

NRA NORTH WEST 89

SILLOTH SEDIMENT SURVEY

APRIL. JULY 1990

Marine and Special Projects
N.R.A. North West
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Report MSP - 009

SILLOTH SEDIMENT SURVEY

APRIL, JULY 1990

INTRODUCTION

Yates Circuit Foil, Silloth, discharges trade effluent to the Great Gutter, a small ditch running from the disused airfield at Silloth, through Skinburness, and out to Grune point (see figure 1). This discharge measures approximately 1.2 Ml/d and arises from the manufacture of printed circuit boards. It contains residual amounts of toxic metals, most notably copper, and has a high sulphate concentration. Table 1 shows the mean concentrations found in samples from the effluent during the years 1989 and 1990. The consent to discharge is listed in Appendix A.

Table 1 : Mean concentrations in effluent
1/1/1989 to 31/12/1990

	Cu	Zn	Cr	Cd	Pb	Ni	SO ₄ -S
	µg/l						mg/l
MEAN	746.0	1511	257.3	3.144	17.0	430.4	1584

There is only minimal dilution in the Great Gutter so it has been suggested by the NRA that the discharge should be connected to Silloth sewerage system.



OBJECTIVES

Two surveys were carried out with the following aims:

- to assess the impact that the discharge was having in the vicinity of Great Gutter,
- to evaluate background levels and any contamination around Silloth upon which an additional input to Silloth Sewer would have an impact.

FIELDWORK

On the 25th April, 1990, a hovercraft was used to take sediment samples along the tidal section of the Great Gutter and around Grune and Stenor Scars. Two samples were taken from land at the bridge marking the beginning of the salt marsh (See figure 1).

Position fixing was carried out on the hovercraft with the use of DECCA navigation equipment. This system has a minimum resolution of 200 metres.

On the 30th July, 1990, sediment samples were taken from the land along the tidal section of the Great Gutter and the section of coast from Skinburnessbank to the Southern end of Silloth. (See figure 2).

On both surveys the samples were taken near low water when the channel of Great Gutter was clearly discernible past Grune point.

The determinands analysed were Cu, Zn, Cr, Pb, Ni and Cd. Sulphate was not measured as its background level in marine waters is so high as to make the additional input to this environment insignificant.

FIGURE 1 : SILLOTH SURVEY 1

25/4/1990

site	Cu DW	Zn DW	Cr DW	Pb DW	Ni DW
B3	12.7	109.1	44.0	27.7	40.4
B2	15.3	166.3	96.5	45.6	62.5
B1	11.0	104.7	56.8	26.7	36.9

B4	7.4	91.1	35.4	18.5	32.0
B5	8.3	76.1	35.9	22.5	30.0

B6	15.3	141.0	72.9	44.1	56.2
B7	10.7	104.5	45.6	37.3	40.3
B14	13.1	84.4	35.8	25.0	23.1
B15	10.2	95.4	39.4	18.8	28.5

B8	14.3	130.0	74.9	36.8	48.4
B9	11.9	106.0	53.4	26.8	35.6
B12	13.7	103.1	44.8	30.1	31.8
B13	9.9	82.2	40.4	22.8	25.5
B11	12.4	87.0	43.9	26.6	25.4
B10	10.2	83.0	27.7	21.7	26.8
B16	10.9	66.2	28.1	23.7	17.1
B17	263.3	156.0	49.0	43.9	16.4

All values in mg/Kg normalised to 5% organic matter content.

