

**Marine Science Section**

**Phase 1 of Blyth Estuary PCB Monitoring**

**December, 1994**

**MB\94\04\P1**



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**Report of Phase 1 of Blyth Estuary PCB Monitoring**

**MB\94\04\P1**

**Author: Roger K. Proudfoot (Marine Scientist)**

**Distribution: Blyth Harbour Commission  
Northumberland County Council  
R. Creswell  
G. Williams  
H. Taylor  
A. Hunter  
J. Orr  
C. Vivian (MAFF)**

**AMMENDMENTS:**

Table 1 Site 1.1 No result was obtained due to sampling error

Table 1 Site 17 No further results are expected as site 17 was only sampled at the surface.

# REPORT OF PHASE 1 FOR BLYTH ESTUARY PCB MONITORING

## 1. INTRODUCTION

Following discussions with Northumberland County Council on the 18th of August, 1994, the NRA agreed to carry out further monitoring work in relation to proposed clean-up operations in the vicinity of Battleship Wharf where estuary sediments are severely contaminated with PCB's.

MAFF have agreed a  $200\mu\text{g}/\text{kg}$  (200ppb) concentration in dredge spoil as permissible for disposal of dredgings at sea, with sediments above this limit being unacceptable for sea disposal. NRA have agreed that sediments above this level should be removed from the estuary for land-based disposal.

The County Council is proposing to dredge contaminated sediment above the  $200\mu\text{g}/\text{kg}$  level from the estuary for encapsulation on reclaimed land at Battleship Wharf. The removal of contaminated sediment should result in significant environmental improvements to the estuary and remove the threat of PCB accumulation in marine food chains.

A three phase monitoring plan was proposed covering the period of the clean-up (Appendix 1). The following is an interim report covering Phase 1 of the monitoring plan.

The objectives of Phase 1 were as follows:

1. Assess pre-dredging concentrations of PCB's in the sediments to determine the extent of any further spread of PCB contamination in the Blyth estuary.
2. Establish the current  $200\mu\text{g}/\text{kg}$  concentration contour in the vicinity of Battleship Wharf.
3. Carry out limited bioaccumulation studies in and around the tidal basin of the estuary to assess the bioavailability of the PCB's.

## 2. METHODS

### Sediments

Following a survey conducted by Wimpey Environmental on behalf of Blyth Harbour Commission (BHC) in July 1992 the extent of PCB contamination was mapped. The site locations for this survey and maximum sediment surface concentrations were mapped and are illustrated in Appendix 2. The proposed  $200\mu\text{g}/\text{kg}$  contour is also illustrated. This is the point to which contaminated sediment has to be removed before normal dredging operations can resume in the area.

A survey, repeating as close as possible many of the sites sampled by Wimpey was conducted on the 14th of October using the same sampling and position fixing equipment.

23 sites were sampled (Figure 1) using a 500kg, 1.5m gravity corer. Cores were of variable length depending on the substrate. Each core was sectioned into approximately

20cm sections. Sub-samples were taken using a metal spatula from both the top and bottom of each section. In addition, samples for particle size analysis (PSA) were taken from the surface section of each core.

Position fixing was conducted using a Trimble 4000 DGPS (WGS84) with onshore base station. Projection was Transverse Mercator and the spheroid used was Airy 1830 (OSGB).

Samples were submitted for analysis to the NRA's Exeter Laboratory. All samples were analysed for 10 PCB congeners.

PSA samples were analysed by Zeneca's Brixham Laboratory using a Malvern Laser Particle Sizer.

### **Bioaccumulation**

Bioaccumulation monitoring was conducted at a number of sites in the vicinity of the tidal basin (Figure 2) and at a number of trawl stations (Figure 3) from August to October. Target species are listed below:

*Nereis diversicolor* (Common Ragworm)

*Littorina littorea* (Common Periwinkle)

*Platichthys flesus* (Flounder)

*Pleuronectes platessa* (Plaice)

In addition ragworm samples were also collected at the Sleekburn mud-flats.

Ragworms were depurated for six days in acid-washed sand and one day in clean sea water. Winkles were washed in clean water and dissected to remove tissue from the shells. Fish livers were dissected and bulked where necessary to obtain sufficient sample weight for analysis.

Samples were submitted for analysis to the NRA's Exeter Laboratory. All samples were analysed for 10 PCB congeners.

## **3. RESULTS AND DISCUSSION**

### **Sediments**

Sediment PCB results are shown in Table 1 for each section of the cores. The principal congeners recorded were 138, 153 and 180.

17 sites recorded PCB congeners above the LOD. However, only 3 sites recorded PCB's in excess of 200 $\mu$ g/kg - sites 11, 17 and 21. Sites 11 and 17 are closest to Battleship Wharf and high levels were to be expected.

In comparison with the Wimpey study in 1992 an additional three congeners were determined - 31, 105 and 156. Of these congeners only congener 31 was recorded, in relatively low concentrations, away from Battleship Wharf. All three congeners were present, albeit in low concentrations, at site 17, closest to the area of greatest contamination.

Figure 4 shows the 200 $\mu$ g/kg contour based on MAFF and Wimpey surface concentrations from 1991 and 1992 respectively. At sites 4, 5, 6 and 7, PCB's are

below the L.O.D. indicating that the 1992 contour should be redrawn to exclude this area since PCB levels are not regarded as significant.

Sites over the whole survey area show similar patterns of contamination with the exception of site 21. There is no evidence of a spread of the contaminated area in a northerly or westerly direction. However, at site 21 (NRA) a greater depth of penetration was attained with the corer than in the Wimpey survey at a comparable site (Site BH 13, Appendix 2). Results showed significant contamination at 20-40cm ( $<1351.2\mu\text{g}/\text{kg}$ ).

Neither study investigated downstream of the contaminated area thoroughly enough to highlight the extent of contamination in a southerly direction. The 1992  $200\mu\text{g}/\text{kg}$  contour does not include this area. It appears from the results at site 21 that contamination may be significant enough to warrant an extension to the contour in a southerly direction. Further sampling is necessary to map the extent of contamination in this area before dredging operations commence and to allow more detailed mapping of the  $200\mu\text{g}/\text{kg}$  contour around Battleship Wharf.

Variability in concentrations of PCB's is illustrated at Site 11 (NRA 1994) where two samples were taken at the same site. Some PCB congeners varied between the two samples by an order of magnitude. This may be as a result of the relatively low silt/clay content (31.9) in the first sample though this is speculative since no particle size sample was taken for the second sample.

High levels of PCB's in the north eastern corner are thought to be as a result of the hydrographic conditions in the estuary carrying contaminated oil into this corner where it was seen to accumulate when the oil spills arose from Battleship Wharf in 1991. Concentrations in 1992 were in excess of  $200\mu\text{g}/\text{kg}$  but not in 1994 (Wimpey Site BH15, NRA Site 1) though the sites are some distance apart and do not provide a very accurate comparison.

