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INVESTIGATION OF MERCURY
CONTAMINATION IN THE
RED RIVER CATCHMENT
WEST CORNWALL.

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June 1992

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INVESTIGATION OF MERCURY CONTAMINATION
IN THE RED RIVER CATCHMENT, WEST CORNWALL

SUMMARY

The NRA South West Region carries out regular water quality monitoring on the Red River at Gwithian Towans. Samples are taken and analysed for mercury. The results of which are used for EC Dangerous Substances Directive, Harmonised Monitoring, Red List and Paris Commission returns.

Total mercury concentrations exceeded the Environmental Quality Standard (EQS=1.0 ug/l) in two samples taken from the Red River at Gwithian Towans on the 13 and 21 June 1990. The samples contained 3.9 ug/l and 6.6 ug/l of total mercury respectively. However, this did not result in failure of the EQS, which is based on the annual average concentration. An investigation was carried out to find the source of mercury contamination.

Samples of river water taken throughout the Red River catchment on 29 October 1990 had mercury concentrations between 0.008 ug/l and 0.04 ug/l. A specific source of mercury contamination could not be identified.

Sediment samples taken of river sediments showed the highest level of total mercury concentrations (28 mg/kg) directly below the discharge point for South Crofty Mine. The lowest levels (0.1 mg/kg and <0.1 mg/kg) were found immediately upstream of this discharge point indicating an input of mercury from South Crofty Mine.

The source of high mercury concentrations detected in both river water and sediments in the Red River remains unresolved. It has been difficult to discern whether the mercury input has arisen from the milling and storage of foreign ore or from metalliferous drainage from disused workings within South Crofty mine.

It is recommended that sampling is continued at Gwithian Towans to assess the degree of mercury contamination in the Red River and that the analysis of samples from the discharge at South Crofty Mine includes mercury. If the discharge from South Crofty Mine is found to contain mercury then the discharge consent should be reviewed. Finally, it is also recommended that the sediment sample survey is repeated to confirm the high concentrations detected previously and is expanded to determine the extent of the mercury contamination downstream.

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INVESTIGATION OF MERCURY CONTAMINATION IN THE RED RIVER, WEST CORNWALL

1.0 INTRODUCTION

Two river water samples taken from the Red River at Gwithian Towans during June 1990 had total mercury concentrations of 3.9 ug/l and 6.6 ug/l. These exceeded the EQS for total mercury for inland surface water quality of 1.0 ug/l although as the EQS is based on an annual mean overall compliance with the EQS during 1990 was achieved at this site.

Mercury data from this site are used in reporting for the EC Dangerous Substances Directive, Harmonised Monitoring, Red List and Paris Commission programmes.

The Department of the Environment is committed to the reduction of substances described as Red List Substances, by approximately 50%, by 1995.

An investigation was undertaken to provide information on the source of the high levels of mercury.

1.1 Catchment Description

The Red River rises on Nine Maidens Down (SW 677 375) and flows between the two main conurbations of Redruth and Camborne entering St. Ives Bay at Gwithian Towans (Fig. 1).

Historically, land use in the catchment was dominated by mining. The granite geology is rich in metals especially tin. However, due to world recession, the price of tin and other metals have fallen, forcing small mines to close.

Industrial activity in the catchment is mainly located on the periphery of Camborne and Redruth.

Farming activity in the catchment is primarily beef and sheep.

The river receives storm sewer discharges, especially during periods of high rainfall. These discharges are located on the Red River at SW 657 418 and on the Treswithian Stream at SW 638 412.

The main mine discharges to the catchment are located on the Red River, at South Crofty Mine SW 662 408 and 2 km downstream at the Dolcoath Adit SW 647 418. Smaller mine discharges, which are remnants of older mine workings, also occur within the catchment (Fig. 2). The consent details for South Crofty Mine are given below:

Suspended solids (mg/l at 105°C)	80 000
pH between 9 and 5.	

1.2 River Uses

River Quality Objectives and Environmental Quality Objectives are identified in Table 1.

Table 1 Environmental Quality Objectives and River Quality Objectives

River	River Length	Environmental Quality Objectives							RQO
		1	2	3	4	5	6	7	
Red River	Source to Brea	x			x	x	x	x	1B
	Brea to Gwithian Towans	x						x	3
Tehidy Stream	Source to confluence with Red	x		x		x	x	x	1A
Tolvadon Stream	Source to confluence with Red	x				x	x	x	1B
Roseworthy Stream	Source to Penponds Intake	x	x	x		x	x	x	1B
	Penponds intake to confluence with Red	x		x		x	x	x	1B
Praze River	Source to confluence with Roseworthy Stream	x	x	x		x	x	x	1B
Reen Stream	Source to confluence with Roseworthy Stream	x	x	x		x	x	x	1B

Notes	1	Aesthetic Quality	5	Other Aquatic Life/Dependent Organisms
	2	Direct Abstraction for Potable Supply	6	Livestock Watering
	3	Salmonid Fish	7	Irrigation of Crops
	4	Coarse Fish		

Recent water quality classifications using the National Water Council water quality system are given in Table 2.

Table 2 Historical Water Quality - Red River and tributaries

River	Reach upstream from:	NGR	Year				
			1985	1986	1987	1988	1989
Red	Point above Brea Tin Works	SW 667 397	1B	1B	2	2	2
Red	Point above South Crofty	SW 661 409	4	4	3	2	2
Red	Roscroggan Bridge	SW 650 420	4	4	3	2	3
Red	Kieve Bridge	SW 629 423	4	4	3	2	3
Red	Gwithian Towans	SW 583 422	4	4	3	2	3
Roseworthy	Ramsgate (Reen)	SW 642 384	2	2	2	2	2
Roseworthy	Penponds	SW 631 391	1B	2	2	2	2
Roseworthy	Nancemellin	SW 606 410	1B	2	2	2	2
Tehidy	Coombe (Kieve Bridge)	SW 629 423	1B	1B	1B	1A	1A

1.3 Historical Mercury Levels

Sampling for the presence of mercury at Gwithian Towans began in 1978 with 1 sample collected in 1978 and 1 in 1979. Regular sampling for mercury commenced in 1982 and mercury concentrations between 1982 and 1991 have been shown graphically in Appendix 1. Mercury concentrations have exceeded the EQS of 1.0 ug/l at Gwithian Towans on 4 occasions between 1978 and 1991.