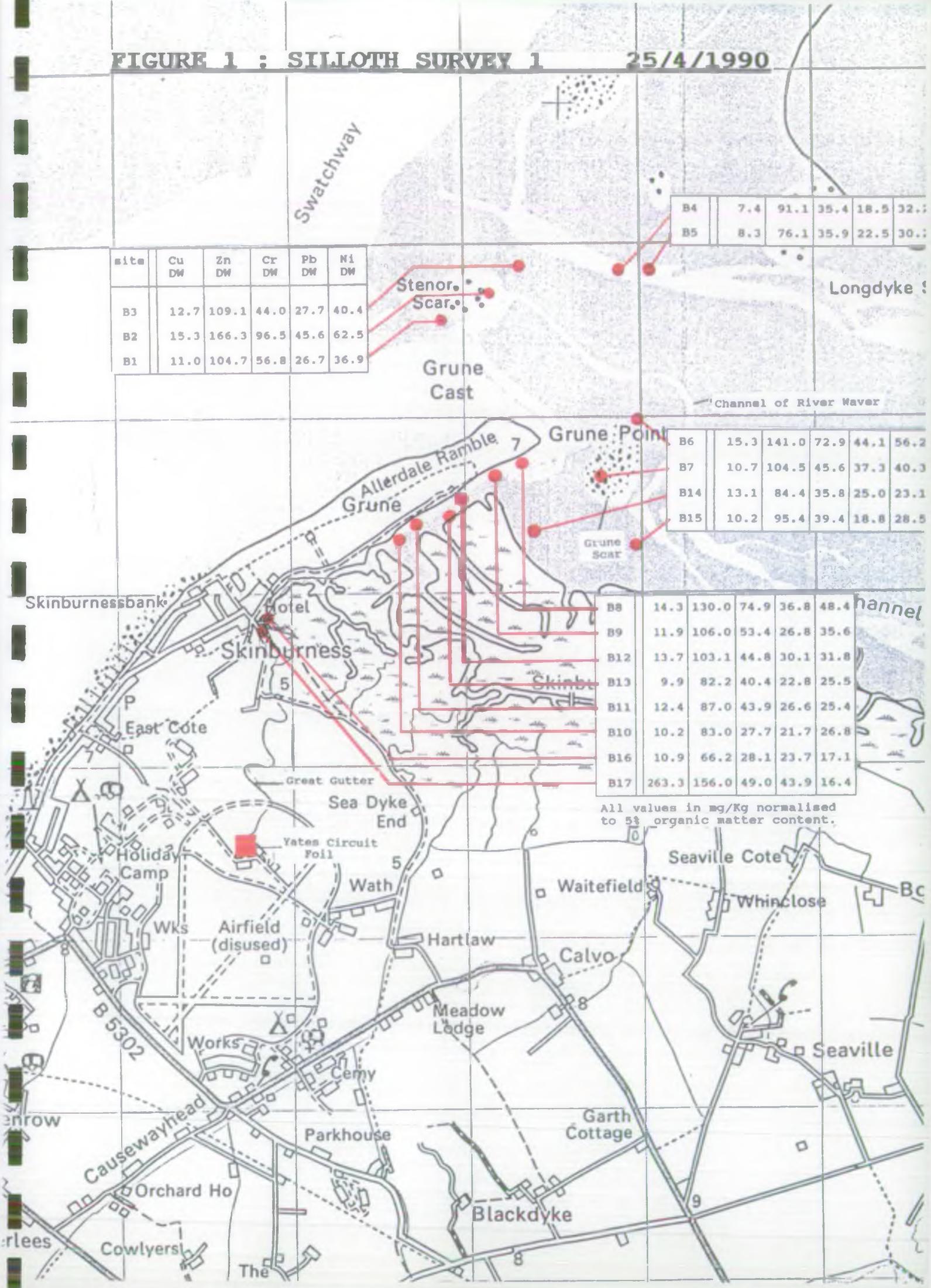


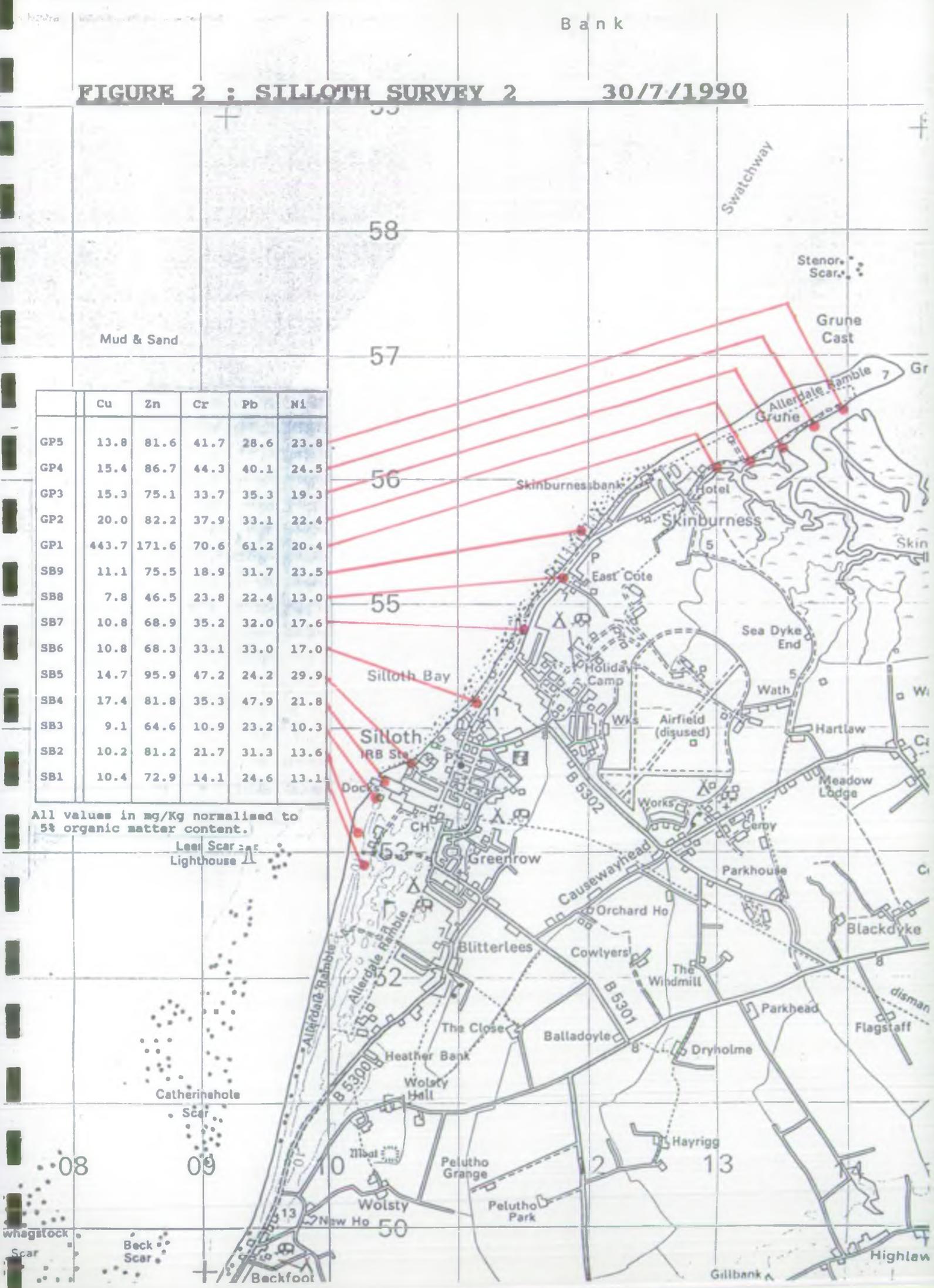
FIGURE 2 : SILLOTH SURVEY 2 30/7/1990

Mud & Sand

	Cu	Zn	Cr	Pb	Ni
GP5	13.8	81.6	41.7	28.6	23.8
GP4	15.4	86.7	44.3	40.1	24.5
GP3	15.3	75.1	33.7	35.3	19.3
GP2	20.0	82.2	37.9	33.1	22.4
GP1	443.7	171.6	70.6	61.2	20.4
SB9	11.1	75.5	18.9	31.7	23.5
SB8	7.8	46.5	23.8	22.4	13.0
SB7	10.8	68.9	35.2	32.0	17.6
SB6	10.8	68.3	33.1	33.0	17.0
SB5	14.7	95.9	47.2	24.2	29.9
SB4	17.4	81.8	35.3	47.9	21.8
SB3	9.1	64.6	10.9	23.2	10.3
SB2	10.2	81.2	21.7	31.3	13.6
SB1	10.4	72.9	14.1	24.6	13.1

All values in mg/Kg normalised to 5% organic matter content.