#### **Bioaccumulation**

Bioaccumulation results are illustrated in Table 2. Without comparable data prior to contamination of the estuary it is difficult to assess the significance of the results. However, concentrations do not appear to be significantly elevated. Further data on fish tissues is pending. A more complete assessment will be undertaken when all the results are available.

It is not thought at this stage that PCB levels in biota warrant cause for concern though further monitoring will be undertaken during and after the removal of contaminated sediments.

#### **4. CONCLUSIONS**

1. PCB contamination does not appear to have spread in a northerly or westerly direction in the period 1992-94.
2. PCB sediment contamination is generally consistent with that in 1992 though site comparisons with the Wimpey survey are difficult due to the patchy distribution of PCB's.

3. Significant contamination greater than  $200\mu\text{g}/\text{kg}$  was recorded south of Battleship Wharf, an area not yet fully investigated.

4. The  $200\mu\text{g}/\text{kg}$  contour can be redrawn to exclude some of the area previously included to the north of Battleship Wharf.

5. The PCB congeners determined show no significant accumulation in the biota of the estuary so far at sites near to Battleship Wharf though further data is awaited before a more complete assessment can be made.

## **5. RECOMMENDATIONS**

1. A further survey is required to determine the extent of PCB contamination south and downstream of Battleship Wharf where significant contamination has been found.

2. Further samples are required in the vicinity of Battleship Wharf to map the  $200\mu\text{g}/\text{kg}$  contour in more detail.

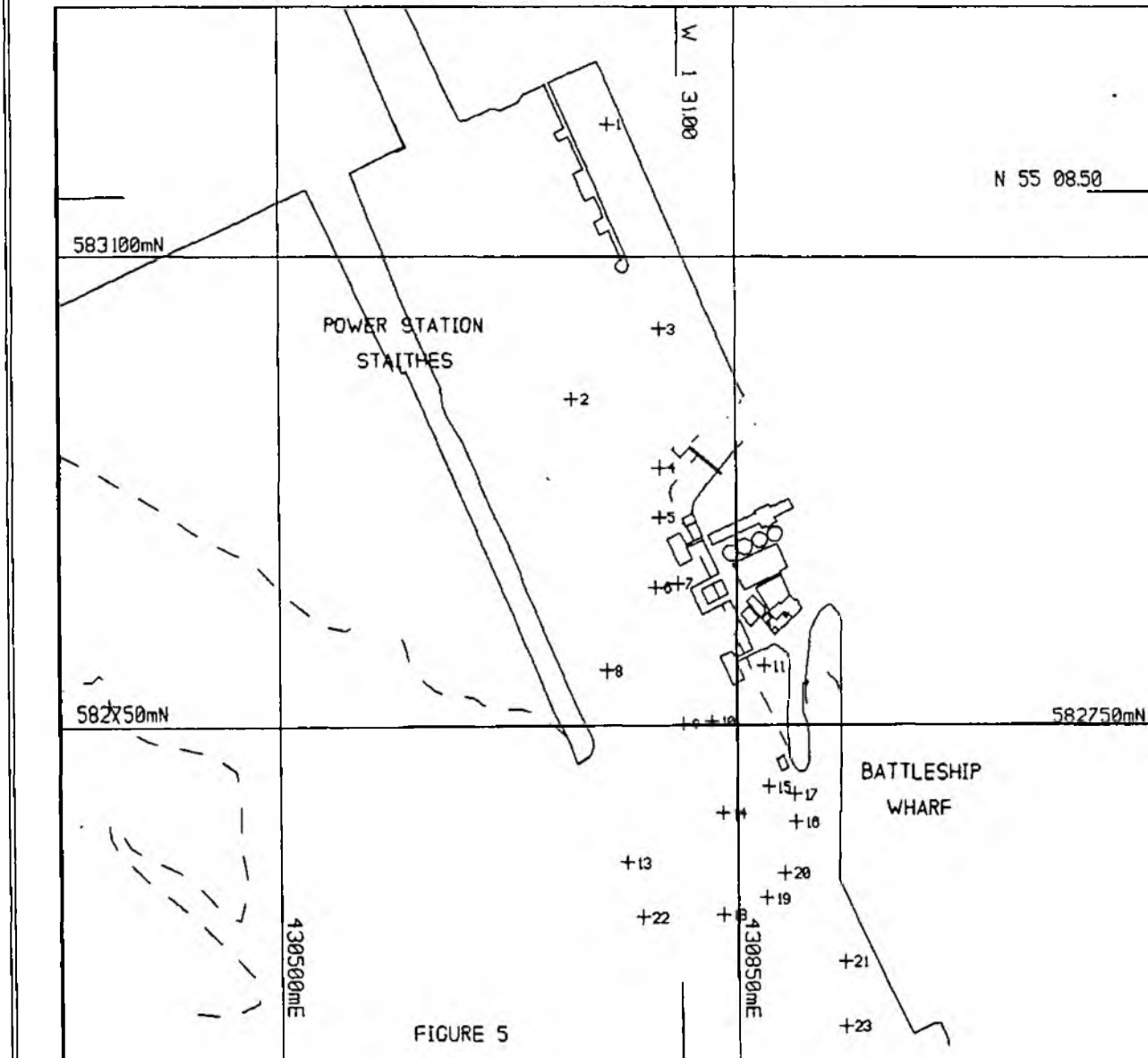
3. A more complete assessment of bioaccumulation results should be undertaken once all the results have been received. Further bioaccumulation work may be necessary downstream of Battleship Wharf.

## **6. ACKNOWLEDGEMENTS**

Thanks to the marine section of the NRA for managing to carry out this survey at such short notice, especially Claire Buckler for technical support with position fixing. A real team effort at making a difference!



