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STONY BROOK MILL POND PROJECT:

RESULTS AND DISCUSSION

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PREFACE

This document summarizes the results of a limnological survey of the Mill Pond in the Village of Stony Brook, NY conducted from June, 1984 through May, 1985. This project was initiated at the request of the Stony Brook Community Fund, and was jointly carried out by the Marine Sciences Research Center and the Department of Ecology and Evolution of SUNY at Stony Brook.

INTRODUCTION

1.1 Description of the Study

In 1970, the New York State Department of Transportation (D.O.T.) installed a pipe to collect street runoff along Main Street, Stony Brook, to alleviate a local flooding problem. Prior to placement of the pipe, storm runoff first passed through a bog area before entering the Mill Pond in Stony Brook. This construction project resulted in storm runoff flowing directly into the Pond via the pipe.

Since the outfall pipe was installed in 1970, area residents have complained of peculiar odors from the Pond and the appearance of oil films on the water surface near the pipe, especially during storms. This prompted the Stony Brook Community Fund to initiate this study. The goal of the study was to describe the present limnology of the Mill Pond, to determine the effects of the pipe, and to assess the possible effects removal of the pipe might have on the Pond ecosystem.

Due to the lack of baseline data and the length of time that the pipe has been in place, the investigation concentrated on physical and chemical rather than biological processes. Based on initial assessment of land use in the area (almost completely residential), eutrophication was deemed the most likely problem. The study was designed accordingly. This included an assay of the nutrient characteristics of the Pond and water sources. To determine the effects of the pipe itself, its role as a source of nutrients, pollutants, and sediments was studied. Determination of toxicants such as heavy metals or pesticides was attempted, but a complete survey was not undertaken. Outflow from the pipe was monitored over the course of storms to describe nutrient and sediment loading. The possible implications of removal of the pipe were determined by subtracting the pipe as one of the sources of water, nutrients, pollutants, and sediments to the Mill Pond.

The study can be thought of as having four major topics:

1) Hydrological and morphometric characteristics of the Pond.
2) Physico-chemical characteristics of the Pond and inflows.
3) Physico-chemical characteristics of inflows during storms.
4) Characteristics of the Pond sediments.

1.2 Description of the Study Site

The Mill Pond is located in Stony Brook, New York on the north shore of Long Island. (Figure 1.) It is located in the heart of Stony Brook Village, bordered on the east by Main Street, and surrounded by residential homes. The Mill Pond empties into Long Island Sound to the north, but is cut off from salt water intrusion by a dam that was built in the 1600's to control the outflow used to operate a grist mill. The Pond has a large island in the center, which at one time was accessible from land by a bridge. It has a large, resident waterfowl population and a vigorous plant community of rooted aquatic plants.

The Mill Pond is primarily spring fed: one spring enters above the surface of the Pond in the southeast corner, a creek enters on the south side, and a majority of the inputs to the Pond comes from springs seeping into the Pond itself. The D.O.T.

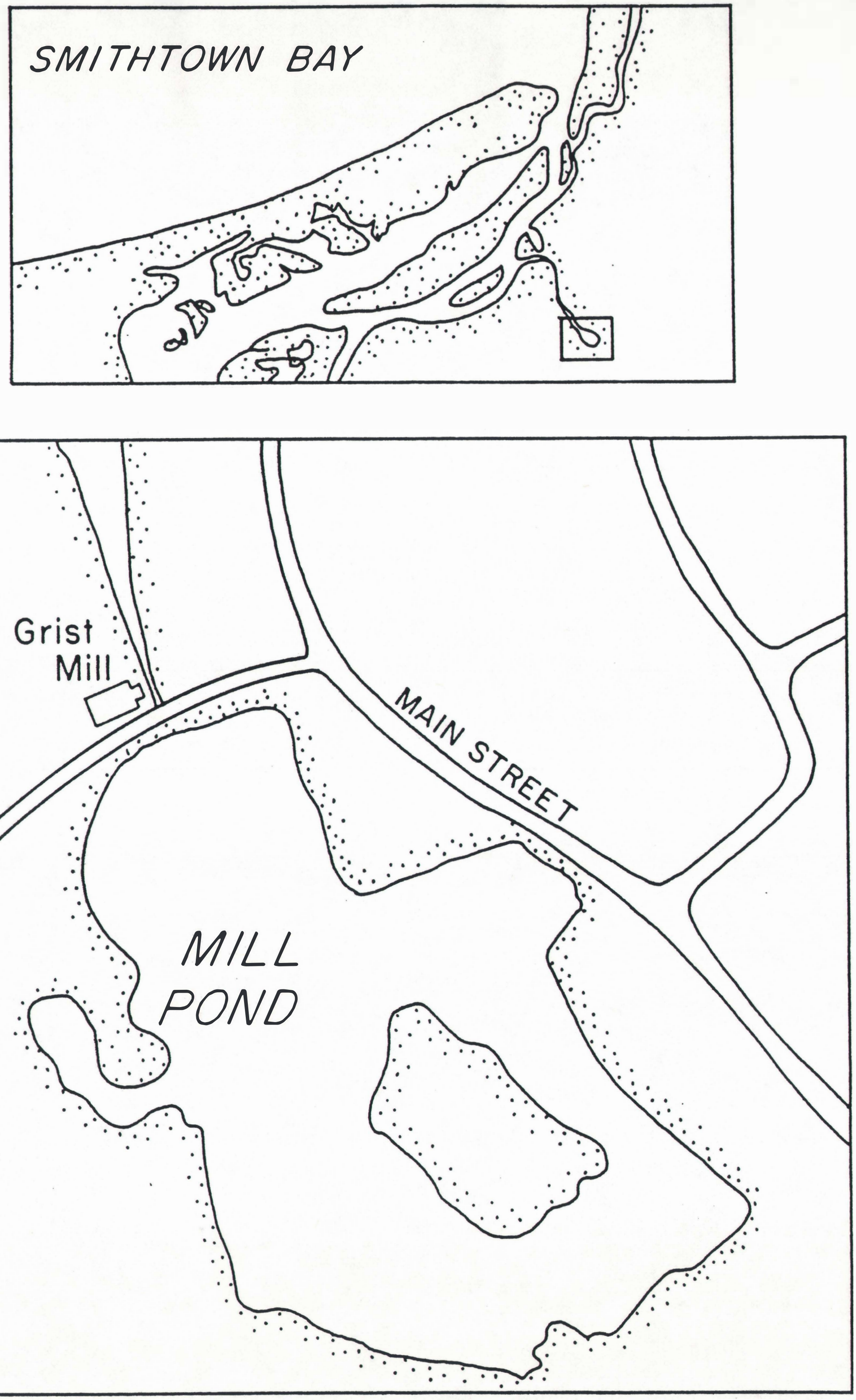


Figure 1. Location of Mill Pond, Stony Brook, NY.

outfall pipe, entering near the spring on the southeast side, is the other primary source of water to the Pond. There are two outlets from the Pond. There is a spillway in the dam over which water constantly flows. At the Grist Mill, a flood gate is used to control the water going over the paddle wheel. This gate usually remains closed.

Through the course of the study, eleven permanent sampling stations were established in the Pond. (Figure 2.) These included seven stations within the Pond watercolumn (stations B through G), the creek (station A), the spring (station H), the pipe (station J), and the outlet (station K).

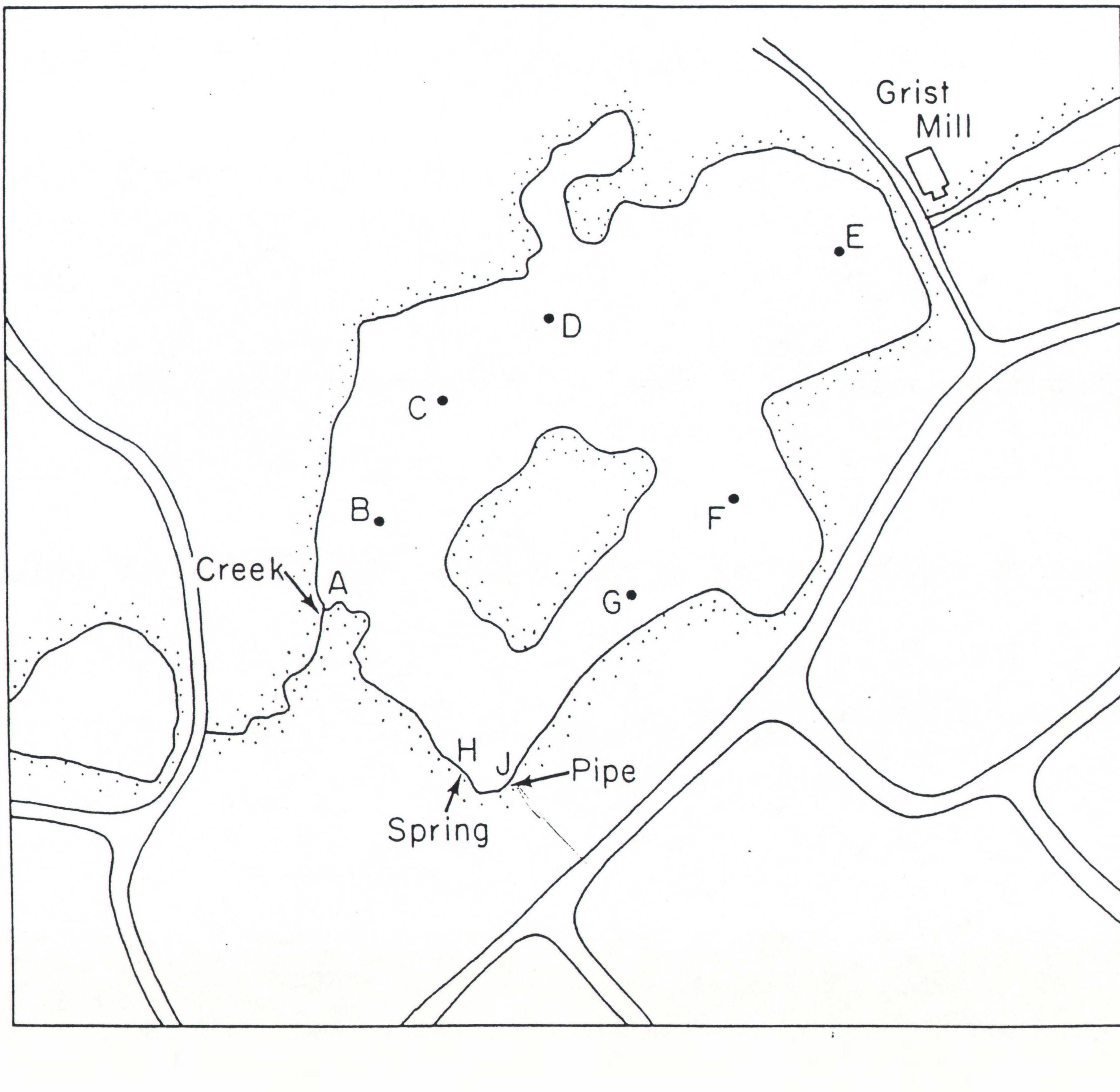


Figure 2. Mill Pond Sampling Stations

HYDROLOGICAL CHARACTERISTICS

The purpose of this aspect of the investigation was three-fold: 1) to describe the bathymetry and morphology of the Pond, 2) to obtain an estimate of the amount of water entering the Pond from the pipe relative to all other sources, and 3) to determine the fate of water entering the Pond from the pipe.

2.1 Bathymetry and Morphology

A map of Mill Pond was provided by the New York State Department of Transportation. From this map, information on the surface area of the Pond and the overall dimensions of the Pond could be gathered. Bathymetric soundings were needed to establish depth contours for the Pond.

Methods

A bathymetric map of the Pond was prepared by measuring depth at 110 locations in the Pond on June 19, 1984. The positions of those locations were marked, using triangulation, by two shoreline observers. The locations were then placed on the map of the Pond by identifying the positons of the shoreline observers on the map, and drawing in the angles from the observation points to the locations of the depth soundings. Depth contours (lines of constant depth) were fitted around these data points. Using planimetry, the area between successive contours was measured. The volume of each segment was calculated as the product of the area and the mean depth contour of the segment. Total volume of the Pond was a summation of all the segments. Mean depth was calculated by dividing the total volume by the total surface area of the Pond.

Results

The descriptions of Pond morphometry provided by the bathymetric survey are listed in Table 1. Figure 3 shows the depth contours for the Pond. It is interesting to note the deepest part of the Pond coincides with the previous location of the Grist Mill, approximately eighty-five feet (twenty-five meters) into the Pond from the dam. This building was destroyed and replaced by the Grist Mill at the present location.

2.2 Discharge Rates

In order to describe the water budget of the Pond, measurements of rates of discharge into and out of the Pond were required. Combining this with the estimate of volume found via the bathymetric survey, an estimate of the residence time, (the time required for all of the water in the Pond to be replaced,) could be made. The effect of removal of the D.O.T. pipe on the water budget could be estimated by subtracting the inflow of the pipe.

Methods

Rates of discharge into and out of the Pond were measured on August 7, 1984. Wooden flumes were placed in the creek and the spring. The cross sectional area of the flume openings was measured. The velocity of the water moving through the flume was measured using an OTT Universal Direct Reading Current Meter. Discharge was calculated accordingly (i.e. velocity X cross sectional area). Construction of a flume was not neccesary to

PARAMETER	VALUE
Maximum length of Pond (north to south) =	292m = 958ft
Maximum width of Pond (east to west) =	184m = 603ft
Maximum length of Island (north to south) =	97m = 318ft
Maximum width of Island (east to west) =	50m = 164ft
Total surface area of Pond =	33940m^2 365330ft^2
Total surface area of Island =	3790m^2 40840ft^2
Total volume =	44490m^3 1571040ft^3
Maximum water depth =	3.4m = 11.2ft
Minimum water depth =	0.2m = 0.7ft
Mean water depth =	1.31m = 4.3ft

Table 1. Descriptions of Pond Morphometry.

Figure 3. Bathymetry of Mill Pond.

measure discharge at the pipe. Discharge out of the Pond (outflow) was measured during low tide at a transect located 60m (approximately 200ft) below the spillway. Depth and current velocity (at the surface, bottom and mid-depth) were measured at 0.5m intervals along the transect. From these measurements, cross sectional area and mean (weighted) current velocity were computed. Residence time was estimated by dividing the volume of the Pond by the total rate of inflow, (equal to the total rate of outflow).

Results

The results of flow measurements are shown in Table 2. The total discharge at the outflow is an estimate of the total minimum inflow (ignoring loss due to evaporation) and was calculated to be 124.9 liters/sec (4.4 cubic feet/sec). Of this 124.9 liters/sec, the pipe, spring and creek contributed 71.3 liters/sec (2.5cfs). This means only 57% of the total minimum inflow is accounted for by these three sources. The remaining 43% comes from unidentified sources. These unidentified sources are probably springs that seep into the Pond itself.

The volume of the Pond estimated from the bathymetric survey was calculated to be 44,486,800 liters (1,571,037 cubic feet). Assuming the total minimum inflow to the Pond to be 124.9 liters/sec (4.4 cfs), it would take 4.1 days for all the water in the Pond to be replaced. This is the estimate of residence time under the present conditions in the Pond. The discharge at the pipe, spring, and creek accounted for about 12%, 14% and 31%, respectively, of the total inflow. Thus, if the pipe were removed, the total inflow to the Pond would be reduced by 12%,

LOCATION	DISCHARGE (l/sec)	PERCENT OF TOTAL
PIPE	14.4	11.6
SPRING	17.9	14.3
CREEK	39.0	31.2
UNIDENTIFIED	53.6	42.9
TOTAL INFLOW (=Total Outflow)	124.9	100.0

Table 2. Rates of discharge at the inflows (pipe, spring, and creek) and outflow.

making the inflow 109.9 liters/sec (3.9 cfs). This corresponds to a residence time of 4.6 days. The residence time does not change greatly when calculated with or without the pipe since it is a minor source of water to the Pond. Discharge from the creek, spring and unidentified sources controls the residence time of the Pond.

Residence time is important when considering the growth of microscopic algae (phytoplankton) in the Mill Pond. Excessive phytoplankton growth (algal blooms) can have serious side effects on a water resource. For most algae, under good growing conditions, it takes 10 days to 2 weeks for a population to reach bloom size. The Mill Pond, with a residence time of 4.1 days, does not provide the needed time for an algal bloom to develop.

Inflow from the pipe accounts for only 12% of the inputs to the Pond under normal flow conditions, but during storm events the discharge from the pipe alone can far exceed the combined inflow from all water sources during non-storm flow. This result indicates the importance of storm events in considering the real effects of the pipe.

2.3 Path of Pipe Water

The path of the water entering the Pond from the pipe was used to assess what parts of the Pond were being affected by the pipe water. Areas of the Pond that were presently under the influence of the pipe, but had not previously been under the influence of runoff before the pipe installation, could be described. Likewise, areas could be found that were previously under the effects of runoff water, but now were not affected by the pipe runoff. This information allowed the determination of within - Pond controls which would be important in determining the sedimentation history of the Pond. Knowing the path of the pipe water would also allow a better description of the effect the pipe has on residence time.

Methods

During normal flow (i.e. not during storm events), the water from the pipe is essentially ground water. During the summer months, this water is about 5°C cooler than the surface water of the Pond. Thus, the cold temperature was a tag for the pipe water, and the path of the water could be tracked by detailing the thermal structure of the Pond in the vicinity of the pipe.

On June 21, 1984, a 25m X 25m (82ft X 82ft)grid was marked out in front of the pipe. Temperature was measured at 5cm depth intervals along transects spaced 5m apart within the grid. Three additional transects were set up north of the pipe, running from the east shore to the island (Figure 4). Temperature was measured at 5cm depth increments at 5m intervals along these transects as well. This procedure defines a view of the thermal structure in this vicinity of the Pond as a series of longitudinal sections extending north from the pipe.

The path of the pipe water under storm conditions was determined by observing the turbidity plume that resulted from the storm discharge from the pipe.

Results

Series of temperature profiles were plotted and isotherms

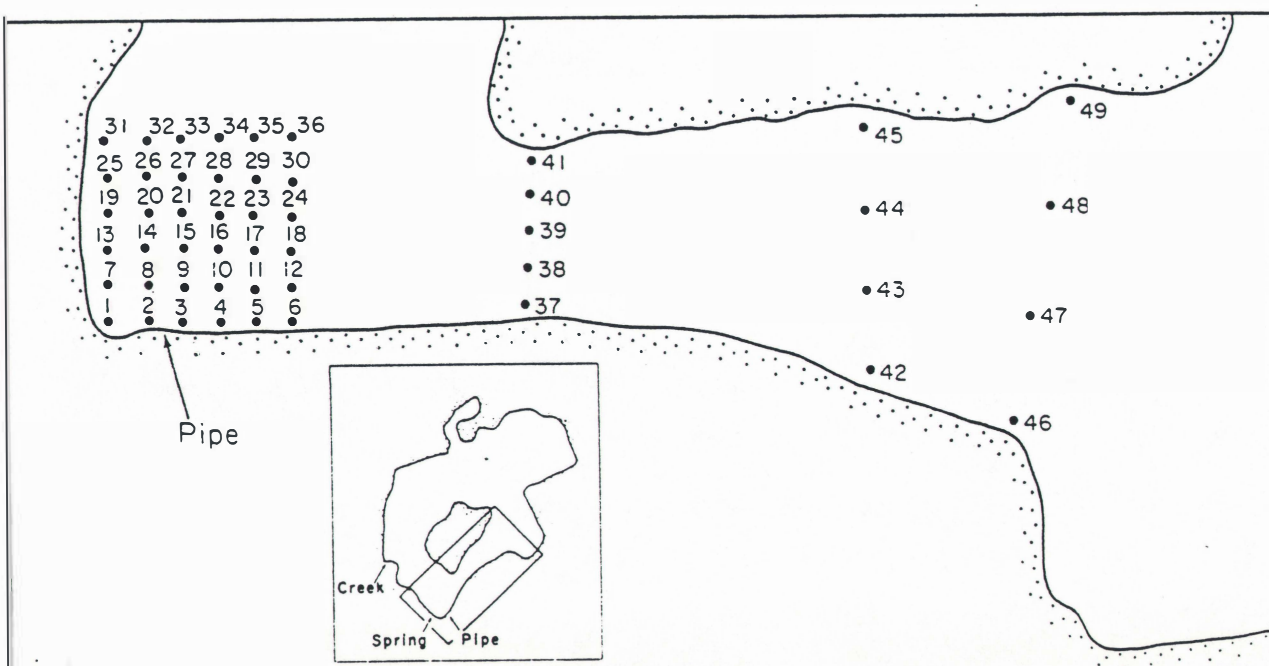


Figure 4. Locations of Temperature Transects in Front of the DOT Pipe.

(lines of constant temperature) were drawn from the temperature data at the pipe under normal flow conditions. Detailed thermal structure in the vicinity of the pipe is illustrated in Figures 5-13. Water from the pipe and the spring first enter a basin which is about 1m deep. This basin results from periodic removal of sediment (dredging) from the area immediately below the pipe. The presence of a cold underflow on the east side of the island indicates that the water travels north upon leaving the basin. Figure 13 indicates that water leaving this basin enters the Pond proper at a somewhat higher temperature than it was when it left the pipe. This temperature increase is a result of the cold water moving over a shallow region where sunlight can warm the water to depth. This part of the Pond is also dominated by stands of the Yellow Pond Lily (Nuphar variegatum) which slow the water movement down, thus making the warming more efficient. It is therefore possible that water from the pipe and the spring enters the surface layers of the Pond rather then flowing directly into colder, deeper layers.

The Pond, especially during the summer months, is thermally stratified; it has discreet layers of water that are different temperatures. Surface waters (the epilimnion) are warm, deep water (the hypolimnion) is cold. The sources of water to the Pond are cold water sources. This water flows along the bottom of the Pond, and contributes to the circulation of bottom water only. The combined pipe and spring water, however, is warmed by the time it enters the main part of the Pond. This means that this water contributes to the circulation of surface waters. These are the only two sources of water to the Pond surface

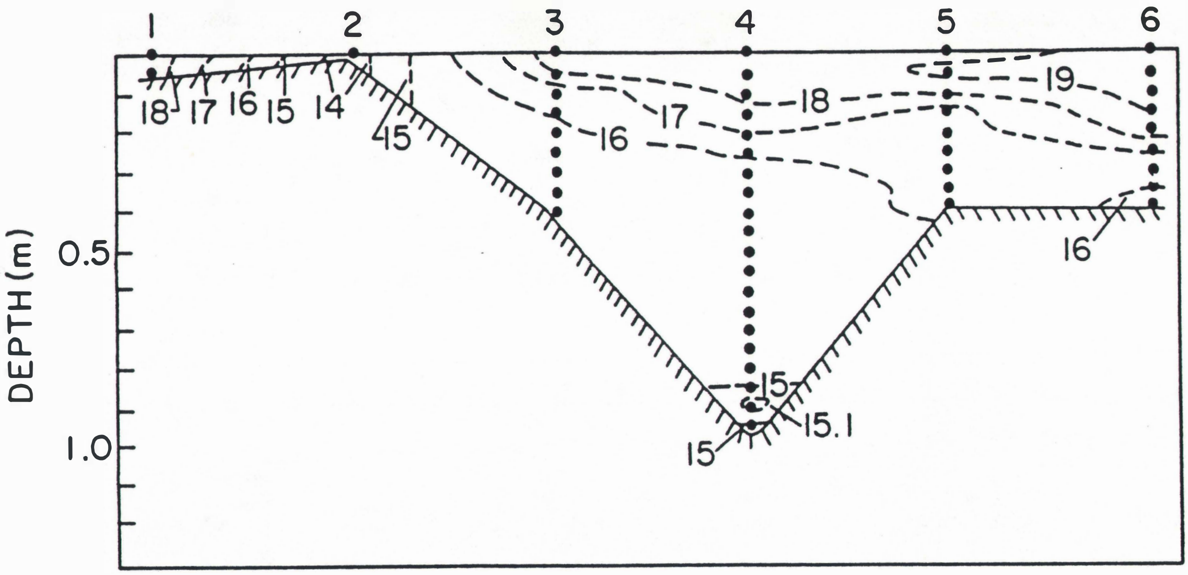


Figure 5. Detailed Thermal Structure In Vicinity of the Pipe Stations 1-6.

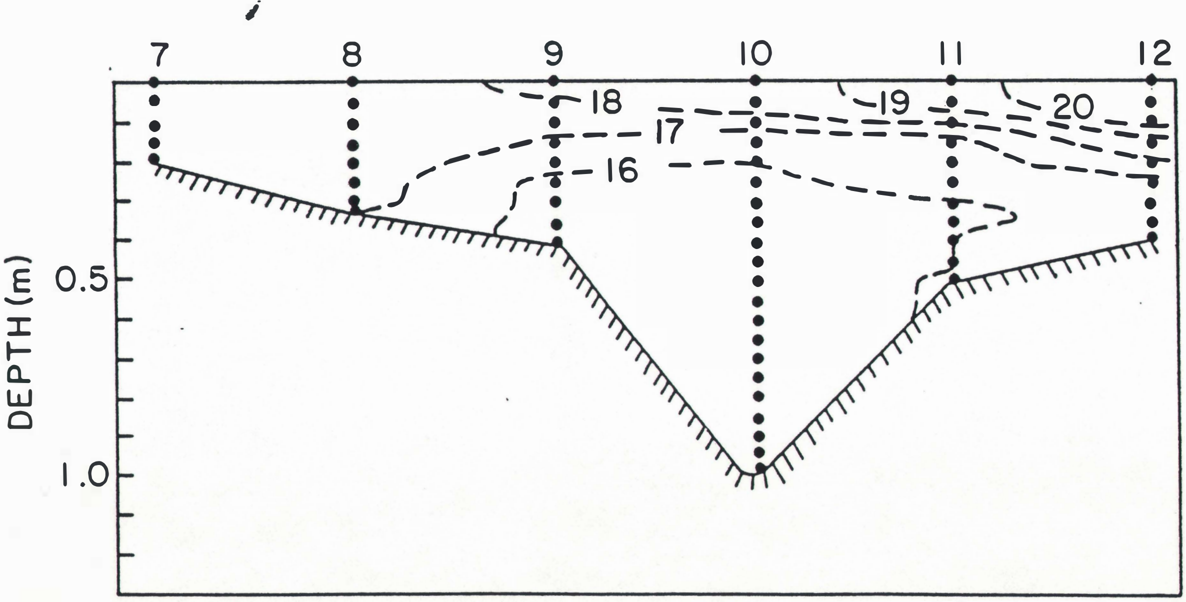


Figure 6. Detailed Thermal Structure In Vicinity of the Pipe Stations 7-12.