River water samples are routinely collected from 5 points in the Red River, including Dolcoath Adit, and 3 locations on the Roseworthy Stream. These have been routinely screened for mercury since January 1991 (see Appendix 2 for a map of site locations and the full data set.)

Mercury concentrations exceeding the limit of detection (0.02 ug/l) but below the EQS have been detected on occasions during 1991 both upstream of South Crofty Mine and on other tributaries in the Red River Catchment; for example, 0.78 ug/l upstream of South Crofty Mine and 0.65 ug/l on the Roseworthy Stream.

Samples taken from the discharges at South Crofty mine have not been analysed for mercury.

2.0 METHODS

Spot samples of river water were taken on the 29 October 1990 throughout the Red River Catchment to identify the source of the high levels of mercury (Fig. 3).

Sediment samples were collected from the river bed on 27 February 1991 in the vicinity of the major discharges to the river, including the storm discharges and mine discharges (Fig. 2).

3.0 RESULTS

3.1 Surface Water Spot Sample Survey

Total mercury concentrations varied from the limit of detection of 0.008 ug/l to 0.040 ug/l and were below the EQS (Fig. 3). No specific source of mercury contamination could be identified.

3.2 Sediment Sample Survey

The highest concentrations of total mercury were found in sediment samples taken from immediately below the discharge point from South Crofty Mine. Thereafter the concentration of mercury was found to decrease steadily from 28 mg/kg to 1.9 mg/kg at Kieve Bridge (Fig. 4). Total mercury concentrations found in sediments upstream of South Crofty Mine were less than or equal to (\leq 0.1 mg/kg).

Total mercury concentrations in the sediments taken from Treswithian Stream upstream and downstream of the storm sewer were 0.3 mg/kg and 0.8 mg/kg respectively.

4.0 DISCUSSION

The results from the sediment survey indicate an input of mercury from the discharge from South Crofty Mine.

Standards for metals in sediments do not exist, and so it is difficult to assess the degree and relevance of mercury contamination in the sediment of the Red River.

Guide standards exist in Germany for mercury in sediment (Table 3). Using these standards, samples collected below South Crofty Mine at site 3 (Fig. 2) are classified as "extremely heavily polluted".

Table 3 Guide values for heavy metals in sediment

Geoaccumulation index for the evaluation of sediment quality
(Heavy metal concentrations in mg/kg dry wt.)

Class	Sediment Quality	Mercury	Nickel	Zinc
0	Unpolluted	0.40 - 0.60	68 - 102	95 - 142
1	Unpolluted to moderately polluted	0.61 - 1.20	103 - 204	143 - 285
2	Moderately polluted	1.30 - 2.40	205 - 408	286 - 570
3	Moderately to heavily polluted	2.50 - 4.80	409 - 816	571 - 1140
4	Heavily polluted	4.90 - 9.60	817 - 1632	1141 - 2280
5	Heavily to extremely heavily polluted	9.70 - 19.2	1633 - 3264	2281 - 4560
6	Extremely heavily polluted	> 19.2	> 3264	> 4560

Source: State of Hamburg, Germany (via T. Zabel, WRc)

Mercury concentrations in river water of a similar magnitude to those detected at Gwithian Towans in 1990 have also been detected in river water samples collected at Devoran Bridge, downstream of Wheal Jane Mine, on the Carnon River. The maximum mercury concentration during 1990 was 6.9 ug/l on 29 May: a concentration of this magnitude had not been previously detected.

The source of mercury detected in both river water and sediments samples collected from the Red River and river water samples from the Carnon River remains unresolved. It has been difficult to discern whether the mercury input has arisen from the milling and storage of foreign ore or from metalliferous drainage from disused workings within South Crofty and Wheal Jane mines.

Mercury has been detected in river water samples collected from Gwithian Towans on the Red River since 1978 (Appendix I). Mercury has also been detected elsewhere in the Red River Catchment in samples collected during 1991.

This low level, historic and widespread input of mercury to the Red River system indicates the possibility of mercury within the local geology. However, the presence of mercury within the host rocks has not been identified within documents reviewed or by the operators at South Crofty Mine.

A relationship between flow and mercury concentration in the Red River is apparent (Fig. 5). Higher concentrations occur at times of low flow. This relationship occurs presumably because summer low flows in the Red River offer little dilution of drainage waters from South Crofty Mine compared with higher flows during winter. It is also possible that during the summer the higher temperatures encourage greater bacterial activity within the geological deposits and release higher concentrations of metals.

The high mercury concentrations detected in river water do not appear to arise from resuspension of mercury contaminated sediments as no clear pattern linking high mercury concentrations in river water to high suspended solid concentrations was found in the data.

Finally, the precision of these results must be borne in mind. Analysis for mercury was undertaken separately for river water samples collected for the Red List at the Welsh Laboratory and for routine monitoring at Truro Laboratory. These data have been plotted separately on the graph in Appendix 1. During 1991 samples taken for Red List and routine monitoring were taken at the same time and there is generally good agreement between the results. However, 2 samples collected at the same time have very different confirmed mercury concentrations: on 25 April 1991 0.73 ug/l and 0.012 ug/l and on 20 August 1991 0.72 ug/l and <0.050 ug/l. The validity of these results have been confirmed at both laboratories.

The confidence limits that can reasonably be expected when considering the collection, transport and analysis of mercury samples should be gauged so that the routine data can be examined with this in mind.

In summary, it is likely that the mercury contamination detected in the river sediments during this survey and in river water in the Red River at Gwithian Towans was due to an input from South Crofty Mine. The validity of this hypothesis can be tested once the discharge from South Crofty Mine is regularly analysed for mercury content.

5.0 CONCLUSIONS

1. Concentrations of mercury were higher in sediments downstream of South Crofty Mine when compared with concentrations in sediments immediately upstream.
2. The source of the high concentrations of mercury detected in river water samples collected at Gwithian Towans during 1990 were probably originated from the discharge at South Crofty Mine.
3. It has been difficult to discern whether the mercury input has arisen from the milling and storage of foreign ore or from metalliferous drainage from disused workings within South Crofty and Wheal Jane mines.

