

Sea Vigil Water Quality Monitoring

The Wash : 1992 - 1993

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National Rivers Authority
Anglian Region - Marine Section
Peterborough

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'Sea Vigil' Water Quality Monitoring

The Wash

1992 - 1993

DRAFT

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ENVIRONMENT AGENCY



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EXECUTIVE SUMMARY

The NRA has an obligation to monitor and safeguard the coastal waters of England and Wales out to a designated 3 nautical mile limit. To help meet this obligation, Anglian Region uses a purpose-designed coastal survey vessel, *Sea Vigil*, purchased in 1991.

All of the Wash is within the defined 3 mile limit. The NRA is therefore responsible for all water quality aspects of the Wash.

The Wash is an embayment covering an area of about 700 km². The sea surface is only about half this at low water. Consequently, much of the Wash is shallow. There are four major tributary estuaries, the Great Ouse, Welland, Witham and Nene, forming one of the largest estuarine systems in Britain. Successful monitoring of the Wash can only be carried out by the use of survey vessels.

The estuaries flowing into the Wash do not finish at their high-water geographical mouths. At low water, their effective mouths extend almost to the centre of the Wash, seen most dramatically in the case of the Nene.

Data from surveys within the Wash during 1992 and 1993 are reported here. Their purpose was to gain information on the nutrient levels and to help determine eutrophic status.

The interpretation of nutrient data in the Wash is complicated by the seasonal influence of the four major estuarine inputs, each with a freshwater flow that varies considerably throughout the year. Data collected so far suggests that nutrient levels in the outer Wash may not consistently fall to "background" North Sea levels, although data from beyond the 3 mile limit would be necessary to confirm this.

It is anticipated that the monitoring programme will continue in the short term, with more emphasis on the collection of chlorophyll data. Knowledge of the phytoplankton and zooplankton would be an added benefit.

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THE WASH

WATER COLUMN SURVEYS

'SEA VIGIL', 1992 - 1993.

BACKGROUND.

Since its formation in September, 1989, the National Rivers Authority has had an obligation to monitor and safeguard the coastal waters of England and Wales out to a designated 3 nautical mile limit. This responsibility was defined differently for the previous Water Authorities. Consequently, prior to 1989 there was very little, if any, data collected for offshore coastal water sites between the Humber and the Thames, the area covered by the Anglian Region of the NRA. All of the Wash is within the 3 mile limit.

During August, 1991, the Anglian Region of the NRA took delivery of a coastal survey vessel. It started its work programme with an extensive benthic survey of the Wash. In order to follow up with chemical surveys, techniques were developed during the following months to analyse water samples for the low levels of nutrients encountered in outer estuaries and coastal waters.

By August 1992 it was possible to carry out a corresponding water column survey, using an on-board auto-analyser. The data from this and subsequent surveys in the Wash are presented here. Separate reports will cover the Humber Estuary, the Lincolnshire Coast and the East Coast (outer Wash to outer Thames).

The lack of historical data limits the extent to which comparisons can be made or detailed explanations be provided.

DESCRIPTION OF THE WASH AREA.

The Wash embayment and its four main tributary estuaries of the Great Ouse, Nene, Welland and Witham form the largest estuarine system in Britain. These main tributary rivers (together with four smaller ones: the Heacham, Ingol, Babingley and Steeping) drain about 12% of the total area of England. At high water of a Spring tide, the area of open coastal water within the Wash covers about 700 km². However, the sea surface area at low water of a spring tide is only about 350 km², due to a seven metre tidal range (one of the highest in the North Sea) and the shallow nature of the Wash. This results in the uncovering of numerous sandbanks, mudflats and marshes.

Much of the sediment present in the Wash may be transported there from the Humber and Tees estuaries, due to a water current that flows in a south easterly direction from Scotland.

Each of the four major tributaries has one major sewage discharge and relatively few industrial discharges located along their length. The catchments of these rivers are predominantly agricultural, thus agricultural chemicals are likely to be present from land drainage runoff. A sea outfall pipe at Hunstanton discharging effluent from nitrate removal plants at Fring and Sedgeford directly to the Wash became operational in mid-1993; its previous use as a sewage outfall ceased in 1989 when Hunstanton sewage was diverted to the nearby Heacham STW. It is the only discharge direct to the Wash.

The Wash is not a major tourist attraction, mainly because there are few points of access. It is all a site of international nature conservation importance and contains some of Britain's finest coastal wetland areas. The Wash contains one of the largest salt marshes in Britain, which, including the mudflats, supports some of the most sizeable estuarine waterfowl and wader populations in Britain, as well as significant wintering passerine and breeding bird populations. No fewer than 15 of these bird species are present at internationally important levels of abundance. The Wash is also an important breeding ground for juvenile plaice, sole and cod. In addition, it supports the second largest population of common seals in Europe.

The outstanding biological significance of the Wash is recognized both nationally and internationally. It has been designated as a Site of Special Scientific Interest (SSSI) between 1972 and 1976, with further renotification in 1984 under the Wildlife and Countryside Act 1981. In March 1988, it was declared a Ramsar site and Special Protection Area (SPA). The Wash National Nature Reserve (NNR) was named in December 1992; this created the largest NNR in England, encompassing 9,900 hectares.

There are a number of major shellfisheries in the Wash. These are predominantly for cockles and mussels. Significant numbers of brown and pink shrimp are also caught commercially. Other traditional interests occurring within the Wash are grazing of the saltmarsh, bait digging and wildfowling. Additionally, the Wash is used for navigation, with commercial shipping using the main ports of Boston, King's Lynn, Sutton Bridge and Wisbech, predominantly for wood importation and grain export. The weapons ranges for military aircraft located at Wainfleet and Holbeach constitute a less traditional form of use of the Wash.

There is a large seaside resort at Hunstanton on the east side of the Wash, unusual in that it is on the east coast but sees the sun set over the sea. There are two designated Bathing Beaches in the Wash, at Hunstanton and Heacham. Skegness, another seaside resort (famous for its "bracing air") is just outside the Wash at its extreme north west edge.

Bathymetry

Along the bay enclosing line, at the seaward end, the Wash is at its narrowest, being approximately 19.3 km wide (10.4 nm). At low water (LAT), the width of the main body of the Wash drops to about 6.5 km, the rest being a mixture of sandbanks and channels.

As noted above, up to half of the Wash can dry at low water. A large part of the remainder is less than 10m deep at low water. The Wash is deepest at its mouth in the northeast, reaching over 25m.

Although containing a large body of relatively sheltered water, the Wash is not very popular for leisure boating. This is partly due to the high tidal ranges preventing ready access from the rivers for much of the time. Additionally, the shallowness and mudbanks around the edges do not make it attractive to yachtsmen. There are no

marinas around the Wash.

Although the Wash is well known for being muddy around the accessible edges, the middle of the Wash contains many drying sandbanks with much of the centre having a sandy, shingly or gravelly bed.

OBJECTIVES.

The purpose of the 1992/93 surveys was to begin to collect data on nutrient levels in the Wash, particularly on a seasonal basis and compare the results with similar data from other coastal waters of the Anglian Region. The survey methodology (analytical and sampling) was new to the NRA Anglian Region and a subsidiary purpose of the surveys was to gain familiarity with the methodology and determine its reliability.

In recent years, interest in nutrient levels in coastal waters of the North Sea has increased. This is a reaction to concerns expressed at the Inter Ministerial North Sea Conferences and the identification by the Paris Commission of eutrophication problem areas and possible problem areas. These surveys would measure any evidence of algal blooms and hence eutrophication.

On the UK side of the North Sea, two major national estuary nutrient research projects, JoNuS and LOIS, have been commissioned for which the NRA is providing nutrient data from the Wash estuaries; data from the Wash itself will complement this.

This report complements the Wash Zone Report (1994) produced by the Central Area of NRA, Anglian Region, which reported the first nutrient survey in the Wash and the results of the major benthic survey in 1991.

WORK PROGRAMME DETAILS.

Tidal constraints in the Wash require each survey to start and finish around high water. *Sea Vigil* operated from Boston Dock during the August 1992 programme but from King's Lynn for later surveys. On a survey from Boston, the southwestern Wash was mostly sampled above half-tide with the outer and eastern Wash sampled below half-tide. The converse applied for surveys from King's Lynn. Sampling of the northwest edge of the Wash and the southwest corner were restricted due to the presence of military aircraft bombing ranges at Wainfleet and Holbeach Marshes, as well as sandbanks.

Water was collected from the surface layer of the sea, at a standard set of sites previously designated for the benthic grid survey, shown in Figure 1, with details in Table 1. Field data collected at the same time, included temperature, salinity and dissolved oxygen. Samples were immediately filtered and then run through the auto-analyser. Results were then entered onto the laboratory database at Peterborough. The methods employed contained built-in Analytical Quality Control procedures and have satisfactorily passed special marine AQC exercises, particularly the stringent ones prepared for ICES (International Council for the Exploration of the Seas).

Occasionally it was possible to carry out data measurements at a restricted number of

sites but over a wide range of tidal states. Sometimes this was for a full tidal cycle when bacteriological surveys were in progress. Others were when *Sea Vigil* was able to cruise between a group of sites sampling at each on an hourly basis. Sub-surface samples were also collected on these surveys.

A summary of the surveys carried out in the Wash is shown in Table 2.

PRESENTATION OF RESULTS.

The nutrient data reported here are from water column samples, which after collection were filtered through 0.45µm membrane filters and are therefore termed "dissolved nutrients". All results are in microgrammes per litre (µg.l⁻¹) and are given in Tables 4 to 12. There are some chlorophyll data. Field data are also listed.

In this summary, the term nitrate is used in preference to T.O.N. (Total Oxidised Nitrogen) which was the measured parameter. There is an analytical distinction, caused by nitrite. Since the levels of nitrate are generally vastly higher than those of nitrite, the distinction does not significantly influence the data interpretation.

The data is presented as a mixture of graphs and charts, by survey. Table 3 lists the figure and table numbers. For each survey, where data are adequate, there is a:

- Table of Data;
- Chart of Sample Programme, showing Order of Sampling;
- Graph of Nutrient Data Values against Site;
- Contour Plot of Ammonia Data;
- Contour Plot of Phosphate Data;
- Contour Plot of Silicate Data;
- Contour Plot of Nitrate Data;
- Contour Plot of Nitrite Data;
- Contour Plot of Chlorophyll Data;
- Contour Plot of Temperature Data;
- Contour Plot of Salinity Data;
- Contour Plot of Dissolved Oxygen Data;

Salinity variations were usually small and since the salinometer did not have the accuracy of an oceanographic specification instrument, no significance can be placed on these small variations.

The contour plots are not a "snapshot" of concentrations at a fixed tidal state but merely a means of providing a feel to the data, which is difficult to visualise if presented in a traditional linear graph format. No allowance has been made for the variations in tidal state, but these are unlikely to have much effect except very close to the tributary estuaries, where a freshwater influence would be encountered at the latter end of the ebb tide. Hence, for the majority of the Wash survey area, a contour plot will be similar to a "snapshot". This view is supported by most of the time series data, particularly in

Figures 61 and 62.

Freshwater Flows: Figures 67(a) and 67(b) show the relative flows to tide of the four Wash tributary estuaries during 1992 and 1993 respectively.

GENERAL COMMENTS.

Summer is the peak period in the year for planktonic growth and nutrient uptake. Consequently dissolved nutrients are expected to be at minimum concentrations around early August. Nutrients in coastal waters are very low in comparison to estuaries. Due to the nature of the Wash system, not all of the Wash can be considered to be coastal water. Comparison of Wash data with data from the coastal waters of Lincolnshire and Norfolk may help determine how much of the Wash is coastal water.

The known nutrient inputs to the Wash are the four estuaries of the Great Ouse, Nene, Welland and Witham, all along the southern edge. The effluent from the nitrate removal plant at Hunstanton is not expected to have other than a local effect, although this was not determined.

Nitrate is normally the most abundant of the nutrients at a level around twice the silicate concentration. There is only limited data for Nitrite because of difficulties in sample preservation; this has now been overcome by carrying out on-board analysis. Nitrite is present at very low levels and is rapidly oxidised to nitrate, although it can provide meaningful information on nutrient processes.

The surveys should provide information in two forms:

- 1) Variations in spatial distribution of nutrient concentrations;
- 2) Seasonal variations in nutrient concentrations.

There are a number of factors to be borne in mind when considering the data:

- there are major fresh water nutrient inputs via the tributary estuaries;
- the freshwater input to the Wash is nearly always greatest from the Great Ouse, followed by the Welland, then the Witham and then the Nene.
- there is a sea outfall off Hunstanton discharging effluent from a nitrate removal plant but the volume is limited;
- there are significant sewage effluents discharged to each of the major estuaries;
- there is a sewage effluent discharge entering via the Heacham river;
- the shallow waters and fluctuating bed profile of the Wash should lead to good mixing;
- a thermocline is unlikely to develop in summer and nutrient strip-ping is therefore unlikely;

- the strong tides in the area should create enough water turnover for sufficient light energy to penetrate the water and facilitate a normal level of photosynthetic activity;
 - the deposition and resuspension of sedimentary material will influence the budgets of the dissolved nutrients;
 - the relatively consistent high salinity level in the middle and outer Wash should enable a stable plankton species diversity in the water column;
 - soluble nutrients are part of a very complex chemical equilibrium, involving phytoplankton, zooplankton and sediments;
 - it has previously been assumed that high turbidity within an estuary will retard primary productivity due to the restricted light intensity. This may not be the case, since water in shallow estuaries (like those of the Wash) turns over sufficiently rapidly to permit the constituent organisms to receive adequate light for useful productivity.
-

AUGUST, 1992 SURVEY.

Results are given in Table 4, the sample programme is shown in Figure 2 and nutrient data is presented in Figure 3.

Time and conditions permitted the sampling of 58 of the 66 grid sites, throughout the Wash, with some additional sites near the mouth of the Witham.

Immediately prior to the survey period, there was very little freshwater flow from the Welland, Witham and Nene. Only the Great Ouse had a significant input, and that only a fraction of normal winter flows.

Comparison with Coastal Data, August 1992.

Data from about 3 km off the Lincolnshire Coast is provided for comparison in Figure 64. This is regarded as an area of clean coastal water, although nutrient levels are higher than further north, off the Yorkshire Coast.

NOVEMBER, 1992 SURVEY.

Results are given in Table 5, the sample programme is shown in Figure 12 and nutrient data are presented in Figure 13.

Time and conditions only permitted the sampling of 18 of the 66 grid sites, these all being within the inner Wash.

Immediately prior to the survey period, there was significant freshwater input from the Great Ouse, Welland, Witham and Nene, in roughly the ratio 5:3:2:1 respectively.

FEBRUARY, 1993 SURVEY.

Results are given in Table 6, the sample programme is shown in Figure 21 and nutrient data are presented in Figures 22.

Time and conditions permitted the sampling of 34 of the 66 grid sites, throughout the Wash, with some additional sites near the mouths of the Witham and Great Ouse.

A month prior to the survey, there was a period of massive freshwater input from all estuaries except the Nene. This peak tailed off towards summer flow values at the time of the survey, with the Great Ouse contributing nearly half the total flow.

JUNE, 1993 SURVEY.

Results are given in Table 7, the sample programme is shown in Figure 30 and nutrient data is presented in Figure 31.

Time and conditions permitted the sampling of 62 of the 66 grid sites, throughout the Wash, with some additional sites near the mouth of the Witham.

Freshwater flows were at summer levels prior to the survey period (lower than in February) with the Great Ouse accounting for about two-thirds of the total flow.

AUGUST, 1993 SURVEY.

Results are given in Table 8, the sample programme is shown in Figure 40 and nutrient data is presented in Figure 41.

Time and conditions permitted the sampling of 61 of the 66 grid sites, throughout the Wash, with some additional sites.

There was virtually no freshwater input from any of the Wash estuaries in the period prior to the survey.

The influence of the outflow from the Great Ouse was not as apparent in the outer Wash as from other surveys. This could be a reflection of low freshwater inputs during this period - see Figure 67(b).

SEPTEMBER, 1993 SURVEY.

Results are given in Table 9, the sample programme is shown in Figure 50 and nutrient data is presented in Figure 51.

Time and conditions permitted the sampling of 64 of the 66 grid sites, throughout the Wash, with some additional sites.

There was little freshwater input from any of the Wash estuaries in the period prior to the survey, except for a short period 10 days beforehand. Freshwater flows started to increase at the time of the survey.

The nutrient data was in line with seasonal expectations.

TIDAL CYCLE SURVEY, OUTER GREAT OUSE, JUNE 1993.

Sea Vigil was anchored for a 12 hour period at Site 61, 3.6 km offshore of Heacham, in order to carry out investigations into tidal cycle changes in nutrients and bacteria in the outer part of the Great Ouse estuary. Samples were collected at half-hour intervals.

Results are given in Table 10 and the nutrient data is presented in Figure 61(a). Water Quality data is presented in Figure 61(b).

TIME SERIES SURVEY, OUTER WITHAM, SEPTEMBER 1993.

Sea Vigil sampled hourly at three sites (6, 11 and 17) near the Freeman Channel in the Wash, associated with the outflow from the Witham and Welland system. Sub-surface, as well as surface samples were collected.

The intention was to investigate whether there were local differences in nutrient concentrations, caused by the vagaries of hydrodynamics in the Wash. This proved not to be so. The data collected at all 3 sites throughout the day was consistent and similar, with average nutrient values at a particular point not significantly influenced by tidal state.

Results are given in Table 11 and the nutrient data for each site is presented in Figures 62(a) to 62(e). It was not possible to measure DO, temperature or salinity on the sub-surface samples.

High water at Hunstanton was 0538 hrs and 1818 hrs BST. Low water was at 1242 hrs BST.

TIME SERIES SURVEY, OUTER NENE, OCTOBER 1993.

Sea Vigil sampled hourly at three sites (Westmark Knock, 22 and 29) near the middle of the Wash, associated with the outflow from the Nene estuary. Sub-surface, as well as surface samples were collected.

The intention was to investigate whether there were local differences in nutrient concentrations, caused by the vagaries of hydrodynamics in the Wash. Only the Westmark Knock site (innermost) demonstrated a significant tidal trend, producing distinctive maximum nutrient levels and minimum DO levels about ½ hour after low water. The sub-surface samples were not as variable, suggesting stratification at this point.

N.B. The water is unusually deep in the channel at Westmark Knock, charted at over 16m, with the sub-surface samples taken at about 6m depth. Inshore of this point, water depths are charted at 1 to 2m, where it is unlikely that stratification would be possible. Thus only the surface layer of the stratified water would be expected to pass inshore on the flood tide.

Results are given in Table 12 and the nutrient data for each site is presented in Figures 63(a), 63(b) and 63(c) respectively. The dotted lines are for sub-surface samples.

High water at Hunstanton was 0718 hrs and 1950 hrs BST. Low water was at 1420 hrs BST.

SEASONAL DATA COMPARISON AT SITE 66.

Figure 65 shows seasonal nutrient variations for the more extensively sampled Site 66 in the Outer Wash off the Lincolnshire Coast.

Nutrient levels in the outer Wash are at their lowest during July and August.

Silicate uptake and regeneration nearly always preceded that of nitrate, reflecting diatom blooms.

Phosphate levels did not change as dramatically as the two major nutrients of nitrate and silicate.

The ammonia trends were out of step with the other nutrients, being regenerated much earlier than silicate and taken up again when silicate and nitrate were at still peak winter levels.

BOSTON PILOTS DATA, SITE WMP1.

As part of the JoNuS Project, MAFF made arrangements with the Port of Boston Authority for the Pilot boat to collect a water sample out in the Freeman Channel each day it went out. The sample was filtered on-site and later put in a freezer until collected by MAFF for analysis. Field measurements were also taken for temperature and salinity. Data is shown for the period April '91 to December '92.

Figure 66 presents data collected for the JoNuS Project by the pilot boat at Boston within the Freeman Channel, on an almost daily basis. Whilst the nature of the sampling is rudimentary, results clearly show the seasonal trends in nutrient concentrations, based on quantity rather than quality.

Whilst this method of sample collection has its limitations, it has provided an opportunity to assess the daily variations in nutrient levels, as compared to normal monthly surveys.

CONCLUSIONS.

The following conclusions can be drawn from the data, although some must be tentative, in view of the limited time frame (2 years) of the data.

- The Wash was not often well mixed, particularly during summer months. This is in conflict with the earlier idea that the Wash was expected to be well mixed.
- The inner and middle Wash was greatly influenced by inputs from all four Wash tributary estuaries.
- The outer Wash was influenced by the outflow of the Great Ouse throughout most of the year, except when winter storms had caused the Wash to become well mixed.
- The nutrient balance for the Wash is different from that of the Lincolnshire Coast, silicate being proportionately much higher in the

Wash. It is possible that there is a net export of silicate along the Norfolk Coast.

- When the Wash was well mixed (February 1993) there was a distinct upward trend in nutrient concentrations in the outer Wash along a line from the Lincolnshire Coast to the Norfolk Coast.
 - During June 1993, the influence of the Great Ouse spread outside the survey area into the North Sea.
 - Data collected over most of a tidal cycle at Westmark Knock showed a significant tidal influence from the Nene estuary at this point. This data reflects the nature of the Nene and the drying channel that forms in the Wash. The poor quality of the Nene is evident and it would appear that some of this poor quality water returns from the Wash to the Estuary.
 - Tidal cycle data from other sites in the Wash showed very little variance, suggesting that the average nutrient values at a particular point were not significantly influenced by tidal state, i.e. each sample point was representative of a wide area. This means that there is little need to compensate for tidal state during a grid survey.
 - The direction and order of sampling does not appear to be significant.
 - It is not possible to define "background" nutrient levels in the Wash. Such levels need to be determined during future work.
 - Successful monitoring of the Wash can only be carried out by the use of specialist survey vessels.
-

FUTURE YEARS.

It is planned to continue sampling the Wash. There were 6 surveys in 1994, with 6 planned during 1995. Various quality control procedures are being implemented to improve field data quality, in particular with better precision on salinity and temperature data. Improvements to the on-board sampling and analysis system will allow additional samples to be collected between sites, at little extra cost.

It may be necessary to sample occasionally from beyond the 3 mile limit in order to determine background levels of nutrients and help define eutrophic status.

The NRA's National Marine Surveillance programme has identified the need to link the offshore coastal survey data with the discharges from major estuaries. Wash monitoring will be adjusted as necessary to provide this link.

Developments are in progress to collect continuous electronic data, including chlorophyll and turbidity although the shallow waters of the Wash can cause problems with towed instrumentation "hitting bottom".

Some plankton data has been collected in the Wash and its tributary estuaries during the JoNuS project and will be reported in due course. It is hoped to continue with this plankton work.

In future work, it would be useful to relate water quality data to accurate current and bathymetric data. Such data is now being collected as part of a Wash beach strategy programme.

Further reports on Wash water quality data will be produced on an annual basis with future reports comparing the Wash with results from Lincolnshire and Norfolk Coast surveys.

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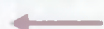


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Figure 1 : Wash Grid
Sampling Points

Order of Sampling

19th August 1992



20th August 1992

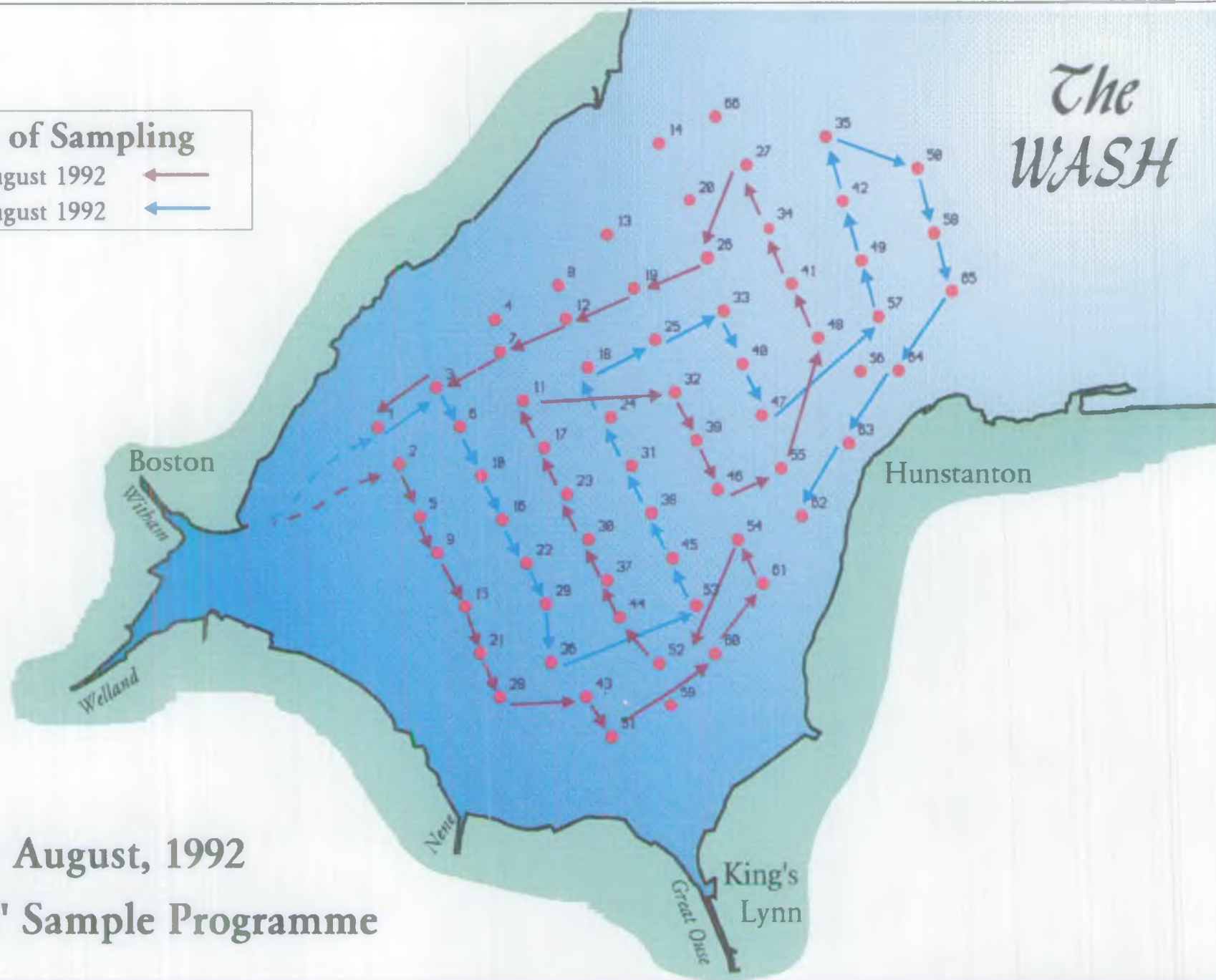


Figure 2 : August, 1992
'Sea Vigil' Sample Programme

Wash Nutrients 19th & 20th August 1992

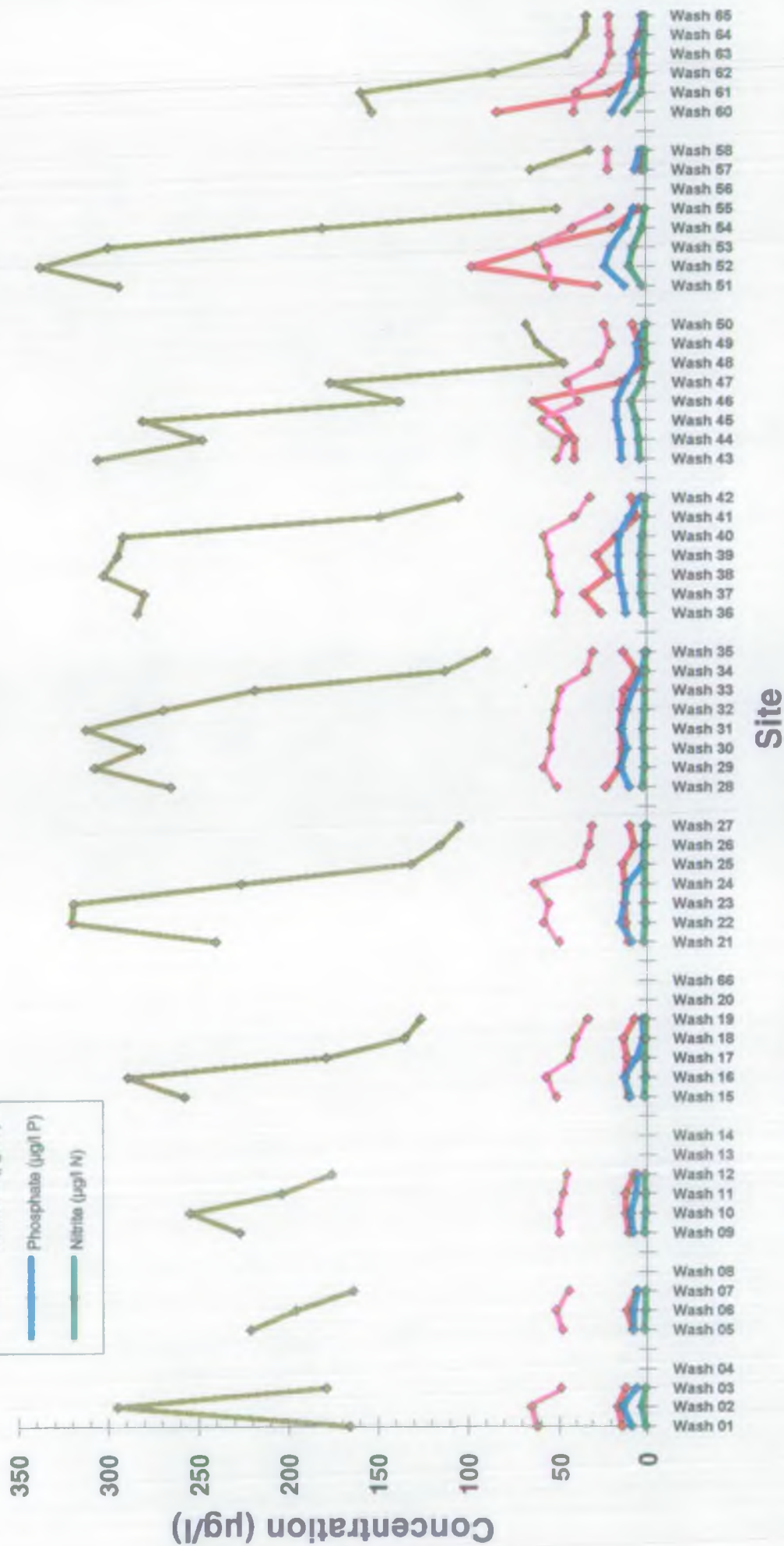
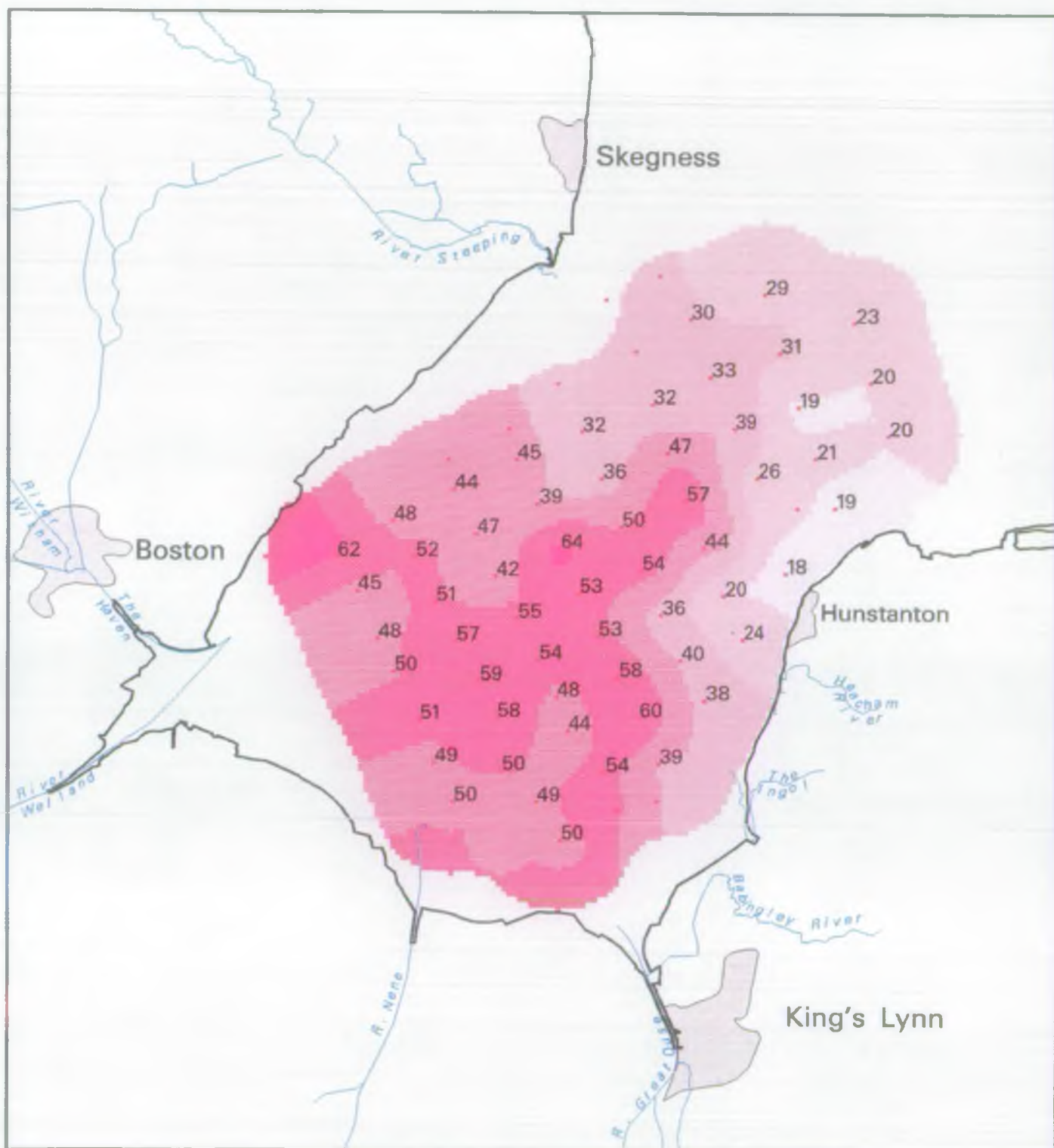


Figure 3 : Wash Grid Survey, August 1992



WASH Survey: August, 1992 – Ammonia ($\mu\text{g/l}$)



NRA
National Rivers Authority
Anglian Region

LEGEND:

$\mu\text{g/l}$	$\mu\text{g/l}$
10 - 19	40 - 49
20 - 29	50 - 59
30 - 39	60 +

20 Sample point and value



0 2 4 6 8 10
Scale (km)

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Figure 4.

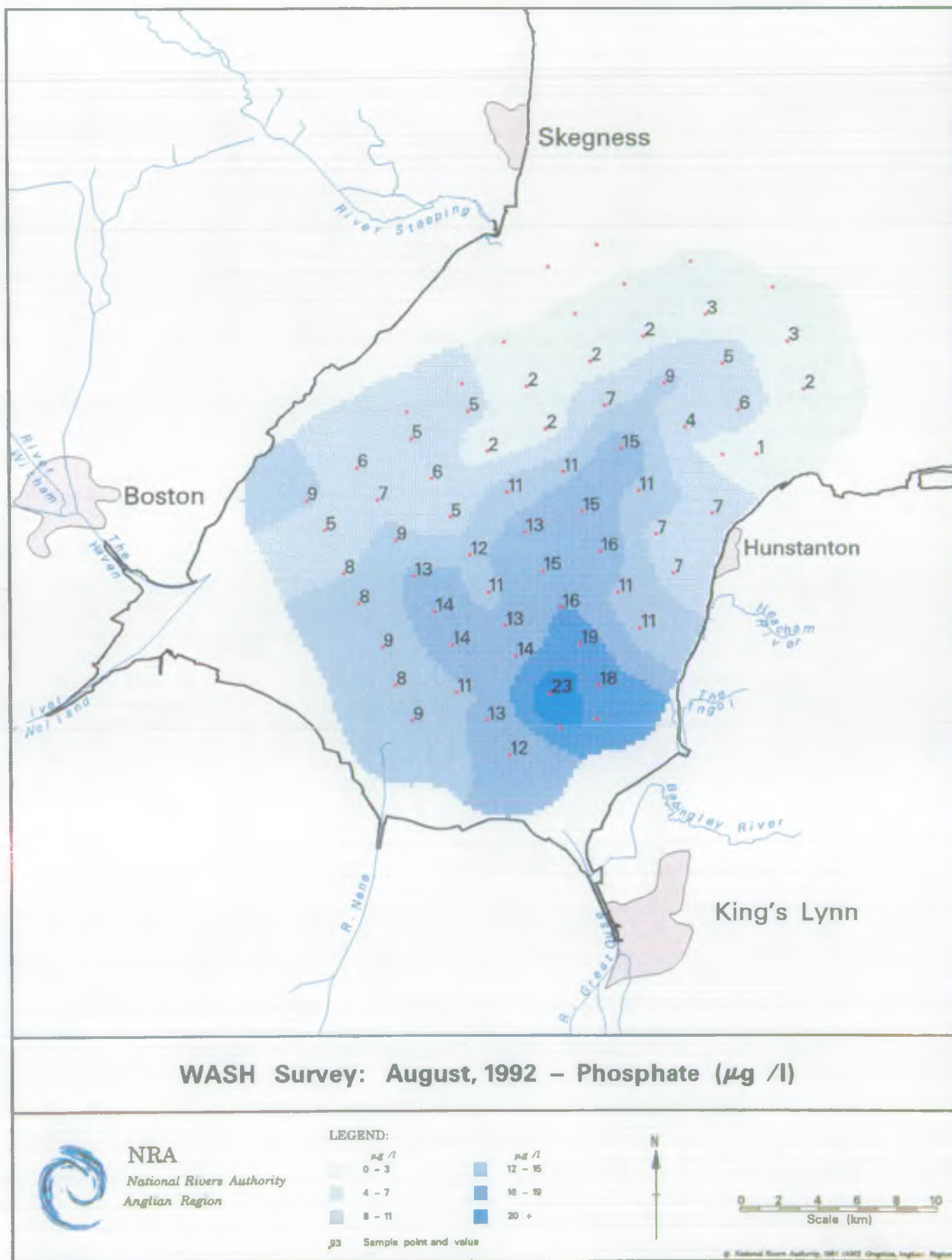
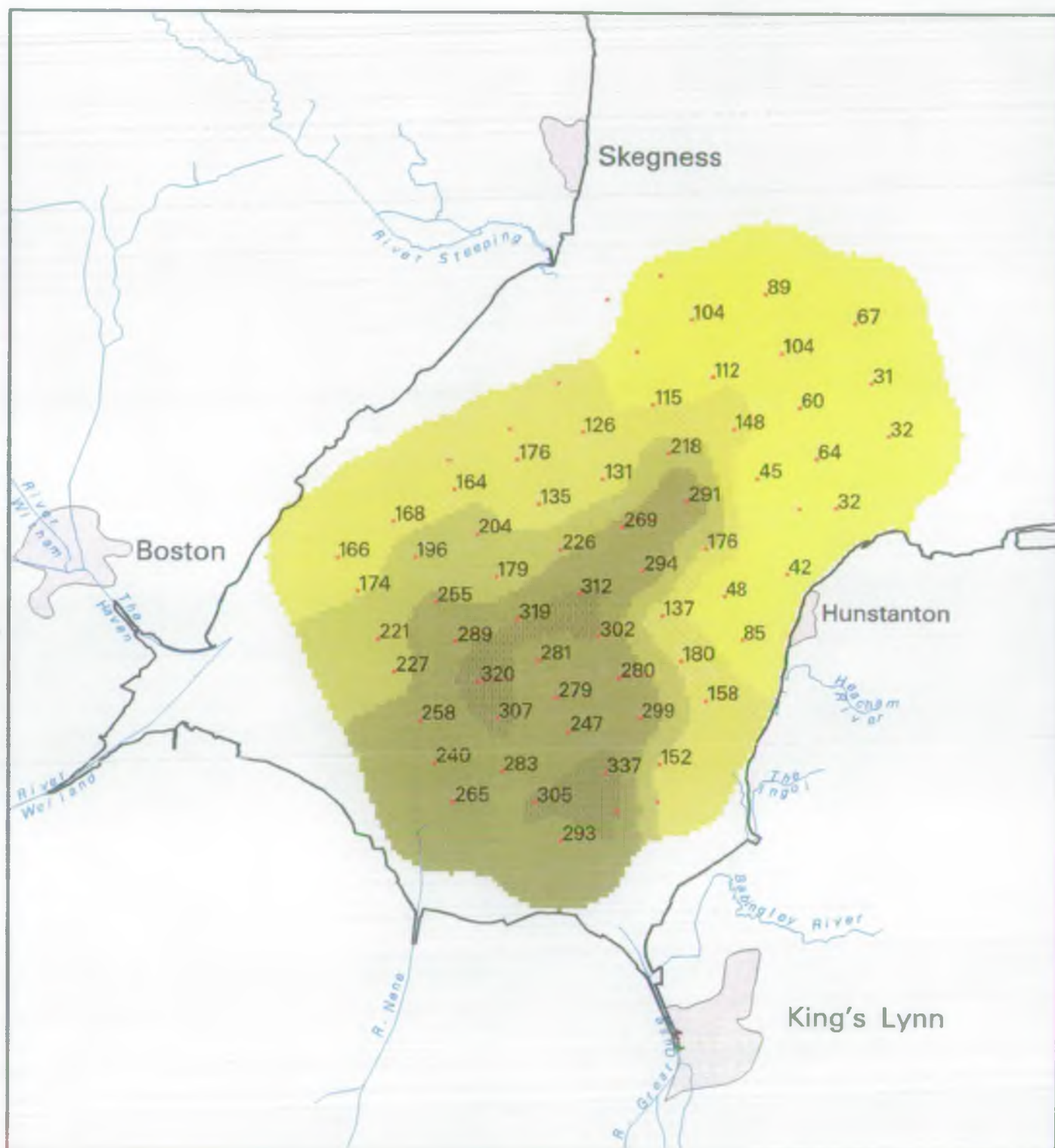


Figure 5.