Leel Scar
Lighthouse



RESULTS

Metals are mainly associated with the silt fraction of sediments. The results of the surveys were normalised to a 5% dry weight organic matter content to approximate to a normalised silt content. 5% was chosen as being in the middle of the range of values. This meant the samples could be compared with greater legitimacy. Cadmium levels were consistently below the detection level of the analytical method and therefore ignored. The raw data is shown in Appendix B.

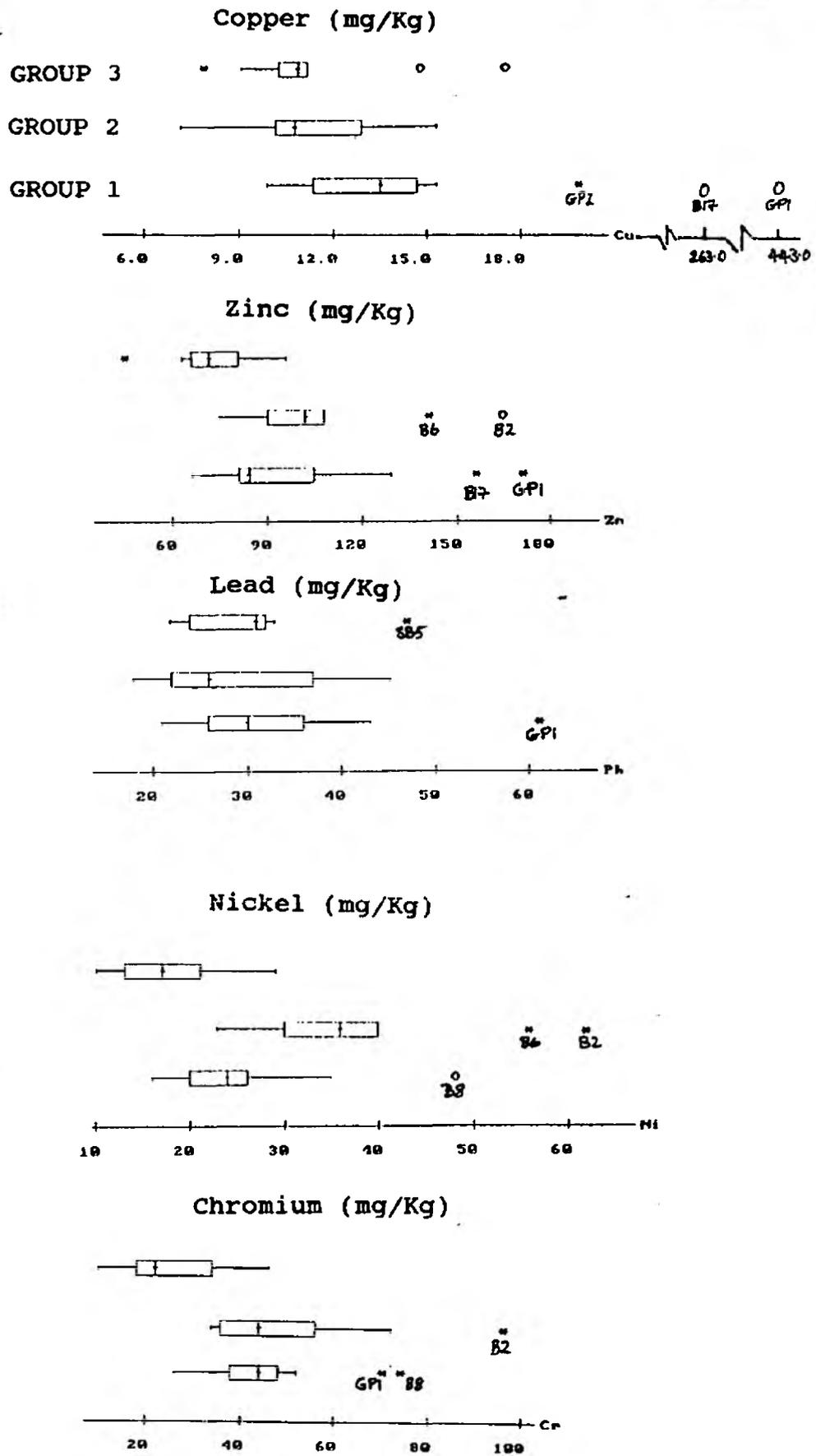
The samples were grouped into three distinct areas:

1. Great Gutter up to Grune Point (Figure 1: B8-B13,B16,B17; Figure 2: GP1-GP5),
2. Off Stenor Scar and Grune Scar (Figure 1: B1-B7,B14,B15),
3. The coast from Silloth to Skinburnessbank (Figure 2: SB1-SB9),

The range of values found in these areas is represented graphically in figure 3. The plots demonstrate that, of the determinands analysed, the major concentrations are of copper and zinc.