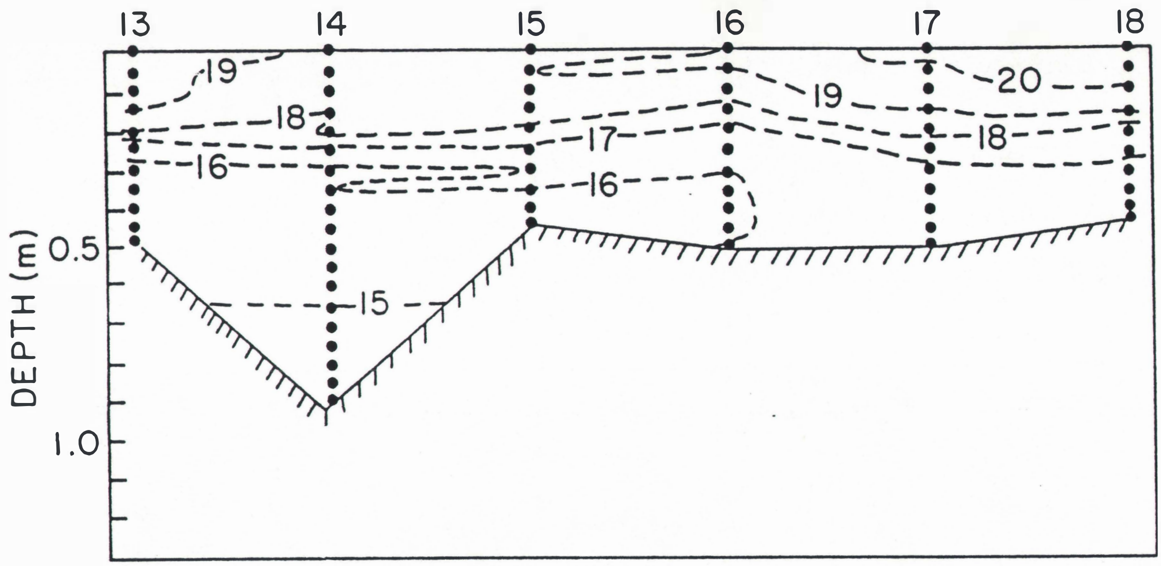


Figure 7. Detailed Thermal Structure in Vicinity of the Pipe Stations 13-18.

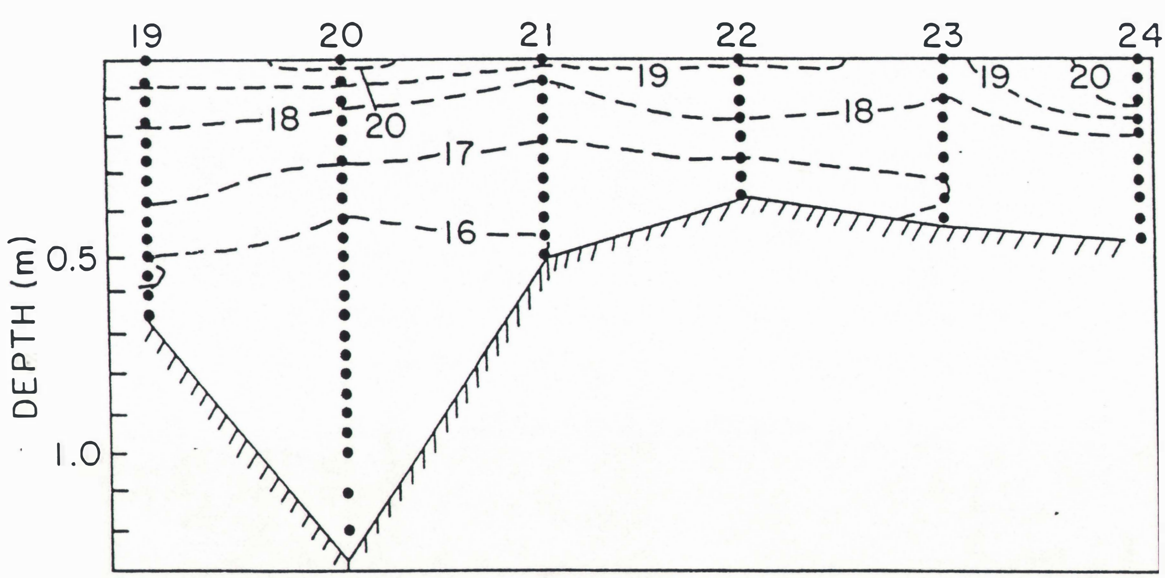


Figure 8. Detailed Thermal Structure in Vicinity of the Pipe Stations 19-24.

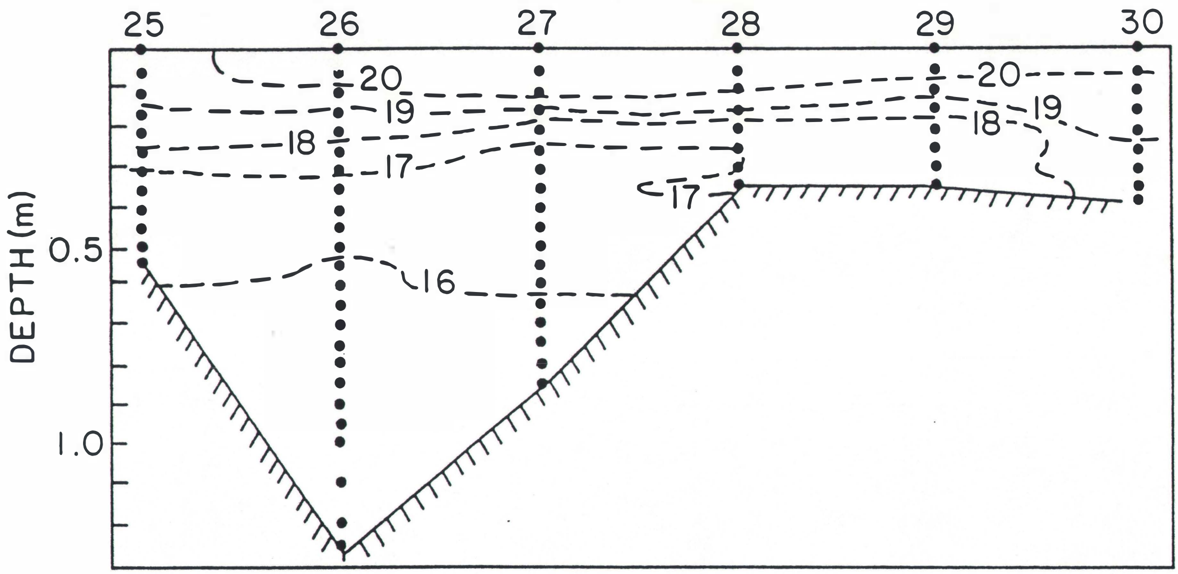


Figure 9. Detailed Thermal Structure in Vicinity of the Pipe Stations 25-30.

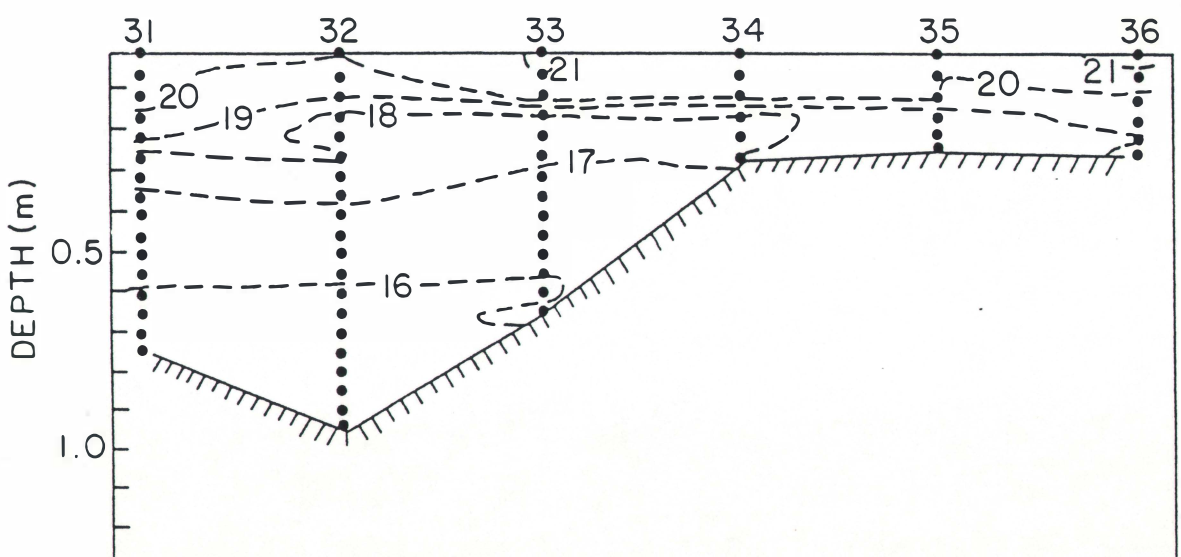


Figure 10. Detailed Thermal Structure in Vicinity of the Pipe Stations 31-36.

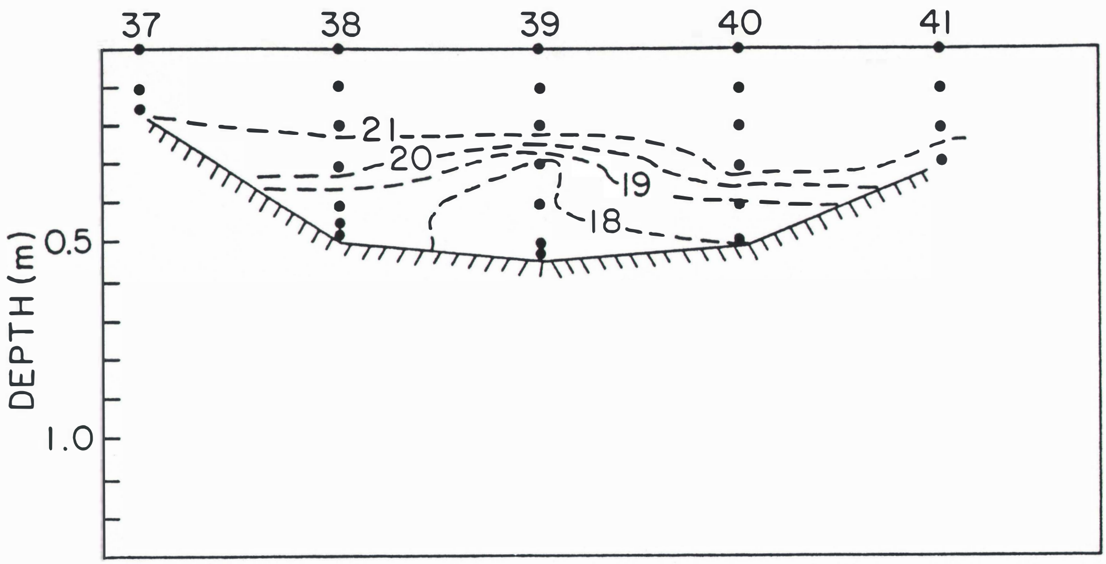


Figure 11. Detailed Thermal Structure in Vicinity of the Pipe Stations 37-41.

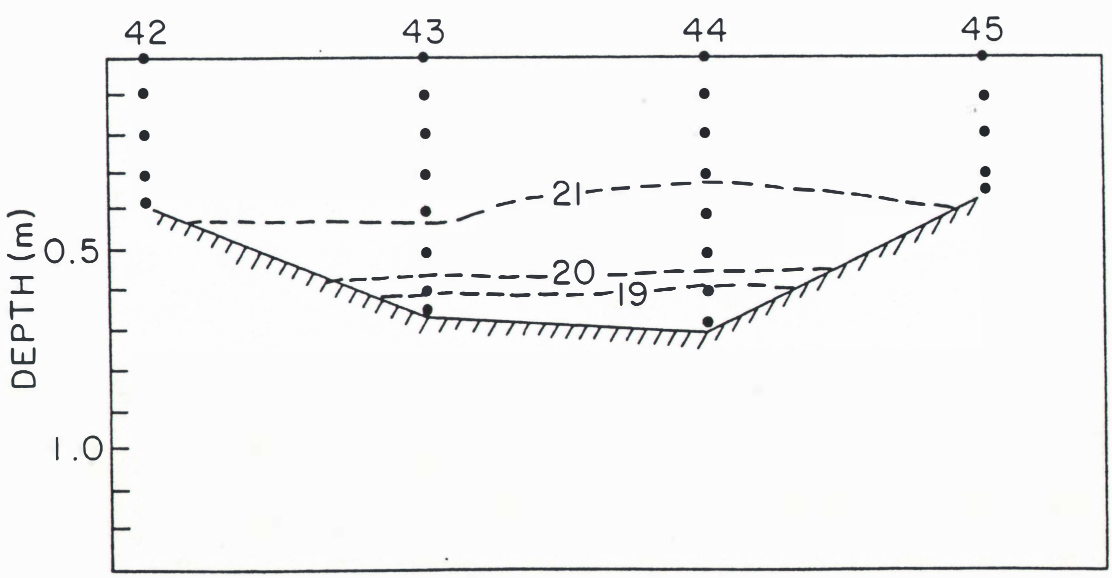


Figure 12. Detailed Thermal Structure in Vicinity of the Pipe Stations 42-45.

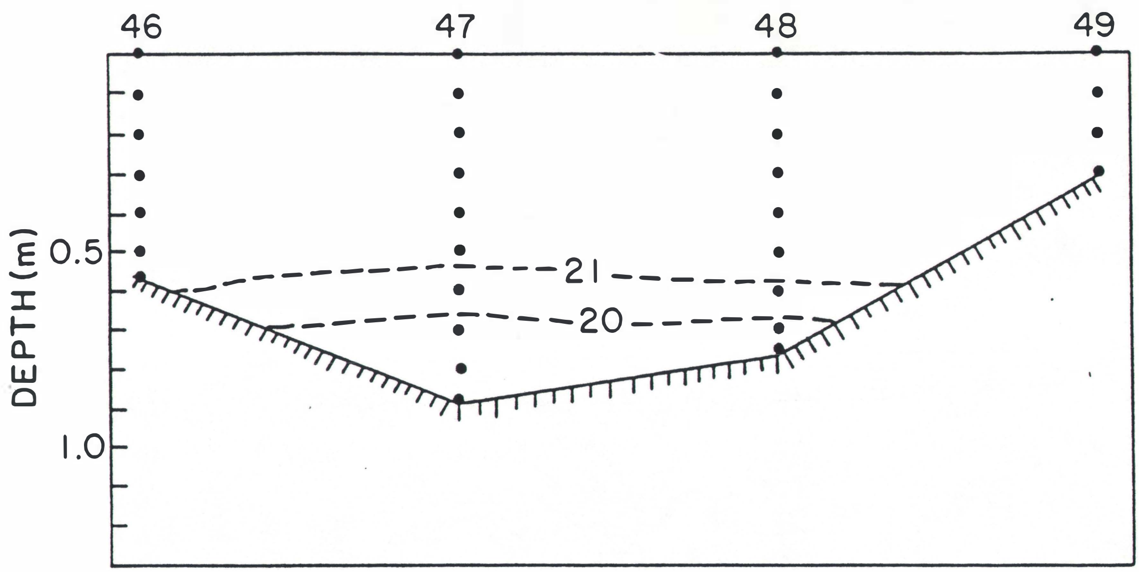


Figure 13. Detailed Thermal Structure in Vicinity of the Pipe Stations 46-49.

(disregarding precipitation), and each contributes the same magnitude of water (the pipe discharges 11.6% of the total inflow, the spring 14.3%). Therefore, the pipe may actually control up to 50% of the circulation of the surface water of the Pond.

Observation during storm events indicates that water flows west out of the pipe beyond the southern tip of the Island (Figure 14). Once past the Island, the water moves north following the shoreline of the Island rather than the far shore of the Pond. Sediment carried by this storm water apparently settles to the west of the pipe, resulting in an extensive shallow area in the south end of the Pond. This shallow region is beyond the reach of dredges, and thus has accumulated pipe sediments.

Through the identification of these two paths of the pipe water, two regions in the Pond were described. The shallow area just west of the pipe has been accumulating pipe sediments since the pipe installation in 1970. This area is not affected by discharge from the creek, which must have been the main source of runoff water before the construction of the pipe. Near the creek, towards the far shore of the Pond, is an area that was subject to sedimentation from runoff prior to the pipe construction. This region is not affected by the storm discharge from the pipe, since storm water moves close to the Island in that section of the Pond.

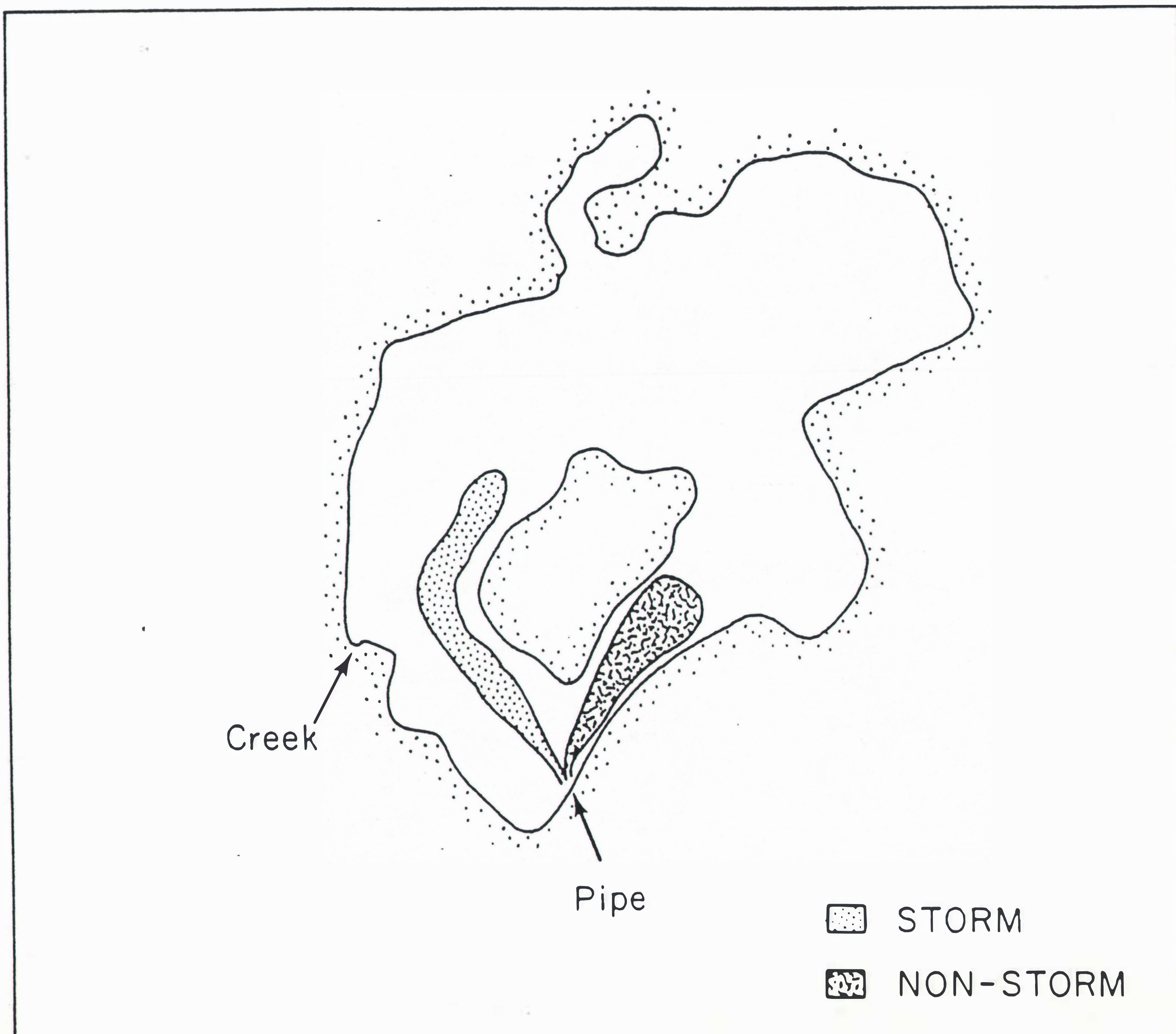


Figure 14. Path of the Pipe Water Under Storm and Non-Storm Conditions.

PHYSICO-CHEMICAL CHARACTERISTICS OF THE POND AND INFLOWS

The purpose of this phase of the investigation was to monitor various physical and chemical parameters in the Pond and inflows to determine how these parameters might be affecting the biology of the Pond. In the process of photosynthesis, plants produce organic matter. This organic matter is the primary source of food and energy for higher animals, thus the production of plant material can control the production of animal matter. By looking at the physical and chemical parameters that limit or control photosynthesis, the potential for production in the Pond can be assessed.

The following parameters were monitored in the Pond and three inflows at biweekly intervals from June through October, 1984, and bimonthly from November, 1984 through May, 1985.

1) Temperature
2) Dissolved Oxygen (DO)
3) pH
4) Soluble reactive phosphorus (SRP)
5) Total phosphorus (TP)
6) Nitrate-nitrite nitrogen (NO_3^--NO_2^-)
7) Ammonia nitrogen (NH_4^+)

Locations of sampling stations are shown in Figure 2.

3.1 Temperature, Dissolved Oxygen, and pH

Water temperature, the concentration of oxygen dissolved in water, and the pH (concentration of acid) all affect photosynthesis. Temperature affects the rate at which chemical reactions (like photosynthesis and metabolism) occur, as well as the existence of certain plant and animal species under different temperature ranges (i.e. some species can not survive in water above or below a specific temperature). Oxygen is produced by plants in photosynthesis, and is used by both plants and animals. Plants use oxygen during respiration, and animals use it for metabolism. A major sink for oxygen is the bacterial decomposition of organic matter which uses oxygen to break down dead plant and animal tissue and produces soluble nutrients. pH is important to photosynthesis in controlling the concentration of a useable form of carbon dioxide in the water. In the process of photosynthesis, plants use light energy to make carbon dioxide, nutrients and water into organic compounds (plant tissue) while giving off oxygen. Thus, the concentration of carbon dioxide in water that is available for plants to use is critical to photosynthesis. pH controls the levels of useable carbon dioxide for photosynthesis. While carbon dioxide is critical for photosynthesis, it is usually present in adequate amounts in aquatic systems. Descriptions of the temperature, dissolved oxygen (DO), and pH throughout the Mill Pond can be used to suggest the biological processes that are occuring within the Pond water.

Methods

At each station, temperature, DO, and pH were measured at 0.5m depth intervals. During the first two months of the study, temperature, DO, and pH were measured in situ using a Martek

MKVIII water quality monitor. Before sampling, the DO probe was air calibrated and the pH probe was calibrated using buffers of pH7 and pH4.2. After August of 1984, DO and temperature were measured _in situ_ using a YSI Model 800 water quality meter with the DO probe being calibrated as before. At this time, pH measurements were taken in the field using an Orion field pH meter. This field pH meter became unsuitable due to the low conductivity of the water in the Pond (about 20 micromhos). As a result, measurements of pH were taken in the laboratory on collected water samples using a Beckman Expandomatic pH meter.

Results

The temperature, DO, and pH data for all eleven stations, for all sampling dates are given in Appendices A, B, and C, respectively. The data are arranged in transects of the west side moving north (stations A-B-C-D-E), and the east side moving north (stations H-J-G-F-E). Refer to Figure 2 for station locations.

The temperature distribution in the Pond goes through a seasonal cycle that is typical of all freshwater ponds or lakes. In June, the water was strongly stratified with surface water approximately 5°C warmer than the bottom water, and the inflow another 4°C cooler than the bottom water. Once this thermal pattern is established, the differences in the densities of warm and cold water help maintain the structure. Warming takes place only at the surface, resulting in warm, less dense water overlying cold, dense water. When the temperature difference between these two water masses is great, wind can not mix the two layers. Strong thermal stratification continued in the Pond through July and August augmented by the inflows from cold water springs. By September, the statification had weakened as surface temperatures dropped and the temperature difference between surface and bottom water was only 3°C, and the inflow 2°C cooler than the bottom water. As temperatures continued to drop, the difference between surface and bottom water temperatures decreased further so that by late October, wind could mix the two layers and the thermal stratification diminished. Throughout the winter months, the entire water column stabilized at nearly the same temperature, with the difference between surface and bottom water being only tenths of degrees. At this time the inflows were actually warmer than the Pond surface water. By April, the Pond surface water approached the temperature of the inflows, and slight stratification began. The temperature difference between surface and bottom was almost 1°C. By mid-May, the surface to bottom temperature difference was up to 3°C, the inflow was 1°C cooler than the bottom, and thermal stratification was evident. Figure 15 sums the annual temperature distribution in Mill Pond.

