collection and subsequent analysis and presents the results. An additional analysis of selected samples was carried out by Dr R E Jones of the Marine Science Laboratory, Menai Bridge to determine the concentration of 'available' as opposed to 'total' metals present. An abbreviated version of his report is presented as an Appendix.

CONTENTS

TABLES (cont'd)

FIGURES:

FIGURES (cont'd)

1 INTRODUCTION

The Department of the Environment (DoE) has commissioned Hydraulics Research (HR) to study the estuarine transmission of heavy metal pollutants in an attempt to determine the extent to which they are accumulated in the estuary or passed out to sea and the factors affecting their transmission. This report is one of a series covering several aspects of this investigation.

Previous research by HR has been directed at known industrially polluted estuaries, and focussed on extensive field studies of the tidal River Parrett in Somerset. In order to put this research in context, comparative data from an industrially unpolluted estuary was sought. To meet these requirements the estuary of the River Conwy, North Wales was selected. The catchment area is shown in Fig 1.

This report presents field data collected by HR during 1982 and 1983 from the tidal reaches of the River Conwy and its tributaries at the positions shown in Fig 2. The emphasis of the report is on collation and presentation of the field data rather than on its interpretation. The survey work has been consolidated into three main categories, metal concentrations, sediment size and sediment transport regime which form the chapter headings. The methods of sample collection and analysis are outlined in each chapter; all the results are presented in tabulated and graphical form.

2 METAL CONCENTRATIONS

Heavy metals occurring in an estuarine environment are generally classified as being either particulate (i.e. sediment-attached) or dissolved. Particulate metals may be present suspended within the estuarine waters or deposited within the estuarine sediments (inter-tidal deposits and bed sediments). Dissolved metals may be present in the surface water or in the interstitial water (i.e. in the pores between the deposited sediment particles).

To measure the concentration of heavy metals in the Conwy Estuary, samples of the estuarine surface waters and sediments, both inter-tidal deposits and bed sediments, were taken and subsequently analysed for zinc (zn), iron (Fe), lead (Pb), copper (Cu), manganese (Mn) and cobalt (Co) concentrations. Details of the sampling exercises to identify metal concentrations on inter-tidal deposits, in suspension and on bed sediments are given under respective sub-titles later in this chapter. No separate sampling of interstitial water took place.

Concentrations of metals occurring in both estuarine sediment and water samples were determined by Charter Consolidated Services Limited using an acid-digestion/atomic absorption method of analysis. The samples were dried and a mixture of nitric/perchloric acid added. Digestion was started at a low temperature to destroy the organics followed by strong heat to evaporate the perchloric acid. The mixture was then leached with 50% hydrochloric acid and diluted with metal-free water. Heavy metal concentration was then determined from the solution by atomic absorption spectrophotometry using a two point (plus blank) linear calibration.

2.1 On inter-tidal deposits

In order to identify the longitudinal distribution of heavy metals, samples of bank sediment were obtained on four separate occasions, May 1982, September 1982, March 1983 and September 1983.

The samples were taken from exposed deposits of fine sediment from just below the high water line at approximately 250 metre intervals along the tidal reaches of the estuary. Each sample (minimum quantity 10 grams dry weight) was obtained using a hand-held plastic scoop and stored in a plastic bag.

The results of metal concentration analysis are presented in Tables 1 to 4. The longitudinal distribution of zinc for each of the four sampling periods is graphically presented in Figs 3 to 6 and is indicative of the general trends for metal concentration to decrease with distance down river from the tidal limit.

2.2 In suspension

To measure the concentrations of metals in suspension, samples of the estuarine waters were taken at four positions along the tidal reaches, Deganwy Narrows, Conwy Town Road Bridge, Tal-y-cafn Road Bridge and Dolgarrog Road Bridge on the Conwy, (marked A, B, C and D respectively in Fig 2) during February and March 1983. Simultaneous collection being impractical, the samples were initially taken at each of the four positions during the four successive day time tides of 27 February to 2 March. Instrument failure at the Deganwy Narrows position on 1 March, however, necessitated a repeat operation there which took place on 5 March.

Bottle samples were taken throughout each tidal cycle at intervals of approximately 30 minutes using an Institute of Oceanographic Sciences (I.O.S.) water sampler modified by HR. This type of horizontal sampler maintains the naturally-occurring sediment

flocs. On collection the pH value of each sample was immediately determined using a PTI-II portable pH/mV/ temperature probe. All samples were later analysed in the HR Sedimentology Laboratory for both suspended solids content (i.e. particulate material) and total solids content (which includes salts and other dissolved matter that has precipitated out on drying) prior to determination of total metal concentrations. The results of this analysis are presented for each of the four survey positions in Tables 5 to 8.

Fresh water inputs to the estuary system were also measured in March 1983. Bottle samples were taken by hand from the tributaries; the sampling positions are shown in Fig 1. The method of analysis was the same as that applied to the estuarine water samples and the subsequent results are given in Table 9.

2.3 On bed sediments

Samples of estuarine bed sediments were collected from positions throughout the tidal length of the River Conwy in March 1983. These were taken from a survey vessel using a 2 litre galvanised steel Van Essen grab sampler at the positions marked in Fig 2, and stored in plastic bags prior to analysis. The samples were taken in mid-channel at each of 40 positions. Additionally, where practicable, a second sample was taken towards the channel side but along the same cross-section.

Selected grab samples were chosen for metal concentration analysis. As there was some risk of contamination from the metal sampler a sub-sample of the central core of each grab sample was carefully extracted for analysis. The results are given in Table 10. The longitudinal distribution of zinc on the bed sediments has been plotted in Fig 7.

3 SEDIMENT SIZE ANALYSIS

Sediment size was determined in two ways, particle diameter and surface area.

3.1 Particle diameter

The samples of the estuarine bed sediment were analysed for particle size distribution by the HR Sedimentology Laboratory using a standard settling velocity technique described in Ref 1. The results of this analysis are presented in Table 11.

It is well documented that heavy metals have an affinity for the silt fraction of a given sediment so, in addition to the particle size distribution analysis, the HR Sedimentology Laboratory analysed a number of samples for percentage silt content. Each sample was dried and weighed, split by wet sieving at

63 μm, dried again and the dry weight of silt (i.e. the fraction < 63 μm) calculated as a percentage of the dry weight of the total sample. This analysis was applied to the March 1983 bed samples and both the March and September 1983 bank samples. The results for each exercise are presented in Figs 8, 9 and 10 respectively.

3.2 Surface area

Another significant factor affecting the concentration of sediment-attached metals is the actual surface area of the sediment particles. Five of the Conwy bank samples collected in September 1983 were selected for determination of surface area. They were analysed in the HR Sedimentology Laboratory using a standard ethylene glycol monoethyl ether adsorption (EGME) procedure whereby the weight of EGME adsorbed (as a monolayer surface cover) by one gram of dried sediment is determined. Table 12 compares these calculations of surface area with percentage silt content for the five samples.

4 SEDIMENT TRANSPORT

4.1 Suspended sediment and related flow data

In order to study the tidal sediment movement within the Conwy Estuary (and to calculate the sediment flux) additional field data was collected during the hydraulic survey conducted in February and March 1983. General details of this boat survey have already been given in Section 2.2 which also reports on the collection of estuarine water samples which formed an integral part of this exercise.

Simultaneous observations of water depths, velocities, direction of flow, suspended solids content, salinities and temperature were recorded on separate days at Deganwy Narrows, Conwy Town Road Bridge, Tal-y-cafn Road Bridge and Dolgarrog Road Bridge (Fig 2). Current velocities and directions were recorded using a Braystoke BFM 008 Mark III directional current meter. Concurrent measurements of salinity and temperature were taken by an I.O.S. Salinometer Mc5 attached to the current meter. Coincidental measurements of suspended solids content were taken by a Partech suspended solids monitor (detailed in Section 4.2) also attached to the current meter. Readings from all instruments were recorded on board the survey vessel and are presented in Tables 5 to 8.

Fresh water flow data

It is generally accepted that salinity is an important factor affecting sediment flocculation. In an

estuary, salinity is affected by the rate at which fresh water enters it. Fresh water flow data for the Conwy has been obtained from the Welsh Water Authority and is presented in Tables 13 to 16. These measurements were taken during the years 1980 to 1983 at the Llanerch gauging station, Betws-y-coed.

4.2 Silt monitoring

To obtain a continuous record of suspended sediment movement two silt monitoring positions were established in the estuary during August 1982. One site was against the west buttress of Conwy Town Road Bridge and the other under the central span of Dolgarrog Bridge (Fig 2). It was intended to collect one year's data from both sites but the equipment at Dolgarrog Bridge was vandalised shortly after installation and as it was considered inappropriate to replace it no data was collected.

The monitoring equipment situated under the Conwy Town Road Bridge consisted of two Partech suspended solids sensors which were mounted on a fixed frame and positioned at 0.1m and 0.6m above the bed. A variety of optical sensors both single and twin path were used during the monitoring period but all operated on the photo-extinction principal described in Ref 2. Initially the sensors at both positions above the bed were calibrated to cover a range from 0 to 500ppm (parts per million). In January 1983 the upper sensor was changed and calibrated to cover a range from 0 to 5000ppm to enable monitoring of the very high suspended solids concentrations which occurred occassionally. Thereafter, however, most of the recorded concentrations were low and the accuracy of the data obtained within this range rendered it of little value. Both sensors were connected to a Microdata logging system which recorded data simultaneously from both sensors onto a magnetic tape cartridge at 10 minute intervals. Each record included the date and time as well as the two channels of suspended solids concentrations. Servicing visits were carried out at approximately four week intervals. Each servicing comprised changing the logger batteries, recovering the data tape and checking the nominal Formazin calibration of the sensors. In addition water samples were taken for analysis in the HR Sedimentology Laboratory using a dry-weight analysis to check the calibration factor relating the logger output to the concentrations of estuary silt.

The recorded data was then processed through a suite of HR developed computer programs detailed in Ref 2. Examples of this analysis are graphically presented in Figs 11 to 14 and the complete results are summarised in Tables 17 to 24. A large amount of good data was obtained from this site.

Special calibration exercise

The routinely collected water samples covered too small a range of concentrations to accurately determine the relationship between nominal Formazin concentrations and estuarine suspended solids concentration so a series of water samples were taken from the Town Bridge monitoring site over a complete tidal cycle in March 1983. These, along with a number of water samples covering a range of concentrations taken from the four March 1983 boat positons (Ref 1) were analysed in the HR Sedimentology Laboratory for suspended solids concentration and used to determine the Formazin/suspended solids concentration relationship for the Conwy Estuary. Figure 15 presents the results of the analysis which gives a multiplication factor of 1.47 (for river solids up to 200ppm) to convert Formazin values to the estuary suspended solids concentrations. This factor has been applied to all silt monitoring data presented in this report.

5 ACKNOWLEDGEMENTS

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(ii) Charter Consolidated Services Limited of Ashford, Kent for the chemical analysis of samples.

(iii) Dr R E Jones of the University of North Wales for advise and assistance in the collection and comparative chemical analysis of samples.

(iv) Mr P R Kiff of the HR Sedimentology Laboratory who prepared all the sediment and water samples for analysis and carried out all particle size, surface area and suspended solids determination.

6 REFERENCES

1. Kiff, P R. Sedimentation method manual, HR, second impression, August 1978.

2. Thorn, M F C and Burt, T N. Transport of suspended sediment in the tidal River Crouch, HR Report No INT 148, November 1975.

APPENDIX

The concentration of "available" metals in Conwy Estuary Sediment
by Dr R E Jones, March 1983

Following discussions between the author and representatives of Hydraulics Research Limited, at the Marine Science Laboratories Menai Bridge, it was agreed that the former should analyse twenty sediment samples from the Conwy Estuary. The method specified was a weak acid reducing agent leaching procedure which measures the weakly bound metal fraction present. This method is more representative of the "available" metals which are involved in biological or chemical processes than the more aggressive leaching procedures such as that previously adopted by Hydraulics Research Limited.

A known weight of sediment was oven dried overnight at 90°C before being re-weighed and the moisture content determined on a dry weight basis. Approximately 3 grams of dried sediment was accurately weighed and transferred to a round bottomed flask. To the dried sediment 50ml of the mixed acid reducing reagent composed of one molar hydroxyl ammonium chloride and 25% (v/v) acetic acid were added and the flasks shaken for four hours. The sample was then filtered through a Whatman No 5 filter paper, care being taken to wash the filter paper free of any remaining leaching agent with distilled de-ionized water and the filtrate retained.

The filtrate was evaporated to dryness with the excess reducing reagent being destroyed by the addition of 2ml of concentrated nitric acid (aristar grade). The sample was then dissolved in 2ml of concentrated nitric acid and made up to 100ml with distilled de-ionized water. Reagent blanks were run with each batch of samples to check for contamination.

Determination of the concentration of metals in the leachate was carried out using a Pye Unicam SP90 atomic absorption spectrophotometer using metal standards prepared from appropriate atomic absorption standards purchased from BDH.

The concentration of the metals on a dry weight basis is presented in Table A1, along with the moisture content of the sediment.

Eight of the sediment samples were run in duplicate so as to provide a combined measure of the analytical reproducibility and within sample variation. It can be seen that the agreement is better for some elements than for others. In the case of copper, concentrations are very low and approach the limit of detection for this element.

The concentration of metals in the fine particle size fraction of sediments from the Conwy Estuary have been recorded by Jones (1972). The mean concentration of leachable metals determined by a mixed acid reducing agent leaching procedure similar to that used here are shown in Table A2.

The concentrations of metals recorded are higher than those generally recorded in this investigation and reflect the enrichment of metals in the fine sediment fraction (see, for example, De Groot et al 1971). Jones (1972) also assessed the size of the leachable metal fraction in relation to the total metals present. In the case of manganese the easily leachable fraction approximated to the total metal present and for zinc and lead

approximately two thirds of the total metal present. In contrast, only about one third of the copper is present in an 'available' form and less than one fifth of the iron.

The influence of changes in analytical technique on the concentration of metals measured for a given sample will vary from element to element. A comparison of the present data with results obtained by the more aggressive technique used by Charter Consolidated, is likely to show closest agreement for manganese. In contrast, large differences are likely to occur between the concentrations of iron measured by the two methods; this reflecting the small proportion of total iron removed by the mixed acid reducing agent.

References

Chester, R and Hughes, M J. 1967. A chemical technique for the separation of ferro-manganese minerals, carbonate minerals and adsorbed trace elements from pelagic sediments. Chem Geol, 2, 249-262.

De Groot, A J, De Goeij, J J M and Zegers, C. 1971. Contents and behaviour of mercury as compared with other heavy metals in sediments from the Rivers Rhine and Ems. Geologie Mynb, 50, 393-398.

Jones, R E. 1972. Some aspects of the Geochemistry of the Conwy Estuary. M.Sc Thesis. UCNW Bangor.

TABLE A1

Concentration of metals in Conwy sediment samples (mg/kg)

Sample No	Moisture content	Cadmium	Copper	Iron	Manganese	Lead	Zinc
SS DC 4	81	2.3	2.7	2,400	439	47	183
SS AC 17	38	1.4	2.6	1,700	1,260	61	108
SS AC 31	40	1.9	1.2	1,400	278	26	161
SS AC 25	52	2.0	2.6	2,300	489	38	169
SS AC 33	69	2.2	2.9	1,400	472	47	185
SS AC 11	55	1.1	2.5	1,000	462	47	160
SS AC 13	44	1.9	4.2	3,700	2,210	130	218
SS AC 5	21	0.7	2.7	900	155	37	56
SS AC 15	80	2.7	5.5	4,300	2,380	130	166
SS AC 29	56	1.8	2.0	1,700	359	35	163
SS AC 28	71	2.4	2.5	2,000	451	49	216
SS DC 2	52	1.8	2.5	1,600	369	41	147
SS AC 19	72	2.2	3.1	2,700	1,330	72	210
	97	2.8	1.8	2,300	1,450	78	238
SS AC 23	130	2.7	2.4	2,700	818	71	294
	120	2.8	2.8	2,800	852	65	280
SS AC 35	54	2.1	2.4	1,900	431	44	179
	57	2.1	2.4	1,900	382	42	173
SS DC 5	93	2.1	3.3	2,300	501	54	211
	120	2.3	7.1	2,800	649	69	153
SS AC 26	70	2.0	2.5	1,800	420	44	170
	67	2.2	4.0	2,000	418	47	179
SS AC 21	70	2.5	2.5	2,100	703	52	228
	75	2.5	2.0	1,700	686	51	219
SS AC 3	65	1.6	6.8	2,100	486	59	89
	62	1.5	5.4	1,800	490	46	79
SS AC 8	113	2.1	6.7	3,300	684	79	167
	81	2.3	2.7	2,200	477	49	208

TABLE A2

Mean metal concentrations of the fine sediment fraction of sediments from the Conwy Estuary

(The later HR/Charter Consolidated analyses are shown in brackets)

Metal	**Mean Concentration mg/kg**	
Iron	7,400	(30,000)
Manganese	650	(600)
Zinc	450	(200)
Lead	130	(60)
Copper	30	(300)

TABLES

TABLE 1
Longitudinal distribution of metal concentration
on inter-tidal deposits, May 1982

Chainage u/s (km)		Sample No	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
-1.425	CM	88	71	25	7840	6	4	320
		87	63	21	8530	6	4	300
-0.525		86	111	48	15910	15	7	710
		85	107	54	15870	12	10	610
0.125		84	142	54	17080	19	10	560
		83	135	51	16400	17	10	610
1.6		90	385	107	41900	38	18	1500
		89	367	106	34400	36	17	1090
1.9		92	331	94	32800	35	16	810
		91	306	89	32100	33	15	760
2.275		82	228	75	26600	27	14	700
		81	275	85	29200	31	16	1140
2.425		80	228	73	28200	27	14	730
		79	237	76	28200	27	14	660
2.5		78	186	63	25430	23	12	750
		77	177	59	23930	20	11	690
2.775		76	202	68	26210	26	14	960
		75	219	72	27900	27	15	1320
3.1		74	167	53	25390	21	12	670
		73	166	53	26100	22	14	660
3.3		72	228	67	23640	26	12	610
		71	192	58	22340	21	11	640
3.625		70	203	61	24020	23	12	610
		69	200	62	23170	23	11	550
6.55		68	190	22	11670	7	8	360
		67	226	37	15010	12	9	480
6.825		66	197	20	10760	6	7	330
		65	248	26	11490	12	8	410
7.15		64	226	50	19700	19	10	510
		63	236	52	19940	19	11	510
7.575		62	216	46	18180	20	8	530
		61	240	52	20020	18	10	570
7.925		60	307	62	21570	20	11	670
		59	289	55	20860	19	11	630
8.45		58	281	53	19610	18	9	550
		57	229	44	17360	15	9	530
8.775		56	530	95	38000	34	18	1460
		55	550	98	38900	35	18	1490
9.025		54	238	36	14880	10	8	610
		53	265	41	17100	13	9	660
9.325		52	277	48	18490	17	10	700
		51	284	50	18610	18	10	690
10.250		50	234	36	33200	16	15	750
		49	315	57	28300	19	15	830
10.675		48	390	80	28500	29	13	870
		47	388	77	26270	28	13	850
10.950		46	256	38	19190	13	10	670
		45	218	36	17980	12	9	610
11.450		44	279	51	20330	19	10	760
		43	386	70	24790	26	12	910

TABLE 1 (cont'd)

Chainage u/s (km)	Sample No cm	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
11.775	42	423	78	28400	29	12	890
	41	330	60	22700	23	11	700
12.150	40	514	84	31300	31	14	1000
	39	453	71	24400	25	14	800
12.525	38	468	81	25100	30	15	980
	37	418	71	23000	27	15	900
13.175	36	497	88	33400	34	16	1000
	35	467	81	30700	31	16	970
13.275	34	264	46	35400	14	16	1000
	33	308	48	29000	15	13	790
13.525	32	262	41	21280	14	11	650
	31	262	42	19030	14	11	610
13.775	30	475	81	27800	32	16	840
	29	494	83	34500	31	16	860
14.175	28	342	58	23540	18	12	750
	27	302	50	22420	18	13	680
14.6	J 8	442	73	24130	25	12	720
	7	440	74	24970	29	13	720
14.975	6	552	82	26300	27	14	610
	5	376	64	22400	20	11	690
15.225	4	450	73	23970	24	12	740
	3	405	65	23480	22	10	680
15.575	2	397	66	23820	22	11	680
	1	391	62	23370	22	12	720
15.85	cm 26	454	71	26000	27	14	850
	25	409	64	25990	23	14	820
16.275	24	499	77	25300	25	15	760
	23	467	79	23360	23	14	710
16.475	22	610	95	25100	33	17	880
	21	660	100	28000	36	17	830
16.750	20	413	86	21950	21	16	680
	19	550	90	25300	28	16	860
17.0	18	495	75	25720	23	13	790
	17	436	67	23960	21	12	790
17.325	16	530	90	26700	25	15	880
	15	530	103	29000	26	15	980
17.6	14	650	131	30300	29	16	950
	13	580	96	32800	29	17	1030
17.85	12	670	101	33900	35	16	870
	11	630	95	35100	32	16	920
18.075	10	680	101	24300	36	16	860
	9	600	87	23600	30	15	810
18.3	8	610	91	25100	30	15	900
	7	458	77	30500	25	17	1060
18.55	6	422	78	33800	26	18	1190
	5	510	147	35100	29	19	1170
18.8	4	670	98	31100	34	16	870
	3	517	83	33100	27	16	950
19.25	2	950	134	33600	37	22	780
	1	770	119	34300	38	19	900

TABLE 2
Longitudinal distribution of metal concentration on inter-tidal deposits, September 1982

Chainage u/s (km)	Sample No	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
-0.65	85	188	63	23540	25	9	630
	84	202	59	26050	28	10	600
-0.4	83	140	39	19550	15	7	630
	82	129	40	18530	15	7	560
0.125	87	181	46	21110	20	8	600
	86	153	51	25380	25	10	800
0.5	89	132	24	17920	13	8	390
	88	135	26	16920	13	7	390
0.95	91	121	23	14820	10	6	318
	90	116	25	22020	17	6	270
1.3	93	268	59	33920	29	13	1130
	92	213	47	36460	27	13	680
2.15	101	233	66	31380	28	11	980
	100	227	60	30800	26	11	1020
2.55	99	269	65	31300	30	12	660
	98	262	66	31020	30	11	820
2.78	95	232	58	29780	25	11	810
	94	224	57	28730	24	11	860
3.03	97	280	52	28830	24	10	660
	96	226	50	28040	24	11	760
3.58	103	209	59	27830	23	10	800
	102	227	58	27800	25	11	850
6.4	81	426	81	36470	34	16	1320
	80	425	81	36470	34	16	1310
6.68	79	422	79	36440	36	15	1010
	78	431	80	36290	25	15	1090
7.03	77A	326	61	28710	27	11	740
	76A	368	67	31900	30	13	1100
7.8	75A	471	87	38670	39	16	1340
	74A	415	89	39260	40	17	1380
8.08	73A	369	70	31350	31	14	1080
	72A	388	73	32990	32	15	1270
8.28	71	338	50	25720	21	11	920
	70	327	49	25930	22	10	800
8.78	73	309	43	23360	19	10	760
	72	296	33	19430	17	8	620
9.05	75	319	46	22770	20	11	760
	74	397	60	28870	31	12	980
9.35	77	289	41	21490	18	10	730
	76	262	37	21130	16	9	700
9.5	56	307	46	24550	23	10	840
	55	320	48	26040	22	10	910
9.78	54	338	54	26280	32	10	730
	53	306	46	24510	22	10	700
10.25	69	443	72	32670	33	13	1140
	68	412	65	31450	30	14	1150
10.53	67	348	50	26390	24	11	960
	66	353	50	27280	24	12	1140
10.75	65	388	51	25700	24	11	940
	64	428	51	25440	23	11	1000

