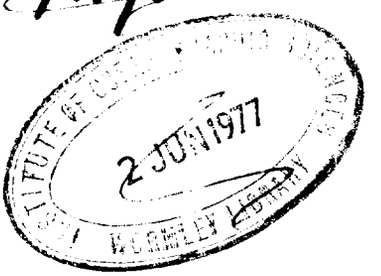

I.O.S.

SWANSEA BAY (SKER) PROJECT

by

A.P. CARR, A.D. HEATHERSHAW and M.W.L. BLACKLEY

PROGRESS REPORT FOR THE PERIOD
AUGUST 1975 to JULY 1976

REPORT NO 26

1976

NATURAL ENVIRONMENT RESEARCH COUNCIL

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This project is supported financially by
the Department of the Environment

Institute of Oceanographic Sciences
Crossway
Taunton
Somerset

CONTENTS

Swansea Bay (Sker) : Second Progress Report

1. INTRODUCTION

The First Progress Report (IOS Report No 20/1975) outlined the work which had been undertaken up to 31 July 1975. The Introduction to that Report explained both the Department of the Environment's and the local authorities' interest in the practical problems affecting the Swansea Bay area together with the way in which Institute of Oceanographic Sciences had become an active participant in the research. It is not necessary to repeat the background here.

The present Report covers the period from 1 August 1975 to 31 July 1976, and is similar in form to its predecessor. Thus it contains three sections:

1. Report of progress to 31 July 1976
2. Summary
3. Plans for future work

IOS Report No 20/1975 stated that during the Research Contract(s) two series of Reports would be published: those,such as the present one, which would describe progress on the study; and a second series based on specific topics. It is hoped that the first of the latter, on evidence provided by documentary sources, can be published by the beginning of 1977. Three other subjects were mentioned for early treatment in the last Report: Observed Wave Data, Wave Refraction, and the first Radioactive Tracer Study. A considerable body of wave data has been and is being obtained and analysed (see 2.3 below) but, because the initial wave refraction computations suggested a focus of energy in the Sker Point area (Figure 1, which shows the sites of all places mentioned in the text), additional wave data needs to be obtained before Reports are produced on this subject which have any pretension of comprehensiveness. The final survey of distribution of labelled material from the first Radioactive Tracer study took place in April 1976, and, because -

(i) the next injection was due later the same month, and

(ii) the work forms a composite whole -

it was decided to incorporate this aspect into one Report to be published at a later date.

2. PROGRESS ON THE SWANSEA BAY PROJECT TO 31 JULY 1976

2.1 Historical and cartographic data.

Towards the end of 1975 visits were made both to the British Museum and the

Public Records Office to examine the documentary sources there. In particular, the Tithe Maps - which frequently provide the earliest large scale maps of a given area - were examined. For the E side of Swansea Bay all the parishes are covered except the critical Margam area. While there are some obvious inaccuracies in the series, in general they provide a useful source which can be checked both one against another and with more recent Ordnance Survey 6" to 1 mile or 1:10000 or larger scale maps.

These data and subsequent surveys show that the area subject to the greatest change is that of the Neath estuary, rather than the coastline further south which has become the prime source of attention. However, consistent landward retreat of the low water mark totalling some 370m between the surveys of 1843 and 1963, characterises the Port Talbot harbour area. The picture elsewhere is less straightforward although there appears to have been an overall tendency towards a steepening of the beach gradient either by erosion at low water level or local accretion at high water and above.

The whole of this work will be analysed in more detail in a forthcoming Report.

2.2 Photogrammetry and topographic survey

As the April 1975 flight only covered part of the relevant coastal area it was reflown in October of the same year. This flight together with two earlier flights (April 1968 and June 1970) have now been contoured using the Nature Conservancy Council's Kern PG2 photogrammetric plotter. The contours were drawn at metre intervals and any clay and peat exposures and cobble lag deposits included on the finished Ozatex overlay.

A comparison of the position of the contours for the 1968 and 1975 surveys between Port Talbot and Sker Point was then made. This showed that on most of the beach the contours had retreated landward, except in two areas, one south of the newly constructed Tidal Harbour and the other just north of the River Kenfig.

The surface area of the peats and clay exposed on the beach at the time of each aerial survey was also measured. Table 1 shows the appreciable increase which has occurred, especially between the 1970 and 1975 flights south of the R Kenfig.

In order to monitor changes of height of the beach, monthly topographic surveys of eleven sections have been undertaken since September 1975. Over this period the vertical changes have been relatively small, not exceeding 0.25 to 0.5m

on the Aberavon Beach, around 0.5m between Port Talbot and the RiverKenfig and up to 1m south of the River.

2.3 Wave Data

The Waverider buoy continued to function satisfactorily until February 1976. It was then lost in stormy conditions but later recovered on the Irish coast. A replacement was laid in May.

Data continued to be collected from the self-contained pressure-type wave recorder located just South of Port Talbot tidal harbour until March. At the monthly changeover in April this recorder was lost when mooring wires parted. Subsequent searches using sidescan and divers failed to locate it. The unit was replaced by one cabled to the shore in May. This recorder was laid nearly 1.0km offshore in approximately 12m of water at mid tide.

The information produced by these wave recorders has been stored on magnetic tapes which are being processed to produce monthly and annual printouts of wave period and wave height (such as those shown in Fig 2) as well as more sophisticated wave analyses.

The 3.2 cm X-band radar installed at Mumbles functioned reasonably satisfactorily but has failed to produce the required directional information. This appears to be due to its height and position relative to the research area. It has therefore been decided to move it to a site at the end of the southern breakwater of Port Talbot Tidal Harbour (see Section 4.3).

2.4 Current Meter Data

Since the last progress report (IOS Report No 20/75) the current meter programme has been considerably intensified. This has included the establishment of a long term current meter mooring site and a grid of short term current meter stations. These are shown in Fig 1.

Between October 1975 and July 1976, 26 meter deployments were carried out in Swansea Bay. These have included Plessey M021 and Bergen recording current meters. A further 16 meter deployments are planned in the period up to 31 December 1976.

Near bed current measurements were initially made using steel frames to mount the meters at a height of 1m above the sea bed. It had been hoped that this measurement of the mean flow might be used to derive estimates of the bed shear stress which, together with a knowledge of the sediment grain size characteristics, could be used to determine the ability of tidal currents to transport sediment. Some difficulty was experienced in making these measurements and during the winter

exercise in October/November 1975, 4 Plessey M021 recording current meters were lost as a result of structural weaknesses in the frames and collisions between ships and current meter moorings.

Following these early deployments it was decided to carry out the current measurements in two stages:

(a) to determine the gross features of the circulation (both tidal and non-tidal) in Swansea Bay using conventional 'U' shape current meter moorings with meters secured at heights of 2 - 4m above the seabed and

(b) at a later stage to make measurements of near-bottom currents (at a smaller number of selected sites), using frame mounted current meters with the meters at a height of 1m above bed.

The sites for these latter measurements would be based upon the identification of areas of potentially mobile material using available geophysical data.

Out of 22 successful deployments and recoveries, 16 gave complete records, 4 each gave between 6 and 10 days' records out of a possible 40, and 2 gave no records.

The precise quality of the returned data is not yet known because the records have not been fully analysed. Computer programs are available to carry out this work but at the moment these are being modified as a result of (a) the introduction of the 6 parameter Plessey M021 meter in addition to the usual 4 parameter version and (b) the use of Bergen current meters having a different data format to that of the Plessey.

Further work is also required to provide satisfactory direction calibration data for the Plessey current meters. Individual instruments have shown considerable variation between pre- and post-deployment calibrations. In some cases this has been as much as 5° for a nominal direction setting. This aspect of the current meter measurement programme has to be examined urgently in more detail before the full analyses of the data can be completed.

Details of the current meter data returns are given in Table 2.

2.5 Geophysics

Several days of the RV Edward Forbes Cruise 6/76 during the first half of April were devoted to completing the coverage of the research area with side scan sonar. The records obtained have been interpreted with the help of grab samples and box cores. A sediment distribution map is now being compiled based on the overall information available.

2.6 Geological Sampling

(a) Beach

The sand fraction of the surface of the beach has been sampled on alternate months at high water, mid water and low water along the surveyed beach profiles. The samples were brought back to the laboratory and sieved at $\frac{1}{4}\emptyset$ intervals*. The results will give an indication of changes taking place in the grain size of the material of the beach. So far though, there has been very little variation in size both spatially along the beach and at right angles to it, and through time.

(b) Kenfig Dunes

Six boreholes were put down in the positions indicated in Fig 1. Their aim was twofold, firstly to give an indication of the thickness of sand in the dune system and secondly to obtain radio-carbon dates on the peats that underlie them. It was found that the sand reached a maximum thickness of 12m and thinned out both towards Sker Point in the south and Kenfig Pool in the east. Sufficient peat was encountered in two of the holes for dating purposes and this has been sent for examination. Coarse lag deposits were also encountered at levels comparable with those exposed on the present beach surface.