WASH Survey: August, 1992 – Silicate ($\mu\text{g/l}$)



NRA
National Rivers Authority
Anglian Region

LEGEND:

$\mu\text{g/l}$	$\mu\text{g/l}$
0 - 50	180 - 239
60 - 119	240 - 299
120 - 179	300 +
Sample point and value	



0 2 4 6 8 10
Scale (km)

© National Rivers Authority, 1994 (AMS Graphics, Anglian Region)

Figure 6.



Figure 7.

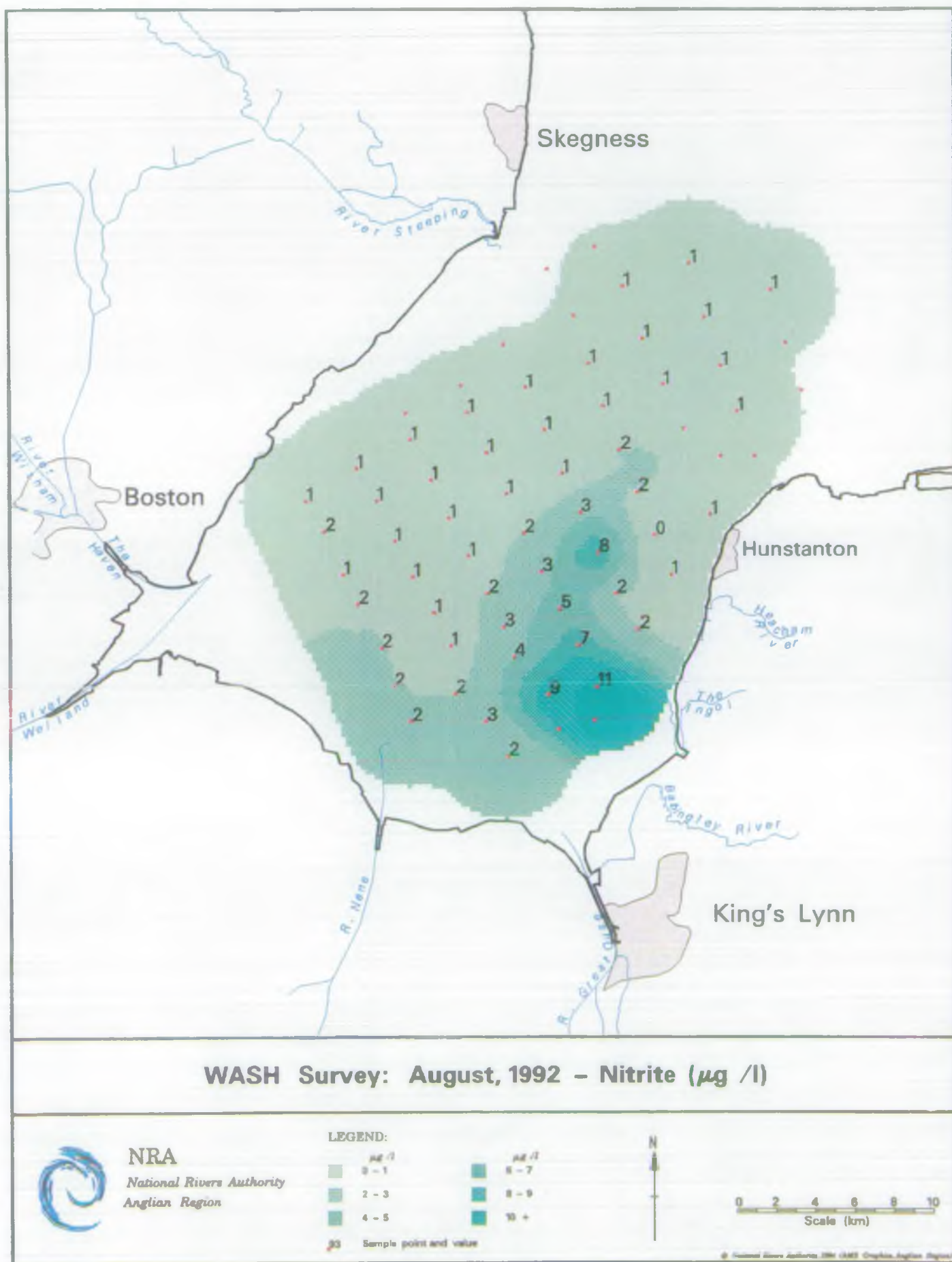


Figure 8.

WASH Survey : August 1992 – Temperature (deg C).



Figure 9.

WASH Survey : August 1992 – Salinity (ppt).

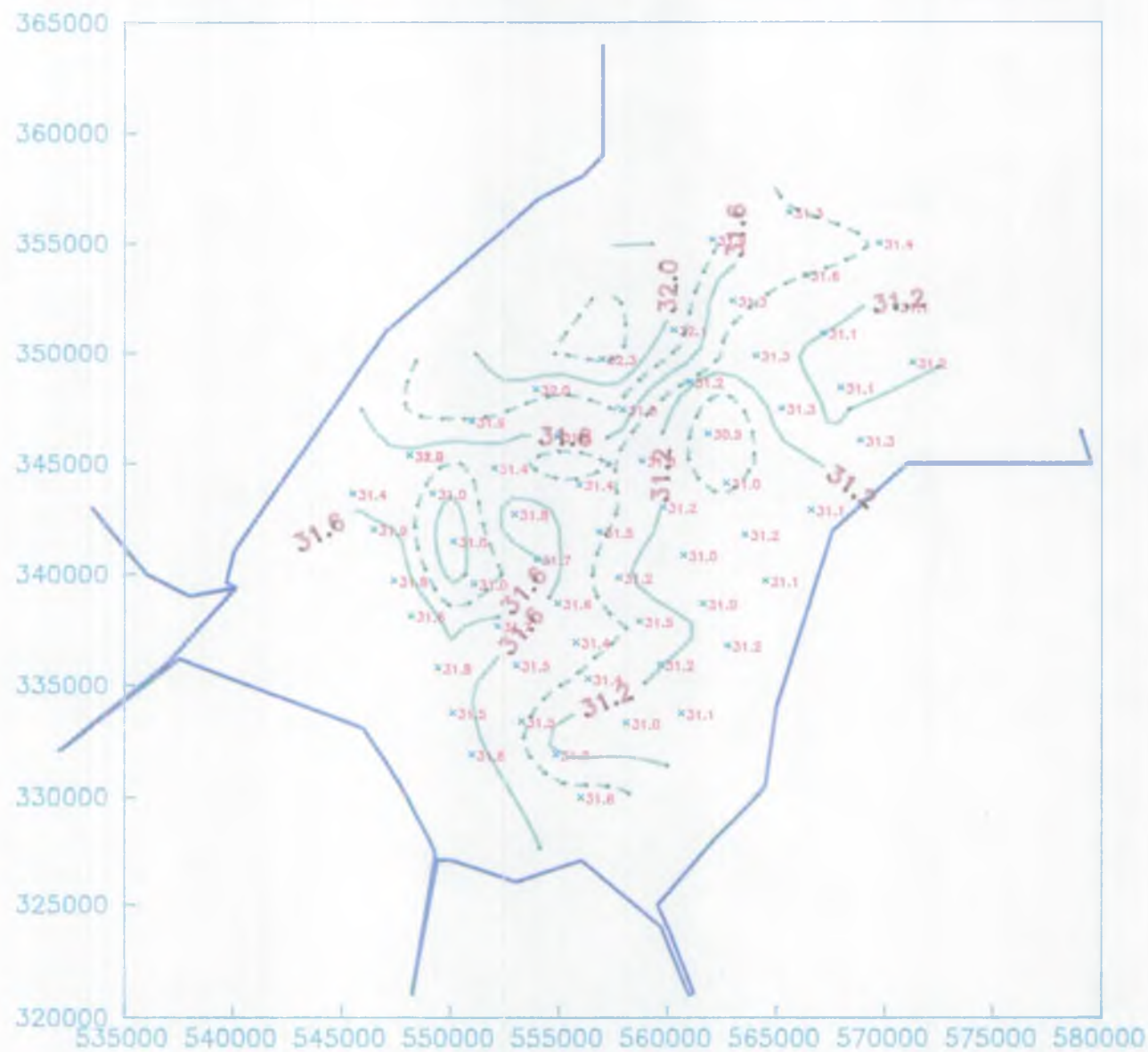
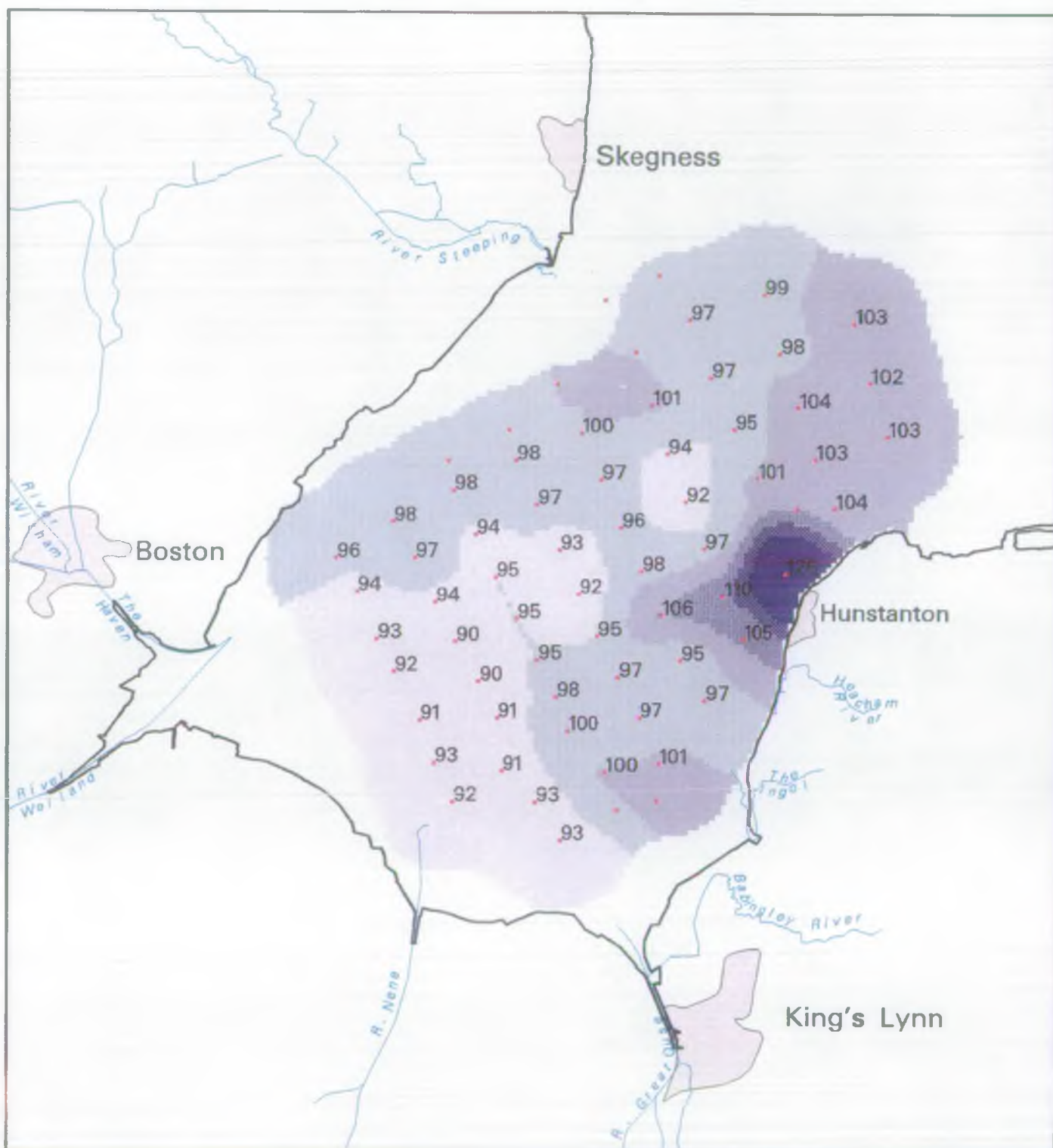


Figure 10.



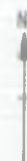
WASH Survey: August, 1992 – Dissolved Oxygen (% Saturation)



NRA
National Rivers Authority
Anglian Region

LEGEND:

% sat 90 - 94	% sat 105 - 109
95 - 99	110 - 114
100 - 104	115 +
93	Sample point and value



0 2 4 6 8 10
Scale (km)

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Figure 11.

Order of Sampling

24th November 1992 ←

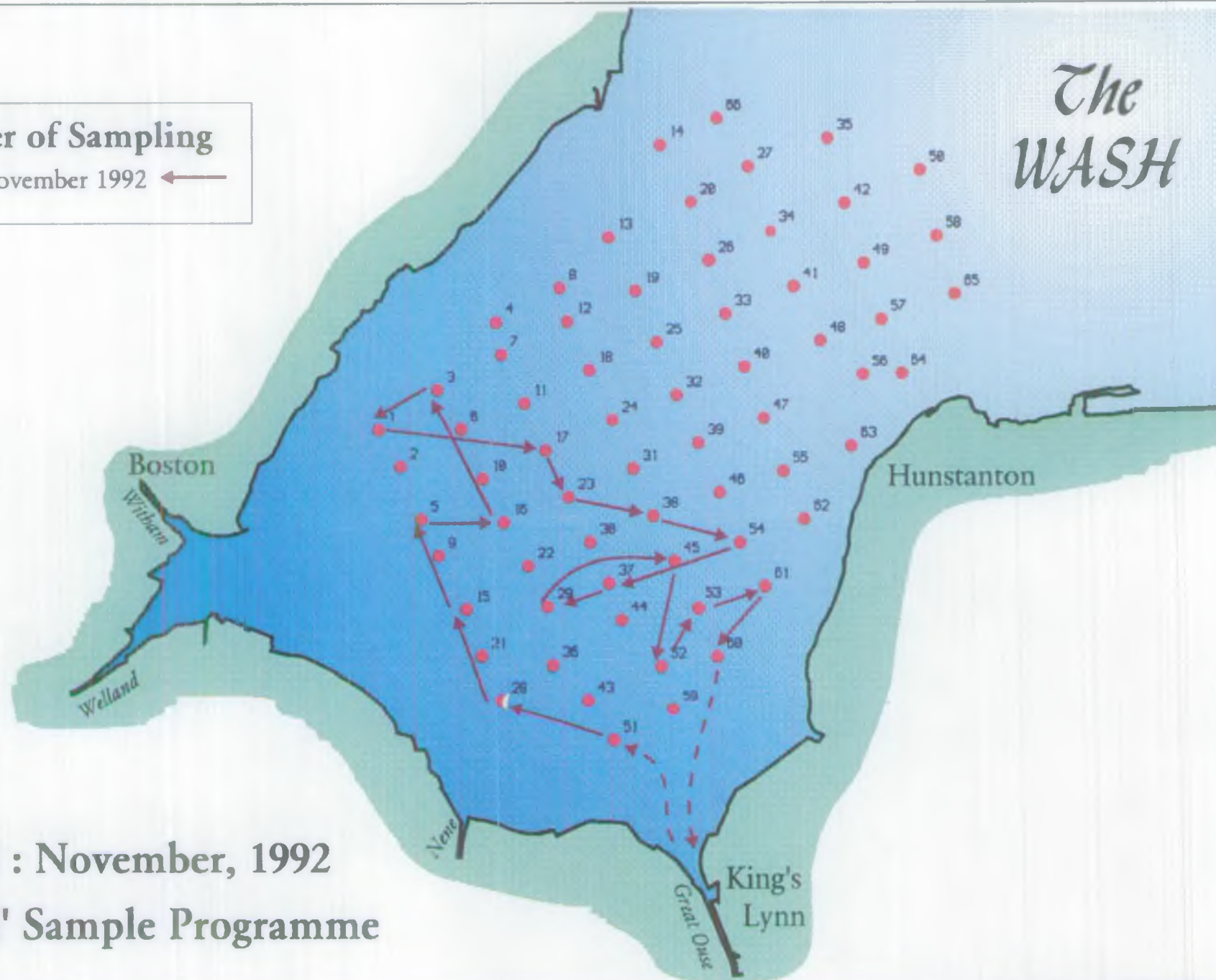


Figure 12 : November, 1992
'Sea Vigil' Sample Programme

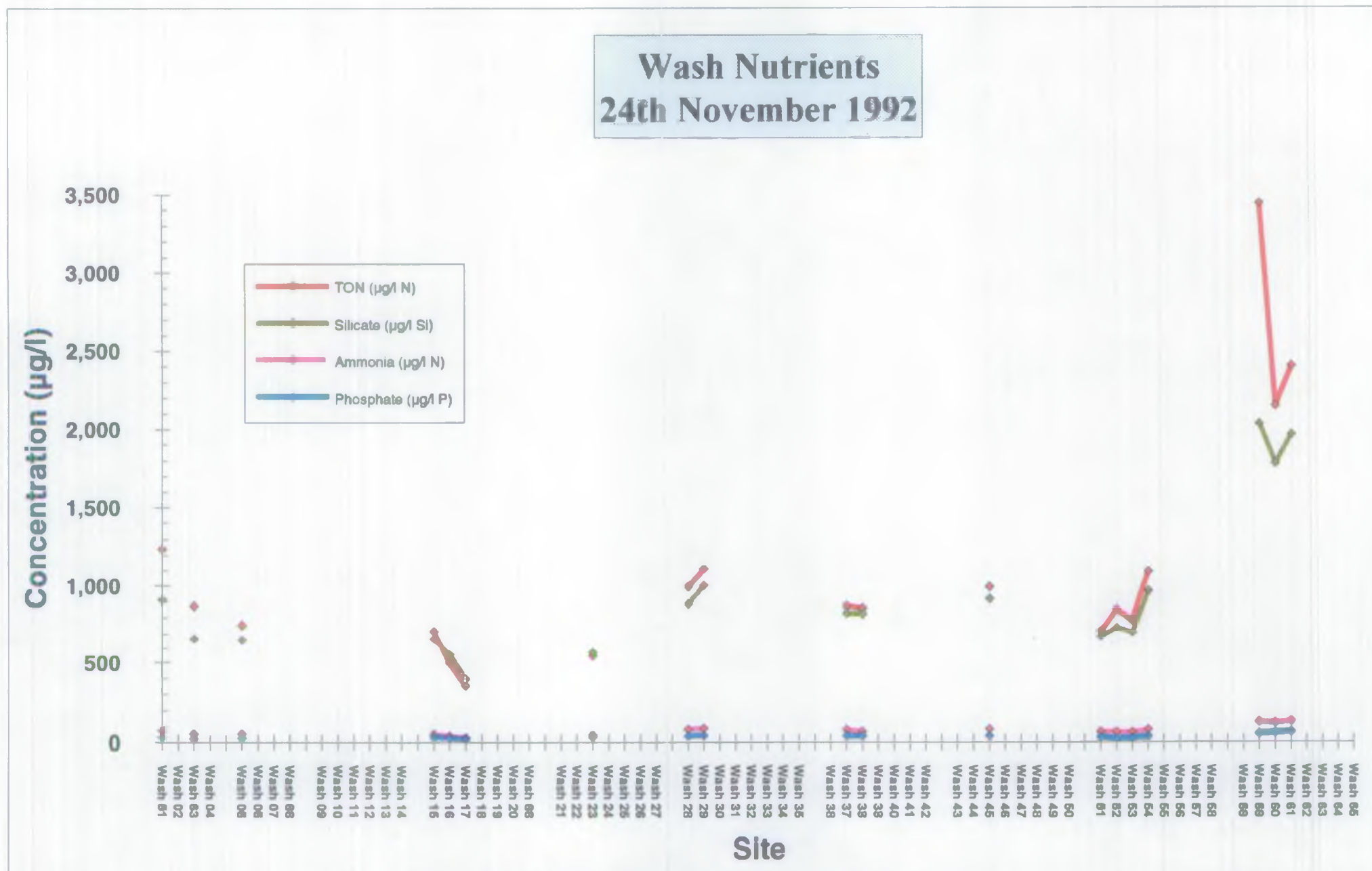


Figure 13 : Wash Grid Survey, November 1992

WASH Survey : November 1992 – Ammonia (ug/L).



Figure 14.

WASH Survey : November 1992 – Phosphate (ug/L).

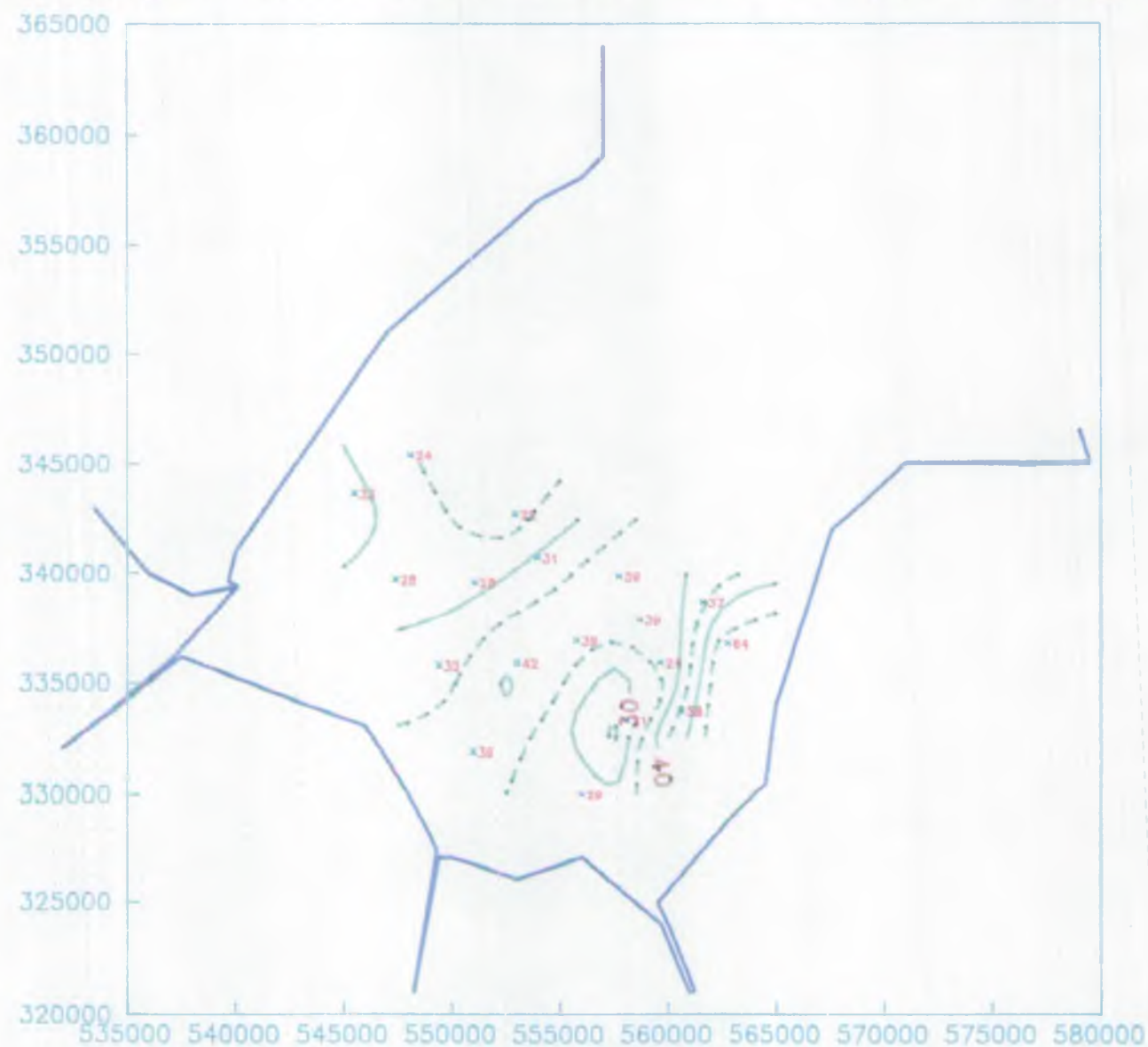


Figure 15.

WASH Survey : November 1992 – Silicate (ug/L).

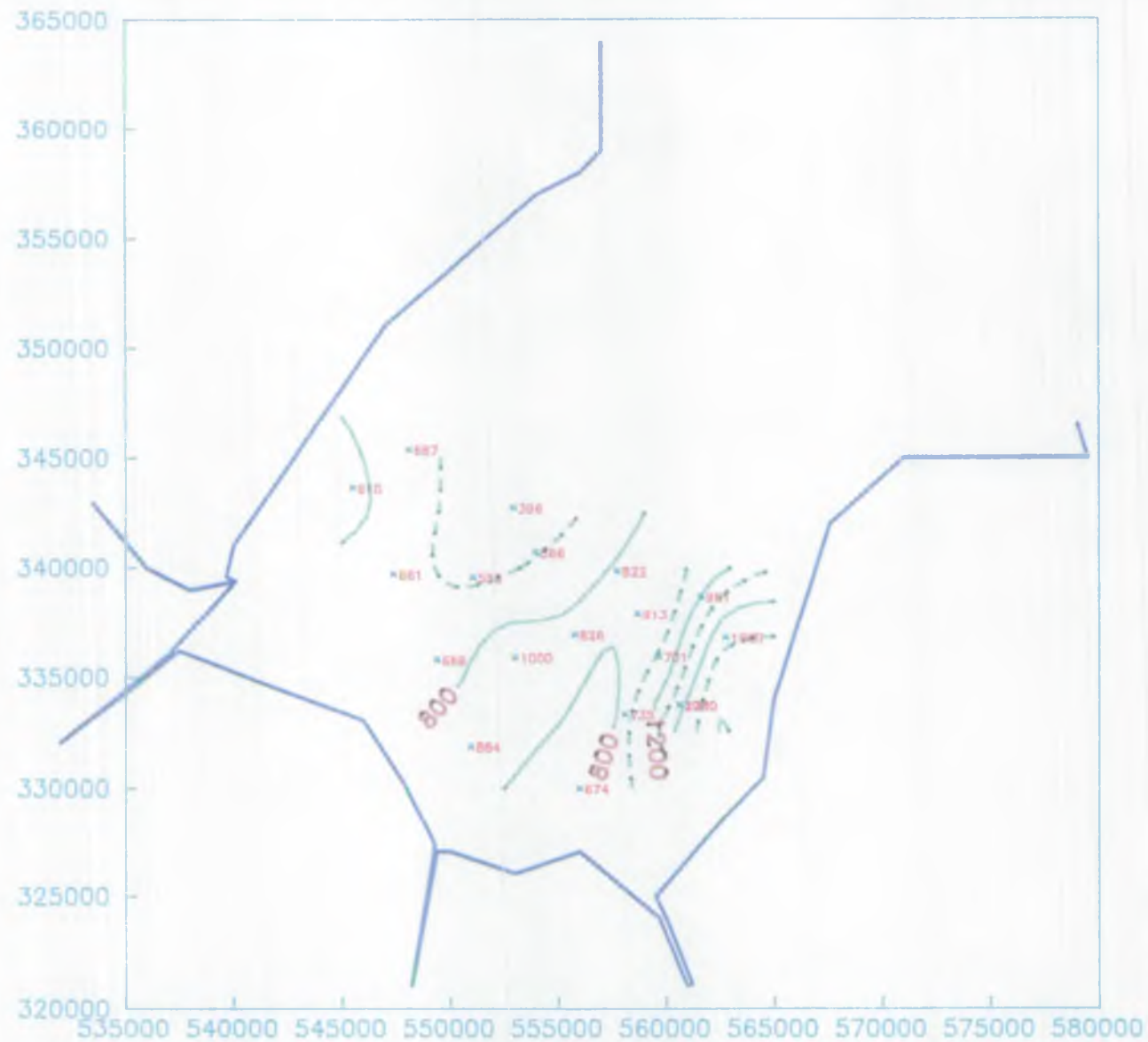


Figure 16.

WASH Survey : November 1992 – Nitrate (ug/L).

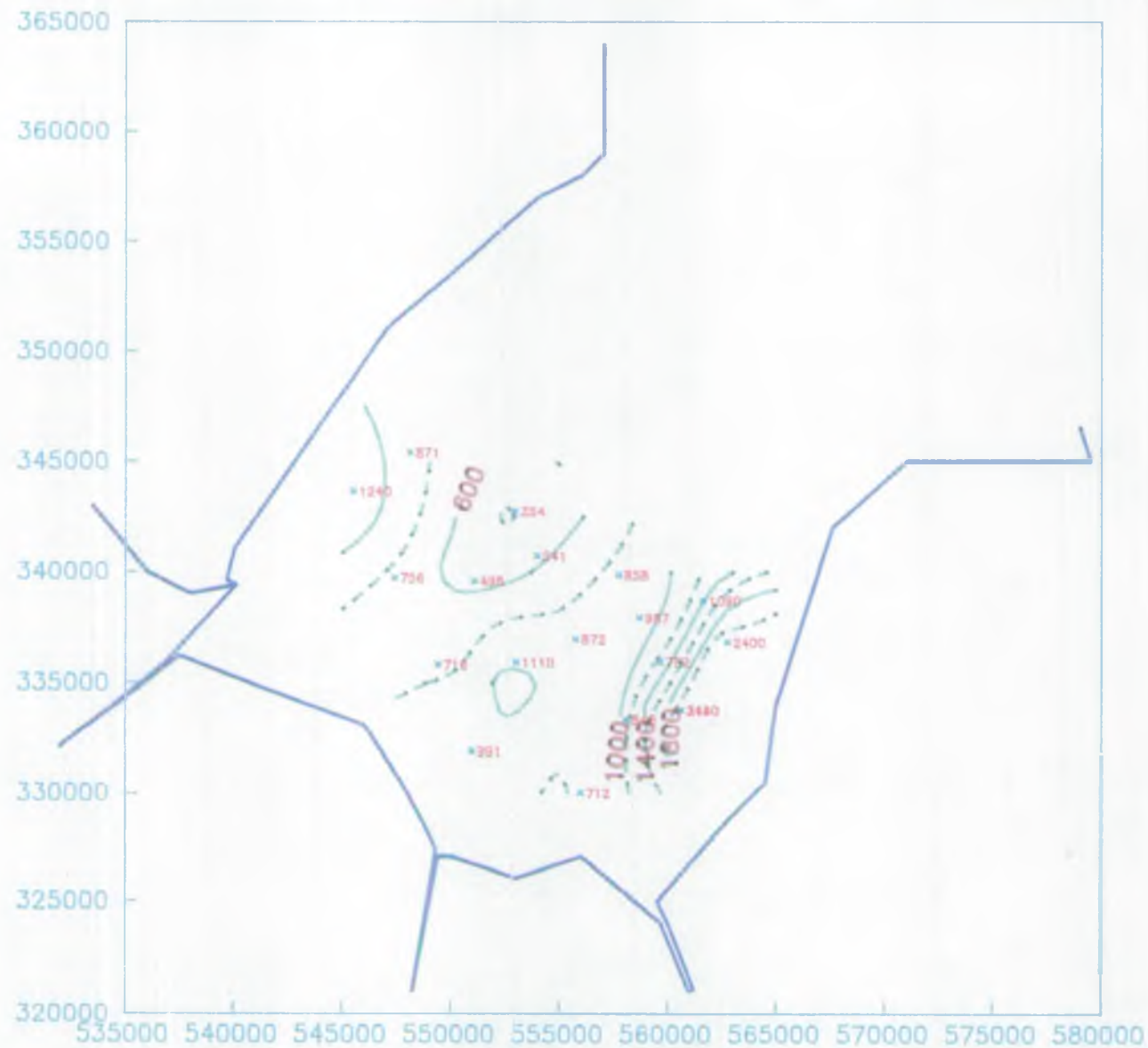


Figure 17.

WASH Survey : November 1992 – Temperature (deg C).

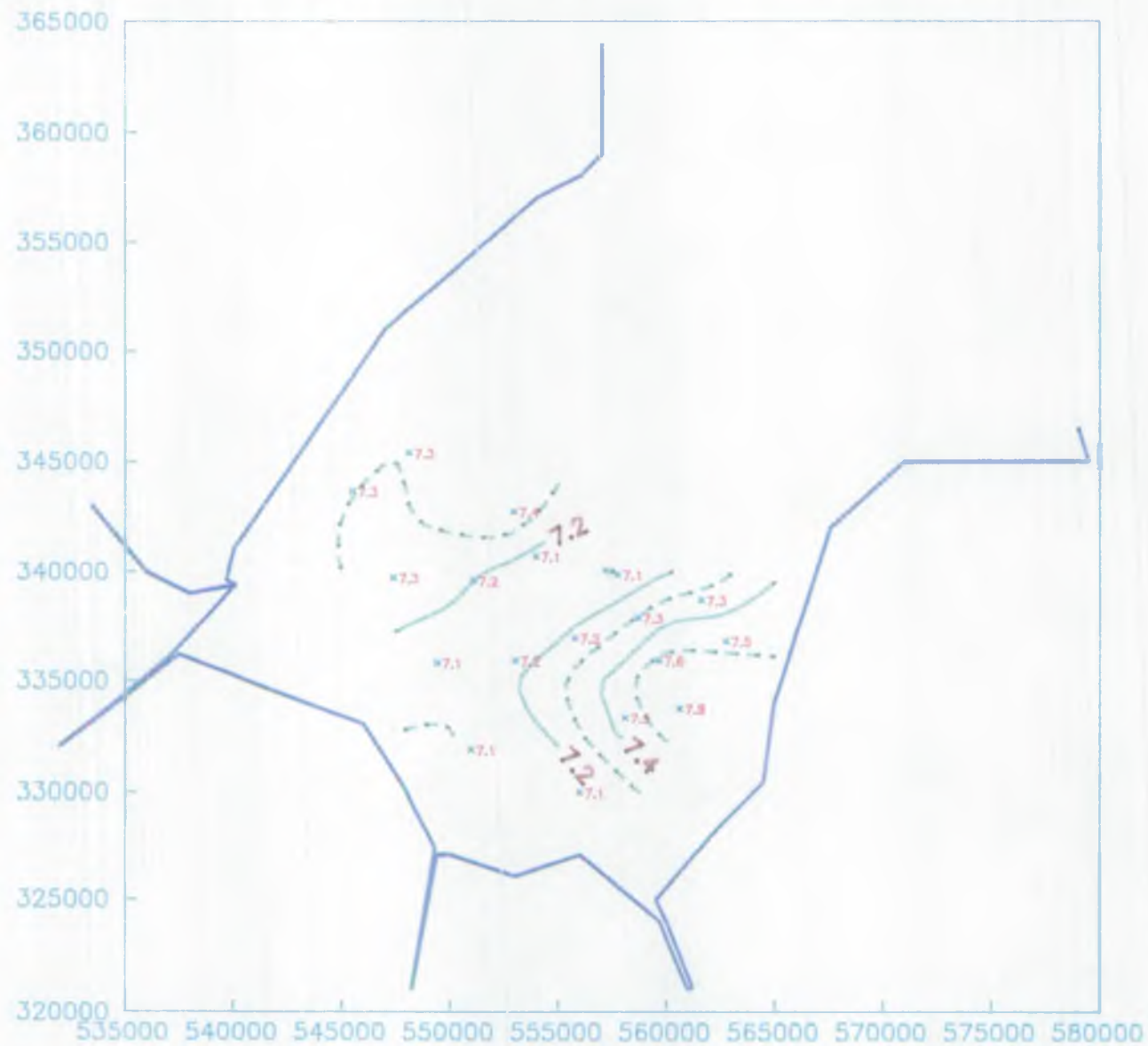


Figure 18.

WASH Survey : November 1992 – Salinity (ppt).

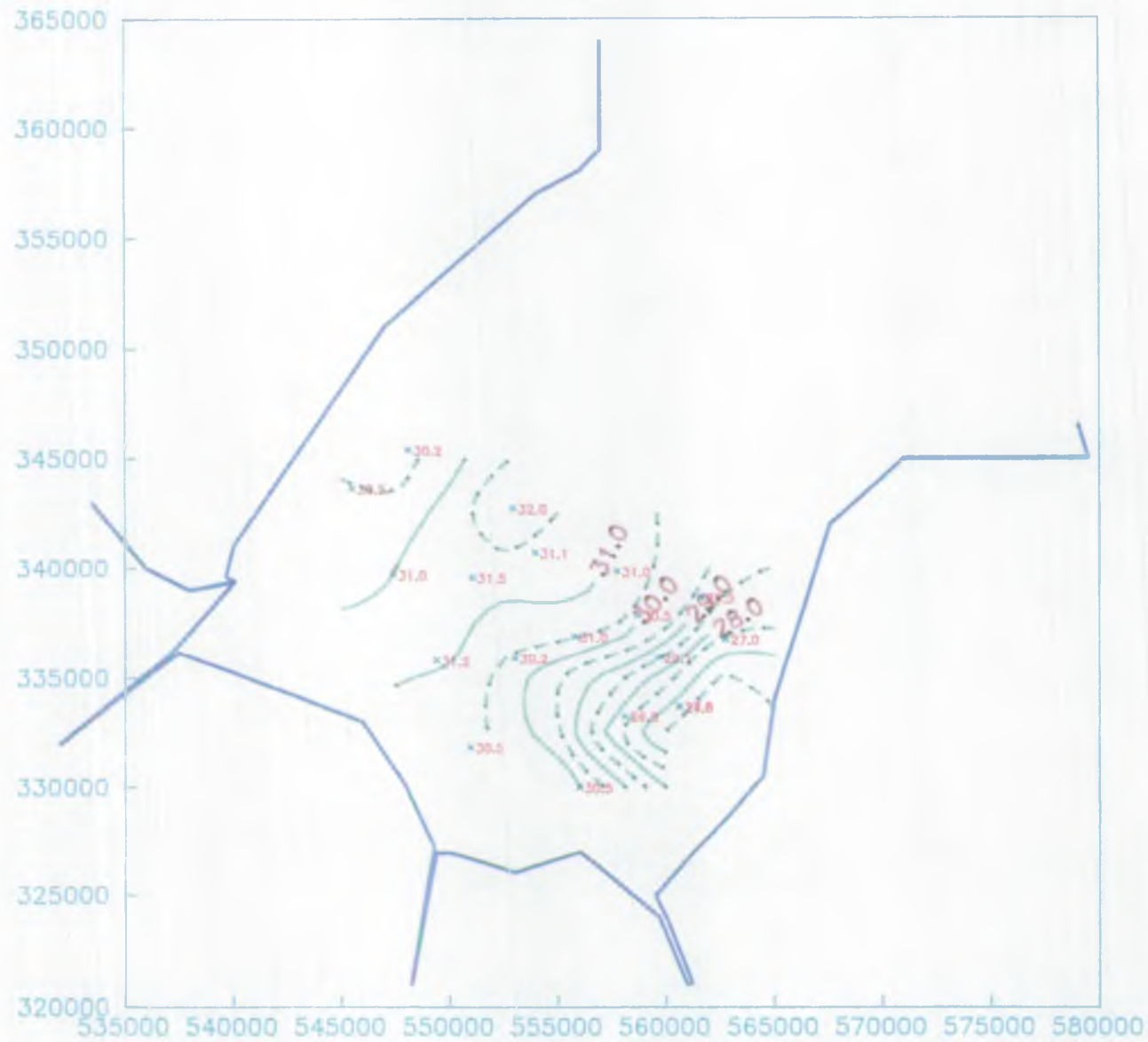


Figure 19.

WASH Survey : November 1992 – Dissolved Oxygen ($\%$ Sat).