FIGURE 1 : SEDIMENT SAMPLING SITES



BLYTH HARBOUR

PCB MONITORING

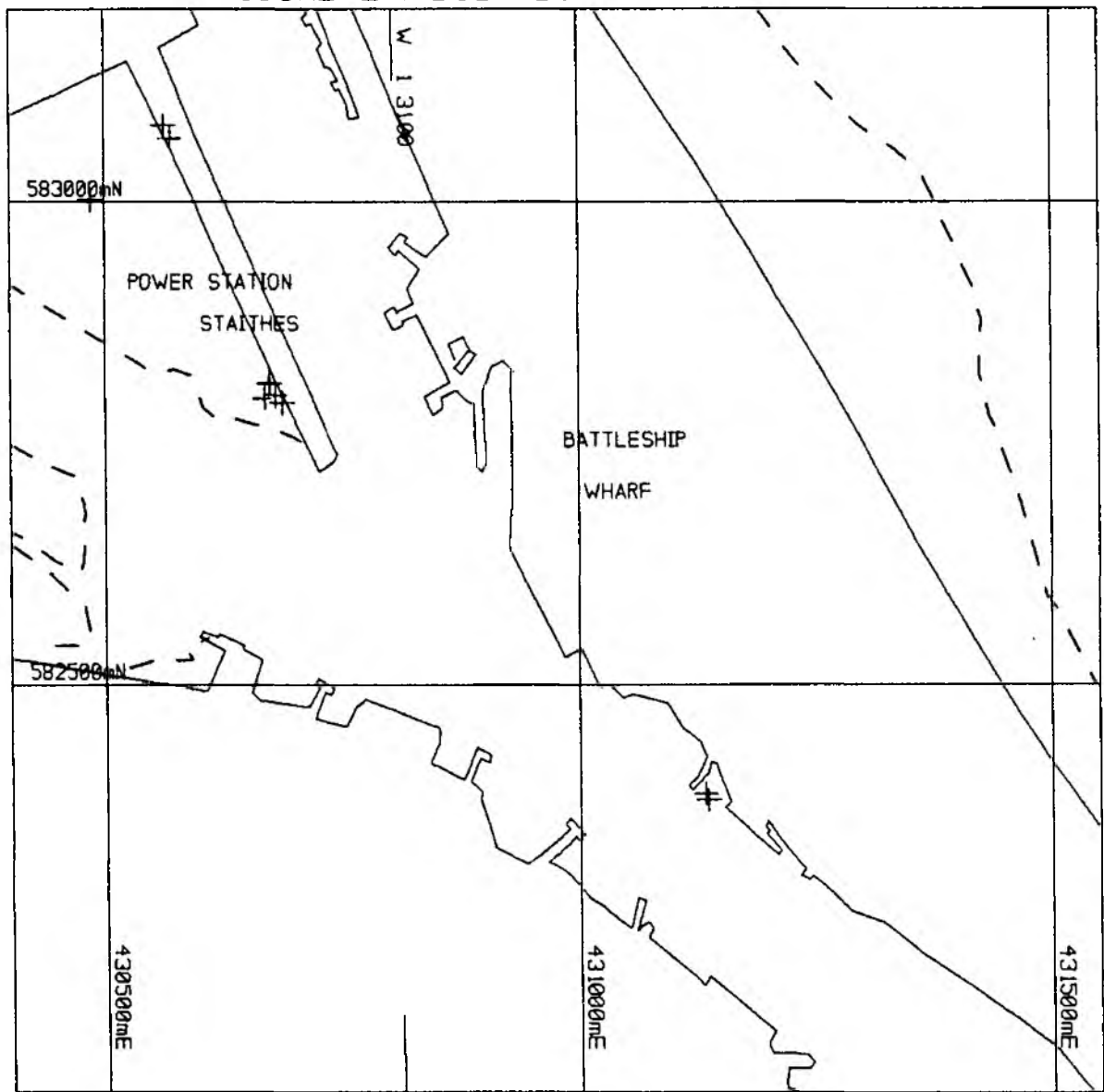
OCTOBER 13th 1994

STATION No.	OSGB POSITION		SAMPLE DEPTH
	E	N	
1	430751	583199	95cm
2	430723	582993	55cm
3	430791	583040	80cm
4	430790	582941	43cm
5	430790	582904	85cm
6	430787	582852	45cm
7	430804	582855	45cm
8	430749	582790	70cm
9	430808	582751	70cm
10	430830	582753	75cm
11	430870	582794	--
12	430870	582677	130cm
13	430764	582653	70cm
14	430838	582689	90cm
15	430873	582708	140cm
16	430894	582683	70cm
17	430893	582702	90cm
18	430838	582616	55cm
19	430871	582628	90cm
20	430885	582640	90cm
21	430931	582583	95cm
22	430770	582614	80cm
23	430931	582536	85cm

PROJECTION - TRANSVERSE MERCATOR  
 SPHEROID - AIRY 1830 (OSGB)

