NRA - Water Quality 51

National Rivers Authority
National Centre for Instrumentation and Marine Surveillance

Report No NC/mar/006
Revision 2.0: December 1995.

National Marine Baseline Survey Manual

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APPENDICES

1.0 SAFETY

1.1 POLICY

- ☐ **All vessels and staff must comply with NRA policy:**

  Health and Safety Manual
  Code of Practice - Marine Activities Part I and II

1.2 COSHH & Risk Assessments

- ☐ Each vessel is responsible for producing risk assessments of all procedures carried out on vessels and COSHH for all chemicals used on baseline survey. These documents will be stored visibly on the vessel and made available to all staff concerned. All personnel using or working near chemicals must have read, and understood, the relevant COSHH documents.

1.3 Protective Clothing

- ☐ All personnel will wear suitable protective clothing relative to conditions and working environment e.g. lifejackets, hard hats, waterproof clothing, disposable gloves in accordance with NRA guidelines.

1.4 Manning levels

- ☐ Vessels performing surveys will have a minimum of three staff on-board whilst underway. Small boats used to perform calibration runs will contain a minimum of two persons in accordance with NRA practice.

1.5 Training

- ☐ Staff will be trained in specific aspects of working in the Marine Environment e.g. survival at sea, fire fighting.

1.6 General Vessel Safety Procedures

- ☐ All personnel joining a survey vessels will be given a full briefing by the Survey Officer to include all aspects of EMERGENCY PROCEDURE prior to sailing. Any defects in vessel emergency equipment must be reported immediately to the Master and Regional Line Manager.

2.0 THE NATIONAL BASELINE SURVEY

The NRA has a duty, under the 1991 Water Resources Act, to monitor controlled waters. Controlled waters include estuarine and coastal waters out as far as the three nautical mile limit. The coastal baseline survey was introduced in 1992, and extended nationally in 1993, as a means of meeting this objective.

The surveys provide a means of collecting background levels of contaminants to provide a baseline of water quality in the coastal zone. These surveys have taken the form of simultaneous boat and airborne surveys in Spring, Summer and Autumn and a boat survey in Winter (when weather conditions render the aerial surveillance difficult), around the coast of England and Wales. The four NRA survey vessels (Water Guardian, Sea Vigil, Coastal Guardian and Vigilance) are used to perform the boat work and a chartered light aircraft used for the aerial surveillance work.

The boat based surveys included:

- Spot data:
  - Samples are collected from sites and analysed at NRA laboratories for nutrients, chlorophyll-a, suspended solids, metals and organics. The samples are collected from a depth of 1 metre.
  - Vertical profile data (transmission, dissolved oxygen concentrations, temperature and salinity and chlorophyll-a) are recorded at set depths at the baseline points.
- Continuous data: underway sampling was performed, such that
  - dissolved oxygen concentrations, conductivity, pH, temperature, depth, salinity, transmission and chlorophyll-a are measured at 10 second intervals. Data are collected from a towfish at a depth of 4.0 m (when possible) and by probes in a flow cell or moon pool with an intake depth of 1.0 m.
  - nutrient data (phosphorus, ammonia, nitrite, TON and silicate) are collected at 2 minute intervals from a depth of 1 m using an on-board Skalar autoanalyser.

The airborne surveys have provided continuously acquired data in the form of:

- image data from the CASI (Compact Airborne Spectral Imager) instrument which has the potential to provide quantitative information on chlorophyll-a and SPM (suspended particulate matter) concentrations as well as providing information on the location and extent of other phenomena affecting water colour.
- thermal data from an infra-red (thermal) imager which is used to provide information on the location and the extent of thermal anomalies.

3.0 SAMPLING METHOD

3.1 Preparation of the sample container

- The sampling container, a five litre HDPE (high density Polyethylene) bottle, should be rinsed at the start of each working day with about 100 ml of 20% Nitric Acid (made by diluting 20 ml concentrated nitric acid with 80 ml deionized water), and rinsed with seawater. The sampling container must be rinsed with sample at each site to reduce cross contamination. The samples must all be collected from over the side of the boat (never from pumped supply), well away from engine discharges and sacrificial anodes.

3.2 TOTAL METALS (except mercury)

- Sample is poured directly into a the bottle without allowing the suspended solids to settle. In exceptional circumstances the sample container may be agitated to ensure a good suspension of solids in the sample.

3.3 TOTAL MERCURY

- Sample is poured directly into a glass bottle containing a few ml of chromic acid as preservative, without allowing suspended solids to settle. In exceptional circumstances the sample container may be agitated to ensure a good suspension of solids in the sample.

3.4 DISSOLVED METALS

- A new syringe and filter cartridge are used for each sample. A 60 ml HDPE (high density polyethylene) syringe is filled with sample and rinsed, a 0.45 µm encapsulated filter is attached and about 20 ml of sample run to waste to flush membrane. About 150 ml of sample is filtered into the bottle, the syringe being refilled as necessary. No more than one filter should be used for each sample; a smaller sample should be submitted for highly turbid waters.

3.5 DISSOLVED METALS - BLANK

☐ A new syringe and filter cartridge are used. A 60 ml HDPE (high density polyethylene) syringe is filled with de-ionized water, supplied by the analysing laboratory, and rinsed. A 0.45 µm encapsulated filter is attached and about 20 ml of water run to waste to flush membrane. About 150 ml of water is filtered into the bottle, the syringe being refilled as necessary.

A blank determination should be carried out no less frequently than once per day or twelve hour period of survey. The blank must be identified by Date, Time and Reference Number:

Vigilance	60899700
Sea Vigil	60399800
Water Guardian	60199900
Coastal Guardian	60799600

For boats using Llanelli, logs and labels should be supplied for blanks and used as for all other samples.

3.6 ORGANICS

☐ The sample should be removed directly from the sea into a glass bottle without using a separate sampling container. An air space roughly level with the neck of the bottle is normally required in the bottle to allow addition of extraction solvent at the laboratory. Do not rinse the bottle as it contains traces of solvent (acetone or hexane).

3.7 SUSPENDED SOLIDS

☐ The bottle should be filled directly from the HDPE sampling container, without allowing the particles to settle, and capped. The bottle should be stored in a cool place. In exceptional circumstances the sample container may be agitated to ensure a good suspension of solids in the sample.

3.8 NUTRIENTS

☐ A new syringe and filter cartridge are used for each sample. A 60 ml HDPE syringe is filled with sample and rinsed, a 0.45 µm encapsulated filter is attached and about 20 ml of sample run to waste to flush membrane. About 100 ml of sample is filtered into the bottle, the syringe being refilled as necessary. No more than one filter should be used for each sample. The sample is immediately frozen and a temperature of -20°C maintained until the samples are analysed.

☐ A second sample is filtered for nutrients, in an identical manner, and retained for analysis by the on-board Skalar auto analyser at the end of each days work to help AQC procedures.