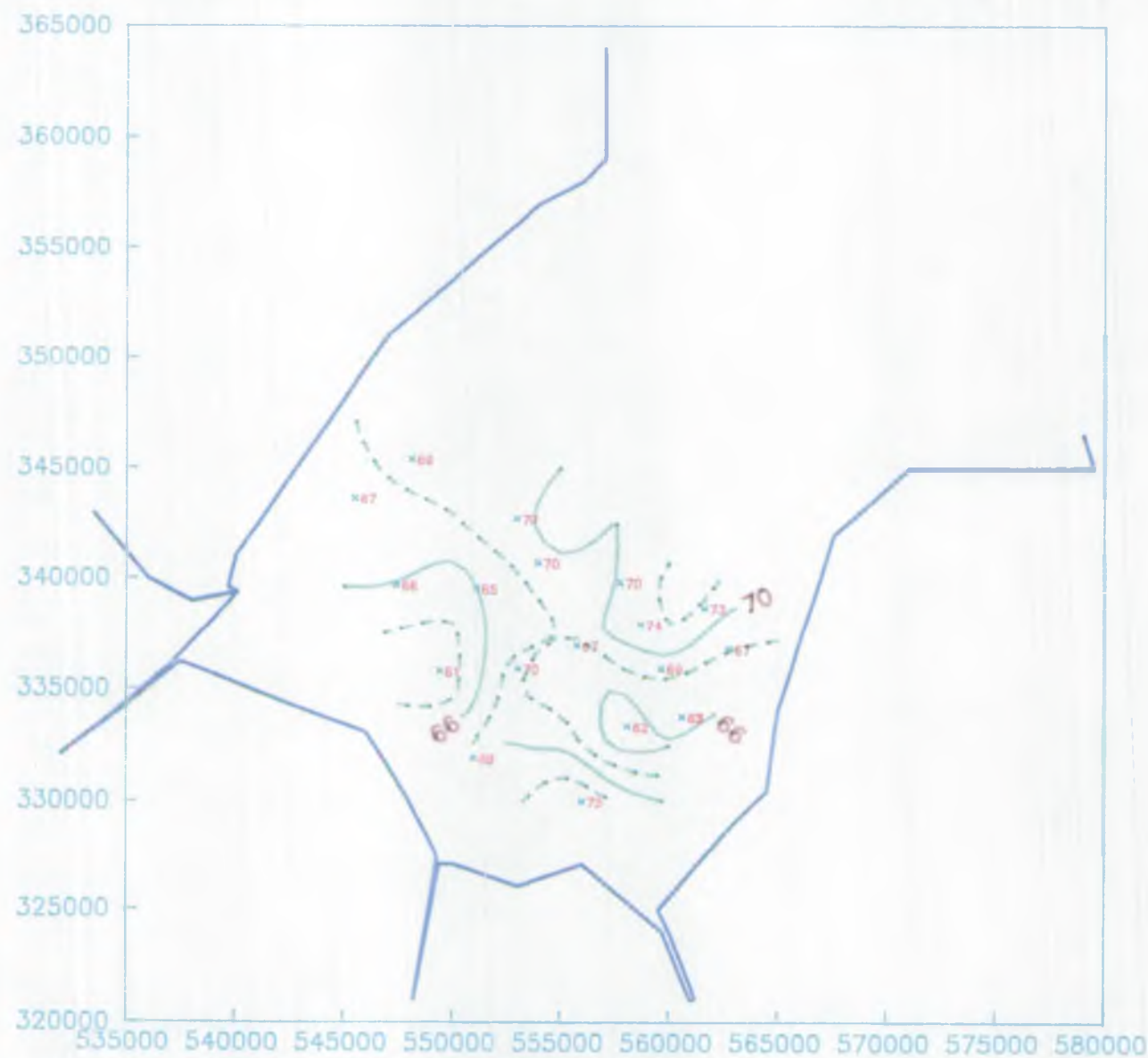


Figure 20.

Order of Sampling

9th February 1993 ←

11th February 1993 ←

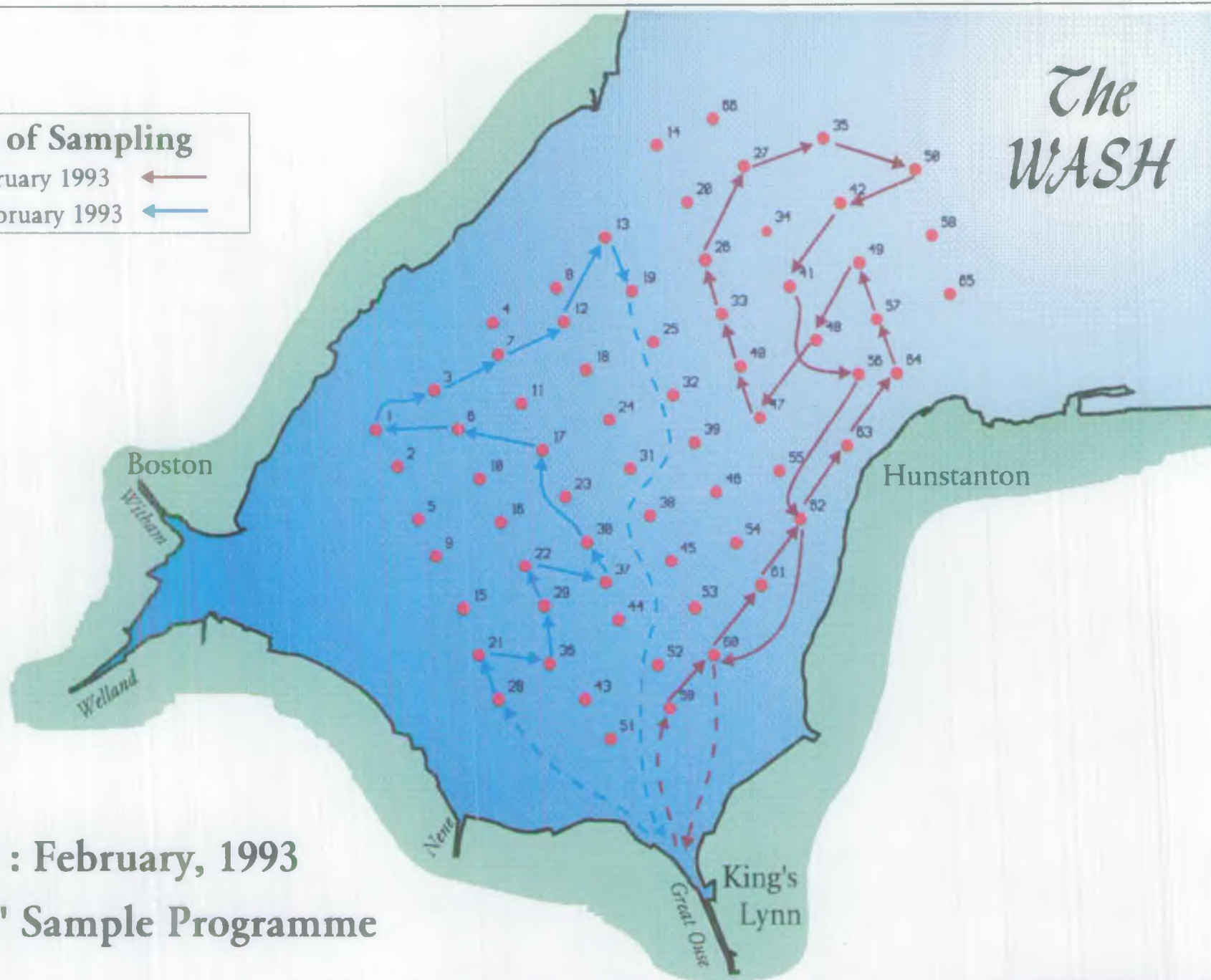


Figure 21 : February, 1993
'Sea Vigil' Sample Programme

Wash Nutrients 9th & 11th February 1993

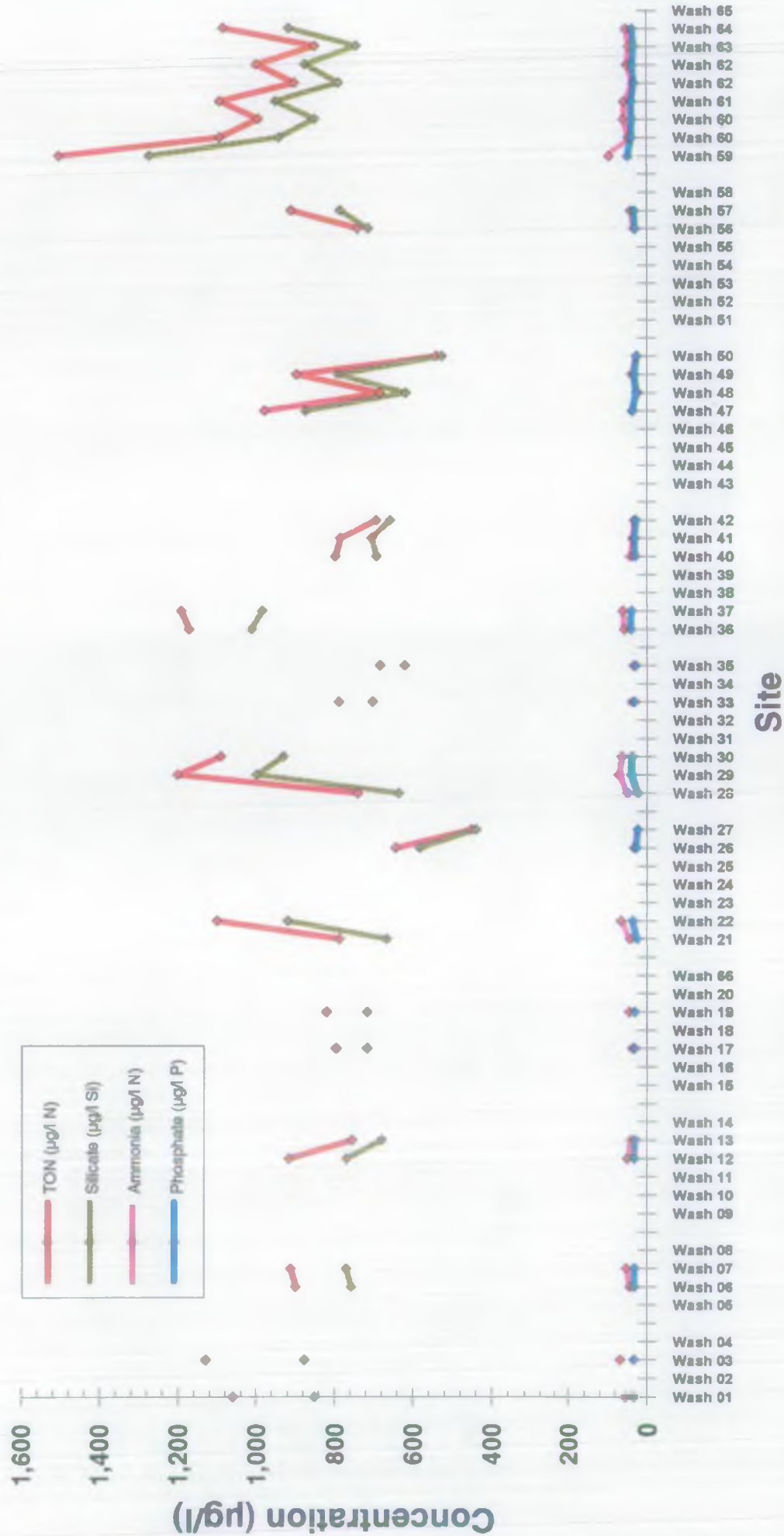


Figure 22 : Wash Grid Survey, 9th and 11th February 1993

WASH Survey : February 1993 – Ammonia (ug/l).

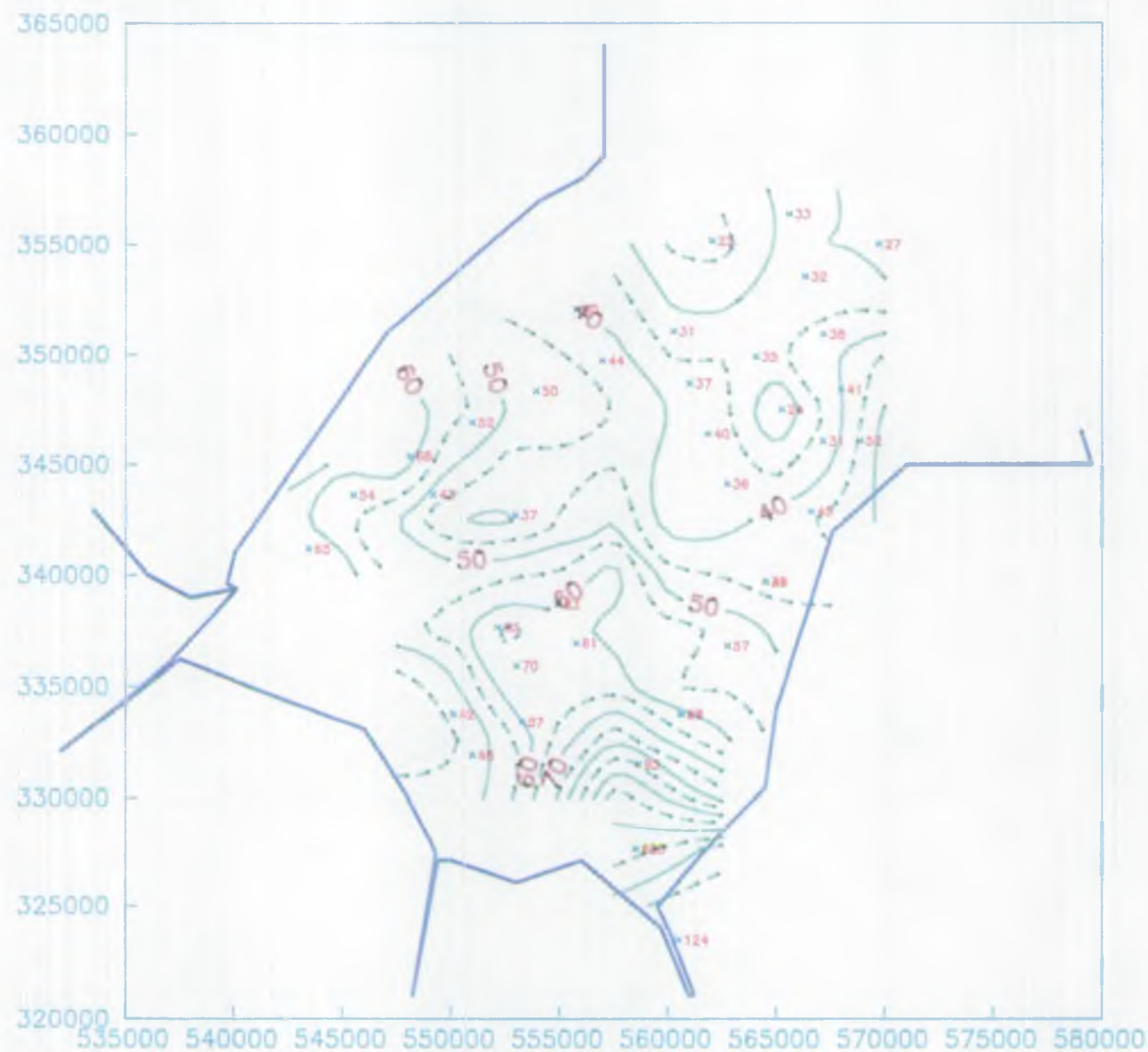


Figure 23.

WASH Survey : February 1993 – Phosphate (ug/l).

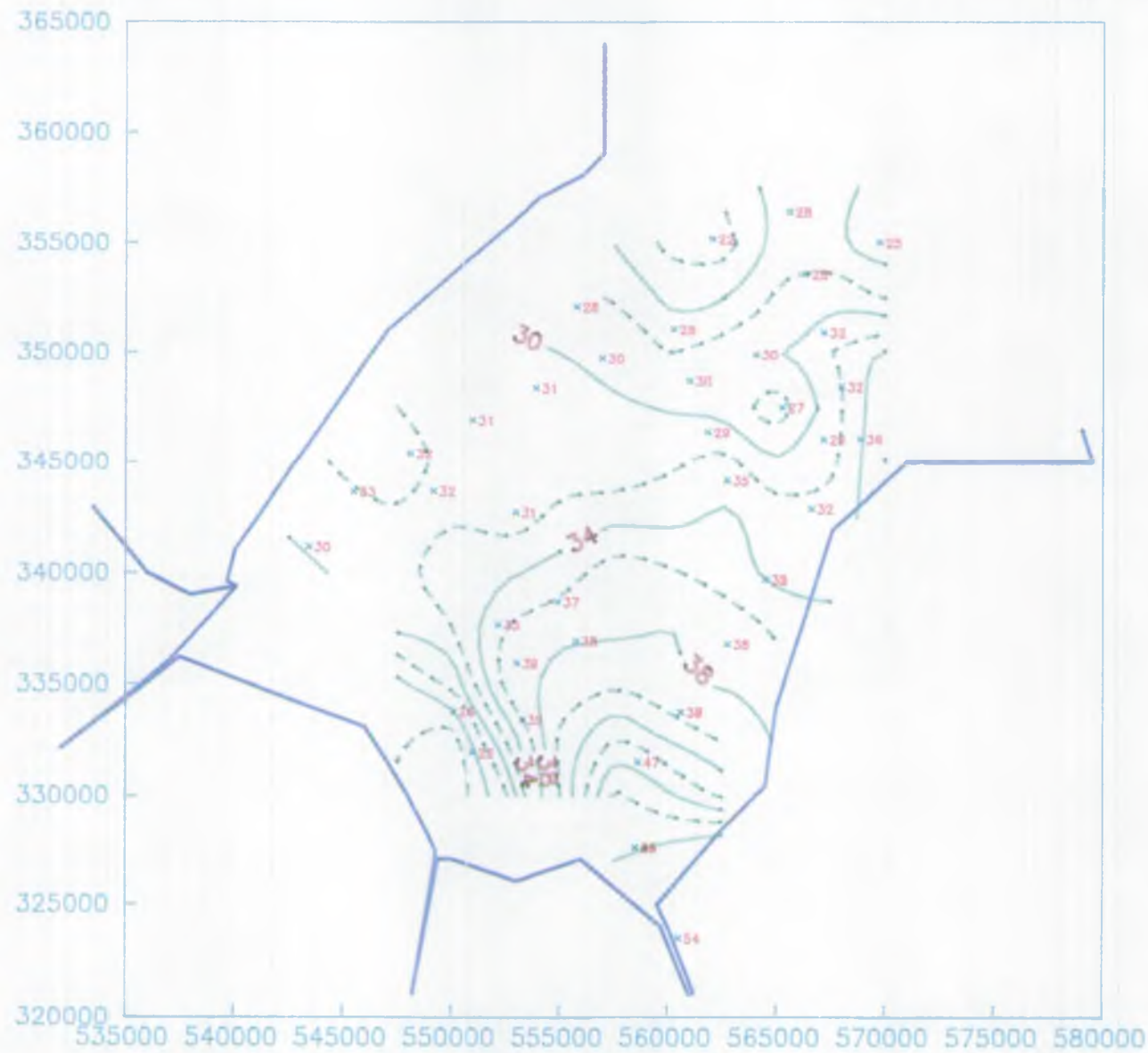


Figure 24.

WASH Survey : February 1993 — Silicate (ug/l).

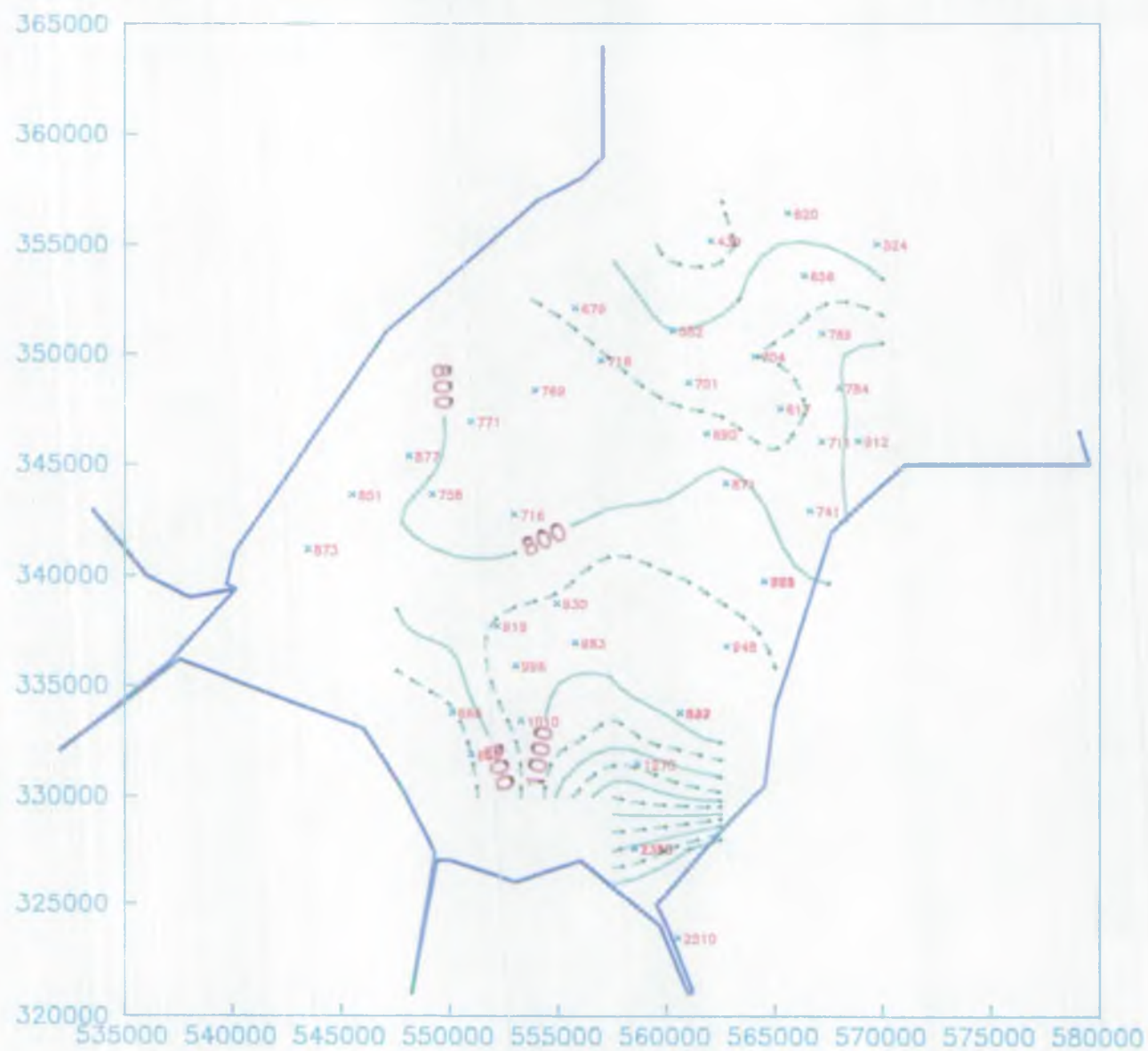


Figure 25.

WASH Survey : February 1993 — Nitrate ($\mu\text{g/l}$).



Figure 26.

WASH Survey : February 1993 – Temperature (deg C).



Figure 27.

WASH Survey : February 1993 – Salinity (ppt).

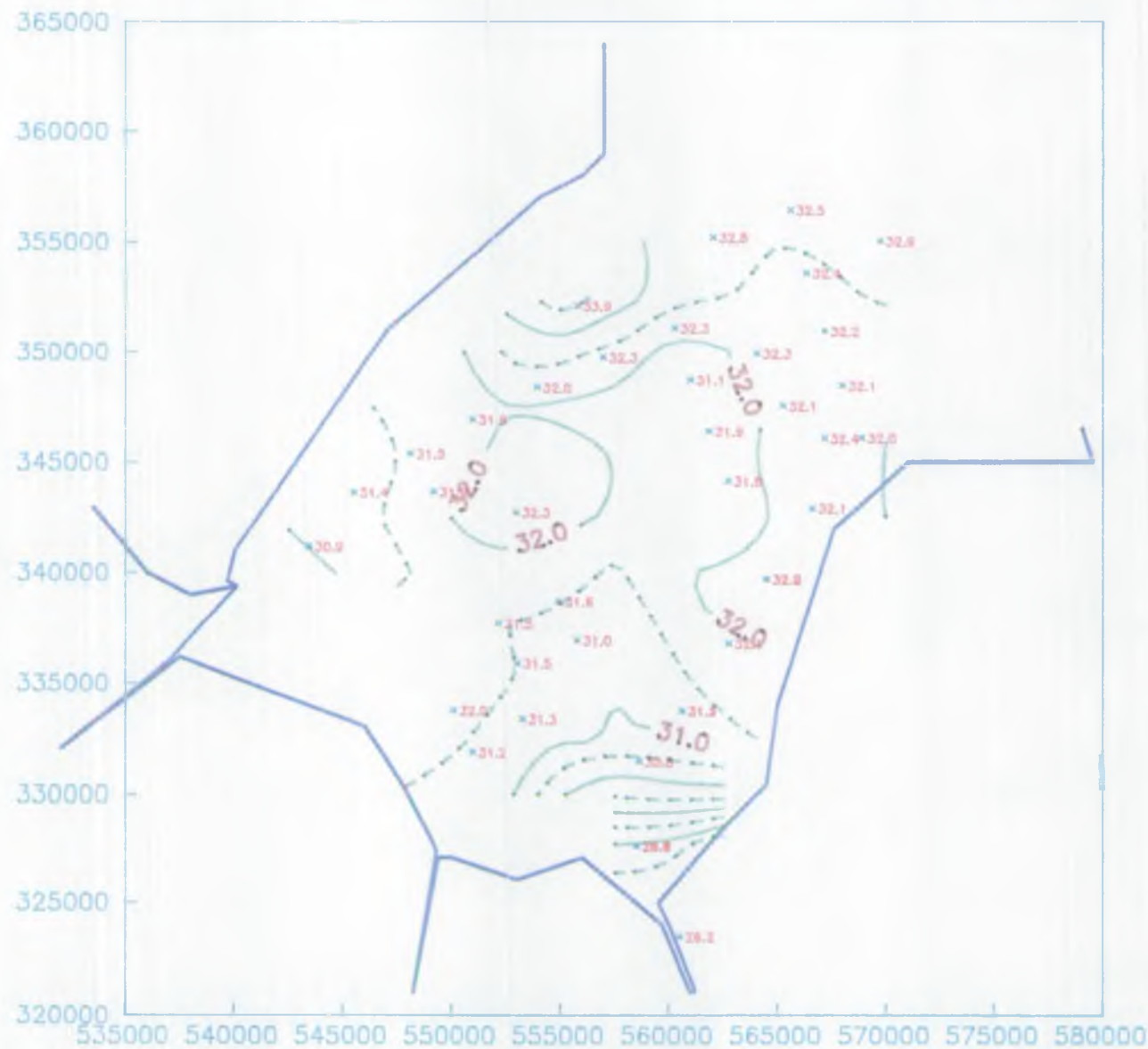


Figure 28.

WASH Survey : February 1993 – Dissolved Oxygen (x Sat).



Figure 29.

Order of Sampling

7th June 1993



8th June 1993

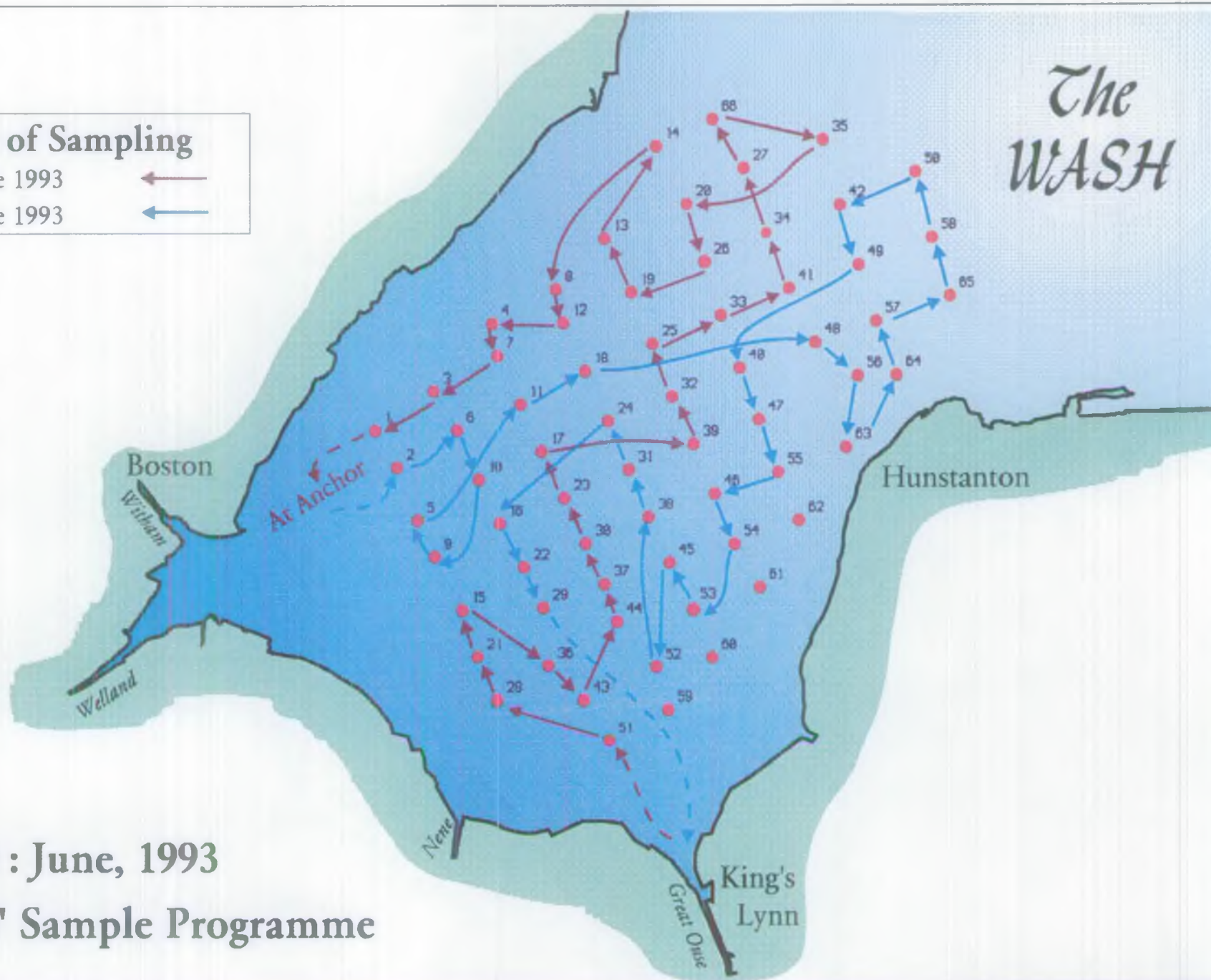


Figure 30 : June, 1993
'Sea Vigil' Sample Programme

Wash Nutrients 8th & 9th June 1993

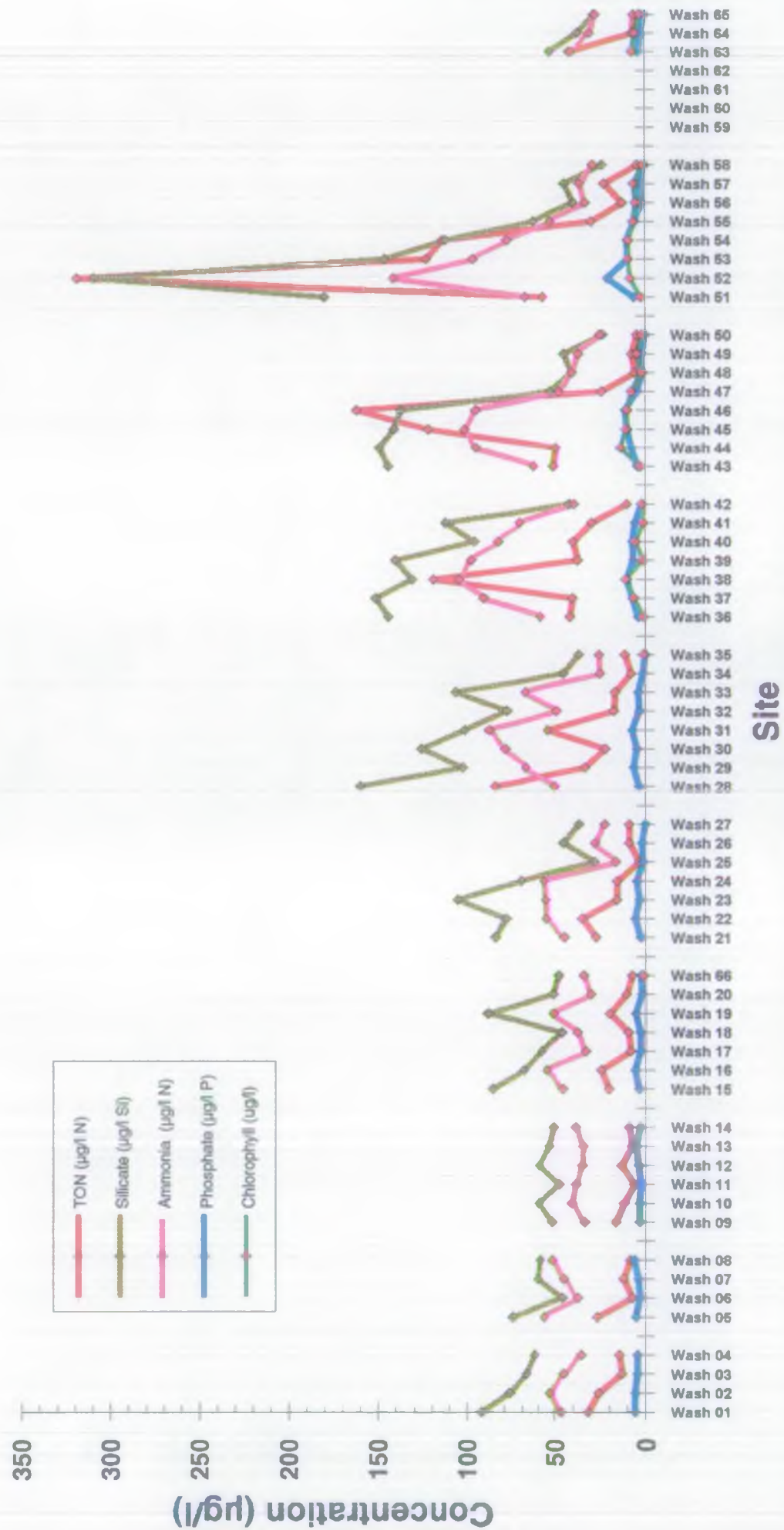


Figure 31 : Wash Grid Survey, 8th and 9th June 1993

WASH Survey : June 1993 – Ammonia (ug/L)

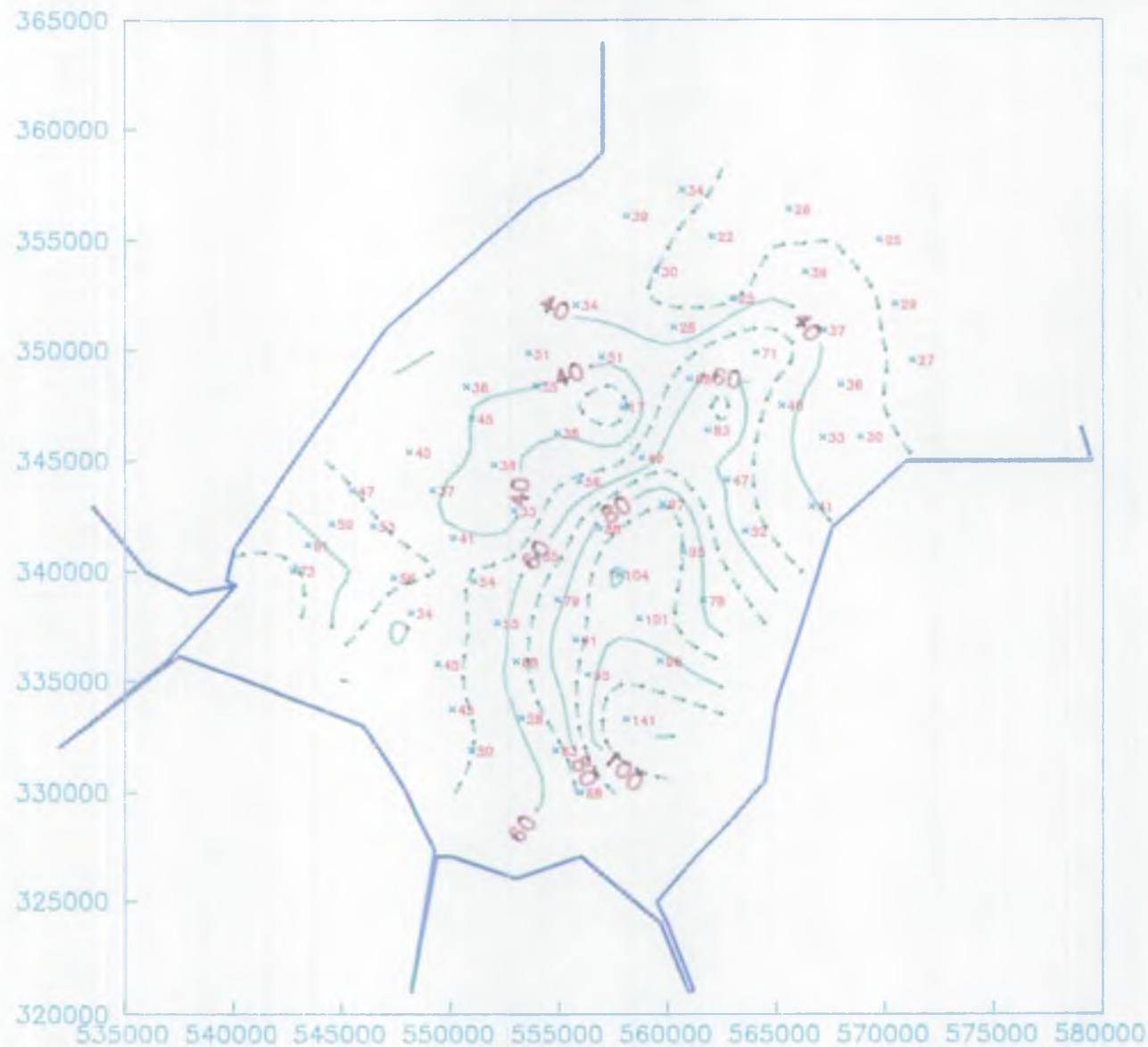


Figure 32.

WASH Survey : June 1993 – Phosphate (ug/L)



Figure 33.

WASH Survey : June 1993 – Silicate (ug/L).

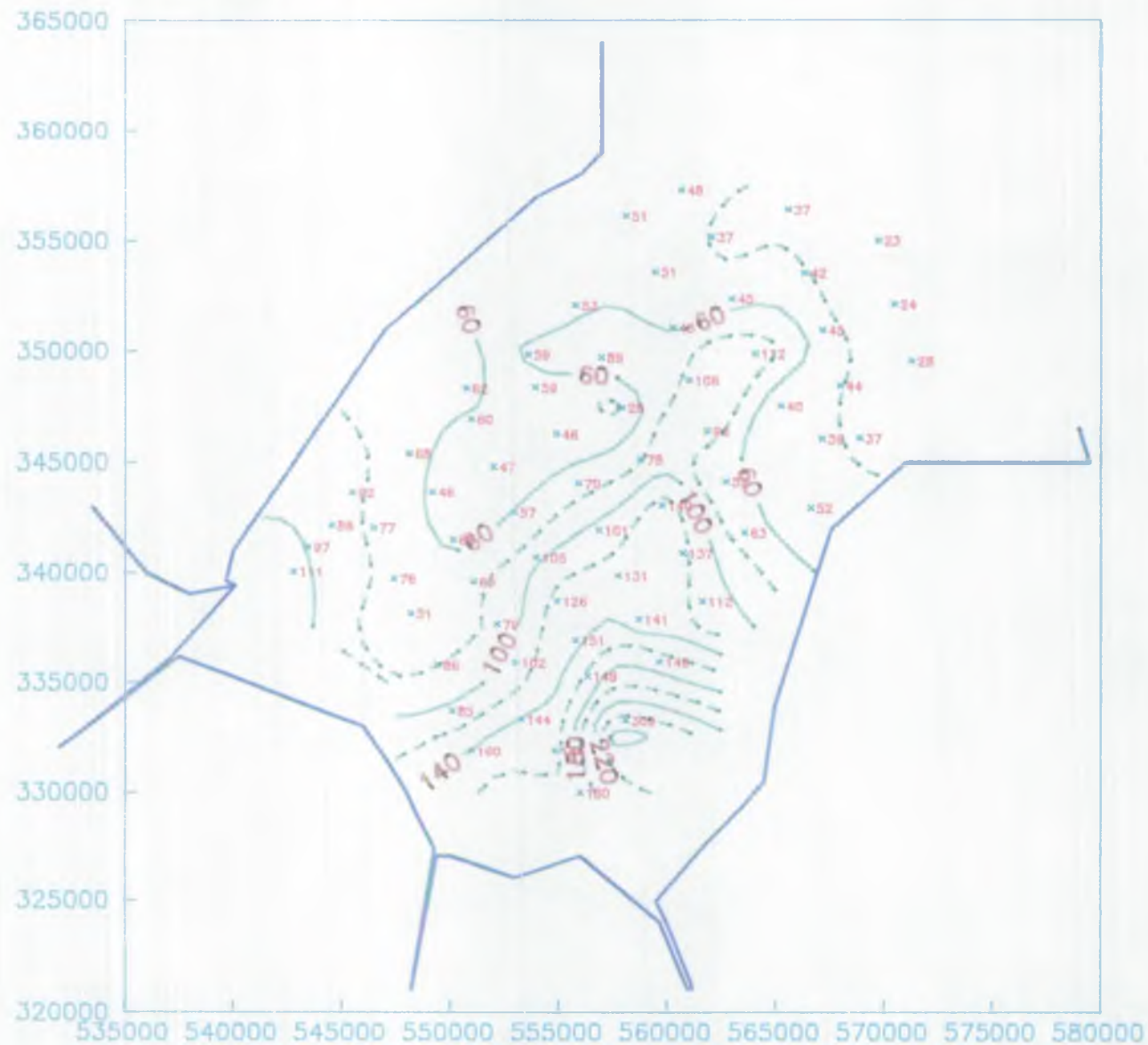


Figure 34.

WASH Survey : June 1993 – Nitrate (ug/L).