TABLE 2 (cont'd)

Chainage u/s (km)	Sample No cm	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
11.35	61	421	63	30440	35	12	920
	60	421	61	31840	29	13	980
11.53	63	489	79	36450	36	15	1200
	62	476	75	35680	35	14	1240
11.65	52	359	53	26480	23	12	900
	51	325	43	22840	18	10	720
11.95	50	371	52	25450	21	12	880
	49	321	38	22110	18	10	720
12.13	48	382	54	27430	24	13	1050
	47	330	46	25320	20	11	900
12.38	46	458	69	32340	31	15	101
	45	480	69	33850	33	15	1030
13.23	44	136	18	29370	21	13	380
	43	530	71	33940	33	16	1110
13.5	42	560	82	37100	37	17	1440
	41	493	64	28570	26	14	770
13.93	40	287	31	20570	13	9	740
	39	354	44	24130	19	11	940
14.2	38	510	69	34870	33	15	1160
	37	300	70	33520	33	15	1080
14.5	36	480	67	32380	28	16	1280
	35	480	66	32180	28	17	1370
14.8	34	510	71	30640	28	15	990
	33	530	73	35580	31	16	1300
15.08	32	450	76	34510	34	15	1300
	31	520	63	30320	28	13	1100
15.48	30	400	53	28070	26	12	930
	29	420	56	28350	26	13	950
15.73	28	600	88	39380	40	18	1520
	27	580	82	37140	38	16	1430
15.88	26	490	68	30230	28	15	1120
	25	480	67	29870	27	15	1110
16.15	24	510	74	31560	30	16	1290
	23	430	64	29360	23	15	1130
16.35	22	550	73	32260	29	17	1340
	21	460	69	28590	24	16	1270
16.78	20	460	58	29150	23	13	990
	19	550	70	33130	29	15	1070
17.05	18	580	78	35650	34	17	1210
	17	550	74	34020	31	17	1280
17.33	16	670	8	38460	38	17	1270
	15	630	82	36700	36	17	1250
17.6	14	580	78	36410	35	16	1200
	13	550	83	34390	34	15	1150
17.85	12	530	68	31680	31	14	1060
	11	610	83	35980	37	16	1240
18.1	10	670	8	38760	37	17	1210
	9	650	80	36530	36	17	1310
18.33	8	680	95	38660	38	21	1540
	7	640	93	39920	38	22	1580
18.5	6	660	94	40860	38	17	1310
	5	690	96	39500	40	18	1270
18.85	4	600	108	40530	34	29	2230
	3	710	99	41310	42	19	1140
19.13	2	640	133	48630	26	25	1780
	1	690	121	42300	34	24	1630

TABLE 3
Longitudinal distribution of metal concentration on inter-tidal deposits, March 1983

Chainage u/s (km)	Sample No		Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn	% silt content
-1.58	AC	1	261	84	33130	39	13	940	95.6
-1.45		2	40	9	9380	5	< 5	188	3.3
-0.65		3	130	42	18920	16	7	610	6.6
0.13		4	175	62	22680	25	10	620	92.8
0.38		5	125	24	17330	13	7	352	19.0
0.88		6	123	23	17570	14	7	401	31.8
1.23		7	233	60	21710	23	9	376	43.9
3.73		9	304	97	35020	44	15	830	87.6
3.78		8	275	79	32680	34	13	940	88.9
6.85		12	320	67	30180	32	13	900	63.5
7.18		11	241	44	21540	18	9	670	37.2
7.75		10	294	55	25280	25	11	700	40.4
8.3	DC	4	290	49	23500	22	10	600	43.2
8.73		3	257	34	17660	13	8	530	19.5
9.06		2	253	47	21800	19	10	610	42.6
9.66		1	282	56	25510	23	10	680	46.9
9.98		5	373	69	31050	30	13	860	55.2
10.33	AC	37	353	72	28480	28	13	740	57.7
10.51		36	276	40	20150	18	10	610	50.1
10.93		35	262	39	20750	17	9	610	37.9
11.21		34	331	64	26590	29	12	810	53.1
11.5		33	325	60	24940	26	12	730	48.9
11.64		32	353	74	28710	33	13	870	67.5
11.89		31	291	39	18600	15	9	600	8.2
12.31		30	LOST SAMPLE						
12.94		29	291	52	23600	24	11	660	48.1
13.19		28	312	48	22590	23	11	640	41.6
13.54		27	388	70	29130	34	14	750	63.9
13.69		26	308	51	23970	24	11	680	42.1
13.97		25	284	41	22750	16	11	700	26.2
14.19		24	333	55	24300	22	12	840	43.6
15.48		23	454	77	34150	32	17	990	77.1
15.88		22	401	76	32390	30	16	1090	65.5
16.43		21	398	71	29320	28	15	1060	55.7
16.73		20	461	95	36380	29	21	1520	76.6
17.0		19	497	129	44630	27	32	2530	64.6
17.25		18	408	122	47950	28	32	2830	64.8
17.65		17	293	89	50300	24	28	1930	14.3
17.93		16	291	93	58600	24	40	3650	16.8
18.25		15	270	115	55200	25	34	2690	37.6
18.4		14	470	75	50250	25	23	1940	8.9
18.73		13	362	157	55880	30	40	3480	53.5

TABLE 4
Longitudinal distribution of metal concentration
on inter-tidal deposits, September 1983

Chainage u/s (km)	Sample No	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn	% silt content
-1.5	CC 50	87	33	13050	8	9	368	17.2
-0.4	51	143	60	19530	18	12	560	44.7
0.2	52	199	80	25180	26	15	550	56.9
0.3	44	338	77	25700	26	16	570	44.4
0.5	45	287	88	30290	31	18	680	72.5
0.7	46	194	61	22360	22	14	590	34.5
1.0	47	243	71	26100	25	16	510	55.7
1.3	48	377	106	35100	37	22	770	76.4
1.7	49	346	103	33760	36	20	790	78.6
2.4	17	362	115	37550	38	20	570	95.9
2.7	18	330	107	37460	37	20	540	86.3
3.6	53	295	91	31440	31	18	630	82.8
5.9	54	220	51	21580	18	12	550	44.4
6.8	43	360	83	29000	28	17	660	57.0
7.1	42	300	61	21910	21	13	510	37.9
7.3	41	323	73	26840	25	16	570	47.9
7.5	39	297	62	23430	21	14	590	50.0
7.8	38	290	52	22210	16	13	540	30.0
8.0	37	343	63	24020	21	15	580	35.7
8.3	40	468	100	34760	35	20	1060	65.7
9.1	35	352	72	27010	25	17	700	53.5
9.5	34	367	72	25260	25	16	680	48.9
9.8	33	325	57	20680	18	13	640	34.9
10.0	32	454	100	34500	35	21	1010	78.2
10.2	31	416	87	29490	30	19	780	59.4
10.4	36	490	94	31360	33	20	930	74.0
10.8	30	477	107	35200	37	21	990	85.1
11.0	29	456	88	30970	30	20	900	63.4
11.5	28	530	119	39040	41	24	1090	92.7
11.7	27	316	55	21670	19	14	600	34.8
12.0	26	409	80	28420	26	18	910	51.5
12.2	25	560	115	38890	44	24	1420	86.2
12.7	24	484	92	32760	31	20	1380	80.3
12.9	23	368	66	25730	22	16	1110	59.9
13.1	22	530	102	36580	37	22	1730	77.5
13.3	21	491	92	31890	33	20	1060	71.4
13.6	20	473	77	27630	25	17	910	42.0
13.9	19	508	98	34360	34	21	950	74.5
14.2	16	394	65	25030	21	16	650	50.9
14.5	15	369	62	24680	20	15	610	40.1
15.3	14	433	67	25640	22	16	800	44.8
15.7	13	454	81	29490	26	20	940	68.6
16.0	12	480	83	29460	26	19	790	49.9
16.3	11	580	86	34420	19	20	850	25.3
16.5	10	550	101	34490	32	23	960	61.2
16.8	9	500	93	31810	32	22	1080	74.6

TABLE 4 (cont'd)

Chainage u/s (km)	Sample No	Metal Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn	% silt content
17.1	8	620	119	39730	37	26	1100	81.6
17.3	7	610	117	38850	37	25	1280	73.2
17.6	6	500	115	41850	33	26	1110	44.4
17.9	5	600	102	37290	37	24	1080	74.2
18.2	4	710	119	39250	38	26	1030	77.1
18.6	3	790	118	36550	39	26	1040	86.4
19.1	2	770	112	39350	40	25	1090	77.2
19.5	1	860	126	24700	42	28	1380	89.1

TABLE 5 - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

			Continuous in-situ measurements					**Discrete samples**									
Time (GMT)	**Water depth (m)**	**Height of instrument above bed (m)**	**Velocity (m/s)**	**Direction (°mag)**	**Suspended Solids (ppm)**	**Salinity (ppt)**	**Temperature (°C)**	**Sample bottle number**	**pH**	**Solids Content Suspended (ppm)**	**Total (g/l)**	**Zn**	**Metals Concentration (ppm) Pb**	**Fe**	**Cu**	**Co**	**Mn**
0911	4.2	0.2	0.27	010	13	0.5	2.5										
		0.5	0.25	010	13	0.5	2.5										
0923		1.0	0.13	010	13	0.5	2.4	116B	6.14	16	0.06	512	129	11175	140	< 5	362
0926		2.0	0.09	120	12	0.5	2.5										
		3.0	0.08	170	10	0.5	2.5										
0932		4.0	0.15	140	1	0.5	2.4										
0940	5.0	0.2	0.27	160	16	0.5	2.4										
0945		0.5	0.27	160	21	0.5	2.5	126B	6.63	15	0.0	1080	160	24400	240	< 5	840
0948		1.0	0.44	150	16	0.5	2.5										
0955	6.0	2.0	0.53	170	21	0.5	2.5										
0959		3.0	0.63	160	21	0.5	2.5										
1002		5.0	0.71	170	15	0.5	2.5										
1004	6.2	0.2	0.29	140	26	0.5	2.5										
1007		0.5	0.43	150	28	0.5	2.5	137B	6.83	18	0.0	853	93	11400	107	13	667
1010		1.0	0.50	150	31	0.5	2.5										
1013		2.0	0.61	160	25	0.5	2.5										
1015		4.0	0.75	180	15	0.5	2.5										
1030	6.9	0.2	0.21	100	96	0.5	2.5										
1037		0.5	0.20	70	81	0.5	2.5										
1040		1.0	0.20	100	62	0.5	2.5	108B	6.75	66	0.27	295	89	6320	135	< 5	244
1042	7.2	2.0	0.22	30	56	0.5	2.5										
1047		4.0	0.18	100	65	0.5	2.5										
1049	7.0	6.0	0.18	100	44	0.5	2.5										
1104	7.0	0.2	0.03	040	44	0.5	2.8										
1106		0.5	0.04	030	41	0.5	2.9										
1109		1.0	0.03	050	40	0.5	2.8										
1111		2.0	0.03	050	38	0.5	2.8										
1115		4.0	0.04	060	35	0.5	2.8										
1116		5.0						147B	7.10	49	0.23	164	89	3950	85	< 5	140
1117		6.0	0.05	350	21	0.5	2.8										
1121	7.0	0.2	0.00	270	38	0.5	2.8										
1125		0.5	0.05	290	37	0.5	2.8										
1127		1.0	0.08	300	35	0.5	2.8										
1129		2.0	0.12	300	34	0.5	2.8										
1132		4.0	0.20	290	31	0.5	2.8	135B	7.27	6	0.08	446	107	8605	124	< 5	376
1135	7.0	6.0	0.24	280	22	0.5	2.8										

TABLE 5 (Cont'd) - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1140	7.0	0.2	0.15	340	32	0.5	2.8										
1144		0.5	0.19	360	31	0.5	2.8	105B	7.26	20	0.04	560	56	6898	69	< 5	230
1146		1.0	0.28	350	29	0.5	2.8										
1148		2.0	0.37	350	28	0.5	2.8										
1150		4.0	0.39	350	26	0.5	2.8										
1153	6.9	5.9	0.22	350	16	0.5	2.8										
1204	6.7	0.2	0.32	360	29	0.5	2.7										
1207		0.5	0.31	350	25	0.5	2.7										
1209		1.0	0.38	350	26	0.5	2.7	115B	7.30	43	0.25	**Bottle sample lost**					
1212	6.6	2.0	0.48	350	22	0.5	2.8										
1214		4.0	0.52	350	18	0.5	2.8										
1216		5.6	0.48	340	15	0.5	2.8										
1220	6.5	0.2	0.30	360	24	0.5	2.8										
1224		0.5	0.34	360	24	0.6	2.8										
1227		1.0	0.46	350	21	0.5	2.8										
1229		2.0	0.54	350	18	0.5	2.8										
1231		4.0	0.53	360	18	0.5	2.8										
1231		4.5						114B	7.27	30	0.40	400	51	2617	49	< 5	143
1233	6.5	5.5	0.55	350	7	0.5	2.8										
1240	6.3	0.2	0.43	300	18	0.5	2.8										
		0.5	0.54	290	18	0.5	2.8										
1243		1.0	0.49	310	16	0.5	2.8										
1246		2.0	0.54	290	15	0.5	2.8	106B	7.25	17	0.10	960	67	4910	100	< 5	1190
1249	6.1	4.0	0.54	300	15	0.5	2.8										
1250	6.0	5.0	0.48	300	18	0.5	2.8										
1255	6.0	0.2	0.33	290	18	0.5	2.8										
1258		0.5	0.47	300	15	0.5	2.8										
1300		1.0	0.51	300	15	0.5	2.8										
1302		2.0	0.56		15	0.5	2.8										
1305		4.0	0.50	300	7	0.5	2.8	125B	7.25	22	0.0	484	80	10040	80	< 5	500
1309	5.8	4.8	0.57	290	1	0.5	2.5										
1313	5.75	0.2	0.40	310	13	0.5	2.5										
1315		0.5	0.45	300	13	0.5	2.5										
1317		1.0	0.43	300	15	0.5	2.5										
1320	5.6	2.0	0.50	360	13	0.5	2.5	127B	7.10	8	0.04	650	53	5750	74	< 5	337
1323	5.5	4.0	0.54	310	3	0.5	2.5										

TABLE 5 (Cont'd) - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

					Continuous in-situ measurements			**Discrete samples**									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1329	5.5	0.2	0.40	300	12	0.5	2.5										
1330		0.5	0.41	300	12	0.5	2.5										
1333		1.0	0.47	300	13	0.5	2.5										
1335		2.0	0.49	300	12	0.5	2.5										
1338	5.3	4.0	0.48	310	3	0.5	2.5	136B	7.15	16	0.0	1343	116	7600	242	< 5	347
1402	5.3	0.2	0.29	300	12	0.6	2.6										
1405		0.5	0.29	10	13	0.6	2.6										
1407		1.0	0.32	360	12	0.5	2.6	146B	7.43	3	0.0	158	86	8630	200	< 5	457
1410		2.0	0.44	310	10	0.5	2.6										
1412	5.2	3.5	0.41	300	4	0.5	2.6										
1418	5.1	0.2	0.21	350	12	0.5	2.6										
1420		0.5	0.31	20	12	0.5	2.6										
1422		1.0	0.30	310	13	0.5	2.6										
1425		2.0	0.30	300	12	0.5	2.6	107B	7.41	8	0.33	391	58	6630	125	< 5	367
1429		3.4	0.35		4	0.5	2.6										
1440	5.2	0.2	0.25	20	13	0.5	2.6										
1442		0.5	0.21	10	13	0.5	2.6										
1444		1.0	0.23	300	13	0.5											
1446	5.3	2.0	0.32	10	12	0.5											
1450		4.0	0.34	310	4	0.5	2.7	117B	7.44	25	0.01	427	82	6930	155	< 5	436
1500	5.1	0.2	0.24	10	15	0.5	2.7										
1502		0.5	0.21	20	15	0.5	2.7										
1505		1.0	0.21	10	13												
1507		2.0	0.28	310	15	0.5	2.7										
1511		4.0	0.29	10	3	0.5	2.7										
1526	5.1	0.2	0.05	310	15	0.5	2.8										
1528		0.5	0.13	330	15												
1531		1.0	0.15	330	13			113B	7.20	16	0.06	462	69	5910	90	< 5	345
1533		2.0	0.25	310	13												
1536	5.0	4.0	0.32	330	3												
1545	5.0	0.2	0.07	300	15	0.5	2.8										
1547		0.5	0.12	320	15	0.5	2.8										
1550		1.0	0.22	330	15												
1552		2.0	0.19	330	15												
1555		4.0	0.40	320	9			104B	7.37	16	9.98	463	200	1610	75	<	363

TABLE 5 (Cont'd) - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1604	5.0	0.2	0.10	300	15	0.5	2.8										
1607		0.5	0.17	330	15												
1610		1.0	0.16	330	15			145B	7.34	10	0.0	367	100	3930	100	< 5	167
1612		2.0	0.22	320	15												
1615	5.0	4.0	0.30	320	10												
1619	4.9	0.2	0.08	320	15	0.5	2.8										
1621		0.5	0.10	310	15												
1624		1.0	0.16	330	15												
1626		2.0	0.24	320	15												
1630	4.8	3.8	0.31	330	9			124B	7.34	27	0.0	631	108	3770	77	< 5	308
1635	4.9	0.2	0.13	350	15	0.5	2.9										
1637		0.5	0.17	310	13			123B	7.34	4	0.0	425	88	4590	113	< 5	388
1639		1.0	0.15	320	15												
1642		2.0	0.23	320	15												
1644	4.8	3.8	0.34	320	12												
1655	4.9	0.2	0.10	330	15	0.5	3.0										
1657		0.5	0.19	340	13												
1701		1.0	0.20	350	15												
1703		2.0	0.29	340	13												
1706	4.8	3.8	0.39	330	10			121B	7.32	19	0.01	850	123	15400	154	< 5	400
1711	4.9	0.2	0.14	320	10	0.5	3.0										
1714		0.5	0.23	330	12												
1716		1.0	0.23	330	9												
1718		2.0	0.32	310	7		3.0										
1721	4.9	3.8	0.42	330	0			134B	7.35	34	0.0	785	81	17600	104	< 5	370
1746	5.0	0.2	0.15	310	9	0.5	3.0										
1749		0.5	0.26	300	10			133B	7.39	25	0.0	325	63	5210	75	< 5	263
1751		1.0	0.30	300	9												
1753		2.0	0.38	300	9												
1755	4.8	3.8	0.48	300	7												
1800	5.0	0.2	0.21	320	7	0.5	3.0										
1802		0.5	0.25	310	7												
1803		1.0	0.34	310	9			144B	7.46	10	3.82	610	113	7300	100	< 5	425
1806		2.0	0.42	310	10												
1809	4.8	3.8	0.48	330	10												

TABLE 5 (Cont'd) - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1812	5.0	0.2	0.24	320	7	0.5	3.0										
1814		0.5	0.25	320	7												
1817		1.0	0.27	320	9												
1819		2.0	0.29	320	10			129B	7.50	13	0.0	415	151	5190	83	< 5	331
1825	5.0	4.0	0.49	330	10												
1836	5.0	0.2	0.06	280	10	0.5	3.0										
1839		0.5	0.23	270	10												
1841		1.0	0.30	280	10												
1843		2.0	0.43	280	10												
1846	5.0	4.0	0.50	340	10			143B	7.54	4	0.04	137	30	4550	37	< 5	137
1850	5.1	0.2	0.21	350	12	0.5	3.0										
1852		0.5	0.25	330	12			122B	7.59	23	0.39	400	400	6520	160	< 5	360
1854		1.0	0.27	330	12												
1857		2.0	0.38	330	10												
1859	5.0	4.0	0.49	330	9												
1914	5.0	0.2	0.24	310	10	0.5	3.0										
1917		0.5	0.28	310	10												
1920		1.0	0.34	310	10			131B	7.36	11	0.06	41	9	839	9	< 5	33
1922		2.0	0.37	310	9												
1926	5.0	4.0	0.54	330	10												
1930	5.0	0.2	0.25	320	10	0.5	3.0										
1932		0.5	0.26	320	9												
1934		1.0	0.35	320	9												
1937		2.0	0.44	320	9												
1940	5.0	4.0	0.49	330	9												
1953	5.1	0.2	0.29	300	9	0.5	3.0										
1955		0.5	0.29	310	9												
1957		1.0	0.35	310	9												
2000		2.0	0.43	310	10			141B	7.40	4	0.0	350	75	5025	75	< 5	325
2003	5.0	4.0	0.46	330	9												
2006	5.0	0.2	0.27	310	9	0.5	3.0										
2008		0.5	0.32	310	9												
2010		1.0	0.34	310	9												
2012		2.0	0.46	310	10												
2015	5.0	4.0	0.57	330	9			100B	7.41	13	0.09	610	95	5600	1080	< 5	305

TABLE 5 (Cont'd) - OBSERVATIONS AT DOLGARROG ROAD BRIDGE 27.2.1983

	Continuous in-situ measurements							**Discrete samples**									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
2020	5.0	0.2	0.24	350	9	0.5	3.0										
2022		0.5	0.22	350	9			101B	7.46	9	0.02	353	71	7620	200	< 5	306
2024		1.0	0.37	350	10												
2027		2.0	0.36	350	10												
2031		4.0	0.48	320	12												
2034	5.0	0.2	0.26	300	10	0.5	3.0										
2036		0.5	0.30	300	12												
2038		1.0	0.28	300	12			132B	7.53	14	0.0	**Bottle Sample Lost**					
2040		2.0	0.29	300	13												
2044		4.0	0.45	330	12												
2053	5.0	0.2	0.20	320	15	0.5	3.0										
2055		0.5	0.27	320	15			142B	7.51	66	0.02	237	197	4680	117	< 5	217
2057		1.0	0.33	300	15												
2059		2.0	0.21	300	15												
2101		4.0	0.16	310	15												
2107	5.0	0.2	0.18	320	15	0.5	3.0										
2109		0.5	0.26	310	15												
2111		1.0	0.28	310	16			140B	7.48	21	0.12	103	18	1405	24	< 5	113
2114		2.0	0.40	320	15												
2118		4.0	0.47	330	16												