3.9 CHLOROPHYLL

- A one litre volume of sample is filtered through a 4.7 or 7.0 cm diameter GF/C filter paper preferably at atmospheric pressure. If pressure must be used to speed up the filtration then it must be applied below the paper at less than 10 psi. Pressure applied above the filter paper may cause cell rupture and subsequent loss of chlorophyll. The paper should not be allowed to dry since this will cause cells to split and result in leaching of pigments. The paper is folded together to trap the residue and wrapped in a small piece of aluminium foil. The sample is placed in a plastic bag, frozen and a temperature of -20°C maintained until the samples are analysed at the laboratory. When the sample is highly turbid a smaller volume may be filtered (volume clearly marked on each sample bag and the log sheets).

4.0 ANALYTICAL QUALITY CONTROL AND CALIBRATION

4.1 Introduction

- Good quality instrumentation which is regularly calibrated and checked with quality control standards is absolutely essential to any survey. Without confidence in the results produced by the boat, it is not worthwhile leaving port. The main approaches to calibration and quality control recommended here include:
  - standard and reference solutions e.g. pH buffers, zero oxygen water.
  - the use of "physical standards" e.g. standard resistors and transmission filters.
  - the use of cross calibration between two or more units measuring the same determinand.

4.2 pH

- Continuous pH measuring devices should be calibrated at least every 12 hours. If on a long survey it may be necessary to suspend the data collection to recalibrate. The pH should be calibrated using ready-made buffers pH 7, 8 & 9 (Fisons or any reputable ready made pH buffer manufacturer). A low ionic strength pH 7.6 buffer, supplied by the National Centre, will be used as a check of pH electrode operation.

  The first three buffers are used to calibrate the probes and the value logged on the calibration sheet and the last pH 7.6 buffer will highlight slow response times.

  The pH probe should be cross-checked with all other pH measuring devices on board. All devices are lowered into an area of water at the rear of the vessel and after a short period the various readings noted on the log sheet. This will ensure that any drift, or mechanical damage, associated with individual instruments will be detected.

4.3 Temperature

- Ensure that the calibration from the manufacturer is valid prior to the start of the survey.

  The temperature probe should be cross-checked with all other temperature measuring devices on board. All devices are lowered into an area of water at the rear of the vessel and after a short period the various readings noted. This will ensure that any drift, or mechanical damage, associated with individual instruments will be detected.

4.4 Dissolved Oxygen

☐ Continuous dissolved oxygen measuring devices should be calibrated at least every 12 hours. If on a long survey it may be necessary to suspend the data collection to recalibrate. Saturated water may be obtained by bubbling air, from an aquarium pump and air stone for instance, through distilled water for 15-20 minutes. The oxygen probe is then placed in the solution and left for several minutes, stirring continuously, until the reading stabilises and may be taken as representing the 100% value. Alternatively, the probe is held in a bucket containing sea water for a few minutes. It is then removed, shaken and placed in a container with moist tissue at the bottom and the readings observed. The 100% value is obtained when the reading from the instrument reaches a maxima. Note, which ever of the above methods are used, the previous 100% readings must be noted for QC purposes. The probe is then placed in a beaker containing a saturated solution of sodium sulphite and allowed to stand for about five minutes to allow full removal of dissolved oxygen. The previous value is noted for 0% saturation before inserting the calibration value. This will give details about the drift associated with the equipment since the last calibration.

The DO probe should be cross-checked with all other DO measuring devices on board. All devices are lowered into an area of water at the rear of the vessel and after a short period the various readings noted. This will ensure that any drift, or mechanical damage, associated with individual instruments will be detected.

4.5 Conductivity

☐ The conductivity probes should be checked on a daily basis using resistance loop.

The conductivity probe should be cross-checked with all other conductivity measuring devices on board. All devices are lowered into an area of water at the rear of the vessel and after a short period the various readings noted. This will ensure that any drift, or mechanical damage, associated with individual instruments will be detected.

4.6 Transmission

☐ The transmission should be checked at least every week. Transmission values for 0%, blocking the light path totally, and 100%, maximum light passage, can be recorded and the raw values recorded to give details about the drift associated with the equipment since the last check. The shutter can be used to check the transmission value when the light passage is partially blocked and this value used to assess stability.

The transmission device should be cross-checked with all other transmission measuring units on board. All devices are lowered into an area of water at the rear of the vessel and after a short period the various readings noted. This will ensure that any drift, or mechanical damage, associated with individual instruments will be detected.

4.6 Chlorophyll

- The fluorometer must be calibrated by the manufacturer and one unit e.g. Turner should be cross checked against boat units from other regions to confirm similar operating specification. Chlorophyll-a standards appear to be so unstable that it is not recommended that they are employed.

  The chlorophyll measuring devices should be cross-checked with any others devices available on board. All devices are lowered into an area of water at the rear of the vessel, or allowed to examine water removed from that vicinity, and after a short period the various readings noted. This should ensure that any drift, or mechanical damage, associated with individual instruments will be detected. In the case of pumped devices (e.g. Turner) the sample intake should be in the same vacinity as the in-situ instrument.

5.0 WATER COLUMN PROFILING

5.1 Introduction

☐ At Baseline sites a profile is required of the water column from the surface down to the sea bed where practical. Information recorded includes depth, temperature, salinity and dissolved oxygen with additional data from transmission and chlorophyll-a, if available. This data will be used to assess stratification and detect different bodies of water.

5.2 Method

☐ A water quality probe such as the Chelsea Chemitraka is suspended in the water from a frame well away from the engine discharges. The unit is held at various depths and the readings allowed to stabilize prior to recording. When weather conditions do not permit the near surface measurements to be recorded accurately, due to swell, only the deeper values should be recorded. In very rough sea conditions, vertical profiling should not be attempted on the grounds of health and safety, in this situation it is probable that the water will be well mixed and little stratification will occur.

5.3 Depths

☐ Values for probe should be recorded at:

- Surface - if this seems sensible given the prevailing sea conditions
- 0.5 m
- 1 m
- 2 m
- 5 m
- 10 m
- 15 m etc. at 5 m intervals to the sea bed.

5.4 Recording

☐ Data from vertical profiles must be logged in two ways. At the baseline site the Qubit line should be halted and a new line name entered (e.g. VP51 for site 51). The line is then started to record data as the profiler is lowered through the water column. At each depth allow the probes to stabilize and the stable values for temperature, salinity and dissolved oxygen should be recorded into the profiler data sheet (see attached copy). The probe should be recovered slowly with the line still logging to produce a second set of data. Once the probes have been recovered the Qubit line should be stopped and the next Baseline point and line selected. Data logged onto paper must be entered into spreadsheet format and sent to the National Centre by the required dates (a spreadsheet template is supplied).

NOTE - On-scene conditions such as wind and tide conditions must also be logged on data sheets.