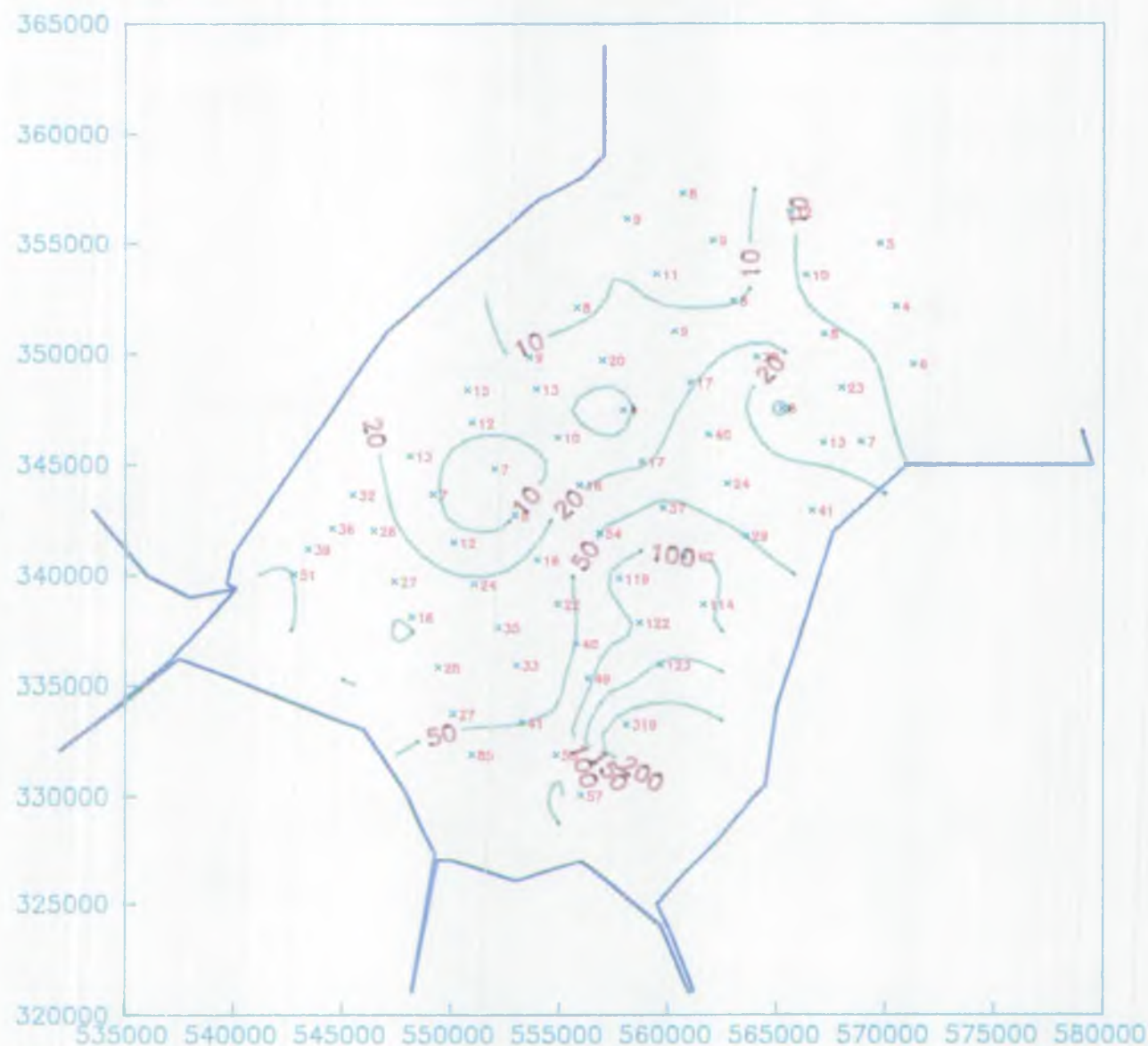


Figure 35.

WASH Survey : June 1993 – Chlorophyll (ug/L)

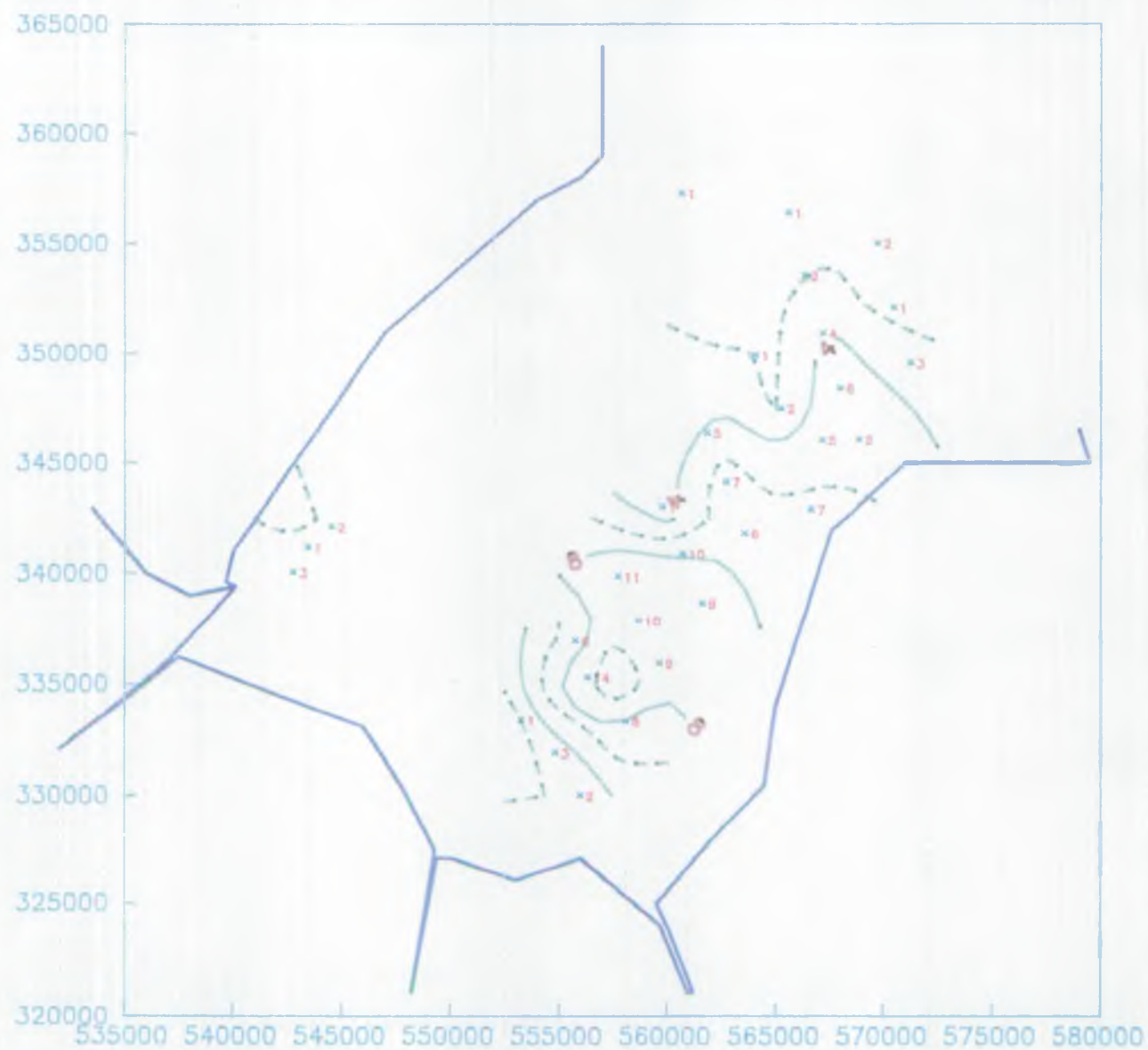


Figure 36.

WASH Survey : June 1993 – Temperature (deg C).

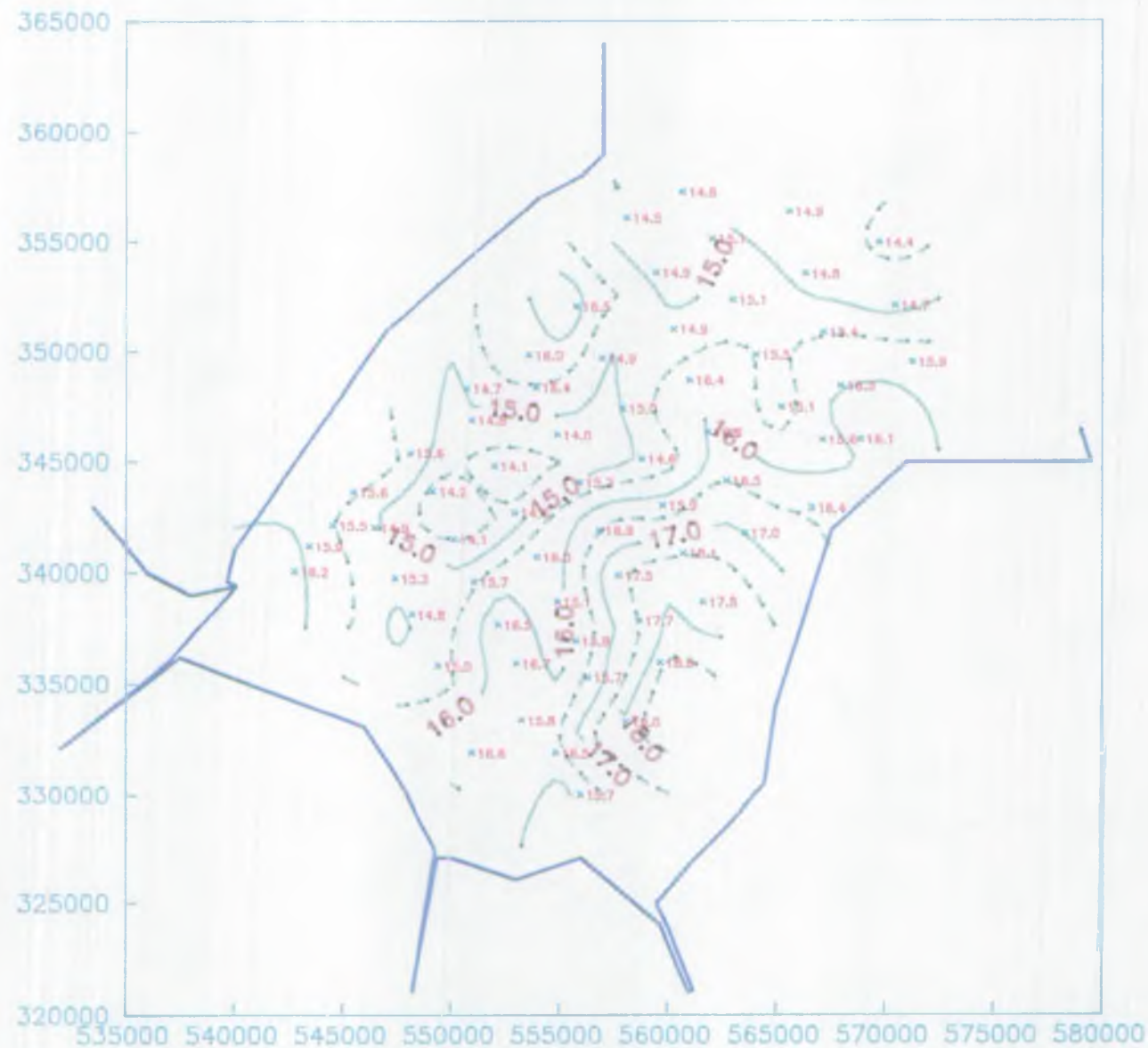


Figure 37.

WASH Survey : June 1993 – Salinity (ppt).

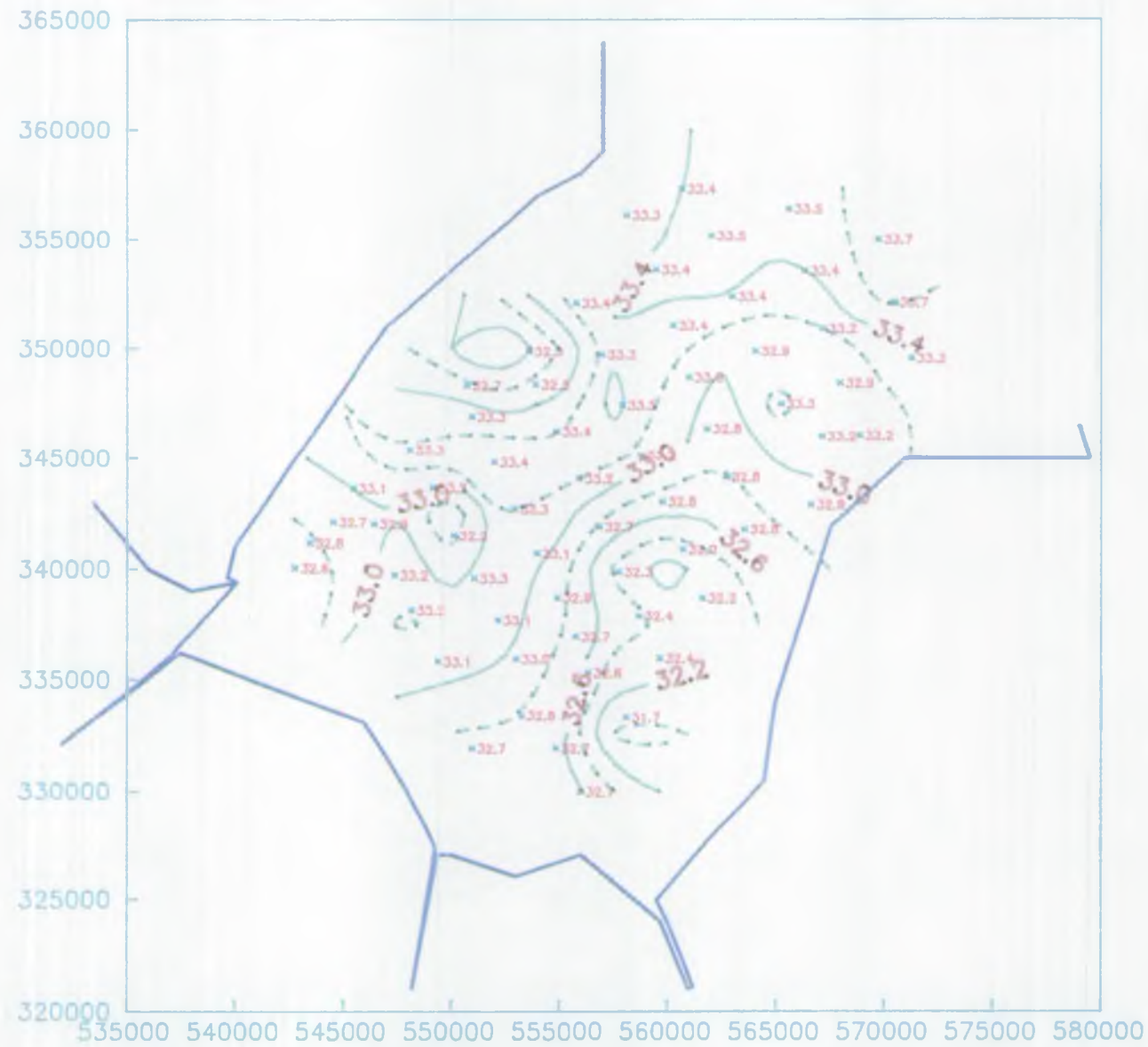


Figure 38.

WASH Survey : June 1993 – Dissolved Oxygen ($\%$ Sat).

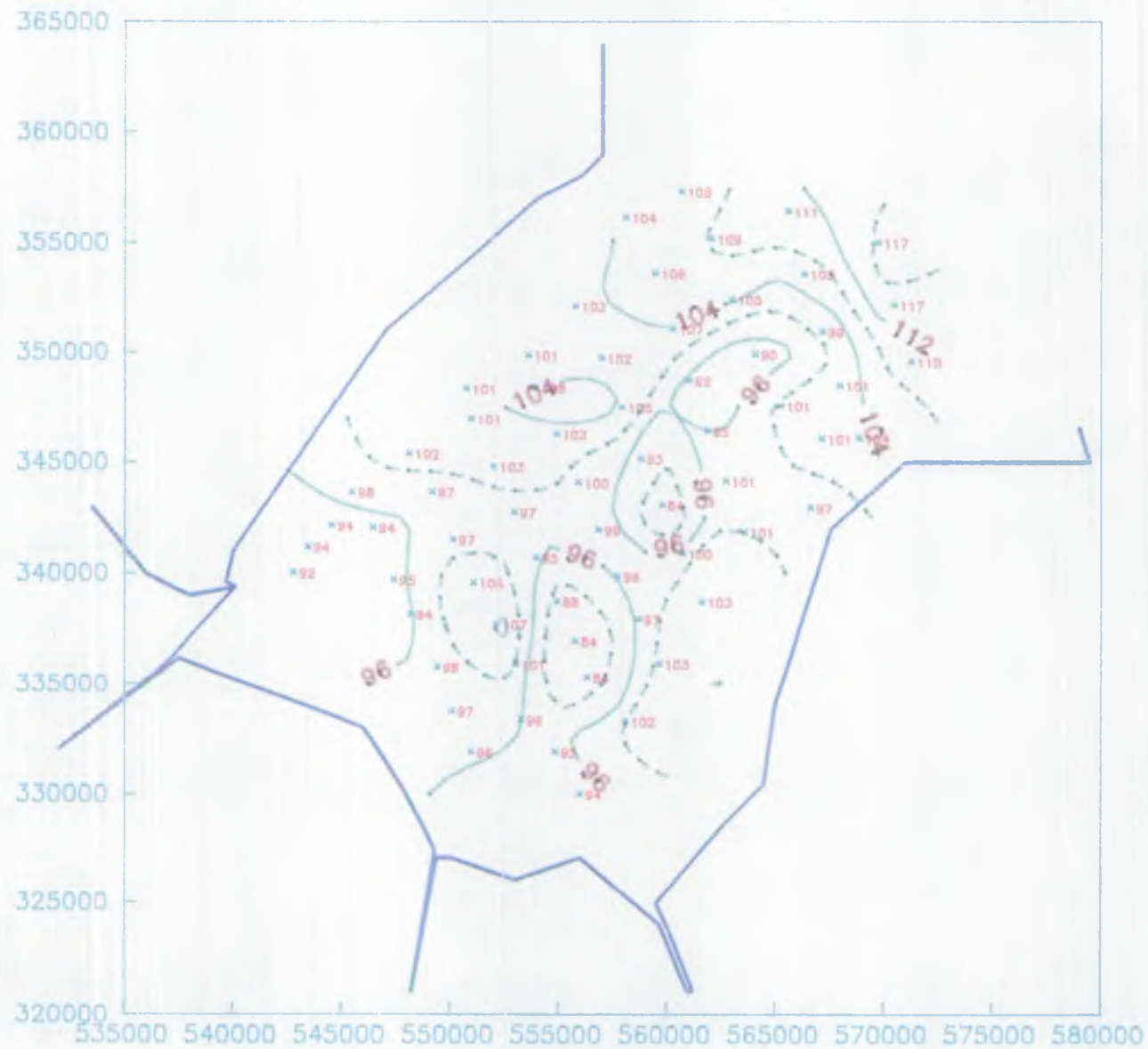


Figure 39.

Order of Sampling

- 12th August 1993 ←
- 17th August 1993 ←
- 18th August 1993 ←

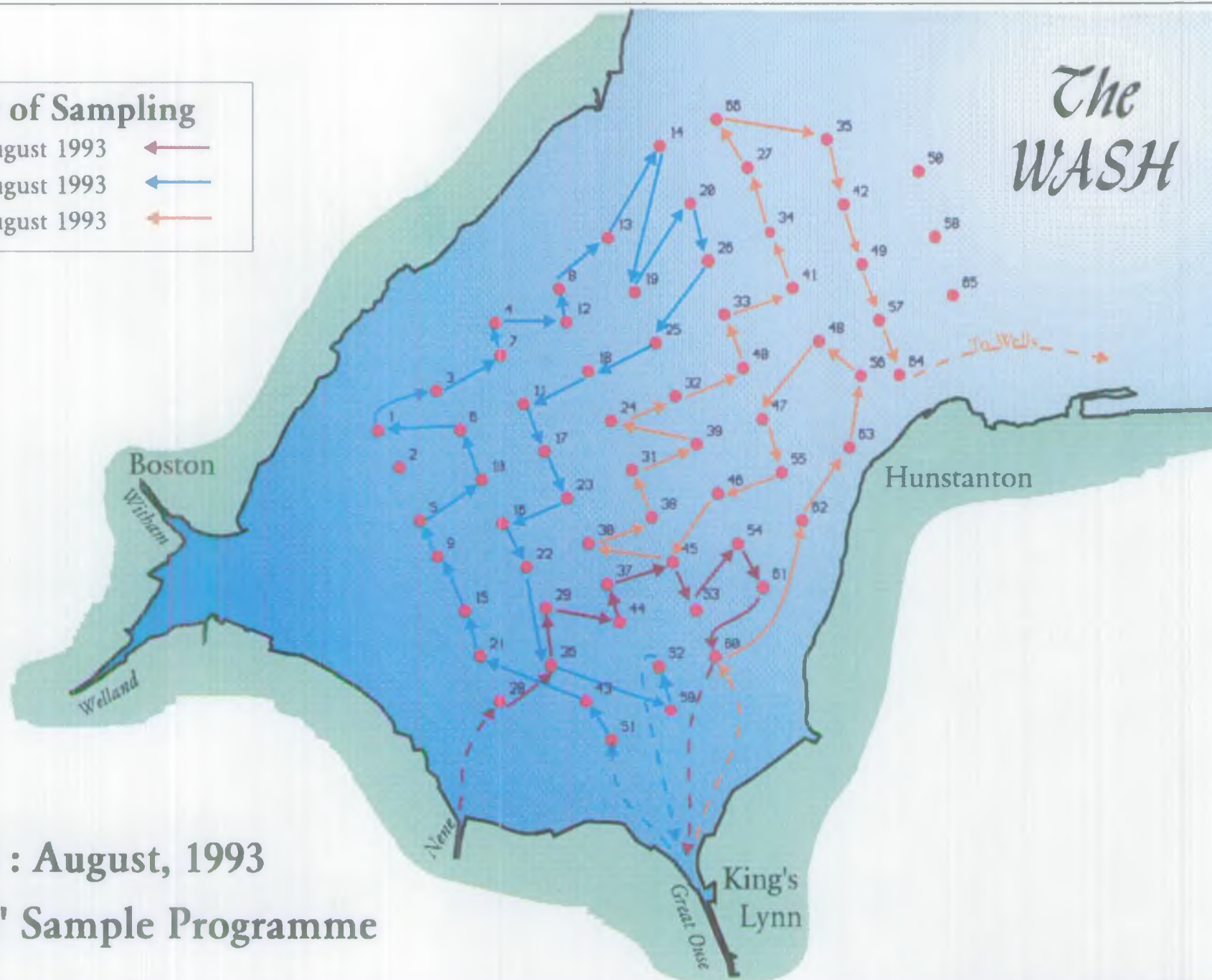


Figure 40 : August, 1993
'Sea Vigil' Sample Programme

Wash Nutrients 12th, 17th & 18th August 1993

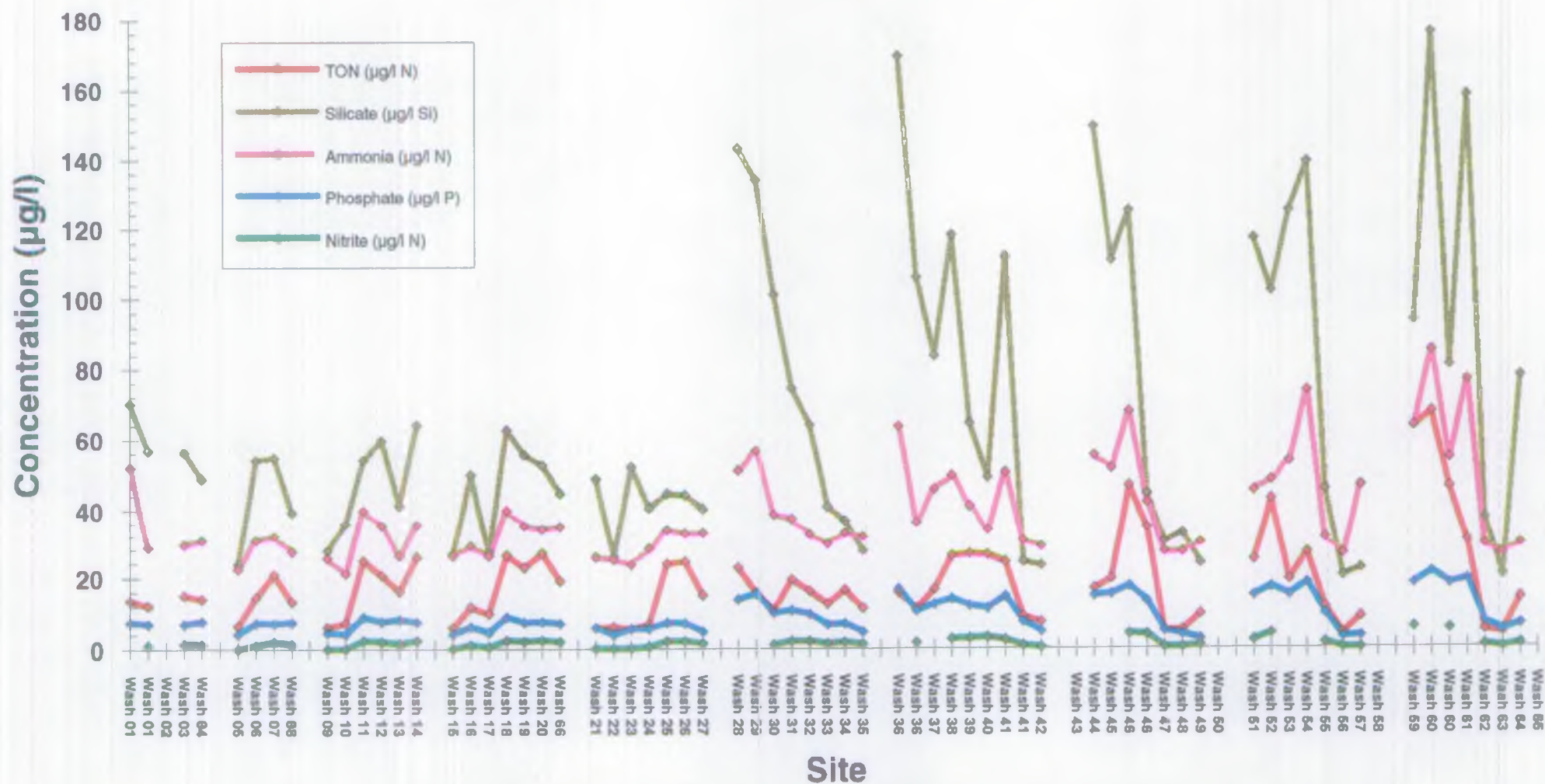


Figure 41 : Wash Grid Survey, 12th, 17th and 18th August 1993

WASH Survey : August 1993 – Ammonia (ug/L).

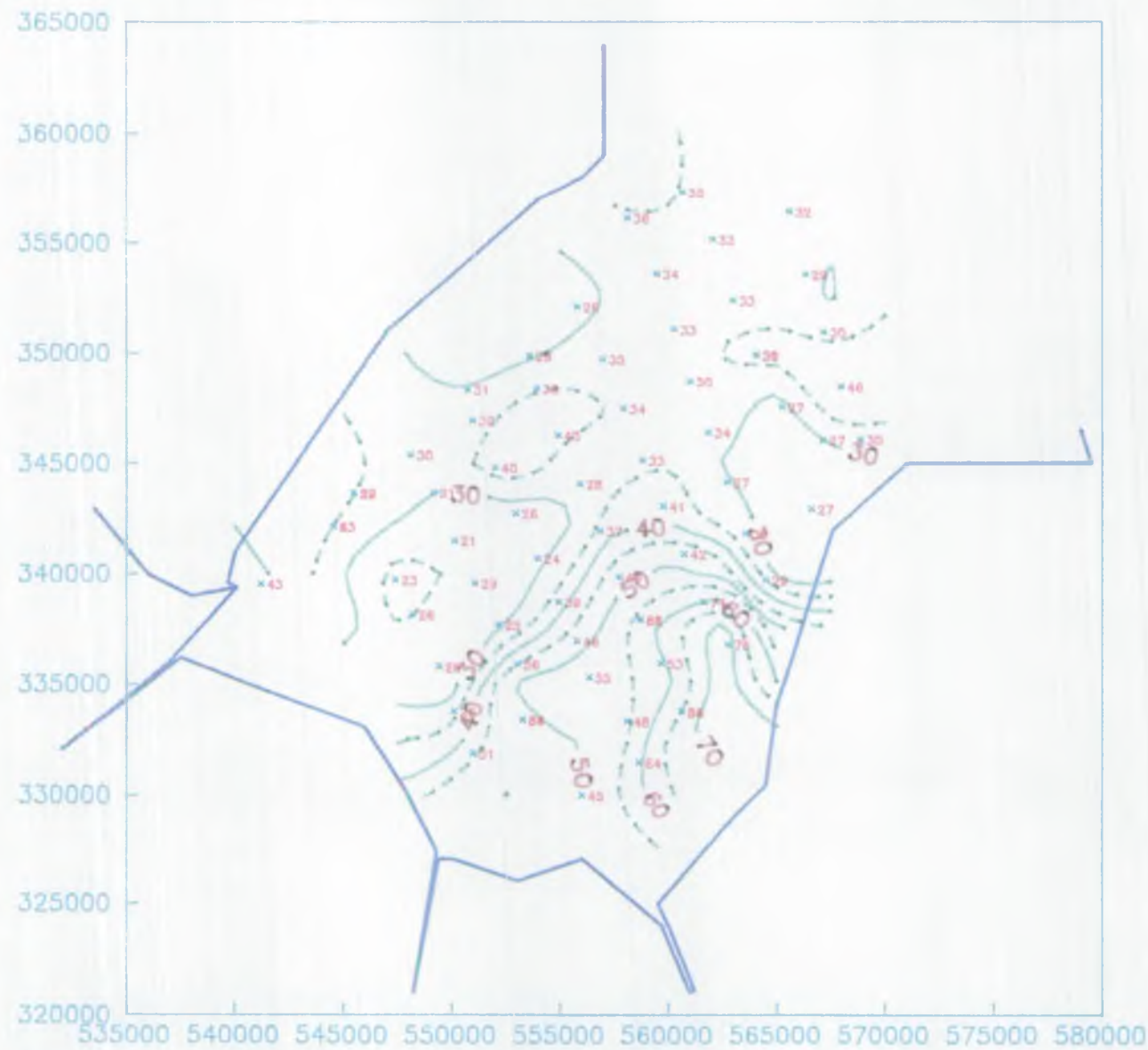


Figure 42.

WASH Survey : August 1993 – Phosphate (ug/L).

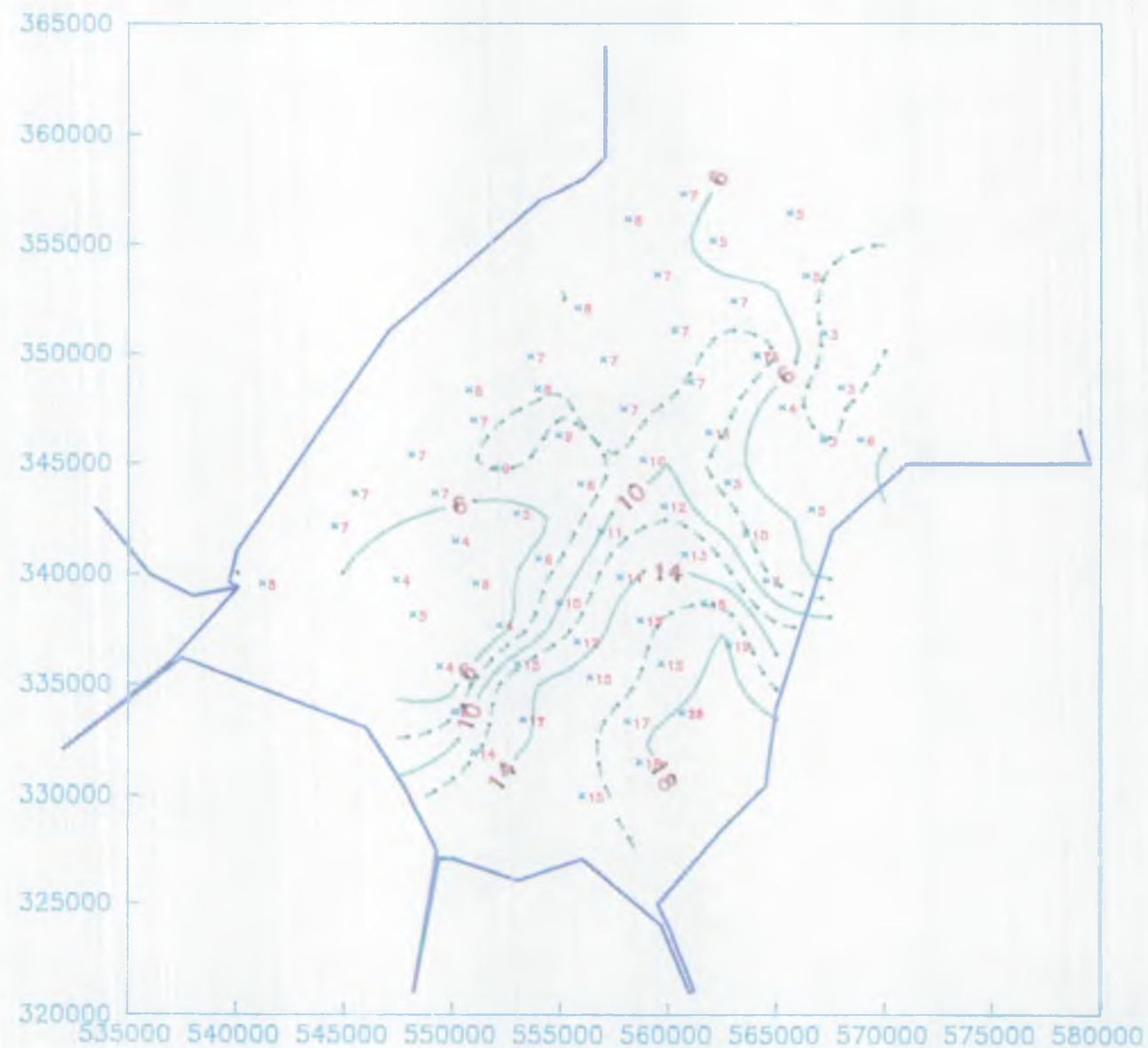


Figure 43.

WASH Survey : August 1993 — Silicate (ug/L).



Figure 44.

WASH Survey : August 1993 – Nitrate ($\mu\text{g/L}$).

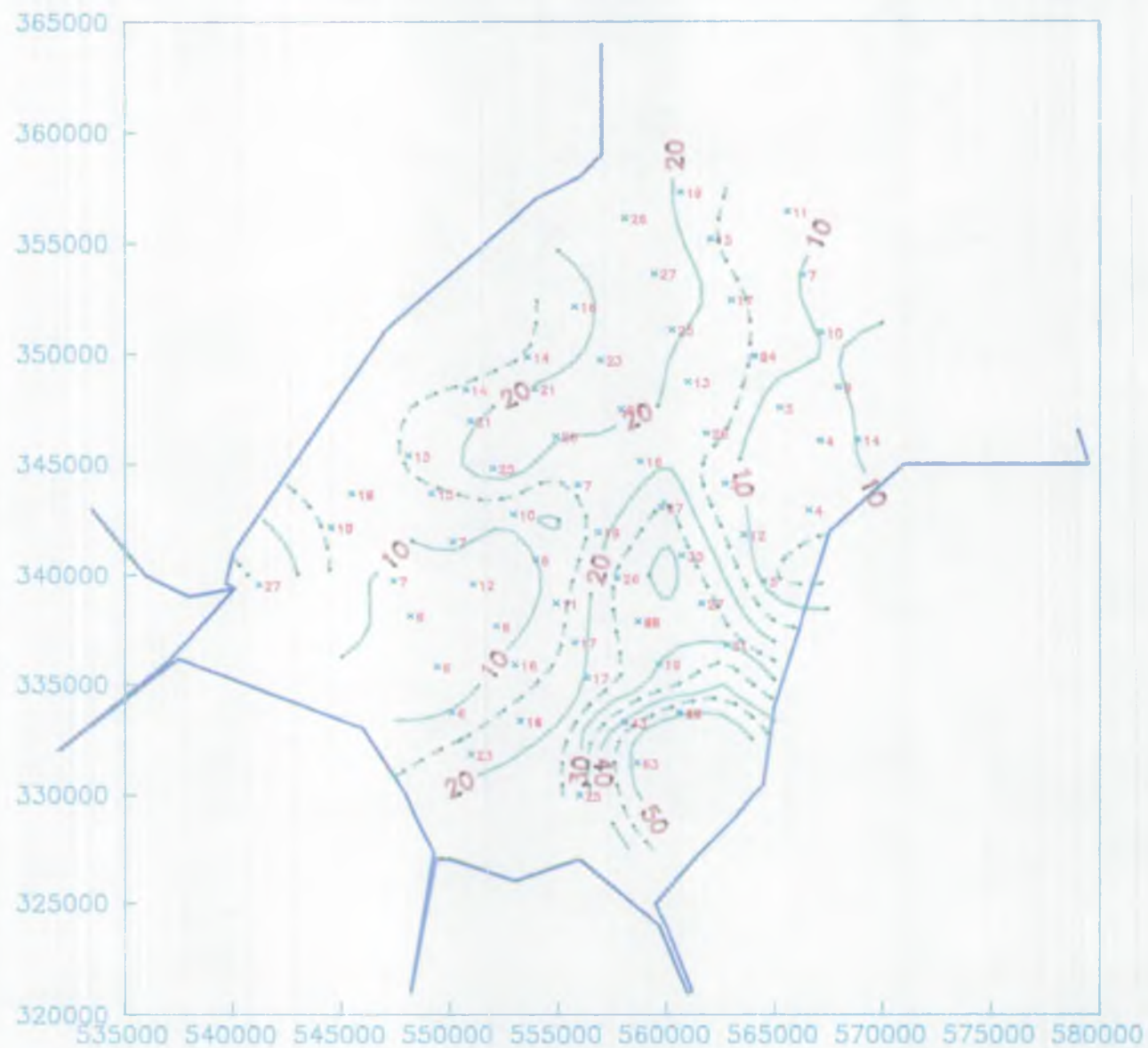


Figure 45.

WASH Survey : August 1993 – Nitrite (ug/L).

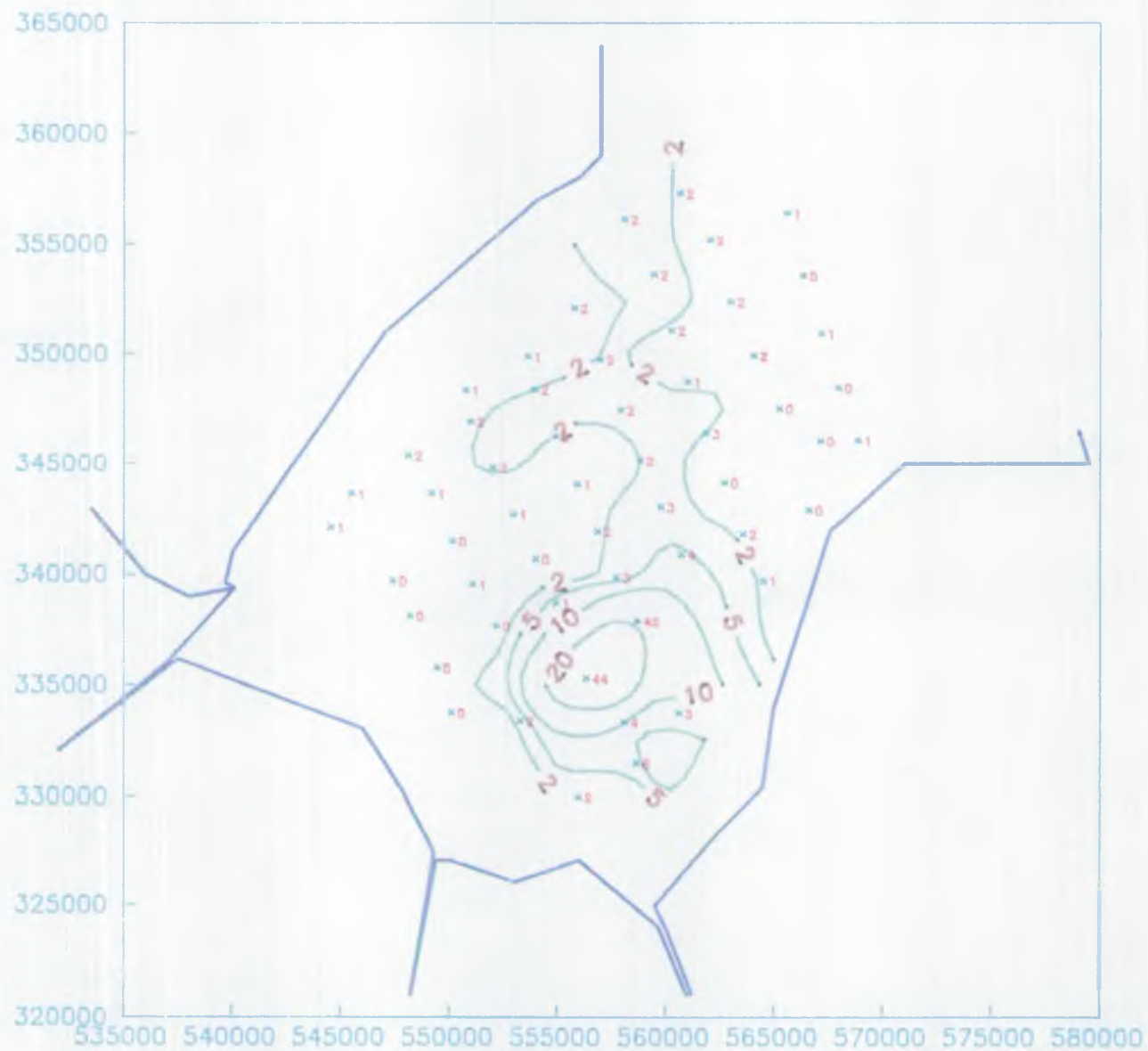


Figure 46.