TABLE 6 - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
0916	3.5	0.2	0.48	260	29	0.5	3.0										
0919		0.5	0.64	260	51												
0921		1.0	0.66	270	49												
0924		2.0	0.64	250	43												
0927		2.4	0.77	260	75			102B	6.05	64	0.55	171	64	3314	72	< 5	130
0936	4.8	0.2	0.63	250	82	0.5	3.0										
0940		0.5	0.78	240	198	0.9	3.0										
0942	5.3	1.0	0.84	260	196	1.0	3.0	130B	6.26	143	0.06	128	72	4860	53	< 5	142
0944		2.0	0.86	240	196	1.0	3.0										
0948		4.0	0.76	240	141	0.9	3.0										
1000	5.6	0.2	0.36	240	185	2.9	3.0										
1002		0.5	0.78	250	198	2.9	3.0	110B	6.74	20	2.51	50	15	1639	15	< 5	64
1004		1.0	0.84	250	182	2.9	3.0										
1006		2.0	0.97	250	176	3.0	3.0										
1009	5.9	4.0	1.05	250	176	3.0	3.0										
1012		4.7	1.02	250	172	3.0	3.0										
1020	6.2	0.2	0.66	290	176	3.7	3.0										
1022		0.5	0.78	250	176	4.0	3.0										
1024	6.4	1.0	0.95	250	185	4.1	3.0	111B	7.01	158	5.74	49	14	1028	17	< 5	39
1026		2.0	1.08	250	168	4.4	3.0										
1029		4.0	1.19	260	159	4.4	3.0										
1033	6.5	5.5	0.97	250	159	4.6	3.0										
1040	6.7	0.2	0.44	250	209	7.1	3.0										
1043		0.5	0.76	230	203	7.0	3.0										
1045	6.9	1.0	0.75	240	245	7.7	3.0										
1047		2.0	0.82	240	260	8.4	3.0	103B	7.34	126	10.48	17	8	528	7	< 5	21
1050		4.0	1.07	240	203	8.8	3.0										
1052	6.9	5.8	1.02	240	156	8.0	3.0										
1100	7.0	0.2	0.65	240	316	11.8	3.0										
1102		0.5	0.73	240	235	12.1	3.0										
1105		1.0	0.74	240	198	12.8	3.0										
1107		2.0	0.84	240	168	12.8	3.0										
1110		4.0	0.98	240	162	12.8	3.0	119B	7.59	140	12.23	34	8	555	10	< 5	24
1113	7.1	6.0	0.87	250	135	12.6	3.0										

TABLE 6 (Cont'd) - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1120	7.1	0.2	0.49	250	163	14.4	3.0										
1122		0.5	0.65	240	156	14.5	3.0										
1124		1.0	0.73	250	159	14.9	3.0										
1126	7.1	2.0	0.73	230	151	15.1	3.0										
1129		4.0	0.67	230	140	15.4	3.0										
1132	7.1	6.1	0.69	230	88	15.0	3.0	112B	7.80	74	14.54	16	8	368	8	< 5	15
1140	7.1	0.2	0.44	260	141	17.0	3.0										
1142		0.5	0.41	270	159	17.2	3.0	118B	7.79	116	16.66	12	5	296	5	< 5	12
1143		1.0	0.43	260	163	17.5	3.0										
1146		2.0	0.46	240	182	17.7	3.0										
1148		4.0	0.46	240	140	18.0	3.0										
1152	7.1	6.1	0.45	230	71	17.3	3.0										
1200	7.1	0.2	0.23	240	209	18.7	3.0										
1202		0.5	0.29	250	156	18.9	3.0										
1204		1.0	0.19	280	144	19.0	3.0	109B	7.86	122	19.13	12	5	256	6	< 5	11
1206		2.0	0.21	270	140	19.0	3.0										
1209		4.0	0.18	270	62	18.6	3.0										
1212	7.1	6.1	0.08	270	44	18.0	3.0										
1230	7.0	0.2	0.21	20	132	19.0	3.0										
1233		0.5	0.32	40	203	18.5	3.0										
1235		1.0	0.45	40	125	18.4	3.0										
1237		2.0	0.55	40	147	18.0	3.0	138B	7.92	72	18.21	11	3	180	6	< 5	8
1239		4.0	0.76	40	113	17.0	3.0										
1242	6.9	5.9	0.85	30	96	16.5	3.0										
1247	6.7	0.2	0.46	50	118	16.0	3.0										
1249		0.5	0.52	40	122	15.5	3.0										
1251		1.0	0.71	50	129	15.1	3.0										
1254		2.0	0.78	20	143	14.5	3.0										
1256		4.0	0.91	50	135	13.9	3.0	60Z	7.94	77	14.76	13	3	267	6	< 5	11
1259	6.8	5.8	1.04	50	122	13.5	3.0										
1303	6.4	0.2	0.61	10	110	13.1	3.0										
1305		0.5	0.72	50	107	12.9	3.0										
1307		1.0	0.79	350	106	12.8	3.0										
1309		2.0	0.91	60	103	12.5	3.0										
1312		4.0	0.99	50	103	12.2	3.0										
1315	6.3	5.3	1.08	50	97	11.5	3.0	139B	8.00	98	12.92	16	6	318	7	< 5	14

TABLE 6 (Cont'd) - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

			Continuous in-situ measurements					**Discrete samples**									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1320	6.4	0.2	0.61	50	91	11.5	3.0										
1321		0.5	0.67	50	82	11.1	3.0	99B	7.97	58	11.54	17	11	393	9	< 5	15
1323		1.0	0.76	10	81	10.6	3.0										
1325		2.0	0.91	30	78	10.3	3.0										
1327		4.0	1.00	10	81	9.8	3.0										
1330	6.1	5.1	1.09	40	87	9.4	3.0										
1344	5.8	0.2	0.62	70	119	8.0	3.0										
1345		0.5	0.70	40	132	7.6	3.0										
1347		1.0	0.76	350	132	7.5	3.0	120B	8.08	120	8.00	**Sample lost**					
1350		2.0	0.93	30	135	7.0	3.0										
1352		4.0	1.03	40	141	6.5	3.0										
1355	5.7	4.7	1.05	40	144	6.1	3.0										
1400	5.4	0.2	0.62	60	138	5.7	3.0										
1403		0.5	0.67	30	137	5.4	3.0										
1405		1.0	0.79	50	134	5.1	3.0										
1408		2.0	0.93	30	147	4.9	3.0	99C	8.04	86	4.82	36	9	965	29	< 5	43
1410		4.0	1.00	40	143	4.5	3.0										
1412	5.1																
1420	5.0	0.2	0.61	50	123	4.0	3.0										
1423		0.5	0.70	50	121	3.9	3.0										
1425		1.0	0.79	50	118	3.8	3.0										
1427		2.0	0.90	60	119	3.6	3.0										
1429	4.8	4.0	0.96	50	118	3.5	3.0	89C	8.09	90	3.60	50	9	1017	12	< 5	58
1440	4.8	0.2	0.48	330	107	3.0	3.0										
1442		0.5	0.61	50	107	2.9	3.0	80C	8.05	47	2.73	79	7	1244	13	< 5	55
1444		1.0	0.70	50	104	2.9	3.0										
1446		2.0	0.81	60	106	2.6	3.0										
1448	4.7	4.0	0.92	50	98	2.5	3.0										
1500	4.5	0.2	0.57	40	103	2.1	3.0										
1502		0.5	0.60	10	103	2.0	3.0										
1504		1.0	0.66	350	104	2.0	3.4	70C	8.03	64	1.90	53	29	2065	23	< 5	82
1506		2.0	0.79	40	104	2.0	3.4										
1508	4.5	3.1	0.79	60	103	1.8	3.4										

TABLE 6 (Cont'd) - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1521	4.5	0.2	0.46	50	98	1.5	3.5										
1523		0.5	0.52	60	96	1.5	3.5										
1524		1.0	0.39	50	96	1.5	3.5										
1527		2.0			96			60C	7.94	85	0.94	182	26	3041	56	< 5	120
1550	3.8	0.2	0.40	60	91	1.1	3.6										
1552		0.5	0.44	50	88	1.1	3.6										
1554		1.0	0.51	40	88	1.1	3.6										
1556		2.0	0.60	60	88	1.0	3.6										
1558	3.6	2.4	0.60	30	88	1.0	3.6	59C	7.94	69	0.67	149	28	3926	107	< 5	180
1631	3.5	0.2	0.25	60	81	1.0	3.8										
1634		0.5	0.33	20	79	1.0	3.8	98C	-	64	0.63	107	19	3640	32	< 5	179
1636		1.0	0.36	80	78	1.0	3.8										
1638	3.5	2.0	0.45	10	74	1.0	3.8										
1700	3.4	0.2	0.15	40	69	0.9	3.8										
1702		0.5	0.32	10	74	0.9	3.8										
1704		1.0	0.36	40	71	0.9	3.8	88C	8.01	58	0.70	117	18	3657	21	< 5	160
1707		2.0	0.41	20	71	0.9	3.8										
1725	3.3	0.2	0.28	70	74	0.9	3.8										
1726		0.5	0.32	20	71	0.9	3.8										
1728		1.0	0.35	20	71	0.9	3.8										
1730		2.0	0.38	20	74	0.9	3.8	78C	7.75	37	0.60	210	71	3677	67	< 5	131
1744	3.1	0.2	0.24	20	72	0.9	3.8										
1747		0.5	0.31	10	71	0.9	3.8	68C	7.67	50	0.56	160	26	4734	72	< 5	171
1749		1.0	0.32	10	72	0.9	3.8										
1751	3.0	2.0	0.38	20	72	0.9	3.8										
1800	3.0	0.2	0.23	40	74	0.8	3.8										
1802		0.5	0.25	10	72	0.8	3.8										
1803		1.0	0.31	60	74	0.8	3.8	58C	7.66	58	0.40	276	34	5346	108	< 5	249
1805		2.0	0.35	10	68	0.8	3.8										

TABLE 6 (Cont'd) - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1820	2.9	0.2	0.17	10	60	0.7	3.8										
1823		0.5	0.23	30	59	0.7	3.8										
1825		1.0	0.29	30	59	0.7	3.8										
1827		2.0	0.35	20	57	0.7	3.8	57C	7.60	52	0.77	1340	30	2747	88	< 5	124
1840		0.2	0.23	40	53	0.7	3.8										
1842		0.5	0.24	10	51	0.7	3.8	97C	7.62	34	0.40	194	20	3845	31	< 5	147
1844		1.0	0.29	20	50	0.7	3.8										
1846	2.8	2.0	0.33	20	49	0.7	3.8										
1900		0.2	0.20	10	46	0.7	3.8										
1903		0.5	0.21	10	44	0.7	3.8										
1905		1.0	0.29	10	44	0.7	3.8	67C	7.59	29	0.43	180	30	4257	83	< 5	181
1907	2.7	2.0	0.31	20	44	0.7	3.8										
1920		0.2	0.21	20	44	0.7	3.8										
1922		0.5	0.21	10	44	0.7	3.8										
1924		1.0	0.27	20	44	0.7	3.8										
1926	2.6	2.0	0.29	10	44	0.7	3.8	87C	7.50	10	0.21	134	21	3803	33	< 5	170
1940	2.7	0.2	0.19	10	41	0.7	3.8										
1942		0.5	0.21	10	41	0.7	3.6	96C	7.44	25	0.43	292	50	21100	158	< 5	447
1944		1.0	0.23	10	41	0.7	3.6										
1946	2.7	2.0	0.29	30	40	0.7	3.6										
2000	2.5	0.2	0.13	10	35	0.6	3.7										
2002		0.5	0.19	30	35	0.6	3.7										
2004		1.0	0.27	30	32	0.6	3.7	86C	7.40	18	0.27	107	25	2512	55	< 5	168
2006	2.5	2.0	0.26	30	31	0.6	3.7										
2020		0.2	0.15	30	31	0.6	3.7										
2022		0.5	0.21	30	28	0.6	3.7										
2024		1.0	0.25	10	26	0.6	3.7										
2026	2.5	2.0	0.26	20	28	0.6	3.7	76C	7.32	4	0.43	170	16	2133	28	< 5	127

TABLE 6 (Cont'd) - OBSERVATIONS AT TAL-Y-CAFN ROAD BRIDGE 28.2.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
2040		0.2	0.16	20	25	0.6	3.7										
2042		0.5	0.18	10	26			56C	7.38	10	0.21	218	27	3534	170	< 5	164
2044		1.0	0.19	20	26												
2046	2.4	2.0	0.22	30	25												
2100		0.2	0.13	50	24	0.6	3.5										
2102		0.5	0.14	40	24			95C	7.33	18	0.25	178	48	2683	97	< 5	173
2104		1.0	0.21	10	24												
2106	2.5	2.0	0.21	10	24												
2120		0.2	0.17	20	22	0.6	3.5										
2121		0.5	0.20	10	22												
2123		1.0	0.21	10	21			66C	7.32	4	0.51	147	44	2301	54	< 5	128
2125	2.0	1.7	0.23	20	21												
2140		0.2	0.13	50	19	0.6	3.5										
2142		0.5	0.07	10	19												
2144	2.6	1.0	0.04	10	19												
2146		2.0						55C	7.25	28	0.49	221	38	2672	302	< 5	198
2200	3.3	0.2	0.64	240	74	0.6	3.5										
2202		0.5	0.80	240	118	0.9	3.5										
2203	3.7	1.0	0.84	240	132	1.0	3.5										
2205		2.0	0.82	240	103	1.0	3.5	94C	7.26	46	0.36	139	32	3043	76	< 5	114

Note: Total solids in bottle samples includes particulate and dissolved matter.

TABLE 7 - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
0926	8.1	0.4	0.45	160	203	16.0	4.0										
0929		0.7	0.45	150	140	16.6	3.8										
0931		1.2	0.54	160	159	16.5	3.8	41C	8.03	200	8	21	6	453	10	< 5	24
0934	8.4	2.2	0.52	150	91	14.0	3.8										
0936		4.7	0.59	150	91	15.0	3.8										
0939		6.2	0.39	160	100	13.6	3.8										
0941	8.8	8.2	0.17	190	78	11.0	3.8										
0954	9.0	0.4	0.50	150	353	18.8	3.7										
0957		0.7	0.63	140	226	20.1	3.7										
0958	9.2	1.2	0.88	150	159	21.5	3.7										
1000		2.2	0.95	140	140	22.7	3.7	31C	7.86	162	19	21	4	285	5	< 5	12
1003		4.2	0.90	150	140	23.5	3.7										
1006		6.2	0.92	160	131	24 0	3.7										
1009	10.0	9.2	0.52	190	100	19.3	3.7										
1022	10.4	0.4	1.01	140	140	29.3	3.6										
1026		1.0	1.19	150	140	29.9	3.6	21C	7.77	120	33	13	6	208	6	< 5	8
1028		2.0	1.24	140	140	30.0	3.6										
1030		4.0	1.24	150	140	30.0	3.6										
1033		6.0	1.23	150	144	30.1	3.6										
1035	10.8	8.0	1.29	170	144	30.1	3.6										
1037		9.9	1.22	170	147	30.6	3.6										
1120	12.0	0.4	1.00	110	81	32.4	3.6										
1122		1.0	1.22	170	74	32.4	3.6										
1124		2.0	1.25	170	74	32.4	3.6	11C	7.72	110	33	13	4	148	5	< 5	7
1126		4.0	1.22	180	69	32.4	3.6										
1130		6.0	1.28	180	66	32.4	3.6										
1132		8.0	1.44	180	63	32.4	3.6										
1135	12.4	11.4	1.44	180	59	32.4	3.6										
1147	12.7	0.4	0.70	180	59	32.4	3.6										
1150		1.0	0.92	180	59	32.4	3.6										
1152		2.0	0.93	180	53	32.4	3.6										
1154		4.0	0.98	180	51	32.4	3.6	1C	7.80	34	33.22	14	5	219	4	< 5	6
1157		6.0	0.97	180	50	32.4	3.6										
1159		8.0	0.93	180	50	32.4	3.6										
1202	12.7	11.7	1.01	180	47	32.4	3.6										

TABLE 7 (CONT'D) - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1212	13.0	0.4	0.46	180	47	32.4	3.6										
1214		1.0	0.64	190	44												
1216		2.0	0.83	180	44												
1218		4.0	0.75	170	44												
1220		6.0	0.65	170	44												
1223		8.0	0.60	170	43												
1226	13.0	12.0	0.66	170	43	32.4	3.6	2C	7.77	56	27.18	7	4	219	4	< 5	8
1240	13.3	0.4	0.30	160	40	32.4	3.5										
1242		1.0	0.29	160	40												
1244		2.0	0.29	160	40												
1246		4.0	0.28	180	41												
1248		6.0	0.30	170	40												
1251		8.0	0.31	190	40												
1253	13.3	12.3	0.38	170	41												
1258		11.3						12C	7.79	91	33	7	4	147	5	< 5	6
1301	13.3	0.4	0.14	150	41	32.5	3.7										
1305		1.0	0.20	270	41	32.5	3.7										
1309		2.0	0.17	220	38	32.5	3.6										
1312		4.0	0.18	180	38	32.5	3.6										
1315		6.0	0.15	220	41	32.5	3.6										
1318		8.0	0.09	290	44	32.3	3.6										
1321	13.0	12.3	0.17	290	43	32.3	3.6										
1317		0.2						22C	7.78	22	33	6	2	297	4	< 5	7
1327	13.0	0.4	0.15	280	41	32.4	3.6										
1331		1.0	0.15	310	47	32.2	3.6	32C	7.79	98	28	7	3	107	4	< 5	6
1335		2.0	0.16	330	46	32.1	3.6										
1338		4.0	0.52	350	59	32.1	3.6										
1341		6.0	0.59	320	59	32.0	3.6										
1344		8.0	0.65	350	57	32.0	3.6										
1348	12.8	11.8	0.59	350	53	32.0	3.6										
1356	12.5	0.4	0.33	320	49	32.1	3.6										
1359		1.0	0.43	310	50	32.1	3.6										
1402		2.0	0.53	350	57	32.1	3.6										
1405		4.0	0.94	330	62	32.0	3.6										
1408		6.0	0.57	330	53	32.0	3.6										
1411		8.0	0.54	310	51	32.0	3.6										
1414	12.5	11.0	1.66	310	59	31.9	3.6	42C	7.75	50	32	8	4	190	6	< 5	7

TABLE 7 (CONT'D) - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1424	12.3	0.4	0.42	310	59	32.3	3.6										
1427		1.0	0.71	340	63	31.5	3.6										
1430		2.0	0.61	330	65	31.5	3.6										
1433		4.0	0.15	340	66	31.6	3.6										
1436		6.0	1.24	350	63	31.1	3.6	43C	7.78	101	32	8	2	159	4	< 5	8
1439		8.0	1.01	320	66	31.1	3.6										
1443	12.4	12.0	0.93	310	66	31.5	3.6										
1453	12.1	0.4	0.82	290	77	31.7	3.6										
1455		1.0	0.68	280	59	31.7	3.6										
1458		2.0	1.06	310	59	31.8	3.6	33C	7.77	80	34	9	3	249	5	< 5	6
1501		4.0	1.08	310	76	31.6	3.6										
1504		6.0	1.03	360	62	31.8	3.6										
1507		8.0	0.96	360	63	31.6	3.6										
1509	11.8	10.8	1.16	360	65	31.5	3.6										
1519	11.5	0.4	0.61	310	49	31.5	3.6										
1522		1.0	0.98	300	69	31.5	3.6										
1525		2.0	0.69	300	62	31.5	3.6										
1528		4.0	0.96	340	68	31.4	3.6										
1531		6.0	0.74	320	74	31.4	3.6	3C	7.75	40	22	9	3	262	4	< 5	9
1533		8.0	0.91	330	76	31.1	3.6										
1536	10.5	9.5	1.10	340	75	31.0	3.6										
1542	11.1	0.4	0.69	320	78	31.4	3.6										
1545		1.0	0.44	310	51	31.2	3.6										
1548		2.0	0.57	310	51	31.5	3.6										
1551		4.0	0.53	280	79	31.1	3.6										
1555		6.0	0.78	260	66	31.8	3.6										
1559		8.0	0.76	290	85	31.4	3.6										
1603	10.0	9.0	0.95	360	79	31.6	3.6										
1616	8.5	0.4	0.33	280	63	31.6	3.6										
1619		1.0	0.59	210	57	31.5	3.6										
1622		2.0	0.58	320	72	31.4	3.6										
1625		4.0	0.66	010	75	30.5	3.6	34C	7.82	49	35	8	3	424	5	< 5	7
1628		6.0	0.75	340	78	31.1	3.6										
1630	8.9	7.5	0.90	340	116	30.1	3.6										

TABLE 7 (CONT'D) - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

		Continuous in-situ measurements						**Discrete samples**									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1642	8.0	0.4	0.50	290	112	30.1	4.0										
1644		1.0	0.24	020	118	29.2	4.0	24C	7.81	134	31	**Sample lost**					
1647		2.0	0.30	070	126	29.2	4.0										
1650		4.0	0.63	270	143	29.1	4.0										
1653		6.0	0.70	010	143	27.9	4.0										
1656	9.0	8.0	0.74	350	140	27.6	4.0										
1710	8.3	0.4	0.29	330	147	26.4	4.0	44C	7.82	104	26	21	9	396	5	< 5	16
1713		1.0	0.34	285	143	26.9	4.0										
1716		2.0	0.38	020	151	25.6	4.0										
1719		4.0	0.53	010	156	25.7	4.0										
1722		6.0	0.46	310	159	25.0	4.0										
1725	7.6	6.6	0.70	360	159	23.6	4.0										
1738	8.1	0.4	0.24	290	147	23.5	4.0										
1741		1.0	0.15	280	147	23.5	4.0										
1744		2.0	0.19	330	147	23.5	4.0	14C	7.80			**Sample lost**					
1747		4.0	0.24	340	147	22.5	4.0										
1750		6.0	0.38	350	151	22.3	4.0										
1753	7.5	6.5	0.54	340	151	21.6	4.0										
1808	6.9	0.4	0.14	280	147	20.9	4.4										
1811		1.0	0.10	300	140	20.6	4.4										
1814		2.0	0.13	250	147	20.6	4.4										
1816		4.0	0.28	340	143	20.2	4.4	13C	7.81	99	17	253	11	438	17	< 5	41
1818	6.9	5.9	0.53	340	151	18.9	4.4										
1830	7.2	0.4	0.06	140	118	20.5	4.4										
1834		1.0	-	-	118	19.4	4.4										
1838		2.0	0.06	220	135	18.9	4.4										
1842		4.0	0.13	290	138	18.0	4.4										
1845	7.1	6.1	0.51	360	151	16.5	4.4	4C	7.78	173	12	13	4	390	6	< 5	15
1852	6.7	6.7)			147	15.9	4.4										
		6.0)			147	15.9	4.4										
		5.5)			143	16.1	4.4										
		5.0)			140	16.1	4.4										
		4.5)			135	16.5	4.4										
	8.9	4.0)	**Salinity profile**		131	17.0	4.4										
		3.5)			131	17.1	4.4										
		3.0)			123	17.2	4.4										
		2.5)			123	17.4	4.4										
		2.0)			123	17.4	4.4										
		1.5)			107	18.3	4.4										
		1.0)			93	19.2	4.4										
1858	6.5	0.4)			100	18.5	4.4										

TABLE 7 (CONT'D) - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1859	6.6	0.4	0.03	210	123	18.6	4.3										
1903		1.0	0.05	350	123	17.0	4.3										
1906		2.0	0.12	210	131	16.5	4.3										
1909		4.0	0.30	330	128	16.0	4.3	40C	7.79	74	17	16	5	292	4	< 5	13
1912	6.4	5.5	0.48	360	140	14.0	4.4										
1920	6.5	0.4	0.15	100	96	18.0	4.4	19C	7.80	86	24	17	3	252	5	< 5	11
1923		1.0	0.03	130	103	17.1	4.4										
1924		2.0	0.07	330	119	15.0	4.4										
1929		4.0	0.26	350	121	14.0	4.4										
1931	6.5	5.5	0.40	360	125	12.8											
1941	6.5	0.4	0.17	140	121	15.9	4.4										
1943		1.0	0.11	140	96	14.5		27C	7.78	51	23	10	6	194	23	< 5	10
1946		2.0	0.06	290	106	13.7											
1948		4.0	0.24	340	112	13.4											
1951		5.5	0.29	360	115	12.6											
2000	6.6	0.4	0.15	180	81	15.7	4.4										
2002		1.0	0.19	110	81	15.6											
2005		2.0	0.05	170	100	12.9		49C	7.78	63	14	14	4	273	5	< 5	16
2007		4.0	0.16	350	103	12.4											
2009	6.6	5.6	0.34	320	113	11.6											
2021	6.2	0.4	0.13	240	76	14.5	4.5										
2023		1.0	0.17	120	81	14.4											
2025		2.0	0.09	130	88	12.9											
2027		4.0	0.16	280	96	11.8											
2030	6.2	5.2	0.29	350	110	10.8		37C	7.80	72	6	19	4	362	5	< 5	16
2041	6.4	0.4	0.11	90	74	13.6	4.6	39C	7.73	2	16	21	4	186	5	< 5	10
2043		1.0	0.15	130	66	13.1											
2045		2.0	0.11	130	88	11.5											
2048		4.0	0.08	310	98	11.0											
2052	6.4	5.4	0.22	350	101	10.5											

TABLE 7 (CONT'D) - OBSERVATIONS AT CONWY TOWN ROAD BRIDGE 2.3.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
2100	6.5	0.4	0.02	100	69	13.3	4.5										
2103		1.0	0.13	170	76	12.5		30C	7.78	45	15	18	3	219	5	< 5	11
2105		2.0	0.11	140	76	11.5											
2107		4.0	0.04	180	97	10.5											
2109	6.5	5.5	0.28	340	115	9.5											
2120	6.5	0.4	0.04	20	66	12.0	4.5										
2123		1.0	0.16	170	66	11.7											
2125		2.0	0.07	90	78	10.5											
2128		4.0	0.09	250	97	9.5											
2131	6.5	5.5	0.19	310	110	9.0											
2132		6.5						20C	7.84	78	4	24	4	490	4	< 5	21
2144	6.5	0.4	0.16	130	74	10.9	4.5										
2146		1.0	0.13	170	74	10.6											
2148		2.0	0.15	120	74	10.4											
2150		4.0	0.13	080	100	9.0											
2152	6.5	5.5	0.14	310	103	8.8											
2153		6.5						29C	7.82	72	2	18	4	449	5	< 5	20

Note: Total solids in bottle samples includes particulate and dissolved matter.