6.0 DAILY PROCEDURES

- During the agreed baseline survey period, or until the assigned survey patch has been covered, the survey vessel and staff will remain available for survey duties. It is the responsibility of the Master to ensure that the vessel is in a seaworthy condition prior to and during the survey period.

- The vessel should only set sail for a survey, or continue, if all the survey equipment is working within tolerance and providing good quality calibrated data. If any of the equipment is not performing then the National Centre will decide whether it should continue, wait for the problem to be solved or another vessel requested to cover the survey area.

- As a minimum each survey vessel must utilize the following equipment during all parts of the baseline survey:

  - A towed body electrode array analysing at a depth of four metres below the surface. In extremely shallow waters the body may be recovered to a depth of two metres below the surface and returned to four metres as soon as the danger has been passed e.g. Wash. (Minimum array must include temperature, depth, conductivity, pH, fluorescence, DO and transmission).

  - An electrode array analysing waters at a depth of one metre below the surface i.e. flow cell or moon pool, and used to profile the water column to the sea bed at baseline sample sites. (Minimum array must include temperature, depth, salinity, pH, fluorescence, DO).

  - A nutrient analyser measuring nitrite, TON, ammonia, phosphate and silicate at regular intervals not exceeding three minutes or 500 metres distance along track.

  - A sampling device capable of removing a water sample from a depth of 1.0 metres without causing contamination.

7.0 SKALAR OPERATION

7.1 Skalar Analytical Methods

- It is not considered necessary to try to adopt one set of methods for the analysis of nutrients. This section will limit itself to a general routine of operation for the analysis of the five nutrients.

7.2 Precision Testing

- All nutrient auto-analysers used for National Centre Baseline work should be tested in accordance with the WRC Technical Report NS 30, or at the least it must be demonstrated that they work to this specification.

7.3 Continuous Analysis

- The Skalar must be run in semi-continuous mode with filtered samples being analysed corresponding to about 500 metre sample points.

- The sample must be removed from the sea using a peristaltic pump sampling water from a depth of one metre well away from any discharges, preferably the bottom of the hull. The positive pressure side of the pump will feed one of the following arrangements:

    - A 0.45 µm exclusion filter (Whatman Gamma 20, Part No. 1915004) is connected to the output from the pump. The output from the filter will feed a flow cell from which the Skalar auto-sampler can remove samples. The delay between the uptake of the water sample and entering the flow cell must not be greater than 90 seconds; increase the peristaltic pump rate, if necessary to achieve this. The exact time delay should be calculated and used to adjust the sample time.

    - A membrane filter holder, utilizing a 0.45 µm membrane, can be attached to the output from the peristaltic pump and only the water required for analysis is filtered and passes directly into the auto-sampler (details available from PAL).

- The clock on the sampler must be checked and adjusted to ensure that all sampling intervals are two minutes, irrespective of the value on the dial. The clock timers are consistent but not accurate.

7.4 Reagents

- Reagents for nutrient analysis should have their shelf lives examined, and the findings used to ensure that all reagents are fit for the purpose.

7.5 Standards

- Standards should be retained in a fridge as a concentrated stock solution and diluted, with a saline matrix when required for use.

- All standards, drifts and AQC samples must be diluted in low nutrient seawater (Ocean Scientific - tel 01428 685245) or Artificial Seawater. Whichever matrix is chosen it must be ensured by analysis that it is free from nutrient contamination. A six point mixed nutrient calibration curve, including blank, should be analysed every six hours with a drift standards analysed regularly.

7.6 Run Length

- The exact length of each run is of little importance provided sufficient drift, blank and calibration standards are acquired. It is sometimes easier to process data from runs containing smaller numbers of samples.

7.7 AQC Solutions

- Two reference "AQC" solutions, one high and one low concentration, should be analysed during each run. These solutions will be supplied in concentrated form, by the National Centre, to be diluted in low nutrient seawater (full dilution instructions and expected levels will be given). When nutrient levels being measured are low then just the low level solution should be measured and at high levels of nutrients the high solution. Check standards should be at the range of the real expected data.

7.8 Sample Positioning

- It is imperative that the sample can be traced to a geographical position when the data is being reported:

    - The sampler can be connected to the remote-fix facility of the Qubit, using a micro-switch on the sampling arm.

    - The sampler micro-switch can act on an electronic counter e.g. Newport, to produce a unique number which logs to the Qubit with date and time either with an analogue or digital signal. This is the best solution (details of a suitable counter are available from the National Centre).

    - The exact Qubit clock start time of the autosampler start should be logged. The time to complete a sample cycle is checked to get its exact time and the sampler adjusted to ensure it is an exact even minute. The time for successive samples is then calculated and the data can be merged with the Qubit positional outputs "Skalpoll" software used at the National Centre.

7.9 Data Returns

- The Skalar data should be edited, exported into a spreadsheet and where no timer was used a series of times included. Skalar data should be supplied to the National Centre within two weeks of the completion of the survey in spreadsheet format, for the attention of Diana Milner.

8.0 OUBIT FORMAT

8.1 Format

- The instrument string format, Qubit channel arrangement (QDCF) and QPF order should remain constant for each coastal survey unless a major instrument failure occurs.

8.2 QDCF / QPF Format

- The name of each measurement type should contain the source, the instrument name and the determinand. The possible sources are FISH, PROF and POOL for towfish, profiler and moon pool. Please use common sense where other sources are involved (e.g. ECHO). Naming of variables and instruments is left up to the operator, but a short name is preferred. An example of the Vigilance set-up is given below and should be adopted for use on other vessels as this will help tremendously at the data processing stage.

QDCF No.	Description	QPF Slot (Shuttle)	QPF Slot (Ex-shuttle)
1	Fish Che Cond	0	0
2	Fish Che Temp	1	0
3	Fish Che Salinity	2	0
4	Fish Che DO	3	0
5	Fish Che Trans	4	0
6	Fish Che ChA	5	0
7	Fish Che pH	0	0
8	Fish Che T (AUX)	0	0
9	Fish Che Flow	0	0
10	Fish Che Depth	6	0
11	Prof Che Cond	0	0
12	Prof Che Temp	7	1
13	Prof Che Salinity	8	2
14	Prof Che Do	9	3
15	Prof Che Trans	0	4
16	Prof Che ChA	0	5
17	Prof Che pH	0	0
18	Prof Che Depth	0	0
19	Pump Tur ChA	0	0
20	Spare	0	0

NOTES

1) Depth from primary echo sounder should be in slot 10 of the QPF.
2) Slots not filled in the 'ex-shuttle' set-up (i.e. 6, 7 ,8 & 9) may be filled with parameters at the discretion of the Survey Officer.

9.0 PRE-SURVEY ROUTINE

9.1 Sample Sites

- ☐ The definitive list of sites, with list of determinands to be sampled at each site for the National Baseline Survey, will be agreed and finalized by each vessel and the National Centre, prior to the survey.