The highest value for copper is found at GP1 with 443.7 mg/kg (see Figure 2), followed by 263.3 mg/kg at B17 (see Figure 1). Both these samples were taken near the landward edge of the salt marsh where dilution is low. Sample B16 was taken near these two samples, but from a side drainage channel just off the Great Gutter. Its close proximity but comparatively low value of 10.9 mg/kg indicates the level

FIGURE 3 : BOXPLOTS OF GROUPED DATA



The 'box' represents the middle half of the data, i.e. the ends are the first and third quartiles. the cross within the box is the median value. Values plotted with an '*' are possible outliers. Values plotted with an 'o' are probable outliers.

of impact caused by the effluent flowing down Great Gutter.

Samples GP1 and B17 also exhibit elevated levels of Zinc. The high levels (171.6 and 156.0 mg/Kg) again contrast with that found at B16 (10.9 mg/Kg). Of the samples taken off Grune and Stenor scar, B2 and B6 have the highest values.

For both Copper and Zinc it can be seen that the high values found at the landward edge of the salt marsh decline markedly over a relatively short distance seaward.

There is little evidence of major lead contamination from Great Gutter, although GP1 is the highest at 61.2 mg/Kg. There does not appear to be significant differences in the rest of the data.

Similarly there is little evidence of elevated levels of nickel or chromium. However, as in the case of zinc, B6 and B2 have the highest values of the samples taken off Grune and Stenor Scars. This suggests that a different source of contamination may be influencing this area, possibly from the channel of the river Waver.

The beach samples taken between Silloth and Skinburnessbank consistently show low values for all the metals analysed. This means that if a new discharge impacted on this stretch of coastline it would be doing so on a largely unaffected area. However, the greater dilution available by connection to Silloth Sewer may make any new impact small in comparison to that seen at present.

CONCLUSIONS

The effluent discharge does have an impact on the sediments surrounding Great Gutter, especially in the case of copper and zinc. This effect is most pronounced on the landward edge of the salt marsh, diminishing quickly with the greater dilution available in the tidal waters.

There is a suggestion that points B2 and B6 may be being influenced by the channel of the river Waver.

The sediments taken from Skinburnessbank to Silloth, upon which any new discharge into Silloth Sewer will have an impact, possess relatively low levels of all the metals analysed.

APPENDIX A : CONSENT TO DISCHARGE



North
West
Water

CONTROL OF POLLUTION ACT 1974

PART II

CONSENT NO. 017590005

CONSENT TO DISCHARGE
ENTERED IN REGISTER

Consent of the North West Water Authority (hereinafter called "the Authority") is hereby granted to Yates Circuit Foil Co. Ltd. ON 27.7.89 BY EB

Yates Circuit Foil Co. Ltd.
The Airfield
Silloth
Carlisle
Cumbria
CA5 4NT

to discharge trade effluent from the processes involved in the manufacture of metal foil, for use in printed circuitry, at their premises at Silloth to "relevant waters" within the area of the Authority, namely the Culverted Great Gutter via the 18 inch surface water drain subject to the following conditions:

Nature and Composition

The effluent discharged to the "relevant waters" shall consist solely of trade effluent from the processes involved in the manufacture of metal foil, for use in printed circuitry, at their premises at Silloth and shall conform to the following standards:-

- (i) The suspended solids in 5 days at 20° Centigrade shall not exceed 40 milligrams per litre.
- (ii) The pH value shall not be greater than 11 nor less than 5.
- (iii) The toxic metals shall not either individually or in any combination exceed 2.5 milligrams per litre.
- (iv) The Sulphate content, expressed as Sulphate Ion SO_4^{-2} , shall not exceed 1500 milligrams per litre.