TABLE 8 - OBSERVATIONS AT DEGANWY 1.3.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
0930	10.5	0.2	0.61	150	151	30.3	3.1										
0935		0.5	1.01		147	30.5	3.2										
0937		1.0	1.03		159	30.8	3.2										
0940		2.0	0.99		156	31.0	3.2										
0942	11.0	4.0	1.26	140	196	31.2	3.2										
0945		6.0	1.69	150	198	31.4	3.2										
0948		8.0	1 78	150	196	31.3	3.2										
0951		10.0	1.78	150	198	30.8	3.2	69C	7.91	118	11.4	15	5	291	8	< 5	12
1140	13.6	0.2	0.61	160	103	32.2	3.3										
1143		0.5	0.61	170	93	32.3	3.3										
1145		1.0	0.66	170	98	32.2	3.3										
1147		2.0	0.70	160	98	32.2	3.3	75C	7.80	46	35.02	11	4	136	5	< 5	7
1149		4.0	0.72	150	101	32.2	3.3										
1152		6.0	0.73	150	98	32.3	3.3										
1154	13.6	8.0	0.75	170	101	32.3	3.3										
1157		10.0	0.62	170	100	32.3	3.3										
1159		12.6	0.59	160	90	32.3	3.3										
1205	13.6	0.2	0.32	180	82	32.4	3.3	65C	7.84	55	33.44	**Sample lost**					
1207		0.5	0.21	170	79	32.4	3.3										
1209		1.0	0.17	150	81	32.4	3.3										
1211		2.0	0.27	150	84	32.4	3.3										
1214		4.0	0.22	140	76	32.4	3.3										
1216		6.0	0.21	150	74	32.4	3.3										
1219		8.0	0.19	170	72	32.3	3.3										
1221		10.0	0.14	80	72	32.3	3.3										
1223	13.6	12.6	0.06	200	69	32.2	3.3										
1234	13.5	0.2	0.06	350	72	32.5	3.3										
1236		0.5	0.11	320	84	32.4	3.3										
1239		1.0	0.17	330	79	32.2	3.3	93C	7.83	93	37.7	15	3	163	5	< 5	7
1242		2.0	0.25	340	97	32.2	3.3										
1245		4.0	0.25	340	82	32.2	3.3										
1248		6.0	0.40	340	96	32.2	3.3										
1251		18.0	0.45	340	91	32.2	3.3										
1254		10.0	0.50	330	88	32.2	3.3										
1257	13.5	12.5	0.52	330	85	32.1	3.3										

TABLE 8 (CONT'D) - OBSERVATIONS AT DEGANWY 1.3.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1305	13.0	0.2	0.43	340	123	32.4	3.3										
1308		0.5	0.43	340	121	32.4	3.3										
1311		1.0	0.56	340	112	32.4	3.3										
1314		2.0	0.74	330	125	32.2	3.3	83C	7.81	76	34.75	20	2	230	6	< 5	8
1317		4.0	0.82	270	125	32.2	3.3										
1320		6.0	0.85	340	128	32.2	3.3										
1323		8.0	0.93	330	131	32.2	3.3										
1326		10.0	0.98	330	119	32.2	3.3										
								5 March 1983									
0702	8.0	0.4	0.40	290	81	16.0	4.5										
0705		1.0	0.38	290	84	14.6	4.5										
0707		2.0	0.26	300	88	14.1											
0710		4.0	0.28	330	90	13.9											
0712		6.0	0.42	340	100	13.3											
0716	8.0	7.0	0.46	340	100	13.0		438B	8.22	79	12	13	1	360	5	< 5	13
0733	8.2	0.4	0.36	260	97	12.5	4.5	448B	8.12	86	13	27	2	448	6	< 5	15
0735		1.0	0.19	250	97	12.1											
0737		2.0	0.08	300	101	11.5											
0740		4.0	0.06	280	104	11.0											
0742		6.0	0.25	350	110	10.5											
0746	8.0	7.0	0.34	350	110	10.2											
0803	7.6	0.4	0.11	220	107	10.1	4.6										
0805		1.0	0.17	250	115	10.0		458B	8.76	54	31	15	2	427	5	< 5	20
0807		2.0	0.13	250	119	9.9											
0809		4.0	0.08	300	122	9.6											
0812		6.0	0.21	360	131	8.6											
0814	7.5	6.5	0.36	340	144	8.4											
0832	7.9	0.4	0.06	010	140	8.5	4.6										
0834		1.0	0.07	280	129	8.6	4.6										
0836		2.0	0.09	190	132	8.2		468B	8.22	95	8	26	92	575	8	< 5	26
0838		4.0	0.09	230	140	7.5											
0840		6.0	0.16	360	141	7.2											
0843	7.5	6.5.	0.32	340	151	7.3											

TABLE 8 (CONT'D) - OBSERVATIONS AT DEGANWY 5.3.1983

		Continuous in-situ measurements						Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
0900	7.5	0.4	0.03	360	62	13.0	4.8										
0902		1.0	0.05	040	51	13.0	4.8										
0904		2.0	0.05	350	47	12.4	4.8										
0907		4.0	0.10	030	112	7.0	4.8	478B	8.14	82	6	23	7	938	6	< 5	30
0910		6.0	0.11	330	113	5.1	4.8										
0913	7.5	6.5	0.25	340	106	4.4	4.8										
0930	7.6	0.4	0.03	360	62	13.0	4.8										
0931		1.0	0.05	040	51	13.0	4.8										
0932		2.0	0.05	350	47	12.4	4.8										
0933		4.0	0.10	030	112	7.0	4.8										
0934		6.0	0.11	330	113	5.1	4.8	477B	8.0	74	5	26	6	862	5	< 5	31
0935	7.6	6.6	0.25	340	106	4.4	4.8										
1000	8.3	0.4	0.03	160	46	12.9	4.8	467B	7.84	45	13	17	16	218	10	< 5	16
1003		1.0	0.05	180	43	12.7	4.8										
1006		2.0	0.04	180	44	11.6	4.8										
1008		4.0	0.08	160	49	9.6	4.8										
1010		6.0	0.13	120	72	6.5	4.8										
1012	8.0	7.0	0.10	180	91	4.0	4.8										
1030	8.3	0.4	0.03	300	46	12.9	4.8										
1033		1.0	0.06	190	38	12.0	4.8	457B	7.87	41	16	16	4	238	5	< 5	11
1036		2.0	0.06	270	43	10.3	4.8										
1039		4.0	0.07	090	54	8.6	4.8										
1042		6.0	0.23	180	72	5.5	4.8										
1045	8.6	7.6	0.37	160	82	4.5	4.8										
1101	8.7	0.4	0.03	130	40	12.7	4.8										
1103		1.0	0.05	110	38	12.7	4.8										
1105		2.0	0.11	120	35	10.5	4.8	447B	7.90	32	9	15	79	178	5	< 5	9
1107		4.0	0.28	150	93	8.0	4.8										
1110		6.0	0.54	140	144	7.0	4.8										
1113	9.2	8.2	0.48	160	81	6.3	4.8										
1130	10.0	0.4	0.33	140	326	11.1	4.8										
1132		1.0	0.56	150	250	12.9	4.8										
1134		2.0	0.63	140	176	14.9	4.8										
1136		4.0	0.53	150	140	15.3	4.8	437B	7.82	74	15	11	1	334	5	< 5	13
1139		6.0	0.55	160	121	15.8	4.8										
1142		8.0	0.64	150	115	15.1	4.8										
1145	9.9	8.9	0.68	150	110	15.5	4.8										

TABLE 8 (CONT'D) - OBSERVATIONS AT DEGANWY 5.3.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1200	10.2	0.4	0.53	140	137	23.5	4.8										
1202		1.0	0.53	140	135	23.6	4.8										
1204		2.0	0.76	150	132	24.8	4.8										
1207		4.0	0.96	150	129	25.6	4.8										
1210		6.0	0.96	160	126	24.6	4.8	436B	7.83	98	23	12	3	213	4	< 5	9
1212		8.0	0.90	150	121	24.6	4.8										
1215	10.5	9.5	0.95	160	112	22.6	4.8										
1230	10.9	0.4	0.64	160	121	28.4	4.8										
1232		1.0	0.75	150	119	28.6	4.8										
1235		2.0	0.67	130	119	29.0	4.8										
1238		4.0	1.07	140	122	28.7	4.8										
1241		6.0	1.13	160	123	28.6	4.7										
1243		8.0	1.11	160	123	28.0	4.7	446B	7.82	84	29	9	4	205	4	< 5	9
1245	11.0	10.0	1.25	160	118	25.0	4.7										
1304	11.2	0.4	0.72	140	123	31.5	4.6	456B	7.80	28	35	10	3	153	4	< 5	8
1307		1.0	0.96	150	125	31.6	4.6										
1310		2.0	1.16	140	122	31.6	4.6										
1313		4.0	1.24	150	125	31.7	4.5										
1316		6.0	1.26	150	121	31.0	4.5										
1318		8.0	1.19	150	118	30.1	4.5										
1320	11.5	10.5	1.22	160	115	29.5	4.5										
1330	11.6	0.4	0.71	140	135	32.1	4.5										
1333		1.0	0.75	140	138	32.2	4.4	466B	7.80	70	39	10	2	180	4	< 5	9
1336		2.0	0.93	140	134	32.2	4.4										
1339		4.0	1.22	140	144	32.3	4.5										
1342		6.0	1.18	160	168	32.0	4.5										
1344		8.0	1.19	160	172	32.0	4.6										
1346	11.8	10.8	1.02	170	112	28.2	4.6										
1400	11.9	0.4	0.56	130	146	32.5	4.4										
1403		1.0	0.59	140	145	32.5	4.4										
1405		2.0	0.80	150	163	32.5	4.4	476B	7.79	80	35	12	2	244	5	< 5	10
1408		4.0	0.84	150	163	32.5	4.4										
1410		6.0	0.79	160	163	32.4	4.4										
1413		8.0	0.73	150	156	32.3	4.4										
1416	12.2	10.9	0.57	170	147	30.9	4.4										

TABLE 8 (CONT'D) - OBSERVATIONS AT DEGANWY 5.3.1983

	Continuous in-situ measurements							Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1430	12.7	0.4	0.31	160	147	32.6	4.4										
1432		1.0	0.35	140	135	32.6	4.4										
1435		2.0	0.37	130	140	32.6	4.4										
1437		4.0	0.42	160	143	32.6	4.4	435B	7.81	150	34	15	2	178	3	< 5	9
1440		6.0	0.40	140	147	32.6	4.4										
1443		8.0	0.34	150	147	32.5	4.4										
1446	12.7	11.7	0.16	120		30.0	4.4										
1500	12.5	0.4	0.07	320	118	32.6	4.3										
1503		1.0	0.06	350	110	32.6	4.3										
1505		2.0	0.08	150	118	32.6	4.3										
1507		4.0	0.05	50	135	32.6	4.3										
1510		6.0	0.08	310	132	32.5	4.3	445B	7.83	166	33	8	1	160	4	< 5	8
1515		8.0	0.18	300	110	32.1	4.3										
1519	12.4	11.4	0.18	330	88	30.6	4.3										
1530	12.3	0.4	0.24	300	203	32.1	4.2										
1533		1.0	0.38	320	196	32.1	4.2										
1535		2.0	0.31	310	140	32.0	4.2										
1538		4.0	0.39	300	140	32.0	4.2										
1540		6.0	0.38	310	121	32.0	4.2										
1542		8.0	0.42	330	147	31.9	4.2	455B	7.85	76	42	7	3	133	4	< 5	7
1545	12.0	11.0	0.35	320	97	31.3	4.2										
1600	11.7	0.4	0.35	340	122	31.9	4.4										
1603		1.0	0.52	350	128	31.8	4.4										
1605		2.0	0.60	340	132	31.8	4.4										
1607		4.0	0.60	320	104	31.4	4.4										
1610		6.0	0.82	330	96	31.4	4.4										
1612		8.0	0.81	330	103	31.2	4.4										
1615	11.5	10.5	0.89	330	74	30.6	4.4	465B	7.86	74	34	10	5	158	4	< 5	8
1631	11.4	0.4	0.65	360	151	31.5	4.4	475B	7.88	74	33	10	2	196	4	< 5	7
1633		1.0	0.67	350	143	31.4	4.4										
1635		2.0	0.71	350	128	31.0	4.4										
1637		4.0	0.76	320	129	30.6	4.4										
1640		6.0	0.69	320	100	30.2	4.4										
1642		8.0	0.77	320	97	29.8	4.4										
1645	11.4	10.4	0.91	330	100	29.5	4.4										
1700	10.5	0.4	0.66	350	126	30.3	4.4										
1702		1.0	0.73	350	122	29.9	4.4	434B	7.91	68	32	13	3	193	4	< 5	8
1704		2.0	0.80	340	126	29.6	4.4										
1706		4.0	0.79	330	88	28.5	4.4										
1708		6.0	0.78	320	85	28.2	4.4										
1711		8.0	0.88	310	74	27.5	4.4										
1714	10.9	9.9	1.00	330	68	27.2	4.4										

TABLE 8 (CONT'D) - OBSERVATIONS AT DEGANWY 5.3.1983

			Continuous in-situ measurements					Discrete samples									
Time (GMT)	Water depth (m)	Height of instrument above bed (m)	Velocity (m/s)	Direction (°mag)	Suspended Solids (ppm)	Salinity (ppt)	Temperature (°C)	Sample bottle number	pH	Solids Content Suspended (ppm)	Solids Content Total (g/l)	Metals Concentration (ppm) Zn	Pb	Fe	Cu	Co	Mn
1730	10.0	0.4	0.66	330	69	26.9	4.8										
1733		1.0	0.75	340	71	26.6	4.8										
1735		2.0	0.75	330	72	26.5	4.8	444B	7.91	68	12	9	1	151	4	< 5	7
1737		4.0	0.84	320	74	26.2	4.8										
1739		6.0	0.94	340	74	25.6	4.8										
1742		8.0	0.99	340	74	25.4	4.8										
1745	9.8	8.8	0.98	340	76	25.4	4.8										
1801	9.4	0.4	0.70	320	75	25.4	4.8										
1803		1.0	0.71	320	75	25.4	4.8										
1806		2.0	0.73	320	74	25.3	4.8										
1808		4.0	0.78	330	74	24.9	4.8	454B	7.91	106	26	8	1	140	4	< 5	7
1810		6.0	0.86	340	78	24.3	4.8										
1813	9.1	8.0	0.85	340	78	24.1	4.8										
1830	8.8	0.4	0.66	310	81	24.1	4.9										
1833		1.0	0.74	320	81	23.3	4.9										
1835		2.0	0.66	320	81	23.1	4.9										
1837		4.0	0.59	340	84	23.0	4.9										
1839		6.0	0.65	340	87	22.5	4.9	462B	7.89	113	23	11	3	183	4	< 5	9
1842	8.4	8.0	0.71	340	88	21.7	4.9										
1900	8.0	0.4	0.55	310	88	20.5	4.9										
1902		1.0	0.57	310	88	20.2	4.9										
1904		2.0	0.45	330	88	19.5	4.9										
1907		4.0	0.47	340	87	19.1	4.9										
1909		6.0	0.51	340	88	18.6	4.9										
1912		6.8	0.53	330	90	18.6	4.9	464B	7.89	66	20	11	4	217	4	< 5	11
1928	6.5	0.4	0.45	300	96	17.6	4.9										
1930		1.0	0.40	310	98	-	4.9										
1932		2.0	0.34	330	103	16.6	4.9										
1934		4.0	0.36	320	110	16.4	4.9										
1937	6.5	6.0	0.43	330	110	15.7	4.9										
1938		6.5						474B	7.91	69	18	12	3	376	5	< 5	14

Note: Total solids in bottle samples include particulate and dissolved matter.

TABLE 9 - HEAVY METAL INPUTS FROM THE TRIBUTARIES (MARCH 1983)

LOCATION (Grid Ref)	SAMPLE NO	pH	SOLIDS CONCENTRATION SUSPENDED (ppm)	SOLIDS CONCENTRATION TOTAL (g/l)	TOTAL METALS CONCENTRATION (ppm) Zn	Pb	Fe	Cu	Co	Mn
Afon Gyffin$^{\Delta}$ (782 773)	399A	5.7	11	0	207	24	1160	30	< 5	69
Afon Roe (768 699)	434A	7.3	6	0	80	29	2500	29	< 5	69
Afon Dulyn (767 689)	438A	7.0	5	0	78	22	1300	22	< 5	33
Afon Porth-Llwyd (767 677)	436A	7.5	0	0	118	27	4140	27	< 5	64
Afon Ddu (774 663)	433A	7.2	9	0	200	50	3680	70	< 5	60
Afon Crafnant (781 631)	417A	7.3	2	0	970	60	4430	50	< 5	180
Mine stream (791 612)	416A	7.0	2	0	3700	65	4600	29	< 5	494
Afon Llugwy (792 567)	435A	7.3	2	0	750	125	10900	125	< 5	300
Afon Lledr (797 542)	414A	6.9	13	0	455	32	2790	61	< 5	165
Afon Machno (807 529)	413A	7.6	5	0	560	120	3480	160	< 5	200
Afon Conwy (818 530)	400A	4.1*	6	0	590	63	5120	105	< 5	210
Nant y Goron (804 609)	418A	7.3	2	5	224	32	2216	48	< 5	88
Nant y Gareg-ddu (804 747)	439A	7.1	3	0	156	89	1830	56	< 5	56

Notes:
1. Total solids includes particulates and any precipitated dissolved matter
2. Total metals includes sediment-attached and dissolved metals
3. *pH was measured on sample collection with the exception of sample 400A which was measured after 48 hours
4. Δ denotes possibility of saline water in sample
5. Due to the very low solids concentrations in the samples the accurate determination of their metal concentration is difficult to achieve.

TABLE 10 - LONGITUDINAL DISTRIBUTION OF METAL ON BED SEDIMENTS. MARCH 83

Sample No	Chainage (Km)	Cu (ppm)	Zn (ppm)	Pb (ppm)	Mn (ppm)	Fe (ppm)	Co (ppm)
2B	-1.3	7	85	9	1040	19890	7
S2B	-1.3	5	50	9	240	11010	<5
3B	-0.8	2	53	6	129	6090	<5
S3B	-0.8	6	45	6	221	6820	<5
4A	-0.3	2	63	9	182	7780	<5
4B	-0.3	3	61	6	185	7630	<5
S5B	0.2	12	108	12	224	9240	<5
6B	0.7	2	70	5	158	8670	<5
S6B	0.7	2	72	4	118	6500	<5
7B	1.2	2	76	5	111	6390	<5
S7B	1.2	23	250	51	500	21650	10
8B	1.7	2	85	7	130	6770	<5
S8B	1.7	2	73	5	110	6010	<5
9B	2.2	3	129	9	186	11490	5
S9B	2.2	2	78	5	120	6330	<5
10B	2.6	2	84	4	118	6430	<5
S10B	2.6	27	300	64	700	26870	12
11B	3.1	2	95	3	139	7030	<5
S11B	3.1	40	375	92	850	37110	14
12B	3.7	3	127	8	139	8560	<5
S12B	3.7	31	289	73	580	28970	11
13B	4.2	3	129	7	184	10390	<5
S13B	4.2	33	336	80	630	31830	13
14B	4.7	2	140	6	140	7720	<5
S14B	4.7	34	358	70	720	29490	12
16B	5.7	19	262	44	389	19060	9
S17B	6.2	3	165	8	169	8950	<5
18B	6.7	3	159	8	165	8810	5
S18B	6.7	4	195	12	210	12350	6
19B	7.3	4	205	12	302	13140	6
S19B	7.3	19	379	47	469	21410	11
S20B	7.8	15	300	36	350	18950	9
23B	9.2	9	580	29	2500	52940	23
S24B	9.7	11	296	27	880	30890	12
25B	10.2	12	271	33	770	22900	10
S25B	10.2	16	138	20	332	29340	16
26B	10.7	14	312	31	570	32180	12
S26B	10.7	20	311	45	560	22850	10
S28B	11.8	12	289	46	1060	48880	16
S29B	12.3	12	305	42	870	38460	14
S30B	12.8	27	400	67	760	28760	12
S32B	13.9	31	550	76	1300	31690	14
S33B	14.4	22	334	54	940	32520	15
S34B	14.9	17	303	69	1490	41620	19
S35B	15.4	21	334	51	1510	38160	15
S36B	15.9	26	600	81	1120	32250	17
37B	16.5	16	412	79	1990	46280	26
S37B	16.5	24	310	73	1240	40790	24

Note 1 Prefix "S" denotes taken from side, remainder mid-channel.