9.2 Survey Dates

- ☐ Dates of flexibility, around the allocated survey period, should be notified to the National Centre as soon as possible.

9.3 Laboratory Samples

- ☐ Each vessel will liaise with their laboratory contact to ensure that they have sufficient log sheets, bottle labels, consumables and bottles for the allocated sample sites, calibration runs and blanks determinands.

9.4 Qubit Database

- ☐ Each vessel should check that their Qubit sample site database contains all the correct positions for the survey. They should also ensure that the Data Format is set up in accordance with instructions.

9.5 Skalar Nutrient Analyser

- ☐ Sufficient reagents must be acquired or prepared for the duration of the survey. Ensure that sufficient filters and consumables are available. Ensure that there are standards and AQC solutions created by two different laboratories.

9.6 Couriers

- ☐ It is essential to ensure that a courier will be available for transporting water samples to the laboratory as soon after the end of the survey as possible. Any lengthy breaks during the survey may necessitate the transport of samples to the Laboratory part way through the Survey. It is now national policy that samples are transported in refrigerated vans. Saline nutrients and chlorophyll samples must remain frozen during transit to the laboratory.

9.7 AQC and Calibration Standards

- ☐ The Survey Officer must ensure that there are sufficient supplies of standards and calibration solutions to maintain the performance of all equipment used during a Baseline Survey.

10.0 DAILY PROCEDURES

10.1 Communication with the National Centre

- Each vessel should make contact with the National Centre as early as possible on each day that survey is to be carried out. If a late start is anticipated then please notify the Survey Planner the previous day to avoid an early wake up call. The National Centre needs to know the location of the boats on a daily basis..

10.2 Calibration check of instruments

- Calibration logs must be completed on a daily basis and submitted to the National Centre with the survey data.

10.3 Beginning/End of survey

- When two vessels are starting their portion of the survey from the same port: e.g. Poole, Hull, Milford, they should ideally try and schedule their departures at a mutually convenient time. On departure they should follow the same track for a period of not less than one hour to try and gain coincident data from probes and nutrient analysers.

- At the end of the survey all data and log sheets are sent to the National Centre within the timescales given in the Manual. All returns should be labelled for the attention of **Diana Milner**.

11.0 ARRANGEMENTS FOR OVERFLIGHTS

11.1 Communications with National Centre with CASI in association with case studies

- The vessel will be contacted by the National Centre prior to and on the day of the proposed overflight, to notify the vessel of the intention to proceed. A working channel (not channel 16) for marine VHF communication will be decided upon by the master of the vessel prior to the departure of the aircraft. Any emergency alterations to overflight arrangements after aircraft departure can be made by message on the aircraft pager. (See contacts list)

11.2 Communications with Aircraft

- When the aircraft is 45 minutes away from the vessel, the aircraft will contact the boat. Working channels will be moved if necessary. It is possible to page the aircraft (see contact list), but the only method of communication with the aircraft in flight is marine VHF radio. A flight line map is included to allow the vessel to give the aircraft a quick approximate location on the basis of the flightlines they are using as this is how they navigate around the coastline.

11.3 Procedure

- A note of the position of the boat must be made. The boat will log Qubit and Skalar data and follow the procedure below: (see diagram)

    - Select a course from present position that is a much off-shore as possible. Steam the reciprocal course TOWARDS SHORE until the vessel is approximately HALF A NAUTICAL MILE FROM SHORE (or as close as is deemed safe by the Master).

    - TURN to the original offshore course and note the position of the vessel. This is the first sample point of the calibration run.

    - Communicate the position of this point and the heading of the offshore course to the aircraft immediately.

    - Proceed along this course at normal baseline sampling speeds and take 10 spot samples as close to the surface as possible at 6 minute intervals (approximately 1 hour).

    - At the last sampling point, a note of the position must be made, and communicated to the aircraft (if the aircraft has not completed the run).

    - The vessel must then return to point of departure from the original baseline route at best possible speed and resume normal baseline operations.

    - The vessel will contact the National Centre to report the position of the

calibration run and the success of the above procedure.

11.5 Laboratory Samples

- At each calibration site a water sample is taken, in accordance with the sampling protocol, and prepared for laboratory suspended solids and chlorophyll analysis. For calibration samples three chlorophyll-a filtrations are required. The samples are labelled with date and time and the calibration reference number. For boats using Llanelli, logs and labels should be supplied for calibration samples and used as for all other samples.

Boat	Calibration Overflight Run Number	Calibration Sample Ref. Number
Vigilance	*x*	6089890*x*
Sea Vigil	*x*	6039920x
Water Guardian	*x*	6019950*x*
Coastal Guardian	*x*	6079860*x*

Samples are sent to the laboratories in the usual manner.

11.6 Continuous Monitoring Data

- The Qubit line for these exercises will be large, but the line should not be stopped and a new one started. No special procedures are necessary for the handling of the data, except a note of the file number that contains the calibration data should be made in the relevant logsheet.