DATUM SHIFTS BY C BUCKLER VIA QUBIT

FIGURE 2 : BODY BURDEN SITES



BLYTH HARBOUR

PCB MONITORING  
OCTOBER 13th 1994

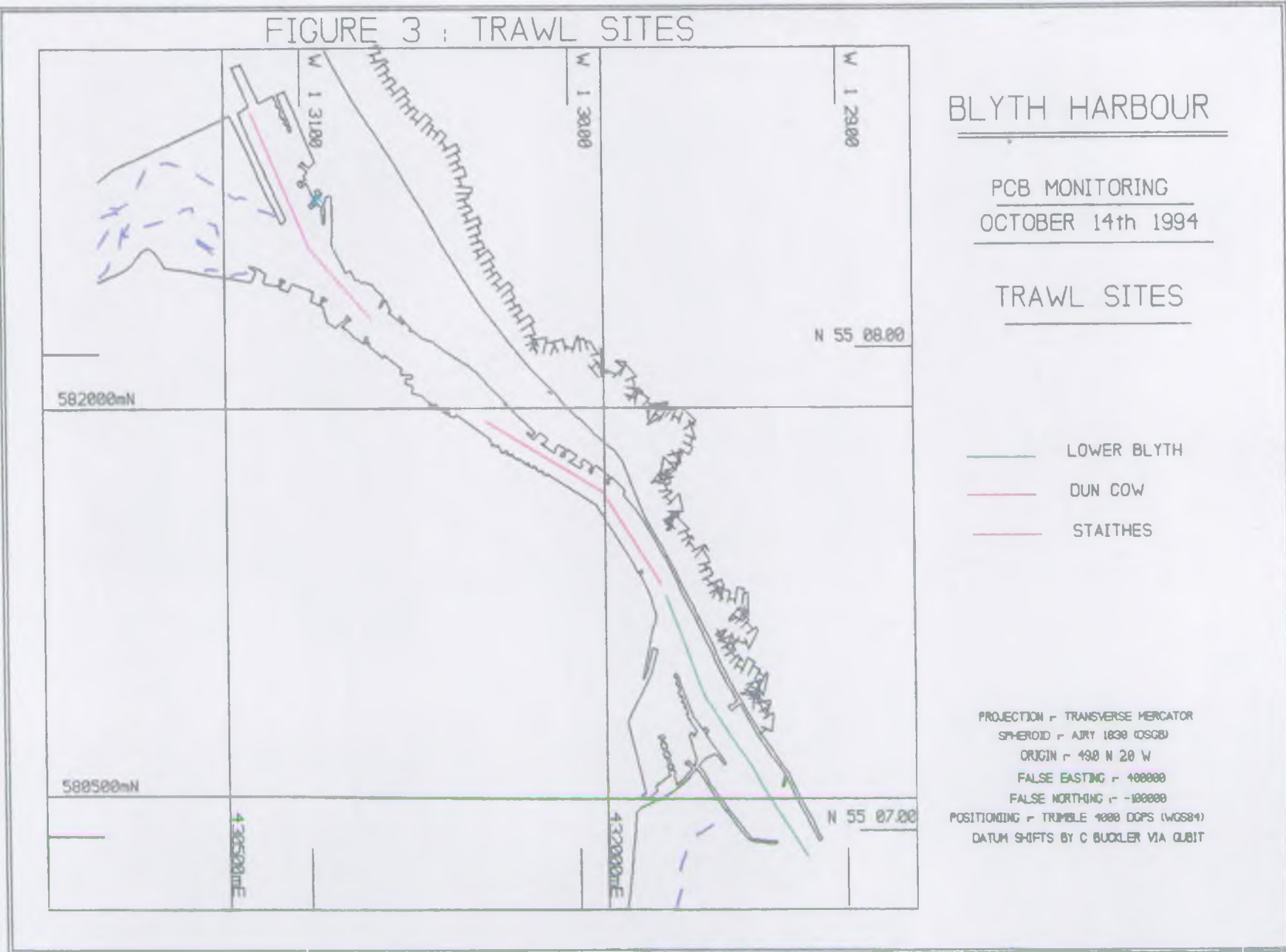
ADDITIONAL SAMPLE SITES

KEY :-

- + RAGWORM SAMPLE SITE
- + WINKLE SAMPLE SITE
- + SEDIMENT SAMPLE SITE
- + MUSSEL SAMPLE SITE

PROJECTION - TRANSVERSE MERCATOR  
 SPHEROID - AJRY 1830 (OSGB)  
 ORIGIN - 490 N 20 W  
 FALSE EASTING - 400000  
 FALSE NORTHING - -100000  
 POSITIONING - TRIMBLE 4000 DGPS (WGS84)  
 DATUM SHIFTS BY C BUCKLER VIA QUBIT

FIGURE 3 : TRAWL SITES



BLYTH HARBOUR

PCB MONITORING  
OCTOBER 14th 1994

TRAWL SITES

- LOWER BLYTH
- DUN COW
- STAITHES

PROJECTION = TRANSVERSE MERCATOR  
 SPHEROID = AIRY 1830 (OSGB)  
 ORIGIN = 490 N 20 W  
 FALSE EASTING = 400000  
 FALSE NORTHING = -100000  
 POSITIONING = TRIMBLE 1000 DGPS (WGS84)  
 DATUM SHIFTS BY C BUCKLER VIA QUBIT

STAITHES

FIGURE 4 200µg/kg Contours

+2

+4

+5

+6 +7

+8

+9 +10

+11

+14

+15 +17

+16

+13

+20

+22

+18

+19

+21

+23

— 1992 Wimpey Contour

— Proposed 1994 NRA Contour

BATTLESHIP WHARF

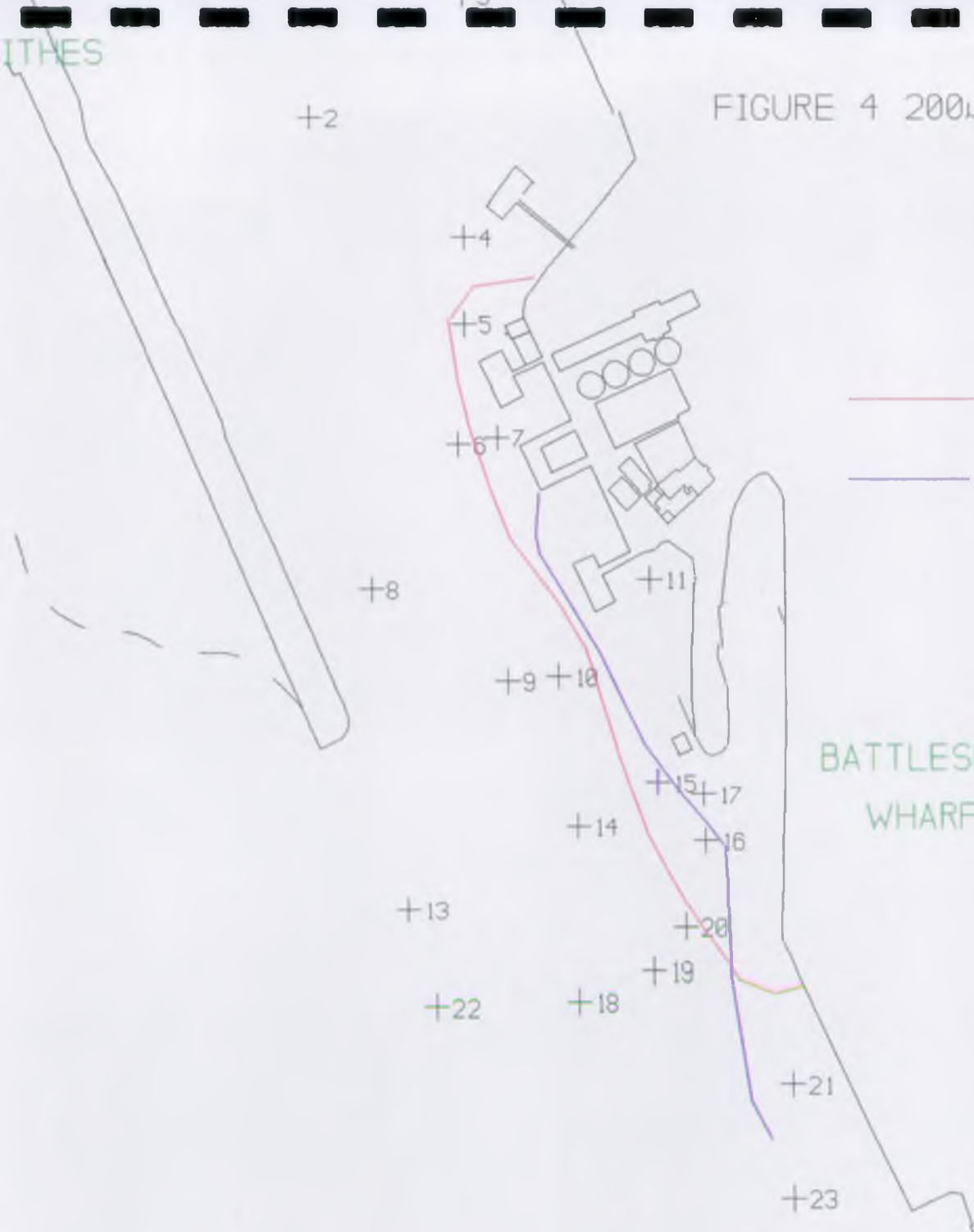


Table 1. PCB Sediment Results, October 1994.