TABLE 11 - PARTICLE SIZE DISTRIBUTION OF BED SEDIMENTS, MARCH 83

Grab Sample No	SIZE (mm) W10	W20	W30	W40	W50	W60	W70	W80	W90
1A	Sample consisted of 3 large stones								
100	2.6	4.8	6.5	8.3	10.3	12.6	16.0	22.0	30
S1A	9.5	13.6	17.6	22.5	27.5	33.0	38.5	-	-
2A	0.46	0.60	0.76	0.93	1.5	1.35	1.80	2.55	7.5
S2A	0.06	0.115	0.152	0.166	0.175	0.185	0.200	0.210	0.245
3A	0.178	0.189	0.200	0.210	0.223	0.237	0.255	0.272	0.295
S3A	0.153	0.167	0.180	0.190	0.204	0.217	0.232	0.250	0.280
4A	0.170	0.208	0.240	0.264	0.275	0.290	0.310	0.328	0.365
6A	0.178	0.194	0.205	0.214	0.224	0.235	0.247	0.260	0.277
S6A	0.155	0.170	0.180	0.188	0.196	0.204	0.210	0.220	0.242
7A	0.175	0.192	0.204	0.214	0.222	0.232	0.245	0.262	0.280
S7A		SILT		0.084	0.125	0.152	0.171	0.182	0.220
8A	0.169	0.180	0.184	0.190	0.200	0.212	0.226	0.247	0.270
S8A	0.163	0.178	0.188	0.195	0.205	0.215	0.226	0.240	0.256
9A	1.800	2.00	2.15	2.30	2.43	2.57	2.75	2.97	3.60
S9A	0.175	0.187	0.191	0.199	0.208	0.220	0.235	0.250	0.275
10A	0.168	0.180	0.191	0.200	0.205	0.215	0.225	0.238	0.263
10A			SILT			0.070	0.085	0.100	0.135
11A	0.161	0.179	0.190	0.200	0.210	0.218	0.228	0.241	0.260
11A				SILT					0.075
12A	0.160	0.174	0.185	0.195	0.204	0.214	0.224	0.240	0.257
12A				SILT					0.070
13A	0.146	0.162	0.172	0.180	0.183	0.187	0.192	0.199	0.210
13A					SILT				
14A	0.150	0.161	0.170	0.178	0.182	0.187	0.192	0.200	0.215
14A			SILT					0.065	0.101
15A	0.141	0.155	0.162	0.166	0.170	0.176	0.182	0.190	0.207
15A	0.095	0.195	0.850	1.550	2.320	3.300	4.600	6.700	11.200
16A	0.148	0.158	0.165	0.171	0.177	0.182	0.185	0.190	0.205
16A		SILT		0.070	0.084	0.095	0.104	0.115	0.136
17A	0.167	0.190	0.210	0.230	0.252	0.273	0.310	0.510	3.300

TABLE 11 (Cont'd) - PARTICLE SIZE DISTRIBUTION OF BED SEDIMENTS, MARCH 83

Grab Sample No	SIZE (mm) W10	W20	W30	W40	W50	W60	W70	W80	W90
S17A	0.121	0.138	0.148	0.154	0.158	0.165	0.172	0.180	0.195
18A	0.121	0.140	0.152	0.160	0.170	0.180	0.195	0.213	0.241
S18A	0.116	0.139	0.153	0.163	0.172	0.185	0.205	0.230	0.265
19A	0.120	0.144	0.160	0.170	0.176	0.185	0.195	0.210	0.235
S19A	SILT		0.097	0.120	0.135	0.145	0.155	0.166	0.185
20A	1.000	2.200	3.200	6.300	9.600	13.500	17.200	20.50	23.00
S20A			0.082	0.105	0.118	0.130	0.140	0.150	0.170
21A	0.86	1.05	1.28	1.57	1.87	2.25	2.65	3.25	4.50
S21A		SILT		0.094	0.110	0.128	0.145	0.155	0.175
23A	0.360	0.455	0.570	0.690	0.830	1.000	1.210	1.630	2.700
S23A	17.30	20.00	22.00	24.50	28.00	33.00	–	–	–
24A	0.305	0.380	0.450	0.570	0.730	0.970	1.630	3.300	6.600
S24A	0.086	0.125	0.148	0.162	0.170	0.177	0.199	0.315	0.730
25A	0.063	0.135	0.154	0.162	0.170	0.180	0.196	0.235	0.410
S25A				SILT					0.094
26A	9.600	14.200	19.00	24.00	28.50	32.50	–	–	–
S26A		SILT		0.068	0.092	0.110	0.128	0.145	0.170
27A	13.50	23.50	29.50	–	–	–	–	–	–
S27A	2.500	6.30	11.00	16.00	19.50	21.00	23.00	25.50	28.50
28A	0.480	0.850	1.300	1.850	2.450	3.050	3.850	4.800	6.700
S28A	0.225	0.325	0.380	0.430	0.490	0.560	0.680	0.900	1.600
29A	0.730	1.600	2.850	4.300	6.200	8.400	10.500	13.500	20.500
S29A	0.330	0.720	1.350	3.300	7.700	11.200	14.800	19.000	25.500
30A	2.950	6.900	10.600	13.20	16.200	19.50	–	–	–
S30A				SILT			0.065	0.087	0.108
31A	0.720	1.400	2.550	4.400	7.200	10.80	14.50	18.00	22.50
S31A	1.150	2.500	3.750	5.300	6.80	8.25	9.75	11.50	15.50
32A	0.830	2.00	3.700	5.40	6.30	9.00	11.00	14.20	21.50
S32A				SILT				0.084	0.108
33A	4.00	7.20	9.60	11.40	13.00	14.50	16.20	18.00	20.00
S33A			SILT				0.077	0.092	0.116

TABLE 11 (Cont'd) - PARTICLE SIZE DISTRIBUTION OF BED SEDIMENTS, MARCH 83

Grab ample No	SIZE (mm) W10	W20	W30	W40	W50	W60	W70	W80	W90
34A	5.700	7.900	9.600	11.000	12.300	13.50	14.50	16.50	20.00
34A		SILT			0.132	0.305	0.400	0.440	0.550
35A	0.950	1.400	2.100	3.050	4.450	6.500	9.300	13.00	18.00
36A	7.30	10.30	13.20	16.20	19.50	24.00	29.00	-	-
36A		SILT			0.069	0.230	0.800	1.800	3.000
37A	0.450	0.510	0.590	0.710	1.050	3.650	7.500	10.80	16.50
37A			SILT				0.069	0.172	0.310
38A	9.300	13.50	19.00	24.50	29.50	-	-	-	-
39A	7.40	11.60	16.50	21.50	26.00	30.00	34.50	-	-
40A	13.50	19.50	25.30	31.00	36.00	40.00	43.00	44.00	46.50
os 4									
735 hrs	0.150	0.170	0.183	0.193	0.203	0.215	0.230	0.250	0.270
os 4									
745 hrs	0.230	0.265	0.293	0.320	0.380	0.480	0.700	1.600	14.00
5a	0.085	0.135	0.165	0.180	0.218	6.400	-	-	-
-y-C	0.760	1.450	1.850	2.250	2.800	3.400	4.200	5.500	8.100
5	0.145	0.160	0.170	0.178	0.185	0.198	0.207	0.220	0.250

ote 1 Samples prefixed "S" taken from side remainder mid-channel.

TABLE 12 - SURFACE AREA DETERMINATIONS OF INTER-TIDAL SEDIMENTS, SEPT 1983

SAMPLE NUMBER	CHAINAGE (km)	PERCENTAGE CONTENT OF SILT	SURFACE AREA m^2/g dry wt
CC19	13.9	74.5	27.4
CC28	11.5	92.7	34.0
CC33	9.8	34.9	8.2
CC39	7.5	50.0	13.6
CC50	-1.5	17.2	2.9

TABLE 13 - FRESH WATER FLOW DATA 1980

DAY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	9.872	23.370	6.207	14.890	1.245	2.593	7.897	1.481	4.175	12.020	10.820	18.670
2	7.854	49.590	5.396	11.040	1.127	3.009	4.846	1.351	3.354	6.047	8.874	24.270
3	130.000	31.430	4.789	7.907	0.998	3.732	3.933	2.160	2.868	11.530	7.363	12.910
4	36.480	87.700	4.438	6.228	0.917	2.334	9.650	19.040	2.640	13.330	6.403	11.860
5	24.290	73.750	6.093	5.356	0.865	2.137	5.170	28.450	7.669	10.110	5.434	11.680
6	15.850	32.790	15.610	4.704	0.871	2.410	3.843	60.600	4.260	124.900	4.486	10.820
7	11.300	68.310	25.950	4.265	0.885	4.256	3.309	27.420	3.462	47.240	6.711	8.466
8	9.103	95.250	15.290	3.853	0.871	4.885	2.865	11.660	3.996	26.190	8.125	7.566
9	7.854	77.330	11.730	3.605	0.810	3.020	2.462	6.761	5.704	18.500	5.385	8.492
10	6.602	28.280	35.110	3.323	0.751	2.553	2.206	5.648	22.080	17.810	3.759	183.900
11	6.094	17.740	28.610	3.100	0.680	3.762	1.983	29.180	68.680	16.180	4.374	64.390
12	6.075	12.900	54.340	2.783	0.621	3.296	1.926	14.430	27.940	12.540	3.729	88.860
13	4.958	10.420	18.320	2.726	0.583	2.591	1.879	31.700	12.140	10.060	5.554	66.410
14	6.846	18.050	12.280	3.220	0.546	18.710	1.789	44.050	15.030	8.373	123.000	53.130
15	6.784	15.550	9.223	2.818	0.506	18.640	1.573	18.870	18.510	6.709	54.250	34.640
16	5.777	14.310	8.683	2.479	0.486	18.860	1.411	9.696	44.070	7.910	73.350	47.040
17	5.007	15.670	14.750	2.275	0.456	18.090	3.168	13.830	15.680	15.360	158.100	90.110
18	4.257	14.900	18.920	2.113	0.438	12.510	4.747	16.180	10.220	10.460	35.320	28.550
19	4.146	14.900	12.450	1.951	0.450	16.270	17.270	9.473	8.485	20.260	115.000	38.030
20	4.297	9.359	8.978	1.727	0.763	16.350	7.795	12.210	17.610	15.340	67.140	52.580
21	27.290	10.470	7.798	1.644	0.881	20.730	4.656	12.870	42.990	16.590	229.600	29.580
22	47.180	16.220	7.463	1.629	0.709	18.250	3.204	5.968	13.150	92.300	82.910	26.920
23	38.730	16.460	9.059	1.566	0.612	37.990	2.693	4.376	19.070	43.970	34.200	26.910
24	18.160	9.738	25.640	1.475	0.557	14.340	2.390	3.616	12.600	17.980	66.650	52.360
25	13.320	11.630	17.190	1.397	0.505	9.998	1.996	3.130	7.739	12.050	38.520	27.850
26	9.681	17.380	15.900	1.341	0.677	6.653	2.297	2.719	5.854	158.800	31.300	22.140
27	7.448	10.870	23.960	1.269	0.790	5.061	1.977	2.417	7.098	285.200	29.980	15.870
28	13.510	8.510	31.170	1.235	0.918	7.822	1.670	2.885	7.871	73.900	18.460	22.720
29	27.680	7.362	20.880	1.196	0.879	4.850	1.561	13.160	6.468	35.980	14.160	28.340
30	32.660		11.680	1.198	0.731	7.186	1.801	12.210	5.894	22.740	11.950	33.290
31	67.570		15.180		1.441		1.662	6.398		17.470		27.410

DAILY MEAN FRESH WATER FLOWS AT LLANERCH (m^3/s)

TABLE 14 - FRESH WATER FLOW DATA 1981

DAY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	17.970	4.284	16.180	6.649	8.730	3.714	2.059	1.770	1.257	123.080	96.088	18.879
2	72.040	133.500	12.210	5.707	4.942	12.590	1.960	1.582	1.271	49.496	51.147	12.988
3	35.290	57.390	11.300	4.975	45.820	6.727	2.074	1.431	1.244	26.350	45.756	10.234
4	17.180	26.240	8.284	4.443	22.630	11.380	1.841	1.415	1.187	16.761	23.976	19.696
5	14.570	18.950	14.040	4.072	14.320	7.499	10.460	1.426	1.104	11.935	14.705	19.912
6	17.800	16.310	46.890	3.754	11.970	17.260	9.960	1.490	0.973	10.366	10.823	27.977
7	13.500	14.250	205.600	3.600	8.764	21.380	7.157	1.640	0.973	63.843	8.364	28.878
8	13.760	93.810	60.620	3.553	6.767	39.730	4.082	1.614	1.934	193.807	6.795	15.961
9	22.780	44.480	52.840	3.483	5.097	24.150	2.932	1.513	1.449	222.717	5.567	11.427
10	13.460	22.680	237.300	3.106	4.600	15.060	2.282	1.321	1.346	54.855	5.274	8.966
11	11.150	16.710	68.550	2.859	3.958	44.980	4.654	1.197	2.668	31.502	23.471	7.750
12	17.600	30.270	38.230	2.822	3.504	16.920	4.000	1.148	2.273	23.520	10.461	5.874
13	38.880	16.330	22.480	2.840	3.706	25.010	2.672	3.530	2.041	15.387	6.775	6.186
14	113.700	13.030	16.270	2.469	3.390	60.930	2.133	6.208	17.898	11.300	5.220	31.525
15	24.270	11.810	13.810	2.239	3.172	25.180	1.920	2.662	13.760	8.618	5.134	22.744
16	35.770	11.500	12.650	2.087	6.611	11.470	2.289	2.023	5.167	6.839	6.742	11.985
17	48.790	10.070	11.040	1.965	6.398	8.108	6.194	1.549	31.890	5.639	80.751	9.996
18	34.410	8.864	17.640	1.858	5.679	6.162	4.223	1.334	35.807	11.460	135.724	6.327
19	18.620	8.018	54.170	1.802	4.361	5.477	3.279	3.226	130.836	80.799	25.118	6.071
20	15.870	7.259	59.390	1.722	6.965	4.752	10.380	7.557	35.330	52.066	41.547	16.803
21	27.050	6.662	318.400	1.659	6.583	3.946	19.300	3.637	47.043	45.262	25.667	13.527
22	15.170	6.297	66.660	1.613	9.415	3.367	67.550	8.478	12.091	22.767	22.290	8.408
23	12.490	6.054	109.500	1.604	17.840	3.092	38.890	6.060	35.071	13.983	60.795	6.673
24	13.230	5.578	80.920	4.577	16.720	2.863	11.330	3.323	46.698	31.744	19.924	5.764
25	10.620	4.720	70.800	6.369	13.350	2.650	6.107	2.273	50.847	40.997	14.096	4.883
26	10.220	4.259	37.310	4.826	8.700	2.883	4.515	1.842	50.944	38.365	140.722	6.802
27	9.457	5.111	20.660	8.384	7.853	3.175	3.477	1.597	84.890	23.825	66.670	6.750
28	8.041	10.350	15.870	19.060	8.353	2.488	2.878	1.421	31.098	29.435	30.764	5.508
29	6.972		13.130	15.770	6.015	2.134	2.466	1.383	26.805	23.206	22.284	8.071
30	6.035		11.630	10.600	4.786	2.060	2.114	1.343	91.825	38.936	32.937	27.038
31	5.135		10.640		4.265		1.923	1.278		22.954		18.467

DAILY MEAN FRESH WATER FLOWS AT LLANERCH (m^3/s)

TABLE 15 - FRESH WATER FLOW DATA 1982

DAY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	10.685	12.751	36.090	2.976	1.609	1.967	9.239	1.875	7.377	54.958	42.427	8.384
2	145.810	8.440	109.551	2.758	23.491	1.711	5.777	2.125	5.072	28.186	43.176	7.343
3	137.805	6.279	40.957	3.086	9.211	1.563	4.331	1.644	4.202	16.975	32.076	6.546
4	75.219	5.548	28.152	5.196	4.769	5.340	4.399	1.567	4.362	35.817	19.091	30.355
5	60.020	41.357	15.971	3.775	3.443	3.541	3.952	1.516	3.767	62.690	34.105	20.372
6	21.671	40.923	50.663	4.639	2.823	2.681	4.585	1.346	4.122	34.727	22.110	11.068
7	13.039	18.904	19.218	25.391	2.459	1.930	3.521	1.232	7.966	19.691	14.434	69.549
8	8.169	50.837	16.434	13.037	2.131	1.645	2.991	1.182	3.902	15.315	19.449	78.294
9	8.206	53.589	137.091	7.198	1.888	1.500	4.325	2.146	3.307	10.687	22.989	83.782
10	6.627	19.630	55.829	6.304	1.698	5.377	5.076	2.117	3.248	7.869	40.859	30.186
11	5.395	27.763	58.581	4.417	1.558	10.387	3.137	3.139	3.438	6.217	93.782	18.619
12	4.771	61.497	50.653	3.575	1.438	5.720	2.607	9.628	3.632	10.958	96.988	14.985
13	4.345	26.949	23.058	3.082	1.377	3.531	3.315	10.834	3.233	37.248	29.110	11.466
14	3.835	17.278	196.591	2.780	1.319	2.467	14.424	3.887	2.624	18.945	61.585	55.409
15	4.387	11.639	66.019	2.574	1.505	5.569	43.208	6.424	2.301	12.941	53.739	118.889
16	22.445	8.720	31.400	2.381	1.467	5.397	9.923	35.773	2.089	20.114	55.667	32.053
17	23.093	7.146	25.682	2.217	1.272	3.061	5.501	120.738	1.914	54.233	41.559	19.509
18	13.719	6.026	19.281	2.094	1.217	3.165	4.099	53.758	1.789	43.985	46.822	38.852
19	10.613	5.129	19.432	1.939	1.293	2.936	3.256	24.616	1.936	77.238	24.190	181.977
20	11.598	4.410	15.360	1.822	1.314	2.461	2.788	17.322	31.433	76.663	33.132	37.503
21	18.895	4.367	15.557	1.727	6.816	3.715	2.505	9.772	33.415	22.430	126.238	52.169
22	18.981	5.714	10.670	1.665	7.352	17.159	2.239	35.353	11.705	13.812	156.128	25.571
23	10.620	5.056	7.764	1.627	8.454	9.535	2.063	16.532	22.449	9.631	68.292	53.933
24	7.571	7.207	6.082	1.543	4.597	5.378	1.919	54.944	43.465	18.895	94.971	41.790
25	17.946	15.180	4.984	1.494	22.295	37.451	1.808	16.230	21.561	11.768	48.441	29.097
26	42.690	23.905	4.388	1.441	16.194	20.366	1.693	9.787	36.432	12.881	26.503	128.370
27	16.711	11.020	3.944	1.366	7.396	13.209	1.562	6.847	57.913	8.417	20.592	32.613
28	12.271	38.605	3.505	1.311	4.783	29.336	1.490	4.661	79.314	6.141	16.634	19.673
29	24.334		4.673	1.306	3.276	13.603	1.404	12.318	55.901	4.902	12.551	16.615
30	15.694		3.726	1.356	2.532	8.709	1.341	30.935	18.658	4.347	10.071	14.767
31	10.308		3.208		2.200		1.278	11.238		4.977		26.812

DAILY MEAN FRESH WATER FLOWS AT LLANERCH (m^3/s)

TABLE 16 - FRESH WATER FLOW DATA 1983

DAY	JANUARY	FEBRUARY	MARCH	APRIL	MAY	JUNE	JULY	AUGUST	SEPTEMBER	OCTOBER	NOVEMBER	DECEMBER
1	88.720	40.023	6.940	12.266	16.395	10.202	18.833	0.900	4.029	4.287	5.173	9.051
2	77.761	27.112	46.766	9.443	20.062	11.215	17.316	1.179	118.276	11.299	4.785	7.037
3	161.566	20.638	58.250	8.189	12.187	11.810	5.283	1.025	85.372	15.462	4.753	5.837
4	99.703	65.869	24.678	11.368	7.876	7.414	3.204	0.899	24.571	21.174	4.651	5.149
5	178.766	38.205	13.072	15.854	25.610	4.810	2.629	0.870	11.791	13.704	3.870	5.753
6	111.140	23.956	9.192	18.551	36.695	3.534	2.291	0.751	7.734	39.441	3.435	5.320
7	36.243	14.936	7.206	14.666	30.805	14.162	3.155	0.701	5.950	43.311	3.273	8.082
8	40.763	11.323	6.121	16.437	16.201	16.676	2.398	0.654	17.712	43.403	3.160	139.170
9	34.305	9.359	5.268	12.186	28.285	11.641	1.890	0.642	13.385	137.854	3.056	115.556
10	43.341	8.289	4.677	25.850	45.020	6.740	1.859	0.558	62.195	45.819	2.940	28.275
11	24.630	7.168	4.201	24.609	31.849	20.285	1.504	0.487	43.598	40.242	2.816	17.459
12	84.295	6.601	3.723	12.778	23.911	8.350	1.370	0.417	17.238	57.590	2.719	16.421
13	54.872	5.893	7.717	11.169	18.269	11.057	1.265	0.315	13.232	36.704	2.605	26.852
14	85.977	5.192	26.855	9.498	22.049	9.894	1.120	0.230	17.438	31.088	2.508	35.137
15	34.146	4.706	9.410	7.561	15.917	5.943	1.013	0.190	49.862	134.658	2.509	23.144
16	27.494	4.250	15.315	6.484	14.883	4.393	1.538	5.593	52.404	89.253	2.500	20.282
17	25.564	3.745	23.138	5.636	16.838	3.609	1.416	5.567	45.946	55.156	2.469	15.640
18	20.859	3.423	37.270	4.838	14.421	3.129	1.106	3.007	35.007	33.845	2.382	11.971
19	14.119	3.246	24.055	5.547	15.616	2.767	1.001	2.020	21.035	20.415	2.288	15.271
20	11.628	3.111	27.202	5.546	10.257	2.496	0.893	1.608	43.681	14.413	2.318	22.285
21	10.003	2.949	29.018	6.243	7.643	2.306	0.851	1.483	34.476	11.091	2.281	51.232
22	8.372	2.664	13.413	11.625	6.922	3.979	0.801	1.407	19.238	9.049	2.073	47.120
23	7.419	2.615	52.289	13.653	6.508	8.867	2.340	1.190	14.084	7.597	1.942	32.440
24	35.989	2.804	22.577	10.442	6.343	4.376	4.713	1.344	10.612	6.506	2.169	124.617
25	13.889	3.060	41.096	24.801	4.998	3.243	2.627	1.170	8.612	5.666	52.499	37.104
26	16.437	29.761	21.674	12.494	4.136	2.881	2.067	1.005	7.281	5.028	40.089	26.891
27	37.631	28.588	21.134	10.012	3.597	2.591	1.574	0.881	6.304	4.611	49.951	37.856
28	188.273	11.381	12.343	7.814	4.641	2.328	1.298	0.817	5.420	4.644	30.650	24.020
29	32.368		15.711	6.778	4.458	3.188	1.108	0.739	4.685	4.001	16.598	16.603
30	22.224		22.769	6.627	4.701	4.136	0.942	0.629	4.110	5.449	11.536	12.472
31	135.014		20.055		4.704		0.850	0.725		5.207		10.048

DAILY MEAN FRESH WATER FLOWS AT LLANERCH (m^3/s)