- Lines should be named as normal but a note in the log sheet should contain

  CALIB1, CALIB2, CALIB3 etc. for each calibration run of the survey

12. DATA RETURNS / TIMESCALES

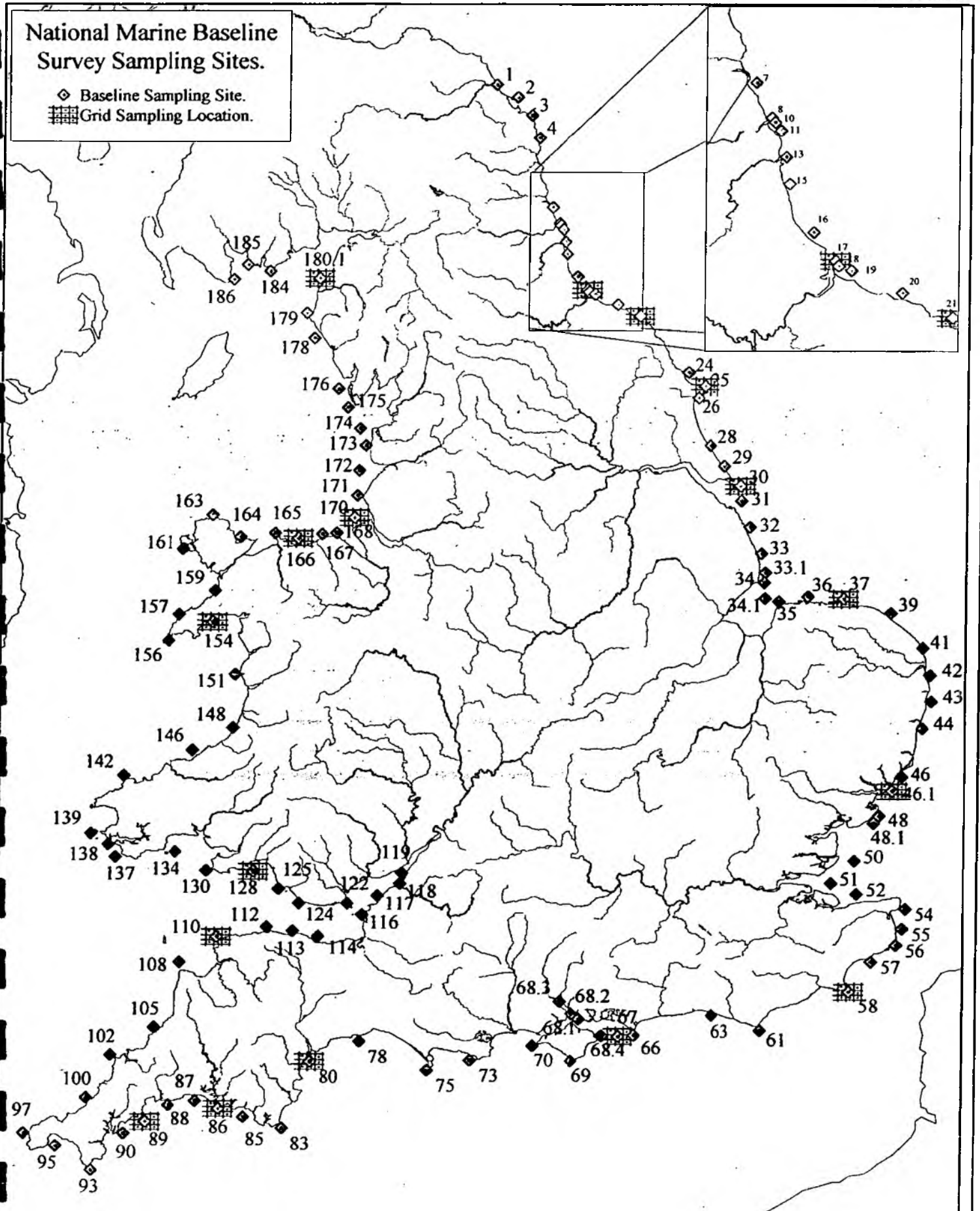
The following data must have arrived at the National Centre (for the attention of Diana Milner) within 2 weeks of the baseline survey being completed:

- Calibration log and Survey Sheets
- Qubit data on optical disk or floppies (QDCFs, RAW DATA and QPFs)
- Profile data on paper **and** in Lotus spreadsheet format (template supplied)
- Edited Skalar data containing sample times and limits of detection

Should vessels have difficulty in meeting these targets please notify the Centre as soon as possible.

National Marine Baseline Survey.

NRA
National Centre for Instrumentation and Marine Surveillance



Det Code	Determinand	Units
Group 1		
105	Mercury Total	ug/l
106	Cadmium Dissolved	ug/l
135	Suspended Solids 105°C	mg/l
143	Suspended Solids 500°C	mg/l
189	Orthophosphate	ug/l P
729	Chlorophyll a	ug/l
3403	Ammonia	ug/l N
3404	Nitrite	ug/l N
3420	Silicate	ug/l Si
7213	Copper Dissolved	ug/l
7230	Lead Dissolved	ug/l
7243	Zinc Dissolved	ug/l
7354	Arsenic Dissolved	ug/l
7373	Chromium Dissolved	ug/l
7427	Nickel Dissolved	ug/l
9991	Total Oxidised Nitrogen	ug/l N
Group 2		
108	Cadmium Total	ug/l
7215	Copper Total	ug/l
7229	Lead Total	ug/l
7245	Zinc Total	ug/l
7356	Arsenic Total	ug/l
7375	Chromium Total	ug/l
7429	Nickel Total	ug/l
Group 3		
3081	Isodrin	ug/l
3276	Aldrin	ug/l
3301	Dieldrin	ug/l
3306	Endrin	ug/l
3082	Hexachlorobenzene	ug/l
3083	Hexachlorobutadiene	ug/l
3142	PCB 28	ug/l
3145	PCB 52	ug/l
3148	PCB 101	ug/l
3151	PCB 118	ug/l
3154	PCB 138	ug/l
3157	PCB 153	ug/l
3160	PCB 180	ug/l
3294	DDE (Pp')	ug/l
3295	DDE (Op')	ug/l
3296	DDT (Op')	ug/l
3297	DDT (Pp')	ug/l
3310	HCH alpha	ug/l
3311	HCH beta	ug/l
3312	HCH delta	ug/l
3313	HCH gamma	ug/l
3329	TDE (Op')	ug/l
3330	TDE (Pp')	ug/l

CHEMICAL DETERMINAND LISTS

Group 1 - Inorganics. Measured at every baseline site

Det Code	Determinand	Units	MRV	Precision %	Bias %
0105	Mercury Total	ug/l	0.01	5 (7)	10
0106	Cadmium Dissolved	ug/l	0.07	5 (9)	10
0135	Suspended Solids 105 C	mg/l	5	5 (6)	10
0145	Solids non-volatile 500)	mg/l	5 (?)	?	10
0189	Orthophosphate	ug/l	1.5	5	10
0729	Chlorophyll-a	ug/l	0.2 (1)	5 (15)	10
3403	Ammonia	ug/l N	7	5	10
3404	Nitrate	ug/l N	0.7	5	10
3420	Silicate	mg.l Si	0.012	5	10
7213	Copper Dissolved	ug/l	0.5	5 (9)	10
7230	Lead Dissolved	ug/l	0.12	5 (9)	10
7243	Zinc Dissolved	ug/l	0.7	5 (9)	10
7354	Arsenic Dissolved	ug/l	1.0	5	10
7373	Chromium Dissolved	ug/l	1.5	5 (9)	10
7427	Nickel Dissolved	ug/l	0.25	5 (9)	10
9991	Total Oxidised Nitrogen	mg/l N	0.007	5	10

Group 2 - Inorganics. (Total metals) measured at one third of all baseline sites (see site selection lists). These samples are taken to cross check internal sampling contaminants.

Lab. Code	Determinand	Units	MRV	Precision %	Bias %
0108	Cadmium total	ug/l	0.07	5 (9)	10
7215	Copper total	ug/l	0.5	5 (9)	10
7229	Lead total	ug/l	0.12	5 (9)	10
7245	Zinc total	ug/l	0.7	5 (9)	10
7356	Arsenic total	ug/l	1.0	5	10
7375	Chromium total	ug/l	1.5	5 (9)	10
7429	Nickel total	ug/l	0.25	5 (9)	10
	Mercury dissolved	ug/l	0.01	5 (7)	10

Group 3 - Organics. Measured at one third of all baseline sites (see site list).