Site No.	Position		Depth	PCB 28	PCB 31	PCB 52	PCB 101	PCB 105	PCB 118	PCB 138	PCB 153	PCB 156	PCB 180	Total	% Dry Matter	% Silt/Clay	
	East	North															
1	430751	583199	0-20	*	*	*	*	*	*	*	*	*	*	*			94.8
			20-40	<2.8	<3.4	<3.4	<3.4	<3.4	<2.3	<3.4	3.1	<3.4	<2.3	<30.9	44.0		
			40-60	<2.7	<3.2	<3.2	<3.2	<3.2	<2.1	5.0	5.3	<3.2	3.7	<34.8	47.0		
			60-80	<2.5	<3.0	<3.0	3.7	<3.0	<2.0	6.4	7.5	<3.0	5.2	<30.3	51.0		
			80-95	<2.3	2.8	3.1	9.8	<2.8	2.7	11.7	12.2	<2.8	7.8	<58.0	54.0		
2	430723	582993	0-20	<3.1	<3.7	<3.7	4.2	<3.7	<2.5	10.8	10.2	<3.7	8.8	<54.4	40.4	96.8	
			20-40	<1.8	<15.3	<2.1	<2.1	<2.1	<2.8	<4.4	<4.3	<2.1	<3.2	<40.2	69.9		
			40-55	<2.7	<6.8	<3.2	<3.2	<3.2	<2.1	6.4	5.7	<3.2	3.7	<40.2	46.5		
3	430791	583046	0-20	<3.3	<23.7	<3.9	<3.9	<3.9	<2.6	<5.8	<5.8	<3.9	<4.7	<61.5	38.3	96.7	
			20-40	<2.9	<12.0	<3.5	<5.7	<3.5	<7.8	<6.8	<7.7	<3.5	<5.4	<58.8	43.4		
			40-60	<2.8	<3.5	<3.3	<3.3	<3.3	<2.2	<3.3	<2.8	<3.3	<2.2	<30.0	45.0		
			60-80	<2.5	<5.6	<3.9	<3.3	<3.0	<2.0	<4.0	<4.3	<3.0	<2.4	<34.0	50.0		
4	430790	582941	0-20	<3.2	<9.1	<3.8	<3.8	<3.8	<2.7	<4.0	<4.1	<3.8	<3.6	<41.9	40.0	96.1	
			20-43	<2.1	<3.4	<2.5	<2.5	<2.5	<1.9	<2.8	<2.8	<2.5	<1.9	<24.9	59.0		
5	430790	582904	0-20	<3.0	<7.9	<3.6	<4.1	<3.6	<6.7	<8.1	<9.4	<3.6	<7.4	<57.4	41.30	96.7	
			20-40	<2.7	<3.7	<3.3	<4.4	<3.3	<4.9	<5.9	<6.2	<3.3	<5.0	<42.7	45.0		
			40-60	<2.8	<4.9	<3.4	<3.4	<3.4	<2.3	<3.4	<3.1	<3.4	<2.3	<32.4	44.0		
			60-85	<2.6	<3.1	<3.1	<3.1	<3.1	<2.1	<4.7	<5.5	<3.1	<3.2	<33.6	48.0		
6	430787	582852	0-20	<3.1	<17.9	<3.7	<3.7	<3.7	<2.5	<4.0	<3.6	<3.7	<2.7	<48.6	41.0	95.7	
			20-45	<2.8	<26.7	<3.3	<3.3	<3.3	<5.0	<6.8	<7.2	<3.3	<4.6	<66.3	45.0		
7	430804	582855	0-20	<3.0	<19.1	<3.6	<3.6	<3.6	<3.0	<4.7	<4.6	<3.6	<3.1	<51.9	42.0	96.1	
			20-45	<2.8	<11.7	<3.4	<3.4	<3.4	<2.3	<4.5	<4.2	<3.4	<3.7	<42.8	44.0		
8	430749	582790	0-20	<3.0	<18.4	<3.6	<3.6	<3.6	<2.4	<3.6	<3.0	<3.6	<2.4	<47.2	42.0	95.2	
			20-40	<2.6	<10.0	<3.2	<3.9	<3.2	<2.1	<4.5	<4.0	<3.2	<2.9	<39.6	47.0		
			40-70	<2.5	<6.3	<3.0	<3.0	<3.0	<2.0	<3.0	<2.0	<3.0	<2.0	<29.8	51.0		
9	430808	582751	0-20	<3.0	<13.3	<3.7	<3.7	<3.7	<2.4	<3.7	<3.0	<3.7	<2.4	<42.6	41.0	94.6	
			20-40	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	4.5	5.0	<3.3	3.8	<34.8	45.0		
			40-70	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	4.9	5.5	<3.0	4.6	<34.5	48.5		

Table 1. PCB Sediment Results, October 1994.

Site No.	Position		Depth	PCB 28	PCB 31	PCB 52	PCB 101	PCB 105	PCB 118	PCB 138	PCB 153	PCB 156	PCB 180	Total	% Dry Matter	% Silt, Clay
	East	North														
10	430830	582753	0-20	<2.7	<3.3	<3.3	<3.3	<3.3	<2.2	<3.3	3.4	<3.3	2.2	<31.3	45.8	94.
			20-40	<3.2	<3.8	<3.8	<3.8	<3.8	<2.5	<3.8	3.7	<3.8	3.1	<35.3	39.3	
			40-60	<2.9	<3.4	<3.4	<3.4	<3.4	<2.3	<3.4	3.0	<3.4	<2.3	<30.9	43.8	
			60-75	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	3.6	4.0	<3.3	2.7	<31.8	44.9	
11	430870	582794	0-20 (A)	<1.4	2.7	<1.7	10.0	<1.7	<1.2	33.83	36.54	3.8	27.6	<120.47	86.0	31.
			0-20 (B)	<1.5	2.9	6.5	83	<1.8	<1.2	195.9	275.3	8.0	207.6	<783.70	81.0	
12	430576	582677	0-20	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	<2.5	<3.0	<2.0	<27.0	50.1	69.
			20-40	<2.2	<2.7	<2.7	<2.7	<2.7	<1.8	2.7	<2.2	<2.7	<1.8	<24.2	56.2	
			40-60	<2.2	<2.7	<2.7	4.1	<2.7	3.3	5.3	4.6	<2.7	2.7	<33.0	56.3	
			60-80	<2.2	<2.7	<2.7	<2.7	<2.7	3.0	4.6	<2.2	<2.7	<1.8	<27.3	55.9	
			80-100	<1.9	<2.3	<2.3	2.6	<2.3	<1.5	2.5	1.9	<2.3	<1.5	<21.1	65.7	
			100-120	<1.9	<2.3	<2.3	<2.3	<2.3	<1.6	<2.3	<1.9	<2.3	<1.6	<22.8	64.5	
120-130	<2.1	<2.5	<2.5	<2.5	<2.5	<1.7	<2.5	<2.1	<2.5	<1.7	<22.6	60.5				
13	430764	582653	0-20	<2.6	<3.1	<3.1	<3.1	<3.1	<2.1	<3.1	<2.6	<3.1	<2.1	<28.0	47.9	87.
			20-40	<2.4	<2.9	<2.9	<2.9	<2.9	<1.9	<2.9	<2.4	<2.9	<1.9	<26.0	51.4	
			40-60	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	<2.5	<3.0	<2.0	<27.0	49.7	
			60-70	<2.6	<3.1	<3.1	<3.1	<3.1	<2.1	<3.1	2.6	<3.1	<2.1	<28.0	48.2	
14	430838	582689	0-20	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	<3.3	<2.8	<3.3	<2.2	<29.8	44.9	92
			20-40	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	<3.3	3.5	<3.3	3.5	<31.8	44.9	
			40-60	<2.6	<3.1	<3.1	<3.1	<3.1	<2.1	3.4	4.6	<3.1	2.7	<29.9	48.3	
			60-90	<2.5	<3.0	<3.0	5.1	<3.0	<2.0	13.6	16.9	<3.0	12.4	<64.4	49.6	
15	430873	582708	0-20	<2.9	<3.4	<3.4	6.7	<3.4	<2.3	14.9	17.2	<3.4	13.3	<70.9	43.6	96
			20-40	<2.8	<3.3	<3.3	4.8	<3.3	<2.2	9.9	11.7	<3.3	8.2	<52.8	45.4	
			40-60	<2.4	<2.9	2.9	7.3	<2.9	<1.9	12.6	15.5	<2.9	9.1	<65.4	51.4	
			60-80	<2.2	<2.6	4.0	4.9	<2.6	<1.8	7.4	9.5	<2.6	3.3	<40.7	56.7	
			80-100	<2.1	<2.6	<2.6	3.7	<2.6	<1.7	<2.6	<2.1	<2.6	<1.7	<24.3	58.2	
			100-120	<2.1	<2.6	<2.6	<2.6	<2.6	2.2	2.8	<2.2	<2.6	<1.7	<24.0	57.6	
120-140	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	<2.5	<3.0	<2.0	<27.0	50.5				

Table 1. PCB Sediment Results, October 1994.