The concentration of dissolved oxygen in Pond waters can become critical to the biology within the Pond. Plants receiving plenty of light and nutrients will photosynthesize and reproduce, creating an algal bloom. All these plants need light and nutrients, and at some point, some nutrient will be in short supply and become limiting to plant growth. As plant production occurs, some portion will die, sink and decompose. The decomposition process, taking place on the bottom, requires

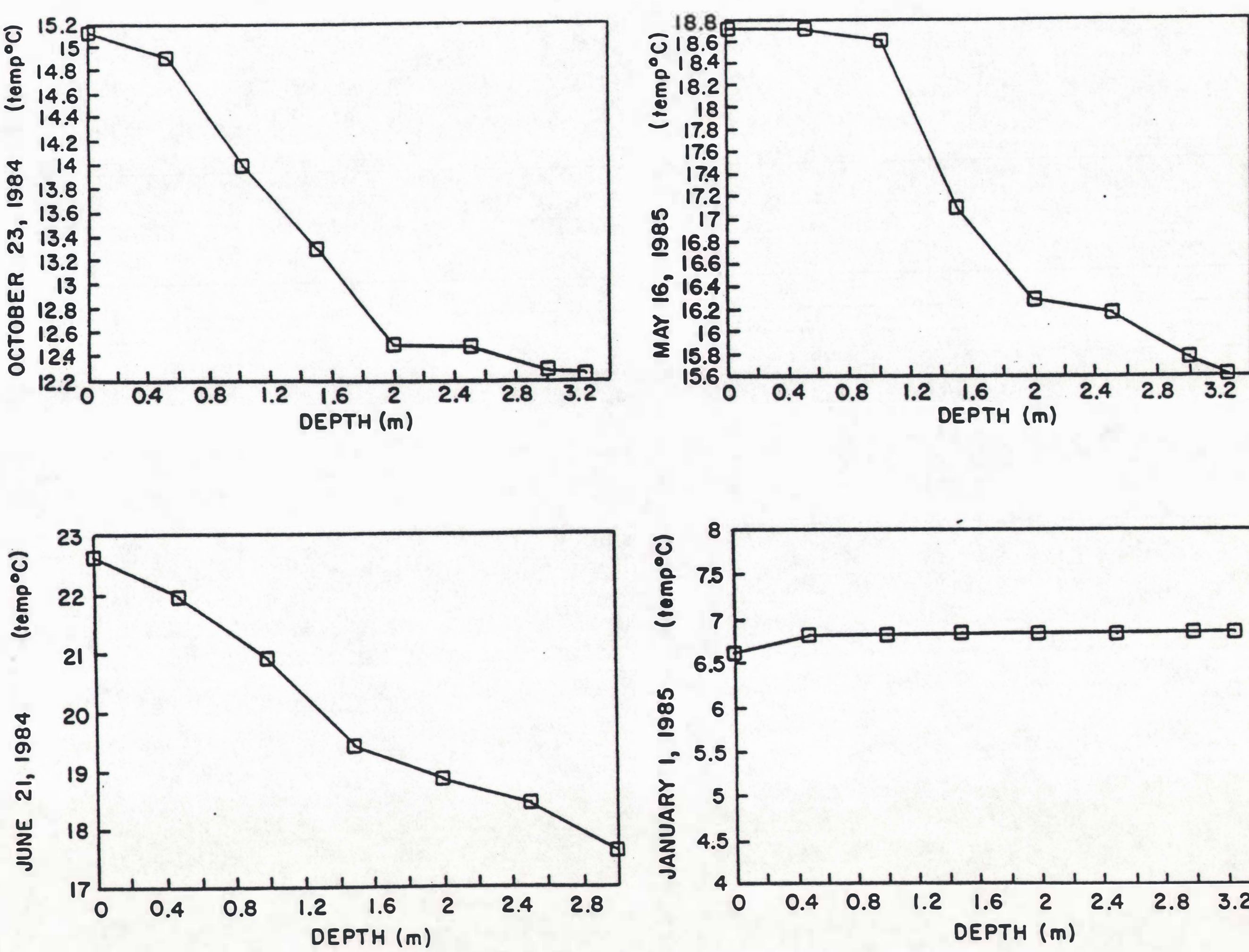


Figure 15. Annual Cycle of Temperature Distribution for Mill Pond.

oxygen, increasing the biological oxygen demand (BOD) in deep water. The only sources of oxygen to the water column are inflows, atmospheric exchange at the surface, and oxygen produced in photosynthesis. Thus, the supply of oxygen to deep water is dependent on mixing with the surface water, photosynthesis, or cold water inflows. Thermal stratification can cut off this source of oxygen to deep water, and as a result, the bottom water can become "anoxic" ("lacking oxygen"). Anoxia can be accompanied by fish kills.

The annual distribution of oxygen in the Mill Pond is summarized in Figure 16. It is evident that anoxia is not a serious threat to the Pond. At the height of plant production in June, July and August, DO concentrations in deep water never fell below 4.5 mg/liter. The failure of anoxia to occur is probably due to a combination of photosynthesis in the hypolimnion and recharge by oxygenated water from cold inflows. In May, deep water was supersaturated in oxygen probably as a result of photosynthesis by dense stands of rooted plants that were observed.

pH did not vary greatly throughout the Pond either with depth or with time; the range of values was from 6.0 to 8.0, with the average pH being 6.9. High values were probably a result of instrument malfunction. Reliable values usually averaged about 6.5 with little variation. No substantial effect of pH on Pond biology is likely.

3.2 Phosphorus

Phosphorus and nitrogen are the key nutrients needed for

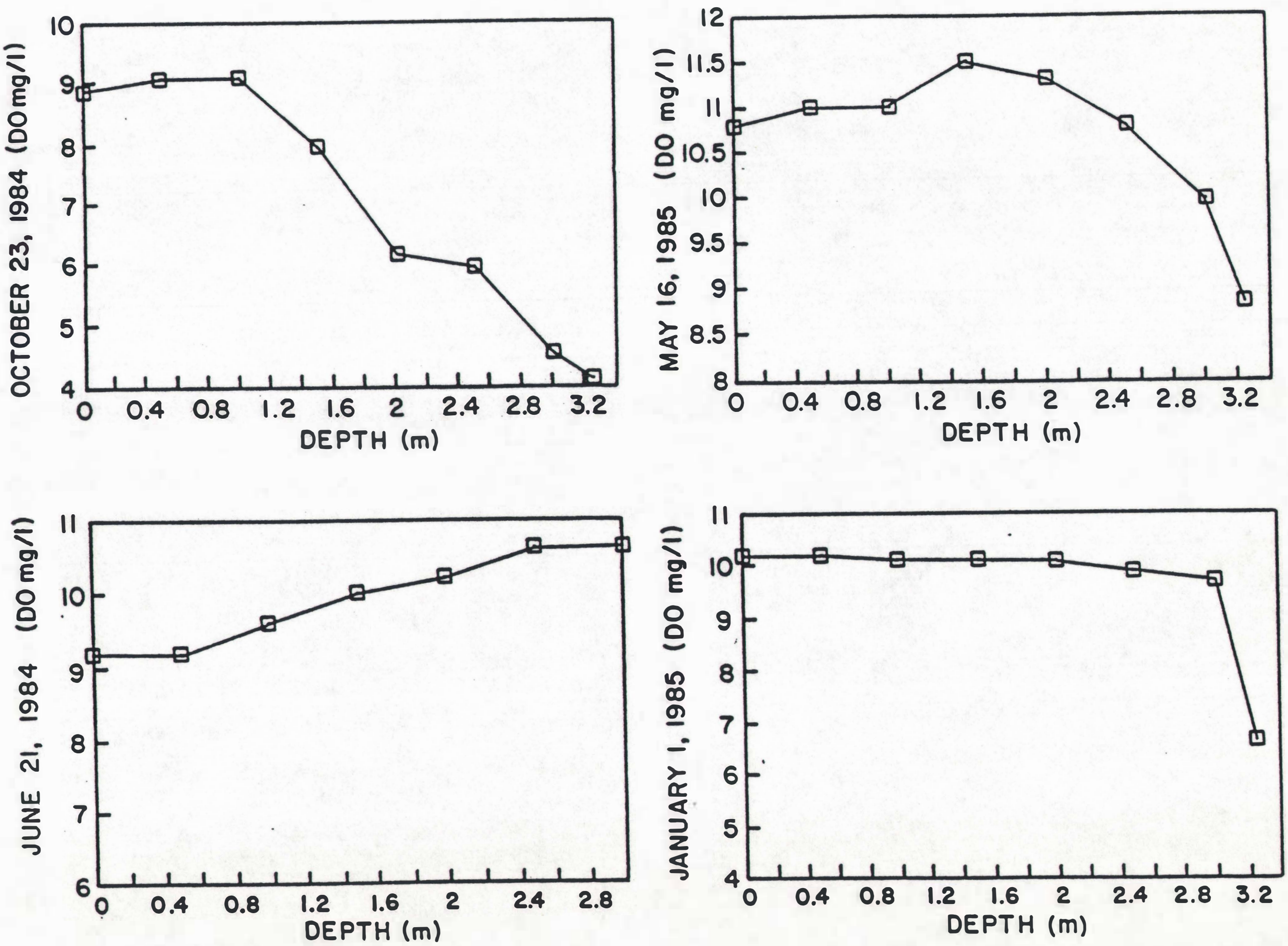


Figure 16. Annual Cycle of Dissolved Oxygen (DO) Distribution for Mill Pond.

photosynthesis. Soluble reactive phosphorus (SRP) in particular, is often limiting in freshwater, thus the concentration of SRP can greatly effect plant production. This form of phosphorus is the form which plants can use immediately. Many other forms of phosphorus exist and can be collectively analyzed as total phosphorus (TP), though these forms can not be used by plants directly. This phosphorus has the potential to greatly effect plant growth if it is cycled through the sediments. These other phosphorus compounds can become buried in the sediments where there is no oxygen. Under anoxic conditions, (which occur deep in the sediments), phosphorus compounds are reduced to the soluble reactive form resulting in large amounts of SRP buried in the sediments. The surface of sediments is oxygenated as long as oxygen persists in the overlying deep water. This oxidized layer of the sediments (the oxidized microzone) acts as a barrier to the pool of SRP in the anoxic sediments. SRP that migrates to surface sediments quickly reacts with oxidized compounds (such as iron) that are present in the oxidized microzone. The iron - phosphorus complex that results is again, an unuseable form of phosphorus for plants. SRP formed in anoxic sediments can only be released to the water column in the absence of the oxidized microzone. The oxidized microzone will only break down when the overlying water goes anoxic. In the Mill Pond, deep water never goes anoxic, so the SRP pool that resulted from the burial of phosphorus containing compounds, is not released to the water column for use by phytoplankton. However, the phosphorus that was tied up in forms other than SRP can, in time, become available for plants when the roots of aquatic plants extend beyond the oxidized microzone and into the anoxic sediments that contain large amounts of reduced phosphorus. SRP and TP were monitored in order to assess the levels of phosphorus available for biological production.

Methods

Water samples were taken at each station using a two liter brass Kemmerer sampler. Depths at which samples were taken are shown in Table 3. Samples were placed in 0.5 liter polyethylene bottles and taken immediately (within two hours) to the laboratory for filtration. Part of each sample was filtered through a 0.45u membrane filter. Analyses of Soluble Reactive Phosphorus (SRP) and Total Phosphorus (TP) were conducted within 48hrs, (usually within 24 hrs) of sampling. Procedures for the nutrient analysis followed the methods outlined in the EPA Manual for Analysis of Water and Waste Water.[1]

Results

The SRP and TP data for all eleven stations for all sampling dates are given in Appendices D and E respectively. The data are arranged in transects of the west side moving north (stations A-B-C-D-E), and the east side moving north (stations H-J-G-F-E). Refer to Figure 2 for station locations.

Concentrations of SRP throughout the Pond were frequently at, or below the detection limit (0.01ppm). Detection of SRP

[1] EPA Manual for Analysis of Water and Waste Water, Environmental Monitoring and Support Lab, Office of R. and D., U.S.E.P.A., Cincinnati, Ohio, March, 1983. EPA-600/4-79-020.

STATION	STATION NAME	DEPTH	NOTATION
A	CREEK	SURFACE	A-1
B	LOWER POND	SURFACE	B-1
		0.5 m	B-2
C	LOWER MID-POND	SURFACE	C-1
		1.0 m	C-2
D	UPPER MID-POND	SURFACE	D-1
		1.5 m	D-2
E	UPPER POND	SURFACE	E-1
		1.0 m	E-2
		2.5 m	E-2
F	EAST INLET	SURFACE	F-1
		1.0 m	F-2
G	CHILD'S	SURFACE	G-1
		0.5 m	G-2
H	SPRING	SURFACE	H-1
J	PIPE	SURFACE	J-1
K	OUTLET	SURFACE	K-1

Table 3. Depth of water samples taken at stations.

levels below 0.01 ppm was not possible with the equipment and methods used. Biologically significant levels of SRP are on the order of 0.005 ppm however, so caution should be taken in interpreting the measured concentrations of SRP as being too low to support plant growth.

Concentrations of TP throughout the Pond were usually at least an order of magnitude greater than the SRP concentration. TP effects the plant production in Mill Pond via the rooted aquatic plants. These plants take up phosphorus from the sediments, not the water column. The roots of these aquatic plants can tap into the pool of SRP formed in the sediments. Thus, the Mill Pond is ideal for these plants, and these plants could potentially overrun the Pond. The large waterfowl population that inhabits the Pond may be playing an important role in limiting these plants. The waterbirds graze on the tips of the rooted plants thereby keeping the plants below growth capacity.

Tables 4 and 5 show a comparison of the average concentration of SRP and TP in the Pond to the SRP and TP concentration in the pipe for all sampling dates. Values for both forms of phosphorus were frequently different between the Pond and the pipe but there was no consistent direction to those differences. Differences smaller than 0.02 ppm should be interpreted with caution because of the limits of sensitivity inherent in our analytical procedure for phosphorus.

The nutrient values of the inflows were compared with those of the Pond using a two-tailed t-test, and the extent to which the values in the inflows were related to those in the Pond was

Date	Xpond	Spond	df	Xpipe	t	P
7-5-84						
7-30-84	0.003	0.0065	12	0.06	31.6	<0.001
8-13-84	0.015	0.0218	12	0.01	0.82	<0.5
8-27-84	0.001	0.0038	12	0.02	18.24	<0.001
9-10-84	0.002	0.0055	12	0.02	11.7	<0.001
9-24-84	0.005	0.0097	12	0.01	1.79	<0.2
10-10-84	0.006	0.0065	12	0.01	2.2	<0.05
10-23-84	0.002	0.0073	12	0.05	23.87	<0.001
1-3-85	0.00	0.00	12	0.05	--	<0.001
4-1-85	0.017	0.0144	11	0.04	5.55	<0.001

where: X_{pond} = mean concentration of all samples taken on that date

S_{pond} = standard deviation of all samples from the mean concentration for that date

df = degrees of freedom (number of samples taken -1)

X_{pipe} = concentration of SRP in pipe on that date

P = probability that the mean of the distribution of phosphorus in the Pond is significantly different from the concentration of phosphorus in the pipe; if P is sufficiently small ($P<0.05$) assume there is a real difference between the values

Table 4. Comparison of SRP in Pond vs. Pipe.

Date	Xpond	Spond	df	Xpipe	t	P
7-5-84	0.04	0.0294	12	0.02	2.45	<0.05
7-30-84	0.09	0.0452	12	0.01	6.37	<0.001
8-13-84	0.069	0.0828	12	0.06	0.39	<0.5
8-27-84	0.036	0.0198	11	0.05	2.45	<0.05
9-10-84	0.019	0.0193	11	0.04	3.79	<0.01
9-24-84	0.043	0.0505	11	0.00	2.95	<0.02
10-10-84	0.093	0.0591	12	0.09	0.18	<0.5
10-23-84	0.002	--	--	--	--	--
1-3-85	0.032	0.0215	12	0.00	5.72	<0.001
4-1-85	0.037	0.0103	12	0.03	2.45	<0.05

where: X_{pond} = mean concentration of all samples taken on that date

S_{pond} = standard deviation of all samples from the mean concentration for that date

df = degress of freedom (number of samples taken - 1)

X_{pipe} = concentration of TP in pipe on that date

P = probability that the mean of the distribution of phosphorus in the Pond is significantly different from the concentration of phosphorus in the pipe; if P is sufficiently small ($P<0.05$) assume there is a real difference between the values

Table 5. Comparison of TP in Pond vs. Pipe.

assessed using stepwise multiple regression (using SAS statistical package). The purpose of this regression analysis was to discover which combination of inflows best described the temporal distribution of nutrients in the Pond. (Appendix H describes the multiple regression procedure in detail.) For each nutrient parameter, the mean value of the Pond was used as the dependent variable and the values from the pipe, spring and creek were used, either individually or in combination, as the independent variables.

This analysis was used for total P but not SRP, and a summary of the results is shown in Table 6. The temporal variance in Pond concentrations of TP was significantly correlated with the temporal variation in concentrations of TP from the creek ($P<0.0395$). The distribution of TP in the creek however, only explained 48% of the variation in the mean value of TP concentration in the Pond. The equation for the line that best describes the relationship of TP in the Pond to the TP in the creek is:

$$[P] = m\,[C] + b$$
$$[P] = 0.15745192\,[C] + 0.04026442$$

where m = slope
b = y-intercept
$[P]$ = average concentration of TP in Pond
$[C]$ = concentration of TP in creek

If the creek were the dominant source of TP to the Pond, the mean TP concentration for the Pond and the TP value for the creek would be approximately equal. If this were the case, then the slope of the line would be one and the y-intercept would be zero. For the relationship of TP in the creek and Pond, the values for the slope and intercept are 0.157 and 0.040, respectively. This

BEST PREDICTOR	CREEK
r^2	0.48
Observed Significance Level	P<0.0395
REGRESSION COEFFICIENT	0.15745
Observed Significance Level	P<0.0395
* Y-INTERCEPT	0.04026
** SLOPE	0.15745

*significantly different from 0
**significantly different from 1

Table 6. Summary of Multiple Regression for TP.

indicates that the creek is probably not the dominant source of TP to the Pond under normal flow conditions, but rather the TP concentration in the Pond is due to a complex contribution from all sources.

3.3 Nitrogen

Nitrogen is another key nutrient needed for photosynthesis. Nitrogen, in the form of ammonia (NH_4^+) is usually found in low concentrations in all waters due to its high reactivity. It can be immediately taken up by plants and assimilated into plant products. Nitrates (NO_3^-) and nitrites (NO_2^-) can be taken up by plants but are first reduced within the plant tissues before being incorporated into organic compounds. Nitrates and nitrites are usually not limiting to photosynthesis in freshwater. Other forms of nitrogen do exist and some plants do preferentially take up other compounds, but these two classes of nitrogen compounds, ammonia (NH_4^+) and nitrate-nitrite (NO_3^--NO_2^-), are the most common. In order to analyze the distribution of nitrogen in Mill Pond then, the distribution of these two forms of nitrogen were monitored.

Methods

Water samples were collected and filtered as in the methods for phosphorus. Analysis of NH_4^+ was conducted on the same day as sampling, while analysis of NO_3^--NO_2^- was conducted within 48 hrs, (usually within 24 hrs) of sampling. Procedures for the nutrient analysis followed the methods outlined in the EPA Manual for Analysis of Water and Wastewater.[1]

Results

The NH_4^+ and $NO_3^- - NO_2^-$ data for all eleven stations for all sampling dates are given in Appendices F and G respectively. The data are arranged in transects of the west side moving north (stations A-B-C-D-E), and the east side moving north (stations H-J-G-F-E). Refer to Figure 2 for station locations.

Concentrations of NH_4^+ and $NO_3^- - NO_2^-$ were always above the detection limit of the techniques employed and $NO_3^- - NO_2^-$ values were an order of magnitude higher than NH_4^+ values. Average $NO_3^- - NO_2^-$ values were in the 1-2 ppm range. This result is evidence that nitrogen is not limiting photosynthesis in the Mill Pond. Studies of Long Island groundwater show nitrate concentrations in groundwater to be very high as a result of rain percolating down through fertilized farm soil over many years. Since the Pond receives groundwater from springs throughout the Pond, the high concentration of nitrate in the Pond reflects the high concentrations of nitrate in Long Island groundwater.

Tables 7 and 8 show a comparison of the average concentration of NH_4^+ and $NO_3^- - NO_2^-$ in the Pond to the NH_4^+ and $NO_3^- - NO_2^-$ concentration in the pipe for all sampling dates. Values for nitrate from the pipe were significantly higher than those from the Pond on all but one sampling date. Differences in ammonia concentrations were less frequent, with the values in the

[1]EPA Manual for Analysis of Water and Waste Water, Environmental Monitoring and Support Lab, Office of R. and D., U.S.E.P.A., Cincinnati, Ohio, March, 1983. EPA-600/4-79-020.

Date	Xpond	Spond	df	Xpipe	t	P
7-5-84						
7-30-84						
8-13-84	0.05	0.1065	10	0.14	2.80	<0.01
8-27-84	0.183	0.0361	12	0.16	2.29	<0.05
9-10-84	0.202	0.0265	12	0.13	9.79	<0.001
9-24-84	0.284	0.0325	12	0.20	9.31	<0.001
10-10-84	0.130	0.0529	12	0.10	2.04	<0.10
10-23-84	0.050	0.0435	12	0.04	0.83	<0.5
1-3-85	0.052	0.0188	12	0.07	3.46	<0.01
4-1-85	0.033	0.1494	12	0.19	37.9	<0.001

where:

X_{pond} = mean concentration of all samples taken on that date

S_{pond} = standard deviation of all samples from the mean concentration for that date

df = degress of freedom (number of samples taken - 1)

X_{pipe} = concentration of NH_4^+ in pipe on that date

P = probability that the mean of the distribution of nitrogen in the Pond is significantly different from the concentration of nitrogen in the pipe; if P is sufficiently small ($P<0.05$) assume there is a real difference between the values

Table 7. Comparison of NH_4^+ in Pond vs. Pipe

Date	Xpond	Spond	df	Xpipe	t	P
7-5-84	2.55	0.1561	12	3.5	21.95	<0.001
7-30-84	1.69	0.5178	12	3.3	11.21	<0.001
8-13-84	1.06	0.0650	12	1.8	41.02	<0.001
8-27-84	2.88	0.2115	12	4.0	19.09	<0.001
9-10-84	2.53	0.3146	12	3.6	12.26	<0.001
9-24-84	2.25	0.2727	12	3.7	19.12	<0.001
10-10-84	2.50	0.2708	12	2.5	0.0	<0.5
10-23-84	2.08	0.0832	12	3.5	61.53	<0.001
1-3-85	2.20	0.0913	12	3.1	35.55	<0.001
4-1-85	1.67	0.0103	12	1.9	5.01	<0.01

where: X_{pond} = mean concentration of all samples taken on that date

S_{pond} = standard deviation of all samples from the mean concentration for that date

df = degress of freedom (number of samples taken - 1)

X_{pipe} = concentration of NO_3^--NO_2^- in pipe on that date

P = probability that the mean of the distribution of nitrogen in the Pond is significantly different from the concentration of nitrogen in the pipe; if P is sufficiently small (P<0.05) assume there is a real difference between the values

Table 8. Comparison of NO_3^--NO_2^- in Pond vs. Pipe.

Pond being less than or equal to those in the pipe on five out of eight occasions.

Results of the multiple regression analysis for NH_4^+ and NO_3^--NO_2^- are summarized in Table 9. None of the inflows or combination of inflows was significantly correlated with the average Pond concentration for NH_4^+. Pond concentration of NO_3^--NO_2^- was significantly correlated with concentrations of NO_3^--NO_2^- from the spring ($P<0.0019$). Values of NO_3^--NO_2^- concentration in the spring explained 77% of the temporal variation in the mean value of NO_3^--NO_2^- concentration in the Pond. In the three variable model of the regression, the combined variance in the pipe, spring and creek accounted for only an additional 3% of the variation in the mean concentration of NO_3^--NO_2^- in the Pond. The one variable model with the spring as the independent variable is the best description of the relationship of NO_3^--NO_2^- from the inflows vs. the Pond. The equation for the line that best describes this relationship is:

$$[P] = m\,[S] + b$$
$$[P] = 1.61946239[S] + 0.04175127$$

where m = slope
b = y-intercept
[P] = average concentration of NO_3^--NO_2^- in Pond
[S] = concentration of NO_3^--NO_2^- in spring

In this case, the slope of the line was not significantly different from one, and the y-intercept was not significantly different from zero. This result was interpreted to mean that the concentration of NO_3^--NO_2^- in the spring was essentially equal to the mean concentration of NO_3^--NO_2^- in the Pond. This result would indicate the spring as a dominant source of NO_3^- -

BEST PREDICTOR	SPRING
r^2	0.77
Observed Significance Level	P<0.0019
REGRESSION COEFFICIENT	1.61946
Observed Significance Level	P<0.0019
* Y-INTERCEPT	0.04751
** SLOPE	1.61946

*not significantly different from 0
**not significantly different from 1

Table 9. Summary of Multiple Regresion for NO_3^--NO_2^-.

NO_2^-, or that the unmonitored springs seeping into the Pond are simillar to the spring with respect to NO_3^--NO_2^-. Thus, the regression analysis does not necessarily indicate that one spring is the primary source of NO_3^--NO_2^- to the Pond, but rather all the springs, or groundwater, dominates the distribution of NO_3^--NO_2^- under normal flow conditions.

4.1 Storm Discharge

The discharge from the pipe needed to be measured over the course of at least three storm events in order to describe a linear relationship between discharge and rainfall. Using this relationship, an estimate of the additional water brought into the Pond by the pipe during storms can be calculated. Combining this estimate with the estimated discharge under normal flow, a value for the total discharge from the pipe during a year can be calculated. These data will be valuable in assessing the removal of the pipe in view of the reduced water flow and effect on residence time of Pond water.

Methods

Three storm events were sampled: July 17, 1984, October 1, 1984, and February 12, 1985. Velocity of water coming through the pipe was measured using an OTT Universal Direct Reading Current Meter immediately before, during and after a storm event. Height of water in the pipe was recorded at the time of the velocity measurements. A baseline measurement was taken before the storm flow began and when the outflow first became turbid. After that, measurements were taken frequently (every 15-30min.) throughout the duration of the storm. Cross sectional area was calculated from the measured height of water in the pipe, and discharge was calculated as velocity X cross sectional area for each sampling time. An integration of the curve of discharge vs. time summed the discharge over the course of the storm event to give the total volume of water flowing out of the pipe during the storm.