(c) Offshore: box cores

Box coring has been undertaken on two cruises and a total of over 80 cores collected. The sand samples have been impregnated and the finer silt and clay samples X-rayed in order to reveal their internal structures.

Box coring during the April cruise, and grab sampling at various times, has revealed a great and apparently unsystematic sedimentological variation. It was therefore decided to investigate this during the RV Edward Forbes Cruise 11/76 (May - June) by closely sampling (1) an area of one square kilometre, (2) two lines of section, one parallel and the other at right angles to the sea shore. These samples are being examined but already evidence of cross bedding and sand overlying clay and vice-versa have been observed.

2.7 Suspended sediment and bed shear stress measurements

Since the submission of the last progress report a programme of near-bed suspended sediment concentration and velocity profile measurements has been instigated.

The objective of these measurements is essentially threefold:

*Where $\emptyset = -\log_2$ diameter in mm.

(a) to determine the concentrations and particle size range distributions of suspended sediment;
(b) to estimate sediment flux rates; and
(c) to estimate bed shear stresses.

The measurements in (a) and (b) will attempt to quantify the contribution of suspended sediment to the sediment budget of the area being studied; the measurements in (c) will hopefully enable some conclusions to be drawn concerning the ability of tidal streams to transport material as bed-load.

The equipment and analytical techniques used for this work are based on those developed by the Hydraulics Research Station, Wallingford. However, the overall design differs in a number of ways in order to make it more suitable for the particular circumstances. The IOS pumped sampling apparatus is shown schematically in Fig 3.

The equipment was first used at sea in March 1976 during Cruise 4/76 of the RV Sarsia (a vessel belonging to the Marine Biological Association of the United Kingdom). The cruise programme is outlined in IOS Cruise Report 'Measurements of suspended sediment in Swansea Bay' - 1976 .

Measurements were planned at a number of locations offshore between Port Talbot and Porthcawl (see Fig 4). Poor weather prevented observations being made at all but one of these stations (PS2) where 18 hours of data were obtained. These have been fully analysed and have been useful in developing the laboratory techniques for determining the concentrations of suspended sediment in samples.

A typical suspended sediment concentration profile is shown in Fig 5 and the concentrations in particular size ranges are given in Table 3.

Computer analysis of the velocity profile data has given reliable results for various hydraulic parameters including the bed shear stress and the drag coefficient.

(It had been hoped to continue this work in October 1976 at those locations shown in Fig 3)and to make velocity profile measurements only at some other sites. Unfortunately the cruise had to be cancelled because of an engine defect. See also Sections 4.4 and 4.5).

2.8 Tracer work

Following the success of last year's radioactive tracer experiment on the Kenfig Patches (see IOS Cruise Reports Nos 28/75 and 31/75) a similar experiment was initiated in April of this year.

For this experiment a site was chosen to the West of that on the Kenfig Patches (see Fig 6). The choice of a position for the new experiment was influenced by three factors:

(a) a need to resolve the apparently paradoxical results from the Kenfig Patches experiment and a nearby British Transport Dock Board experiment (see Figs 1 and 7);

(b) a requirement that at the new site the strengths of tidal and wave induced currents be more typical of those processes affecting Swansea Bay as a whole; and

(c) the proximity of the long term recording current meter station which would enable a comparison to be made between the observed tracer dispersion and residual water movements.

In conjunction with AERE Harwell, the tracer was injected in 18m of water on 29 April 1976 using the RV Edward Forbes (Cruise No 8/76). It consisted of 653 gms of glass particles of a suitable specific gravity labelled with the isotope Scandium 46 (half life of 84 days), having an initial activity of 92 curies and a mean particle size of 160 μ ($\pm$ 20 μ). Background activity measurements had been carried out from the Edward Forbes on a previous cruise (Cruise No 6/76). Initial monitoring of the tracer was carried out during cruise 8/76 and further monitoring carried out on cruise 11/76 of the Edward Forbes. An outline of this programme is given in IOS cruise reports - 'Sedimentological sampling and studies of sediment movement using radioactive tracer in Swansea Bay - A, B and C'(in press). Further monitoring of the tracer was carried out from the MV Nichola (of the University College of Wales, Swansea) between 5 and 8 August 1976. Monitoring will continue on a regular basis throughout the rest of the year. Initial results are shown on Figure 7.

During the course of the year good progress has been made in analysing the results of the tracer studies carried out on the Kenfig Patches during 1975 and early 1976. The results from eight surveys, covering a period of 349 days, have been analysed, making the appropriate corrections for decay and observed background activity.

Recovery rates for the tracer have varied considerably; following injection these were of the order 70% falling to 11% after a period of nearly a year. Some of these losses may be accounted for in terms of tracer burial. However it seems more likely that 'apparent losses' occur as a result of poor spatial resolution of the tracer concentrations, particularly where these are high, and

that there are losses by dispersion of labelled material from the edges of the area at near background activity levels.

Following digitisation of the tracer concentration data, computer analyses have enabled the movement of the tracer to be studied in more detail. This has revealed two important features:

(a) a short term displacement of material as a result of the action of tidal currents; and

(b) a long term displacement of the tracer which may be a response to wave action.

These results are shown in Fig 6.

All such results are being analysed further and it is hoped that they will help to provide estimates of bed load transport rates.

Through the courtesy of the British Transport Docks Board it has been possible to carry out comparable analyses on data obtained by them from two other locations in Swansea Bay (see Fig 7).

2.9 Liaison

Liaison with organisations outside IOS has increased steadily over the past year. This has arisen primarily from the need to establish an extensive programme of field measurements in order to secure a good data base for the project. The assistance of the NERC organisations at Barry, and of the Marine Biological Association at Plymouth, has been much appreciated.

There has been considerable co-operation between AERE Harwell and IOS Taunton in the planning and implementation of radioactive tracer studies. This is continuing this year with the provision of personnel and facilities by Harwell for the analysis of tracer in sediment core samples using Gamma spectroscopy.

Discussions took place last year with the Hydraulics Research Station, Wallingford, prior to the development of pumped sampling equipment at IOS Taunton.

The British Transport Docks Board (BTDB) have co-operated with IOS in numerous ways. These have included the provision of their tracer data from Swansea Bay and the use of the BTDB survey vessel Soniarus in deploying a wave recorder off Port Talbot. IOS has also made extensive use of the BTDB HiFix chain for its own survey work.

The British Steel Corporation have co-operated generously with IOS in supplying survey data which have been used in photogrammetric studies.

IOS has extended its links with the Welsh Office and the Welsh National Water Development Authority. The two bodies have agreed to provide funds to extend the programme of current measurements in Swansea Bay. The work they will help to sponsor is due to start in October 1976.

Useful liaison has been established between IOS and the University College of Wales, Swansea (UCS), through the implementation of a NERC research contract (see Appendix 1) placed with the (then) Department of Geology and Oceanography. A good working relationship has been established with the college, and staff and students have been involved with the IOS project in a number of ways. This has included demonstrations of IOS equipment to UCS students at sea, diving support by UCS personnel, the provision by IOS of sediment (box-core) samples for undergraduate projects and IOS assistance with current meter data analyses for postgraduate projects.

Many other organisations have co-operated with IOS Taunton in various subsidiary aspects of the study. In particular we acknowledge here the assistance we have received from HM Coastguard and the Afan Borough Council.

As more data become available from the field studies it is envisaged that liaison with Government, University and possibly some commercial organisations will increase. A high level of liaison is considered essential to the success of the project during the next year.

3. SUMMARY

The period August 1975 to July 1976 has shown a progressively increasing effort into the research on the Swansea Bay area. This applies particularly to the fieldwork programme which is due to reach its maximum during the latter part of 1976 and early 1977.

In general, while some wave, tidal current, and other data have been lost the programme has progressed satisfactorily in most respects. In particular, the cruises using the NERC RV Edward Forbes have been very rewarding.

The following points of interest have been recorded -

(i) Cartographic evidence since the mid-nineteenth century has shown maximum variability in the area of the Neath estuary and a progressively steepening beach gradient along almost the whole coastline. The latter tendency has been accelerating in the last decade as the series of aerial surveys shows.

(ii) Photogrammetry also demonstrates the progressive increase in clay and peat exposures on the beach between Port Talbot tidal harbour and Sker Point.