TABLE 17 SILT MONITORING DATA ANALYSIS, 27 AUGUST-21 SEPTEMBER 1982

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.5130	0.8964		
2	0.6520	0.9126	No upper	Monitor
3	0.6929	0.9307		
4	0.7484	0.9697		
5	0.5478	0.9761		
6	0.6038	0.9761		
7	0.5834	1.0006		
8	0.6020	0.9666		
9	0.5989	0.9469		
10	0.6452	0.9268		
11	0.6941	1.0708		
12	0.7644	1.1230		
13	0.8279	1.2428		
14	0.7854	1.3891		
15	0.8074	1.5647		
16	0.9914	1.6382		
17	1.0416	1.8061		
18	1.0967	1.7268		
19	1.2242	1.5530		
20	1.2245	1.5265		
21	1.2579	1.2576		
22	1.4239	1.1416		
23	1.5374	1.0701		
24	1.6980	1.0523		
25	1.5444	1.0922		
26	1.4934	0.9239		
27	1.6149	1.0300		
28	1.5795	1.0062		
29	1.6572	0.9248		
30	1.6972	0.8666		
31	1.2686	0.7959		
32	1.1683	0.7269		
33	0.9807	0.6782		
34	1.0517	0.5160		
35	0.9665	0.5654		
36	0.9917	0.8312		
37	0.9593	0.5892		
38	0.9449	0.4710		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 18 SILT MONITORING DATA ANALYSIS, 21 SEPTEMBER-5 OCTOBER 1982

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.6787	1.0162	0.2846	1.7494
2	0.5764	1.0456	0.0504	1.5958
3	0.6272	1.0528	0.0429	1.5426
4	0.8511	1.0795	0.0575	1.5102
5	0.7442	1.0686	0.0723	1.7330
6	0.5714	1.0539	0.2033	2.0661
7	0.5609	1.0412	0.1948	2.2172
8	0.6122	1.0274	0.2439	2.0534
9	0.6436	1.0362	0.3856	1.7740
10	0.6637	1.1436	0.4811	1.5007
11	0.6782	1.3829	0.5794	1.4146
12	0.8417	1.6167	0.4745	1.5154
13	0.8129	1.7495	0.5185	1.6181
14	0.8103	1.7839	0.7805	1.6369
15	0.7660	1.3940	0.7861	1.6854
16	0.8275	1.3249	0.8012	1.5871
17	0.8868	1.3766	0.8632	1.4345
18	0.9212	1.4488	0.8938	1.5107
19	0.9615	1.4538	1.0305	1.4162
20	1.0211	1.3255	1.1546	1.1484
21	1.1604	1.1926	1.4062	1.0546
22	1.2772	1.3025	1.6155	0.8884
23	1.3124	1.2295	1.8839	0.8933
24	1.4295	1.2017	1.9305	0.7508
25	1.5103	0.9468	1.9578	0.6535
26	1.5069	0.7901	1.9865	0.5853
27	1.8235	0.8107	1.8316	0.5226
28	1.7108	0.8048	1.8728	0.5424
29	1.6165	0.7930	1.8937	0.7138
30	1.4490	0.6852	1.7553	0.4279
31	1.4477	0.6346	1.7732	0.3174
32	1.4028	0.5251	2.1301	0.2442
33	1.3595	0.4680	1.8256	0.1462
34	1.3489	0.4489	1.9236	0.1198
35	1.1103	0.4688	1.8981	0.1283
36	1.1160	0.4841	1.8720	0.1442
37	1.0448	0.5023	1.7465	0.2769
38	1.0381	0.7209	1.8704	0.1482

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 19 SILT MONITORING DATA ANALYSIS, 5 OCTOBER-7 NOVEMBER 1982

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.4029	1.3714	0.6332	1.3015
2	0.3653	1.3695	0.6348	1.3714
3	0.3766	1.2735	0.6460	1.3911
4	0.3921	1.1171	0.6433	1.2803
5	0.4148	1.0341	0.6474	1.2501
6	0.4426	1.0554	0.6929	1.2303
7	0.5040	1.1507	0.7302	1.3505
8	0.4704	1.0688	0.7927	1.4368
9	0.4483	0.9862	0.7490	1.3187
10	0.5159	0.8813	0.8227	1.2917
11	0.4888	0.8989	0.8226	1.1654
12	0.5596	1.0035	0.8103	1.1464
13	0.5890	1.1298	0.7517	1.2609
14	0.5803	1.3497	0.7723	1.3413
15	0.5379	1.4753	0.7448	1.3322
16	0.5408	1.5927	0.7582	1.2932
17	0.7384	1.6344	0.7637	1.2578
18	0.8651	1.5222	0.8328	1.2570
19	1.0703	1.4549	0.9228	1.2251
20	1.1951	1.4339	0.9988	1.0715
21	1.3480	1.3222	1.0767	1.0127
22	1.5597	1.2280	1.1728	0.9937
23	1.7527	1.1223	1.2871	0.9476
24	1.7997	1.0432	1.4213	0.9891
25	1.9652	0.9398	1.6190	0.9534
26	1.9865	0.9007	1.7375	0.8734
27	1.9320	0.8337	1.3887	0.8172
28	1.8398	0.7640	1.3308	0.8172
29	1.8368	0.6975	1.3492	0.7877
30	1.4406	0.6772	1.3350	0.7455
31	1.2011	0.5933	1.3591	0.7464
32	1.1123	0.5261	1.4076	0.7626
33	1.1083	0.5420	1.4041	0.7222
34	1.0704	0.4903	1.3977	0.6953
35	1.0415	0.4666	1.3222	0.7074
36	1.0071	0.4344	1.3752	0.7038
37	1.0005	0.4296	1.3822	0.6475
38	1.1400	0.4639	1.3304	0.5953

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 20 SILT MONITORING DATA ANALYSIS, 13 JANUARY-5 FEBRUARY 1983

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.3660	0.8598		
2	0.3496	0.9395	Upper	Monitor
3	0.3461	0.9939		
4	0.3388	1.0158	data	not
5	0.3601	1.1491		
6	0.4004	1.2545		
7	0.5665	1.3707	analysed	
8	0.6075	1.3989		
9	0.5949	1.2966		
10	0.6631	1.2219		
11	0.6291	1.2122		
12	0.6136	1.2729		
13	0.6600	1.3532		
14	0.5815	1.4452		
15	0.5769	1.5635		
16	0.5944	1.6452		
17	0.7466	1.7446		
18	0.7918	1.8216		
19	1.0988	1.7055		
20	1.3775	1.4919		
21	1.3059	1.3368		
22	1.4681	1.2207		
23	1.5907	1.0877		
24	1.7628	1.0534		
25	1.9493	1.0299		
26	2.0116	0.9644		
27	2.0499	0.9415		
28	2.0656	0.8479		
29	2.0369	0.7593		
30	1.8891	0.7052		
31	1.7002	0.6615		
32	1.4792	0.6356		
33	1.0319	0.5869		
34	0.7277	0.5203		
35	0.5344	0.4695		
36	0.6908	0.4366		
37	0.7020	0.4029		
38	0.5227	0.3790		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 21 SILT MONITORING DATA ANALYSIS, 9-27 FEBRUARY 1983

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.3456	0.8627		
2	0.3206	0.8813		
3	0.4622	0.8959	Upper	Monitor
4	0.6455	0.9326		
5	1.1958	1.0320		
6	0.7994	1.1224	data	not
7	0.5945	1.1137		
8	0.6392	1.1227		
9	0.6462	1.1173	analysed	
10	0.6561	1.0091		
11	0.6020	0.9772		
12	0.5959	0.9238		
13	0.5488	0.8727		
14	0.5904	0.9344		
15	0.6623	1.0431		
16	0.7073	1.4878		
17	0.7345	1.6663		
18	0.7611	1.5295		
19	0.8897	1.5662		
20	0.9681	1.4933		
21	1.0258	1.5274		
22	1.1711	1.6231		
23	1.4252	1.5611		
24	1.6847	1.3280		
25	1.7957	1.6255		
26	1.8906	1.4025		
27	1.9279	1.2967		
28	1.8658	1.3447		
29	1.8259	1.0347		
30	1.7650	0.7816		
31	1.7996	0.6952		
32	1.5884	0.6471		
33	1.7854	0.6011		
34	1.7261	0.6880		
35	1.5012	0.5202		
36	1.3974	0.3940		
37	1.3848	0.3576		
38	1.3586	0.3196		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 22 SILT MONITORING DATA ANALYSIS, 19-22 APRIL 1983

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.8591	1.1166		
2	0.7934	1.1234	Upper	Monitor
3	0.7313	1.1720		
4	0.7707	1.1531	data	not
5	0.8382	1.1014		
6	0.8250	0.9979		
7	0.8494	0.8930	analysed	
8	1.0156	0.8231		
9	1.0134	0.7768		
10	0.8401	0.7409		
11	0.7113	0.7082		
12	0.7150	0.6812		
13	0.7626	0.6724		
14	0.8012	0.6848		
15	0.8192	0.6839		
16	0.8380	0.7181		
17	0.8451	0.9017		
18	0.8607	1.0411		
19	0.8969	1.1378		
20	0.8854	1.1936		
21	0.9830	1.1051		
22	1.0553	1.1284		
23	1.1059	1.1914		
24	1.1660	1.2644		
25	1.2313	1.4362		
26	1.3095	1.5057		
27	1.2617	1.5116		
28	1.3008	1.4102		
29	1.3386	1.2792		
30	1.3548	1.1829		
31	1.3206	1.1011		
32	1.3187	1.0230		
33	1.2931	0.9298		
34	1.2288	0.8602		
35	1.1556	0.7846		
36	1.1648	0.7515		
37	1.1554	0.7177		
38	0.9341	0.7309		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 23 SILT MONITORING DATA ANALYSIS, 7-25 JUNE 1983

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.7620	0.7630		
2	0.7784	0.8612		
3	0.9767	1.3275	Upper	Monitor
4	0.8875	1.0375		
5	1.1636	0.8576		
6	1.0158	0.7039	data	not
7	1.0578	0.6802		
8	1.2569	0.6897	analysed	
9	1.4099	0.6170		
10	1.1347	0.5747		
11	1.1748	0.6389		
12	1.1679	0.7602		
13	1.3076	0.8244		
14	1.4823	0.8889		
15	1.3542	0.9992		
16	1.1311	1.0433		
17	0.9093	1.2126		
18	0.8911	1.4096		
19	0.9447	1.4669		
20	0.9256	1.2461		
21	0.9561	1.2087		
22	0.9668	1.1934		
23	0.9988	1.2391		
24	1.0097	1.2197		
25	0.9796	1.1794		
26	0.9426	1.3132		
27	0.8823	1.3673		
28	0.8365	1.2360		
29	0.8170	1.1284		
30	0.8186	1.0807		
31	0.8310	1.0165		
32	0.8664	0.9370		
33	0.8859	0.8406		
34	0.9179	0.7714		
35	0.9959	0.7392		
36	0.9285	0.8128		
37	0.8107	0.6394		
38	0.7985	0.5502		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

TABLE 24 SILT MONITORING DATA ANALYSIS, 13-30 JULY 1983

Element Number	Normalised Concentration			
	Lower Monitor		Upper Monitor	
	Ebb	Flood	Ebb	Flood
1	0.4888	1.7923		
2	0.4664	1.6308	Upper	Monitor
3	0.5691	1.4461		
4	0.7749	1.0967	data	not
5	0.7328	1.1729		
6	0.6769	1.1446		
7	0.7138	1.1256	analysed	
8	0.9727	1.1168		
9	1.0432	1.0608		
10	1.2149	1.2786		
11	1.0118	0.7473		
12	0.7882	0.8239		
13	1.0611	0.9846		
14	1.0316	1.1888		
15	1.0119	1.1562		
16	1.0758	1.3299		
17	1.1923	1.3192		
18	1.2135	1.1685		
19	1.2852	1.1306		
20	1.1366	1.1901		
21	1.1743	1.3793		
22	1.1553	1.3686		
23	1.1887	1.3380		
24	1.2884	1.1696		
25	1.2106	1.0146		
26	1.1050	0.9769		
27	1.0296	0.9683		
28	1.0777	0.8604		
29	1.0900	0.8584		
30	1.1242	0.7907		
31	0.9842	0.6945		
32	0.9063	0.6351		
33	0.9598	0.6168		
34	0.9300	0.5125		
35	0.8858	0.4920		
36	1.4112	0.5437		
37	1.5275	0.5425		
38	2.0053	0.5196		

Notes:

1. The concentration for each of the 38 elements is divided by the mean for the half tide and the value given is the average of these values throughout the period of record.