Rainfall is recorded in Setauket, NY, approximately 3.7miles from Mill Pond, by a National Weather Service observer, Mrs. William Strong. Rainfall for Setauket was assumed to be the same as rainfall in Stony Brook, and total volume of discharge from the pipe for each storm event was plotted against the recorded rain amount for those storms. The equation for the line describing the relationship between rainfall and discharge was found using least square linear regression analysis. Using this relationship, total discharge was calculated for storm events that were not sampled throughout the year. The discharge measured from the pipe under normal flow was used to calculate the total discharge from the pipe for dry days. These two values were added together to find the total input from the pipe during the year. The residual input to the Pond if the pipe is removed was calculated by subtracting the total inflow of the pipe from the total outflow from the Pond. Using this information, the ratio of the annual inflow to the total volume of the Pond was calculated with and without the pipe. This calculation yields the flushing rate of the Pond, i.e. the number of times in a year the entire Pond volume is replaced.

Results

Figures 17, 18 and 19 show the plots of discharge vs. time for the storm events on July 17, 1984, October 1, 1984 and February 12, 1985 respectively. Total discharge and recorded rainfall for each of the three dates are given in Table 10.

Using these three points, a linear relationship between total discharge and rainfall amount was calculated. The equation

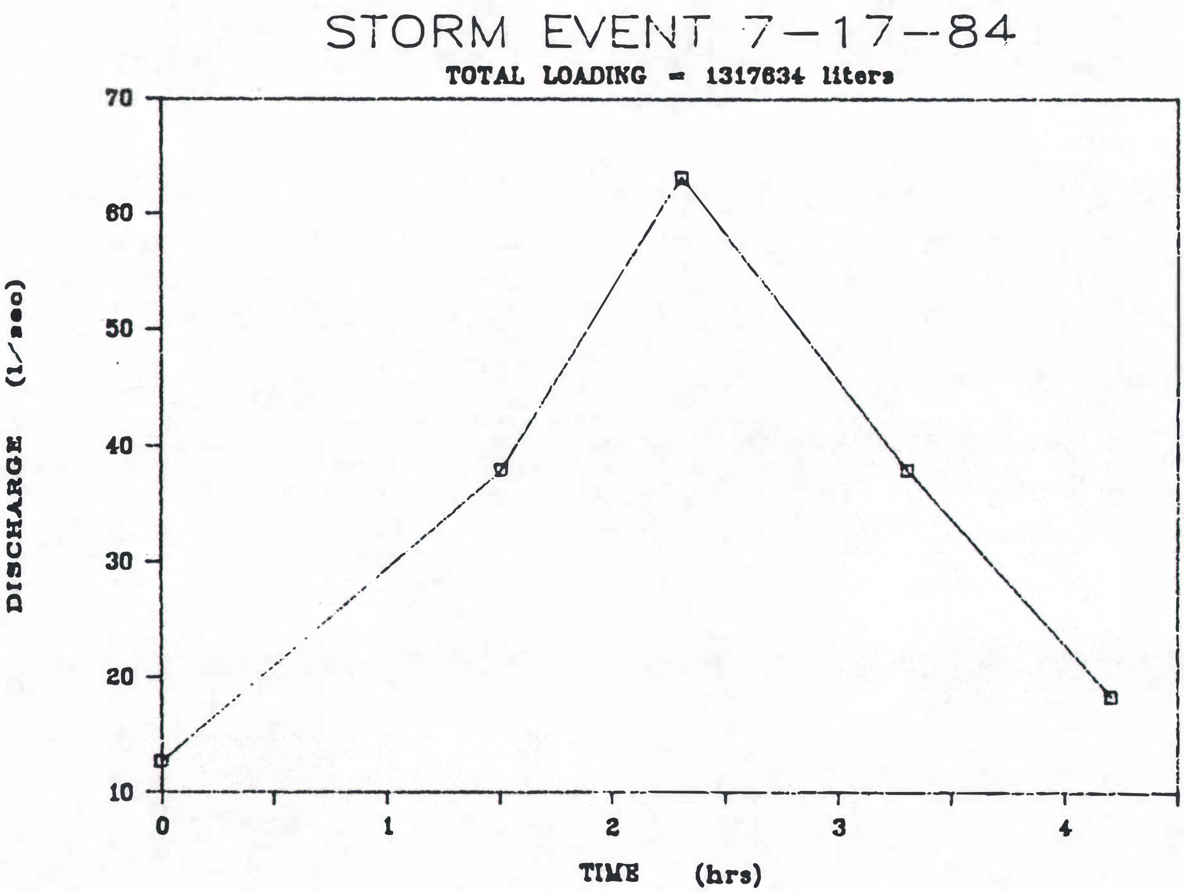


Figure 17. Discharge vs. Time for Storm Event 7-17-84.

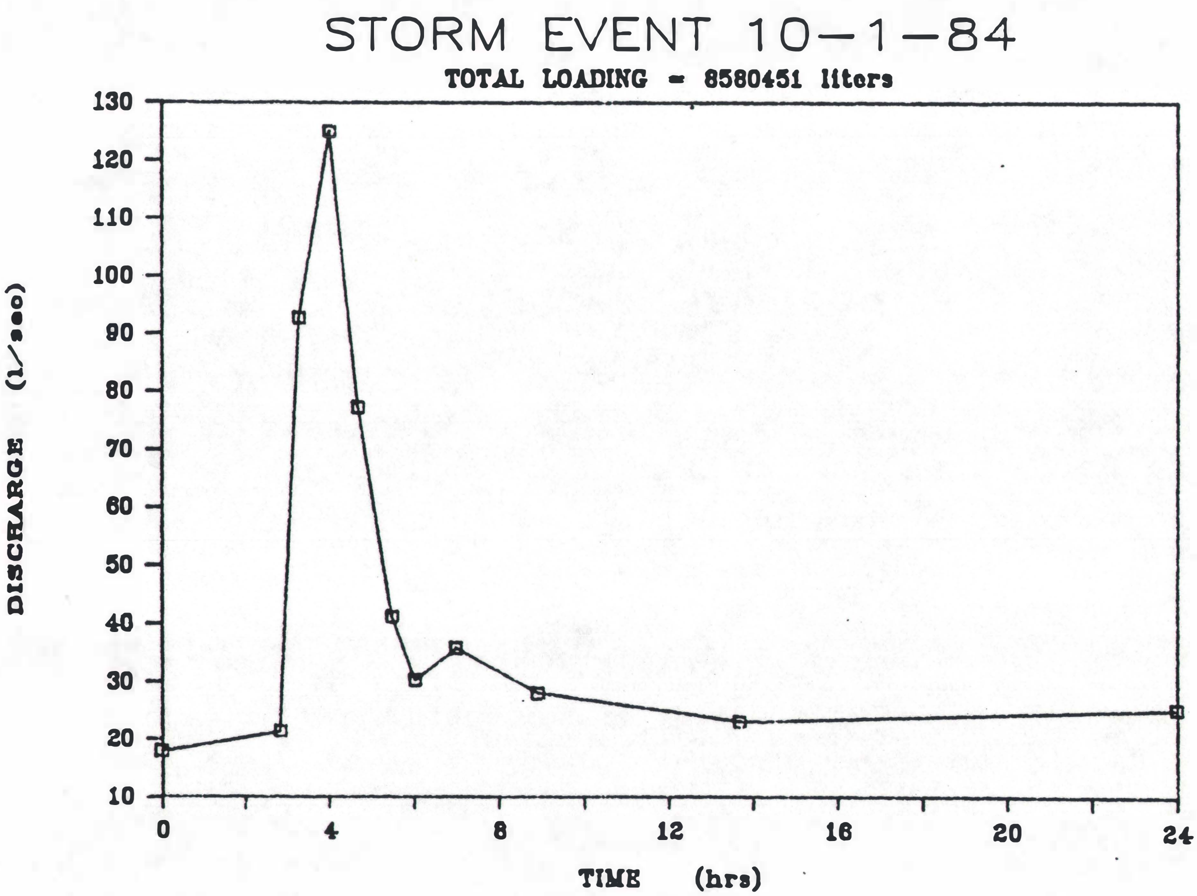


Figure 18. Discharge vs. Time for Storm Event 10-1-84.

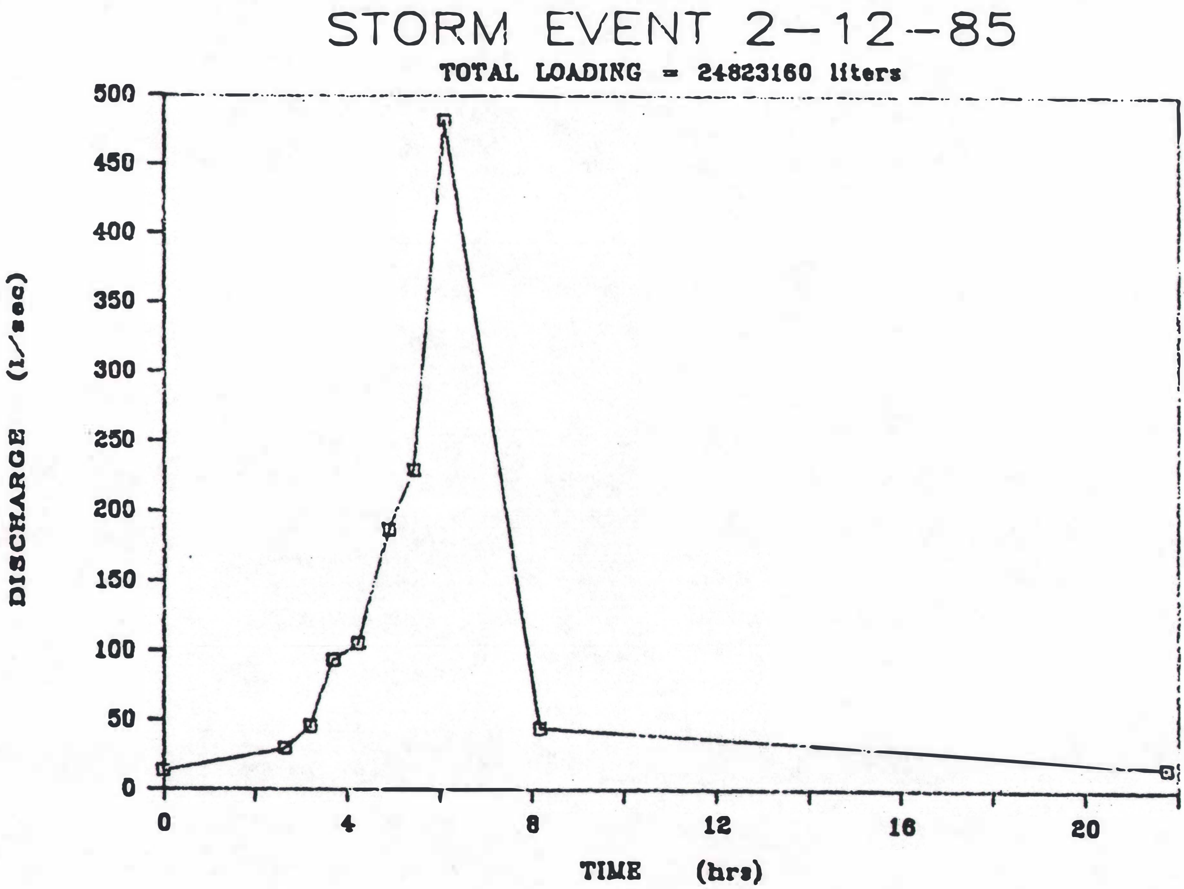


Figure 19. Discharge vs. Time for Storm Event 2-12-85

DATE	TOTAL DISCHARGE		RAIN AMOUNT	
	(l)	(gal)	(cm)	(in)
7-17-84	1,317,634	348082	0.79	0.31
10-1-84	8,580,451	2266715	1.35	0.53
2-12-85	24,823,160	6557585	2.31	0.91

Table 10. Data Points for Linear Relationship of Discharge to Rainfall.

for the line that best describes this relationship is:

$$D = 15621778 (R) - 11598556$$

$$r^2 = 0.9978023$$

where D = Total discharge of storm event (liters)

R = Rainfall amount (cm)

r^2 = Correlation coefficient

A correlation coefficient close to positive one indicates the data are strongly positively correlated, and that the equation for the line describes the relationship of the data very well. Figure 20 shows the calculated and measured relationships.

Monthly Tables of recorded rainfall in Setauket, NY are in Appendix I. These tables include an estimate of discharge for each storm recorded. The estimate is based on the above relationship. A summation of all the estimated discharge for all storm events from June, 1984 to May, 1985 yields 841,285,400 l (222,244,090 gal) of storm water discharged from the pipe annually. During this year, 18.83 days had precipitation and 346.17 days were dry. On these dry days the pipe discharge was assumed to be 14.4 liters/sec (3.8 gal/sec), or 430,690,870 l annually. The combined storm and normal flow water from the pipe amounts to 1,271,976,300 l per year. The relocation of this amount of water must be considered in deciding the fate of the pipe.

Table 11 shows the estimated annual input to the Pond from all sources and the input to the Pond if the pipe is removed. Under present conditions, (i.e. including all sources of water to the Pond), the ratio of inflow to Pond volume is 476:4.4. This

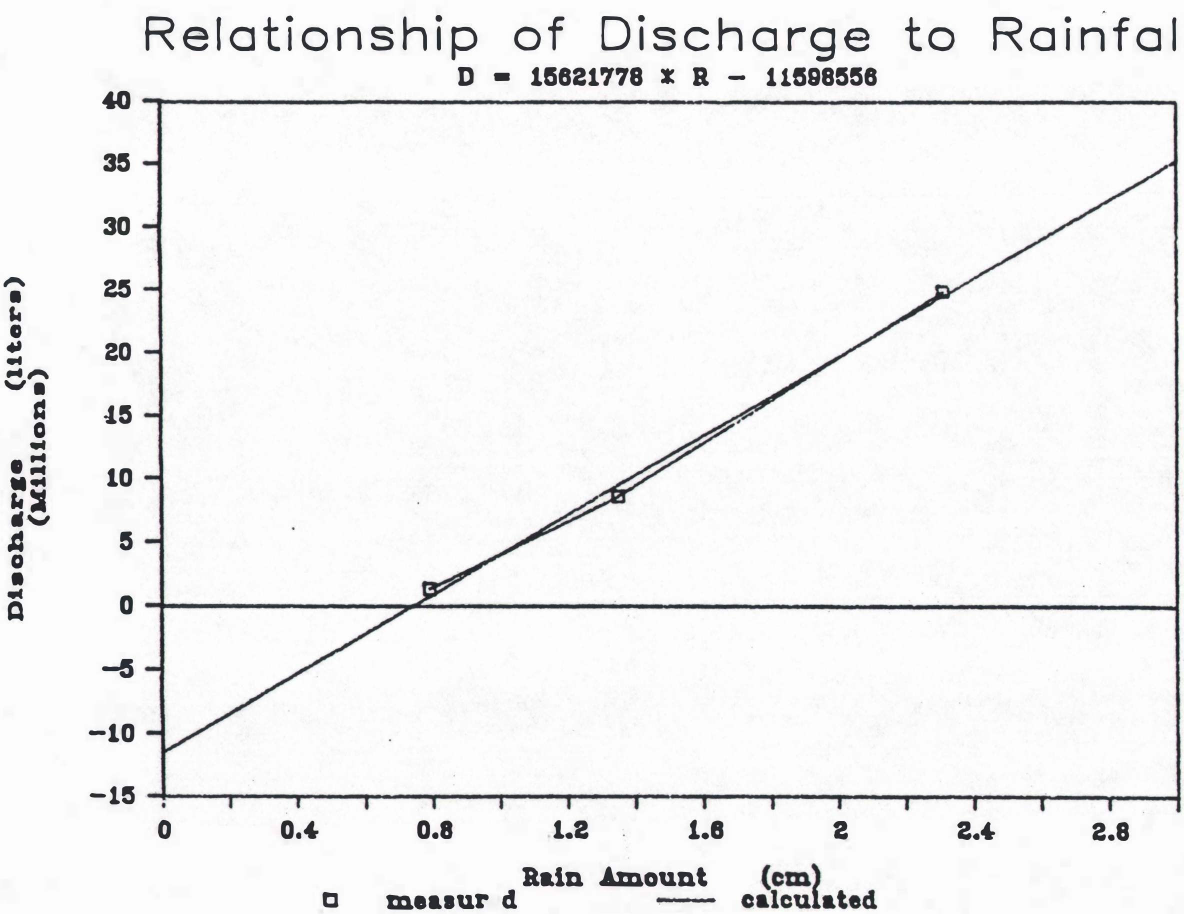


Figure 20. Measured and Calculated Relationship of Discharge to Rainfall.

SOURCE	DISCHARGE (l/sec)	ANNUAL INPUT (l)	ANNUAL INPUT : POND VOLUME	FLUSHING RATE
PIPE -storm water		841,285,400		
-normal flow	14.4	430,690,870		
SPRING	17.9	564,494,400		
CREEK	39.0	1,229,904,000		
UNIDENTIFIED	53.6	1,690,329,600		
TOTAL -all sources		4,756,704,300	476 : 4.4	108/yr
TOTAL -without pipe		3,484,728,000	348 : 4.4	79/yr

Table 11. Annual Input and Estimated Residence Time With and Without the Pipe.

corresponds to the total volume of the Pond being replaced 108 times over the course of a year. If the pipe is removed, the ratio of inflow to Pond volume is 348:4.4 indicating that the entire Pond would be replaced 79 times in a year. From the water budget data, using normal flow conditions, the residence time of the Pond was calculated to be 4.1 days including all inflows. This corresponds to 24.4% of the water replaced in the Pond everyday. The average storm falling on Mill Pond is 0.39in, contributing 3,979,390 liters of storm water to the Pond. This corresponds to 8.94% of the Pond water being replaced by the average storm with the average duration of 4 to 5 hours. Storm water, therefore, can have a tremendous bearing on the water quality of the Pond. Examination of the nutrient characteristics of storm flow was undertaken to determine the nutrient loading of this storm runoff to Mill Pond.

4.2 Nitrogen Loading

Nitrogenous nutrients discharged from the pipe needed to be measured over the course of at least three storm events in order to describe a linear relationship between nutrient loading and rainfall. Using this relationship, an estimate of the additional nitrogen brought into the Pond by the pipe during storms can be calculated.

Methods

Three storm events were sampled: July 17, 1984, October 1, 1984, and February 12, 1985. Water samples were taken at the same time velocity was measured before, during and after a storm event. Samples were taken back to the lab, filtered and analyzed as in the methods for routine chemical analysis outlined in Section 3.3. Plots of ammonia - nitrogen (NH_4^+) concentration and nitrate - nitrite (NO_3^--NO_2^-) concentration vs. time were prepared. The discharge of nutrients (loading) from the pipe was calculated as water discharge X N-concentration for each of the two nitrogen species. An integration of the curve of nitrogen loading vs. time summed the nutrient loading over the course of the storm event to calculate the total loading of ammonia (NH_4^+) and nitrate - nitrite (NO_3^--NO_2^-) from the pipe during the storm.

Total loading from the pipe for each storm event was plotted against the recorded rain amount at Setauket, NY for those storms. The equation for the line describing the relationship between ammonia (NH_4^+) or nitrate - nitrite (NO_3^--NO_2^-) loading and rainfall was found using least square linear regression analysis. Using this relationship, total NH_4^+ and NO_3^--NO_2^- loading was calculated for storm events that were not sampled throughout the year.

Results

Figures 21 and 22 show the plots of NH_4^+ concentration and discharge vs. time for the storm events on October 1, 1984 and February 12, 1985 respectively. Figures 23, 24 and 25 show the same information for NO_3^--NO_2^- for the July 17, October 1, and February 12 events. Note that the peak in ammonia concentration occurs before the peak in discharge. Nitrate - nitrite concentrations actually decrease over the course of the storm. Rainwater, which contains little or no nitrogen, dilutes the

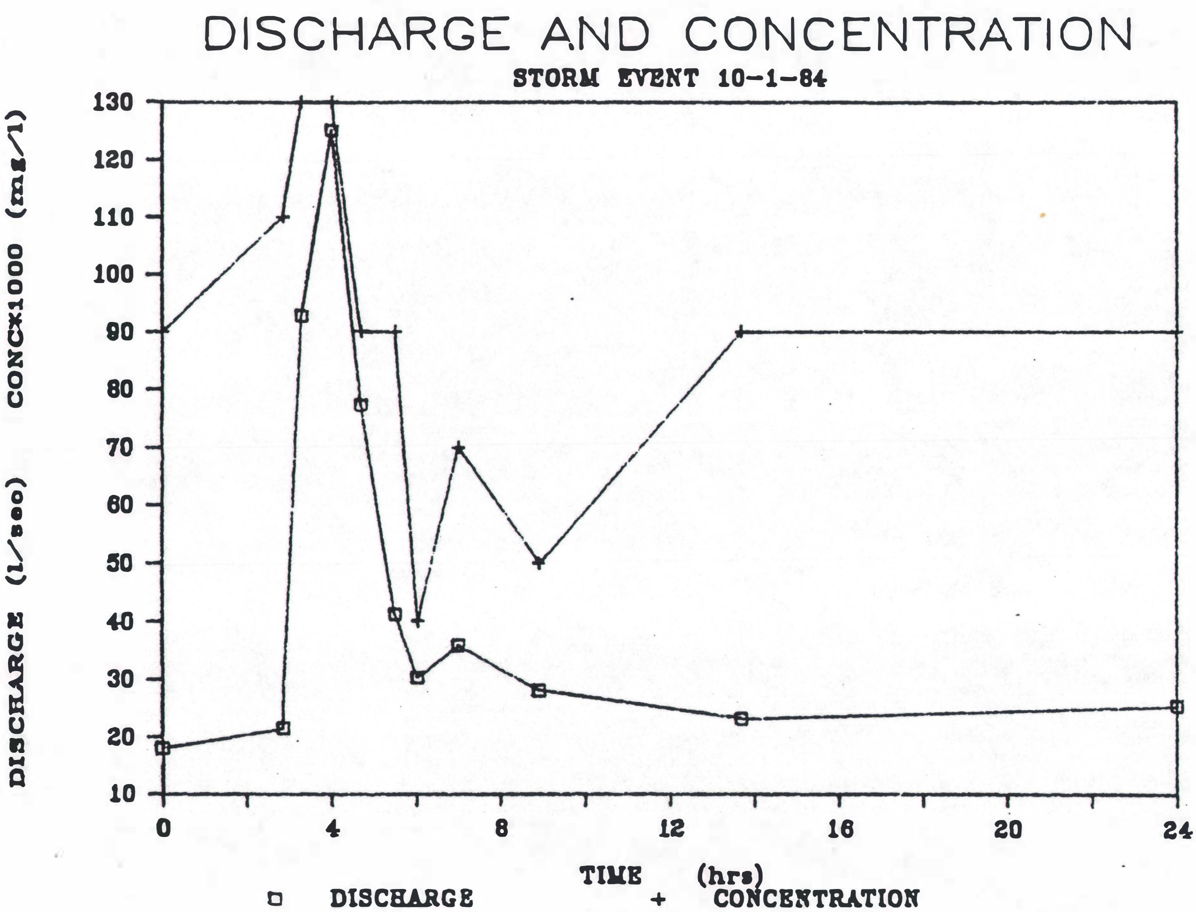


Figure 21. NH_4^+ Concentration and Discharge vs. Time for Storm Event 10-1-84.

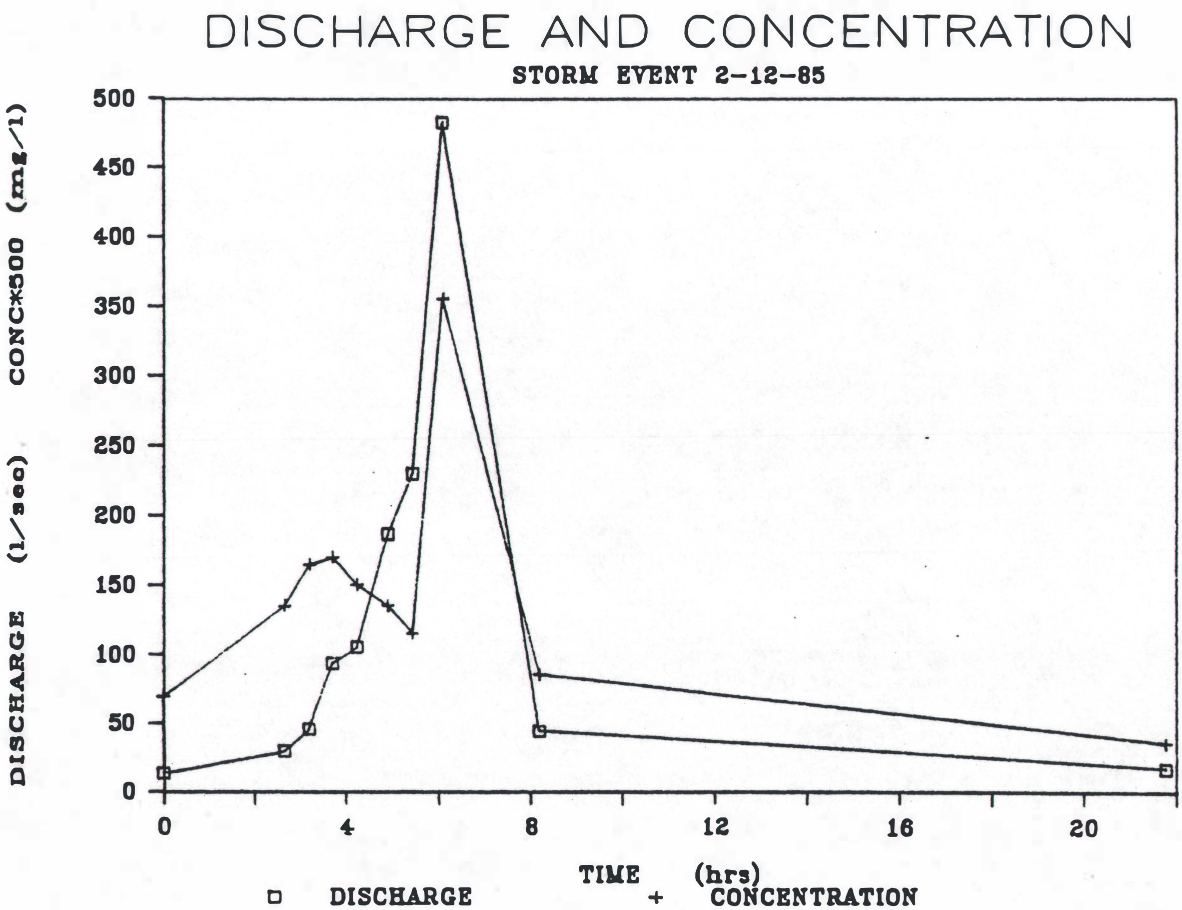


Figure 22. NH_4^+ Concentration and Discharge vs. Time for Storm Event 2-12-85.