Lab. Code	Determinand	Units	MRV	Precision %	Bias %
3081	Isodrin	ng/l	1.0	15 (25)	10
3082	Hexachloro-benzine	ng/l	1.0	15 (25)	10
3083	Hexachloro-butadiene	ng/l	1.0	15 (25)	10
3142	PCB 28	ng/l	1.0	15 (25)	10
3145	PCB 52	ng/l	1.0	15 (25)	10
3148	PCB 101	ng/l	1.0	15 (25)	10
3151	PCB 118	ng/l	1.0	15 (25)	10
3154	PCB 138	ng/l	1.0	15 (25)	10
3157	PCB 153	ng/l	1.0	15 (25)	10
3160	PCB 180	ng/l	1.0	15 (25)	10
3276	Aldrin	ng/l	1.0	15 (25)	10
3294	DDE-PP'	ng/l	1.0	15 (25)	10
3295	DDE-OP'	ng/l	1.0	15 (25)	10
3296	DDT-OP'	ng/l	1.0	15 (25)	10
3297	DDT-PP'	ng/l	1.0	15 (25)	10
3201	dieldrin	ng/l	1.0	15 (25)	10
3206	Endrin	ng/l	1.0	15 (25)	10
3210	HCH-Alpha	ng.l	1.0	15 (25)	10
3211	HCH-Beta	ng/l	1.0	15 (25)	10
3212	HCH-Delta	ng/l	1.0	15 (25)	10
3213	HCH-Gamma	ng.l	1.0	15 (25)	10
3229	TDE-OP'	ng/l	1.0	15 (25)	10
3230	TDE-PP'	ng.l	1.0	15 (25)	10

) Interim values ie currently achievable
?) No firm information at present .

Coastal Water Surveillance Strategy

It has been decided, by the Marine Surveillance Client Group, that there is a requirement to perform a multidimensional grid at certain baseline sample sites. This will allow us to assess the true value of spot data and to determine the homogeneity of the water around the sample sites, and thus understand the dynamics more fully.

Procedure for Assessment of Water Quality at Baseline Grid Sites

The vessel should steam to the specified Baseline sample site and proceed with the standard sampling and profiling operations.

Once the major sample site has been completed, if the sample point has been identified as a grid site the following procedure should be adopted.

A tangential line is drawn between the coast and 5.0km Coastal Limit, and three parallel tracks at distances 0.5, 1.0 and 5.0km offshore, each track being 1.0km in length. This will produce nine extra sampling points, six at the ends of each parallel line and three at the intersections with the tangential line.

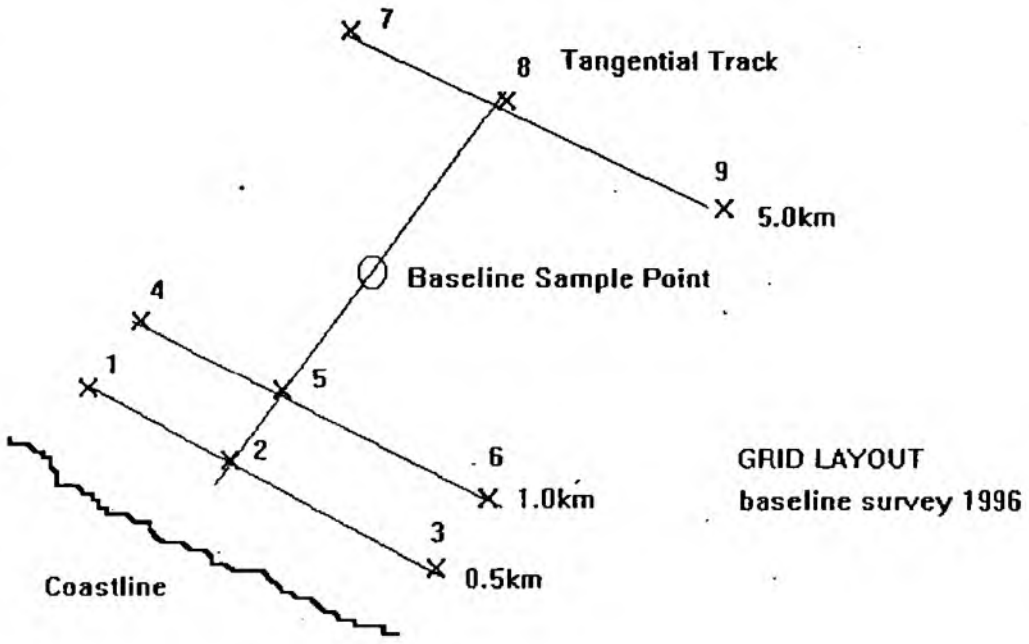
At each of the points water should be sampled for nutrients, chlorophyll a and suspended solids at 105 and 500°C according to the usual sampling protocol.

At each of the new points a profile, down to the seabed or at least 15m, is needed to assess stratification. This profile should be logged on a continuous basis with values at 0.5, 1.0, 2.0, 5.0, 10.0 and 15.0m being noted on log sheets. The important profiling parameters required are temperature, salinity and dissolved oxygen. From the recorded data the survey officer must decide if stratification is occurring.

Stratification definitions, to determine if second samples required are:

a) temperature change of greater than 0.5 °C over 10m
b) salinity change of 0.5 parts per thousand over 10m
c) dissolved Oxygen concentration change of 10% over 10m

If stratification is detected then two samples should be taken for analysis, one of the samples should be taken from 1.0m depth and one should be taken from 10m depth using a "Cassella Sampler".



GRID LAYOUT
baseline survey 1996

Sample Label (baseline point)1-9
Samples for chlorophyll a
suspended solids (105/500)
nutrients

NCIMS - National Marine Baseline Revised Sites (2nd edition)