(iii) Almost continuous wave data have been obtained since late June 1974 either from the Waverider buoy offshore or FM pressure recorders near Port Talbot, or both. Directional information is still providing difficulty.
(iv) Two major recording current meter deployments have taken place and, while the first was disappointing both in the loss of four meters and in the relative paucity of data obtained, the second was far more successful.
(v) Geological investigations have included surface sediment sampling of the beach, shell and auger boreholes in the Kenfig dunes systems and box coring offshore. The beach samples show a striking uniformity of size both temporally and spatially. This conclusion is at variance with evidence submitted to the 1973 Public Inquiry by one of the expert witnesses. Box-coring offshore does, however, indicate marked variability of sediment with depth.
(vi)While the weather prevented much pumped sampling from being carried out during the March 1976 cruise enough was achieved to prove the method and perfect analytical techniques.
(vii) Radioactive tracer work during 1975 and 1976 has shown comparable short-term trends in sediment transport, while detailed analyses of the 1975 data indicate a small residual movement landwards, probably as a response to wave action.

4. FUTURE WORK

A summary of future work in Swansea Bay is given in Table 4. From this it may be seen that a peak effort in field work occurs during the latter part of 1976 and early 1977.

It is envisaged that towards April/May 1977 effort will be concentrated principally in the interpretation of field data and an overall evaluation of the relevant sections of theory to be used in describing and quantifying the sediment transport processes in the area being studied.

Major new field work to be carried out in the next year includes the following:

4.1 Beach experiment:

During November 1976 it is intended to carry out fluorescent tracer experiments on the foreshore approximately 3km south of Port Talbot. The object of these experiments is essentially to determine the direction and possibly the rate of movement of sediment on the foreshore. These observations will be combined with measurements of wave-induced and longshore currents in the nearshore zone using electromagnetic flowmeters and a pressure type wave recorder mounted on a

on a frame on the beach and cabled in to recording equipment housed in a hut on shore. It is also hoped that it will be possibly to study the directional properties of waves with these instruments. At the same time current measurements with recording current meters will be made at two locations offshore of the beach (see Fig 1). It is also hoped to carry out drogue releases in the nearshore zone to provide independent confirmation of the magnitude of longshore currents.

4.2 Current measurements offshore:

As previously mentioned in 2.4 and 2.9 recording current meter measurements will be made later this year.

A total of 12 current meters will be deployed at those locations shown in Fig 1 for a period of approximately 6 weeks in October/November 1976. These data will be available to the Swansea Bay study and will constitute a 'winter' series of measurements thereby supplementing the typical 'summer' measurements made in June/July 1976.

As indicated in 2.4, further current measurements may be carried out at offshore locations using frame-mounted recording current meters. This work is likely to be undertaken in mid-1977.

4.3 Wave data:

Because the radar located at Mumbles Head failed to produce adequate directional wave data (Section 2.3) the equipment was dismantled in July 1976. Following servicing the installation is to be moved to the southern breakwater at Port Talbot, where a site has been made available through the courtesy of the British Transport Docks Board. A new radar tower, designed and constructed by IOS is due on site in early October.

Two new self-contained seabed pressure wave recorders are due to be installed at locations shown in Fig 1 in late October 1976. The object of these additional measurements will be to gain further insight into the longshore variations in wave energy which wave refraction studies have revealed may be a significant feature. In particular there appears to be some focussing of wave energy behind the Kenfig Patches (as shown in Figs 3 and 4 of IOS Report No 20/75).

4.4 Suspended sediment and bed shear stress observations:

While it was not possible to obtain the further measurements planned for October 1976 it is hoped to obtain data during the March/April 1977 period at those locations shown in Fig 4 and at other sites.

4.5 Vibrocoring:

As noted in Section 2.7 it had been hoped to carry out sediment sampling

using the IOS vibrocorer, during a cruise in October 1976. Because this cruise was cancelled the cores will now have to be obtained at a later date. The purpose of these observations will be twofold:

(1) to determine the thicknesses of deposits of potentially mobile sediments and to examine their internal structure and

(2) to determine the depth of burial of radioactively labelled material as a precursor to calculations of the possible rates of sediment transport from the observed displacement of the tracer (see 2.8). Sediment cores will be returned to AERE Harwell where their concentration in the profiles will be determined using gamma spectroscopy techniques.

Other field work likely to be carried out in the next year includes sea bed drifter studies, beach profile measurements and additional sediment sampling.

Desk studies are likely to include further use of computer-based wave refraction techniques, in conjunction with littoral drift calculations, and an appraisal of relevant sediment transport theories which will be combined with available data on tidal and wave induced currents.

5. ASSESSMENT OF PROGRESS TOWARDS THE OVERALL AIMS OF THE PROJECT

The Swansea Bay project has now run for rather more than half its planned duration and it is relevant to consider the extent to which progress has been made towards its declared objectives.

The overall aims of the project are to obtain field data from offshore and the foreshore and to use these data, largely within the limits of present scientific knowledge and techniques for interpretation, to produce an integrated assessment of sediment transport. At the same time it is hoped to improve the techniques themselves as they relate to this type of study. These objectives have relevance not only for Swansea Bay but for wider application elsewhere. For the specific area, the aims are to define the overall circulation pattern of sediment transport within the Bay and to attempt to quantify it, especially in respect of the amount of sediment reaching the coastline from offshore.

Three overlapping phases of the work have been identified:

(a) A desk study to evaluate existing sources of information: the results of this study to be used in developing the main research programme.

(b) A field programme to obtain data.

(c) Analysis and assessment of those data.

Phase (a) is complete and writing-up is in progress. Phase (b) has now reached a fairly advanced stage despite a number of setbacks. However, so far Phase (c) has only been undertaken at a level sufficient to validate the field data obtained. The volume of analysis remaining to be done gives cause for concern, especially since it is on the integration of data and the associated analysis that the project will stand or fall.

IOS is confident that the Swansea Bay project will result in an important advance in both local knowledge and in a more general understanding of physical systems in the coastal environment. Nevertheless several problems have arisen or appear likely to arise which cannot be solved in the present context. These will need a different scientific approach - for example, a detailed study of individual small scale phenomena - or the acquisition of comparative data from other sites in order to provide a reasonable chance of their being resolved.

Table 1

Date of Flight	Area of Peat or Clay exposed on beach (m^2)	
	Pt Talbot - River Kenfig	River Kenfig - Sker Pt
April 1968	32,000	None
June 1970	35,000	3,500
Oct 1975	44,500	28,000

Area of underlying peat and clay exposed on the foreshore between Port Talbot and Sker Point (Fig 1): 1968 - 1975.

Table 2

Summary of Current Meter Data returns from Swansea Bay

(in period October 1975 to July 1976)

Long term current measurements

Meter No	Meter type*	Station	Height (m)	Deployment periods from	to	Record status
KA 237)	P/6	A	10	7.10.75	28.11.75	Incomplete
KA 238)	P/4	A	3	7.10.75	28.11.75	Complete
KA 232)	P/6	A	10	28.11.75	27. 1.76	No data
560)	P/4	A	3	28.11.75	27. 1.76	No data
KA244)	P/6	A	10	27. 1.76	9. 4.76	Incomplete
KA 238)	P/4	A	3	27. 1.76	9. 4.76	Incomplete
KA 237)	P/6	A	10	9. 4.76	6. 6.76	Incomplete
560)	P/4	A	3	9. 4.76	6. 6.76	Complete
KA 232)	P/6	A	10	6. 6.76	27. 7.76	Complete
629)	P/4	A	2	6. 6.76	27. 7.76	Complete
KA 244)	P/6	A	10	27. 7.76		
669)	P/4	A	2	27. 7.76		

Short term current measurements

('Winter')

KA 246	P/4	B	1	7.10.75	LOST	No data
556	P/4	C	1	8.10.75	LOST	" "
559	P/4	D	1	10.10.75	LOST	" "
557	P/4	E	1	10.10.75	LOST	" "
532	P/4	F	1	11.10.75	24.11.75	Complete
573	P/4	G	1	11.10.75	28.11.75	"
626	P/4	H	1	8.10.75	26.11.75	"
				('Summer')		
594	P/4	B	2	2. 6.76	27. 7.76	Complete
667	P/4	C	2	6. 6.76	26. 7.76	"
1877	B/6	D	2	4. 6.76	26. 7.76	"
1878	B/6	E	2	4. 6.76	26. 7.76	"
1885	B/6	F	2	6. 6.76	26. 7.76	"
KA 263	P/4	G	2	4. 6.76	26. 7.76	"
KA 267	P/4	H	2	2. 6.76	26. 7.76	"
534	P/4	I	2	7. 6.76	27. 7.76	"
532	P/4	J	2	7. 6.76	27. 7.76	"

*Meter Types: P denotes Plessey M021 meter, B denotes Bergen meter
4 and 6 denote number of parameters