WASH Survey : August 1993 – Temperature (deg C).



Figure 47.

WASH Survey : August 1993 – Salinity (ppt).

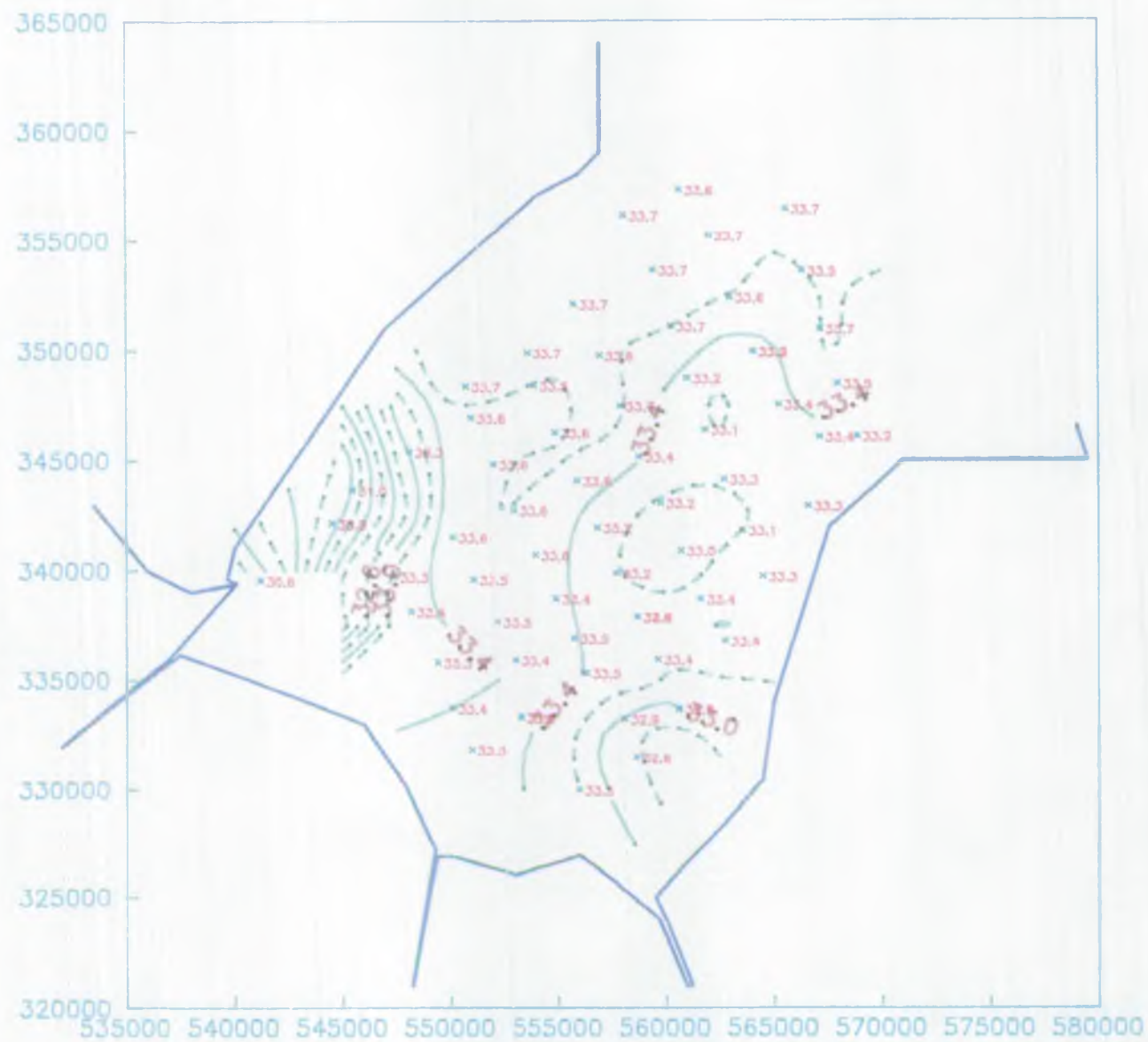


Figure 48.

WASH Survey : August 1993 – Dissolved Oxygen (‰ Sat).

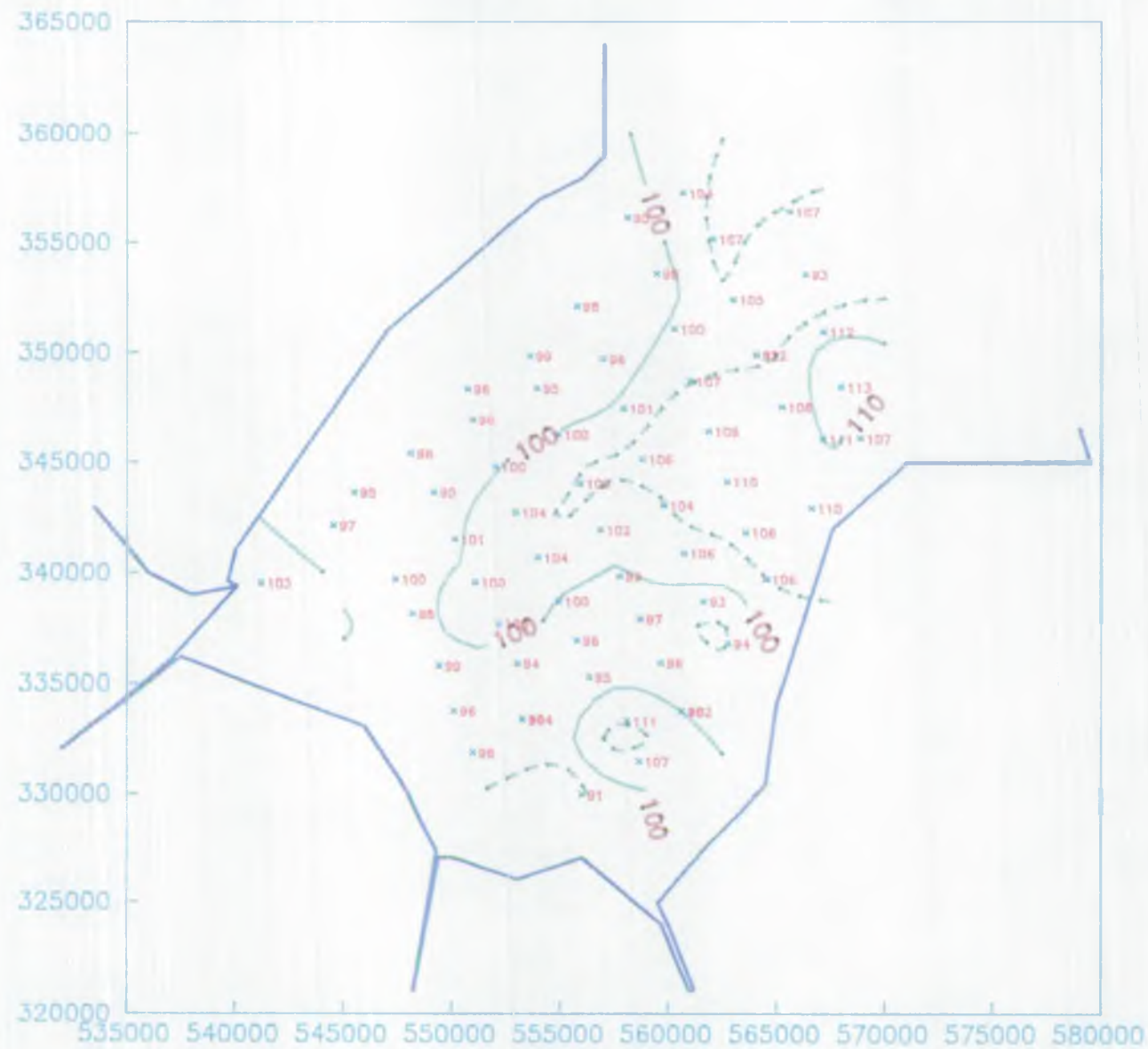


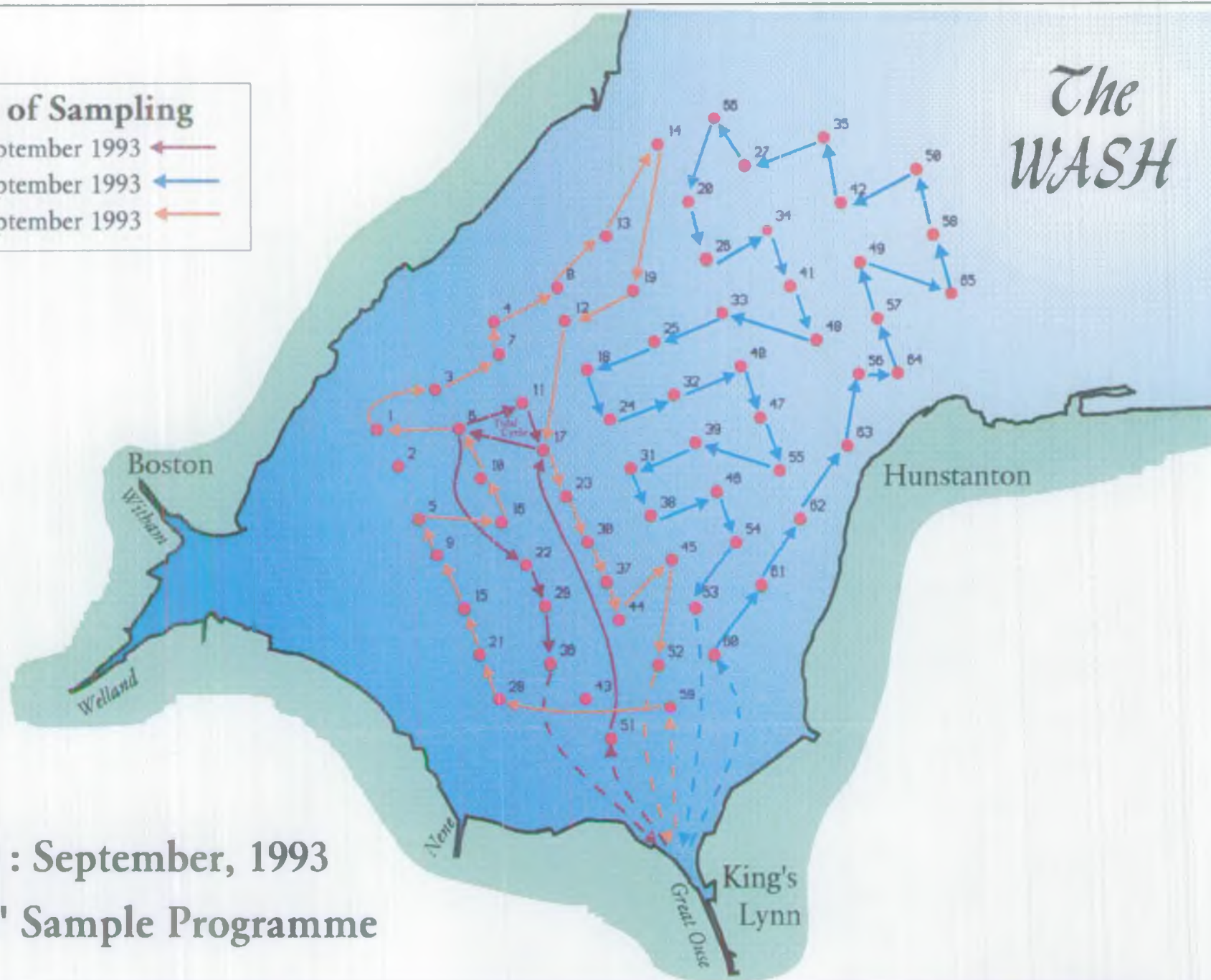
Figure 49.

Order of Sampling

28th September 1993 ←

29th September 1993 ←

30th September 1993 ←



Wash Nutrients 29th & 30th September 1993

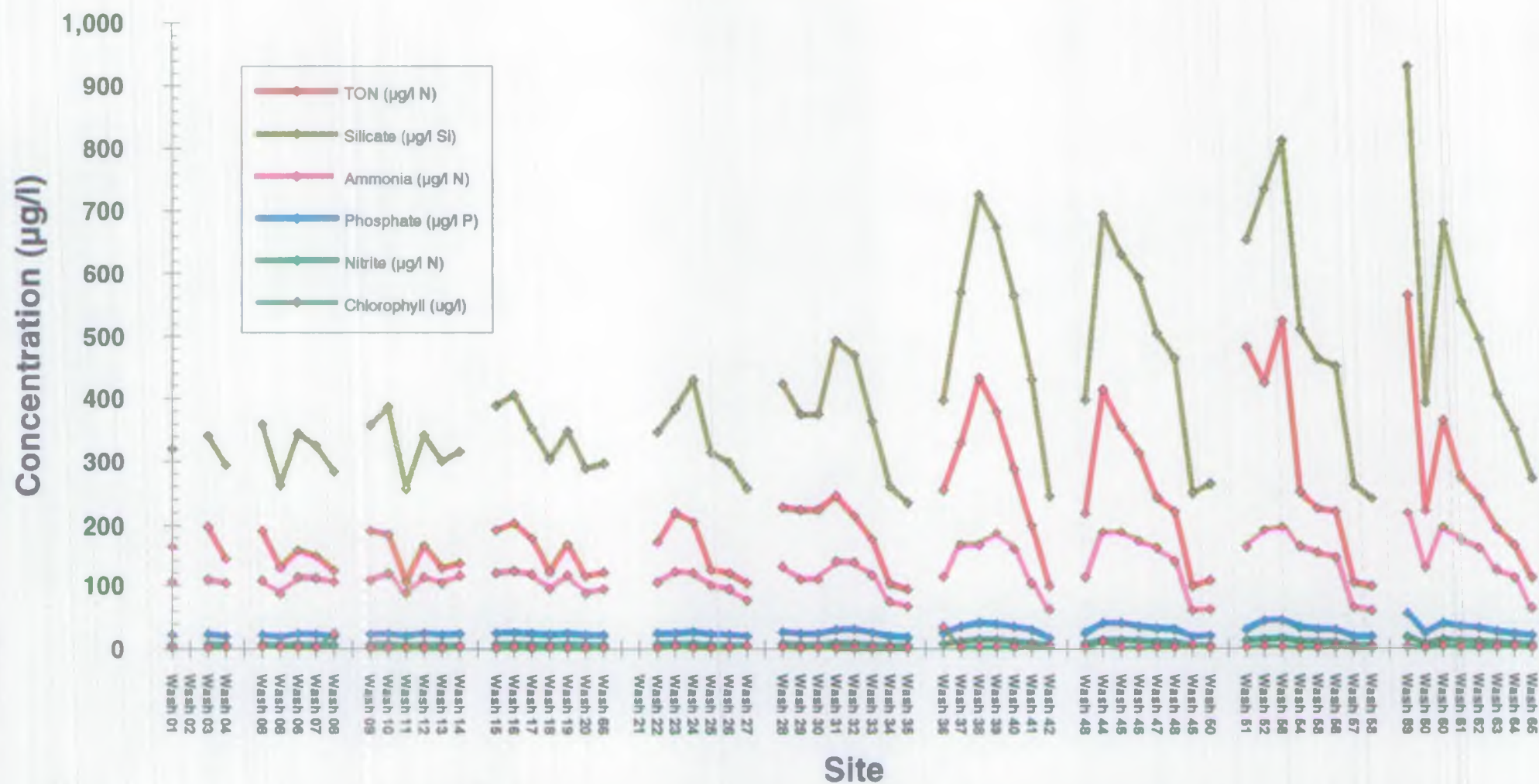


Figure 51 : Wash Grid Survey, 29th and 30th September 1993

WASH Survey : September 1993 – Ammonia (ug/L).

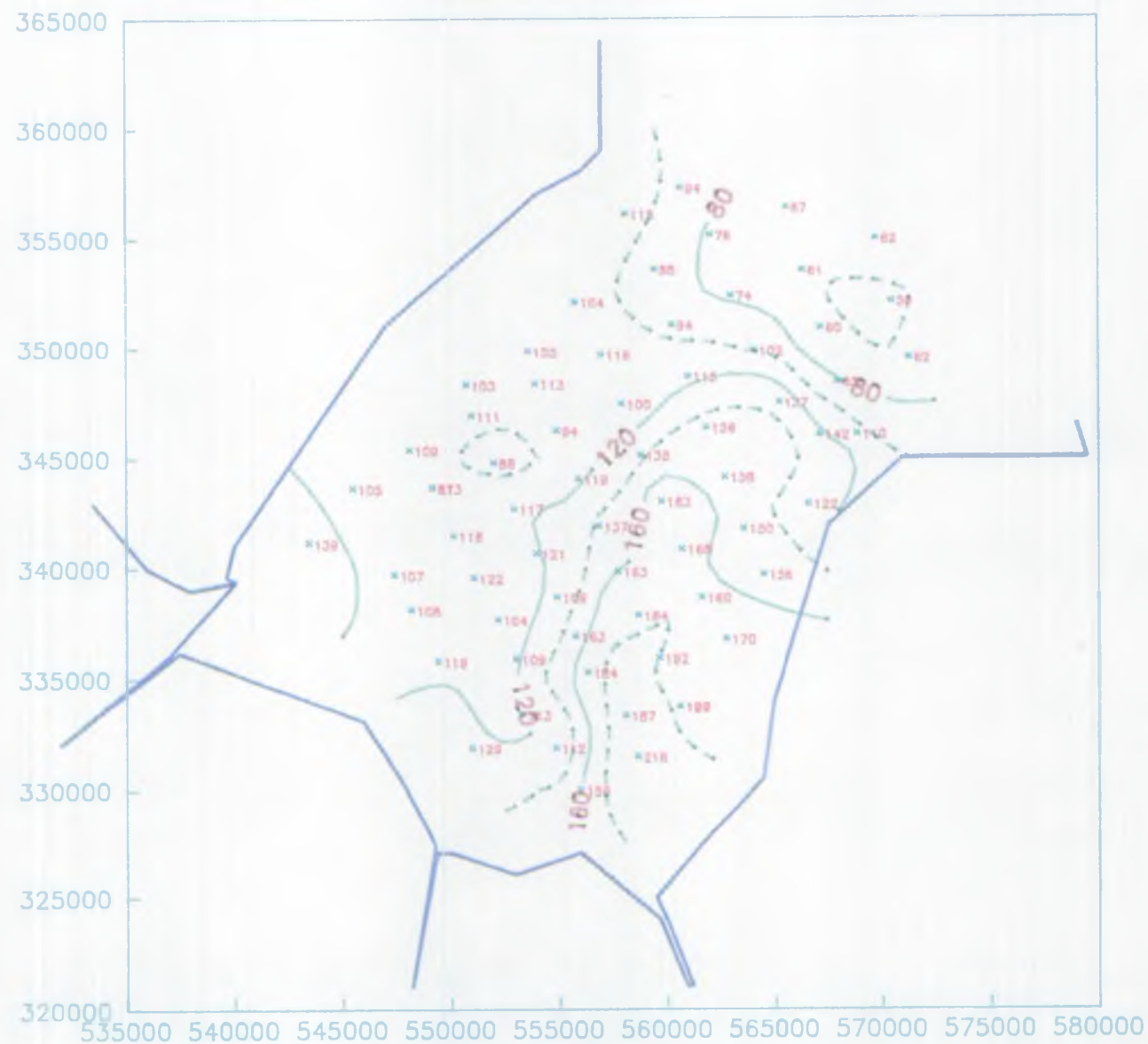


Figure 52.

WASH Survey : September 1993 – Phosphate (ug/L).

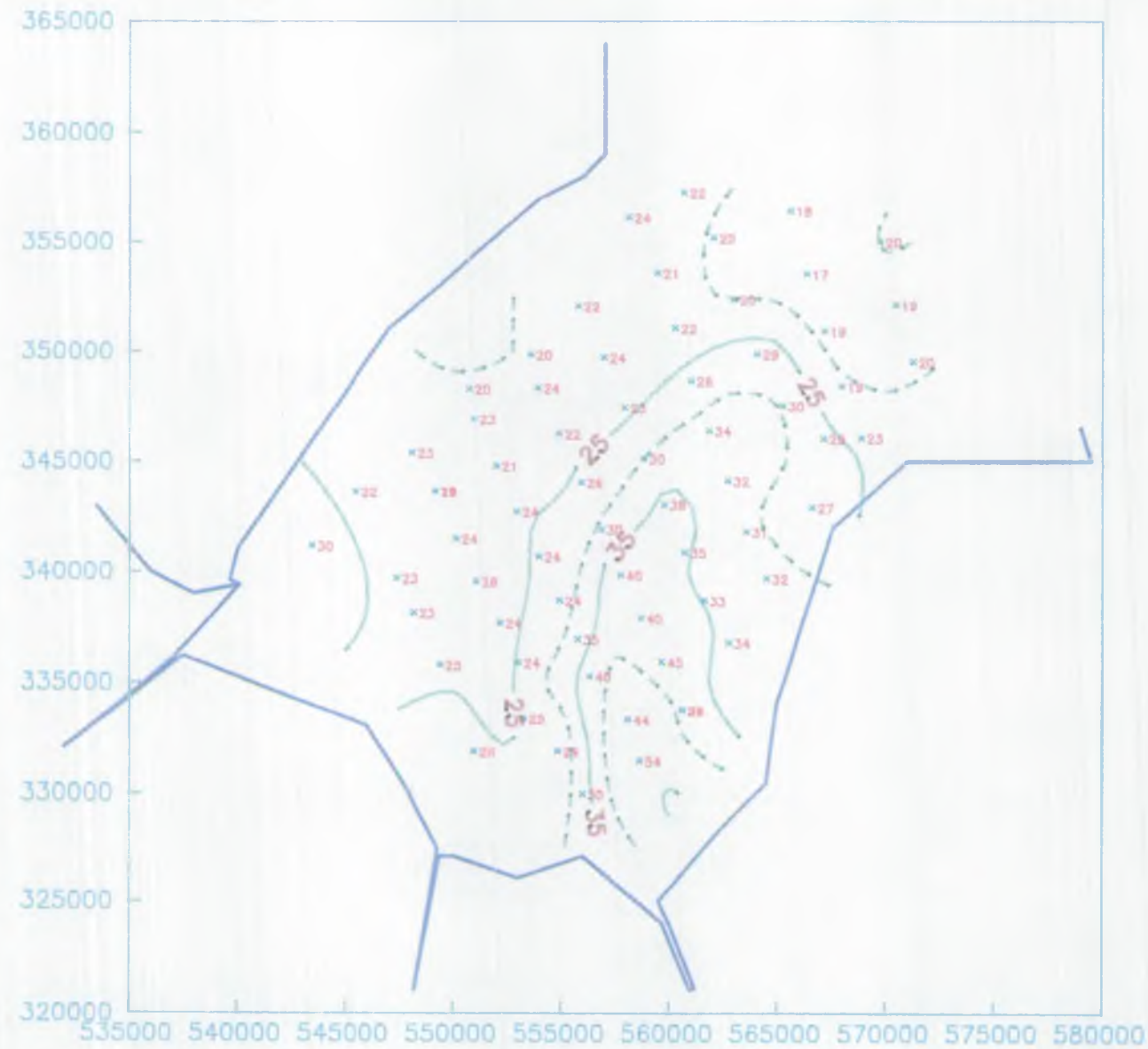


Figure 53.

WASH Survey : September 1993 – Silicate (ug/L).

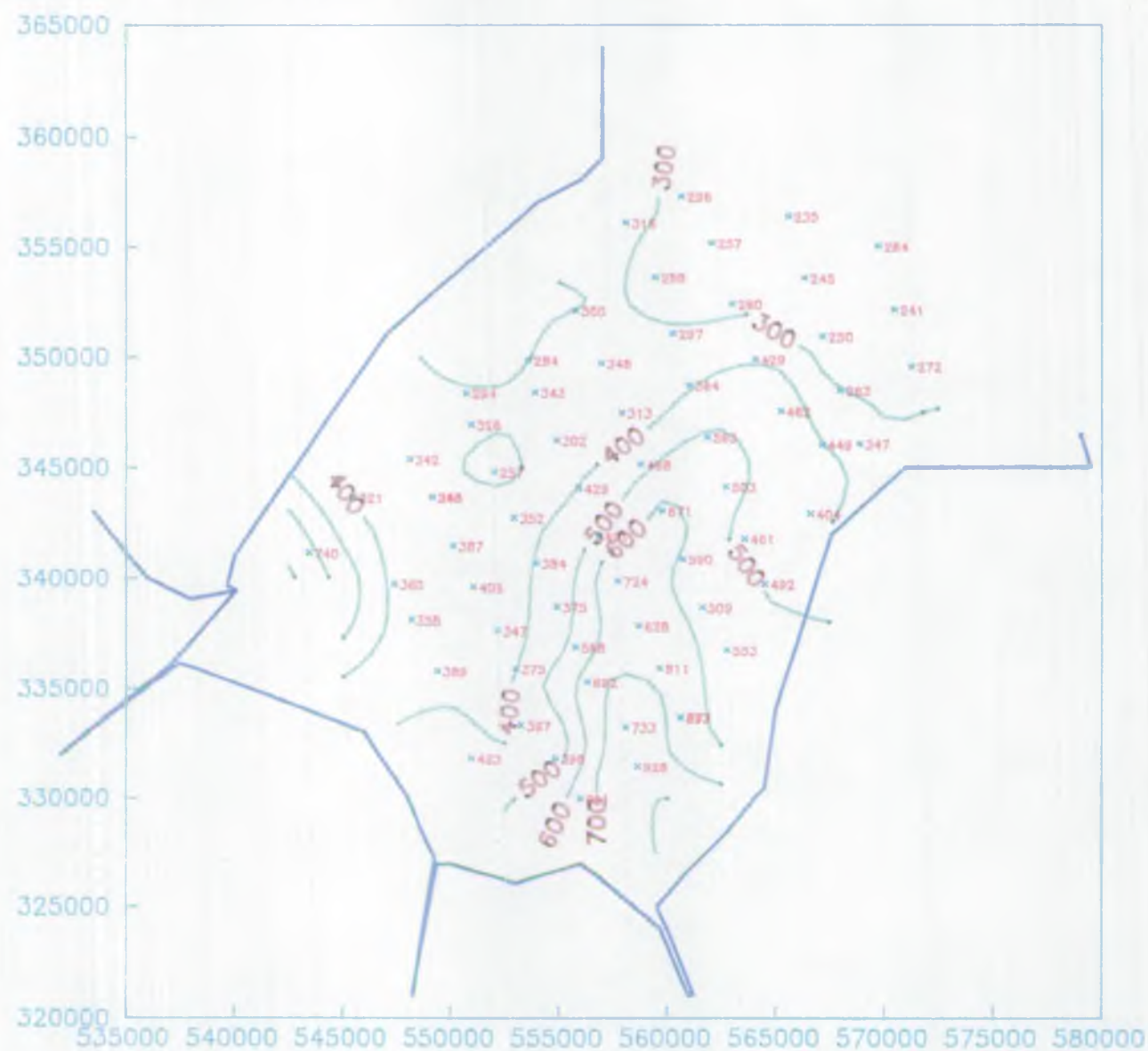


Figure 54.

WASH Survey : September 1993 – Nitrate (ug/L).

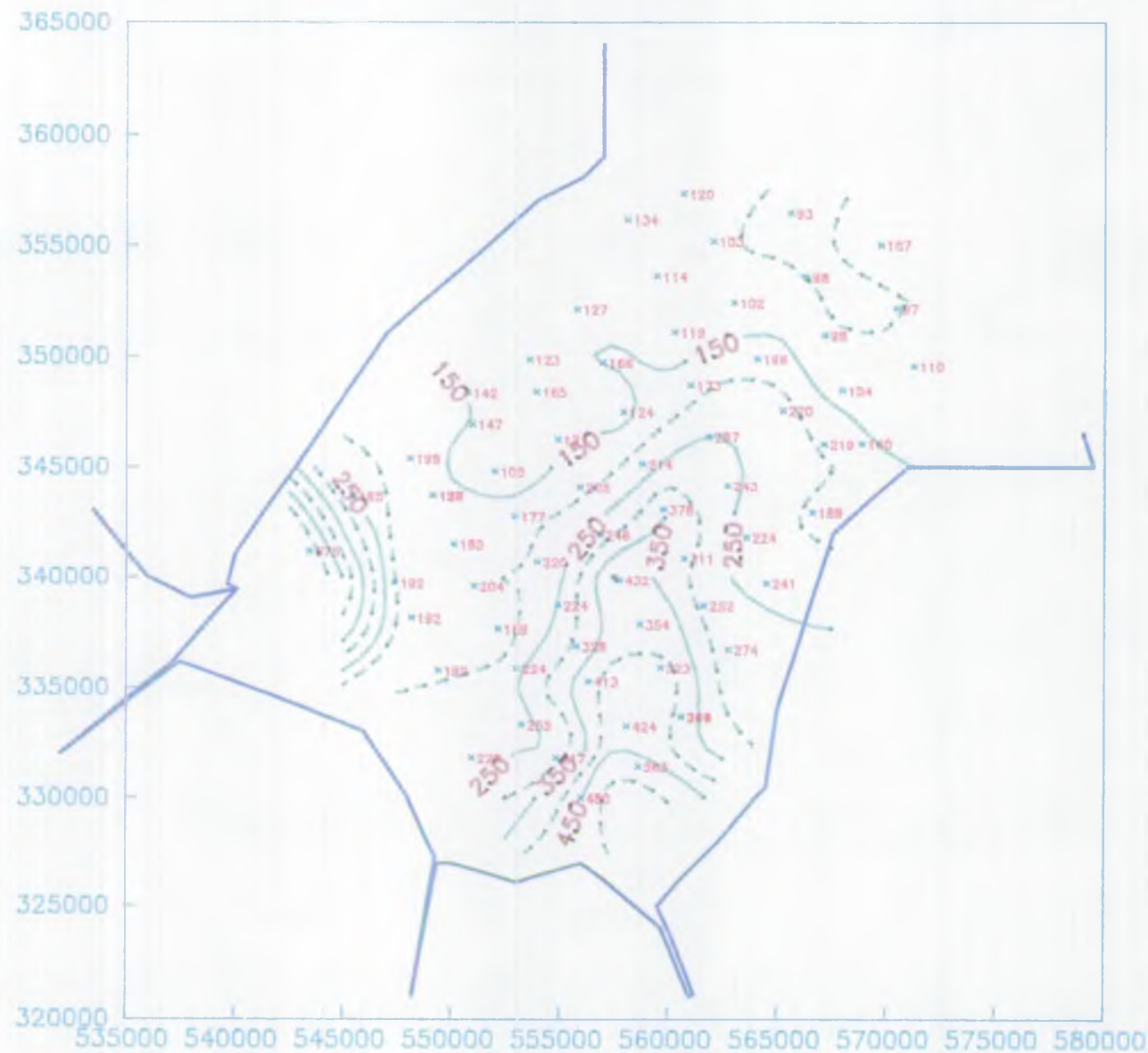


Figure 55.

WASH Survey : September 1993 – Nitrite (ug/L).

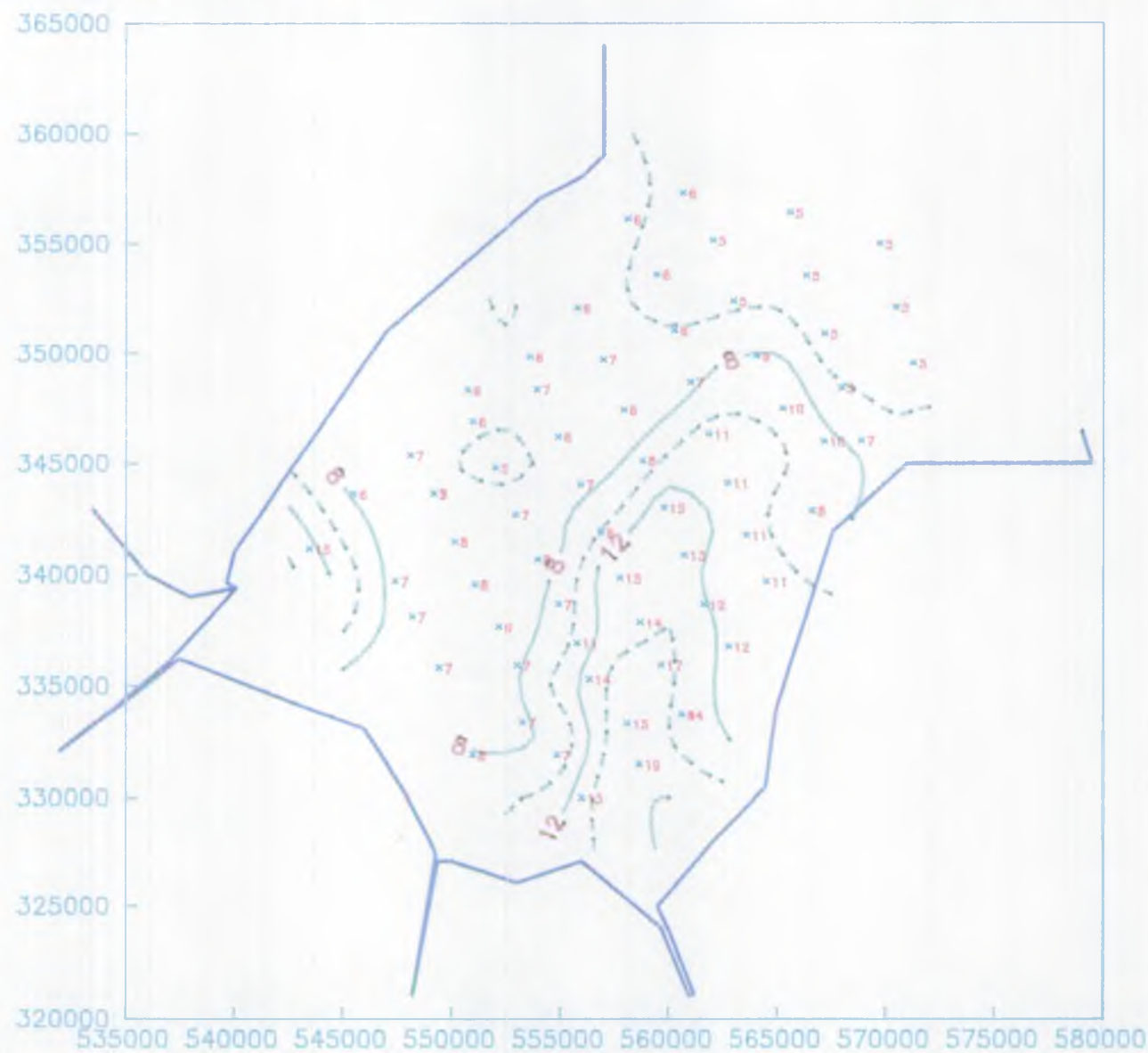


Figure 56.

WASH Survey : September 1993 – Chlorophyll (ug/L).

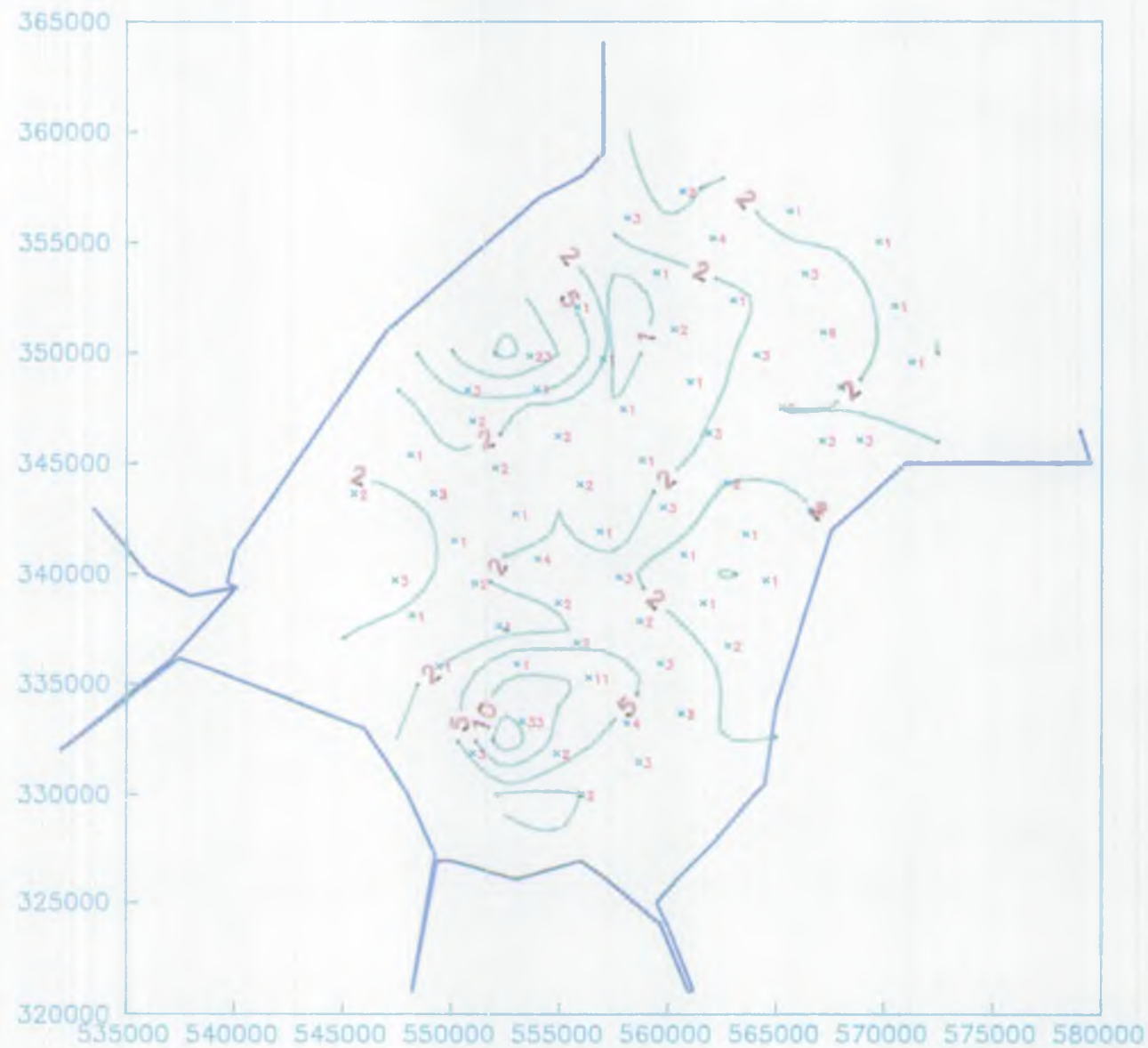


Figure 57.

WASH Survey : September 1993 – Temperature (deg C).



Figure 58.

WASH Survey : September 1993 – Salinity (ppt).

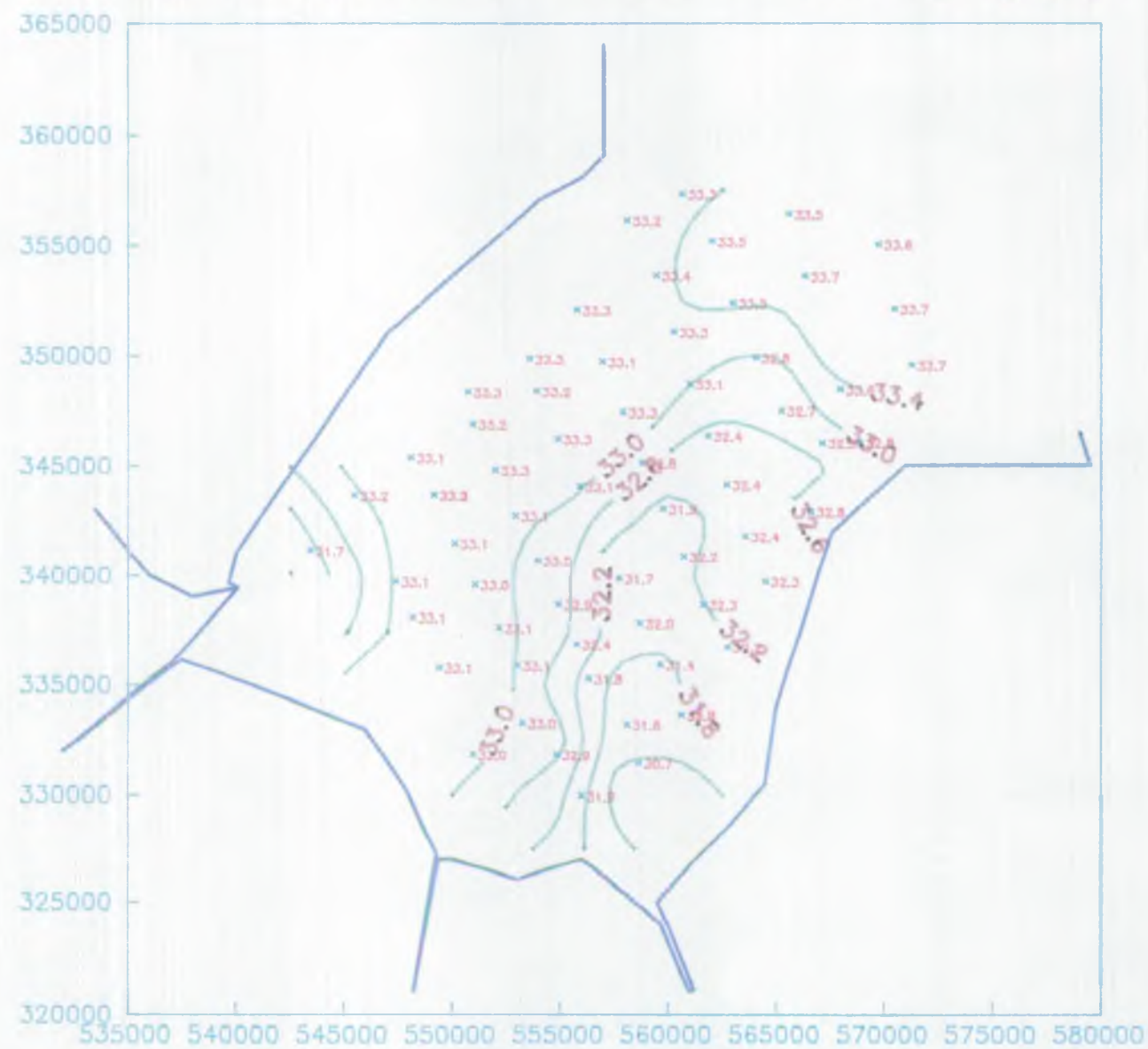


Figure 59.