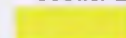
Site No.	Position		Depth	PCB 28	PCB 31	PCB 52	PCB 101	PCB 105	PCB 118	PCB 138	PCB 153	PCB 156	PCB 180	Total	% Dry Matter	% Silt/Clay	
	East	North															
16	430894	582683	0-20	<3.1	<3.8	<3.8	7.5	<3.8	<2.5	16.3	18.1	<3.8	12.7	<75.4	39.9	93.7	
			20-40	<2.8	<3.4	<3.4	13.1	<3.4	<2.3	20.3	28.3	<3.4	17.7	<98.1	44.2		
			40-70	<2.5	<3.0	<3.0	5.9	<3.0	3.1	13.2	16.3	<3.0	11.0	<64.0	49.7		
17	430893	582702	0-20	3.1	5.5	33	160	12.5	<1.6	1116.1	674.2	21.5	1012.4	<3039.0	61.5	86.1	
			20-40	*	*	*	*	*	*	*	*	*	*	*	*		*
			40-60	*	*	*	*	*	*	*	*	*	*	*	*		*
			60-80	*	*	*	*	*	*	*	*	*	*	*	*		*
			80-90	*	*	*	*	*	*	*	*	*	*	*	*		*
18	430838	582616	0-20	<2.7	<3.3	<3.3	<3.3	<3.3	<2.2	<3.3	<2.7	<3.3	<2.2	<29.6	45.9	88	
			20-40	<2.7	<3.2	<3.2	7.6	<3.2	<2.1	34.3	27.6	<3.2	29.3	<116.4	46.8		
			40-55	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	<3.2	<3.0	<2.0	<27.7	49.7		
19	430871	582628	0-20	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	<3.3	<2.8	<3.3	<2.2	<29.8	44.9	91.5	
			20-40	<2.7	<3.3	<3.3	4.9	<3.3	<2.2	8.7	10.1	<3.3	6.5	<48.3	45.5		
			40-60	<2.5	<3.0	<3.0	4.2	<3.0	<2.0	9.3	10.9	<3.0	7.7	<48.6	49.8		
			60-90	<3.6	<4.4	<4.4	7.3	<4.4	<2.9	8.5	11.1	<4.4	6.3	<57.3	52.5		
20	430885	582646	0-20	<2.8	<3.4	<3.4	<3.4	<3.4	<2.2	<3.4	3.2	<3.4	2.5	<31.1	45.0	92.4	
			20-40	<2.8	<3.3	<3.3	<3.3	<3.3	<2.2	7.0	8.4	<3.3	6.0	<42.9	45.0		
			40-60	<2.8	<3.3	<3.3	<7.4	<3.3	<2.2	16.4	18.7	<3.3	10.9	<71.6	45.0		
			60-80	<2.4	<2.9	<2.9	4.1	<2.9	<1.9	6.6	8.5	<2.9	5.4	<40.5	52.0		
			80-90	<2.3	<2.8	<2.8	<2.8	<2.8	<1.9	<2.8	2.7	<2.8	<1.9	<25.6	54.0		
21	430931	582583	0-20	<2.6	<3.1	<3.1	<3.1	<3.1	<2.1	<3.1	<2.6	<3.1	<2.1	<28.0	48.1	93.7	
			20-40	<2.7	4.8	8.1	116.1	<3.2	<2.1	347.6	460	14.3	392.3	<1351.2	46.6		
			40-60	<2.5	<3.1	<3.1	<3.1	<3.1	<2.0	4.3	5.0	<3.1	3.2	<32.5	49.1		
			60-80	<2.5	<3.0	<3.0	7.1	<3.0	<2.0	13.5	16.4	<3.0	10.3	<63.8	51.0		
			80-95	<2.5	3.4	11.7	8.7	<3.1	<2.0	6.9	14.0	<3.1	5.5	<60.9	49.0		
22	430776	582614	0-20	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	<2.5	<3.0	<2.0	<27.0	50.0	83.2	
			20-40	<2.3	<2.8	<2.8	<2.8	<2.8	<1.9	<2.8	2.8	<2.8	<1.9	<26.7	54.0		
			40-60	<2.6	<3.2	<3.2	<3.2	<3.2	<2.1	<3.2	<2.6	<3.2	<2.1	<28.6	47.0		

Table 1. PCB Sediment Results, October 1994.

Site No.	Position		Depth	PCB 28	PCB 31	PCB 52	PCB 101	PCB 105	PCB 118	PCB 138	PCB 153	PCB 156	PCB 180	Total	% Dry Matter	% Silt/Clay
	East	North														
23	430931	582536	0-20	<2.8	<3.4	<3.4	<3.4	<3.4	<2.3	<3.4	<2.8	<3.4	<2.3	<30.6	44.0	90.8
			20-40	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	<3.0	3.3	<3.0	2.1	<27.9	49.0	
			40-60	<2.5	<3.0	<3.0	<3.0	<3.0	<2.0	3.6	4.2	<3.0	3.2	<30.5	50.0	
			60-85	<2.3	<2.8	<2.8	<2.8	<2.8	<1.8	<2.8	2.6	<2.8	<1.8	<25.3	54.0	

N.B. Total expressed as sum of L.O.D + positive results to give a figure of "not greater than"

\* result not yet received

 PCB's above the L.O.D.