6.0 RECOMMENDATIONS

1. Sampling of the South Crofty Mine discharge and the upstream and downstream sites in the receiving watercourse should include analysis for mercury in order to assess the mercury input from the mine.
- Action by Quality Regulation Officer/ Freshwater Scientist.
2. If the discharge is shown to contain mercury then the consent to discharge from South Crofty mine must be reviewed and become a registered site for mercury in the EC Dangerous Substances Directive.
- Action by Quality Regulation Officer/ Freshwater Officer.
3. The river sediment survey should be repeated in order to confirm the high concentrations detected previously and expanded to assess the extent of the mercury contamination downstream of South Crofty Mine.
- Action by Catchment Scientist.
4. Samples of the discharges from South Crofty Mine should be collected and analysed for all possible contaminants.
- Action by Catchment Scientist.
5. Following the repeat sediment survey consideration should be given to remedial action to "clean-up" the mercury contamination and appropriate funding should be sought.
- Action by Pollution Controller.

7.0 REFERENCES

1. Guide values for heavy metals in sediments. State of Hamburg, Germany.
2. Chemical survey of the Red River Catchment (1985). South West Water Directorate of Engineering and Environmental Services. SSW/R23A/02/85/CL/DSN
3. D.G.A. Whitten and J.R.V. Brooks (1972). Dictionary of Geology.
4. U. Forstner and G.T.W. Wittmann 2nd Edition (1983). Metal Pollution in the Aquatic Environment. Springer-Verlag.
5. Council of the European Communities. Directive amending Annex II to Directive 86/280/EEC on limit values and quality objectives for discharges of certain dangerous substances included in List I of the Annex to Directive 76/464/EEC, 16 June 1988 (88/347/EEC). Official Journal (1988), L158, 25 June.