Volume

The volume of the effluent discharged to the "relevant waters" shall not exceed 1.227 Megalitres in any period of 24 hours.

Outlet

The outlet shall be located at National Grid Reference NY 1221 5428 at the position indicated on the plan submitted with the application.

The outlet shall only be used for the discharge of trade effluent derived from the processes involved in the manufacture of metal foil, for use in printed circuitry at their premises at Silloth.

Samples of the discharge

Samples of the discharge will be obtained by the Authority's officers from time to time at the sampling manhole on the final effluent drain prior to its confluence with the 18" diameter surface water drain at N.G.R. NY 1221 5395.

The Conditions attached to the Consent hereby given will be subject to review from time to time but will not without the Consent in writing of the person to whom this Consent is given (or his successor) be altered before the expiration of the period ending with 30th June, 1991.

Your attention is drawn to the statutory right of appeal to the Secretary of State for the Environment should it be considered that the conditions attached to the consent are unreasonable.

This Consent is granted solely under and for the purpose of the Control of Pollution Act 1974 and is without prejudice to the operation of any other legal provisions now or at any other time hereinafter applicable to the aforesaid matter.

This Consent supercedes the Consent of the same number issued on 1st September, 1980.

Dated this 29th day of June 1989.

Signed

D.J. Lea

D.J. Lea
Regulation and Planning Liaison Officer

APPENDIX B : RAW DATA

SITE	Cu	Zn	Dry Weight			Cd	NVMAT 500 C
			cr	Pb	Ni		
			mg/Kg				
SB1	9.58	67.21	13.00	22.67	12.08	<0.5	4.61
SB2	8.75	69.86	18.67	26.92	11.73	<0.5	4.30
SB3	13.10	92.79	15.63	33.27	14.78	<0.5	7.18
SB4	13.11	61.64	26.60	36.13	16.47	<0.5	3.77
SB5	5.74	37.41	18.42	9.44	11.67	<0.5	1.95
SB6	12.16	77.06	37.39	37.25	19.22	<0.5	5.64
SB7	10.84	69.08	35.25	32.06	17.63	<0.5	5.01
SB8	10.62	63.20	32.38	30.41	17.63	<0.5	6.80
SB9	5.88	40.00	10.04	16.80	12.47	<0.5	2.65
GP1	654.0	253.0	104.0	90.18	30.09	<0.5	7.37
GP2	14.58	60.00	27.68	24.17	16.33	<0.5	3.65
GP3	16.39	80.65	36.16	37.96	20.74	<0.5	5.37
GP4	8.7	48.89	24.99	22.59	13.80	<0.5	2.82
GP5	10.24	60.41	30.89	21.13	17.64	<0.5	3.70
B1	2.06	19.68	10.68	5.02	6.94	0.3	0.94
B2	1.53	16.63	9.65	4.56	6.25	<0.5	0.50
B3	2.06	17.67	7.13	4.49	6.55	<0.5	0.81
B4	1.51	18.58	7.23	3.78	6.57	<0.5	1.02
B5	1.71	15.67	7.39	4.63	6.22	<0.5	1.03
B6	1.44	13.25	6.85	4.15	5.28	<0.5	0.47
B7	1.90	18.60	8.11	6.64	7.18	<0.5	0.89
B8	1.91	17.41	10.03	4.93	6.48	<0.5	0.67
B9	2.59	23.10	11.64	5.84	7.75	<0.5	1.09
B10	3.05	24.89	8.30	6.50	8.04	<0.5	1.50
B11	5.65	39.50	19.91	12.06	11.51	0.27	2.27
B12	3.95	29.68	12.90	8.68	9.17	<0.5	1.44
B13	3.37	27.94	13.74	7.75	8.68	0.29	1.70
B14	5.57	35.78	15.16	10.61	9.80	<0.5	2.12
B15	3.04	28.42	11.74	5.59	8.49	<0.5	1.49
B16	6.98	42.26	17.90	15.09	10.89	0.26	3.19
B17	417.0	248.4	77.88	69.82	26.08	0.58	7.95