WASH Survey : September 1993 – Dissolved Oxygen (x Sat).

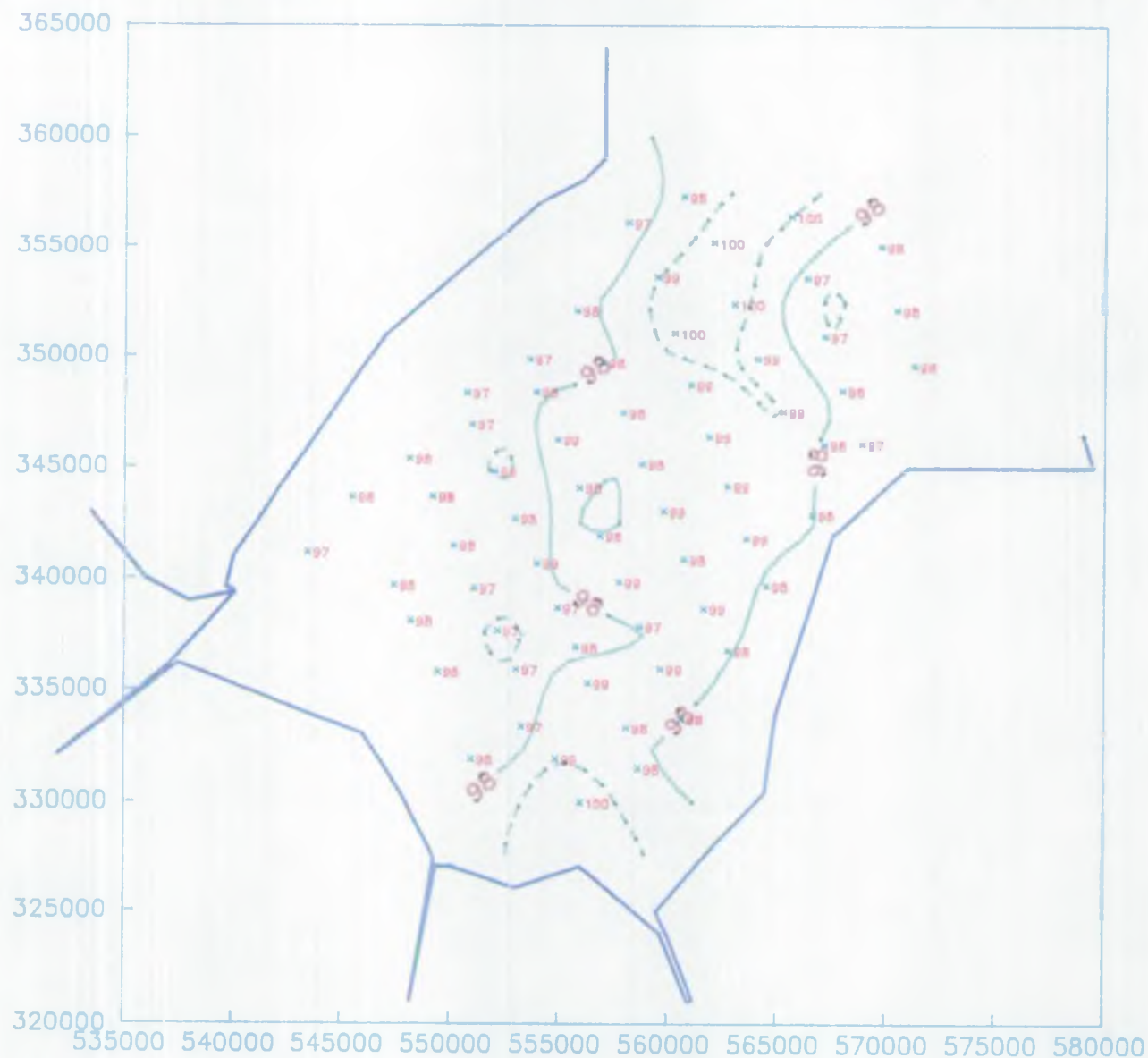


Figure 60.

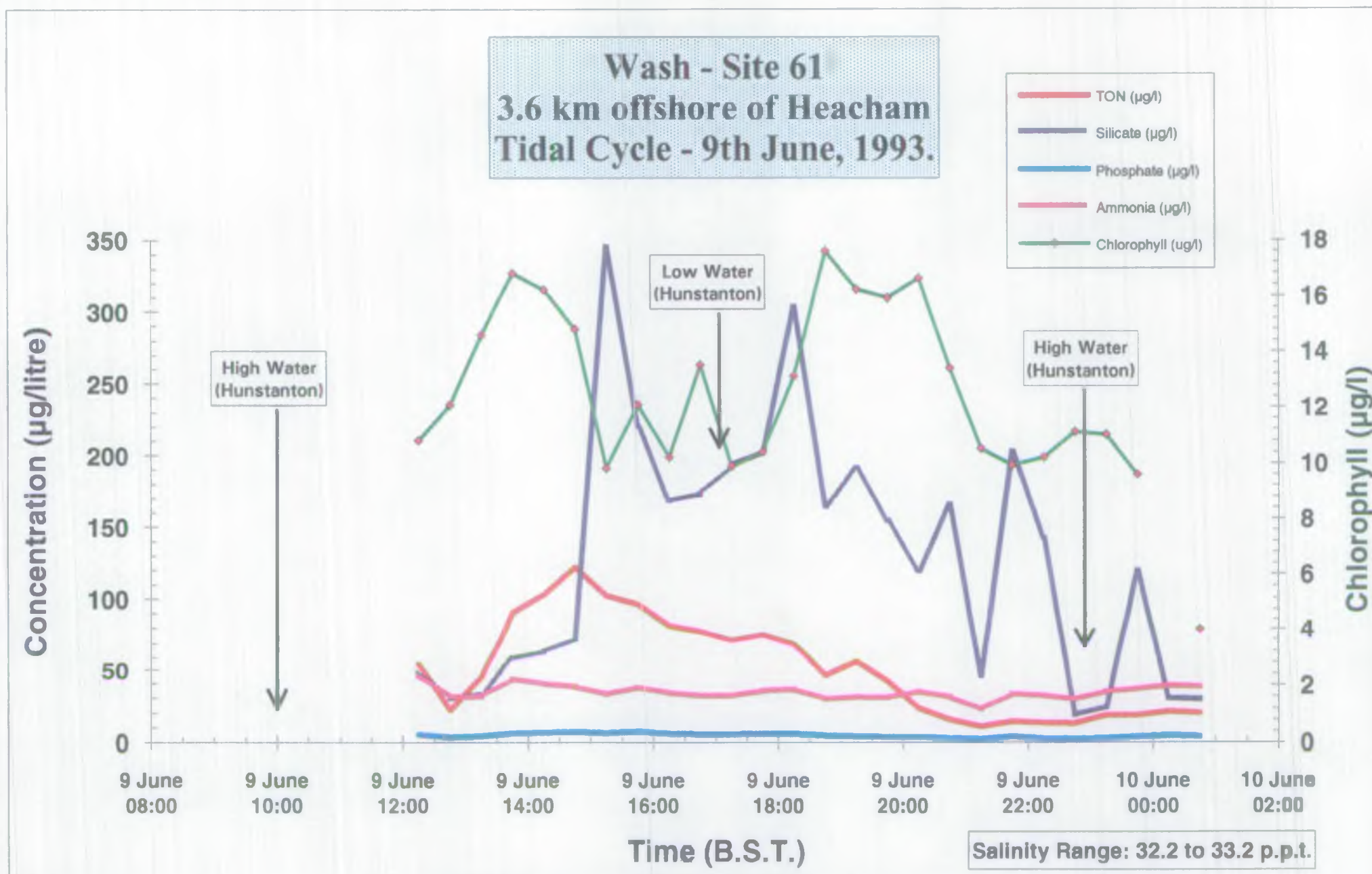


Figure 61(a) : Tidal Cycle in Outer Great Ouse.

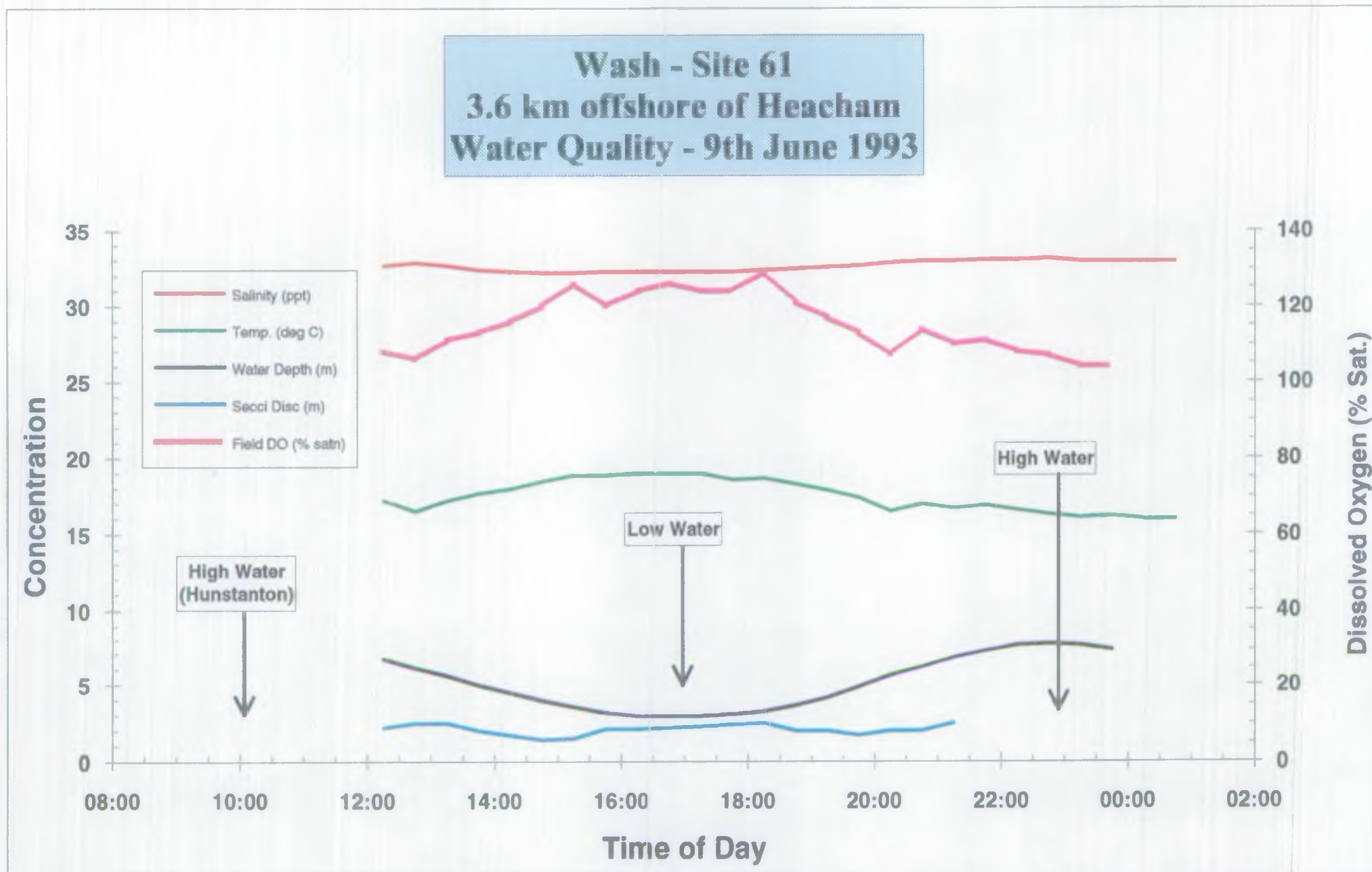


Figure 61 (b) : Tidal Cycle in Outer Great Ouse.

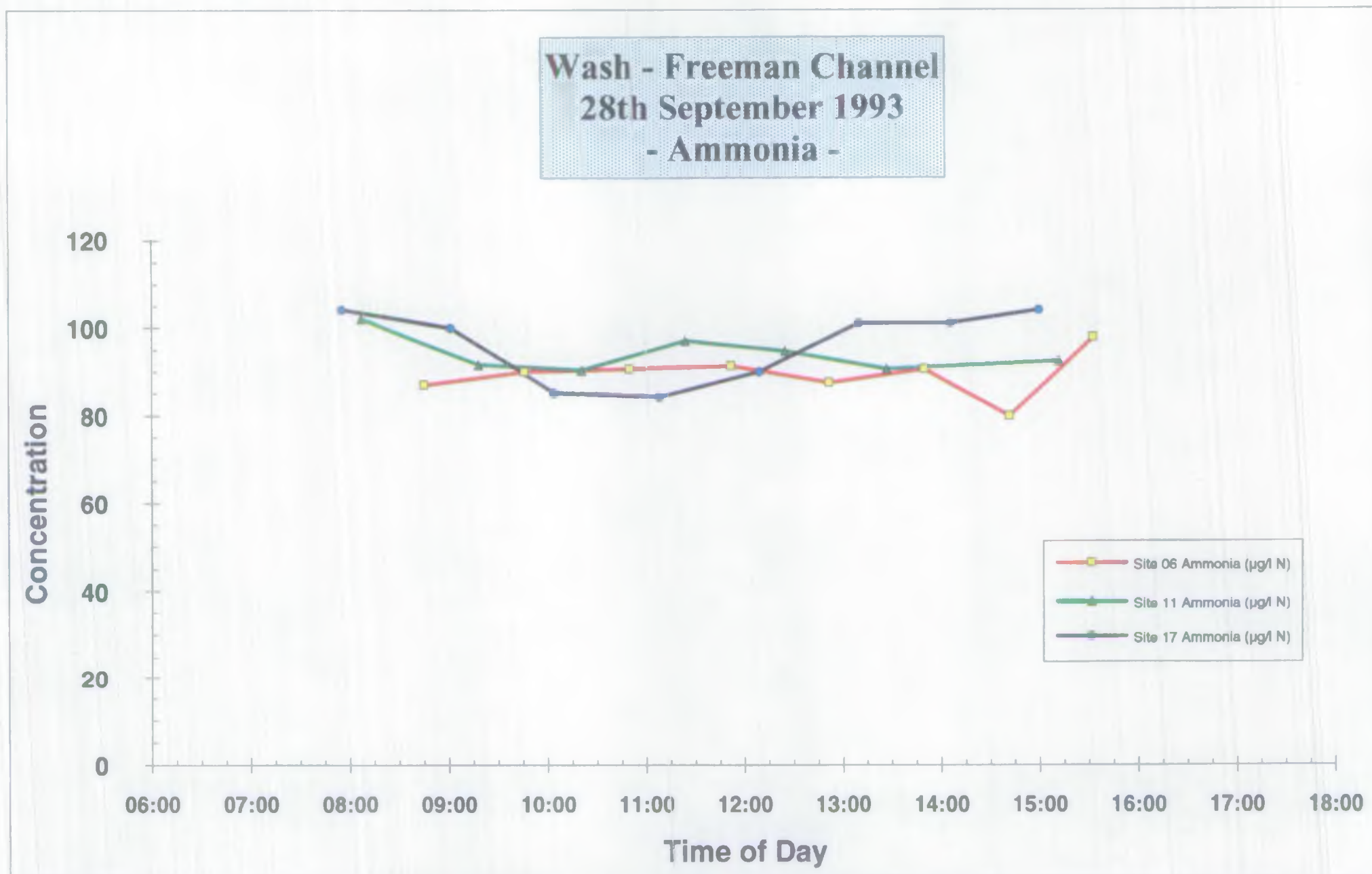
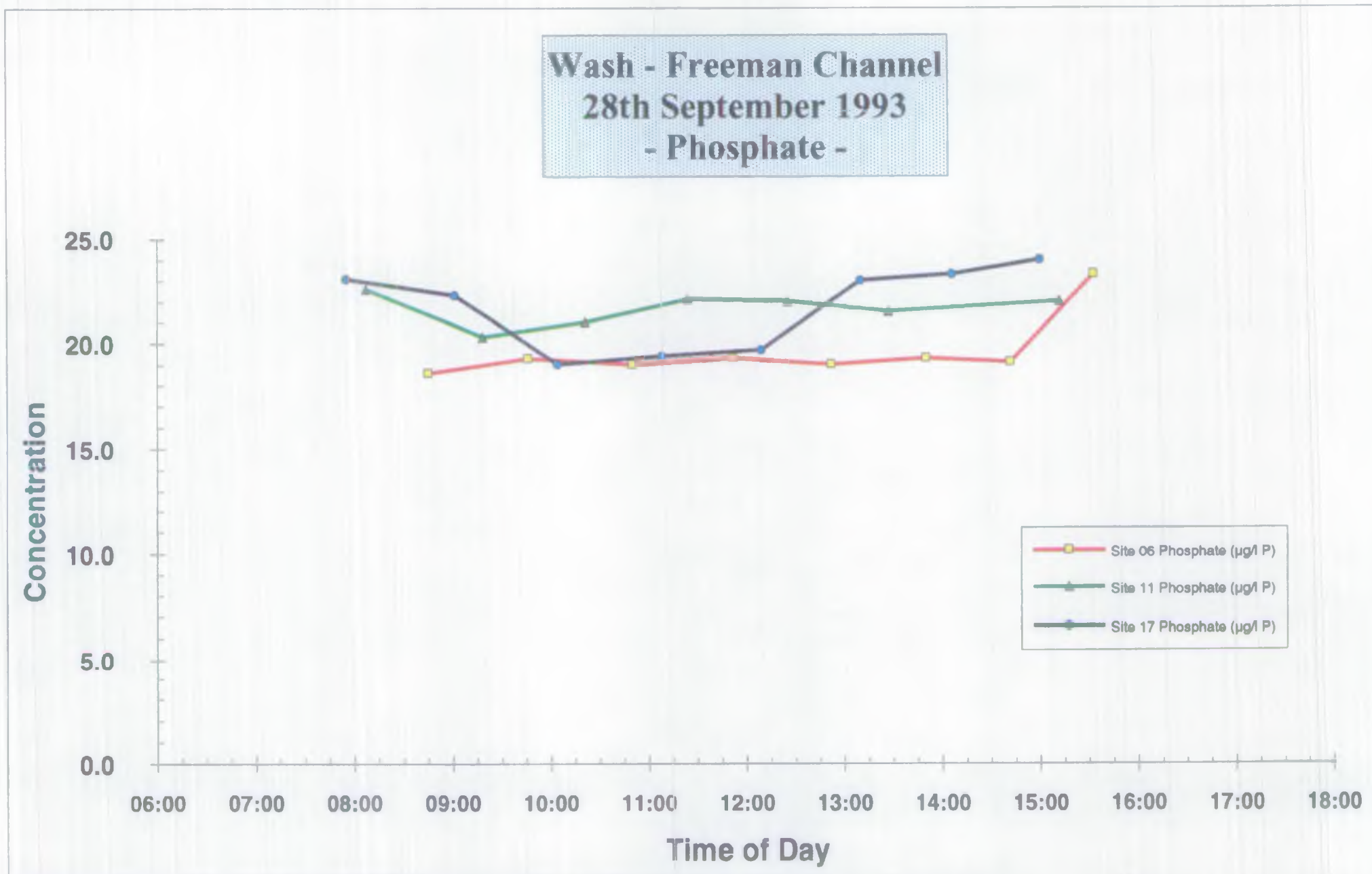


Figure 62(a): Time Series around Low Water.

**Figure 62(b): Time Series around Low Water.**

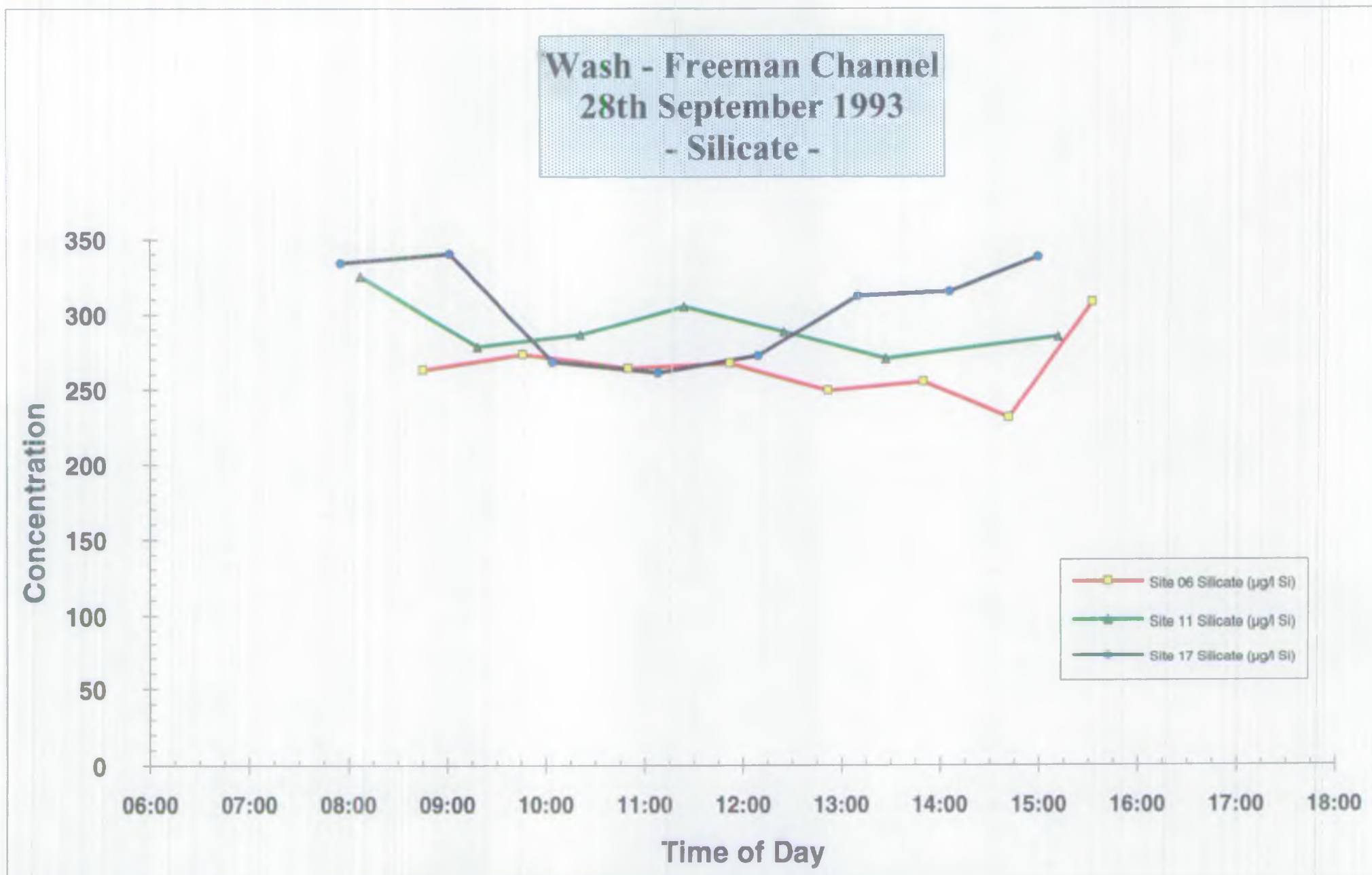


Figure 62(c): Time Series around Low Water.

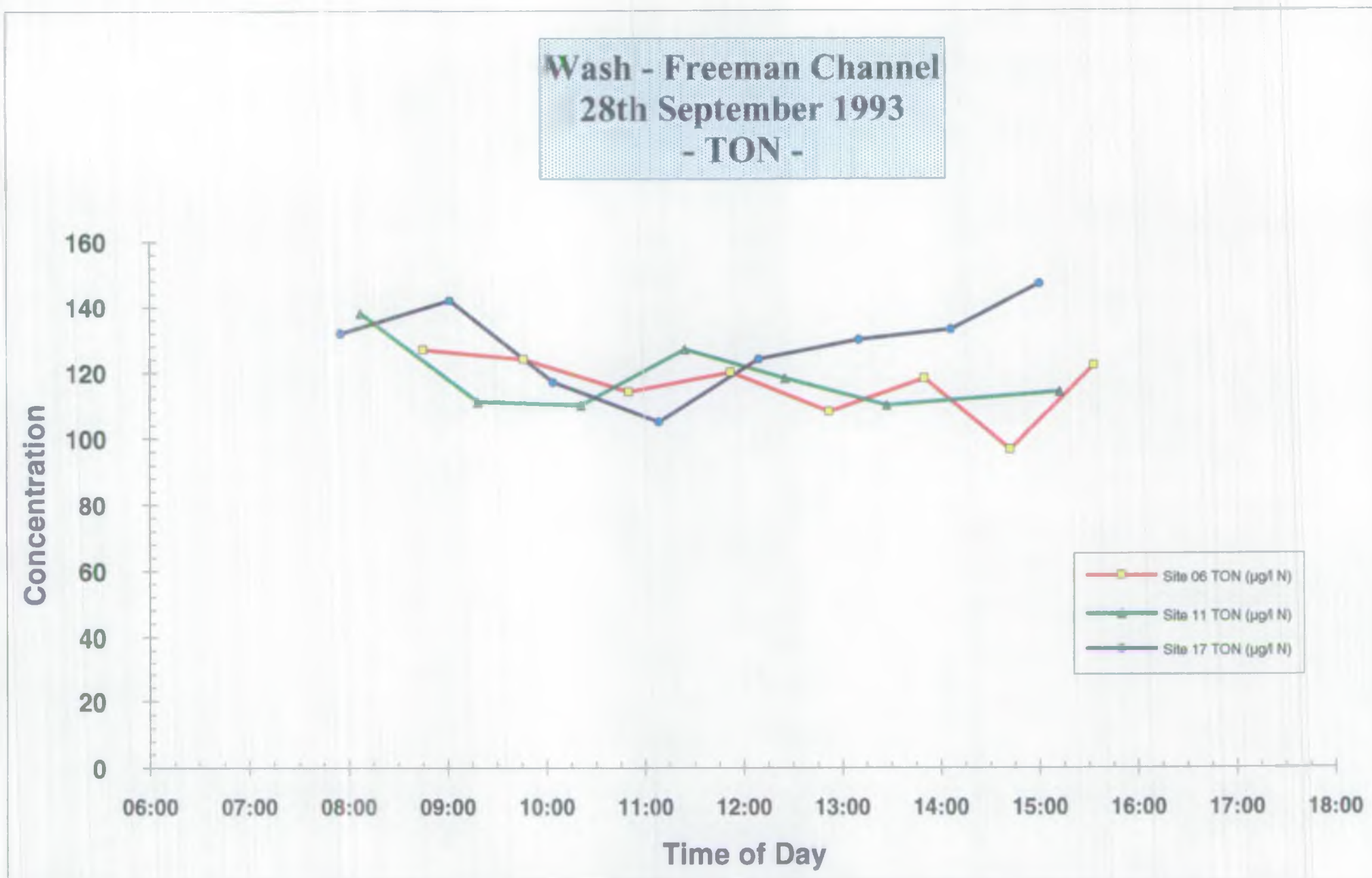


Figure 62(d): Time Series around Low Water.

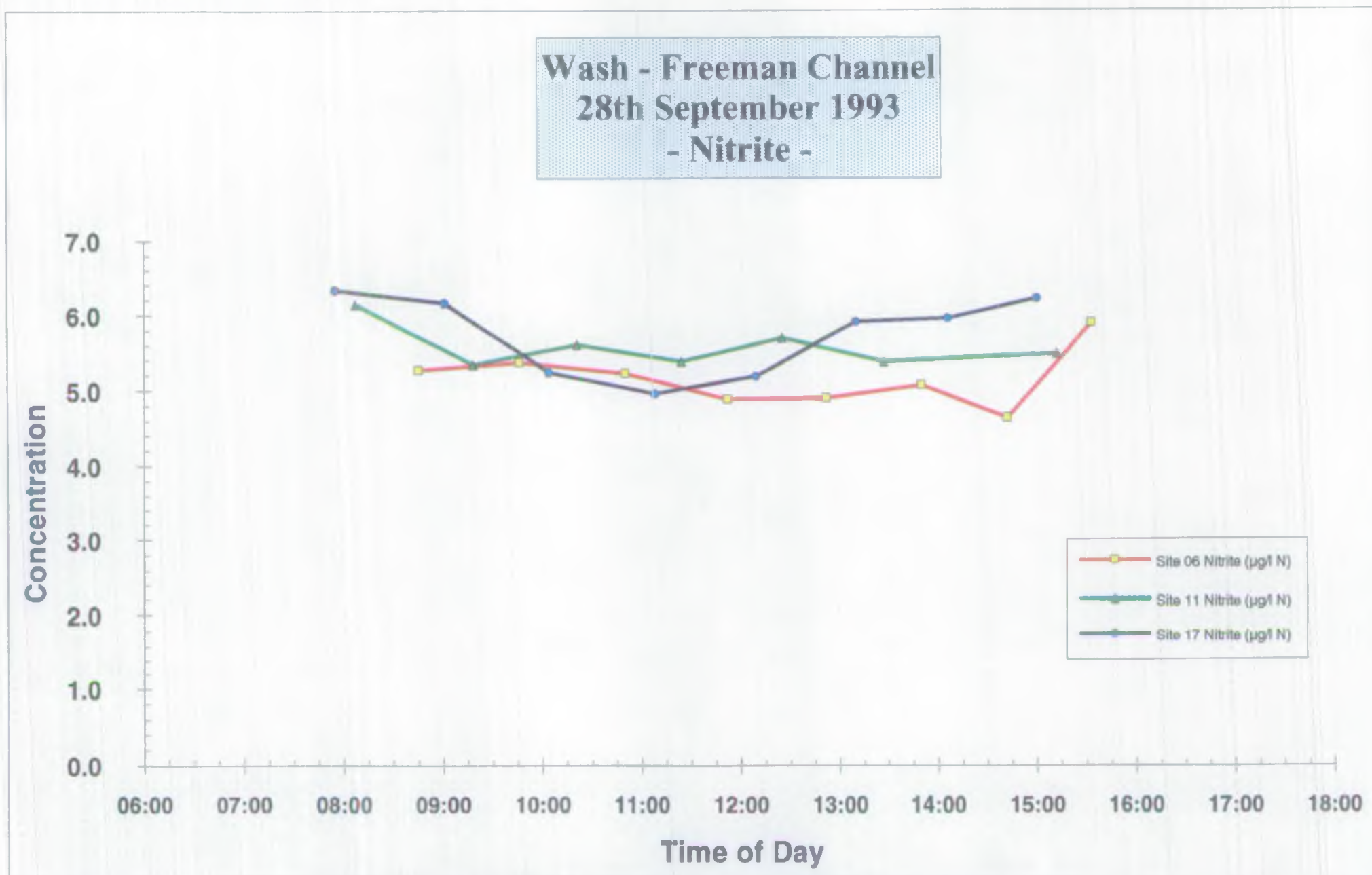


Figure 62(e): Time Series around Low Water.

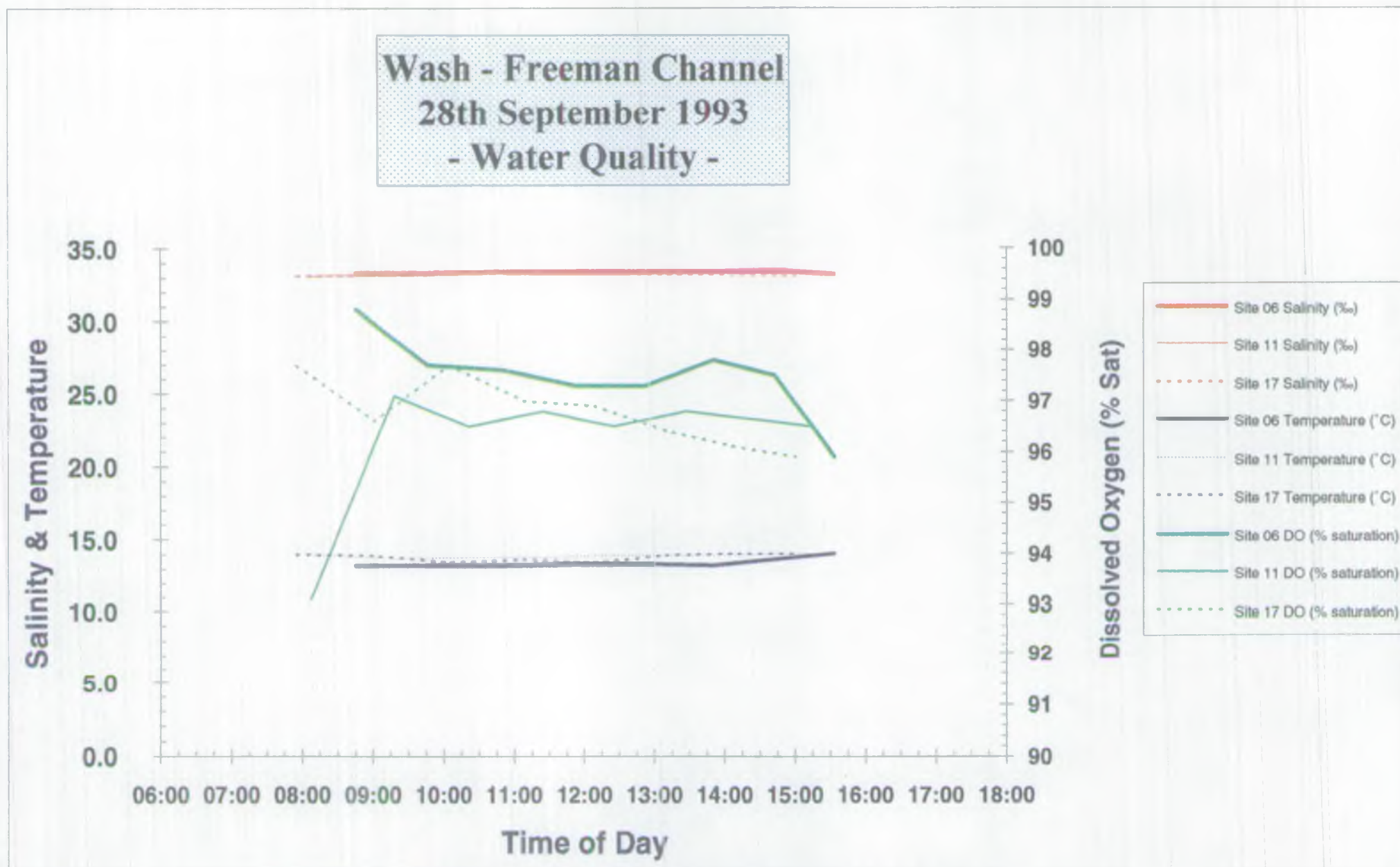
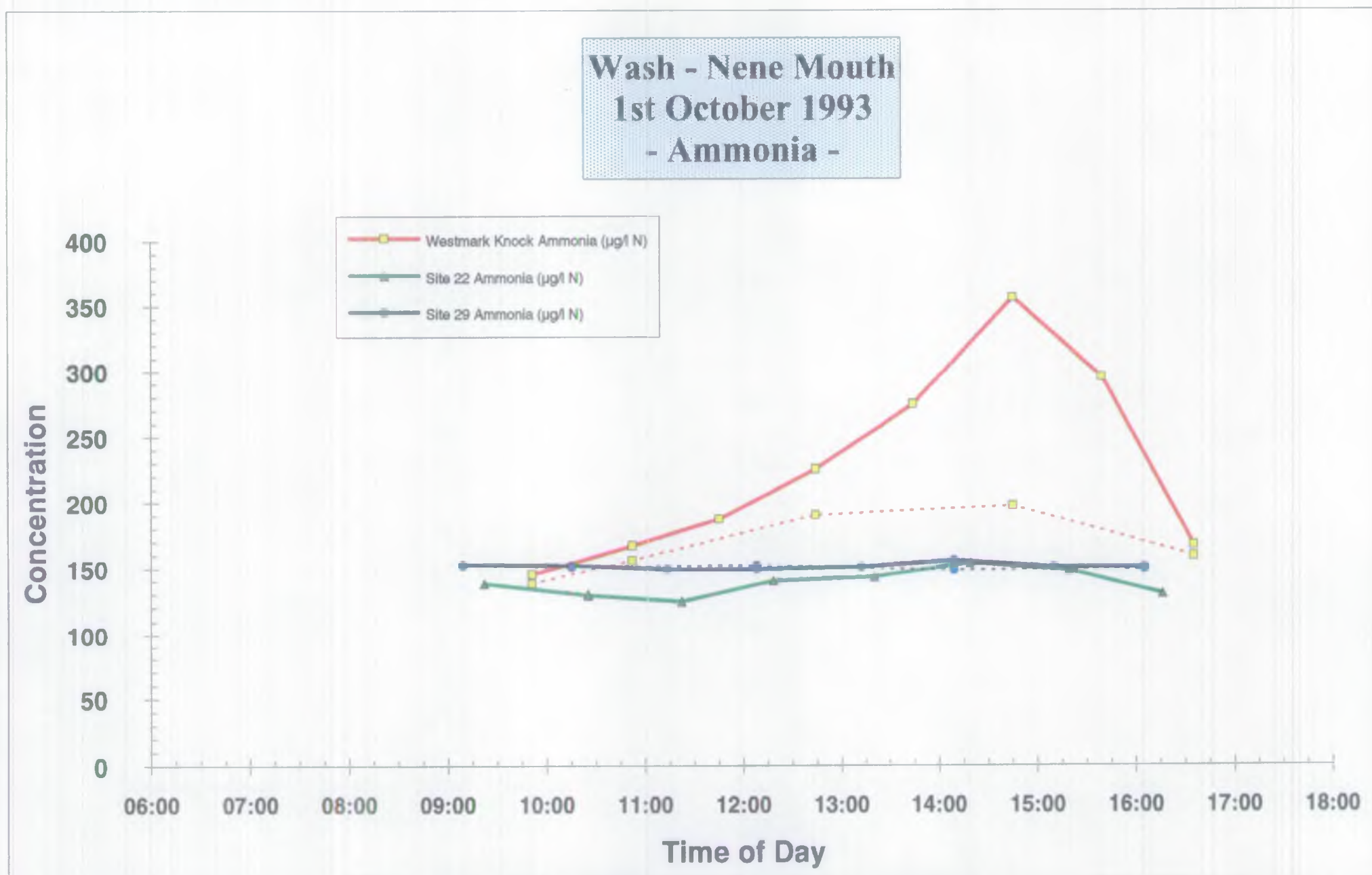


Figure 62(f): Time Series around Low Water.

**Figure 63(a): Time Series around Low Water.**

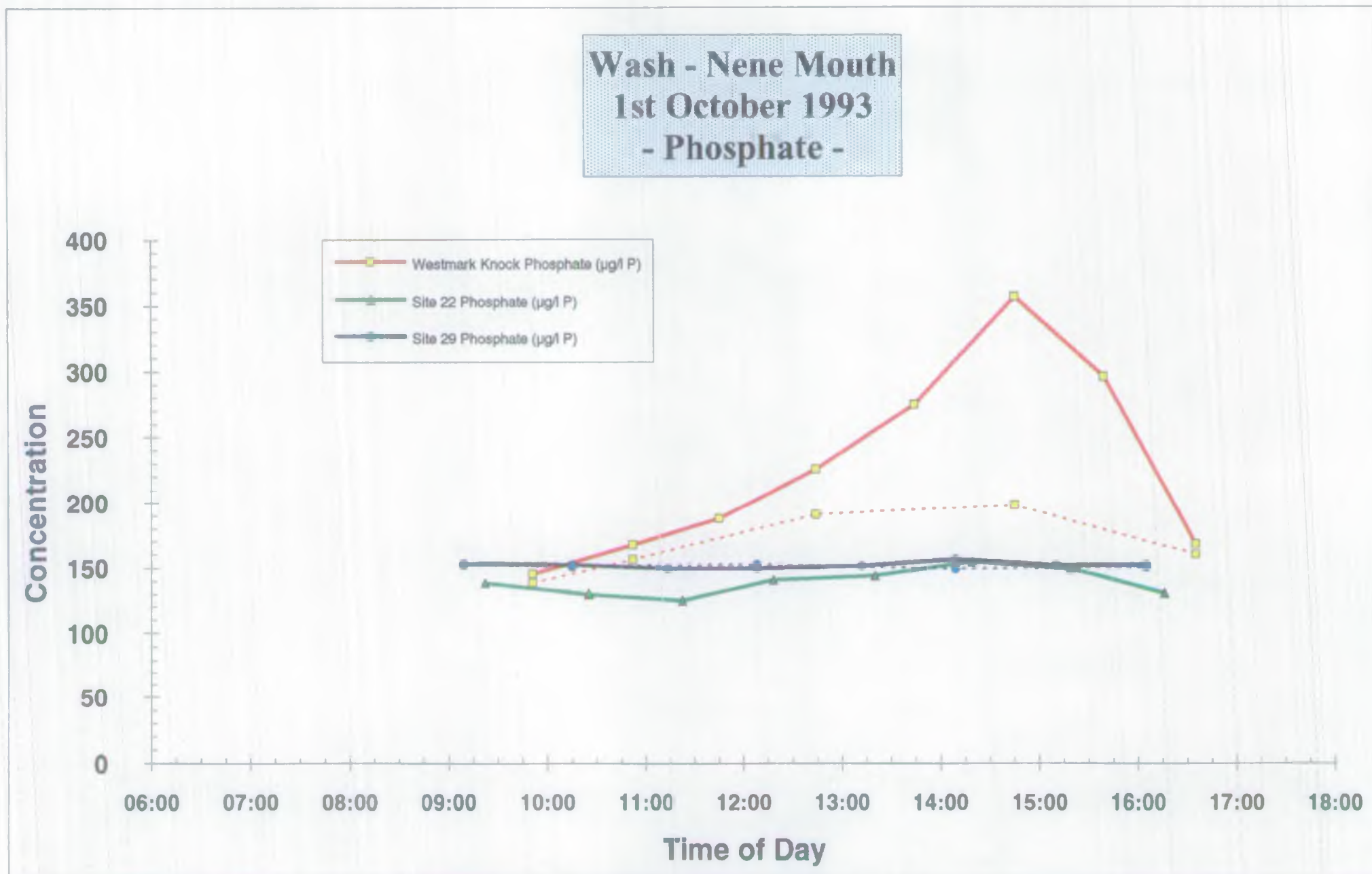


Figure 63(b): Time Series around Low Water.