Fig 1 Location of the Red River Catchment

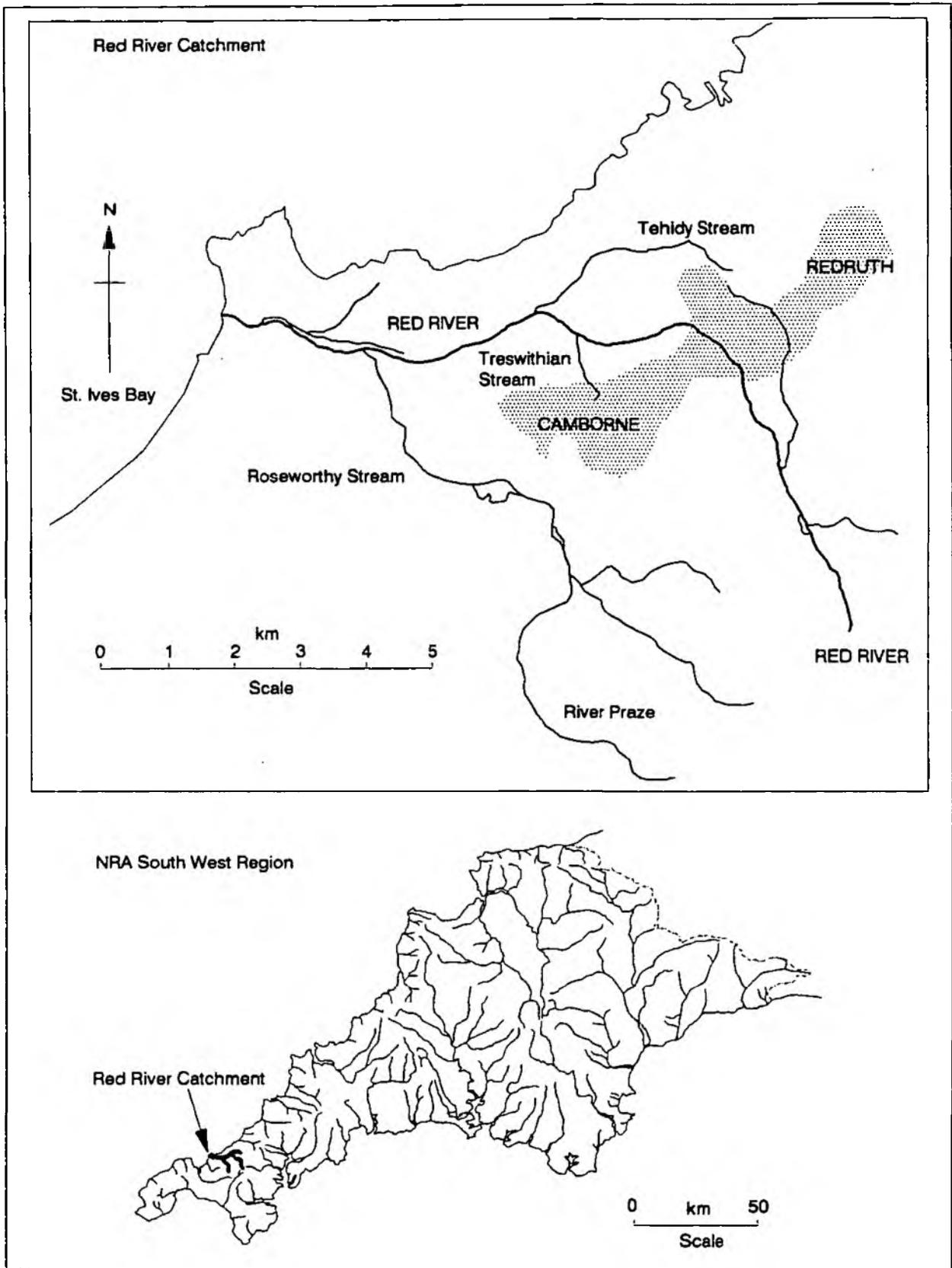


Fig 2 Major discharges to the Red River Catchment

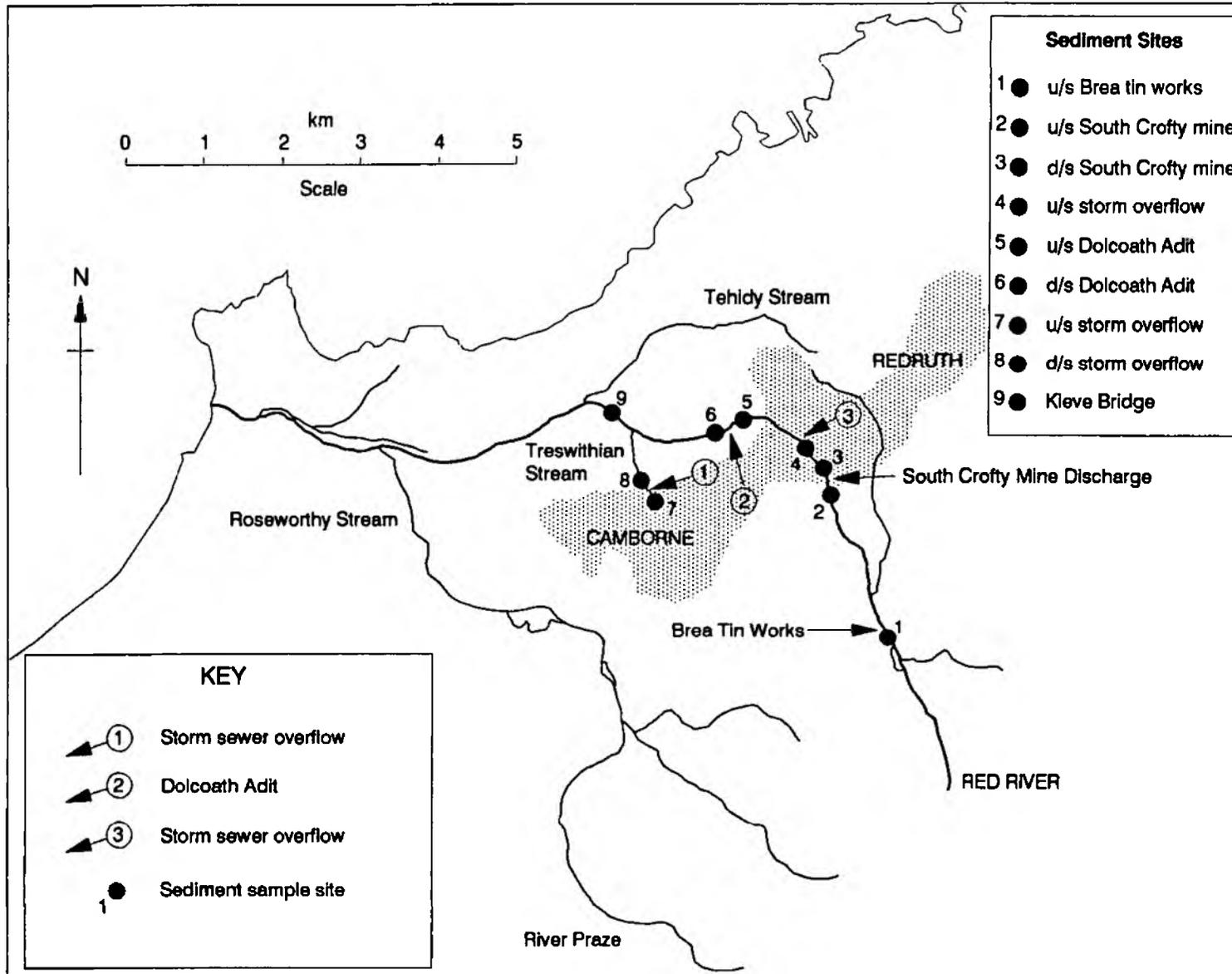