TABLE 3

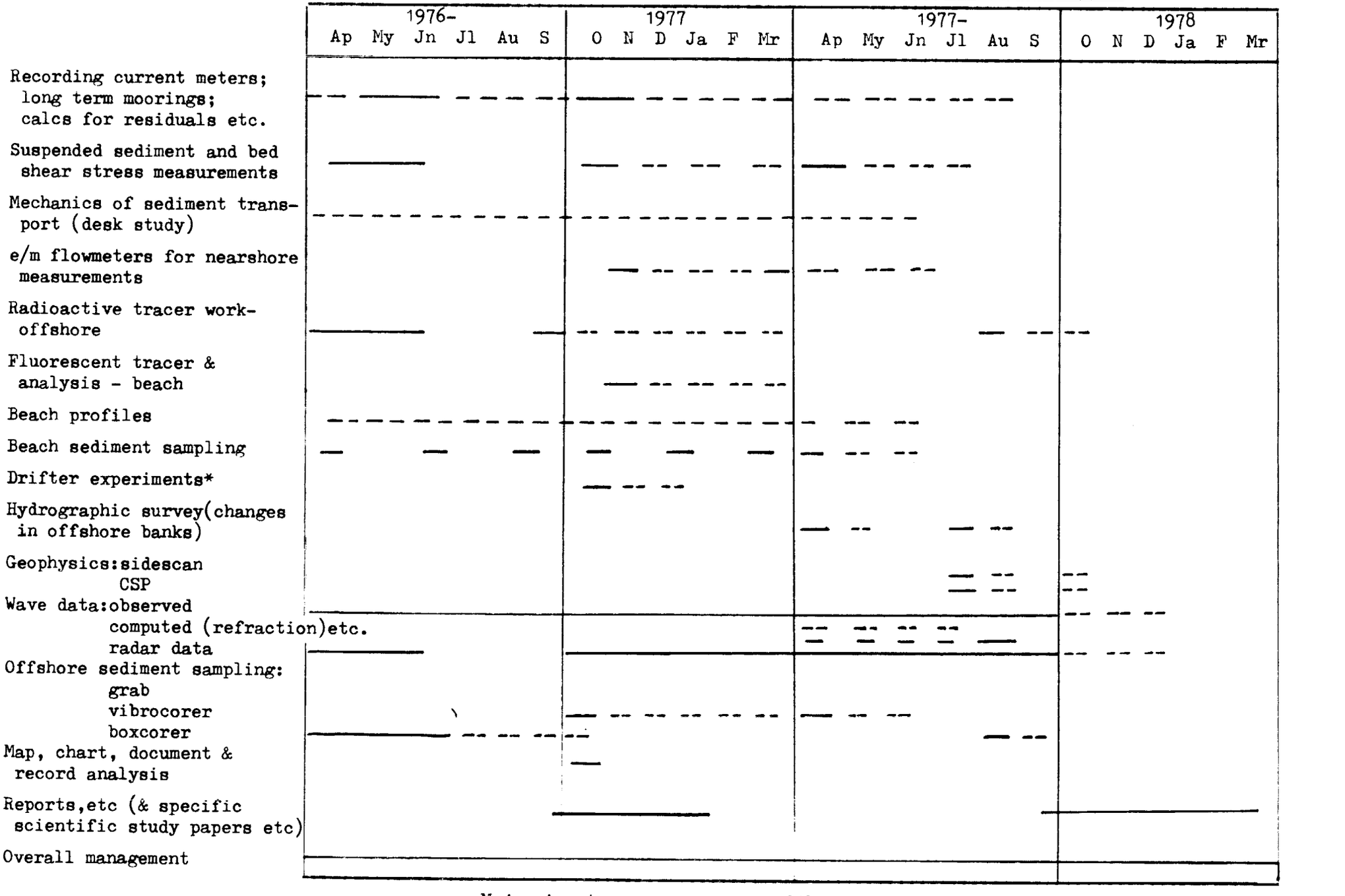
Profile measurement No 7, Stn. PS2: Started 1610/30/3/76. Finished 1633/30/3/76

Sample No	Elevation (m)	Weights of inorganic material (g)					Total weights (g)	Total concentrations (mg l^{-1})
		Particle size ranges (μm)						
		> 150	150-106	106-75	75 - 63	63 - 40		
37	.07	.0087	.0447	.1865	.1132	.2739	.6270	160.36
38	.12	.0107	.0300	.1251	.0990	.2800	.5448	92.18
39	.22	.0062	.0064	.0504	.0476	.1438	.2544	55.96
40	.42	.0026	.0040	.0386	.0534	.1587	.2573	36.05
41	.82	.0035	.0042	.0128	.0167	.1002	.1374	7.91
42	1.72	.0008	.0009	.0056	.0038	.0768	.0279	0.71

Suspended sediment concentrations in various particle size ranges from six elevations above the sea bed at Station PS2 (see Fig 1). The mean flow at the surface was approximately .5 ms^{-1}.

Table 4 Provisional Research Programme : Swansea Bay

April 1976 - March 1978



——— Major input ------- Other input -- -- -- Data processing & lab work

*In conjunction with UCW Swansea

Appendix 1

University College Swansea (UCS) Research Contract

(Sediment transport through the area south of eastern Gower, as related to the sediment budget of Swansea Bay).

The UCS contract research area is illustrated in Fig 1. Work was commenced on the contract, by Dr G Ferentinos, in January 1976. A meeting took place at University College, Swansea, on 15 January 1976, at which the broad outlines of the proposed research were discussed. The first interim report by UCS was submitted to IOS in April 1976 and a second meeting took place on 10 May 1976 at Taunton, to discuss both this and future work.

The first 3 months of the research were confined to collating available sediment grain size data and in determining the grain size and texture of recent sediments in the area offshore of Mumbles and Oxwich Bay.

The broad and tentative conclusion of these early investigations has been that it may be possible to identify areas having different depositional environments in terms of mean grain sizes and sorting coefficients.

More recent work has included continuous seismic profiling and side-scan sonar observations to identify those areas where deposits of potentially mobile material may occur; also some direct reading current meter measurements have been made in Oxwich Bay.

In June and July 1976 IOS Taunton deployed two Plessey M021 recording current meters (Station I and J in Fig 1) in the UCS contract area. It is hoped that the data obtained from these current meters will confirm the likely directions of sediment transport as inferred from available hydrographic and sedimentological data (particularly the orientation and asymmetry of sand wave fields).

UCS also hopes to use the current meter data and inferred wave activity at the sea bed to determine the response of sediments to the various hydraulic regimes.

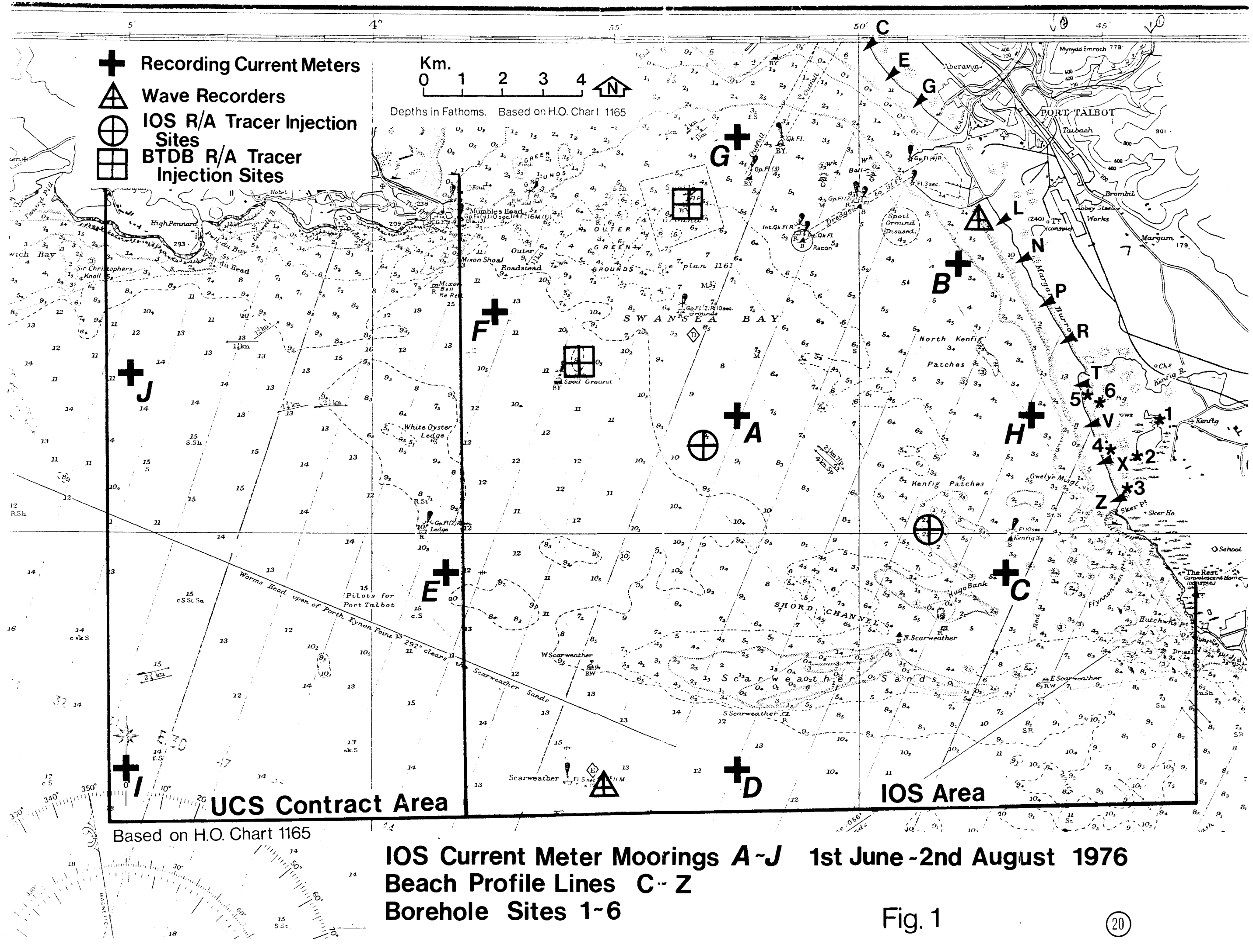
Future work by UCS includes the installation of pneumatic tide gauges at Oxwich Point, Mumbles Pier and Porthcawl.