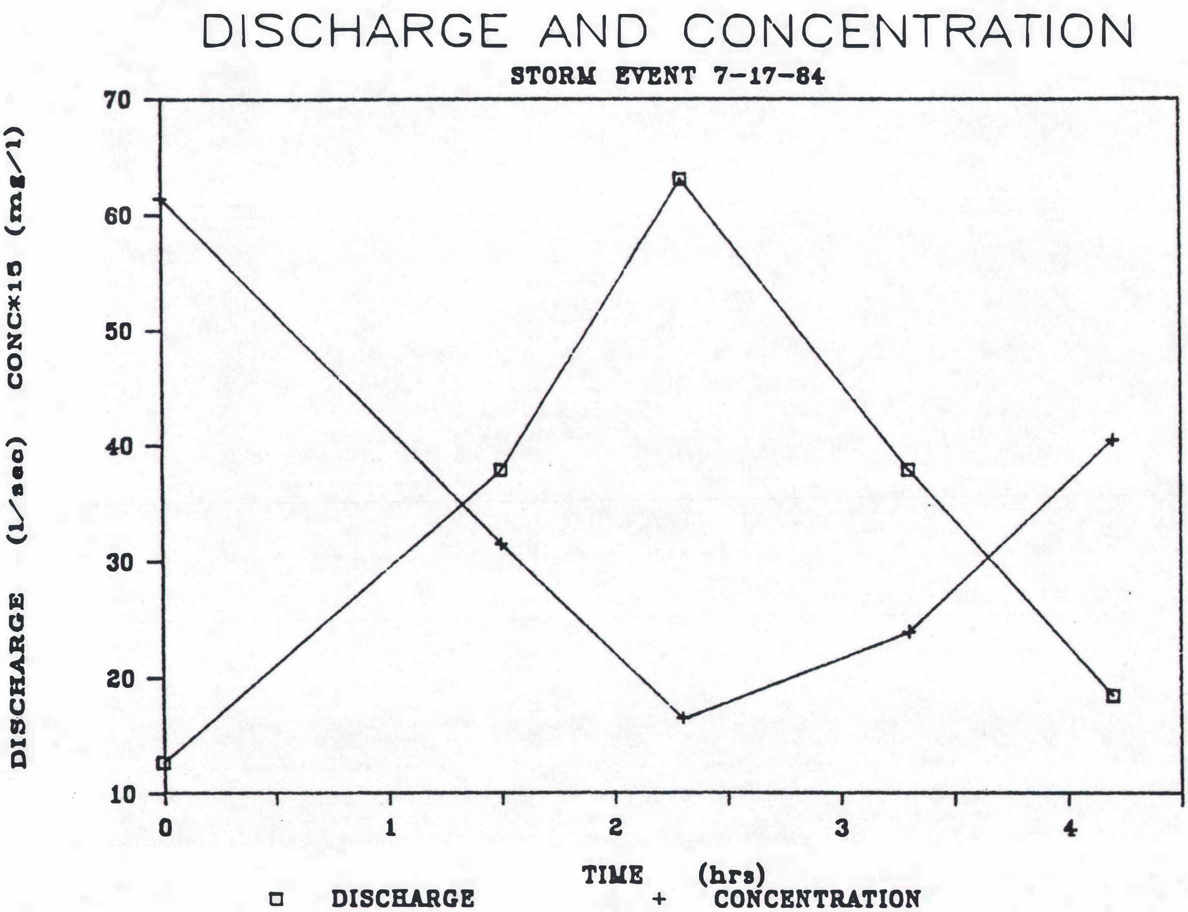


Figure 23. NO_3^--NO_2^- Concentration and Discharge vs. Time for Storm Event 7-17-84.

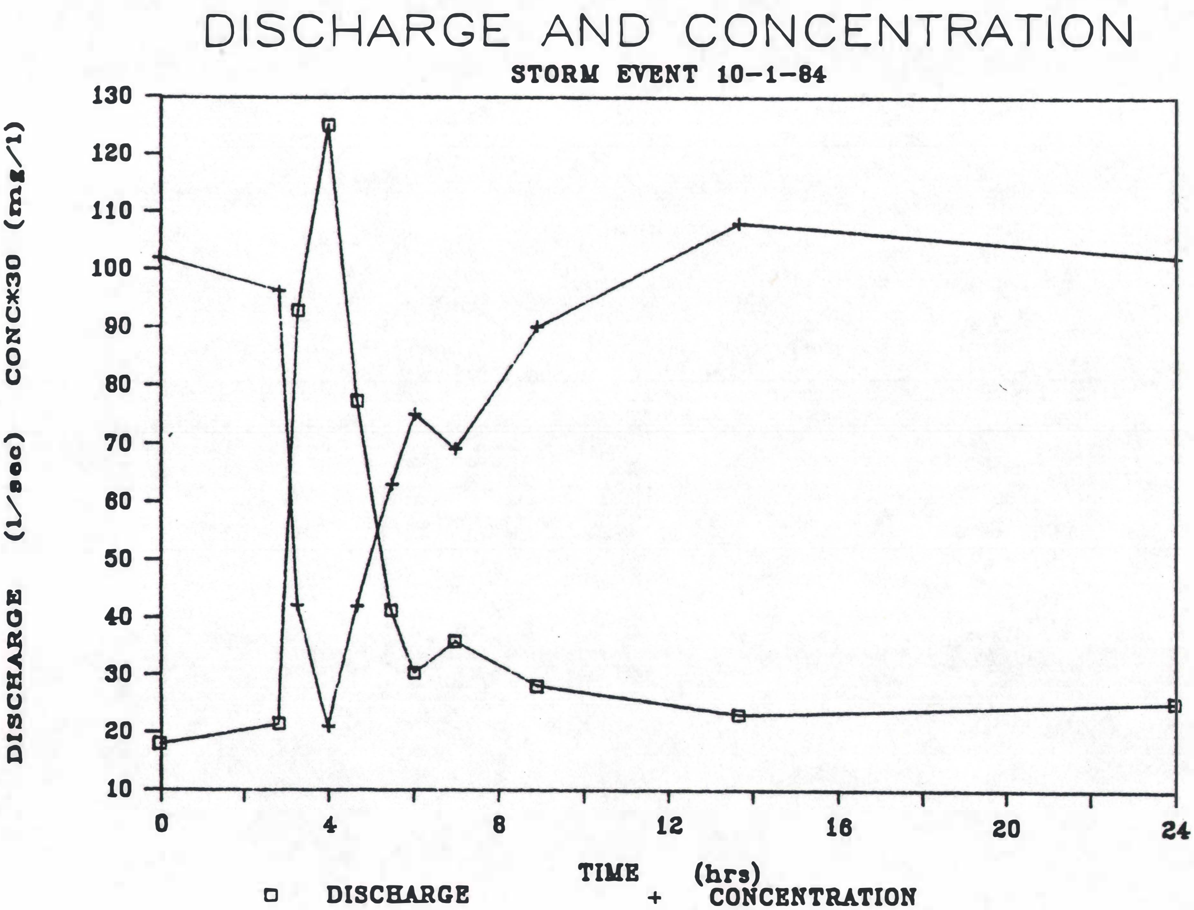


Figure 24. NO_3^--NO_2^- Concentration and Discharge vs. Time for Storm Event 10-1-84.

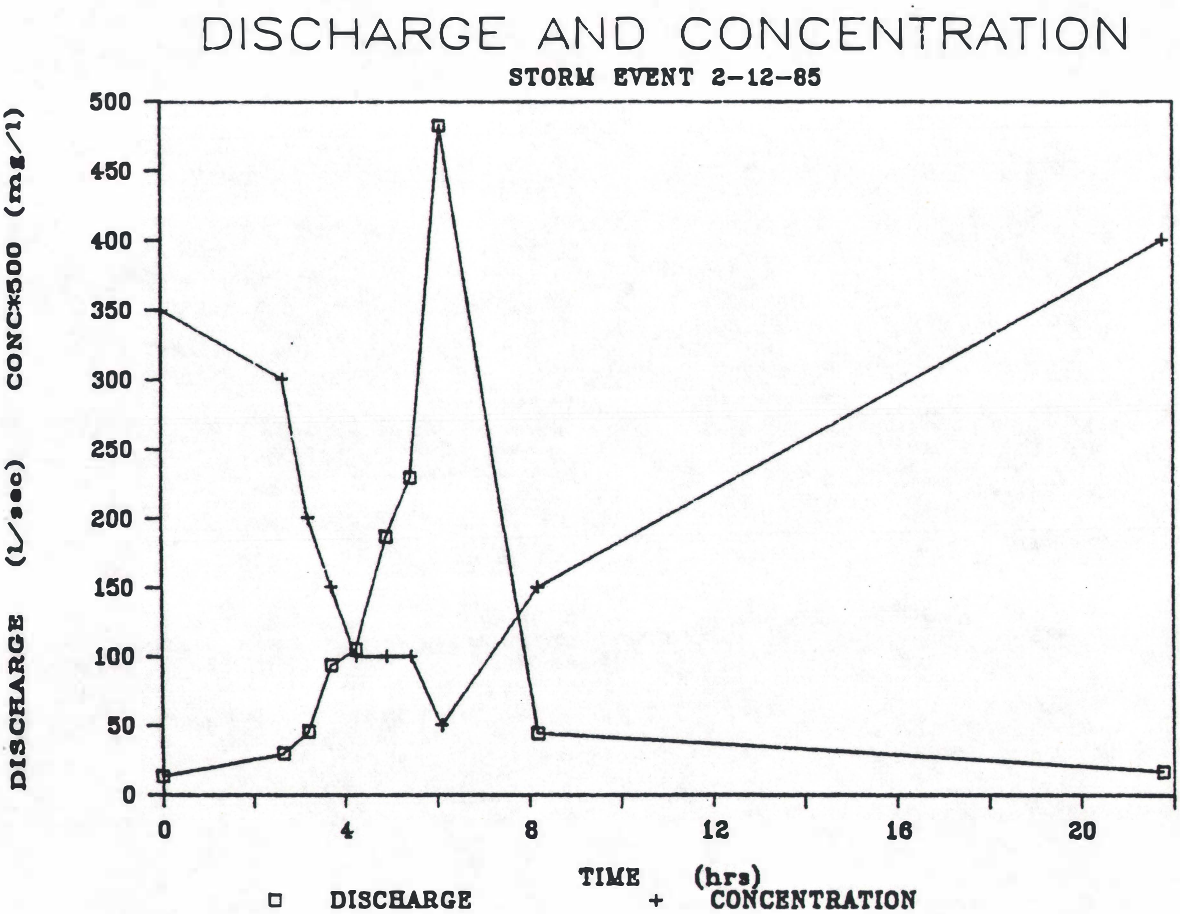


Figure 25. NO_3^--NO_2^- Concentration and Discharge vs. Time for Storm Event 2-12-85.

groundwater present in the pipe. The groundwater is high in nitrate - nitrite concentration. Nitrogen loading still occurs even though the concentration (mg N/l) decreases with time over the storm event since the discharge (l/sec) increses over the storm event. Figures 26 and 27 show the NH_4^+ loading for the October and February storm events respectively. Figures 28, 29 and 30 show the same information for NO_3^--NO_2^-. Total N loading and recorded rainfall for each of the three dates are given in Table 12.

Using these three points, linear relationships between total NH_4^+ loading and rainfall and total NO_3^--NO_2^- loading and rainfall were calculated. The equation for the lines that best describe these relationships are:

- for NH_4^+

$$NH = 10848.2 (R) - 13721.9$$

$$r^2 = 1.0$$

- for NO_3^--NO_2^-

$$NO = 9887.0 (R) - 385.1$$

$$r^2 = -0.028$$

where NH = Total ammonia loading (g)
NO = Total nitrate-nitrite loading (g)
R = Rainfall amount (cm)
r^2 = Correlation coefficient

A correlation coefficient of positive one indicates only two data points were used. A correlation coefficient close to positive one indicates the data are strongly positively correlated. The relationship of NO_3^--NO_2^- to rainfall therefore, is not highly significant indicating that storm events are not controlling the amount of NO_3^--NO_2^- going into the Pond. Figures

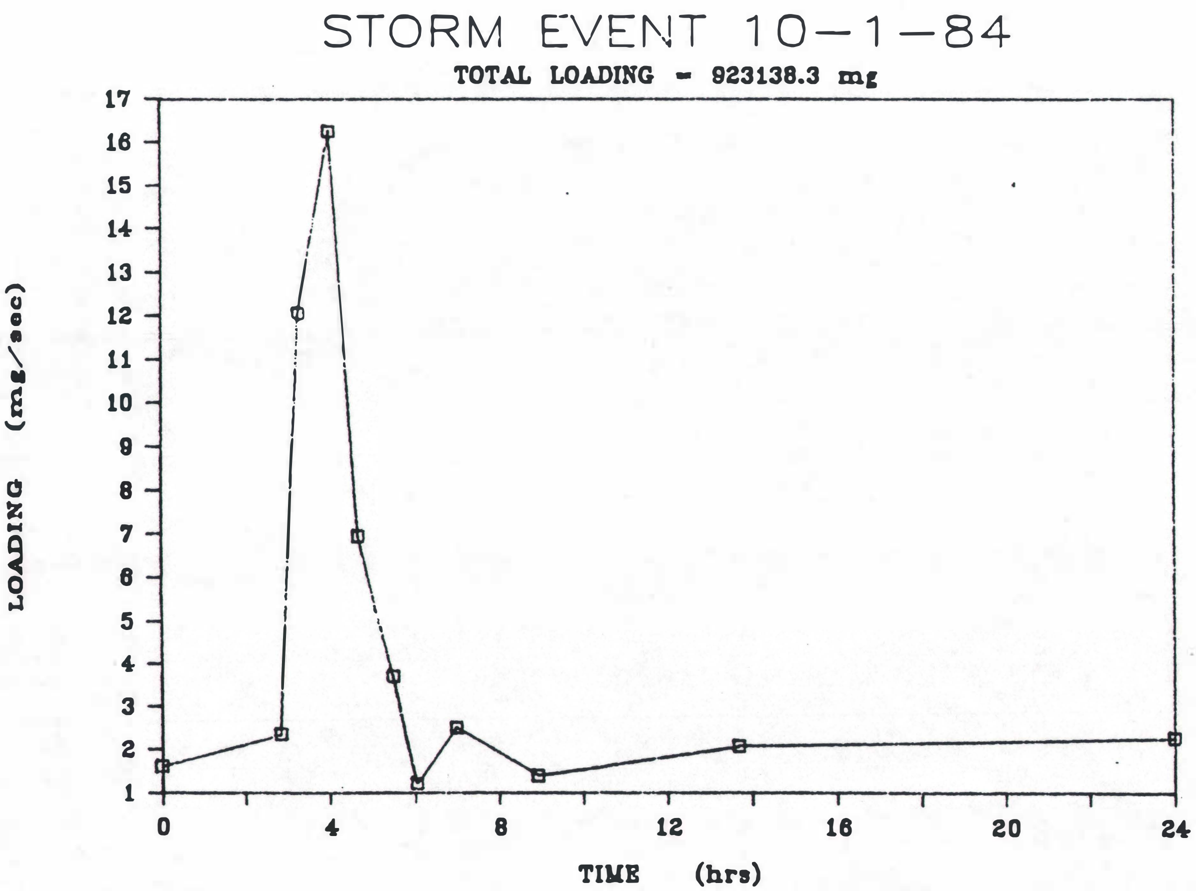


Figure 26. NH_4^+ Loading for Storm Event 10-1-84.

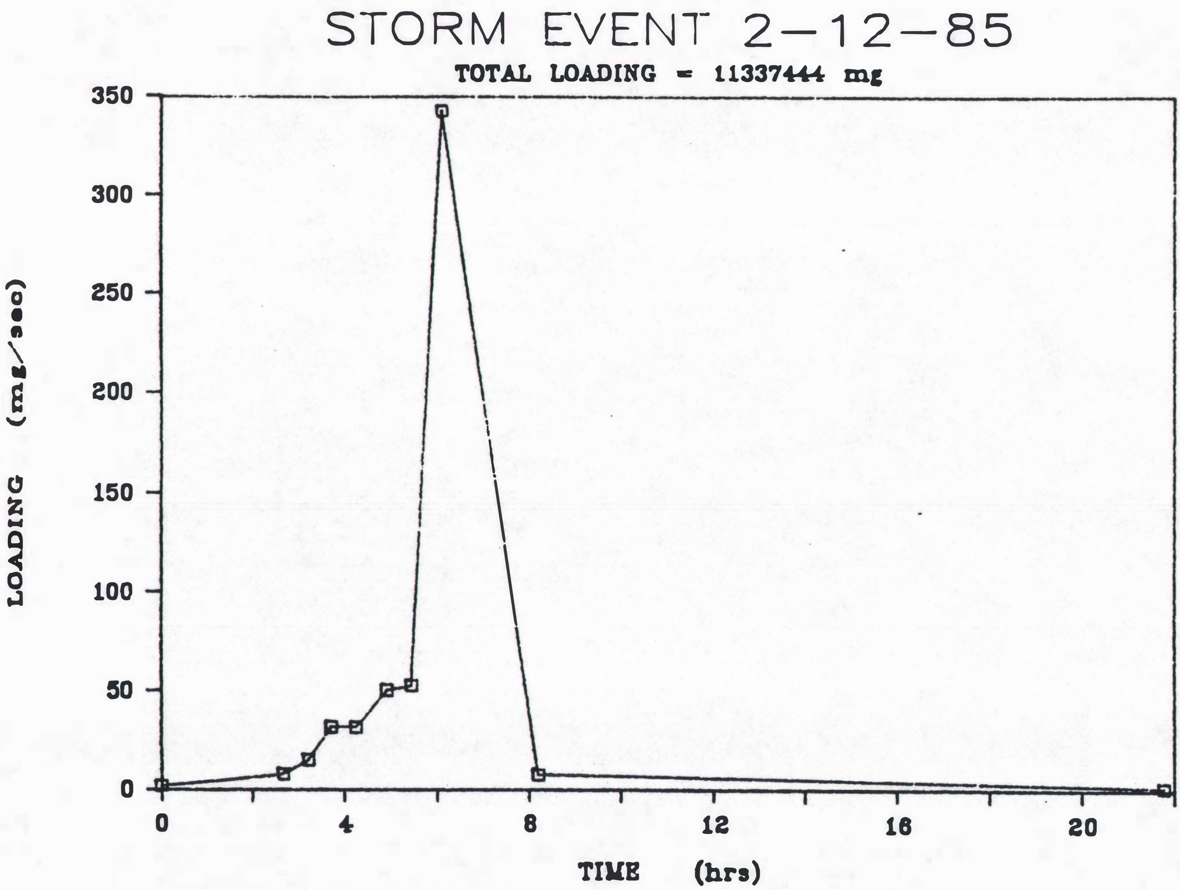


Figure 27. NH_4^+ Loading for Storm Event 2-12-85.

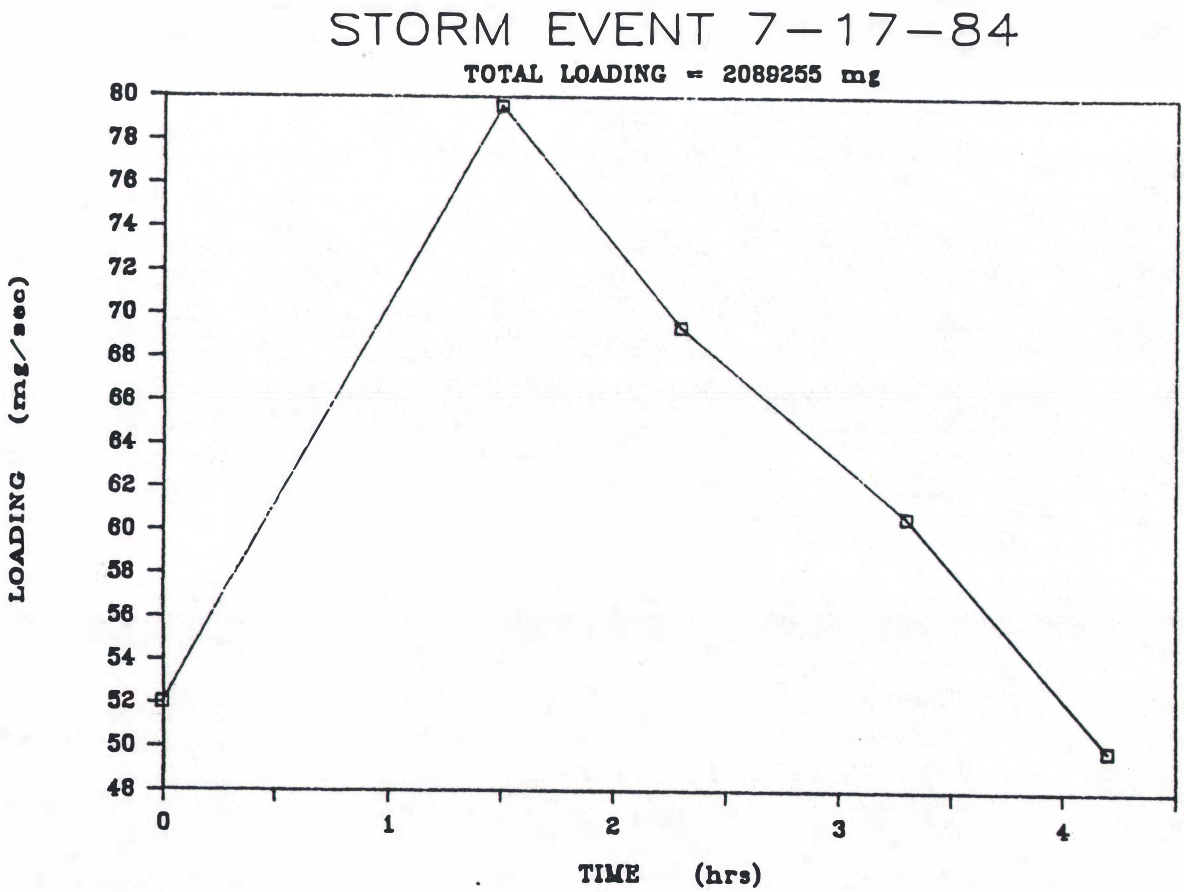


Figure 28. NO_3^--NO_2^- Loading for Storm Event 7-17-84.

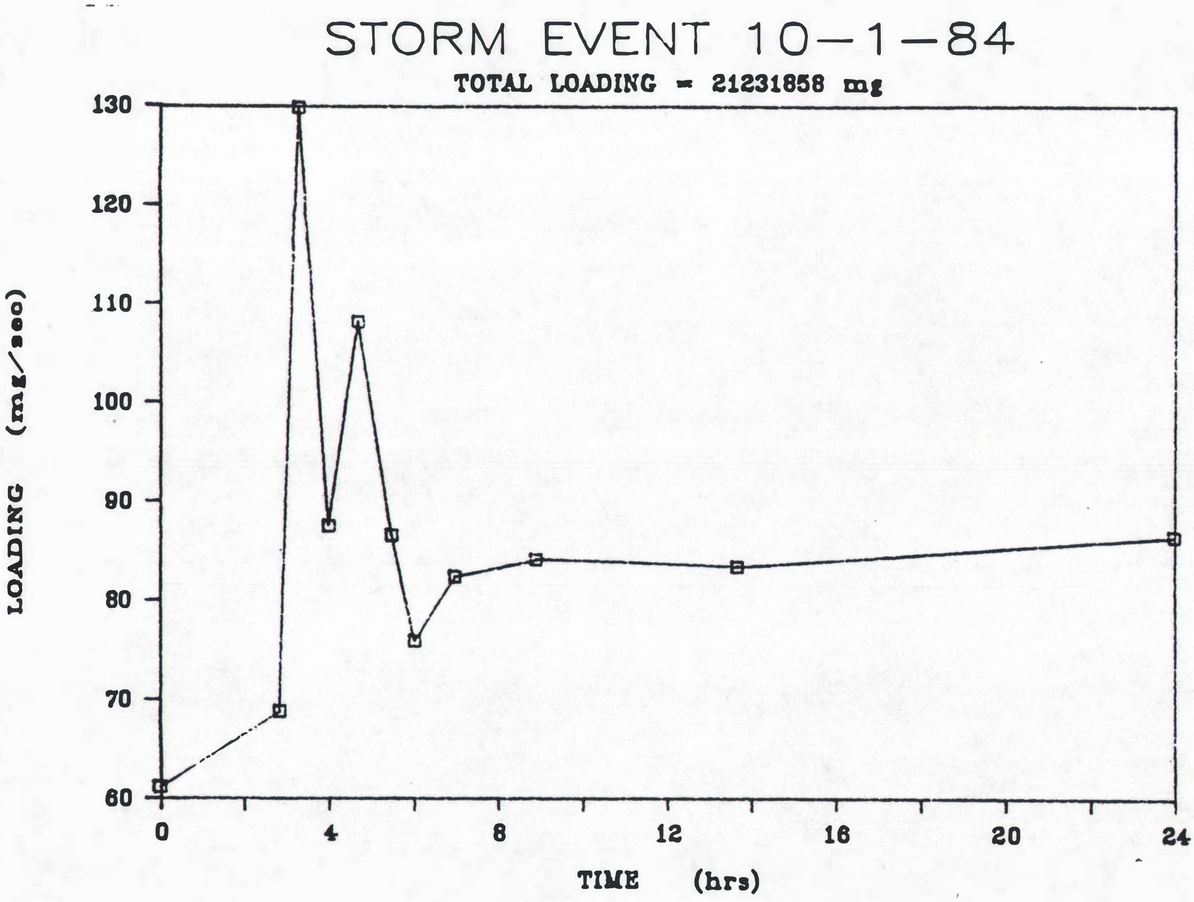


Figure 29. NO_3^--NO_2^- Loading for Storm Event 10-1-84.