Fig 3 Mercury levels (ug/l Hg) from spot samples taken on 29th Oct 1990

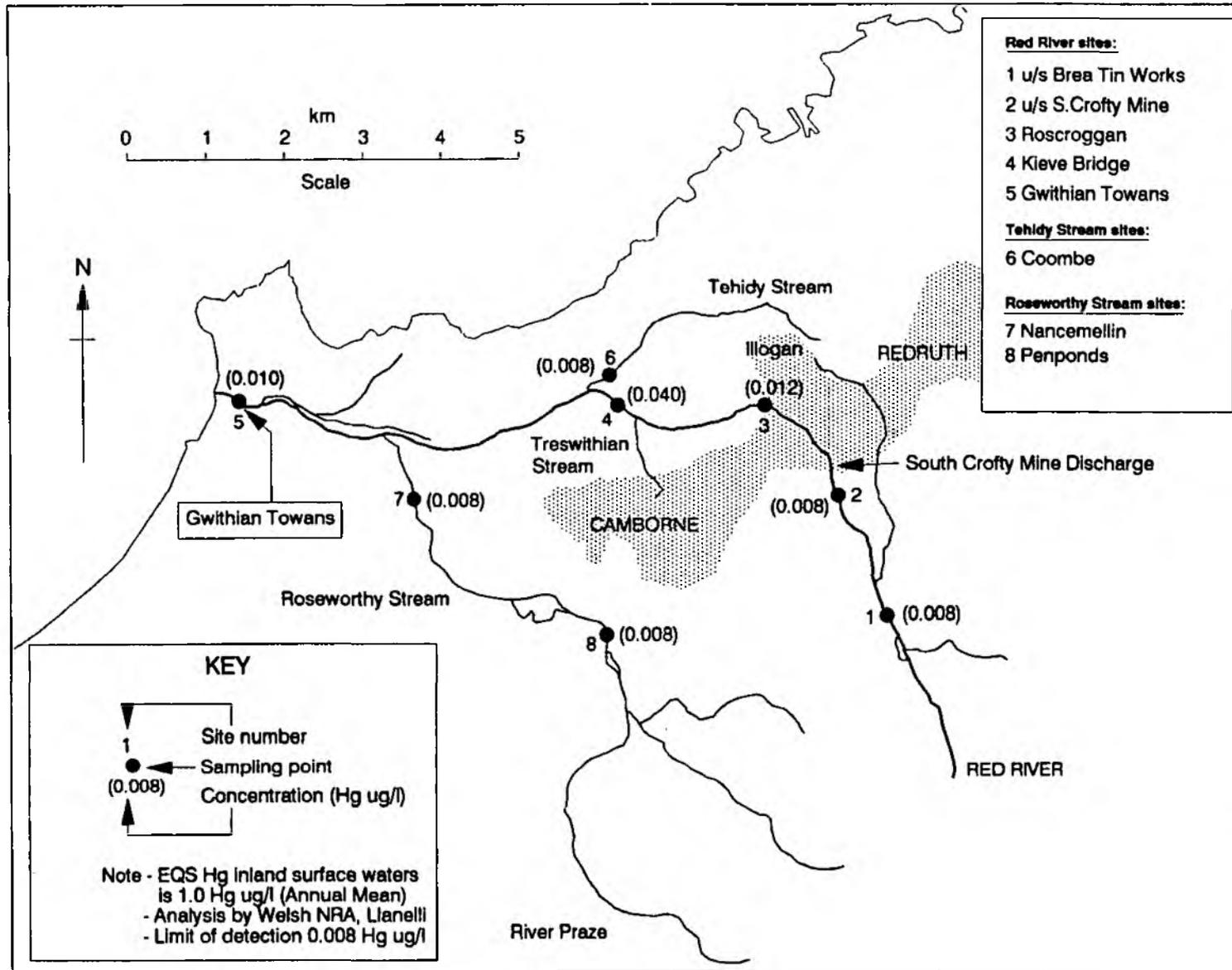