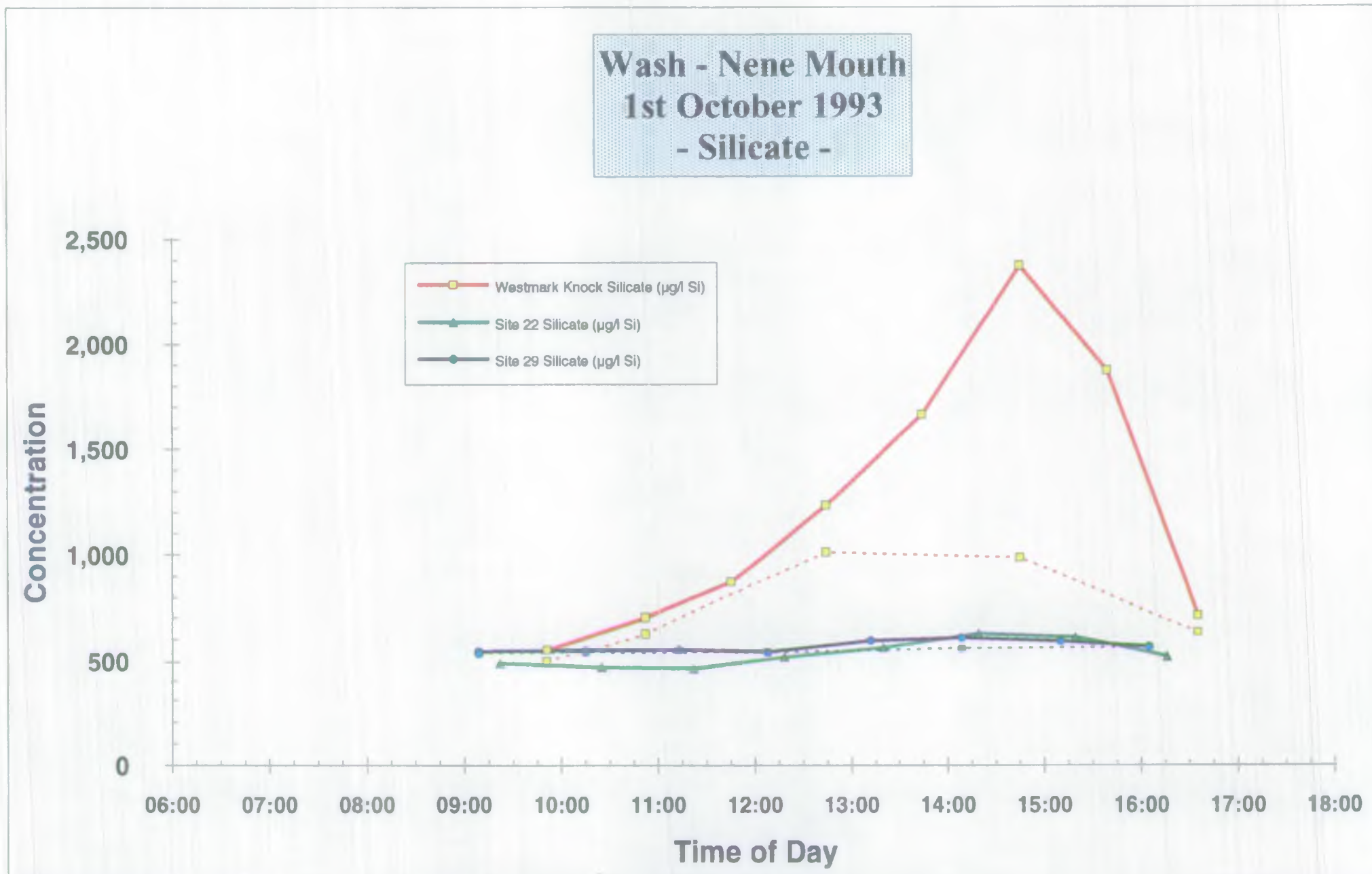


Figure 63(c): Time Series around Low Water.

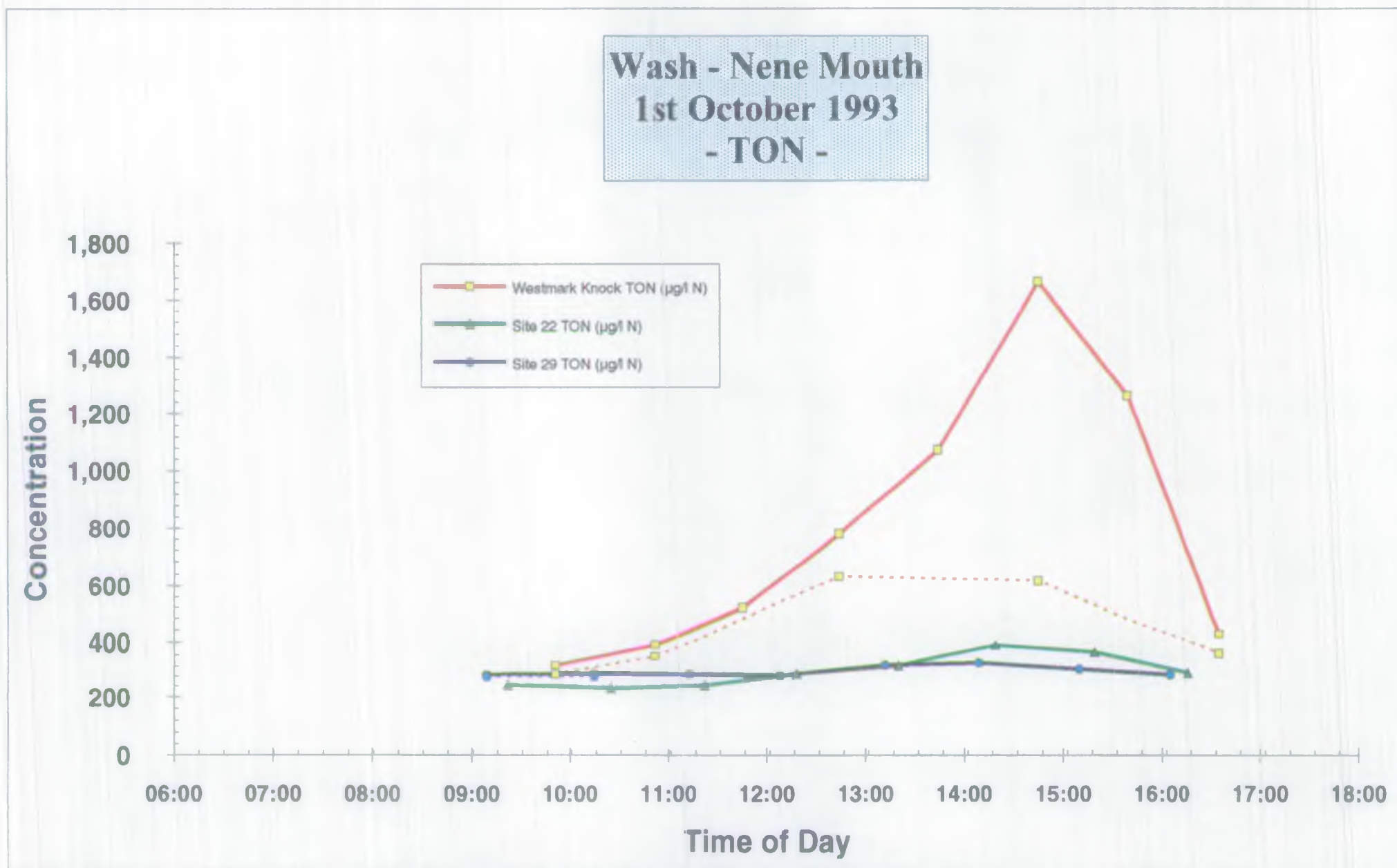


Figure 63(d): Time Series around Low Water.

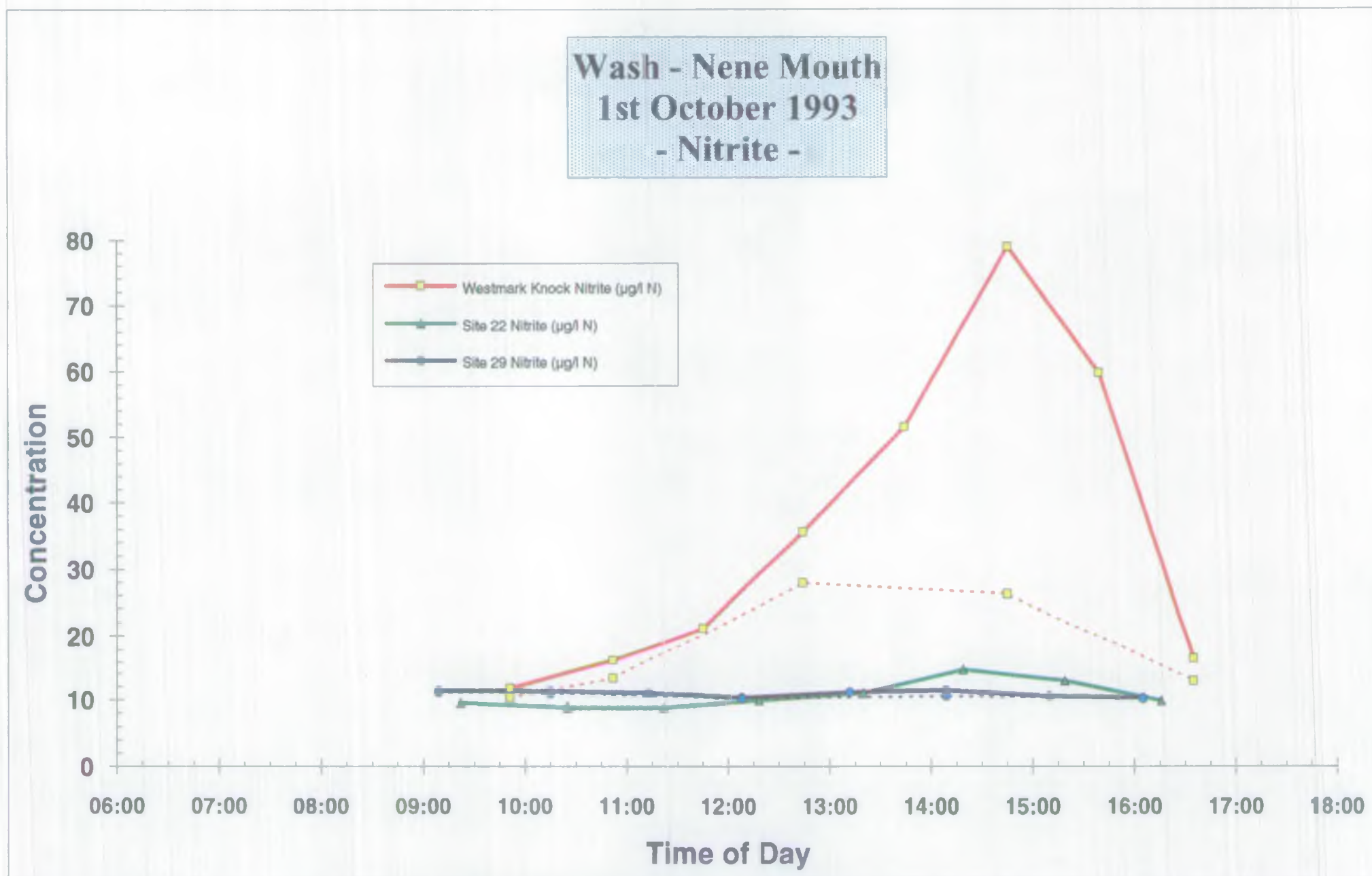


Figure 63(e): Time Series around Low Water.

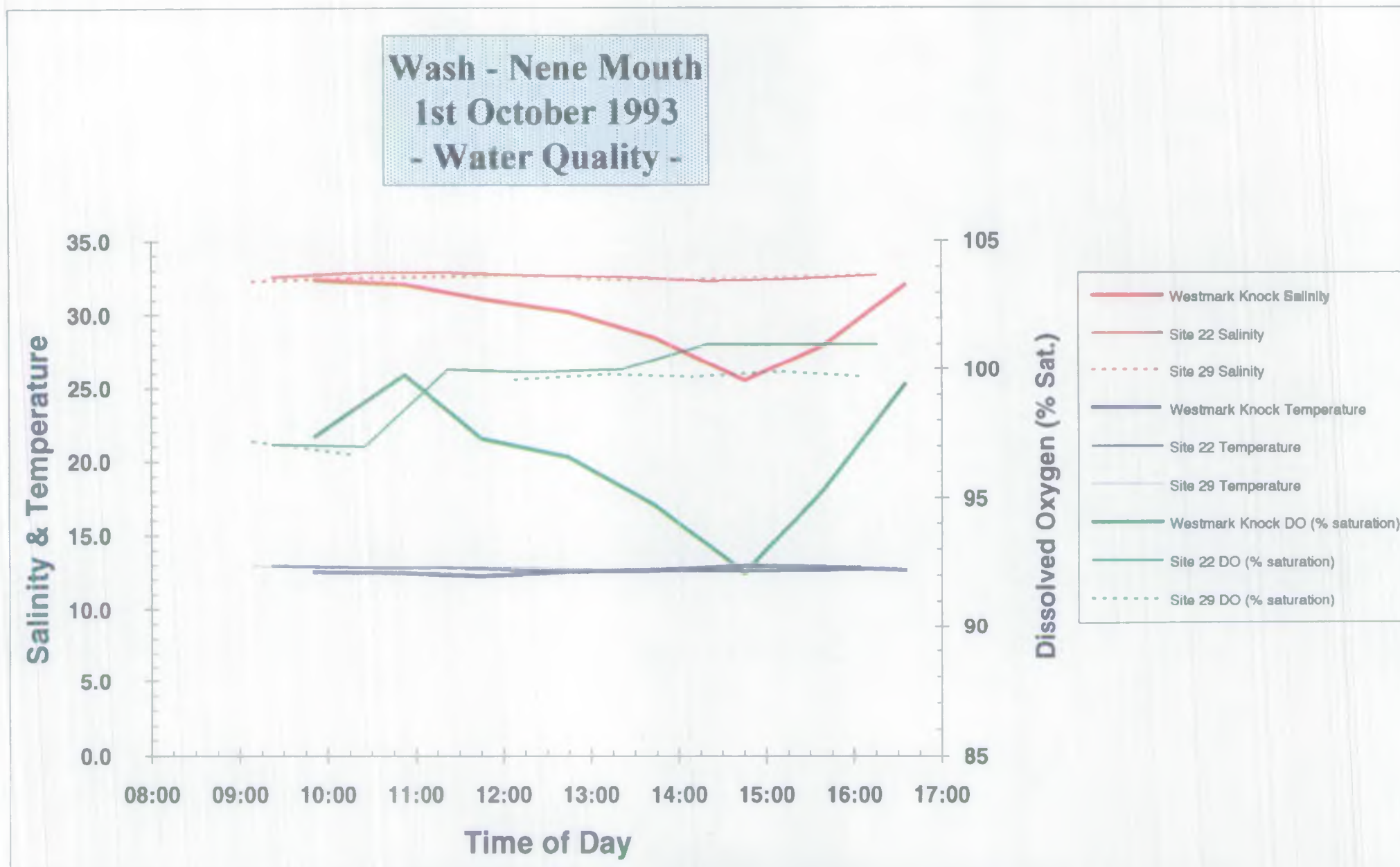


Figure 63(f): Time Series around Low Water.

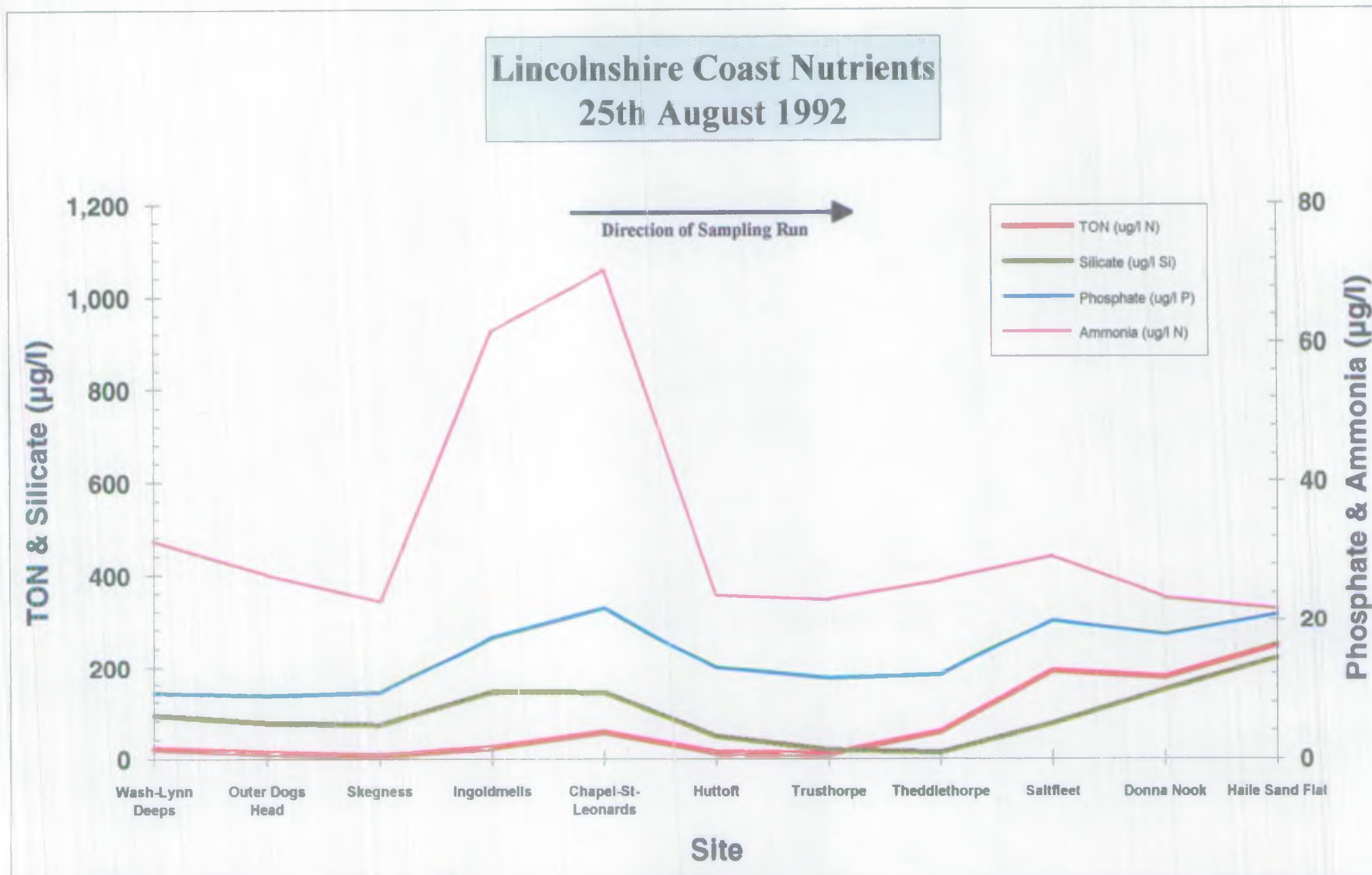


Figure 64

Outer Wash - Site 66
April 1992 to November 1993

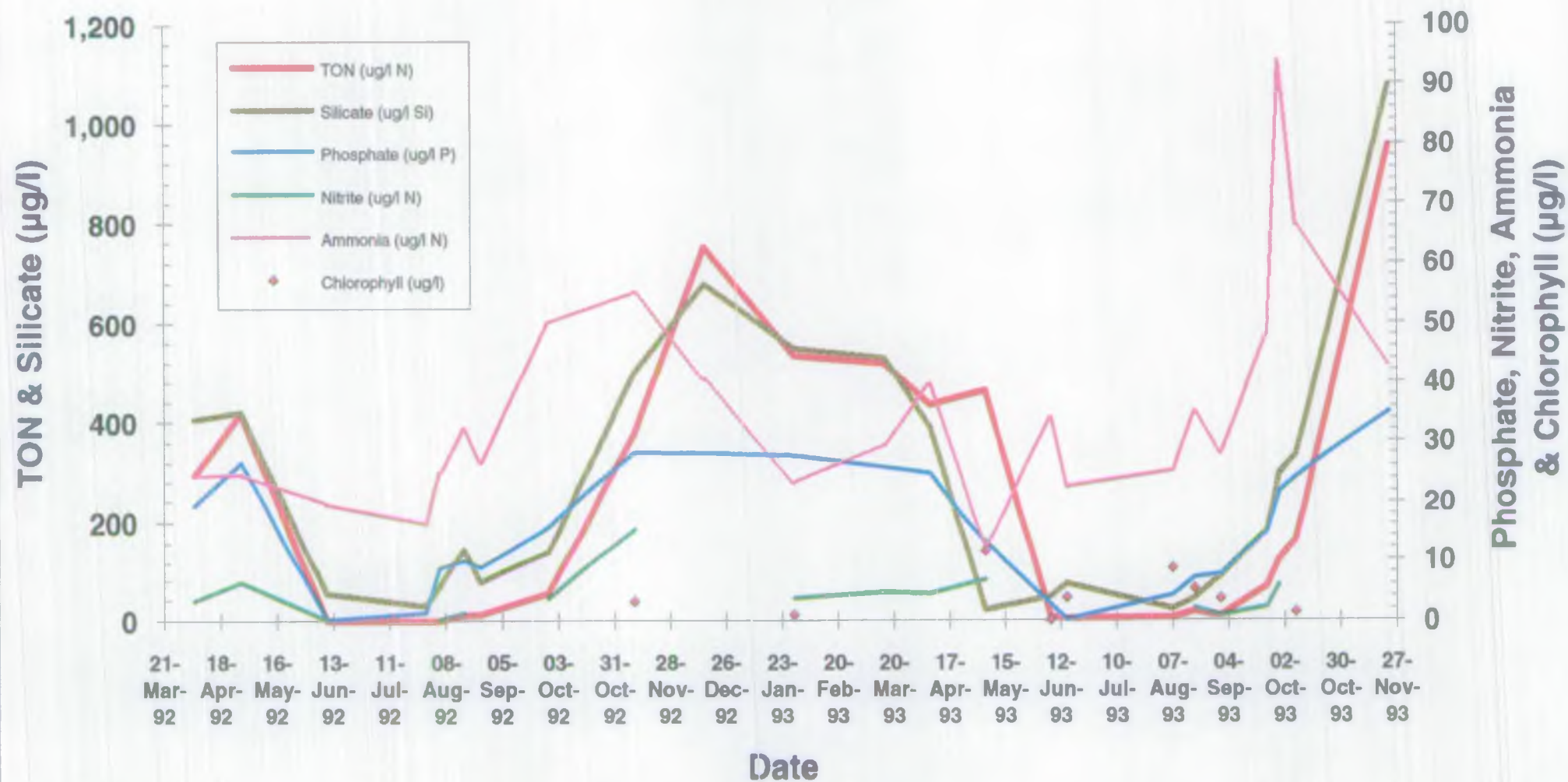
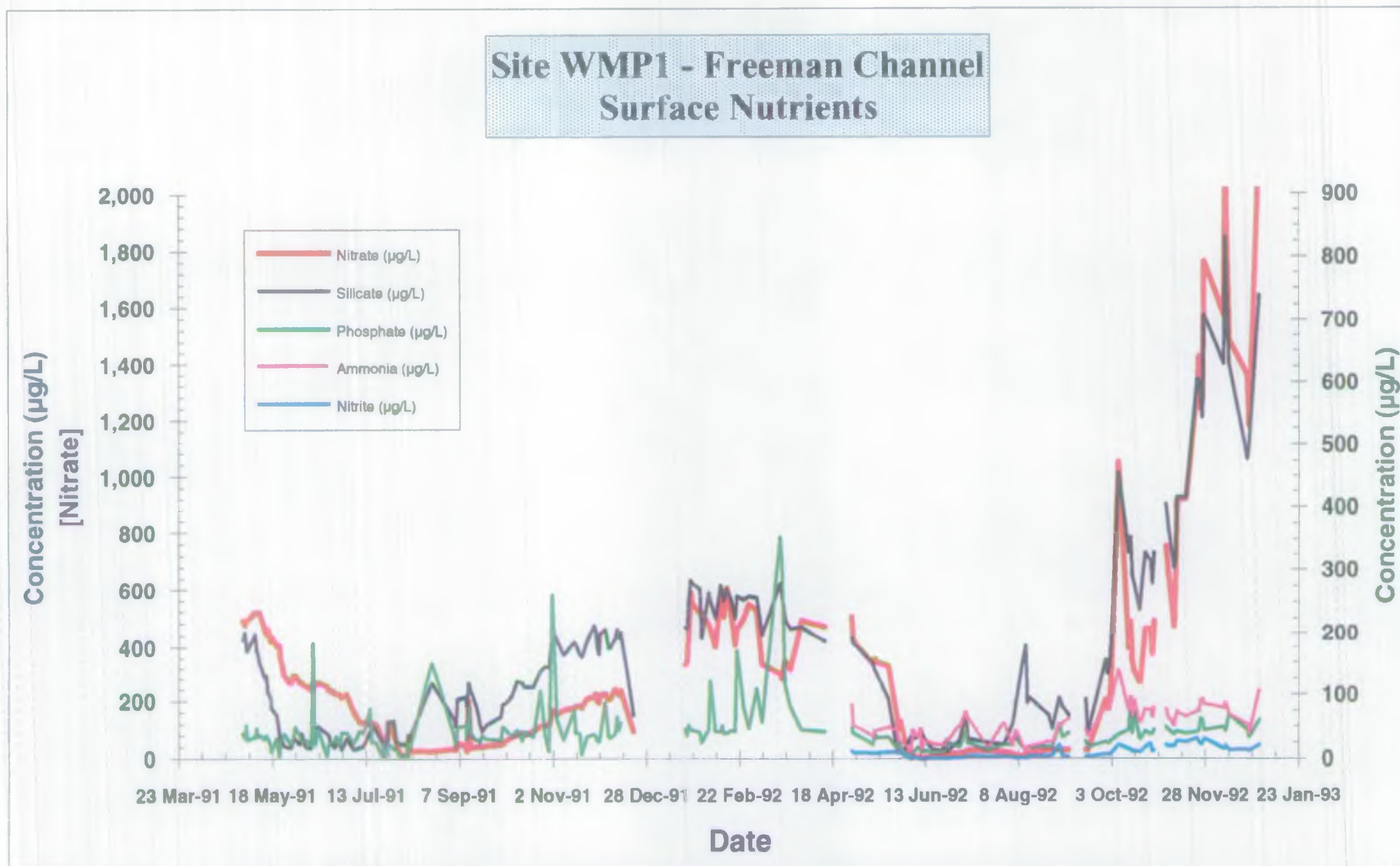


Figure 65

**Figure 66(a) : Sampling by Boston Pilots in the Wash (for JoNuS)**

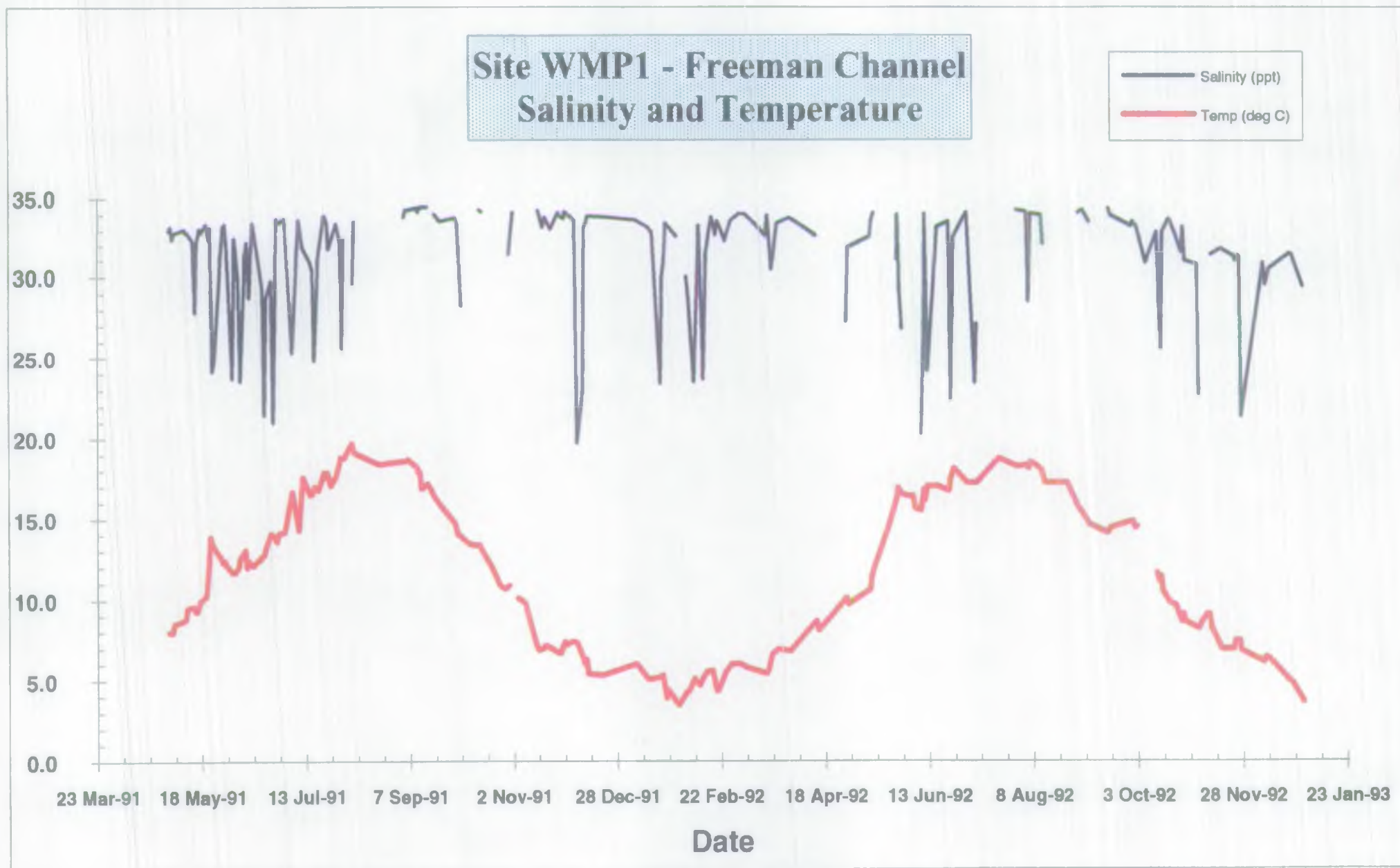


Figure 66(b) : Sampling by Boston Pilots in the Wash (for JoNuS)

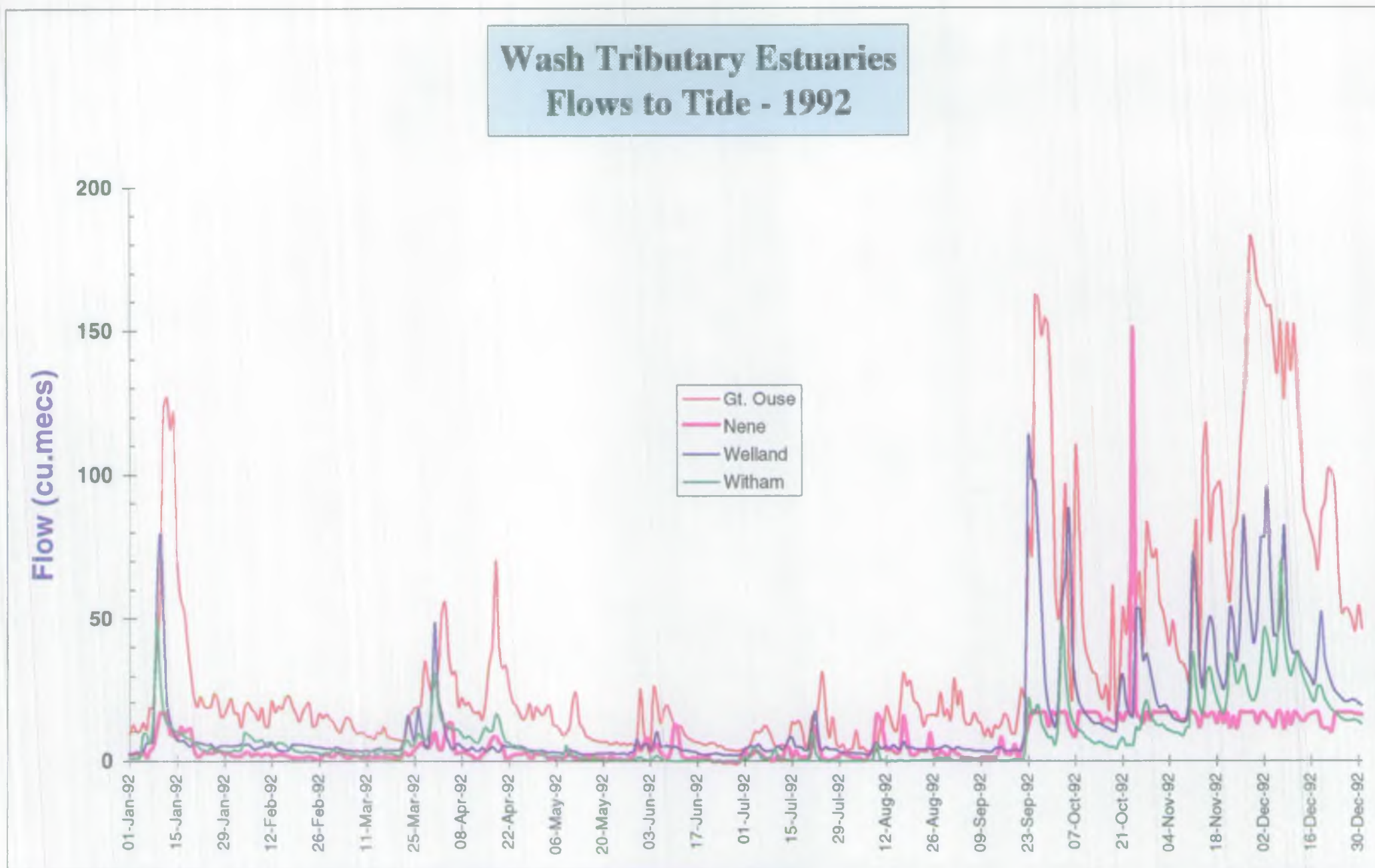


Figure 67 (a) : Freshwater Flows to Wash, 1992.

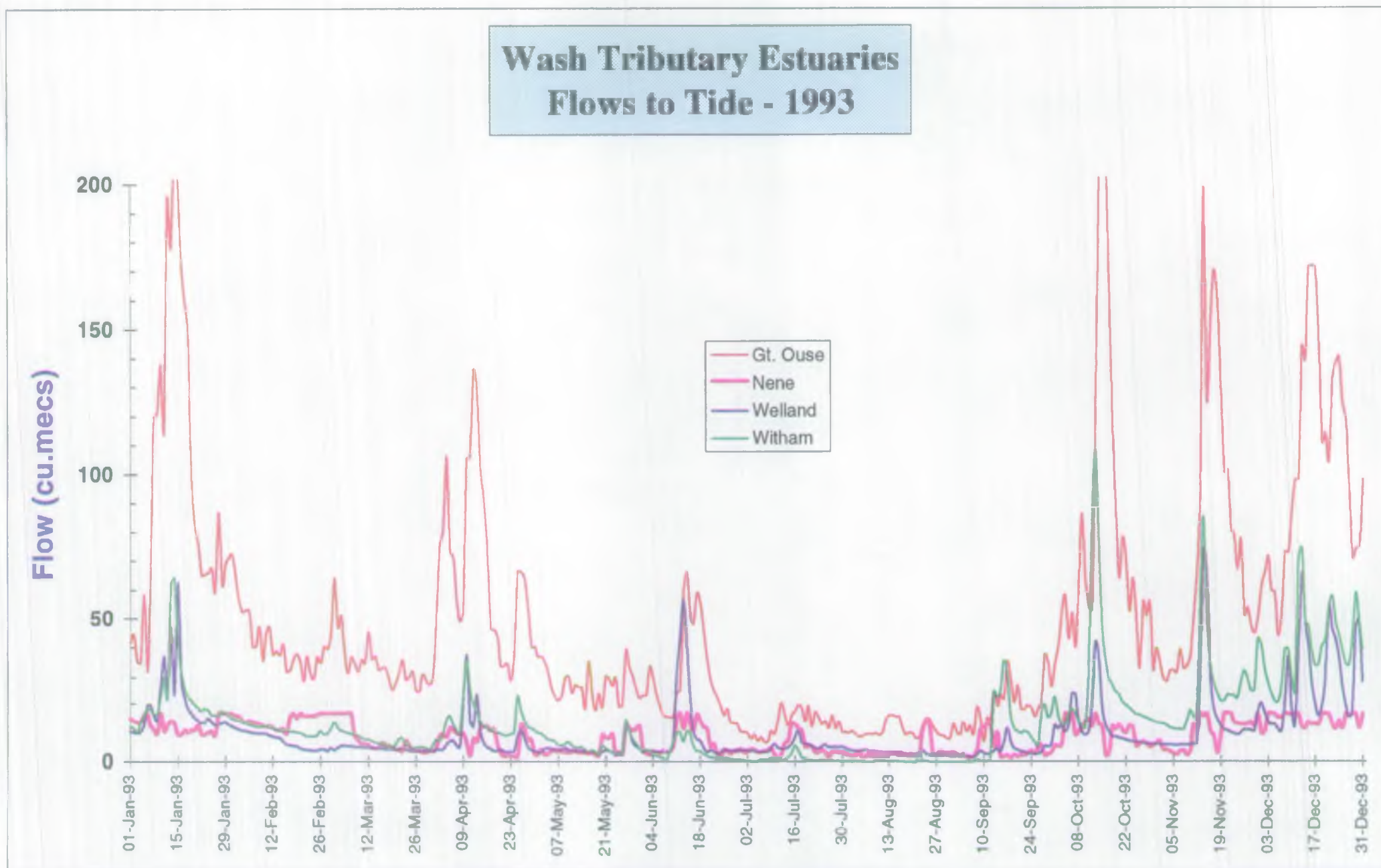


Figure 67 (b) : Freshwater Flows to Wash, 1993.