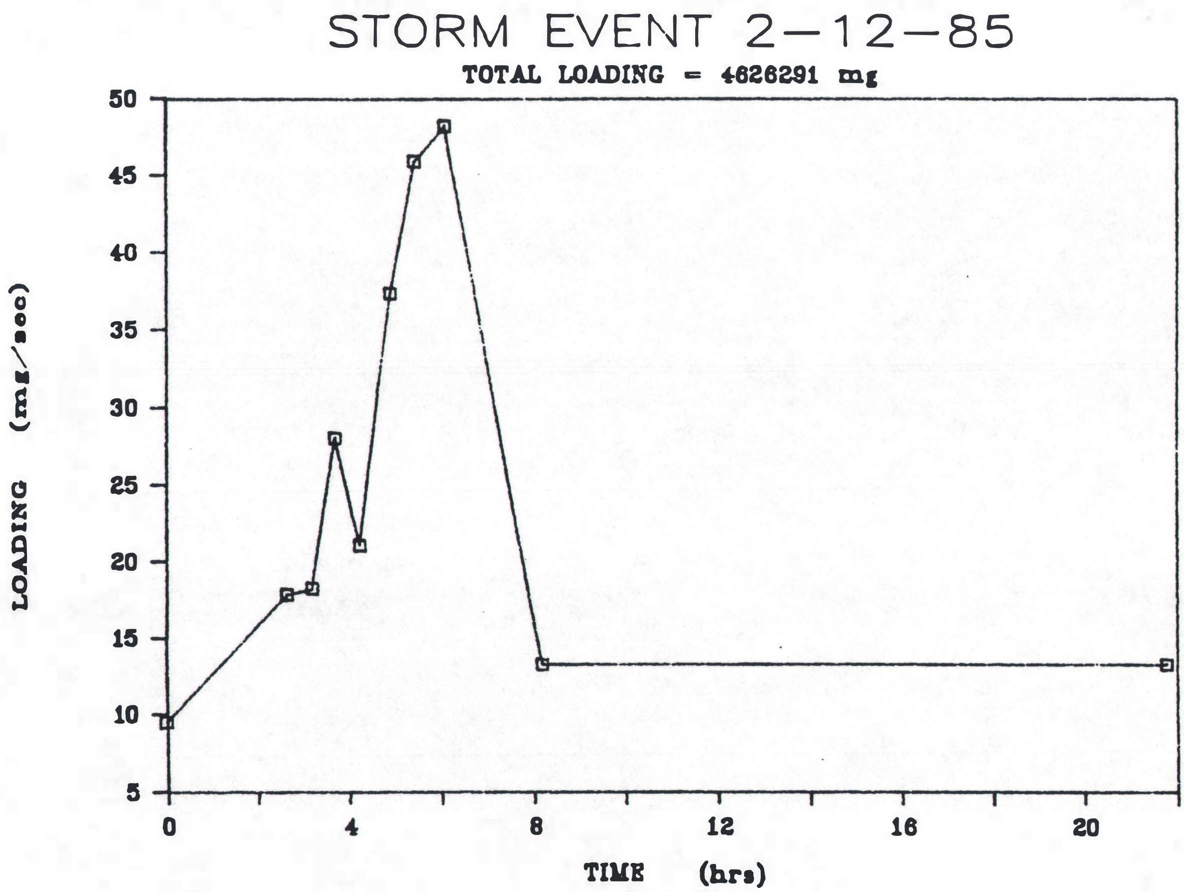


Figure 30. NO_3^{-}-NO_2^{-} Loading for Storm Event 2-12-85.

DATE	TOTAL LOADING		RAIN AMOUNT	
	NH_4^+ (g)	$NO_3^- - NO_2^-$ (g)	(cm)	(in)
7-17-84		2089.3	0.79	0.31
10-1-84	923.14	21231.9	1.35	0.53
2-12-85	11337.4	4626.3	2.31	0.91

Table 12. Data Points for Linear Relationships of Nitrogen Loading to Rainfall.

31 and 32 show the calculated and measured relationships of NH_4^+ loading and NO_3^--NO_2^- loading to rainfall.

Monthly Tables of recorded rainfall in Setauket, NY are in Appendix I. These tables include an estimate of NH_4^+ and NO_3^--NO_2^- loading for each storm recorded. The estimates are based on the above equations. A summation of all the estimated nitrogen loading for all storm events from June, 1984 to May, 1985 yields 460.7kg of NH_4^+-nitrogen (1015.7 lbs) and 857.3kg of NO_3^--NO_2^--nitrogen (1889 lbs) discharged from the pipe annually. During this year, 18.83 days had precipitation and 346.17 days were dry. Nutrient discharge from the pipe on these dry days varied over the year, but a rough estimate can be made by taking the average NH_4^+ and NO_3^--NO_2^- concentration of the pipe water from sampling dates of normal flow. Thus on dry days, the pipe discharged 1.3 mg NH_4^+-N/l (559.9kg annually) and 3.1 mg NO_3^--NO_2^--N /l (1335.1kg annually). Combining this with the annual storm loading value, 1020.6kg of ammonia and 2192.4kg of nitrate-nitrite enter the Pond every year through the pipe. These nutrients are a soluble form of nitrogen, so most of this will not remain in the Pond, yet this nutrient load must be considered when deciding the possible relocation of the pipe.

4.3 Phosphorus Loading

Phosphorus nutrients discharged from the pipe needed to be measured over the course of at least three storm events in order to describe a linear relationship between nutrient loading and rainfall. Using this relationship, an estimate of the additional

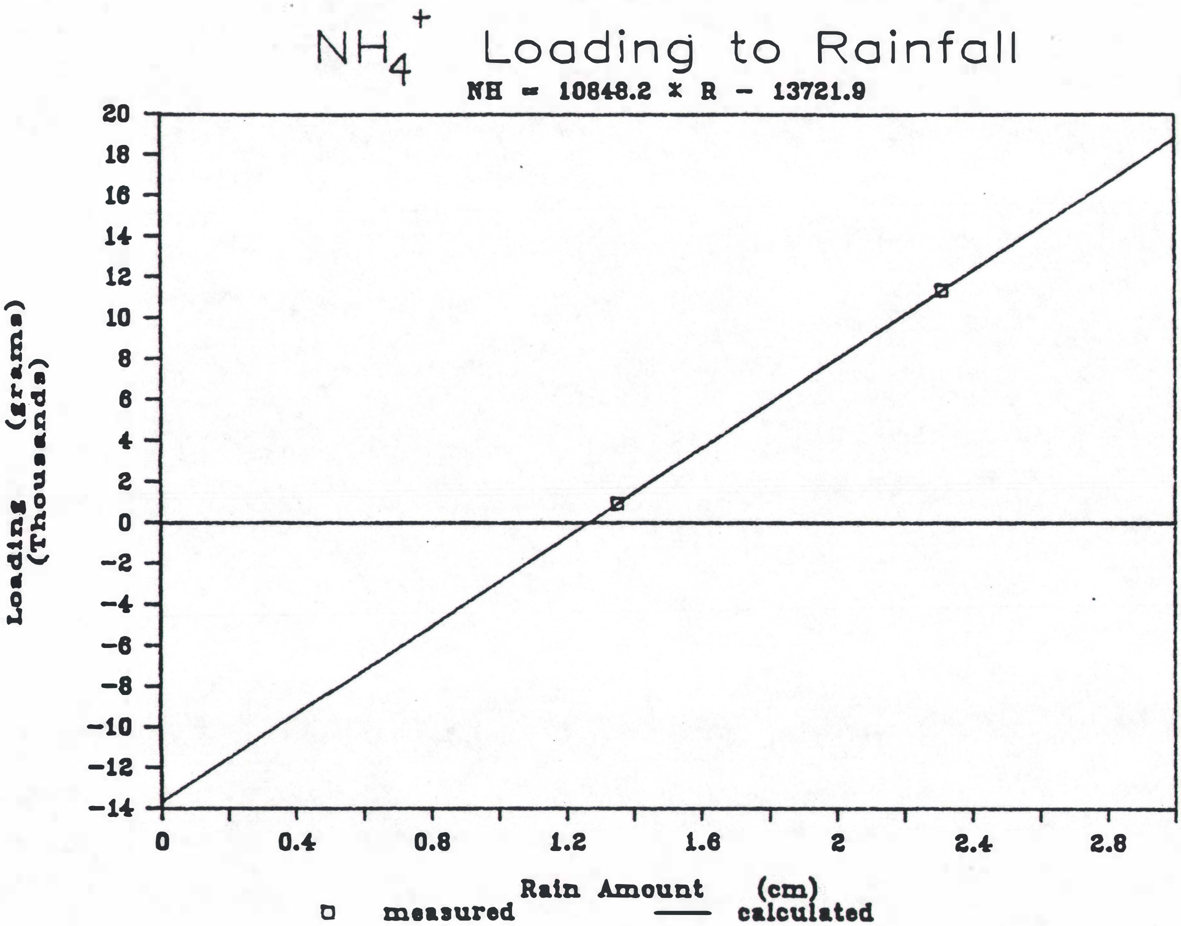


Figure 31. Measured and Calculated Relationship of NH_4^+ Loading to Rainfall

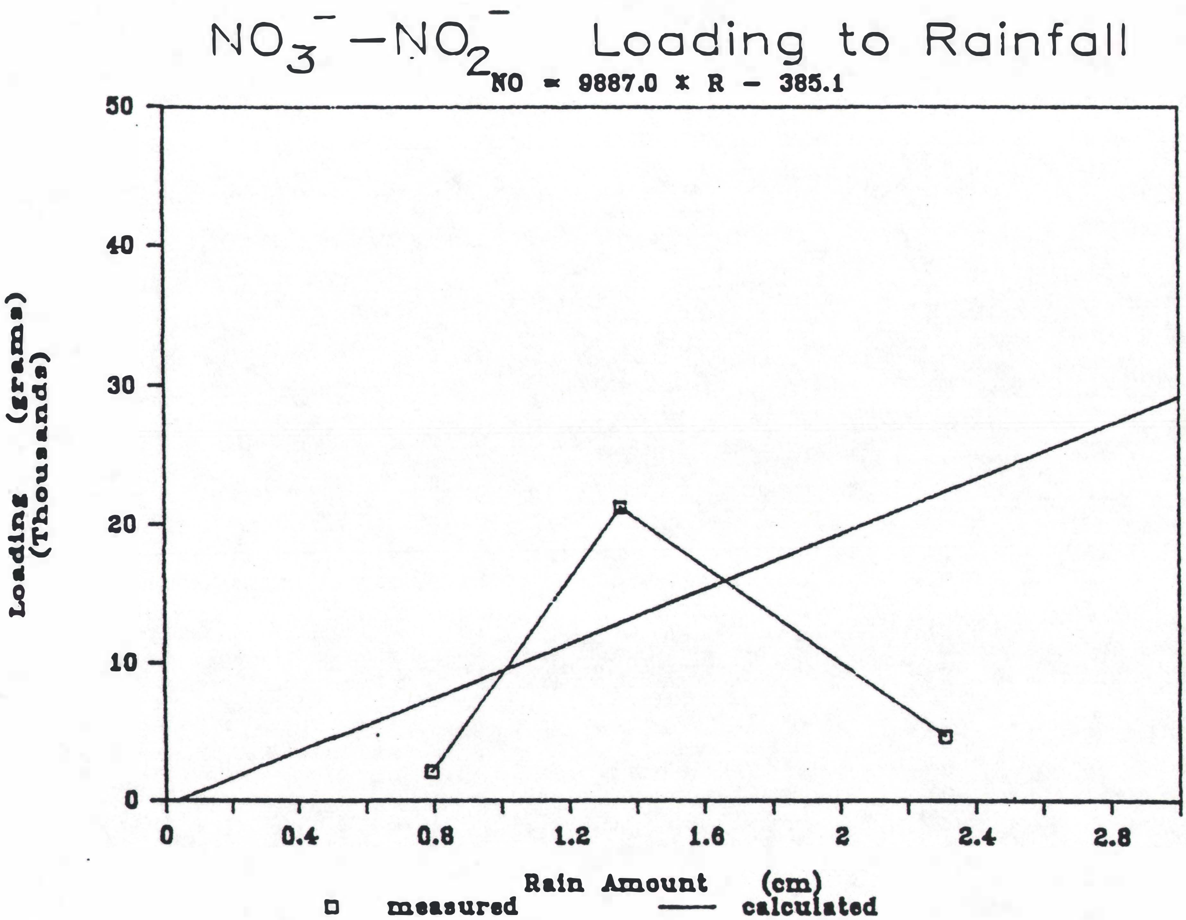


Figure 32. Measured and Calculated Relationship of NO_3^--NO_2^- Loading to Rainfall.

phosphorus brought into the Pond by the pipe during storms can be calculated.

Methods

Three storm events were sampled: July 17, 1984, October 1, 1984, and February 12, 1985. Water samples were taken at the same time velocity was measured before, during and after a storm event. Samples were taken back to the lab, filtered and analyzed as in the methods for routine chemical analysis outlined in Section 3.2. Plots of Soluble Reactive Phosphorus (SRP) concentration and Total Phosphorus (TP) concentration vs. time were prepared. The discharge of nutrients (loading) from the pipe was calculated as water discharge X P-concentration for each of the two phosphorus species. An integration of the curve of phosphorus loading vs. time summed the nutrient loading over the course of the storm event to calculate the total loading of SRP and Total P from the pipe during the storm.

Total loading from the pipe for each storm event was plotted against the recorded rain amount at Setauket, NY for those storms. The equation for the line describing the relationship between SRP or Total P loading and rainfall was found using least square linear regression analysis. Using this relationship, total SRP and TP loading was calculated for storm events that were not sampled throughout the year.

Results

Figures 33, 34 and 35 show the plots of SRP concentration and discharge vs. time for the storm events on July 17, 1984, October 1, 1984 and February 12, 1985 respectively. Figures 36, 37 and 38 show the same information for TP. Note that the SRP concentration increases only slightly. Total P concentration increases dramatically over the course of the storm. Figures 39, 40 and 41 show the SRP loading for the July, October and February storm events respectively. Figures 42, 43 and 44 show the same information for Total P. Phosphorus loading and recorded rainfall for each of the three dates are given in Table 13.

Using these three points, linear relationships between total SRP loading and rainfall and total TP loading and rainfall were calculated. The equation for the lines that best describe these relationships are:

- for SRP

$$SRP = 850.88\,(R) - 765.87$$

$$r^2 = 0.9706253$$

- for TP

$$TP = 7709.16\,(R) - 7138.19$$

$$r^2 = 0.9649362$$

where SRP = Total soluble reactive phosphorus loading (g)
TP = Total phosphorus loading (g)
R = Rainfall amount (cm)
r^2 = Correlation coefficient

A correlation coefficient close to positive one indicates the data are strongly positively correlated and that the equation for the line describes the relationship of the data very well. Figures 45 and 46 show the calculated and measured relationships of SRP loading and TP loading to rainfall.

Monthly Tables of recorded rainfall in Setauket, NY are in

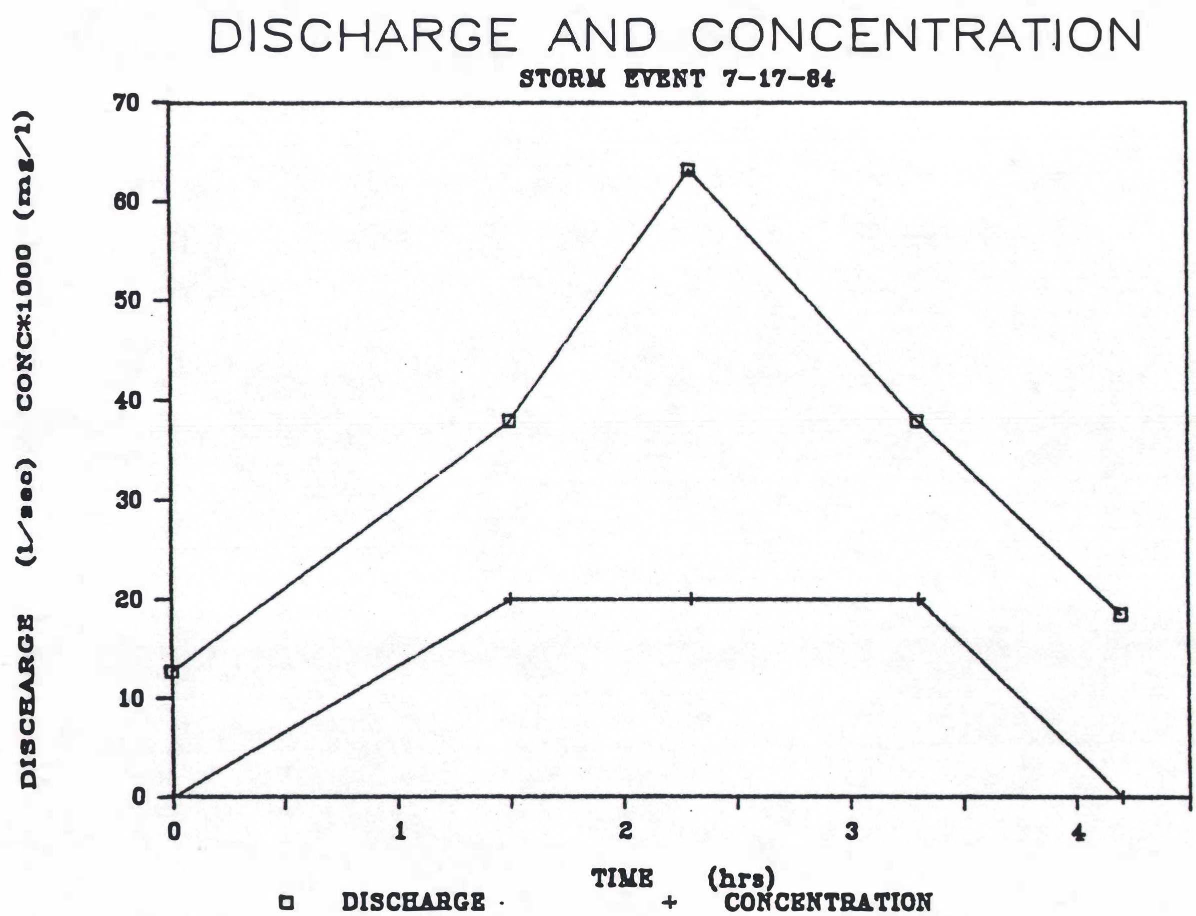


Figure 33. SRP Concentration and Discharge vs. Time for Storm Event 7-17-84.

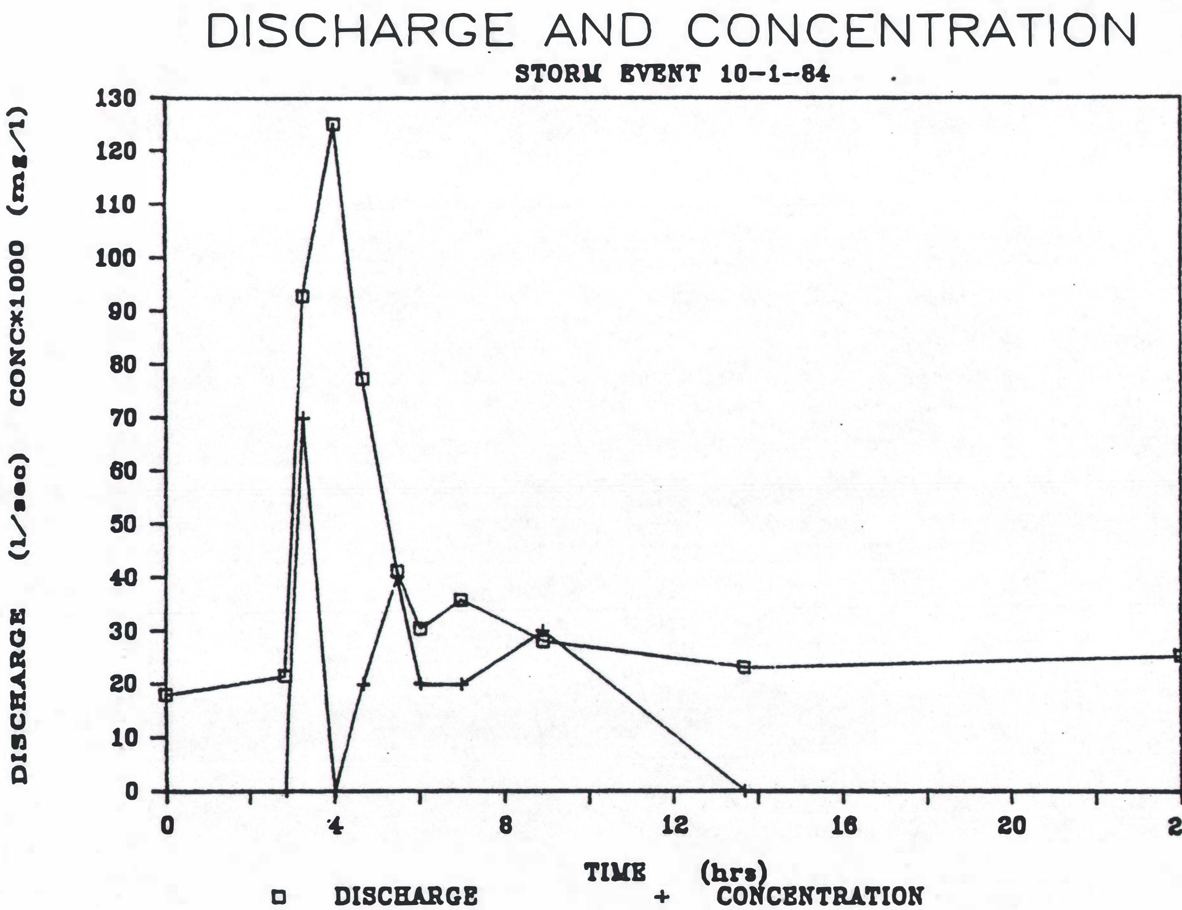


Figure 34. SRP Concentration and Discharge vs. Time for Storm Event 10-1-84.

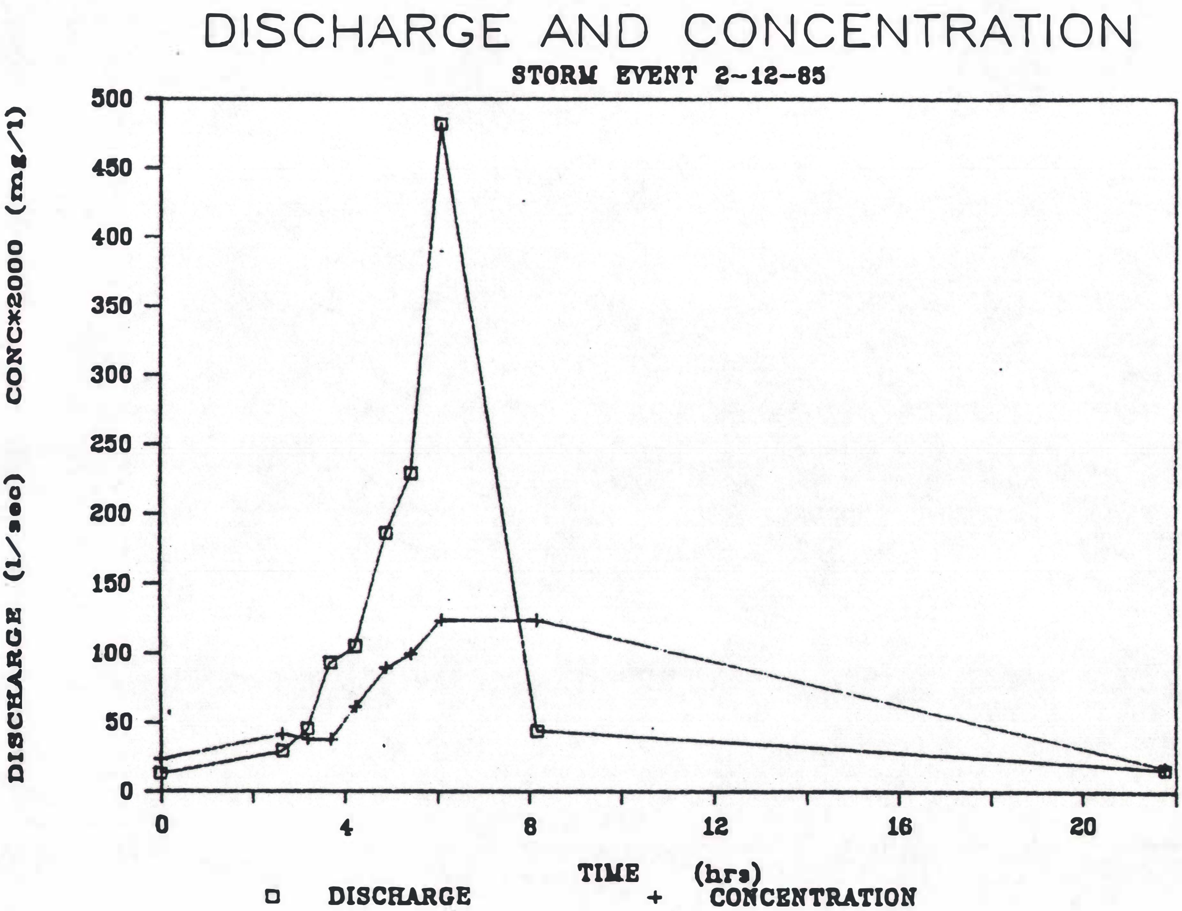


Figure 35. SRP Concentration and Discharge vs. Time for Storm Event 2-12-85.