Fig 4 Total Mercury in river sediment In the Red River

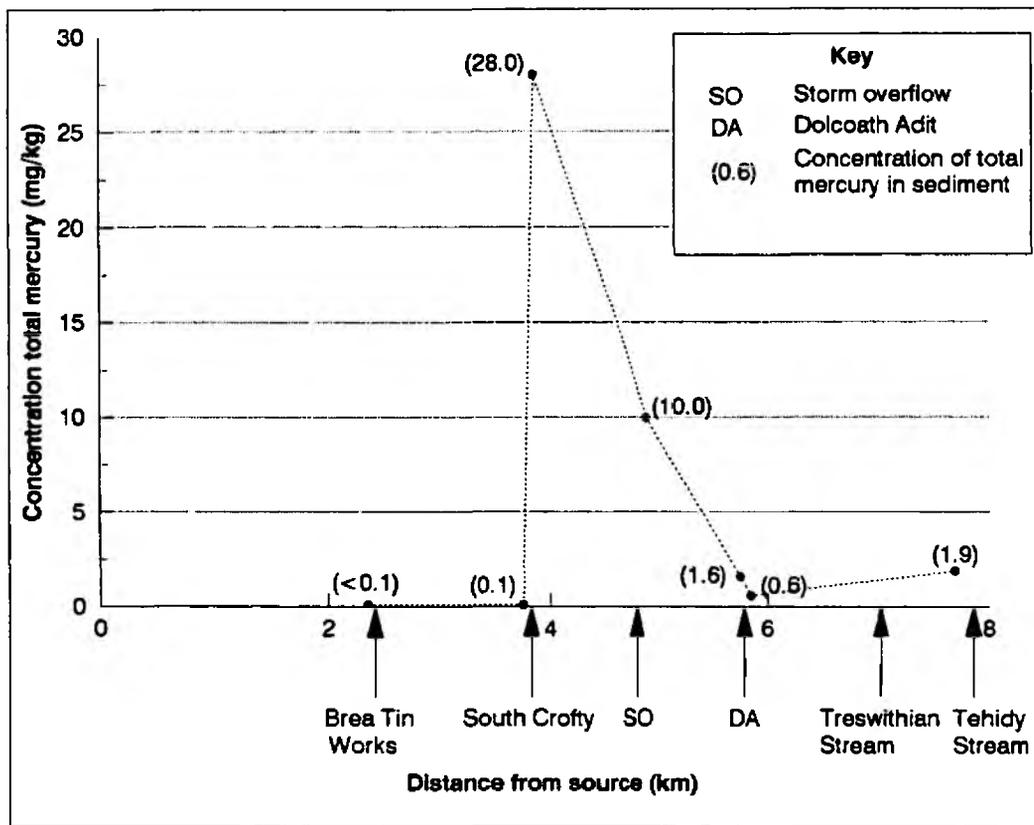
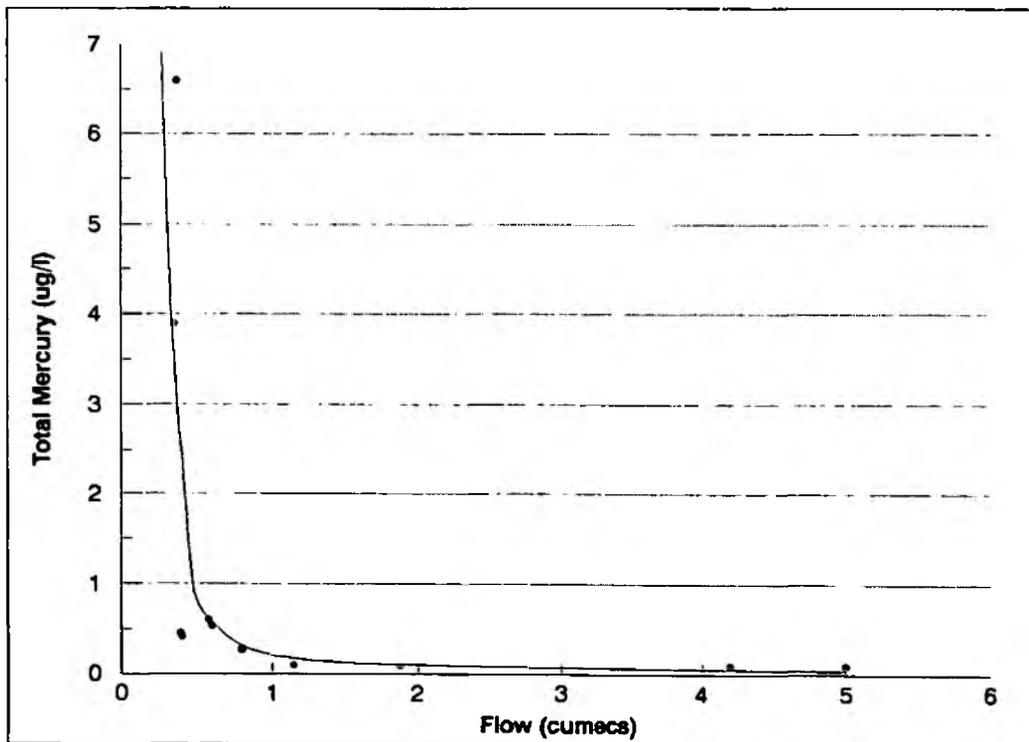
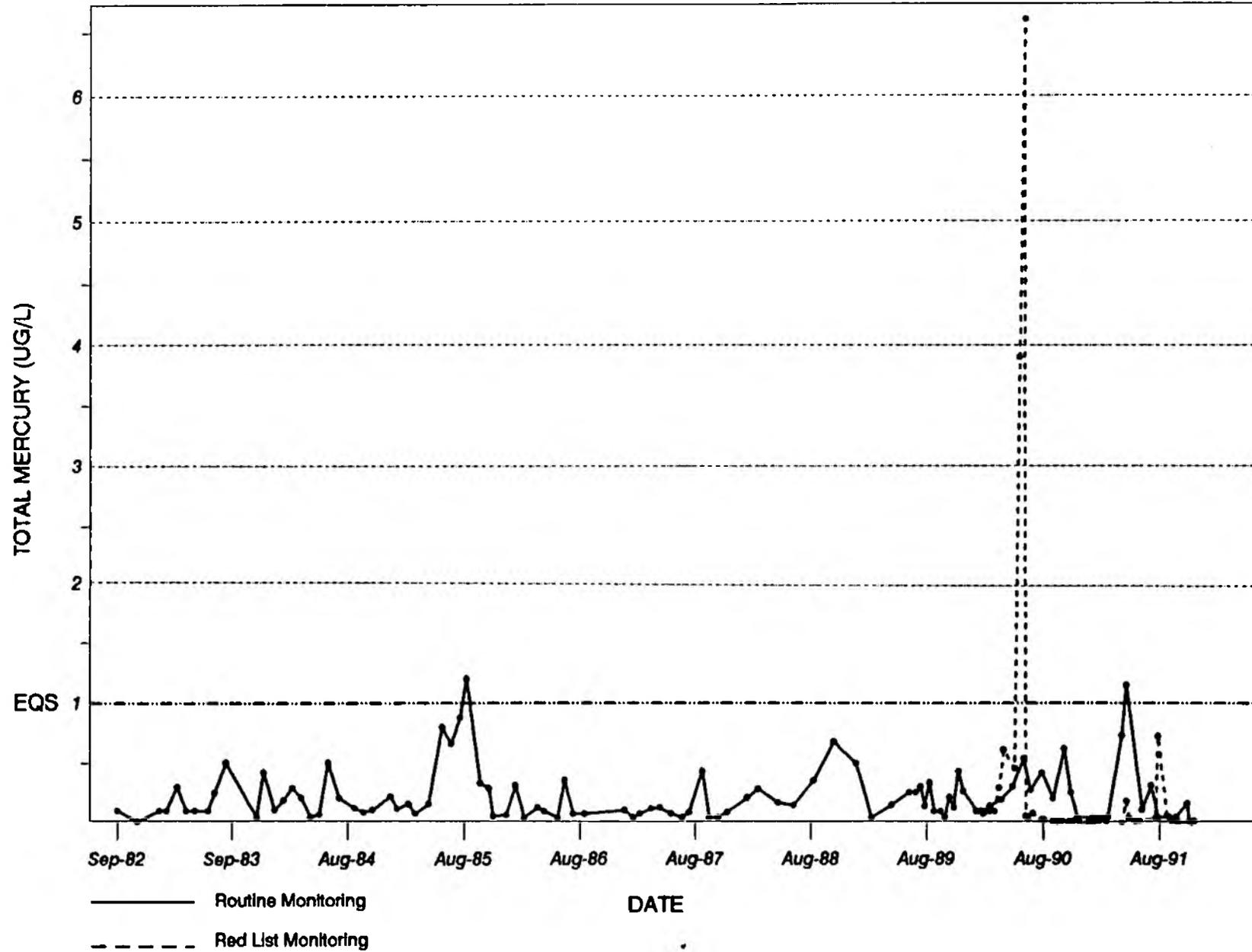