Anglian Site Name	Easting	Northing	Sample Point Name	Sample Point Code
Wash 01	545500	343500	WASH SITE 01 - LOWER ROAD (FREISTON)	R05BJWA545343
Wash 02	546500	342500	WASH SITE 02 - ROGER SAND (W)	R05BJWA546342
Wash 03	548500	345500	WASH SITE 03 - LOWER ROAD (WRANGLE)	R05BJWA548345
Wash 04	550500	348500	WASH SITE 04 - WRANGLE FLATS	R05BJWA550348
Wash 05	547500	339500	WASH SITE 05 - GAT CHANNEL (MID)	R05BJWA547339
Wash 06	549500	343500	WASH SITE 06 - ROGER SAND (N)	R05BJWA549343
Wash 07	550500	346500	WASH SITE 07 - BOSTON DEEP (S)	R05BJWA550346
Wash 08	553500	349500	WASH SITE 08 - FRISKNEY FLATS	R05BJWA553349
Wash 09	548500	338500	WASH SITE 09 - GAT SAND (E)	R05BJWA548338
Wash 10	550500	341500	WASH SITE 10 - ROGER SAND (E)	R05BJWA550341
Wash 11	551500	344500	WASH SITE 11 - W OF THE ANTS	R05BJWA551344
Wash 12	553500	348500	WASH SITE 12 - LONG SAND (NW)	R05BJWA553348
Wash 13	555500	352500	WASH SITE 13 - BOSTON DEEP (N)	R05BJWA555352
Wash 14	558500	356500	WASH SITE 14 - WAINFLEET RDS @ GIB POINT	R05BJWA558356
Wash 15	549500	335500	WASH SITE 15 - WISBECH CHANNEL (N)	R05BJWA549335
Wash 16	551500	339500	WASH SITE 16 - GAT CHANNEL (E)	R05BJWA551339
Wash 17	552500	342500	WASH SITE 17 - BOSTON ROADS	R05BJWA552342
Wash 18	554500	346500	WASH SITE 18 - LONG SAND (SE)	R05BJWA554346
Wash 19	556500	349500	WASH SITE 19 - PARLOUR CHANNEL (W)	R05BJWA556349
Wash 20	559500	353500	WASH SITE 20 - INNER DOGS HEAD (N)	R05BJWA559353
Wash 21	550500	333500	WASH SITE 21 - WISBECH CHANNEL (MOUTH)	R05BJWA550333
Wash 22	552500	337500	WASH SITE 22 - BAR FLAT	R05BJWA552337
Wash 23	553500	340500	WASH SITE 23 - N OF BAR FLAT BUOY	R05BJWA553340
Wash 24	555500	344500	WASH SITE 24 - E OF ROARING MIDDLE BUOY	R05BJWA555344
Wash 25	557500	347500	WASH SITE 25 - LYNN DEEPS (W)	R05BJWA557347

Table 1 : 'Sea Vigil' Sample Sites in the Wash

Anglian Site Name	Easting	Northing	Sample Point Name	Sample Point Code
Wash 51	555500	329500	WASH SITE 51 - DASELEYS SAND (SW)	R05BJWA555329
Wash 52	558500	333500	WASH SITE 52 - SEAL SAND (E)	R05BJWA558333
Wash 53	559500	335500	WASH SITE 53 - OLD BELL MIDDLE (E)	R05BJWA559335
Wash 54	561500	338500	WASH SITE 54 - S OF SUNK BUOY (W CARD)	R05BJWA561338
Wash 55	563500	341500	WASH SITE 55 - SW OF SUNK SAND	R05BJWA563341
Wash 56	567500	346500	WASH SITE 56 - SUNK SAND (NE)	R05BJWA567346
Wash 57	567500	348500	WASH SITE 57 - MIDDLE BANK	R05BJWA567348
Wash 58	570500	352500	WASH SITE 58 - THE SLEDWAY (W)	R05BJWA570352
Wash 59	558500	331500	WASH SITE 59 - PANDORA SAND (W)	R05BJWA558331
Wash 60	560500	333500	WASH SITE 60 - CORK HOLE	R05BJWA560333
Wash 61	562500	336500	WASH SITE 61 - 3.6 KM O/S HEACHAM	R05BJWA562336
Wash 62	564500	339500	WASH SITE 62 - 2.1 KM O/S HUNSTANTON (S)	R05BJWA564339
Wash 63	566500	342500	WASH SITE 63 - 1.0 KM O/S ST EDMUNDS PT	R05BJWA566342
Wash 64	568500	346500	WASH SITE 64 - 1.6 KM O/S GORE POINT	R05BJWA568346
Wash 65	571500	349500	WASH SITE 65 - NORTH OF GORE MIDDLE	R05BJWA571349
Wash 66	560500	357500	LINCS COAST OUTER DOGS HEAD 4.5 KM O/S	R03BJLC560357
Foxtrot	544500	342500	WASH - FOXTROT BUOY, LOWER ROAD	R05BJWA544342
Golf	543500	341500	WASH - GOLF BUOY, LOWER ROAD	R05BJWA543341
Hotel	542500	340500	WASH - HOTEL BUOY WELLAND/WITHAM CHANNEL	R05BJWA542340
Juliet	541500	339500	WASH - JULIET BUOY WELLAND/WITHAM CHANNL	R05BJWA541339
W Mark Knock	549500	333500	WASH - WESTMARK KNOCK BUOY	R05BJWA549333

Survey Date	Survey Area	No. of Surface Samples	No. of Sub-Surface Samples
19 August 1992	Wash Grid	29	
20 August 1992	Wash Grid	38	
24 November 1992	Wash Grid	18	
9 February 1993	Wash Grid	26	
11 February 1993	Wash Grid	18	
7 June 1993	Wash Grid	31	
8 June 1993	Wash Grid	34	
9 June 1993	Tidal Cycle (site 61, outer Gt Ouse)	26	
10 June 1993	Wash Grid	6	
12 August 1993	Wash Grid	10	
17 August 1993	Wash Grid	30	
18 August 1993	Wash Grid	26	
28 September 1993	Tidal Cycle (sites 06, 11 & 17, outer Witham)	24	11
28 September 1993	Wash Grid	5	2
29 September 1993	Wash Grid	34	18
30 September 1993	Wash Grid	26	5
1 October 1993	Tidal Cycle (sites 22, 29, Westmark Knock)	24	12

Table 2 : Wash Grid Water Column Surveys.

Survey Date	Survey Data	Data Table	Sample Programme Chart	Nutrient Data Graph	Ammonia Plot	Phosphate Plot	Silicate Plot	Nitrate Plot	Nitrite Plot	Chlorophyll Plot	Temp. Plot	Salinity Plot	DO Plot
19-Aug-92	Wash Grid	Table 4	Figure	Figure	Figure	Figure	Figure	Figure	Figure	No Data	Figure	Figure	Figure
20-Aug-92	Wash Grid		2	3	4	5	6	7	8		9	10	11
24-Nov-92	Wash Grid	Table 5	Figure 12	Figure 13	Figure 14	Figure 15	Figure 16	Figure 17	No Data	No Data	Figure 18	Figure 19	Figure 20
09-Feb-93	Wash Grid	Table 6	Figure	Figure	Figure	Figure	Figure	Figure	No Data	No Data	Figure	Figure	Figure
11-Feb-93	Wash Grid		21	22	23	24	25	26			27	28	29
07-Jun-93	Wash Grid	Table 7	Figure	Figure	Figure	Figure	Figure	Figure	No Data	Figure	Figure	Figure	Figure
08-Jun-93	Wash Grid												
10-Jun-93	Wash Grid												
			30	31	32	33	34	35		36	37	38	39
12-Aug-93	Wash Grid	Table 8	Figure	Figure	Figure	Figure	Figure	Figure	Figure	No Data	Figure	Figure	Figure
17-Aug-93	Wash Grid												
18-Aug-93	Wash Grid												
			40	41	42	43	44	45	46		47	48	49
28-Sep-93	Wash Grid	Table 9	Figure	Figure	Figure	Figure	Figure	Figure	Figure	Figure	Figure	Figure	Figure
29-Sep-93	Wash Grid												
30-Sep-93	Wash Grid												
			50	51	52	53	54	55	56	57	58	59	60
09-Jun-93	Tidal Cycle (outer Gt Ouse)	Table 10		Figure 61									
28-Sep-93	Tidal Cycle (outer Witham)	Table 11		Figure 62									
01-Oct-93	Tidal Cycle (outer Nene)	Table 12		Figure 63									
25-Aug-92	Lincs Coast			Figure 64									
1992 - 1993	Wash Site 66			Figure 65									
1991 - 1992	Boston Pilots			Figure 66									
1992 - 1993	Flow to Tide			Figure 67									

Table 3 : Wash Grid Surveys - Summary of Data Tables and Figures.

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
20-August 19:27	Foxtrot	31.9	17.3				94		8	174	50	5	1.7	
20-August 19:40	Golf	30.0	17.6				97		42	463	89	22	5.7	
19-August 11:22	Wash 01	31.4	17.6	7.9			96		14	166	62	9	1.1	
20-August 19:20	Wash 01	31.4	17.6				98		16	294	64	14	2.9	
20-August 10:25	Wash 02	31.5	17.6	3.4			98		16	295	65	13	3.1	
19-August 11:37	Wash 03	31.2	17.5	14.8			96		12	179	49	6	1.0	
20-August 19:10	Wash 03	32.0	17.4				98		6	168	48	6	1.3	
20-August 10:44	Wash 05	31.8	17.4	12.0			93		8	221	48	8	1.5	
19-August 11:50	Wash 06	31.0	17.3	6.0			97		11	196	52	7	1.1	
20-August 18:57	Wash 07	31.9	17.3				98		6	164	44	5	1.1	
20-August 10:48	Wash 09	31.6	17.3	3.5			92		10	227	50	8	1.5	
19-August 12:03	Wash 10	31.0	17.3	4.0			94		12	255	51	9	1.1	
20-August 15:35	Wash 11	31.4	17.3				94		12	204	47	6	1.1	
20-August 18:44	Wash 12	32.0	17.3				98		8	176	45	5	1.1	
20-August 11:00	Wash 15	31.8	17.3	5.9			91		10	258	51	9	1.6	
19-August 12:14	Wash 16	31.0	17.9	9.8			90		12	289	57	13	0.9	
20-August 15:18	Wash 17	31.8	17.4				95		11	179	42	5	1.2	
19-August 14:40	Wash 18	31.2	17.6	4.2			97		13	135	39	2	1.1	
20-August 18:27	Wash 19	32.3	17.1				100		7	126	32	2	1.0	
20-August 11:09	Wash 21	31.5	17.3	4.9			93		10	240	49	8	1.7	
19-August 12:25	Wash 22	31.7	18.0	9.7			90		12	320	59	14	1.0	
20-August 15:00	Wash 23	31.7	17.3	13.0			95		12	319	55	12	1.3	
19-August 14:29	Wash 24	31.4	17.7	22.0			93		12	226	64	11	1.2	

Table 4 : Wash Data, 19-20th August 1992

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
20-August 17:13	Wash 48	31.3	17.5				101		<2.33	45	26	4	<0.3	
19-August 16:50	Wash 49	31.1	17.4	13.3			104		4	60	19	5	0.6	
19-August 17:40	Wash 50	31.4	17.0	18.0			103		7	67	23	<1.15	0.7	
20-August 11:47	Wash 51	31.6	17.3	4.7			93		27	293	50	12	2.4	
20-August 13:44	Wash 52	31.0	17.4	4.1			100		97	337	54	23	9.2	
19-August 13:44	Wash 53	31.2	17.8	3.3			97		61	299	60	19	6.9	
20-August 12:54	Wash 54	31.0	17.2	9.4			95		18	180	40	11	2.0	
20-August 16:42	Wash 55	31.2	17.3				110		4	48	20	7	0.4	
19-August 16:38	Wash 57	31.1	17.5	5.6			103		3	64	21	6	0.7	
19-August 17:55	Wash 58	31.1	17.4	5.3			102		2	31	21	3	<0.3	
20-August 12:25	Wash 60	31.1	17.4	4.9			101		83	152	39	18	11.0	
20-August 12:45	Wash 61	31.2	17.2	5.6			97		19	158	38	12	2.2	
19-August 20:03	Wash 62	31.1	17.4	2.7			105		4	85	24	7	1.0	
19-August 19:07	Wash 63	31.1	17.8	3.5			126		6	42	18	7	0.9	
19-August 18:50	Wash 64	31.3	17.5	3.7			104		3	32	19	1	<0.3	
19-August 18:10	Wash 65	31.2	17.5	2.4			103		<2.33	32	20	2	<0.3	

Table 4 : Wash Data, 19-20th August 1992

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
24-November 08:55	Wash 01	30.5	7.3	7.0		8.4	67	6.5	1,240	910	74	33		
24-November 08:42	Wash 03	30.2	7.3	14.7		8.4	69	6.7	871	667	56	24		
24-November 07:52	Wash 05	31.0	7.3	9.6		8.4	66	6.4	756	661	55	28		
24-November 07:27	Wash 15	31.2	7.1	6.8		8.4	61	6.0	716	666	53	32		
24-November 08:07	Wash 16	31.5	7.2	11.1		8.4	65	6.3	498	555	41	28		
24-November 09:27	Wash 17	32.0	7.4	11.5		8.4	70	6.8	354	396	30	22		
24-November 09:39	Wash 23	31.1	7.1	14.6		8.4	70	6.8	541	566	47	31		
24-November 07:07	Wash 28	30.5	7.1	7.0		8.3	69	6.7	991	884	80	39		
24-November 11:04	Wash 29	30.2	7.2	14.6		8.4	70	6.8	1,110	1,000	87	42		
24-November 10:40	Wash 37	31.0	7.2	6.8		8.4	67	6.6	872	826	79	39		
24-November 09:55	Wash 38	31.0	7.1	11.4		8.4	70	6.9	858	822	66	39		
24-November 11:40	Wash 45	30.5	7.3	4.7		8.4	74	7.3	987	913	82	39		
24-November 06:45	Wash 51	30.5	7.1	6.0		8.3	75	7.3	712	674	63	29		
24-November 12:06	Wash 52	26.8	7.5	4.6		8.3	62	6.0	848	735	65	21		
24-November 12:55	Wash 53	29.1	7.6	3.0		8.3	69	6.7	782	701	59	24		
24-November 10:14	Wash 54	29.5	7.3	8.0		8.4	73	7.2	1,090	961	76	37		
24-November 13:38	Wash 60	24.0	7.5	1.8		8.3	65	6.3	3,440	2,030	127	52		
24-November 14:38	Wash 60	27.8	7.7	4.5		8.3	67	6.5	2,150	1,780	120	58		
24-November 13:15	Wash 61	27.0	7.5	3.0		8.3	67	6.5	2,400	1,960	130	64		

Table 5 : Wash Data, 24th November 1992

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Seccl Disc (m)	pH Field	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
11-February 12:53	Golf	30.9	5.4	4.3	0.4	8.1	94	9.6	1,190	873	65	30		
09-February 08:45	Gt. Ouse 77			7.1					2,900	2,510	124	54		
09-February 19:24	Gt. Ouse 77	26.2	5.7	7.4		8.0	91	9.5						
09-February 09:10	Gt. Ouse 83	28.4	5.8	7.4			93	9.6	1,490	1,310	68	45		
09-February 19:03	Gt. Ouse 83	26.8	5.7	8.1		8.1	92	9.7	2,660	2,380	138	54		
11-February 13:08	Wash 01	31.4	5.4	6.0	0.6	8.1	92	9.7	1,060	851	54	33		
11-February 13:22	Wash 03	31.5	5.3	13.0	1.0	8.0	95	9.8	1,130	877	68	32		
11-February 12:10	Wash 06	31.9	5.3	3.9	1.0	8.1	97	10.0	900	758	43	32		
11-February 13:36	Wash 07	31.9	5.3	16.2	1.0	8.1	96	9.8	912	771	52	31		
11-February 13:51	Wash 12	32.0	5.2	10.9	1.1	8.1	96	9.9	917	769	50	31		
11-February 14:10	Wash 13	33.9	5.3	9.3	1.0	8.1	96	9.7	755	679	40	28		
11-February 11:47	Wash 17	32.3	5.3	11.9	0.8	8.1	99	10.1	795	716	37	31		
11-February 14:32	Wash 19	32.3	5.3	11.1	0.8	8.1	96	9.8	820	716	44	30		
11-February 10:17	Wash 21	32.0	5.4	6.3	0.9	8.0	98	10.0	787	666	42	26		
11-February 10:57	Wash 22	31.5	5.3	12.3	1.0	8.1	98	10.0	1,100	919	65	35		
09-February 14:28	Wash 26	32.3	5.3	9.8		8.1	100	10.2	643	582	31	26		
09-February 15:00	Wash 27	32.8	5.2	11.0		8.1	100	10.2	450	439	22	22		
11-February 10:09	Wash 28	31.2	5.4	7.0		8.0	97	9.9	739	635	48	22		
11-February 10:46	Wash 29	31.5	5.3	18.7	0.9	7.8	97	10.0	1,200	996	70	39		
11-February 11:24	Wash 30	31.6	5.3	6.0	1.0	8.1	97	10.0	1,090	930	63	37		
09-February 14:01	Wash 33	31.1	5.2	36.7		8.1	100	10.3	787	701	37	30		
09-February 15:30	Wash 35	32.5	5.2	18.6		8.1	99	10.1	681	620	33	28		
11-February 10:32	Wash 36	31.3	5.3	7.3	0.9	8.0	98	10.0	1,170	1,010	57	39		

Table 6 : Wash Data, 9th, 11th February 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
08-June 08:30	Foxtrot	32.7	15.5	7.4	2.5		94	7.4	36	86	59	7		2.2
08-June 08:20	Golf	32.8	15.9	7.9	2.5		94	7.3	39	97	61	9		1.2
10-June 10:27	Gt.Ouse 83	31.1	18.5	6.4	0.9		102	7.9	447	400	103	19	-----	18.6
08-June 08:06	Hotel	32.6	16.2	6.0	1.3		92	7.2	51	111	73	10		2.7
07-June 19:44	Wash 01	33.1	15.6	8.3	2.4		98	7.9	32	92	47	6		
08-June 08:42	Wash 02	32.9	14.9	4.9	5.0		94	7.7	26	77	53	5		
07-June 19:29	Wash 03	33.3	15.6	15.5	3.6		102	8.3	13	68	45	4		
07-June 19:07	Wash 04	32.7	14.7	4.0	0.5		101	8.3	15	62	36	4		
08-June 09:55	Wash 05	33.2	15.3	9.3	4.2		95	7.7	27	76	56	5		
08-June 09:03	Wash 06	33.2	14.2	9.0	5.0		97	8.1	7	46	37	3		
07-June 19:16	Wash 07	33.3	14.8	16.9	3.5		101	8.3	12	60	45	4		
07-June 18:22	Wash 08	32.3	16.0	3.6			101	8.2	9	59	51	6		
08-June 09:38	Wash 09	33.2	14.8	4.9	4.5		94	7.7	16	51	34	3		
08-June 09:20	Wash 10	32.2	14.1	6.8	5.0		97	8.1	12	60	41	3		
08-June 10:31	Wash 11	33.4	14.1	10.3	5.0		103	8.6	6	47	38	3		
07-June 18:45	Wash 12	32.5	16.4	14.7	3.7		108	8.6	13	59	35	4		
07-June 17:26	Wash 13	33.4	16.5	8.1	2.6		103	8.2	8	53	34	5		
07-June 17:53	Wash 14	33.3	14.5	12.1	2.8		104	8.6	9	51	39	3		
07-June 10:42	Wash 15	33.1	15.0	6.0			98	8.4	20	86	45	3		
08-June 19:03	Wash 16	33.3	15.7	9.0	1.6		106	8.5	24	69	54	6		
07-June 12:58	Wash 17	33.3	14.6	9.8			97	8.0	8	57	33	3		
08-June 10:48	Wash 18	33.4	14.0	9.1	4.0		103	8.6	10	46	38	3		
07-June 17:06	Wash 19	33.3	14.9	7.5	3.7		102	8.4	20	89	51	5		
07-June 16:25	Wash 20	33.4	14.9	3.4	>3.4		106	8.7	11	51	30	2		

Table 7 : Wash Data, 7-8th, 10th June 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
08-June 17:08	Wash 45	32.4	17.7	4.6	1.8		97	7.6	122	141	101	10		10.4
08-June 15:52	Wash 46	32.0	18.1	11.4	2.1		100	7.8	162	137	95	11		9.8
08-June 15:14	Wash 47	32.8	16.5	11.7	3.5		101	8.0	24	52	47	4		7.3
08-June 11:30	Wash 48	33.3	15.1	13.7	3.8		101	8.3	6	40	40	2		1.8
08-June 14:17	Wash 49	33.2	15.4	16.6	3.6		99	8.0	8	45	37	2		4.3
08-June 13:33	Wash 50	33.7	14.4	19.7	3.5		117	9.6	5	23	25	<1.15		1.6
07-June 09:48	Wash 51	32.7	15.7	5.7			94	7.4	57	180	68	6		2.4
08-June 17:33	Wash 52	31.7	19.0	2.5	0.8		102	7.7	319	309	141	21		8.1
08-June 16:30	Wash 53	32.4	18.6	2.4	1.4		103	7.9	123	146	96	9		9.1
08-June 16:07	Wash 54	32.2	17.8	6.5	3.0		103	8.0	114	112	78	10		8.8
08-June 15:33	Wash 55	32.8	17.0	4.4	3.5		101	8.0	29	63	52	6		6.3
08-June 11:46	Wash 56	33.2	15.6	6.2	2.8		101	8.2	13	39	33	2		5.0
08-June 12:37	Wash 57	32.9	16.5	3.9	3.0		101	8.1	23	44	36	3		6.2
08-June 13:18	Wash 58	33.7	14.7	7.5	4.3		117	9.6	4	24	29	<1.15		1.1
10-June 09:04	Wash 62	33.2	16.3	5.9	2.8		105	8.4	8	15	29	2	-----	-----
08-June 12:05	Wash 63	32.8	16.4	5.6	3.3		97	7.8	41	52	41	4		6.8
08-June 12:23	Wash 64	33.2	16.1	6.4	2.0		104	8.3	7	37	30	2		5.4
08-June 13:04	Wash 65	33.3	15.9	5.0	3.0		110	8.8	6	28	27	<1.15		2.6
07-June 15:30	Wash 66	33.4	14.6	10.3	4.2		105	8.6	8	48	34	3		<1
10-June 09:46	WEB 05	32.7	17.5	3.3			106	8.3	35	33	27	4	-----	-----
10-June 09:36	WEB 06	33.0	16.7	4.5			108	8.5	18	24	29	3	-----	-----
10-June 09:26	WEB 07	32.7	17.9	4.5			116	9.0	15	12	25	1	-----	-----
10-June 09:14	WEB 08	33.0	17.1	5.1			115	9.0	9	9	27	<1.15	-----	-----

Table 7 : Wash Data, 7-8th, 10th June 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
17-August 09:59	Foxtrot	33.3	17.4	3.6		8.1	97	7.6	10	50	23	7	0.6	
17-August 09:48	Wash 01			5.8			95	7.5	12	57	29	7	1.0	
17-August 10:17	Wash 03	33.3	17.4	12.9		8.2	96	7.5	15	56	30	7	1.6	
17-August 10:57	Wash 04	33.7	17.1	3.1		8.2	96	7.5	14	49	31	8	1.4	
17-August 08:31	Wash 05	33.3	17.2	11.0		8.2	100	7.9	7	24	23	4	<.3	
17-August 09:30	Wash 06			4.9			95	7.5	15	54	31	7	1.1	
17-August 10:49	Wash 07	33.6	17.0	14.0		8.2	96	7.5	21	55	32	7	2.0	
17-August 11:51	Wash 08	33.7	17.2	4.1		8.2	99	7.8	14	39	28	7	1.4	
17-August 08:17	Wash 09	33.4	17.3	3.3		8.2	98	7.8	6	28	26	5	<.3	
17-August 09:09	Wash 10	33.6	17.0	4.2		8.2	101	8.0	7	36	21	4	<.3	
17-August 15:05	Wash 11	33.6	17.4	5.1		8.2	100	7.8	25	54	40	9	2.4	
17-August 11:11	Wash 12	33.5	17.0	11.3		8.1	95	7.5	21	60	36	8	2.2	
17-August 12:17	Wash 13	33.7	17.3	6.3		8.2	98	7.7	16	41	26	8	1.5	
17-August 12:36	Wash 14	33.7	16.9	6.0		8.2	95	7.5	26	64	36	8	2.4	
17-August 08:05	Wash 15	33.3	17.4	6.3		8.2	99	7.8	6	27	26	4	<.3	
17-August 16:01	Wash 16	33.5	17.3	8.3		8.2	100	7.8	12	50	29	6	1.1	
17-August 15:18	Wash 17	33.6	17.1	8.8		8.2	104	8.1	10	27	26	5	0.6	
17-August 14:52	Wash 18	33.6	17.4	5.0		8.2	100	7.8	26	63	40	9	2.4	
17-August 13:15	Wash 19	33.6	17.1	7.5		8.2	96	7.6	23	56	35	7	2.1	
17-August 13:43	Wash 20	33.7	17.3	2.9		8.2	98	7.6	27	52	34	7	2.3	
17-August 07:42	Wash 21	33.4	17.3	5.9		8.1	96	7.5	6	49	26	6	<.3	
17-August 16:10	Wash 22	33.5	17.4	9.6		8.2	105	8.2	6	26	25	4	<.3	
17-August 15:49	Wash 23	33.6	17.7	13.8		8.2	104	8.1	6	52	24	6	<.3	

Table 8 : Wash Data, 12th, 17-18th August 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
18-August 11:10	Wash 45	32.9	17.6			8.2	97	7.6	46	125	68	17	4.1	
18-August 10:53	Wash 46	33.0	17.5	13.5		8.2	106	8.3	35	44	42	13	3.8	
18-August 10:17	Wash 47	33.3	17.2	14.3		8.2	110	8.7	5	30	27	5	0.4	
18-August 09:53	Wash 48	33.4	17.0	12.2		8.2	108	8.5	5	33	27	4	0.4	
18-August 16:33	Wash 49	33.7	16.9	16.0		8.2	112	8.8	10	24	30	3	0.7	
17-August 06:55	Wash 51	33.3	17.2	6.1		8.1	91	7.2	25	117	45	15	2.2	
17-August 18:25	Wash 52	32.9	18.8			8.2	111	8.5	43	102	48	17	4.1	
12-August 13:01	Wash 53	33.4	16.9			8.1	96	7.6	19	125	53	15		
12-August 13:14	Wash 54	33.4	17.2			8.1	93	7.3	27	139	74	18		
18-August 10:29	Wash 55	33.1	17.3	7.0		8.2	106	8.3	12	45	32	10	1.6	
18-August 09:38	Wash 56	33.4	17.1	5.8		8.2	111	8.7	4	20	27	3	<.3	
18-August 16:43	Wash 57	33.5	17.3	7.6		8.2	113	8.9	9	22	46	3	<.3	
17-August 18:13	Wash 59	32.6	17.9	9.1		8.1	107	8.3	63	93	64	18	5.7	
12-August 13:35	Wash 60	33.1	16.6			8.1	96	7.6	67	176	85	21		
18-August 08:18	Wash 60	32.6	17.3	5.2			102	8.0	46	81	54	18	5.3	
12-August 13:22	Wash 61	33.4	16.9			8.1	94	7.4	31	158	76	19		
18-August 08:58	Wash 62	33.3	17.2	5.4		8.1	106	8.3	5	37	29	7	0.7	
18-August 09:11	Wash 63	33.3	17.1	6.5		8.2	110	8.7	4	20	27	5	<.3	
18-August 16:59	Wash 64	33.2	18.3	5.9		8.2	107	8.2	14	77	30	6	0.9	
18-August 14:52	Wash 66	33.6	17.0	10.1		8.2	104	8.2	19	45	35	7	2.0	

Table 8 : Wash Data, 12th, 17-18th August 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
30-September 09:54	Golf	31.7	12.3	4.9		8.4	97	8.5	675	740	139	30	15.0	
30-September 09:35	Wash 01	33.2	13.1	9.6		8.4	98	8.3	165	321	105	22	6.2	2.3
30-September 10:21	Wash 03	33.1	13.0	13.5		8.4	98	8.3	198	342	109	23	6.8	<1
30-September 10:53	Wash 04	33.3	12.9	3.3		8.4	97	8.3	142	294	103	20	6.2	3.1
30-September 08:23	Wash 05	33.1	13.0	7.6		8.4	98	8.3	192	360	107	23	6.9	3.3
28-September 08:45	Wash 06	33.3	13.2	9.2		8.3	99	8.4	127	263	87	19	5.3	3.1
30-September 09:12	Wash 06	33.2	13.3	7.2		8.4	98	8.3	158	346	113	24	6.6	2.3
30-September 10:37	Wash 07	33.2	13.4	15.6		8.4	97	8.2	147	326	111	23	6.4	2.0
30-September 11:17	Wash 08	33.3	13.0	8.3		8.4	97	8.3	123	284	105	20	6.0	23.4
30-September 08:07	Wash 09	33.1	13.0	3.8		8.3	98	8.3	192	358	108	23	6.9	1.2
30-September 08:51	Wash 10	33.1	13.1	4.8		8.4	98	8.3	185	387	118	24	7.5	1.0
28-September 14:19	Wash 11	33.3	13.9	6.1		8.3	96	8.1	105	257	88	21	5.2	1.6
30-September 13:40	Wash 12	33.2	13.5	12.4		8.4	98	8.2	165	343	113	24	6.7	<1
30-September 11:37	Wash 13	33.3	13.5	10.1		8.4	98	8.2	127	300	104	22	6.2	1.2
30-September 12:23	Wash 14	33.2	13.6	8.3		8.4	97	8.2	134	316	115	24	6.4	2.5
30-September 07:54	Wash 15	33.1	13.1	6.6		8.3	98	8.4	192	389	119	25	7.4	<1
30-September 08:38	Wash 16	33.0	13.2	11.1		8.3	97	8.3	204	406	122	26	7.9	1.6
30-September 14:49	Wash 17	33.1	13.5	8.6		8.4	98	8.2	177	352	117	24	6.7	<1
29-September 12:49	Wash 18	33.3	13.9	5.0		8.4	99	8.3	121	302	94	22	6.0	1.8
30-September 13:16	Wash 19	33.1	13.5	8.5		8.3	98	8.2	166	348	116	24	6.8	<1
29-September 10:42	Wash 20	33.4	13.8	4.0		8.4	99	8.3	114	288	88	21	5.6	1.2
28-September 16:11	Wash 22	33.1	13.5	11.3		8.3	97	8.1	169	347	104	24	6.5	1.4
30-September 14:59	Wash 23	33.0	13.1	12.8		8.4	99	8.4	220	384	121	24	7.6	4.1

Table 9 : Wash Data, 28-30th September 1993

Date & Time	Sample Site	Field Salinity (ppt)	Temp. (deg C)	Water Depth (m)	Secchi Disc (m)	Field pH	Field DO (% Satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
29-September 14:05	Wash 47	32.4	12.7	12.0		8.4	99	8.5	243	503	158	32	11.1	2.1
29-September 11:51	Wash 48	32.7	13.0	10.5		8.4	99	8.4	220	462	137	30	9.6	2.0
29-September 08:16	Wash 49			19.3			97	7.9	98	250	60	19	5.0	5.8
29-September 08:58	Wash 50	33.6	14.1	21.2		8.4	98	8.1	107	264	62	20	5.2	1.4
28-September 06:50	Wash 51	31.9	12.1	4.6		8.0	100	8.1	480	651	159	30	13.2	2.3
30-September 16:32	Wash 52	31.6	12.7	4.0		8.4	98	8.5	424	733	187	44	14.9	4.1
29-September 16:13	Wash 53	31.4	12.3	2.4		8.3	99	8.6	523	811	192	45	16.7	3.1
29-September 15:55	Wash 54	32.3	12.6	9.2		8.3	99	8.6	252	509	160	33	11.6	1.2
29-September 14:23	Wash 55	32.4	12.6	5.1		8.4	99	8.5	224	461	150	31	10.7	1.0
29-September 07:37	Wash 56	32.5	12.6	6.9		8.3	98	8.4	219	449	142	29	9.9	2.7
29-September 08:04	Wash 57	33.6	13.6	5.3		8.4	98	8.3	104	263	65	19	5.2	1.4
29-September 08:47	Wash 58	33.7	14.0	9.0		8.4	98	8.2	97	241	59	19	4.9	<1
30-September 07:03	Wash 59	30.7	12.1	10.6		8.1	98	8.6	563	928	216	54	18.5	3.1
29-September 06:45	Wash 60	31.2	12.3	5.1		7.9	98	8.6	364	677	190	39	14.2	3.3
30-September 07:46	Wash 60	33.0	12.7	5.8		8.3	97	8.4	219	393	127	24	7.6	1.2
29-September 06:59	Wash 61	32.2	12.5	7.6			98	8.5	274	553	170	34	11.7	1.8
29-September 07:12	Wash 62	32.3	12.4	6.1			98	8.5	241	492	156	32	10.7	1.0
29-September 07:25	Wash 63	32.8	12.9	7.0			98	8.4	188	404	122	27	8.4	2.0
29-September 07:50	Wash 64	32.8	12.6	7.6		8.3	97	8.4	160	347	110	23	7.2	2.9
29-September 08:35	Wash 65	33.7	13.9	6.4		8.4	98	8.2	110	272	62	20	5.3	<1
29-September 10:16	Wash 66	33.3	13.8	12.0		8.4	98	8.2	120	296	94	22	5.7	1.6

Table 9 : Wash Data, 28-30th September 1993

Time	Sample Site	Salinity (ppt)	Temp. (deg C)	Sample Depth (m)	Water Depth (m)	Secchi Disc (m)	pH	Field DO (% satn)	Field DO(mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
09-June 12:15	Wash 61	32.7	17.2	1	6.7	2.2		108	8.5	54	48	46	5.4		10.8
09-June 12:45	Wash 61	32.9	16.5	1	6.1	2.5		106	8.4	22	30	31	3.4		12.1
09-June 13:15	Wash 61	32.7	17.2	1	5.6	2.5		111	8.7	45	33	31	4.4		14.6
09-June 13:45	Wash 61	32.4	17.7	1	5.0	2.0		113	8.8	91	58	43	6.2		16.8
09-June 14:15	Wash 61	32.3	18.0	1	4.5	1.7		116	8.9	103	63	40	6.9		16.2
09-June 14:45	Wash 61	32.2	18.5	1	4.0	1.4		120	9.2	122	73	38	7.3		14.8
09-June 15:15	Wash 61	32.2	18.9	1	3.6	1.5		126	9.5	102	345	33	6.7		9.8
09-June 15:45	Wash 61	32.3	18.9	1	3.2	2.1		120	9.1	96	220	37	7.5		12.1
09-June 16:15	Wash 61	32.3	19.0	1	3.0	2.1		124	9.4	82	168	34	6.0		10.2
09-June 16:45	Wash 61	32.3	19.0	1	3.0	2.2		126	9.5	78	173	32	5.6		13.5
09-June 17:15	Wash 61	32.3	19.0	1	3.0	2.3		124	9.4	71	193	32	5.6		9.9
09-June 17:45	Wash 61	32.3	18.6	1	3.1	2.4		124	9.4	75	202	35	6.0		10.4
09-June 18:15	Wash 61	32.4	18.7	1	3.3	2.5		129	9.5	68	303	36	5.9		13.1
09-June 18:45	Wash 61	32.5	18.3	1	3.7	2.0		121	9.3	45	164	29	4.7		17.6
09-June 19:15	Wash 61	32.6	17.9	1	4.2	2.0		117	9.1	55	191	31	4.1		16.2
09-June 19:45	Wash 61	32.7	17.4	1	4.9	1.7		113	8.9	42	154	30	3.9		15.9
09-June 20:15	Wash 61	32.9	16.5	1	5.6	2.0		107	8.5	23	119	35	3.9		16.6
09-June 20:45	Wash 61	33.0	17.0	1	6.2	2.0		114	9.0	16	165	31	2.9		13.4
09-June 21:15	Wash 61	33.0	16.7	1	6.9	2.5		110	8.7	11	45	22	2.2		10.5
09-June 21:45	Wash 61	33.1	16.9	1	7.4			111	8.7	14	202	33	4.0		9.9
09-June 22:15	Wash 61	33.1	16.6	1	7.8			108	8.6	13	142	32	2.6		10.2
09-June 22:45	Wash 61	33.2	16.3	1	7.9			107	8.5	13	19	29	2.4		11.1
09-June 23:15	Wash 61	33.0	16.1	1	7.8			104	8.4	19	24	34	3.0		11.0
09-June 23:45	Wash 61	33.0	16.2	1	7.5			104	8.3	19	119	36	3.7		9.6
10-June 00:15	Wash 61	33.0	16.0	1						21	30	39	5.0		
10-June 00:45	Wash 61	33.0	16.0	1						20	29	38	4.0		4.0

Table 10 : Tidal Cycle Data for Wash Site 61
9-10th June 1993

Time	Sample Site	Salinity (ppt)	Temp. (deg C)	Sample Depth (m)	Water Depth (m)	Secchi Disc (m)	pH	Field DO (% satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
28-September 08:45	Wash 06	33.3	13.2	1	9.2		8.3	99	8.4	127	263	87	18.6	5.3	
28-September 09:46	Wash 06	33.3	13.2	1	7.3		8.3	98	8.3	124	273	90	19.3	5.4	
28-September 10:50	Wash 06	33.4	13.2	1	9.1		8.3	98	8.3	114	264	91	19.0	5.2	
28-September 11:52	Wash 06	33.4	13.3	1	8.8		8.3	97	8.3	120	267	91	19.3	4.9	
28-September 12:52	Wash 06	33.4	13.3	1	8.8		8.4	97	8.2	108	249	87	19.0	4.9	
28-September 13:50	Wash 06	33.4	13.2	1	7.0		8.4	98	8.3	118	255	91	19.3	5.1	
28-September 14:42	Wash 06	33.5	13.6	1	8.4		8.4	98	8.2	97	231	80	19.1	4.6	
28-September 15:33	Wash 06	33.2	14.0	1	11.4		8.3	96	8.0	122	308	98	23.3	5.9	
28-September 08:07	Wash 11	33.1	14.0	1	8.1		8.3	93	7.8	138	325	102	22.6	6.1	
28-September 09:18	Wash 11	33.3	13.7	1	6.2		8.3	97	8.2	111	278	92	20.3	5.3	
28-September 10:21	Wash 11	33.3	13.8	1	5.6		8.3	97	8.1	110	286	90	21.0	5.6	
28-September 11:24	Wash 11	33.2	13.8	1	5.0		8.3	97	8.1	127	305	97	22.1	5.4	
28-September 12:25	Wash 11	33.2	13.9	1	4.9		8.3	97	8.1	118	288	95	22.0	5.7	
28-September 13:27	Wash 11	33.3	13.9	1	5.6		8.3	97	8.1	110	270	91	21.5	5.4	
28-September 15:12	Wash 11	33.3	14.0	1	7.0		8.3	97	8.1	114	285	92	22.0	5.5	
28-September 07:55	Wash 17	33.1	14.0	1	11.6		8.3	98	8.1	132	334	104	23.1	6.3	
28-September 09:01	Wash 17	33.1	13.9	1	10.9		8.3	97	8.1	142	340	100	22.3	6.2	
28-September 10:04	Wash 17	33.3	13.4	1	9.6		8.3	98	8.2	117	268	85	19.0	5.2	
28-September 11:08	Wash 17	33.4	13.6	1	8.7		8.3	97	8.2	105	261	84	19.4	5.0	
28-September 12:09	Wash 17	33.3	13.4	1	8.6		8.3	97	8.2	124	272	90	19.7	5.2	
28-September 13:10	Wash 17	33.2	13.9	1	8.8		8.3	96	8.1	130	312	101	23.0	5.9	
28-September 14:06	Wash 17	33.2	14.0	1	9.4		8.3	96	8.0	133	315	101	23.3	6.0	
28-September 15:00	Wash 17	33.1	14.0	1	10.7		8.3	96	8.0	147	338	104	24.0	6.2	

Table 11 : Time Series Data for Wash Sites 6, 11 and 17
28th September 1993

Time	Sample Site	Salinity (ppt)	Temp. (deg C)	Sample Depth (m)	Water Depth (m)	Secchi Disc (m)	pH	Field DO (% satn)	Field DO (mg/l)	TON (µg/l N)	Silicate (µg/l SiO ₂)	Ammonia (µg/l N)	Phosphate (µg/l P)	Nitrite (µg/l N)	Chlorophyll (µg/l)
01-October 09:51	W. Knock	32.4	12.5	1	11.6		8.3	97	8.4	313	553	145	33	11.7	
01-October 09:51	W. Knock			7	11.6			97		278	493	138	29	10.3	
01-October 10:52	W. Knock	32.1	12.4	1	10.5		8.4	100	8.6	393	700	167	40	15.9	
01-October 10:52	W. Knock			6	10.5			100		347	625	156	37	13.2	
01-October 11:45	W. Knock	31.1	12.2	1	12.2		8.3	97	8.5	516	867	187	49	21.1	
01-October 12:44	W. Knock	30.2	12.5	1	11.5		8.3	97	8.4	778	1,230	225	67	35.6	
01-October 12:44	W. Knock			7	11.5			97		627	1,010	190	55	27.8	
01-October 13:44	W. Knock	28.4	12.6	1	11.3		8.3	95	8.4	1,070	1,660	274	88	51.5	
01-October 14:45	W. Knock	25.5	12.9	1	12.0		8.3	92	8.2	1,660	2,370	356	115	78.9	
01-October 14:45	W. Knock			7	12.0			98		610	983	197	55	26.2	
01-October 15:39	W. Knock	27.9	12.8	1	12.8		8.3	95	8.4	1,260	1,870	295	96	59.7	
01-October 16:35	W. Knock	32.0	12.6	1	11.8		8.4	99	8.6	423	712	167	41	16.1	
01-October 16:35	W. Knock			7	11.8			99		350	628	159	37	12.7	
01-October 09:22	Wash 22	32.6	12.9	1	11.4		8.3	97	8.7	242	483	138	29	9.6	
01-October 09:22	Wash 22			6	11.4			97		241	482	138	29	9.5	
01-October 10:25	Wash 22	32.9	12.8	1	10.0		8.3	97	8.3	230	456	129	27	8.8	
01-October 10:25	Wash 22			5	10.0			97		230	459	130	27	9.0	
01-October 11:22	Wash 22	32.9	12.8	1	8.6		8.4	100	8.6	240	449	124	26	8.8	
01-October 12:18	Wash 22	32.7	12.6	1	7.6		8.4	100	8.6	280	506	140	30	9.9	
01-October 13:20	Wash 22	32.6	12.6	1	7.1		8.4	100	8.7	308	555	143	32	11.0	
01-October 14:19	Wash 22	32.3	12.6	1	7.2		8.4	101	8.7	385	626	154	35	14.5	
01-October 15:19	Wash 22	32.4	12.6	1	7.5		8.4	101	8.7	355	604	148	34	12.8	
01-October 16:16	Wash 22	32.7	12.7	1	8.8		8.4	101	8.7	283	503	130	28	9.8	

**Table 12 : Time Series Data for Wash Sites 22, 29 and Westmark Knock
1st October 1993**