Base	Site name	Wessex site	BNG Easting	BNG Northing	Longitude	Latitude	Det Group Measured			Grid	Boat
							1	2	3		
1	Berwick	60100100	401443	652107	1 58.62 W	55 45.73 N	1	1	1		Water Guardian
2	Castlehead Rocks	60100200	413450	644616	1 47.16 W	55 41.68 N	1				Water Guardian
3	Shoreston Outcars	60100300	421779	633985	1 39.26 W	55 35.93 N	1	1			Water Guardian
4	Craster	60100400	426513	620379	1 34.83 W	55 47.65 N	1		1		Water Guardian
7	Blyth	60100700	434352	579260	1 27.70 W	55 6.38 N	1		1		Water Guardian
8	Tyne (North)	60100800	438454	569686	1 23.90 W	55 1.20 N	1				Water Guardian
10	Tyne (South)	60101000	439317	568451	1 23.11 W	55 0.53 N	1				Water Guardian
11	Marsden	60101100	440937	566073	1 21.61 W	54 59.24 N	1				Water Guardian
13	Wear (Middle)	60101300	442402	558854	1 20.30 W	54 55.34 N	1		1		Water Guardian
15	Pincushion Rock	60101500	443338	551556	1 19.49 W	54 51.40 N	1	1	1		Water Guardian
16	Blackhall	60101600	449679	538324	1 13.70 W	54 44.23 N	1				Water Guardian
17	Tees (North)	60101700	455462	530528	1 8.40 W	54 40.00 N	1			1	Water Guardian
18	Tees (Middle)	60101800	456231	529147	1 7.70 W	54 39.24 N	1	1	1		Water Guardian
19	Tees (South)	60101900	459667	527892	1 4.52 W	54 38.54 N	1				Water Guardian
20	Skinningrove	60102000	472910	521798	0 52.30 W	54 35.15 N	1				Water Guardian
21	Sandsend	60102100	486288	515059	0 40.00 W	54 31.40 N	1	1		1	Water Guardian
24	Filey Brigg	60102400	514516	481769	0 14.61 W	54 13.11 N	1	1			Water Guardian
25	Flamborough (North)	60102500	524615	473502	0 5.52 W	54 8.52 N	1		1	1	Water Guardian
26	Bridlington	60102600	520418	466428	0 9.54 W	54 4.76 N	1				Water Guardian
28	Beacon Hill	60102800	528006	438358	0 3.30 W	53 49.52 N	1				Water Guardian
29	Withernsea	60102900	536920	426310	0 4.50 E	53 42.90 N	1				Water Guardian
30	Spurn Head	60103000	546422	414537	0 12.80 E	53 36.40 N	1	1	1	1	Water Guardian
31	Haile Sand Flat	60303100	547030	405650	0 13.10 E	53 31.60 N	1	1	1		Sea Vigil / Water Guardian
32	Theddlethorpe	60303200	552061	390130	0 17.20 E	53 23.14 N	1				Sea Vigil / Water Guardian
33	Chapel St. Leonards	60303300	558791	374579	0 22.80 E	53 14.64 N	1	1	1		Sea Vigil / Water Guardian
33.1	Skegness	60303310	561065	363243	0 24.50 E	53 8.50 N	1				Sea Vigil / Water Guardian
34	Outer Dogs Head	60303400	560595	357290	0 23.90 E	53 5.30 N	1				Sea Vigil / Water Guardian
34.1	Lynn Deep	60303410	561129	348030	0 24.10 E	53 0.30 N	1				Sea Vigil / Water Guardian
35	Wash	60303500	568866	346069	0 30.95 E	52 59.10 N	1	1	1		Sea Vigil / Water Guardian
36	Overy, Staithe	60303600	585381	349089	0 45.80 E	53 0.40 N	1				Sea Vigil / Water Guardian
37	Cley, Lookout	60303700	605814	347878	1 4.00 E	52 59.60 N	1	1	1	1	Sea Vigil / Water Guardian
39	Mundesley	60303900	632565	339254	1 27.50 E	52 54.00 N	1	1	1		Sea Vigil / Water Guardian
41	Winterton	60304100	651212	318639	1 43.15 E	52 42.40 N	1	1	1		Sea Vigil / Water Guardian
42	Gorleston	60304200	655611	302520	1 46.30 E	52 33.60 N	1				Sea Vigil / Water Guardian
43	Kessingland	60304300	656311	286951	1 46.20 E	52 25.20 N	1	1	1		Sea Vigil / Water Guardian
44	Dunwich Cliffs	60304400	651442	271096	1 41.20 E	52 16.80 N	1				Sea Vigil / Water Guardian
46	Shingle Street	60304600	639608	242466	1 29.60 E	52 1.70 N	1				Sea Vigil / Water Guardian
46.1	Felixstowe, Cobbolds	60304610	634500	234000	1 24.80 E	51 57.26 N	1	1	1	1	Sea Vigil / Water Guardian
48	Walton	60304800	627041	219040	1 17.70 E	51 49.40 N	1				Sea Vigil / Water Guardian
48.1	Holland Radar	60304810	623902	214629	1 14.80 E	51 47.10 N	1				Sea Vigil / Water Guardian
50	Maplin Bank	60305000	613318	192638	1 4.80 E	51 35.50 N	1				Sea Vigil / Water Guardian

January 1996

Base	Site name	Wessex site	BNG Easting	BNG Northing	Longitude	Latitude	Det Group Measured			Grid	Boat
							1	2	3		
51	Medway Buoy	60405100	600023	179518	0 52.85 E	51 28.72 N	1	1	1		Sea Vigil / Water Guardian
52	Shiveringsand Buoy	60405200	614810	173220	1 5.38 E	51 25.00 N	1				Sea Vigil
54	East Brake Buoy	60405400	642560	164290	1 28.91 E	51 19.51 N	1				Sea Vigil
55	Goodwin Fork Buoy	60405500	640780	152520	1 26.91 E	51 13.22 N	1				Sea Vigil
56	South Foreland	60405600	637420	142840	1 23.64 E	51 8.10 N	1	1	1		Sea Vigil
57	Sandgate Bay	60405700	623350	133160	1 11.24 E	51 3.22 N	1				Sea Vigil
58	Dungeness	60405800	610960	115460	1 0.03 E	50 53.96 N	1			1	Sea Vigil
61	Beachy Head	60406100	560440	92640	0 16.37 E	50 42.63 N	1	1	1		Sea Vigil
63	Brighton	60406300	531560	101530	0 7.98 W	50 47.87 N	1				Sea Vigil
66	Selsey Bill	60406600	486600	89740	0 46.42 W	50 42.02 N	1	1	1		Sea Vigil
67	Nab Tower	60406700	477220	89080	0 54.40 W	50 41.75 N	1			1	Sea Vigil
68.1	East Brambles	60406810	454500	99090	1 13.60 W	50 47.30 N	1				Sea Vigil
68.2	Calshot	60406820	449950	102320	1 17.45 W	50 49.07 N	1	1	1		Sea Vigil
68.3	Dockhead	60406830	442954	109622	1 23.37 W	50 53.03 N	1				Sea Vigil
68.4	West Princessa	60406840	467490	89410	1 2.65 W	50 41.98 N	1				Sea Vigil
69	St. Catherines	60406900	449780	74450	1 17.82 W	50 34.03 N	1				Sea Vigil
70	The Needles	60407000	427320	83450	1 36.82 W	50 38.97 N	1				Sea Vigil
73	St. Aldhelms	60507300	391444	74806	2 7.25 W	50 34.33 N	1				Vigilance
75	Portland Bill	60507500	366887	68905	2 28.03 W	50 31.10 N	1				Vigilance
78	Seaton	60607800	327371	85782	3 1.67 W	50 40.00 N	1	1	1		Vigilance
80	Exmouth	60608000	298768	73910	3 25.75 W	50 33.33 N	1			1	Vigilance
83	Start Point	60608300	282855	34413	3 38.48 W	50 11.85 N	1				Vigilance
85	Bigbury Bay	60608500	260244	41176	3 57.38 W	50 15.20 N	1				Vigilance
86	Plymouth	60608600	246016	46192	4 9.73 W	50 17.70 N	1	1	1		Vigilance
87	East Looe	60608700	232461	50530	4 21.25 W	50 19.82 N	1			1	Vigilance
88	Fowey	60608800	216744	48055	4 34.42 W	50 18.20 N	1				Vigilance
89	Dodman Point	60608900	203301	38283	4 45.43 W	50 12.67 N	1			1	Vigilance
90	St. Antony Head	60609000	191045	31497	4 55.50 W	50 8.77 N	1				Vigilance
93	Lizard	60609300	171990	9880	5 10.70 W	49 56.70 N	1				Vigilance
95	Penzence	60609500	151330	23980	5 28.50 W	50 3.78 N	1				Vigilance
97	Cape Cornwall	60609700	132110	31440	5 44.90 W	50 7.48 N	1	1	1		Vigilance
100	St. Agnes	60610000	168780	52800	5 14.95 W	50 19.75 N	1				Vigilance
102	Trevose	60610200	182760	77920	5 4.05 W	50 33.60 N	1				Vigilance
105	Boscastle	60610500	207848	93942	4 43.33 W	50 42.77 N	1				Vigilance
108	Hartland Point	60610800	222623	132318	4 31.90 W	51 3.73 N	1				Vigilance
110	Bull Point	60611000	244082	147356	4 13.93 W	51 12.22 N	1			1	Vigilance
112	Foreland	60611200	272883	153182	3 49.33 W	51 15.78 N	1				Vigilance
113	Porlock	60511300	287856	150676	3 36.42 W	51 14.62 N	1				Vigilance
114	Minehead	60511400	302829	147589	3 23.48 W	51 13.12 N	1				Vigilance
116	Weston-super-Mare	60511600	328422	160435	3 1.67 W	51 20.28 N	1				Vigilance
117	Clevedon	60511700	337342	171688	2 54.10 W	51 26.42 N	1				Vigilance