Fig 5 Flow v. concentration at Gwithian Towans (1990)



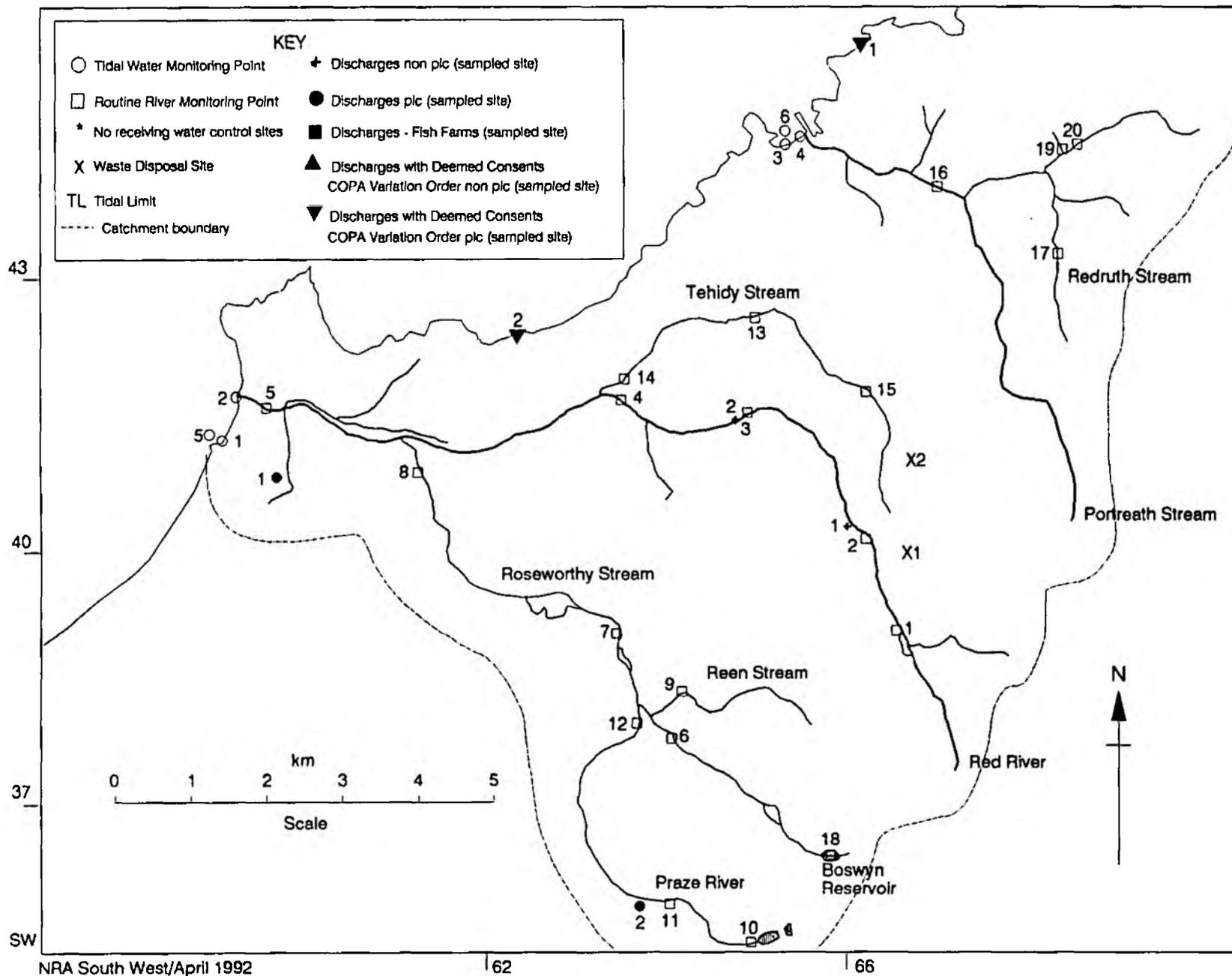
Appendix I. Mercury data collected from Gwithian Towans 1982 - 1990.

Appendix 1. Mercury Data Collected at Gwithlan Towans Sept '82 - Dec '91



Appendix II. Routine monitoring sites in the Red River Catchment with 1991 mercury data.

Red River & Portreath Catchments 23A



RED RIVER AND PORTREATH CATCHMENTS 23A

NO	REFERENCE	NGR	LOCATION	ADDITIONAL DETAILS
DISCHARGES NON PLC				
1	P23A/P/7	SW66204080	South Crofty Mine	Mine drainage water
2	R23A004	SW64804190	Dolcoath Adit	Mine drainage water
DISCHARGES PLC				
1	WSTW0076FE	SW58664157	Gwithian Churchtown	Sewage treatment works
2	WSTW0182FE	SW63273584	Praze an Beeble	Sewage treatment works
DISCHARGES WITH DEEMED CONSENTS - COPA VARIATION ORDER PLC				
1	OUT0579	SW66094613	Portreath, Tunnel	Outfall Red List site Site for current and proposed dangerous substances Site for current dangerous substances
2	OUT0508	SW62154317	Camborne, Outfall	Red List site Site for current and proposed dangerous substances Paris Commission site
WASTE DISPOSAL SITES				
1	080ANAL	SW67003990	Mine shaft, Carn Brea	
	080ANTAL	SW67003990	Quarries, Carn Brea	
2	080ASKAL	SW67704100	Tregajorran, Carn Brea, Redruth	
TIDAL WATER QUALITY MONITORING POINT - BATHING WATERS				
1	ECB0801	SW58104170	The Towans, Godrevy	EC identified bathing waters
2	R23A006	SW58304220	Red River	Watercourse to beach
3	ECB0810	SW65304550	Portreath Beach	EC identified bathing waters
4	ECBR0810	SW65504530	Portreath Stream	Watercourse to beach
TIDAL WATER QUALITY MONITORING POINT - WATER CONTACT SPORTS				
5			Godrevy	
6			Portreath	
ROUTINE RIVER MONITORING				
1	R23A001	SW66903930	Above Brea Tin Works	Chemical site Dangerous substances control site
	2314	SW66923917		Biological site
2	R23A002	SW66134090	Above S.Crofty Mine	Chemical site Dangerous substances site
	2315	SW66154088		Biological site
3	R23A003	SW65024201	Roscroggan Bridge	Chemical site Dangerous substances site
	2301	SW64984197		Biological site
4	R23A005	SW62934230	Kieve Bridge	Chemical site
	2316	SW62924228		Biological site
5	R23A006	SW58254222	Gwithian Towans	Chemical site Dangerous substances site Harmonised monitoring site
	2302	SW58804200		Red List site Biological site
6	R23A038	SW63733774	Botetoe Bridge	Chemical site
		SW64103770	Botetoe Bridge	Enclosed waters programme
	2303	SW64043765		Biological site

RED RIVER AND PORTREATH CATCHMENTS 23A (cont)

NO	REFERENCE	NGR	LOCATION	ADDITIONAL DETAILS
ROUTINE RIVER MONITORING				
7	R23A008	SW63023908	Penponds	Chemical site Dangerous substances site
	2317	SW63043907		Biological site
8	R23A009	SW60624107	Nancemellin	Chemical site
	2304	SW60644097		Biological site
9	R23A007	SW64163849	Ramsgate	Chemical site
	2307	SW64203845		Biological site Dangerous substances site
10	R23A050	SW65083521	Cargenwyn Reservoir	Chemical site Freshwater Fish Directive
11	R23A045	SW64003563	Praze	Chemical site
	2318	SW64093558		Biological site
12	R23A037	SW63303819	Barriper	Chemical site
	2305	SW63343815		Biological site
13	R23A041	SW65104327	Old Melrose	Chemical site
	2319	SW65134327		Biological site
14	R23A017	SW62994240	Coombe	Chemical site
	2306	SW62984238		Biological site
15	R23A042	SW66374217	Tolvaddon Bridge	Chemical site
	2320	SW66334220		Biological site
16	R23A015	SW67364484	Bridge-D/S Cambrose	Chemical site Dangerous substances site Dangerous Substances Directive
	2308	SW67084495		Biological site
17	R23A014	SW68694386	N.Country Bridge	Chemical site Dangerous Substances Directive
	2330	SW68994379		Biological site
18	R23A060	SW65903630	Boswyn Reservoir	EC surface water abstraction directive monitoring site
		SW65903630	Dam steps	Enclosed waters programme
		SW65803630	Dam site	Enclosed waters programme
19	2321	SW68604540	Cambrose Stream	Biological site
20	2322	SW68804530	Mawla Stream	Biological site