Appendix 2
Proposed Major Industrial Developments

After the 1939-45 war the British Steel Corporation built their Margam steel works. This, together with ancillary activities, provides a major impact on the coastline of the research area. In 1968 the BTDB commenced construction of the Tidal Harbour at Port Talbot. The latter became operational in 1971.

There are a number of new developments and proposals for development relating to both these major activities, parts of which will be liable to affect the long-term evolution of the E side of Swansea Bay. These include plans to dredge the deep water approach channel to the Tidal Harbour from 31 to 51 feet (9.4 to 15.5m) and the construction of a new outfall from the extended steelworks down the beach and thence offshore for a length of 3.5km. Both proposals would be likely to have some influence on the offshore and longshore sediment circulation.

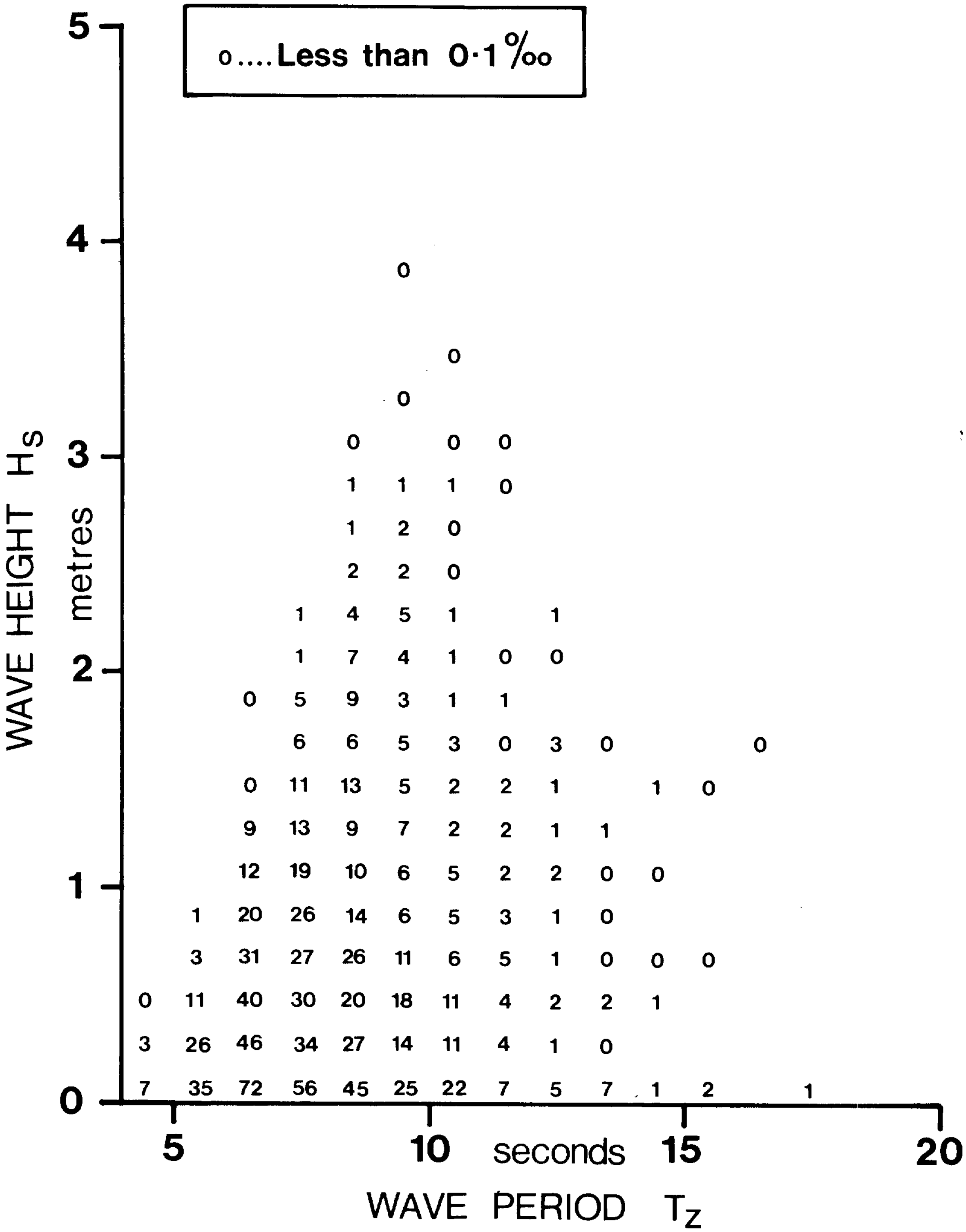
More tentative plans include the reclamation of land south of the tidal harbour. Such a scheme would have greater long-term significance on the research area and might well affect the conclusions of the current IOS Research Programme as far as the latter's local implications are concerned.



Based on H.O. Chart 1165

IOS Current Meter Moorings *A*~*J* 1st June~2nd August 1976
Beach Profile Lines C~Z
Borehole Sites 1~6