 PCB's > 200µg/kg



Table 3. PCB Bioaccumulation Data

Site Name	Sample Type	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	PCB 156	PCB 31	PCB 105	Total	Extr. Lipid	% Dry Matter
Power Stn Staithes End	Winkles	<0.9	<5.6	<1.9	<3.3	<3.7	1.4	<4.3	<1.4	<0.9	<1.7	<25.1	2	
Power Stn Staithes End	Ragworms	<0.9	<5.6	<1.9	<3.3	<3.7	<1.3	<4.3	<1.4	<0.9	<1.7	<22.0	0.4	
Power Stn Staithes End	Mussels	<0.9	<5.6	<1.9	<3.3	<3.7	2.6	<4.3	<1.4	<0.9	<1.7	<23.3	1.3	
Power Stn Staithes End	Sediments	<2.4	<2.8	<2.8	<1.9	<2.8	<2.4	<1.9	<2.8	<2.8	<2.8	<25.4		53.0
Power Stn Staithes	Winkles	<0.9	<5.6	<1.9	<3.3	<3.7	<1.3	<4.3	<1.4	<0.9	<1.7	<22.0	0.4	
Power Stn Staithes	Ragworms	<0.9	<5.6	<1.9	<3.3	<3.7	<1.3	<4.3	<1.4	<0.9	<1.7	<22.0	1.0	
Power Stn Staithes	Sediments	<2.5	<3.0	<3.0	<2.0	<3.0	<2.5	<2.0	5.1	<3.0	<3.0	<29.1		62.9
D/s Battleship Wharf	Winkles	<0.9	<5.6	<1.9	<3.3	<3.7	4.4	<4.3	<1.4	<0.9	<1.7	<25.1	1.5	
D/s Battleship Wharf	Ragworms	.	.	.	.	.	.	.	.	.	.	.	.	.
D/s Battleship Wharf	Sediments	<2.5	<3.0	<3.0	<2.0	<3.0	<2.5	<2.0	<3.0	<3.0	<3.0	<27.0		50.6
Sleekburn	Ragworms	<0.9	<5.6	<1.9	<3.3	<3.7	1.8	<4.3	<1.4	<0.9	<1.7	<22.5	1.1	
Sleekburn	Sediments	<3.3	<3.9	<3.9	<2.6	<3.9	<3.3	<2.6	<3.9	<3.9	<3.9	<35.2		38.2

N.B. Total expressed as sum of L.O.D. + positive results to give a figure of "not greater than"

\* result not yet received

PCB's above the L.O.D.

# APPENDIX 1

## **BATTLESHIP WHARF PCB CONTAMINATION - PROJECT OUTLINE**

Blyth PCB Monitoring Project ref: 51 262 762

### **INTRODUCTION**

Following a meeting with Northumberland County Council on the 18th August 1994, the NRA agreed to carry out further survey work to establish the spread, if any, of contaminated sediment in the vicinity of Battleship Wharf. The NRA is also committed to monitoring the clean-up operations in the estuary. A three phase monitoring plan is proposed over the next six months.

#### **\* Objectives**

##### **PHASE 1**

Assess pre-dredging concentrations of PCB's in the sediments to determine the extent of any further spread of PCB contamination in the Blyth estuary and establish the current 200 $\mu$ g/kg concentration contour in the vicinity of Battleship Wharf.

Carry out limited body burden studies in and around the tidal basin to assess bioavailability of PCB's.

##### **PHASE 2**

Assess disturbance to PCB contaminated sediment as a result of construction works associated with building a new Harbour wall in the vicinity of Battleship Wharf.

Pending the findings of Phase 1 undertake further ecological work to determine PCB impact.

##### **PHASE 3**

Assess post-dredging concentrations of PCB's to determine the success of the dredging operations and make recommendations for future works/monitoring.

### **METHODS PHASE 1**

Following a survey conducted by Wimpey Environmental on behalf of Blyth Harbour Commission in July 1992 the extent of the PCB contamination was mapped.

A survey, repeating many of the sites sampled by Wimpey, is planned for the 12th of October using the same sampling equipment and position fixing.

22 sites are to be sampled using a 1.5m Gravity corer. Cores will be sampled at 20cm intervals. This may yield as many as 80 samples based on the Wimpey core penetration depths.

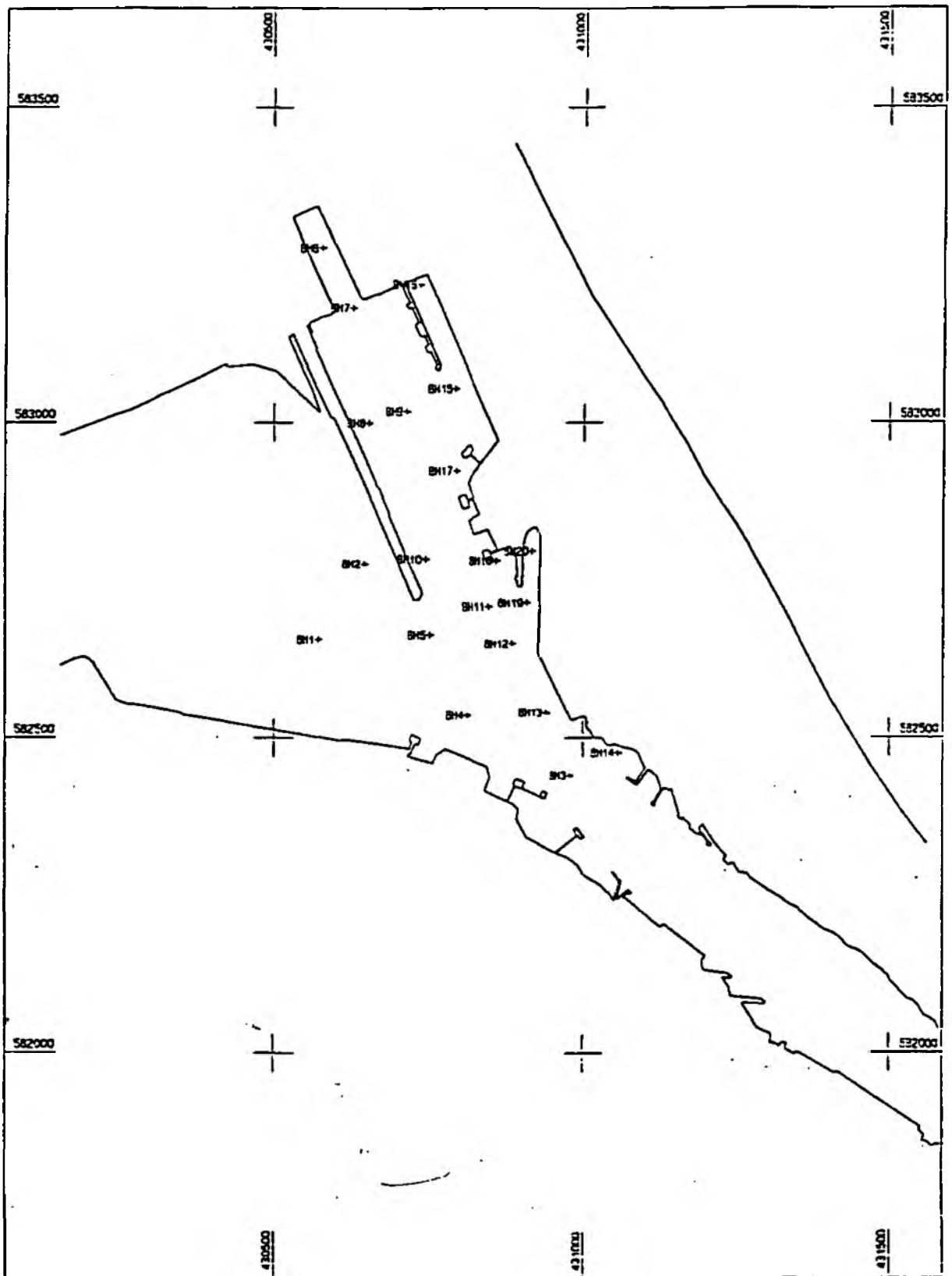
A number of biota samples will also be submitted for body burden analysis to assess the bioavailability of PCB's. Benthic invertebrate samples have already been collected and await submission. Fish samples are to be collected on the 3rd of October.