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR
					AL	SOLVD	TOTAL	Y
					MG/L	MG/L	UG/L	UG/L
POINT ABOVE BREA TIN RED RIVER	280191	1245	2F	SQMR			0.180	
	190391	1210	2F	SQMR			0.050<	
	250491	1415	2F	SQMR				
	150591	1305	2F	SQMR			0.780	
	220791	1440	2F	SQMR			0.050<	
	200891	1420	2F	SQMR			0.050<	
	230991	1418	2F	SQMR			0.050<	
	151091	1445	2F	SQMR			0.050<	
	191191	1420	2F	SQMR				0.02<
	271191	1400	2F	SQMR				0.02<
	091291	1500	2F	SQMR				0.02<

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR	
					AL	SOLVD	TOTAL	Y	
					MG/L	MG/L	UG/L	UG/L	
POINT ABOVE SOUTH CROFTY	RED RIVER	190391	1240	2F	SQMR			0.050<	
		250491	1450	2F	SQMR				
		150591	1410	2F	SQMR			0.380	
		220791	1505	2F	SQMR			0.050<	
		200891	1450	2F	SQMR			0.050<	
		230991	1430	2F	SQMR			0.050<	
		011091	0935	8B	SQMR				
		151091	1305	2F	SQMR			0.050<	
		191191	1440	2F	SQMR				0.02<
		271191	1350	2F	SQMR				0.02<
		091291	1520	2F	SQMR				0.02<

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR
					AL	SOLVD	TOTAL	Y
					MG/L	MG/L	UG/L	UG/L
ROSCROGGAN BRIDGE RED RIVER	280191	0855	2F	SQMR			0.500	
	190391	0920	2F	SQMR			0.200	
	250491	0940	2F	SQMR			0.680	
	150591	0950	2F	SQMR			1.770	
	220791	1005	2F	SQMR			0.500	
	200891	0920	2F	SQMR			0.160	
	230991	1030	2F	SQMR			0.050<	
	011091	1115	8B	SQMR				
	151091	1045	2F	SQMR			0.050<	
	191191	0940	2F	SQMR				0.02<
	271191	1005	2F	SQMR				0.02
	091291	1050	2F	SQMR				0.02<

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR
					AL	SOLVD	TOTAL	Y
					MG/L	MG/L	UG/L	UG/L
KIEVE BRIDGE	280191	0925	2F	SQMR			0.420	
RED RIVER	190391	0935	2F	SQMR			0.050<	
	250491	1015	2F	SAUD				
	250491	1035	2F	SQMR			0.430	
	150591	1025	2F	SQMR			1.680	
	220791	1055	2F	SQMR			0.460	
	200891	1030	2F	SQMR			0.120	
	230991	1105	2F	SQMR			0.050<	
	151091	1125	2F	SQMR			0.050<	
	191191	1030	2F	SQMR				0.06
	271191	1030	2F	SQMR				0.02
	091291	1135	2F	SQMR				0.02

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR	
					AL	SOLVD	TOTAL	Y	
					MG/L	MG/L	UG/L	UG/L	
NANCEMELLIN RIVER)	ROSEWORTHY STREAM	(RED	280191	1020	2F	SQMR		0.050<	
			180291	1045	2F	ZZZZ		0.110	
			190391	1025	2F	SQMR		0.050<	
			250491	1130	2F	SQMR		0.400	
			150591	1135	2F	SQMR		0.590	
			220791	1115	2F	SQMR		0.050<	
			200891	1051	2F	SQMR		0.050<	
			230991	1156	2F	SQMR		0.050<	
			151091	1200	2F	SQMR		0.050<	
			191191	1145	2F	SQMR			0.02<
			271191	1100	2F	SQMR			0.02<
			091291	1255	2F	SQMR			0.02<

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR	
					AL	SOLVD	TOTAL	Y	
					MG/L	MG/L	UG/L	UG/L	
RAMSGATE (REEN) (RED RIVER)	ROSEWORTHY STREAM	280191	1100	2F	SQMR			0.180	
		180291	1125	2F	SQMR			0.150	
		190391	1100	2F	SQMR			0.050<	
		250491	1205	2F	SQMR			0.250	
		150591	1210	2F	SQMR			0.650	
		220791	1255	2F	SQMR			0.050<	
		200891	1311	2F	SQMR			0.050<	
		230991	1238	2F	SQMR			0.050<	
		011091	0955	8B	SQMR				
		151091	1330	2F	SQMR			0.050<	
		191191	1245	2F	SQMR				0.02<
		271191	1240	2F	SQMR				0.02<
		091291	1408	2F	SQMR				0.02<

WATER QUALITY SYSTEM - ANALYTICAL REPORT SUMMARY

DESCRIPTION	DATE	TIME	MAT	PUR	HG TOT	HG DIS	MERCURY	MERCUR
					AL	SOLVD	TOTAL	Y
					MG/L	MG/L	UG/L	UG/L
DOLCOATH ADIT	RED RIVER	280191	0905	2F	SQMR		0.610	
		190391	0928	2F	SQMR		0.090	
		250491	0950	2F	SQMR		0.230	
		150591	1000	2F	SQMR		0.380	
		220791	1030	2F	SQMR		0.160	
		200891	1005	2F	SQMR		0.050<	
		230991	1050	2F	SQMR		0.050<	
		011091	1050	8B	SQMR			
		151091	1135	2F	SQMR		0.050<	
		191191	1005	2F	SQMR			0.02<
		271191	1015	2F	SQMR			0.02<
		091291	1100	2F	SQMR			0.02<