2. The data for each half tide is interpolated onto a fixed time base of 370 minutes.

F I G U R E S

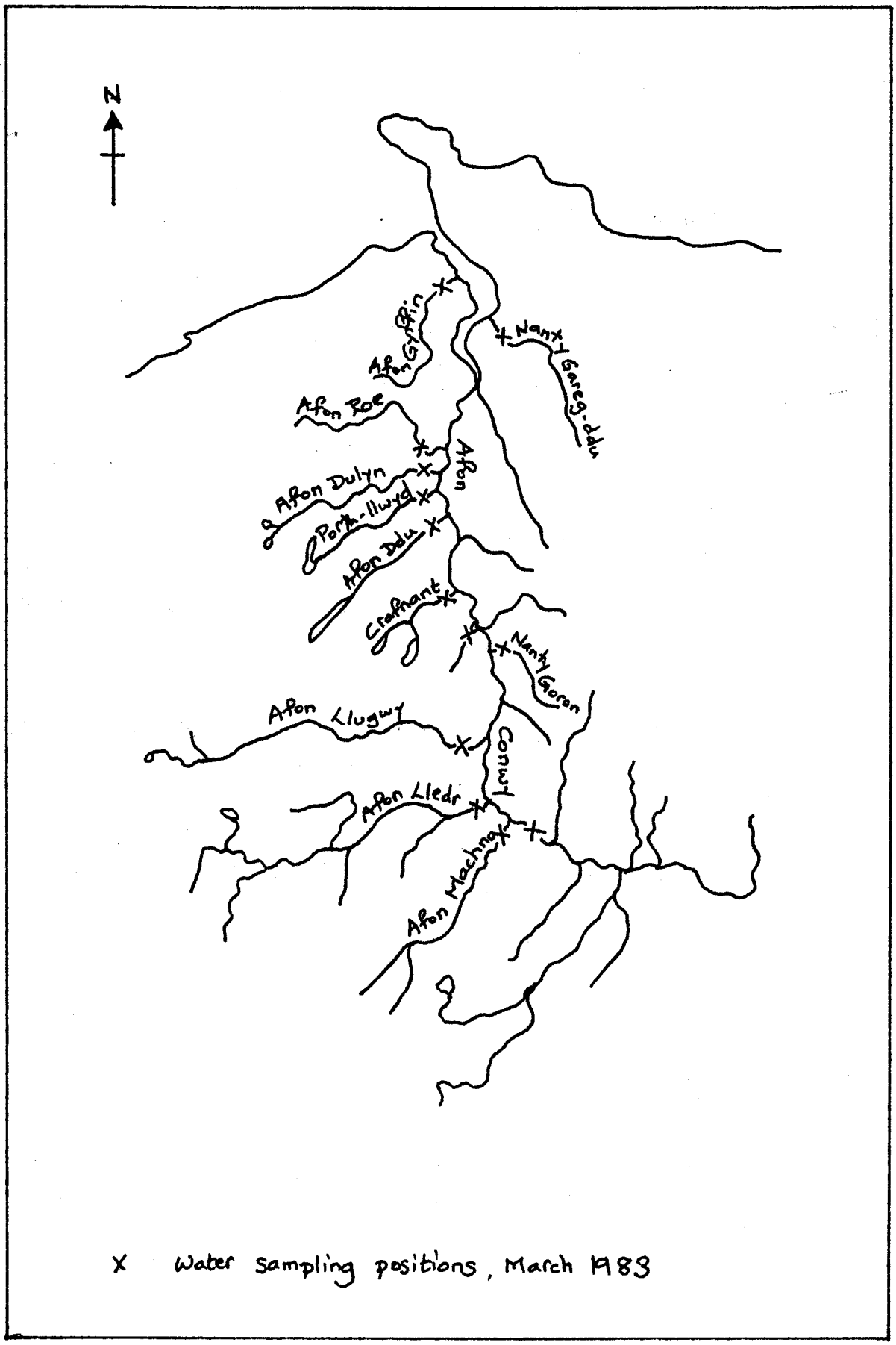


Fig 1 The Conwy catchment area

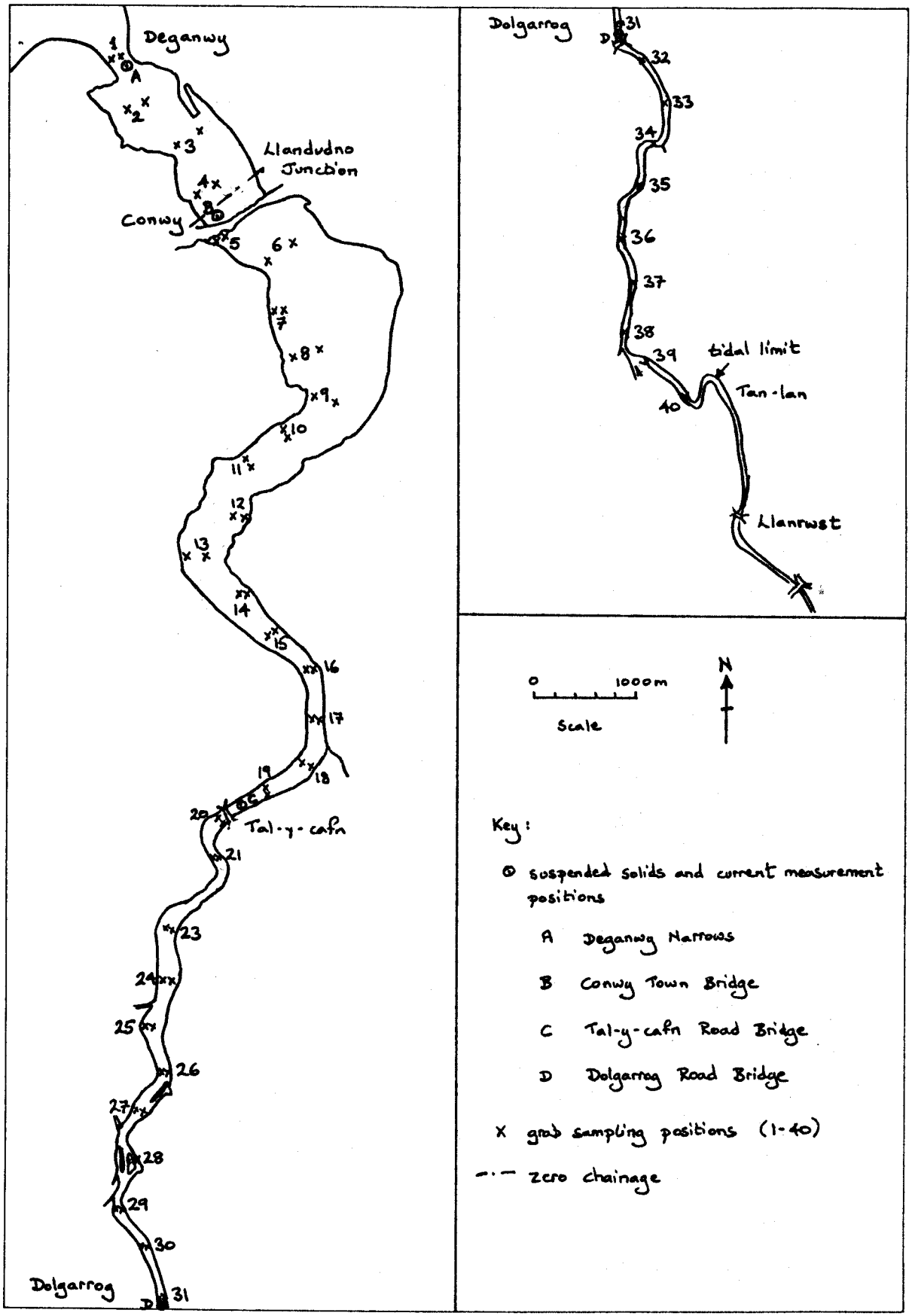


Fig 2 Location chart of spring 1983 survey positions

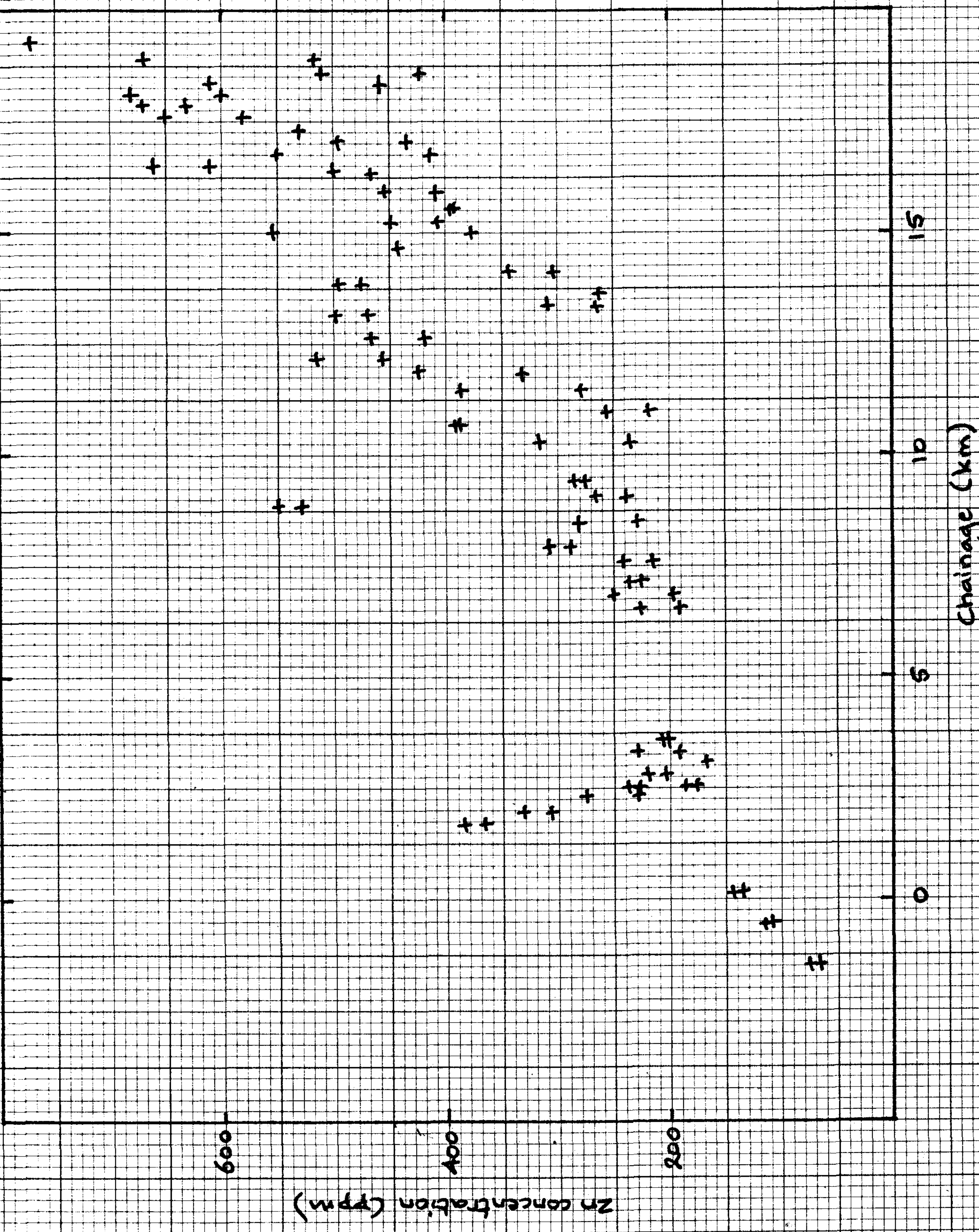
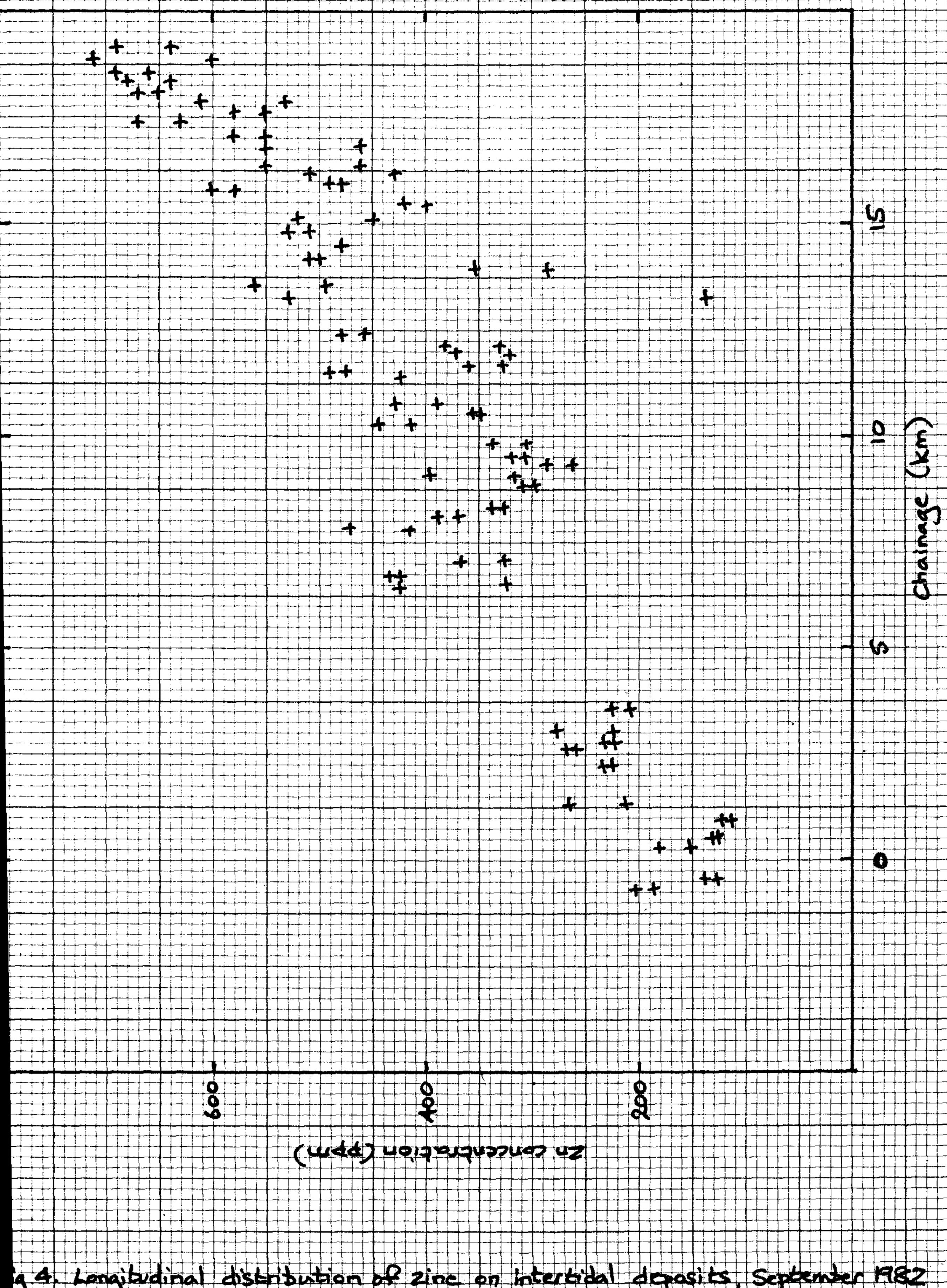
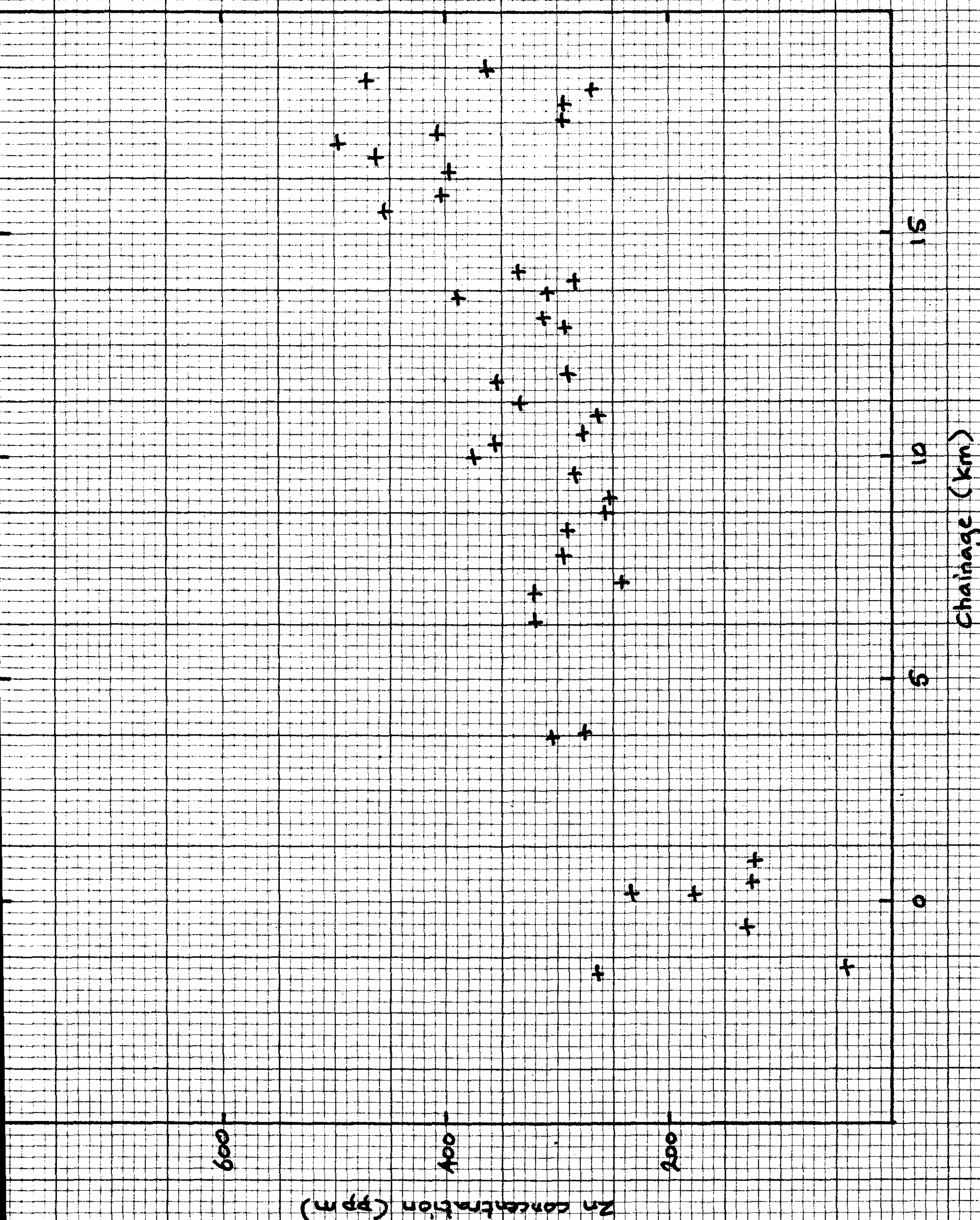


Fig 3. Longitudinal distribution of zinc on intertidal deposits, May 1982



g 4. Longitudinal distribution of zinc on intertidal deposits, September 1982



ig 5. Longitudinal distribution of zinc on intertidal deposits, March 1983

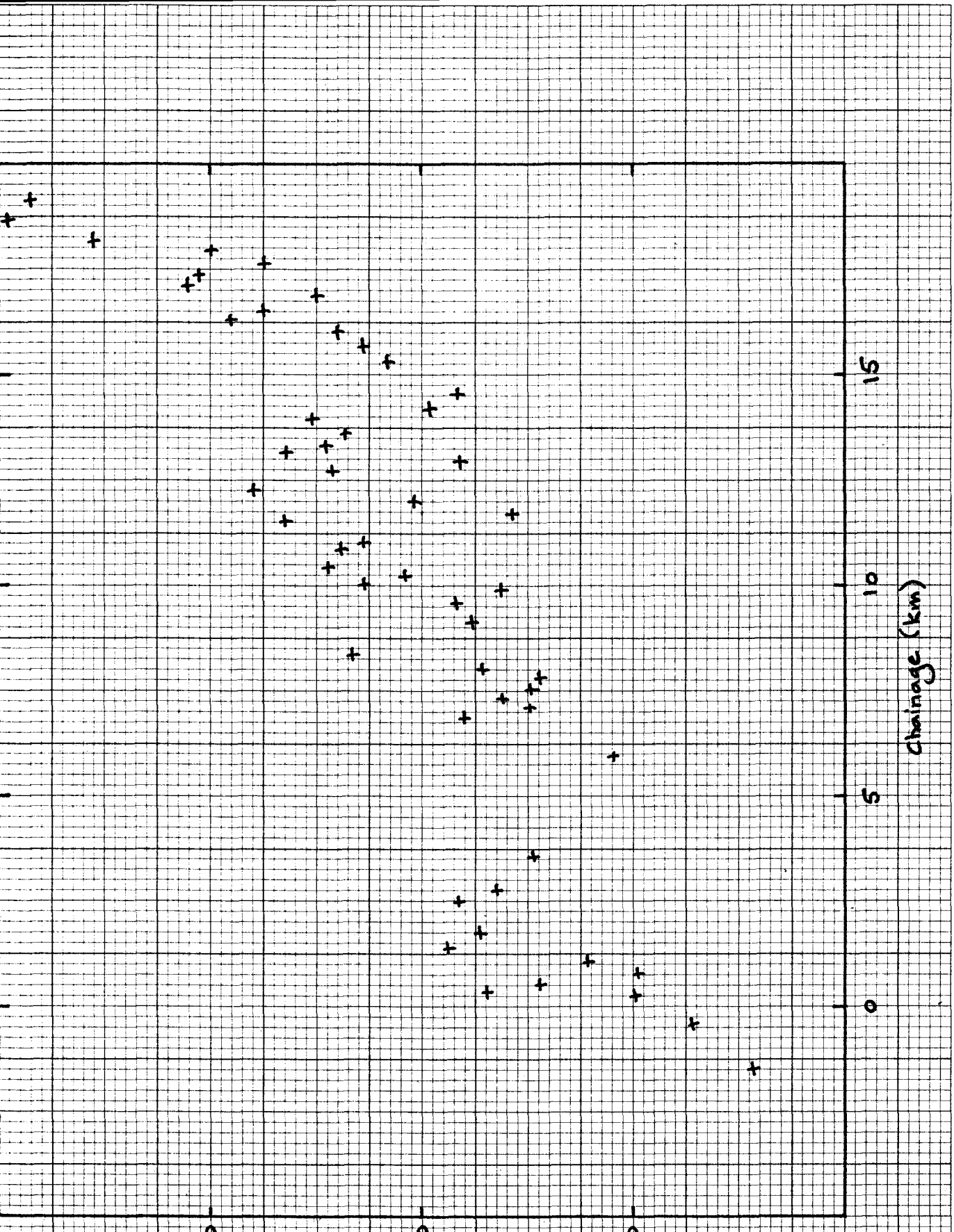
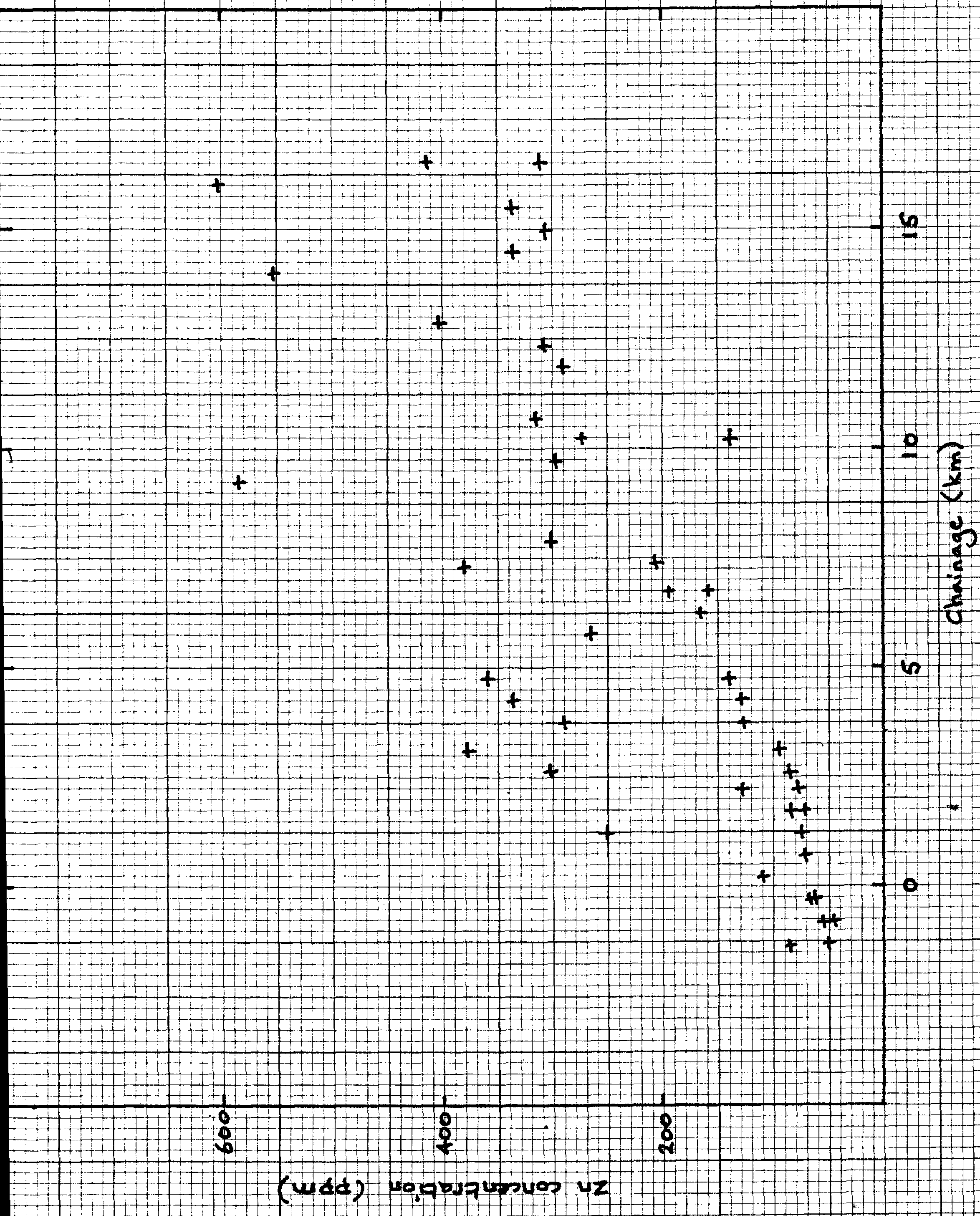


Fig 6. Longitudinal distribution of zinc on intertidal deposits, September 1983



ig 7. Longitudinal distribution of zinc on bed sediments, March 1983

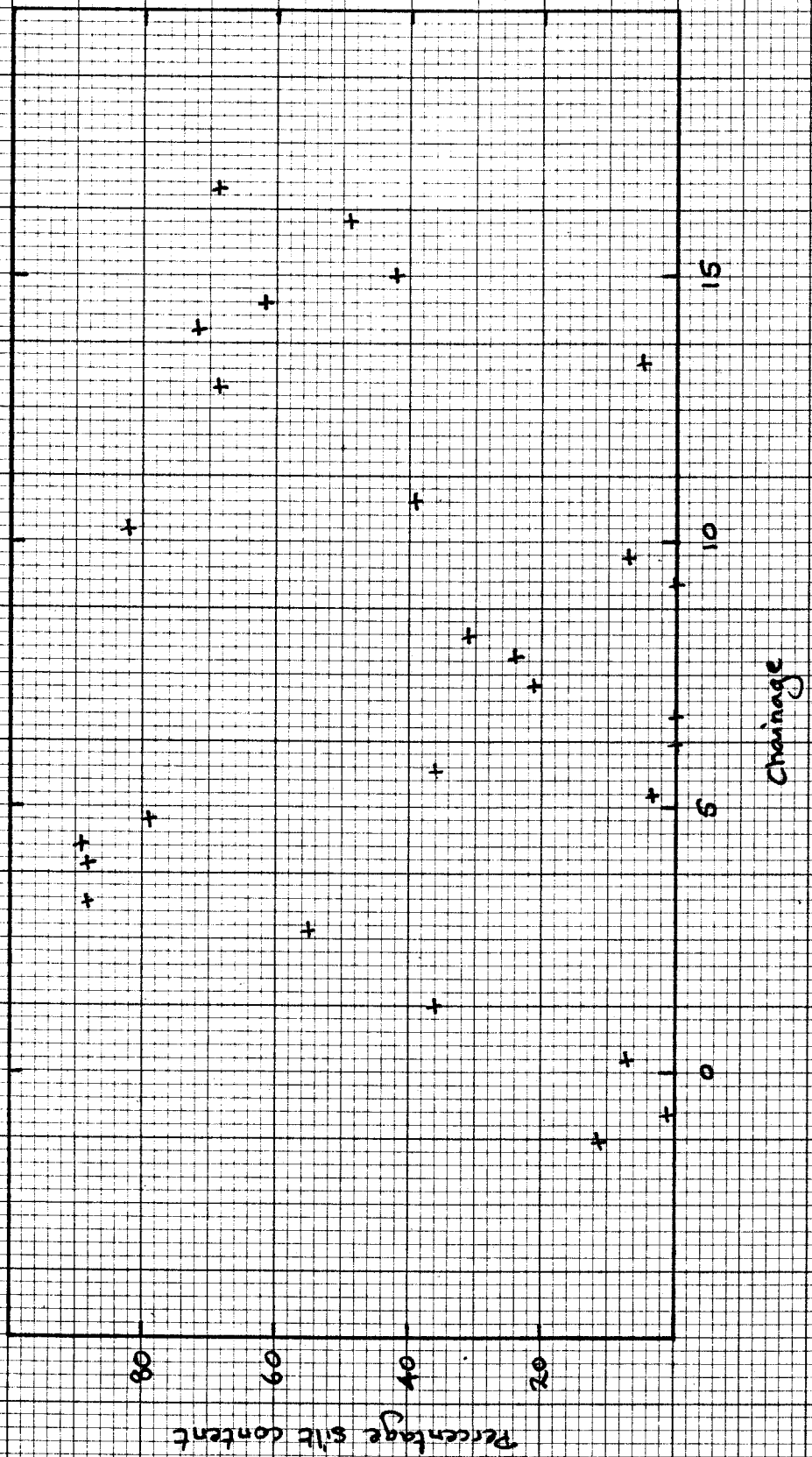


Fig 8. Longitudinal distribution of percentage silt content on bed sediments, March 1983

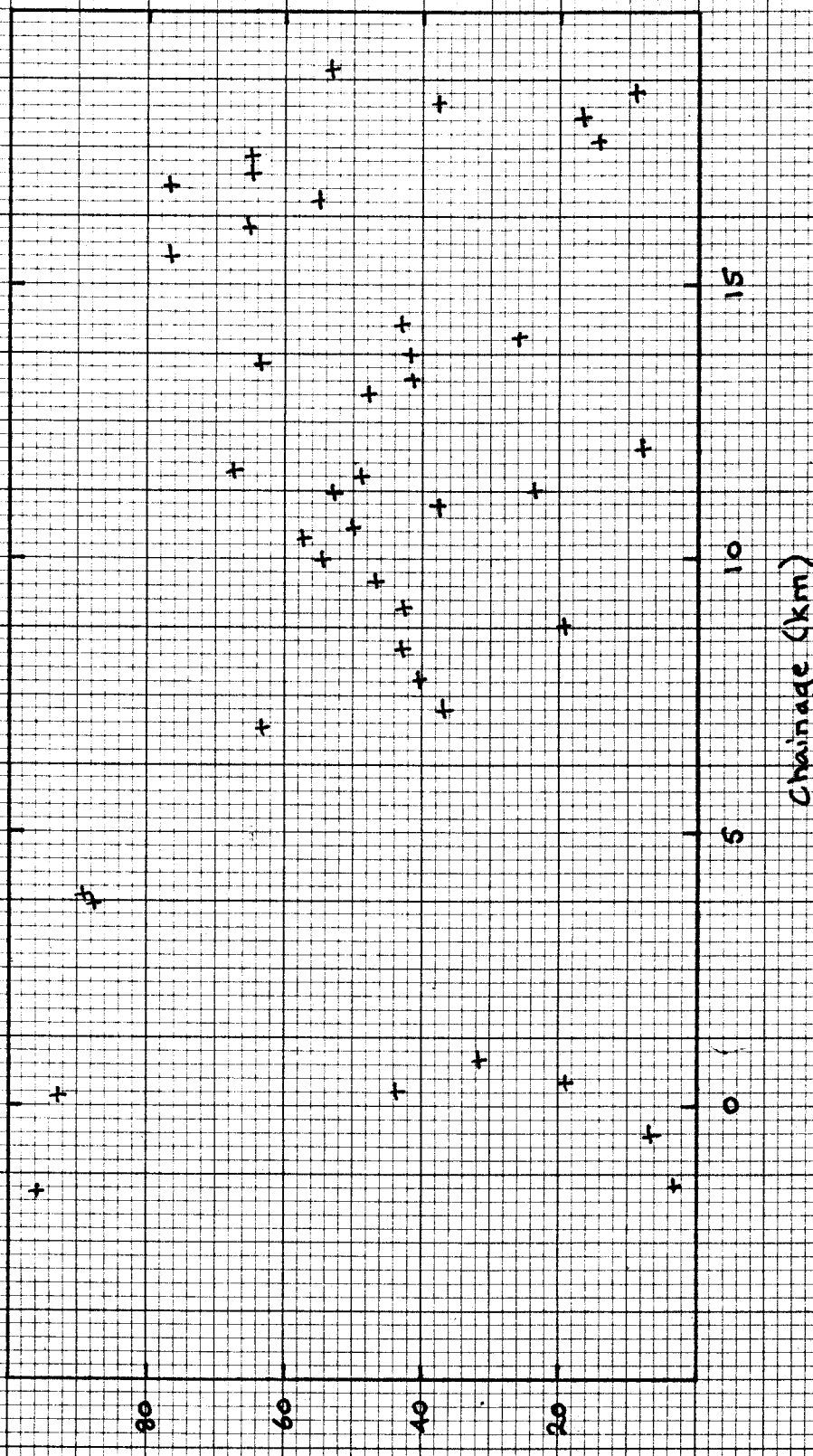


Fig 9. Longitudinal distribution of percentage silt content on inter-tidal deposits, March 1983