Fig. 1

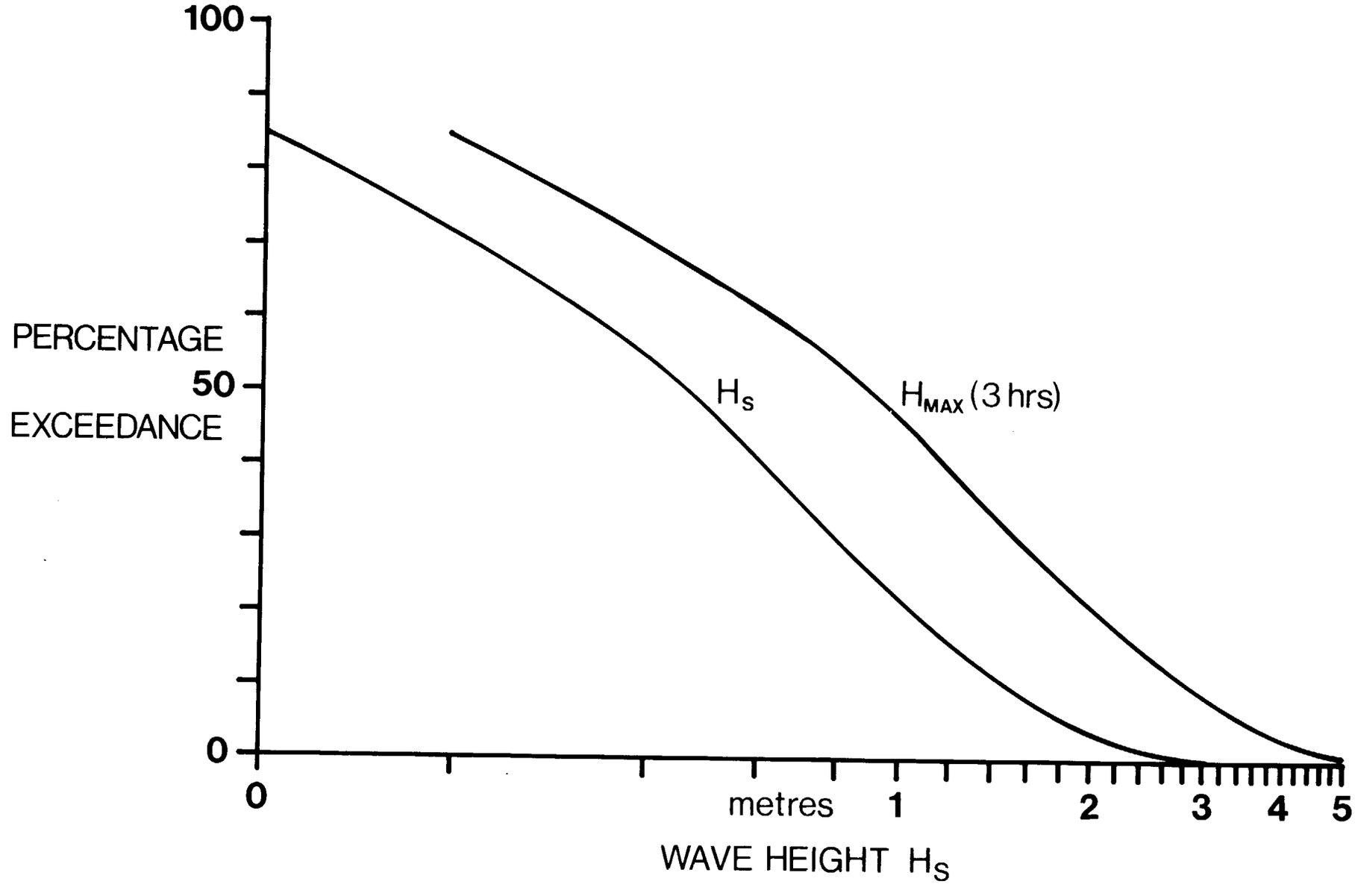


Wave data analysis of 2319 observations for the Waverider buoy situated near Scarweather light vessel. Oct.1974 – Sep. 1975.

Wave scatter diagram. Occurrences per thousand.

Fig. 2a

Fig. 2b



Wave data analysis of 2319 observations for the Waverider buoy situated near Scarweather light vessel. Oct. 1974 - Sep. 1975.

Significant and maximum predicted wave height.

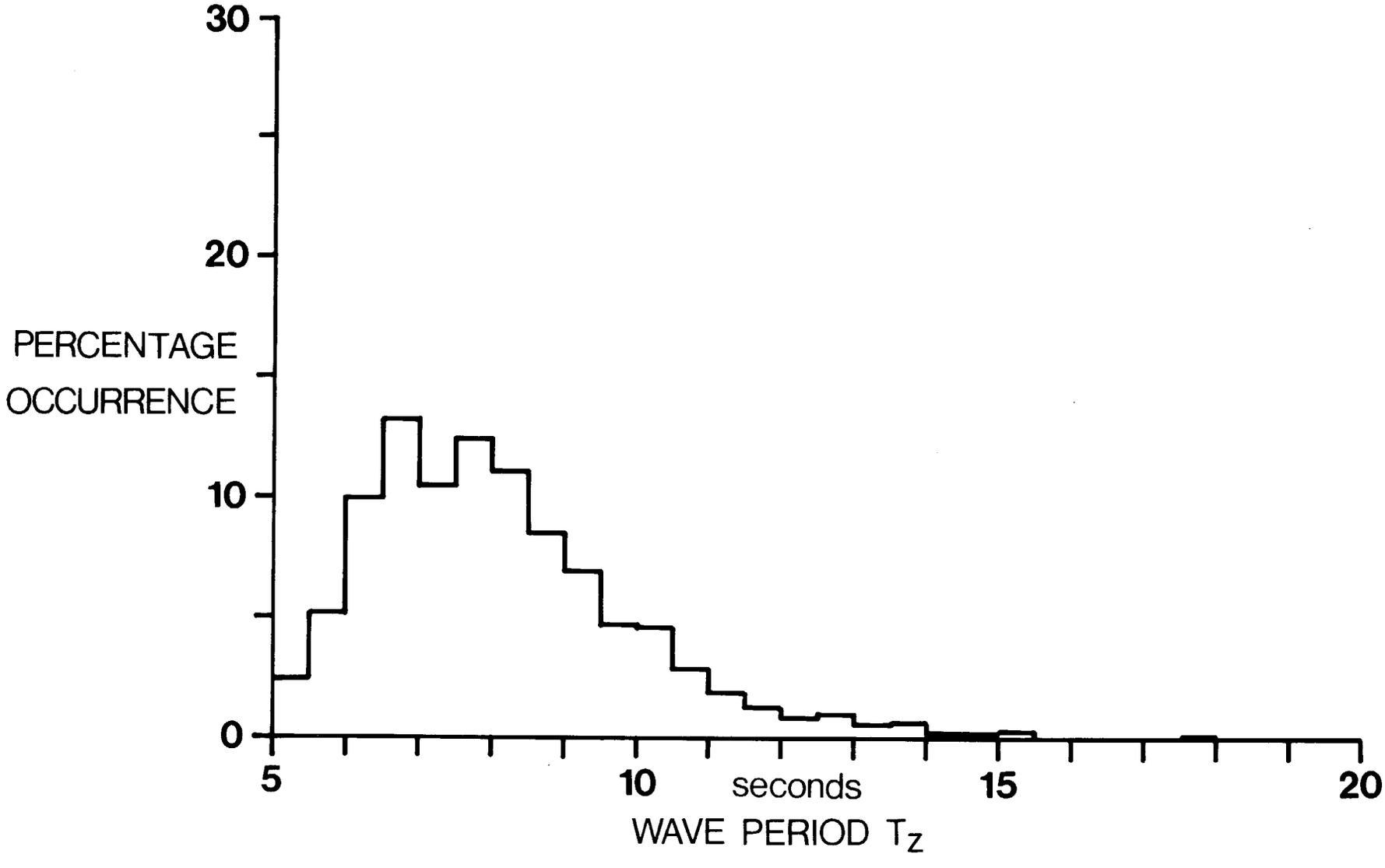


Fig. 2c

Wave data analysis of 2319 observations for the Waverider buoy situated near Scarweather light vessel. Oct. 1974 – Sep. 1975.

Percentage occurrence.