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Base	Site name	Wessex site	BNG Easting	BNG Northing	Longitude	Latitude	Det Group Measured			Grid	Boat
							1	2	3		
118	Avonmouth	60511800	350046	178825	2 43.18 W	51 30.35 N	1				Vigilance
119	No. 1 Beacon	60511900	351230	184940	2 42.22 W	51 33.65 N	1	1	1		Vigilance
122	Lavernock	60812200	319740	166990	3 9.23 W	51 23.75 N	1				Vigilance
124	Nash Point	60812400	291470	167040	3 33.60 W	51 23.48 N	1				Vigilance
125	Porthcawl	60812500	279540	175580	3 44.07 W	51 27.95 N	1	1	1		Vigilance
128	Mumbles	60812800	264920	185970	3 56.93 W	51 33.37 N	1			1	Vigilance
130	Worms Head	60813000	237680	186370	4 20.50 W	51 33.15 N	1	1	1		Vigilance
134	Caldey Island	60813400	219540	197440	4 36.52 W	51 38.78 N	1	1	1		Vigilance
137	Turbot Bank	60813700	184870	194230	5 06.42 W	51 36.32 N	1	1	1		Vigilance
138	St. Anns	60713800	180565	201679	5 10.43 W	51 40.23 N	1	1	1		Vigilance
139	Skomer	60713900	170162	208214	5 19.70 W	51 43.50 N	1				Coastal Guardian
142	Strumble Head	60714200	189368	242641	5 04.30 W	52 02.50 N	1				Coastal Guardian
146	Penly-Badell	60714600	229134	257723	4 30.00 W	52 11.45 N	1				Coastal Guardian
148	Pen Pigyn	60714800	251196	271016	4 11.00 W	52 19.00 N	1				Coastal Guardian
151	Pen-Bwch Point	60715100	251567	301984	4 11.50 W	52 35.70 N	1				Coastal Guardian
154	Pwllheli	60715400	240180	333514	4 22.50 W	52 52.50 N	1	1	1	1	Coastal Guardian
156	Bardsey	60715600	214489	322368	4 45.00 W	52 46.00 N	1	1	1		Coastal Guardian
157	Penrhyn Colmon	60715700	217789	335234	4 42.50 W	52 53.00 N	1				Coastal Guardian
159	Dylan	60715900	241352	352029	4 22.00 W	53 02.50 N	1				Coastal Guardian
161	Penrhos	60716100	222588	376813	4 39.60 W	53 15.50 N	1	1	1		Coastal Guardian
163	Middle Mouse	60716300	239518	396995	4 25.00 W	53 26.70 N	1	1	1		Coastal Guardian
164	Red Wharf	60716400	255740	384043	4 10.00 W	53 20.00 N	1				Coastal Guardian
165	Great Orme	60716500	275785	386259	3 52.00 W	53 21.50 N	1	1	1		Coastal Guardian
166	Llanddulas	60716600	289027	383149	3 40.00 W	53 20.00 N	1			1	Coastal Guardian
167	Chester Flat	60716700	302955	385626	3 27.50 W	53 21.50 N	1				Coastal Guardian
168	Welsh Channel	60716800	311359	390098	3 20.00 W	53 24.00 N	1	1			Coastal Guardian
170	North Wirral	60717000	321644	395462	3 10.80 W	53 27.00 N	1	1		1	Coastal Guardian
171	Formby Point	60717100	323261	408435	3 09.53 W	53 34.00 N	1				Coastal Guardian
172	Gut	60717200	324086	423257	3 09.00 W	53 42.00 N	1	1	1		Coastal Guardian
173	Blackpool	60717300	327725	438035	3 05.90 W	53 50.00 N	1				Coastal Guardian
174	Shell Wharf	60717400	324489	448100	3 09.00 W	53 55.90 N	1	1	1		Coastal Guardian
175	Hilpsford	60717500	317047	460468	3 16.00 W	54 02.00 N	1				Coastal Guardian
176	Duddon	60717600	311551	471698	3 21.23 W	54 08.00 N	1	1	1		Coastal Guardian
178	Calder Hall	60717800	297170	501675	3 35.05 W	54 24.00 N	1	1	1		Coastal Guardian
179	Whitehaven	60717900	292652	516620	3 39.55 W	54 32.00 N	1	1			Coastal Guardian
180.1	Maryport	60718010	299955	537044	3 33.20 W	54 43.10 N	1	1	1	1	Coastal Guardian
184	Abbey Head	60718400	271290	541294	4 00.00 W	54 45.00 N	1	1	1		Coastal Guardian
185	Meggerland	60718500	258289	545024	4 12.22 W	54 46.80 N	1				Coastal Guardian
186	St. Ninians	60718600	250301	536374	4 19.40 W	54 42.00 N	1	1	1		Coastal Guardian

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