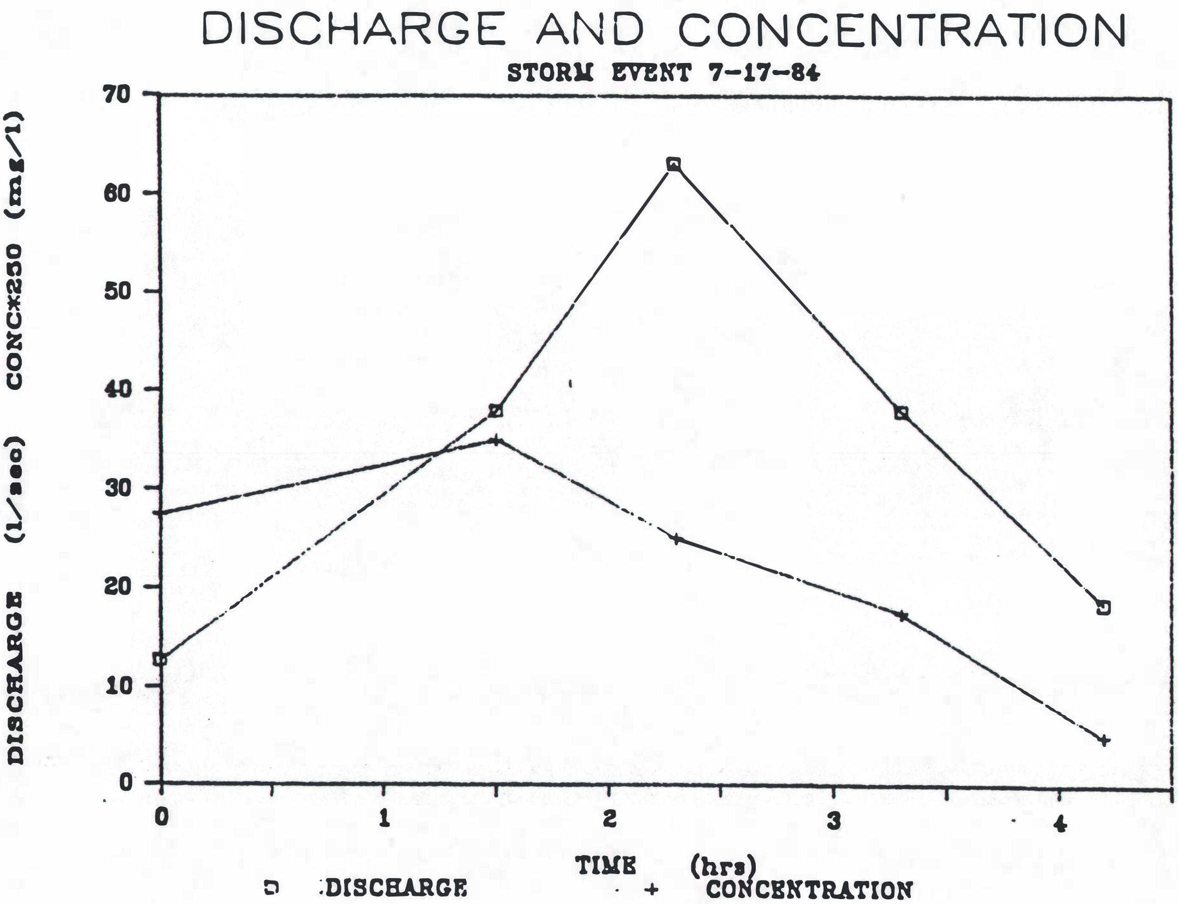


Figure 36. TP Concentration and Discharge vs. Time for Storm Event 7-17-84.

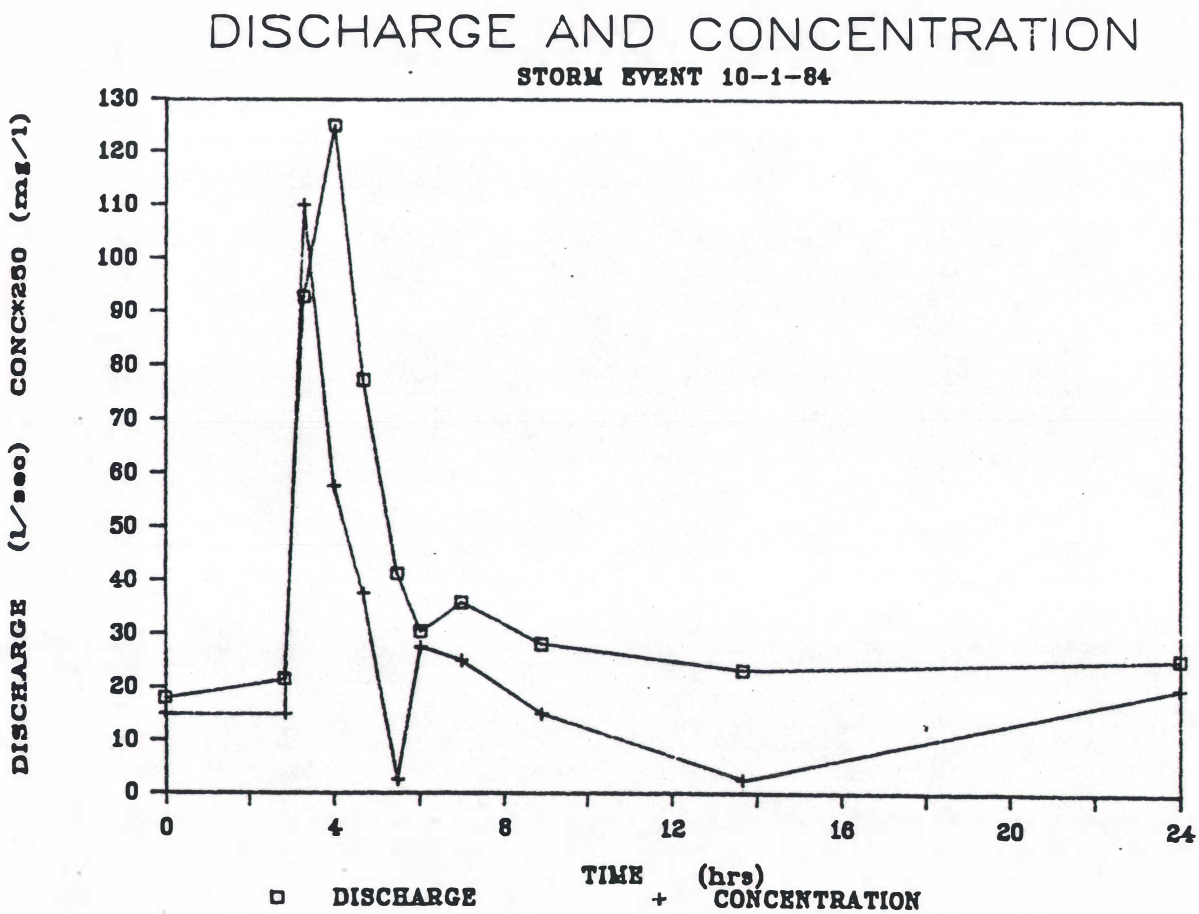


Figure 37. TP Concentration and Discharge vs. Time for Storm Event 10-1-84.

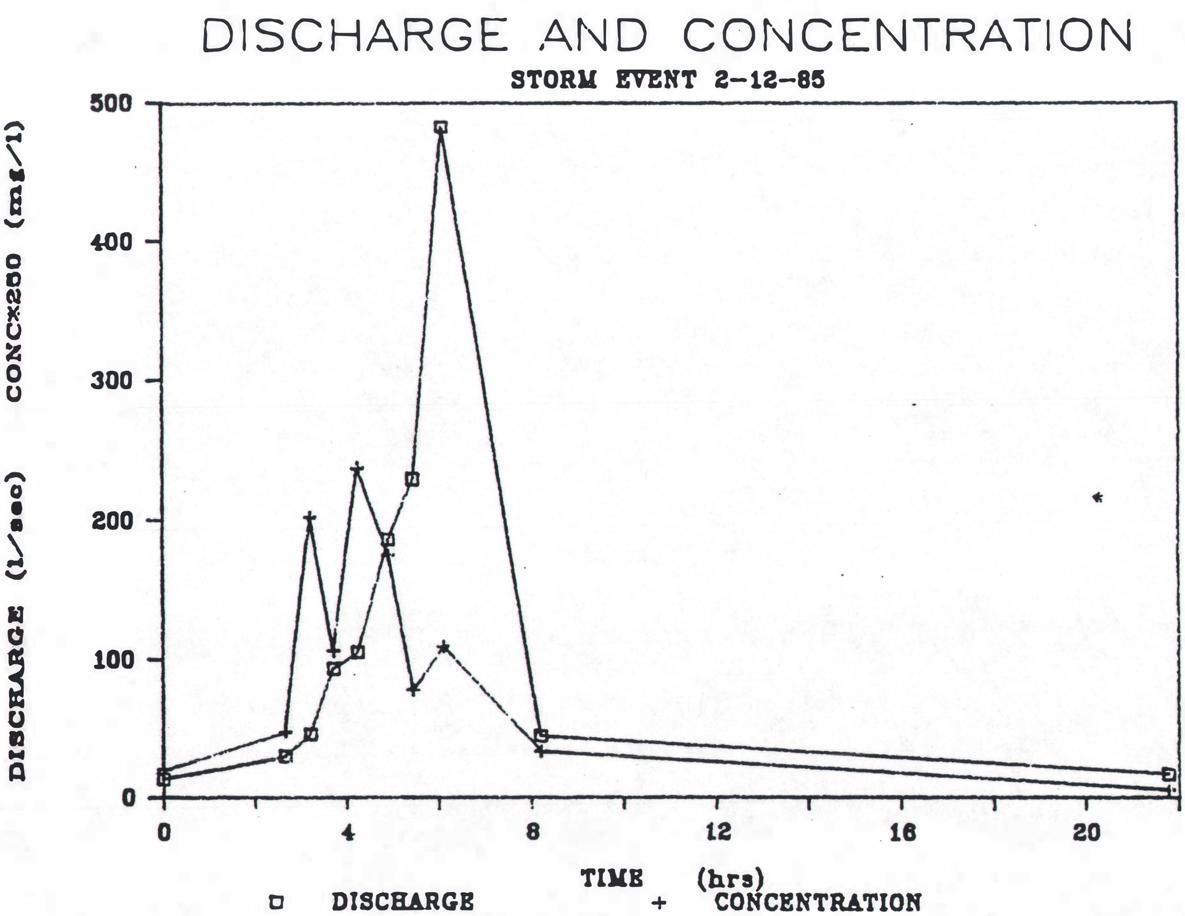


Figure 38. TP Concentration and Discharge vs. Time for Storm Event 2-12-85.

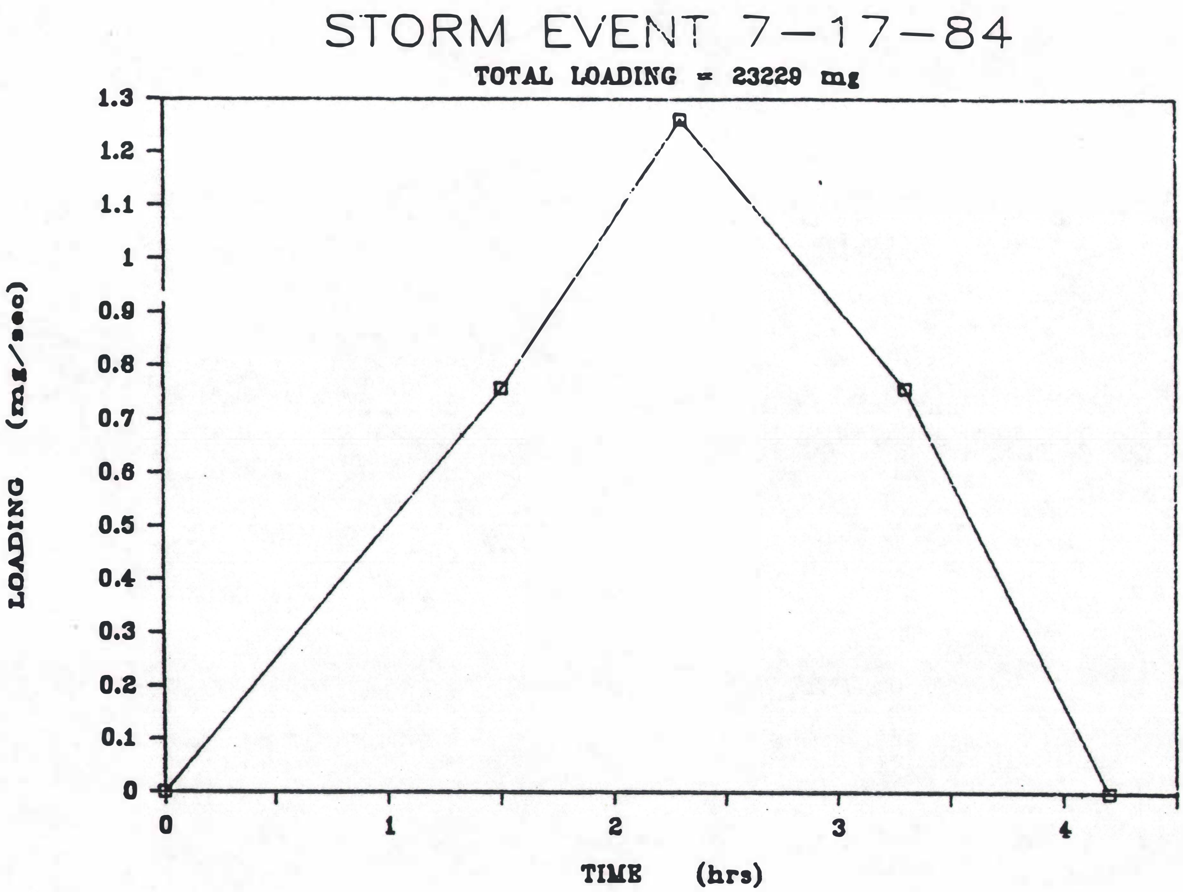


Figure 39. SRP Loading for Storm Event 7-17-84.

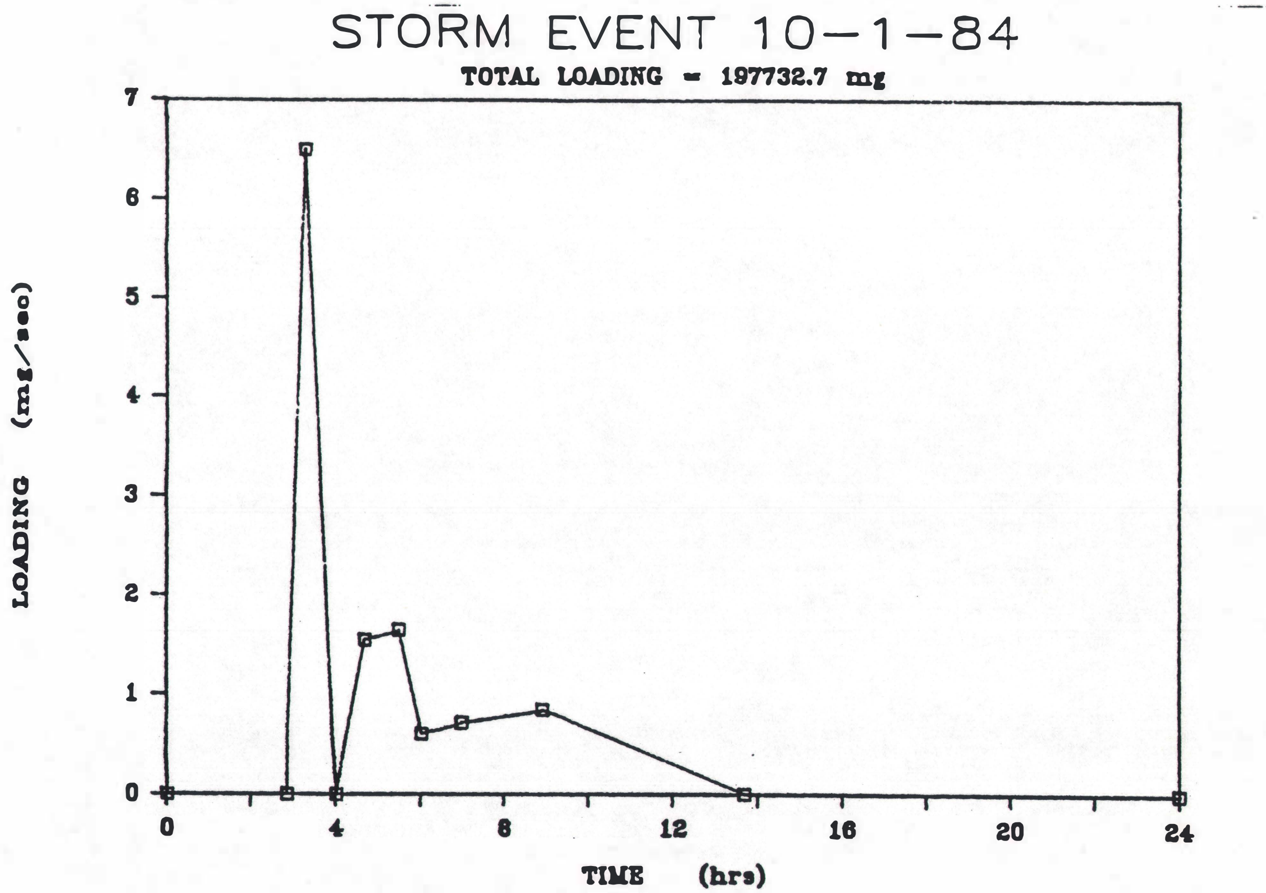


Figure 40. SRP Loading for Storm Event 10-1-84.

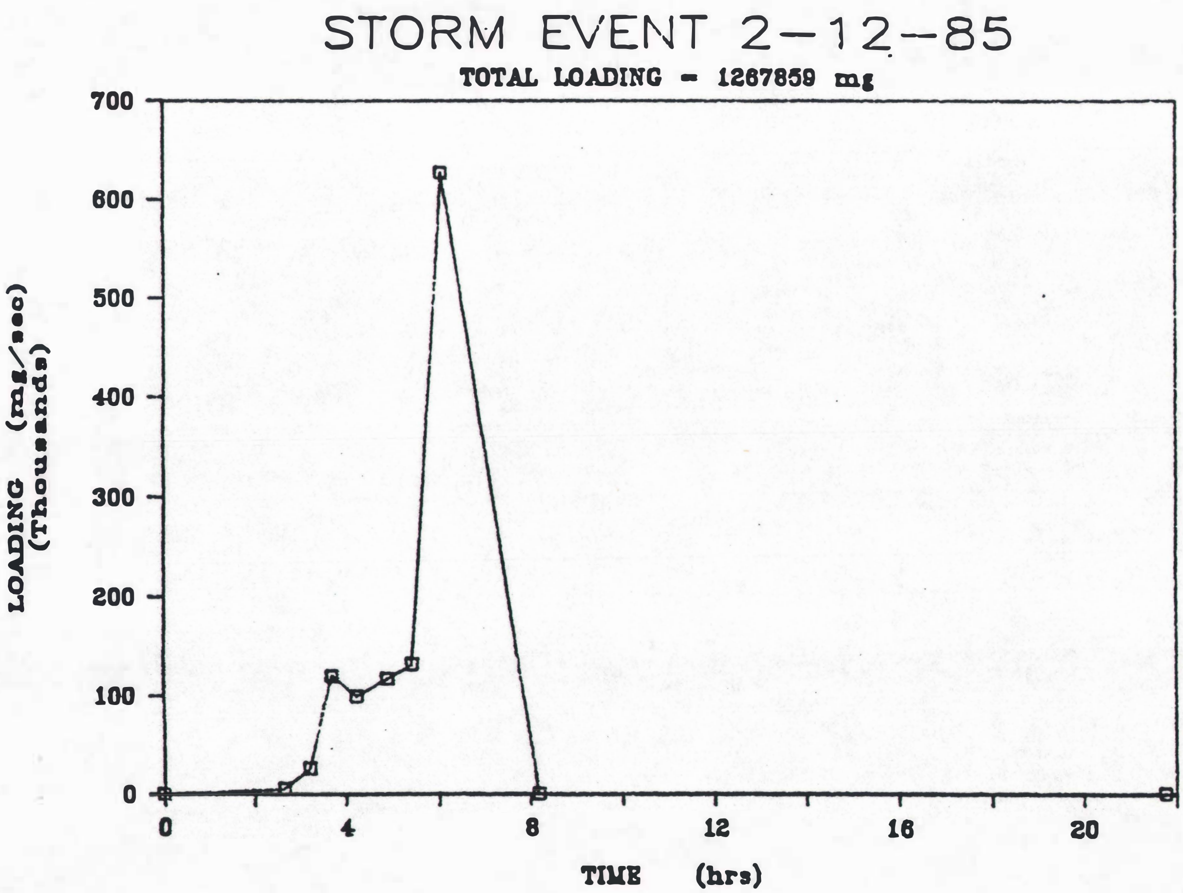


Figure 41. SRP Loading for Storm Event 2-12-85.

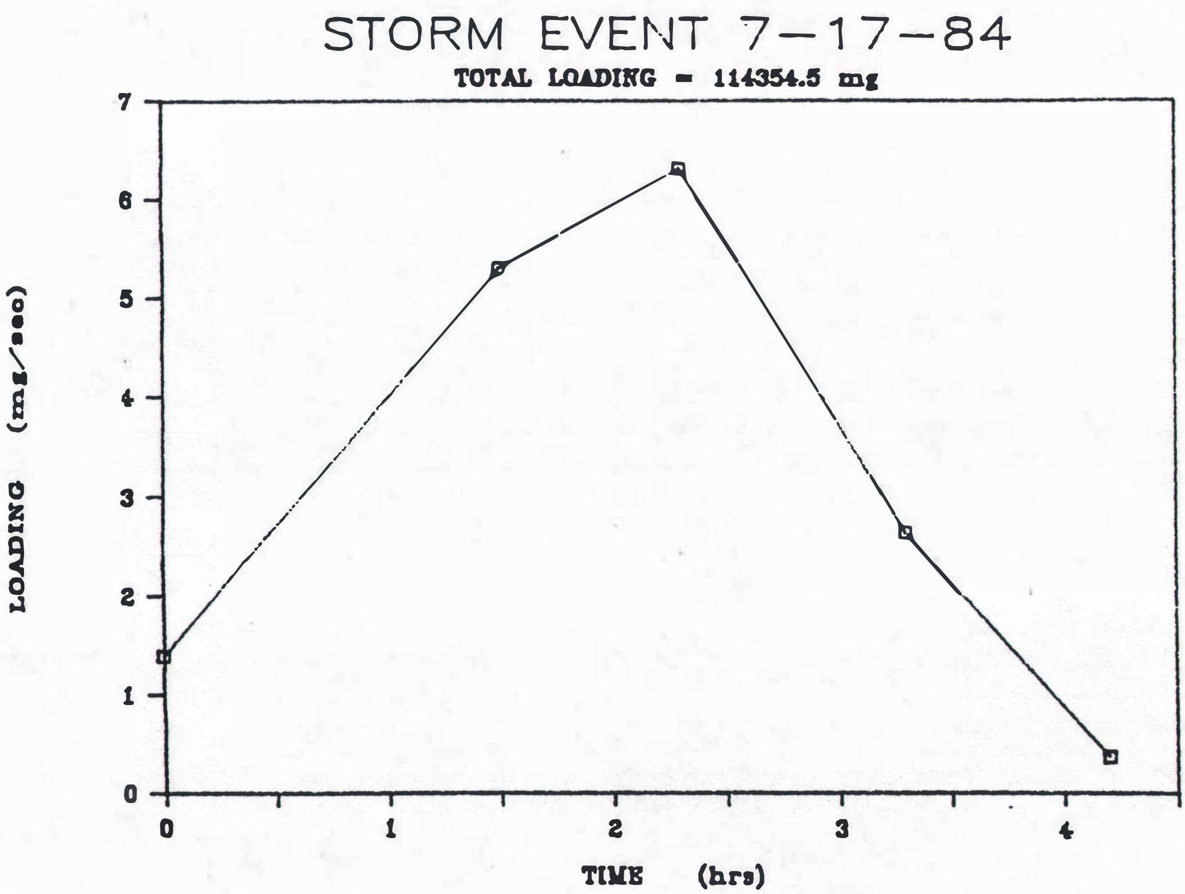


Figure 42. TP Loading for Storm Event 7-17-84.

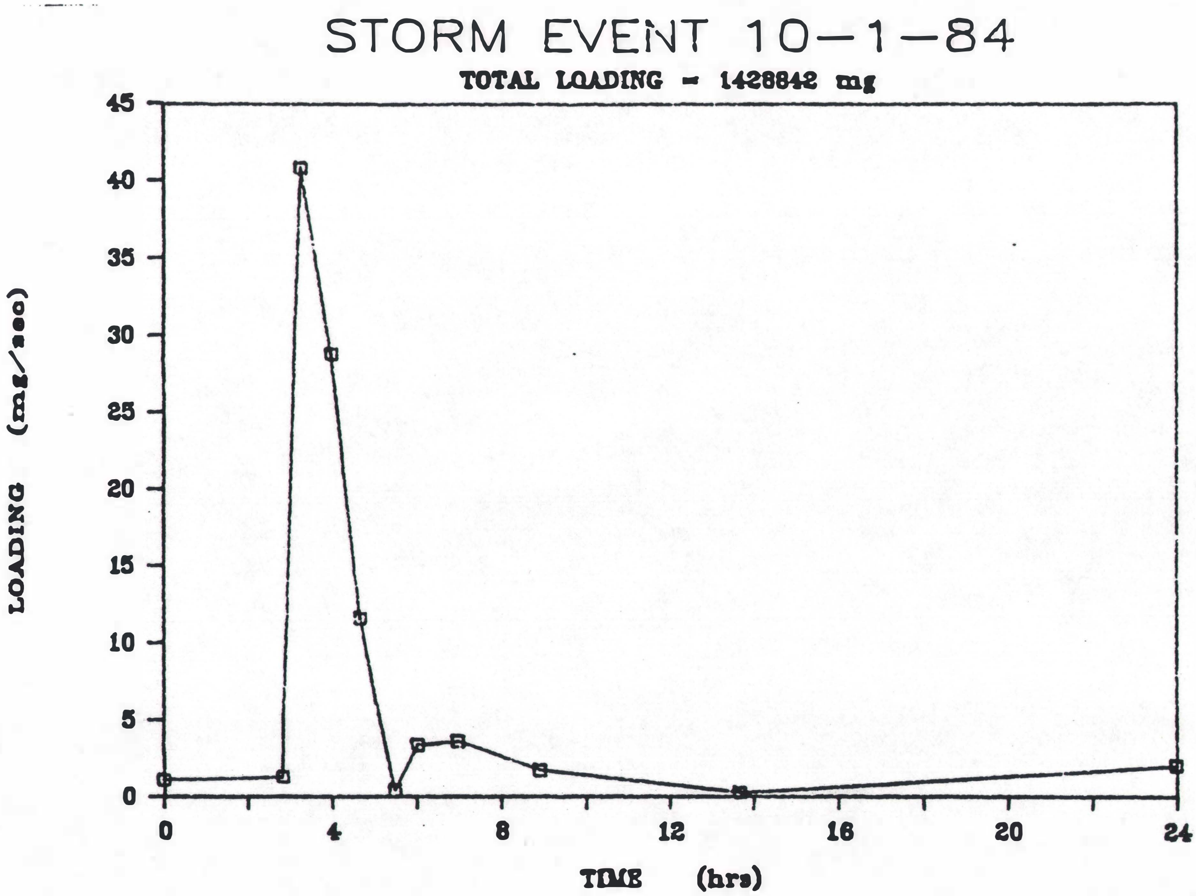


Figure 43. TP Loading for Storm Event 10-1-84.