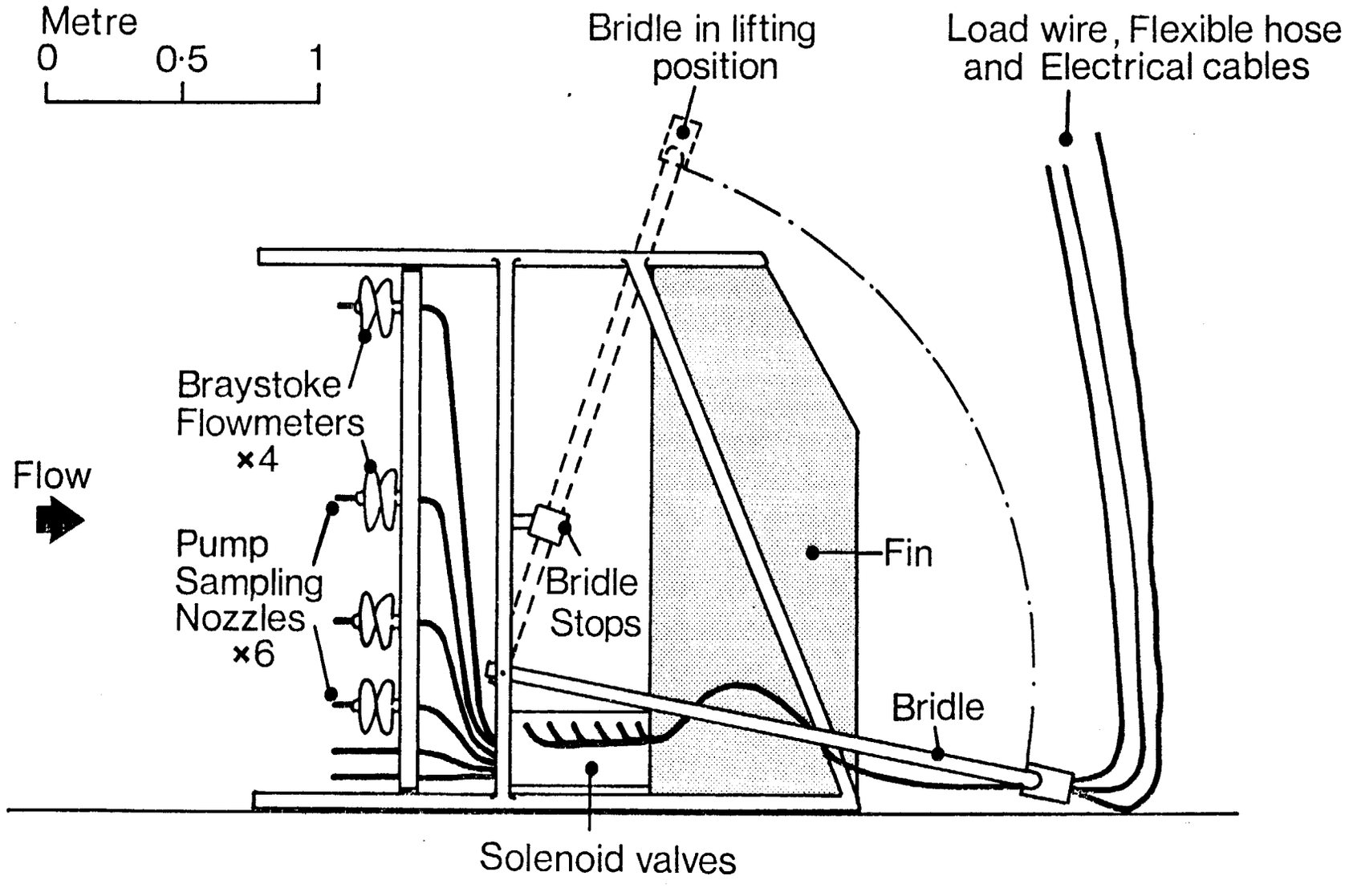
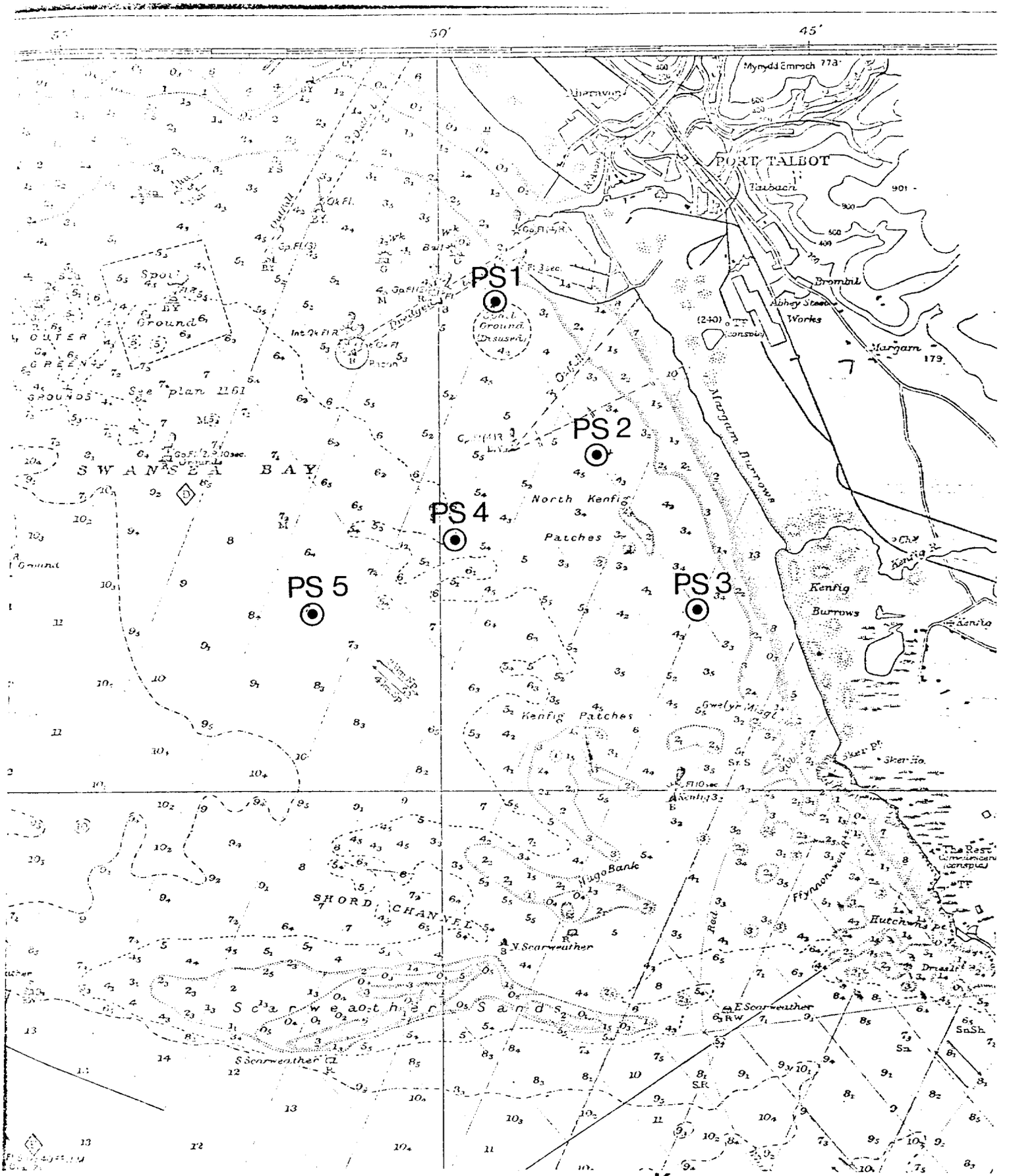


Fig. 3

Schematic diagram of Pumped Sampling Apparatus.