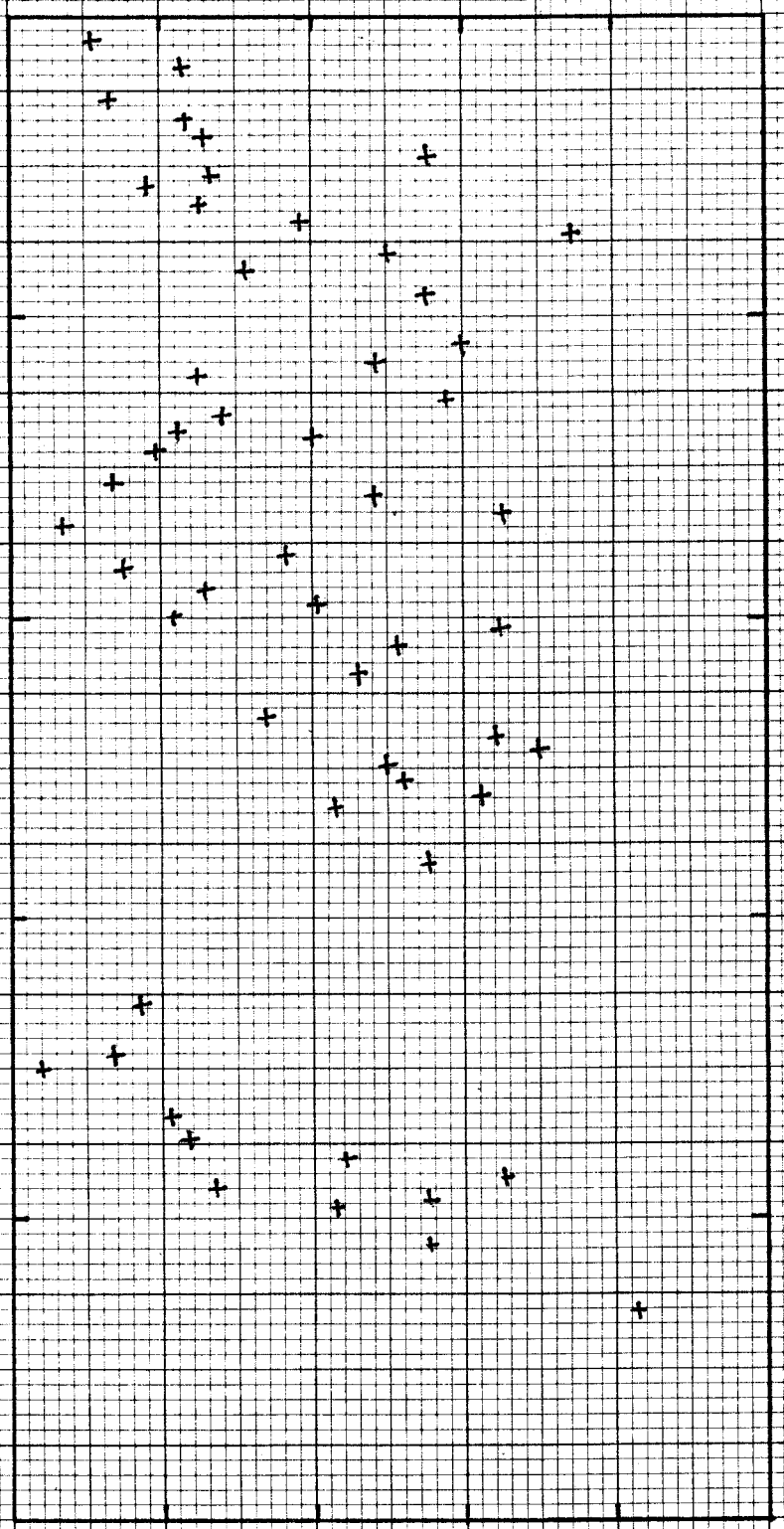


Fig 10. Longitudinal distribution of percentage silt content on inter-tidal deposits, September 1983

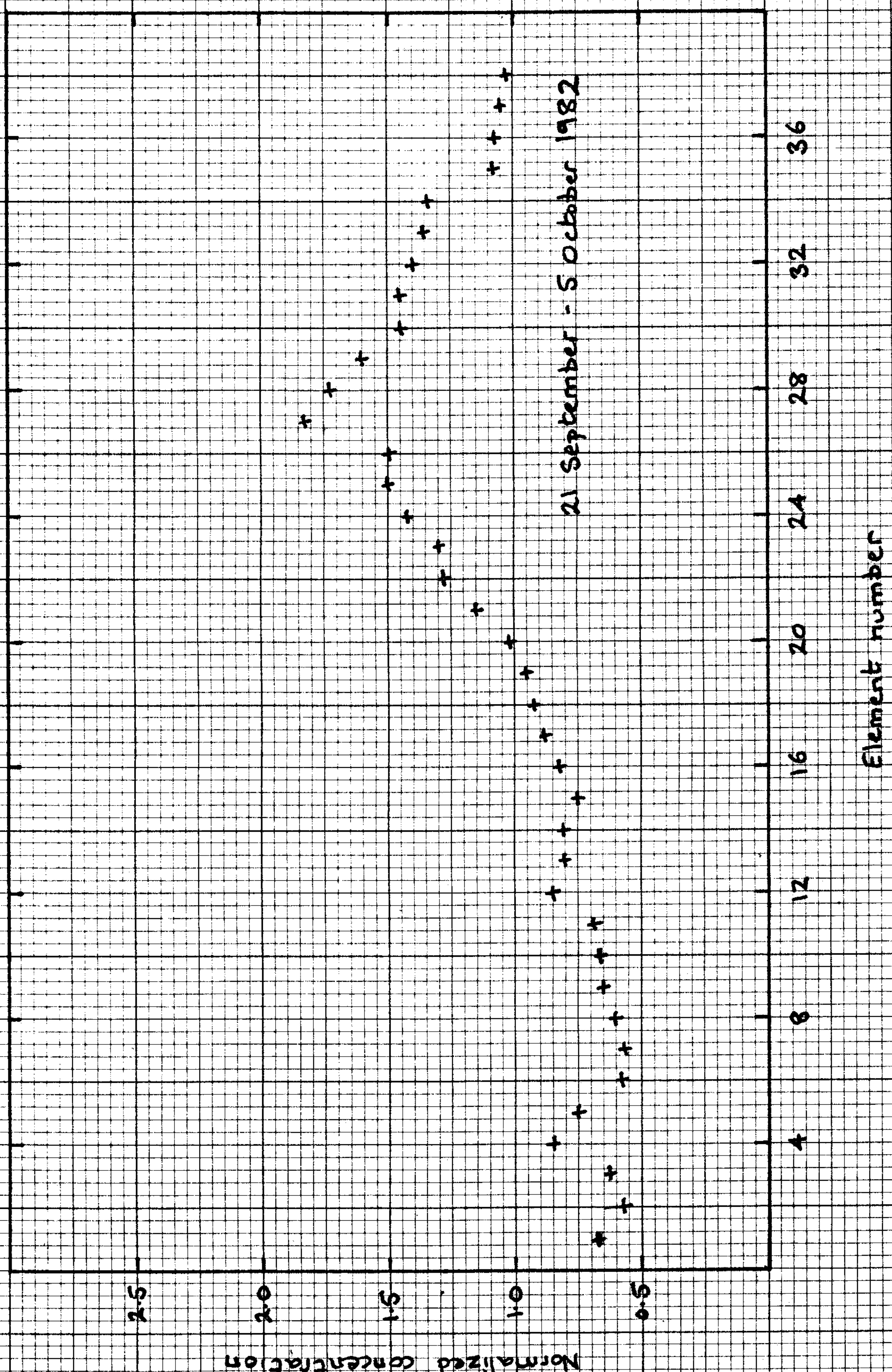


Fig 11. Example of silt monitor analysis: Lower monitor, flood tide

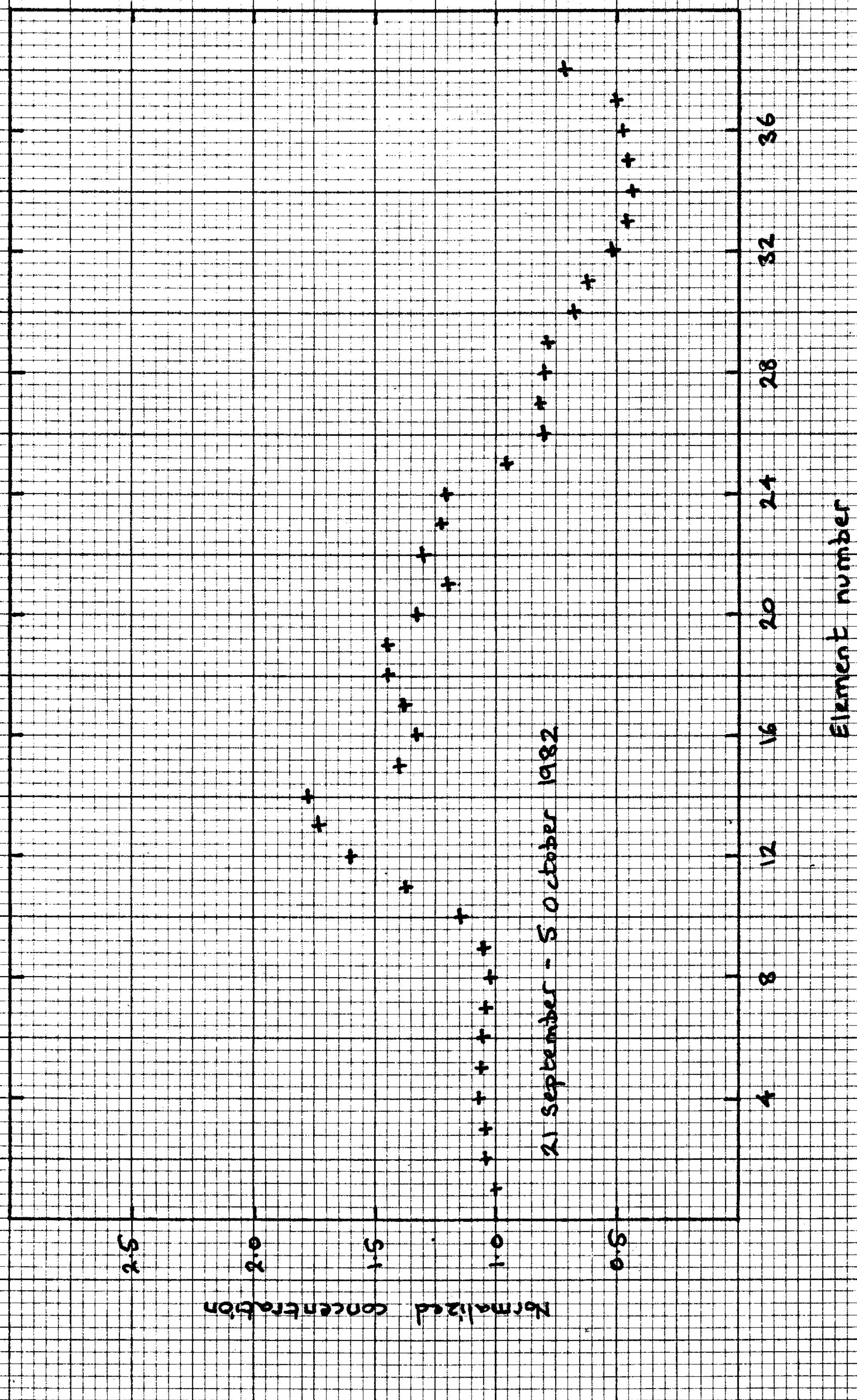


Fig 12. Example of silt monitor analysis : Lower monitor, ebb tide

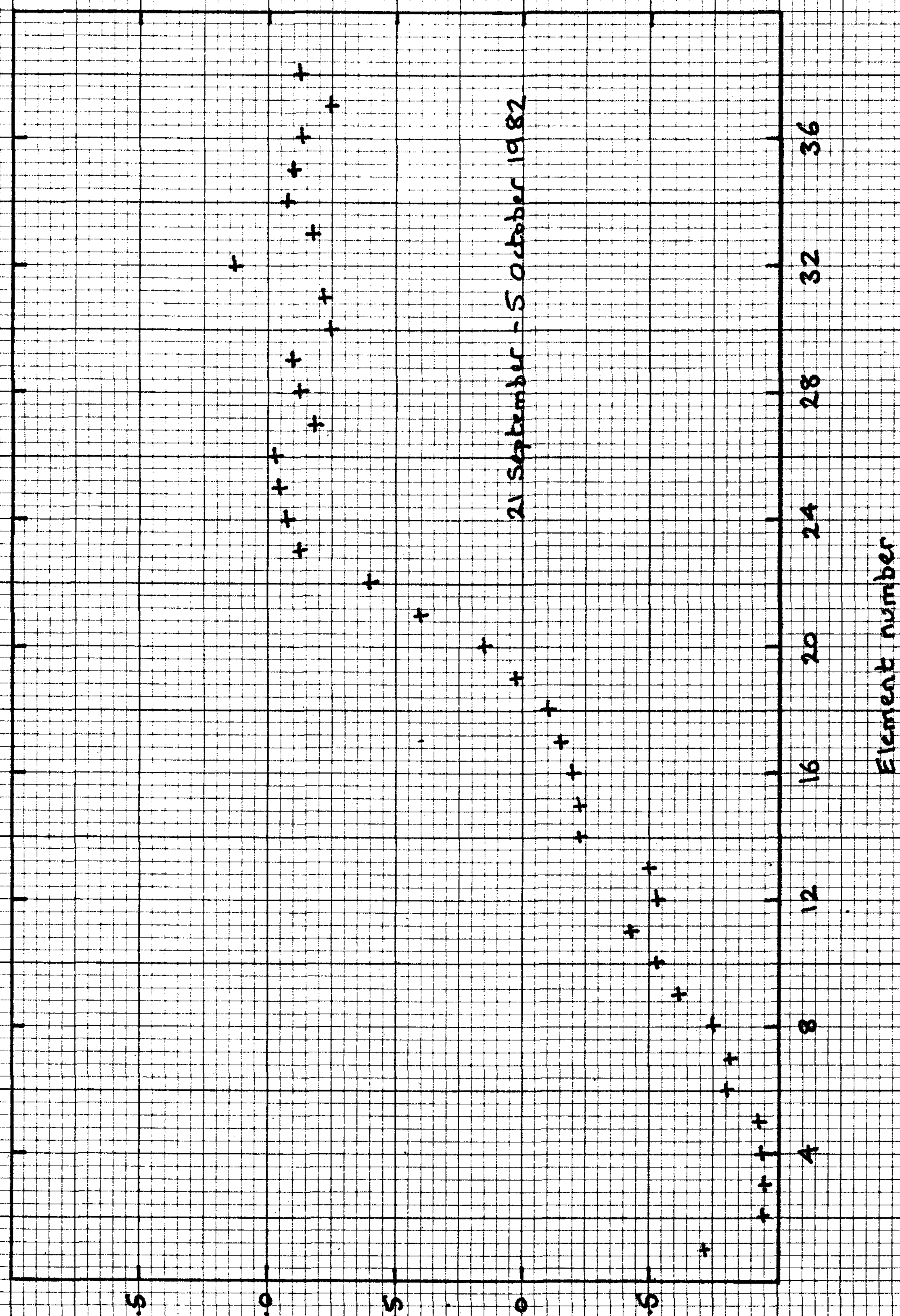


Fig 13. Example of silt monitor analysis: upper monitor, ebb tide

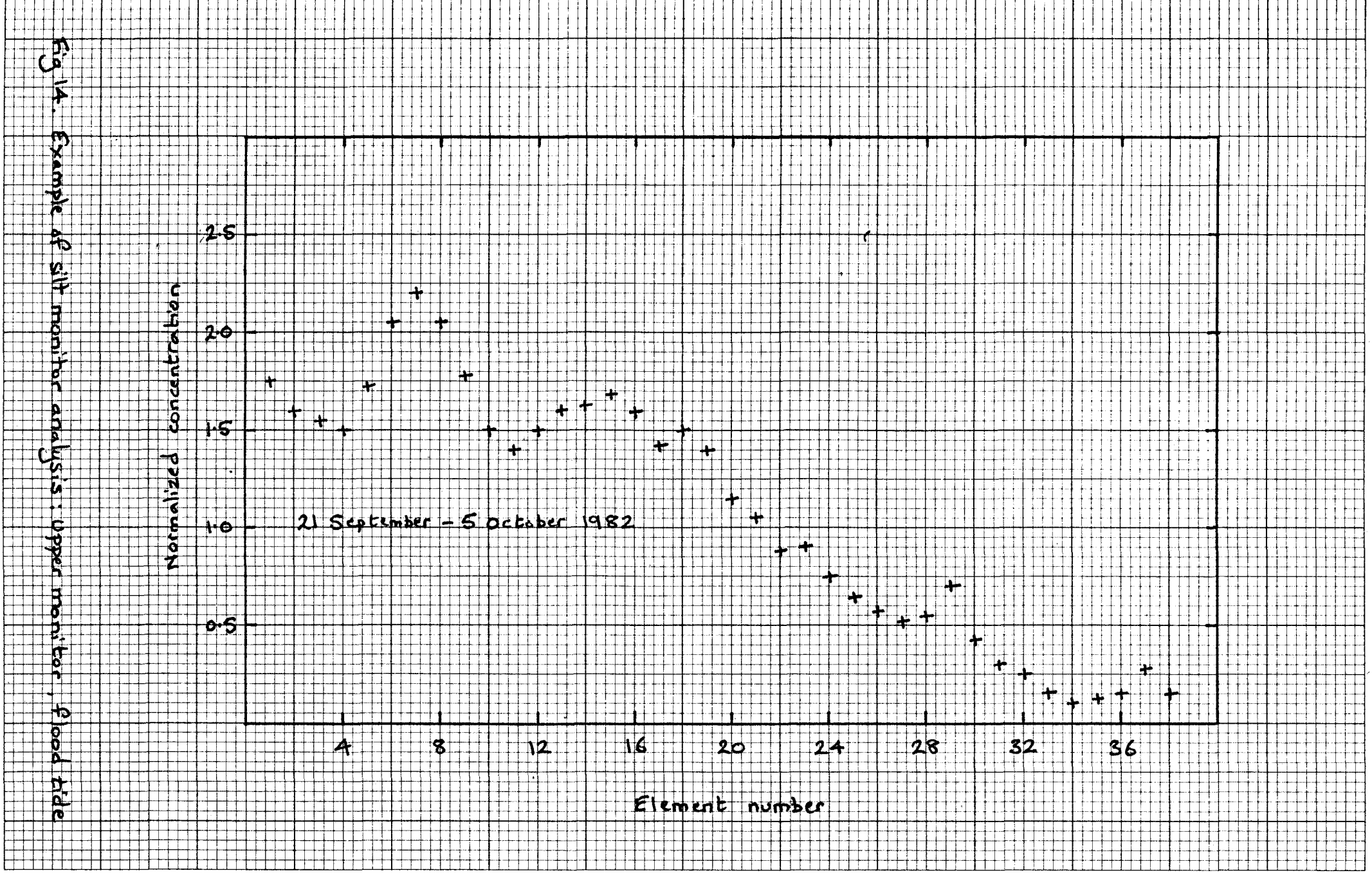


Fig 14. Example of silt monitor analysis: upper monitor, flood tide

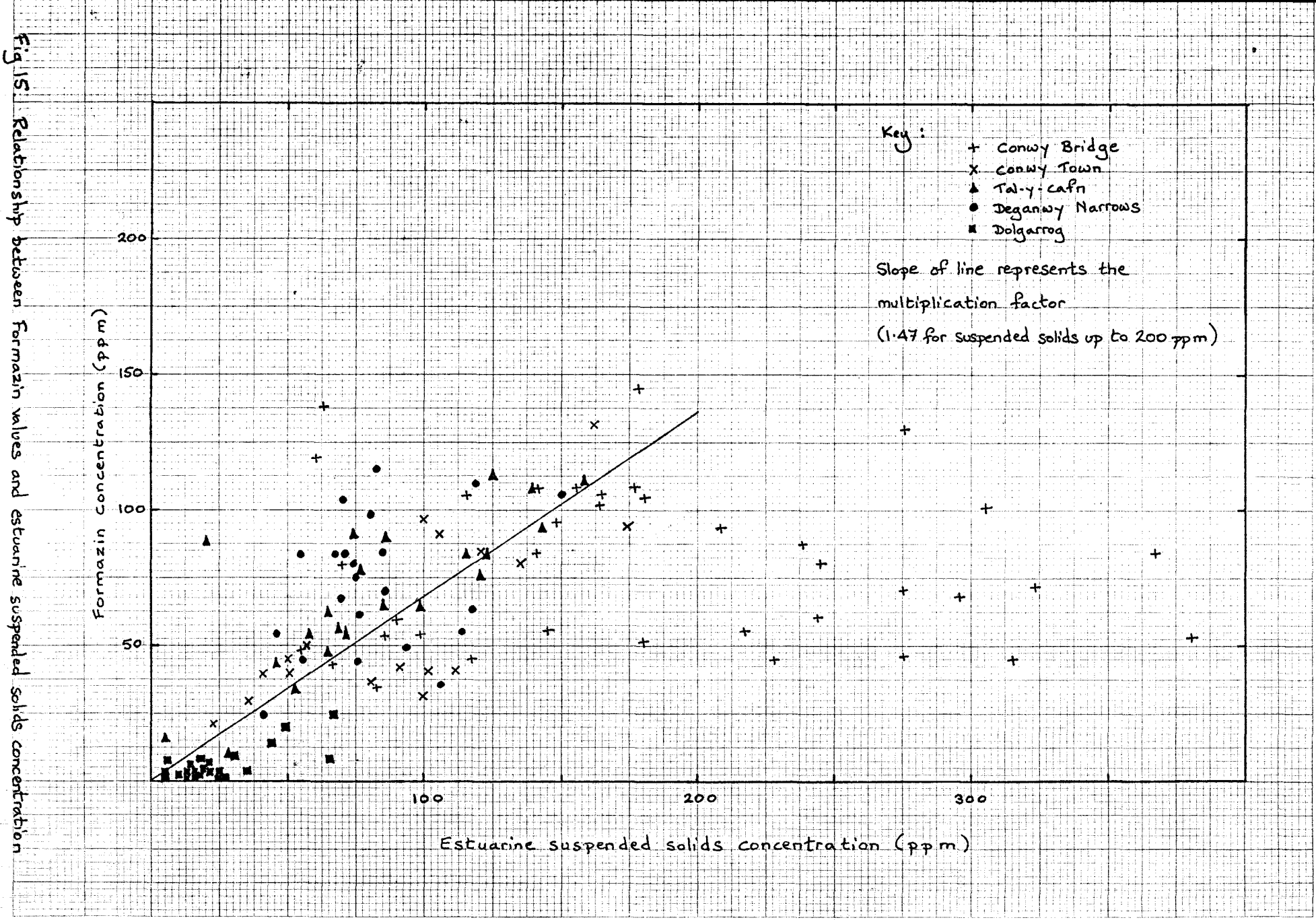


Fig 15. Relationship between Formazin values and estuarine suspended solids concentration