Samples are to be submitted directly to the Exeter Laboratory of the NLS. Exeter has guaranteed that results from the first batch will be received by 7th of November providing they receive the samples by the 14th.

**ROGER PROUDFOOT**  
(Marine Scientist)

c.c Alan Hunter  
Richard Cresswell  
Tony Coddington  
Sally Gallagher

## **APPENDIX 2**



 	<p>BLYTH HARBOUR - SEDIMENT CONTAMINATION          SAMPLE LOCATIONS          8 AND 9 JULY 1992</p>	<p>REFERENCE NO: RREZ 5232          FIGURE NO: 1          DATE PLOTTED: 13-AUG-92</p>
	<p>NOTES</p>	

STATION	DEPTH (m)	PCB 28 PCB 52 PCB 101 PCB 118 PCB 138 PCB 153 PCB 180 µg/kg WET WEIGHT							TOTAL	% SOLIDS AT 105°C	MAX PCB* µg/kg DW
		PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180			
BH11	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	63.0	111.1
	0.1-0.2	<10	<10	<10	<10	<10	11.6	<10	<71.6	66.1	108.3
	0.2-0.3	<10	<10	<10	<10	<10	10.8	<10	<70.8	64.8	109.3
BH12	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	68.3	102.5
	0.1-0.2	<10	<10	<10	<10	<10	<10	<10	<70	57.2	122.4
	0.2-0.3	11.8	<10	<10	<10	<10	11	<10	<72.8	63.5	114.6
BH13	0.0-0.1	22	<10	<10	<10	<10	<10	<10	<82.0	40.8	208.3
BH14	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	44.0	159.1
	0.1-0.15	<10	<10	<10	<10	<10	<10	<10	<70	44.6	157.0
BH15	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	44.6	157.0
	0.1-0.2	<10	<10	<10	<10	<10	10.4	<10	<70.4	30.7	229.3
	0.2-0.3	<10	<10	<10	<10	<10	10.8	<10	<70.8	46.5	152.3
BH16	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	88.8	78.8
	0.1-0.2	<10	<10	<10	<10	<10	<10	<10	<70	96.4	72.6
	0.2-0.3	<10	<10	<10	<10	<10	<10	<10	<70	52.5	133.3
BH17	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	49.2	142.3
	7	<1	<1	<1	<1	<1	<1	<1	<7	54.2	12.9
BH18	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	59.7	117.3
	0.1-0.2	<10	<10	<10	<10	<10	<10	<10	<70	60.2	116.3
	0.2-0.3	<10	<10	<10	<10	11.1	13	<10	<74.1	58.7	126.2
BH19	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	38.7	180.9
	0.1-0.2	<10	<10	<10	<10	<10	10.5	<10	<70.5	46.4	151.9
BH110	0.0-0.1	<10	<10	<10	<10	<10	10.1	<10	<70.1	40.9	171.4
	0.1-0.2	<10	<10	<10	<10	13.5	15.4	<10	<78.9	52.8	149.4
	0.2-0.3	<10	<10	<10	<10	<10	11.9	<10	<71.9	56.5	127.3
BH111	0.0-0.1	<10	<10	<10	<10	<10	13.8	<10	<73.8	37.4	197.3
	0.1-0.2	<10	<10	<10	<10	15.8	22	<10	<87.8	41.8	210.0
	0.2-0.3	<10	<10	<10	<10	<10	<10	<10	<70	39.1	179.0
BH112	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	34.0	205.9
	0.1-0.2	<10	<10	<10	<10	14	20.1	<10	<84.1	38.7	217.3
	0.2-0.3	<10	<10	<10	<10	18.7	25.6	12.2	<96.5	36.6	263.7

TABLE 3. PCB Results: Marine Samples

STATION	DEPTH (m)	PCB 28	PCB 52	PCB 101	PCB 118	PCB 138	PCB 153	PCB 180	TOTAL	% SOLIDS AT 105°C	MAX PCB* µg/kg DW
		µg/kg WET WEIGHT									
BH13	0.0-0.1	<10	<10	<10	<10	<10	<10	<10	<70	65.9	106.2
	0.1-0.2	<10	<10	<10	<10	<10	<10	<10	<70	40.5	172.8
	0.2-0.3	<10	<10	<10	<10	<10	<10	<10	<70	50.3	139.2
BH14	0.0-0.1	<1	<1	<1	<1	<1	<1	<1	<7	82.0	8.5
BH15	0.0-0.1	<10	<10	<10	<10	<10	12.6	<10	<72.6	25.9	280.3
	0.1-0.2	<100	<100	<100	<100	<100	<100	<100	<700	43.5	1609.2
	0.2-0.3	<100	<100	<100	<100	<100	<100	<100	<700	65.7	1065.4
	0.6-0.7	<10	<10	<10	<10	163	238	81	<522	49.5	1054.5
	1.2-1.3	<10	<10	39	<10	80	121	38	<308	68.6	449.0
BH16	0.0-0.1	<10	<10	10.7	<10	18.7	23.7	<10	<91.1	41.2	221.1
	0.1-0.2	<10	<10	<10	<10	14.8	18.8	<10	<83.6	47.5	176.0
	0.2-0.3	<10	<10	<10	<10	<10	13.9	<10	<73.9	49.7	148.7
	0.3-0.4	<10	<10	21	<10	29	49	21	<150	47.6	315.1
	0.45-0.55	<10	<10	19	<10	24	44	21	<138	46.3	298.1
BH17	0.0-0.1	<10	<10	<10	<10	12.8	14.6	<10	<77.4	39.6	195.5
	0.1-0.2	<10	<10	<10	<10	15.2	21.8	<10	<87	43.4	200.5
	0.2-0.3	<10	<10	<10	<10	13.3	20.8	<10	<84.1	45.6	184.4
	0.3-0.4	<10	<10	6.5	<10	9	14	8	<68	43.3	152.4
BH18	0.0-0.1	<10	<10	20.9	<10	54.3	63.2	32.4	<200.8	73.9	271.7
	0.1-0.2	<10	<10	16	<10	41.2	47.9	23.8	<158.9	71.5	222.2
BH19	0.0-0.1	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<7000	52.2	13410.0
	0.1-0.2	<1000	<1000	1712.4	<1000	4320.6	4791.8	2264.1	<16000.3	52.2	30820.5
BH20	0.0-0.1	<2500	<2500	2691.9	<2500	4060.7	6991.6	2936.4	<24180.6	63.5	38079.7

TABLE 3 (continued). PCB Results, Marine Samples