⊙ Pumped Sampling Stations

Depths in Fathoms. Based on H.O. Chart 1165

Pumped Sampling Stations

Fig. 4

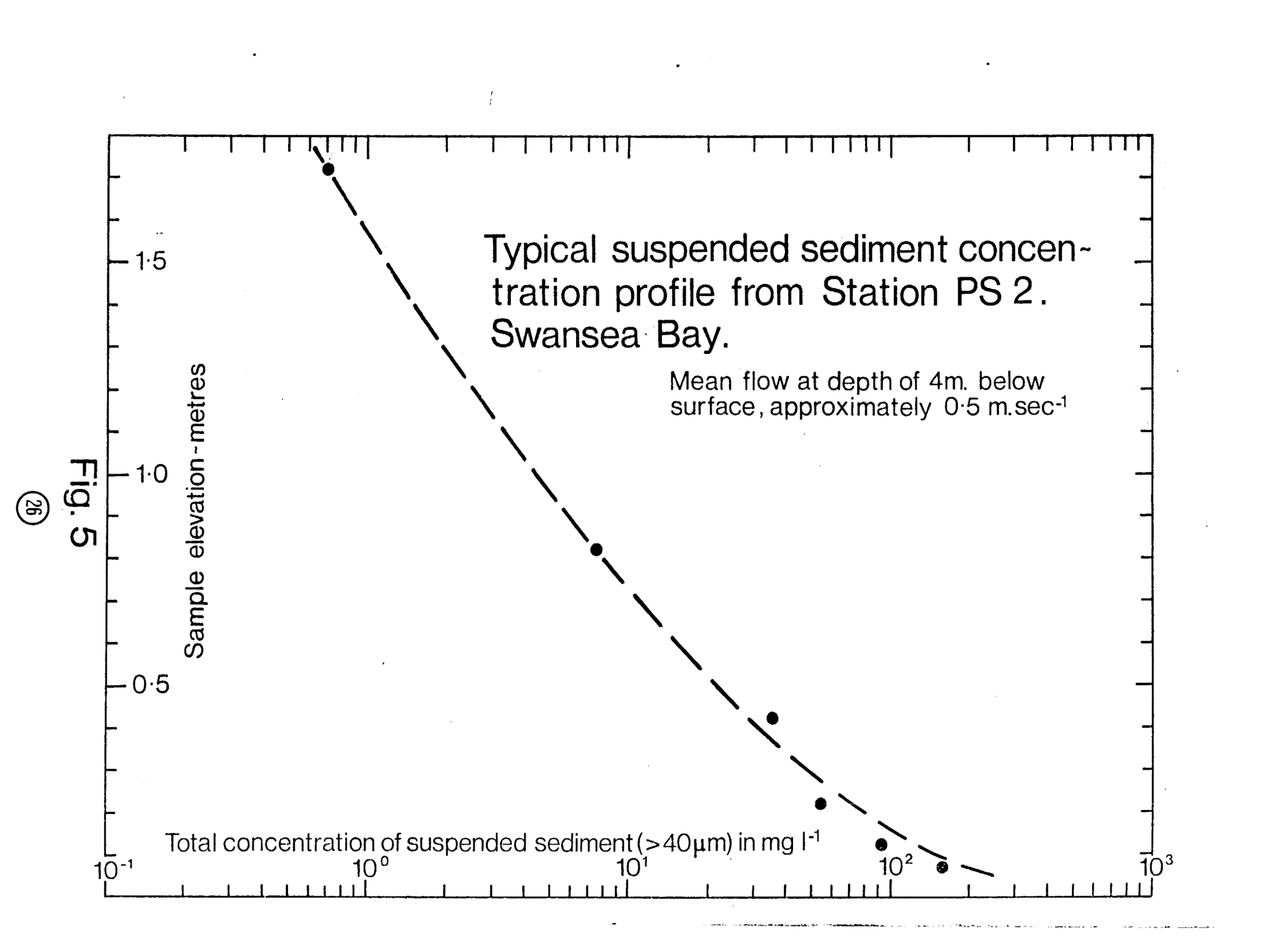
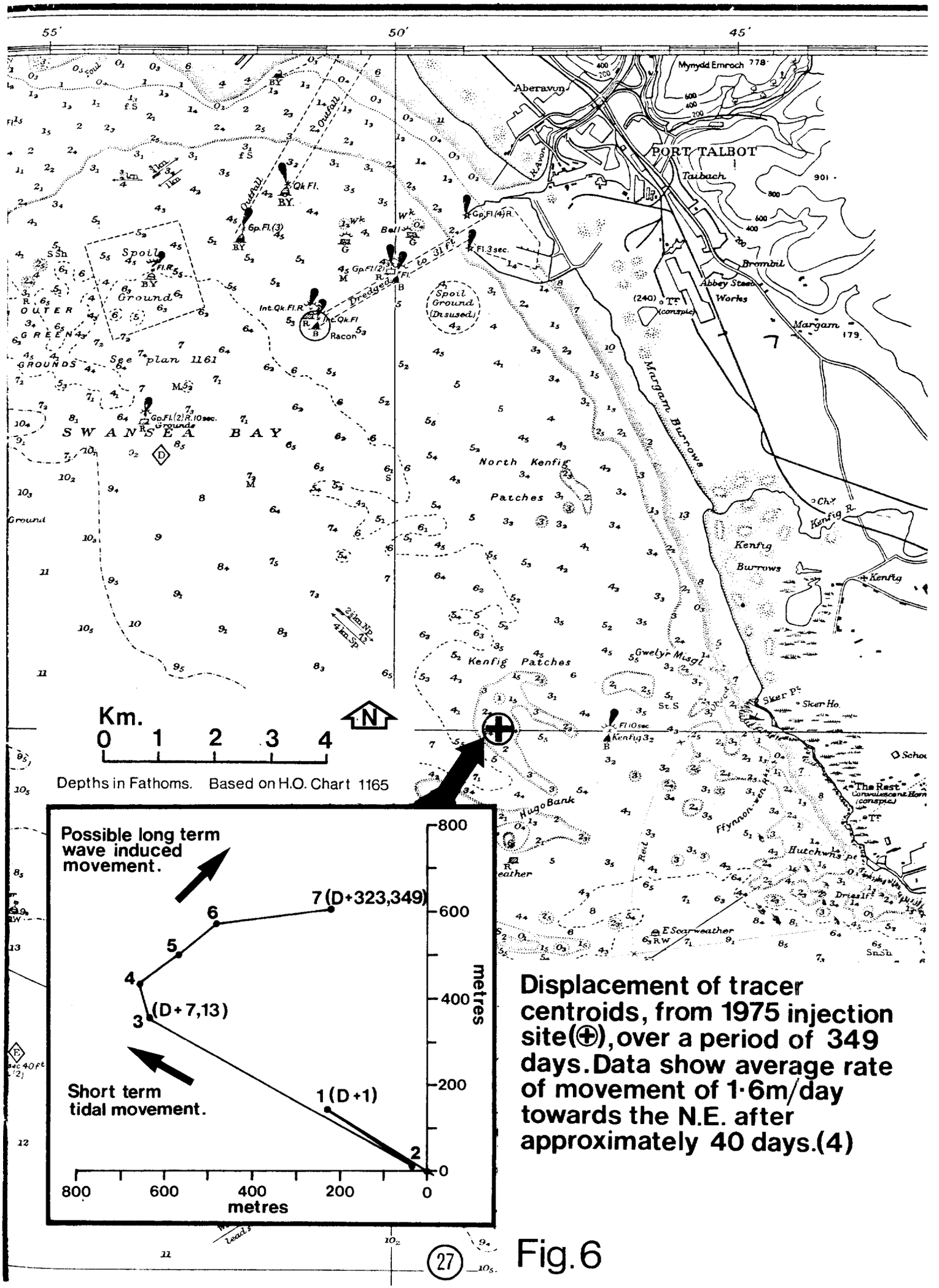
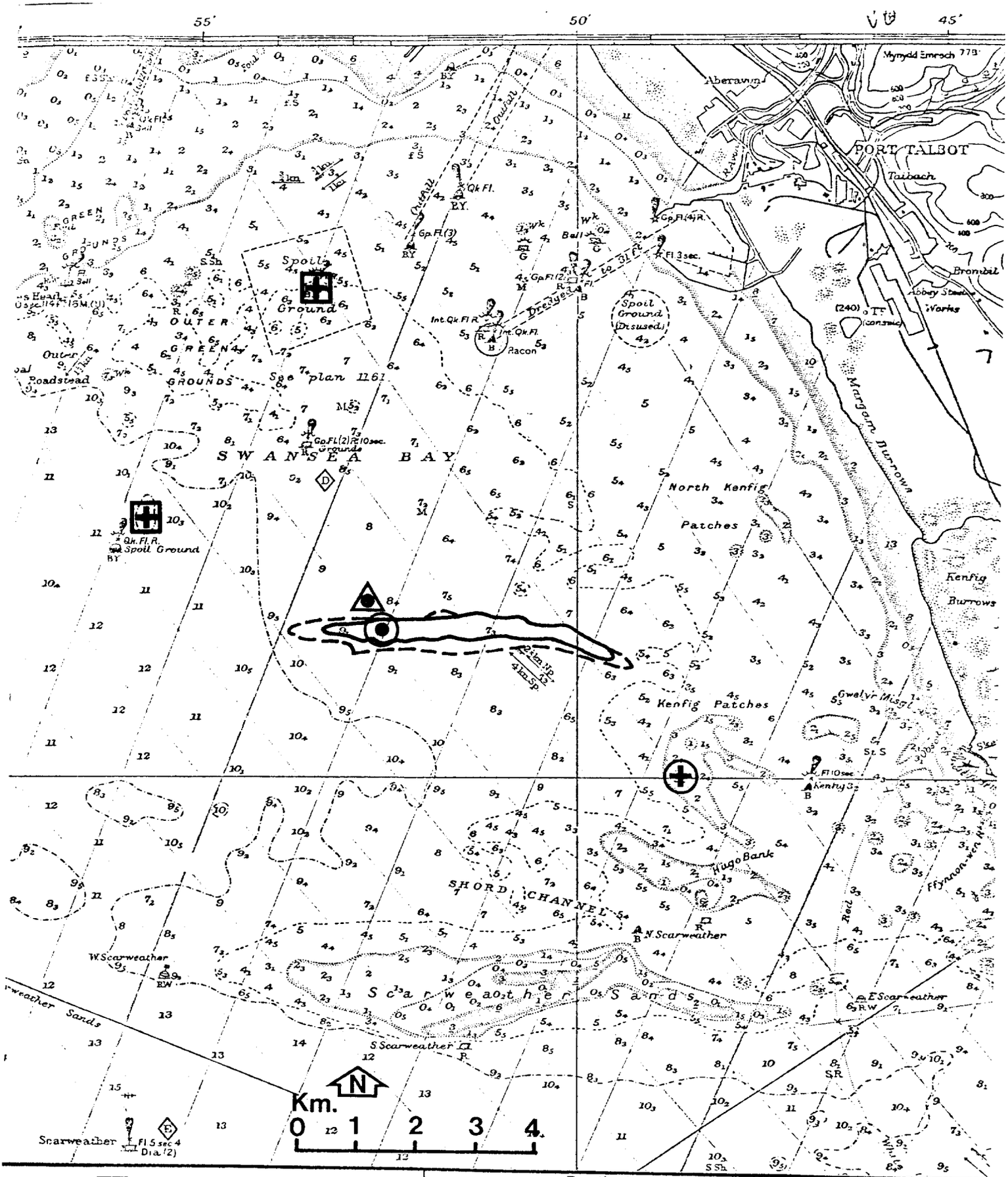

Typical suspended sediment concentration profile from Station PS 2. Swansea Bay.
Mean flow at depth of 4m. below surface, approximately 0·5 m.sec-1
Sample elevation - metres
1·5
1·0
0·5
Total concentration of suspended sediment (>40μm) in mg l-1
10-1
10 0
10 1
10 2
10 3

Fig. 5



Displacement of tracer centroids, from 1975 injection site(⊕), over a period of 349 days. Data show average rate of movement of 1·6m/day towards the N.E. after approximately 40 days.(4)

Fig.6



Depths in Fathoms. Based on H.O. Chart 1165

- BTDB Injection Site.
- 1975 IOS Injection Site.
- 1976 " "
- Long Term Current Meter Mooring
- —— Dispersal after 2-3 Days
- --- " " 5-6 "

RADIOACTIVE TRACER INJECTION SITES AND INITIAL DISPERSION PATTERNS (APPROXIMATE ONLY). FIG. 7