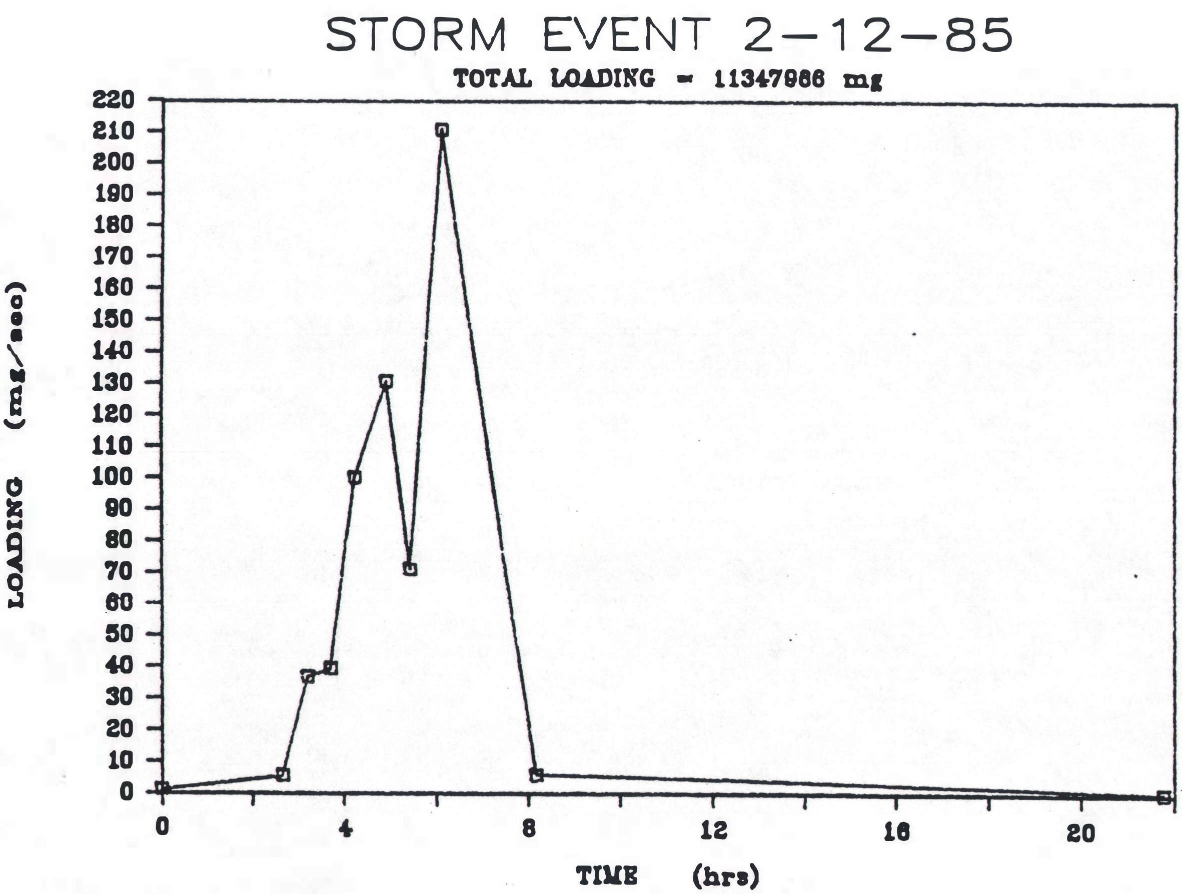


Figure 44. TP Loading for Storm Event 2-12-85.

DATE	TOTAL LOADING		RAIN AMOUNT	
	SRP (g)	TP (g)	(cm)	(in)
7-17-84	23.23	114.35	0.79	0.31
10-1-84	197.73	1428.84	1.35	0.53
2-12-85	1267.86	11347.97	2.31	0.91

Table 13. Data Points for Linear Relationships of Phosphorus Loading to Rainfall.

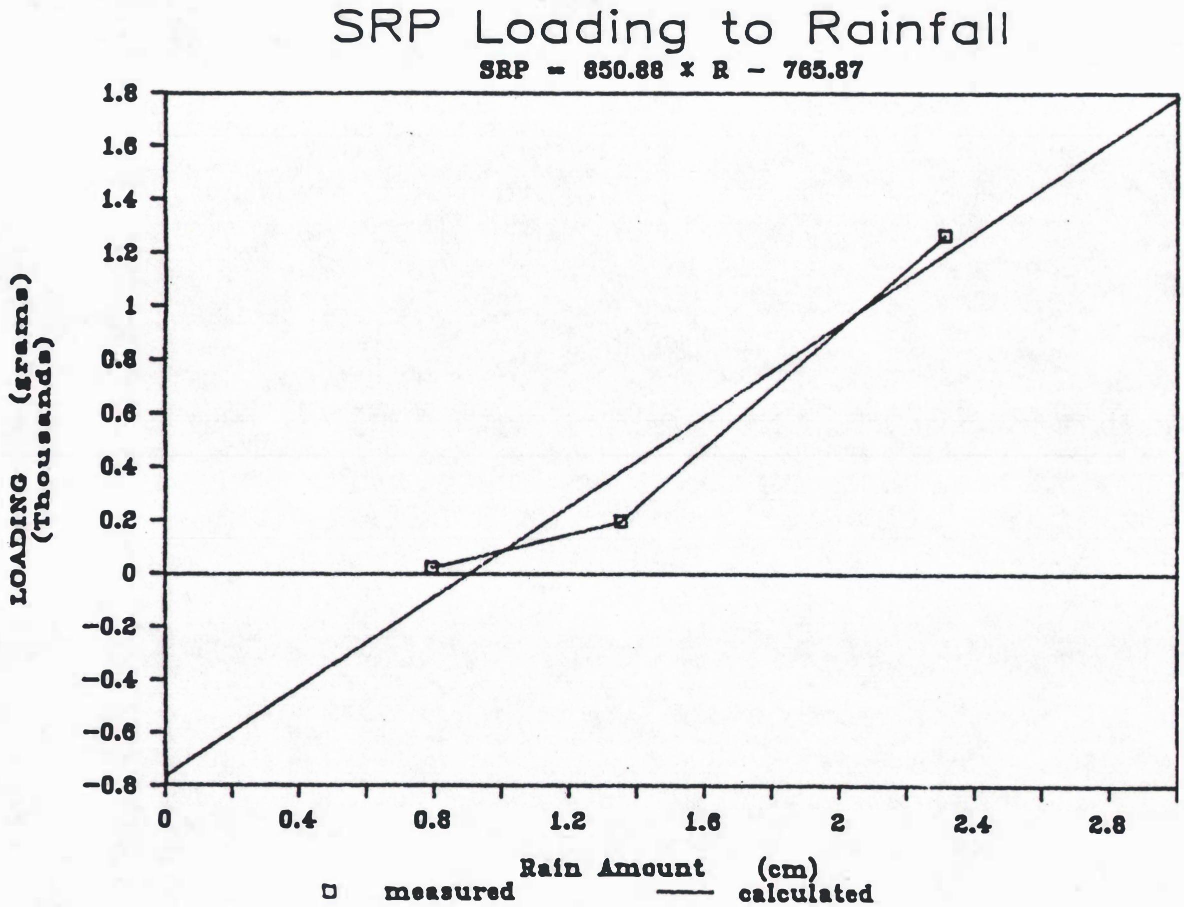


Figure 45. Measured and Calculated Relationship of SRP Loading to Rainfall

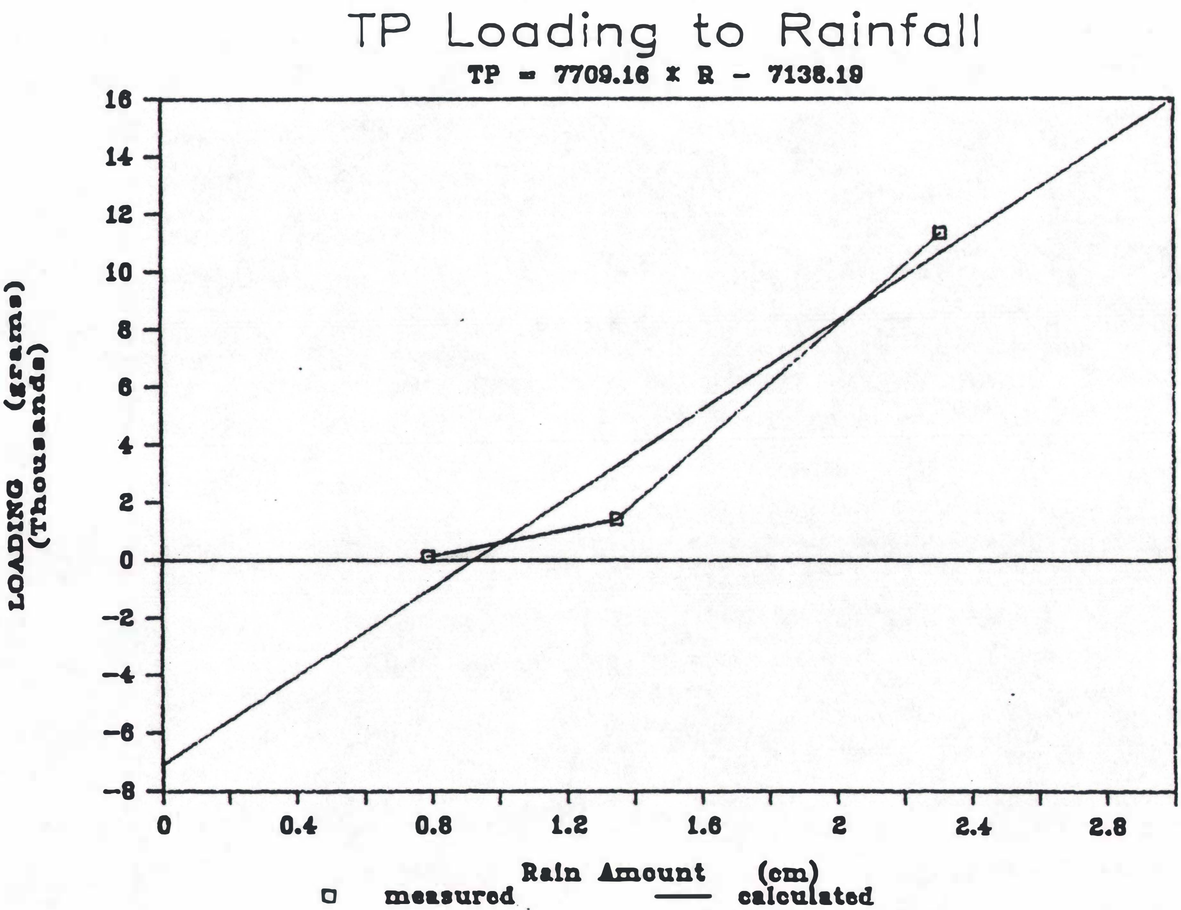


Figure 46. Measured and Calculated Relationship of TP Loading to Rainfall

Appendix I. These tables include an estimate of SRP and TP loading for each storm recorded. The estimates are based on the above equations. A summation of all the estimated phosphorus loading for all storm events from June, 1984 to May, 1985 yields 44.96kg of SRP-phosphorus (99.12 lbs) and 388.9kg of TP-phosphorus (857.4 lbs) discharged from the pipe annually. During this year, 18.83 days had precipitation and 346.17 days were dry. Nutrient discharge from the pipe on these dry days varied over the year, but a rough estimate can be made by taking the average SRP and TP concentration of the pipe water from sampling dates of normal flow. Thus on dry days, the pipe discharged 0.03mg SRP-P/l (12.92kg annually) and 0.03 mg TP-P /l (12.92kg annually). Combining this with the annual storm loading value, 57.88kg of soluble reactive phosphorus and 401.82kg of total phosphorus enter the Pond every year through the pipe. Most of the soluble form of phosphorus, SRP, will not remain in the Pond. Most of Total phosphorus is in the particulate form and will remain in the Pond and may effect the Pond for years even if the pipe is removed. This nutrient load must be considered when determining the fate of the pipe.

4.4 Suspended Sediments

Suspended sediments were measured in the water samples taken during storm events to estimate the amount of solid material entering the Pond from the pipe. By defintion, this included all particles that are retained on a 0.45u filter. The data from sampled storm events was used to define a linear relationship between suspended solids and rainfall. Applying this relationship to all storms over a year, an estimate of the annual input of solids into the Pond from the pipe could be made. This data will be valuable in assessing the effect the pipe has on sedimentation in the Pond.

Methods

Three storm events were sampled: July 17, 1984, October 1, 1984, and February 12, 1985. Water samples were taken at the same time velocity was measured before, during and after a storm event. 25ml aliquots of each sample were put through Gelman glass fiber filters that had been weighed, rinsed with 25ml of distilled water, dried for 18 hours at 25^{o}C and weighed again. The filters with solids were then dried for 18 hours and weighed. Plots of suspended solid concentration vs. time were prepared. Suspended solid loading was calculated as concentration X discharge for each sample. An integration of the curve of suspended solid concentration vs. time summed the suspended solid loading over the course of the storm event to calculate the total loading of suspended solids from the pipe during the storm.

Total loading from the pipe for each storm event was plotted against the recorded rain amount at Setauket, NY for those storms. The equation for the line describing the relationship between suspended solids loading and rainfall was found using least square linear regression analysis. Using this relationship, total suspended solid loading was calculated for storm events that were not sampled throughout the year.

Results

Figures 47, 48 and 49 show the plots of suspended solid concentration and discharge vs. time for the storm events on July 17, 1984, October 1, 1984 and February 12, 1985 respectively. Suspended solid concentration increases dramatically over the course of the storm. Figures 50, 51 and 52 show the suspended solid loading for the July, October and February storm events respectively. Suspended solid loading and recorded rainfall for each of the three dates are given in Table 14.

Using these three points, a linear relationship between total suspended solid loading and rainfall was calculated. The equation for the line that best describes this relationship is:

$$SS = 15550271\ (R) - 14968902$$

$$r^2 = 0.9445535$$

where SS = Total suspended solid loading (g)
R = Rainfall amount (cm)
r^2 = Correlation coefficient

A correlation coefficient close to positive one indicates the data are strongly positively correlated and that the equation for the line describes the relationship of the data very well. Figure 53 shows the calculated and measured relationships.

Monthly Tables of recorded rainfall in Setauket, NY are in Appendix I. These tables include an estimate of suspended solid loading for each storm recorded. The estimates are based on the above equations. A summation of all the estimated suspended solid loading for all storm events from June, 1984 to May, 1985 yields 787077.3kg of solids (1735208.4 lbs) discharged from the pipe annually. Discharge from the pipe under non-storm conditions is not turbid, thus only storm discharge contributes

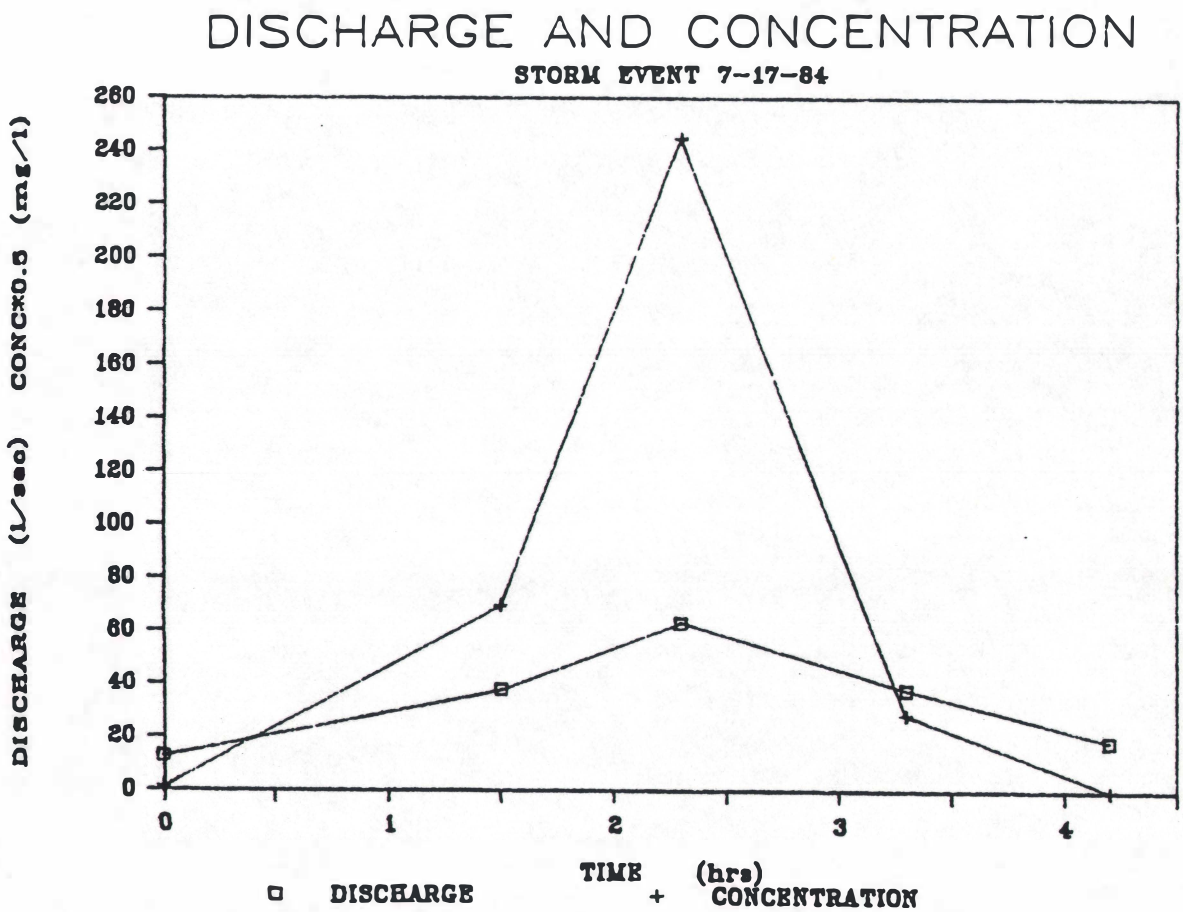


Figure 47. Suspended Solid Concentration and Discharge vs. Time for Storm Event 7-17-84.

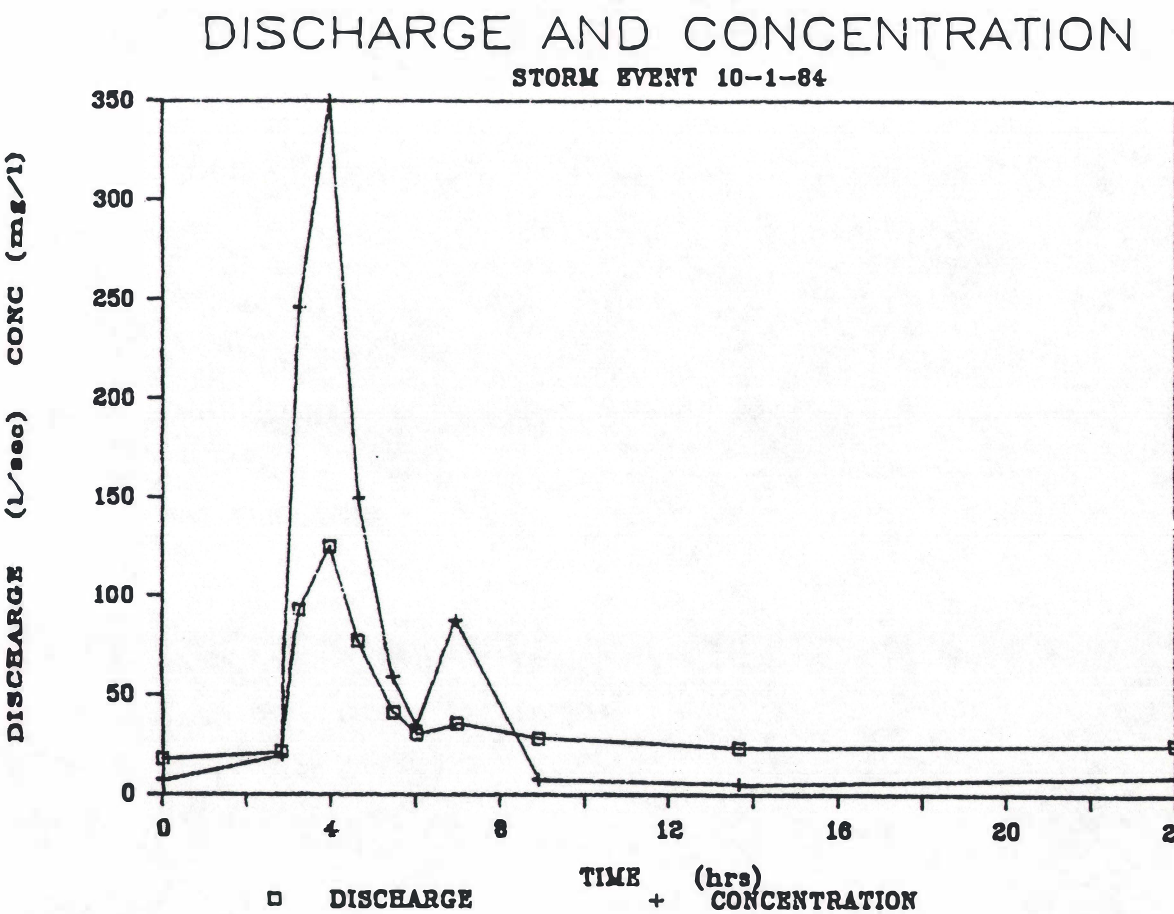


Figure 48. Suspended Solid Concentration and Discharge vs. Time for Storm Event 10-1-84.

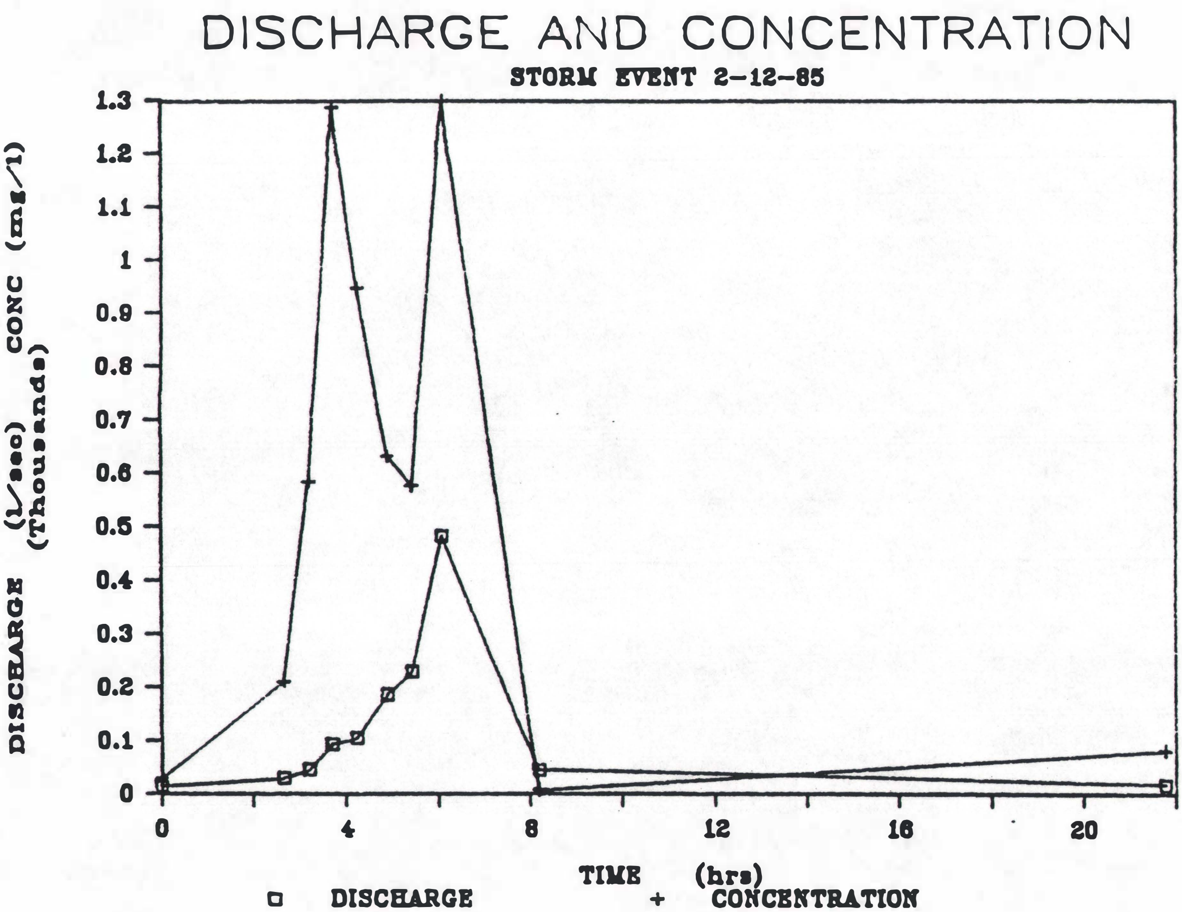


Figure 49. Suspended Solid Concentration and Discharge vs. Time for Storm Event 2-12-85.

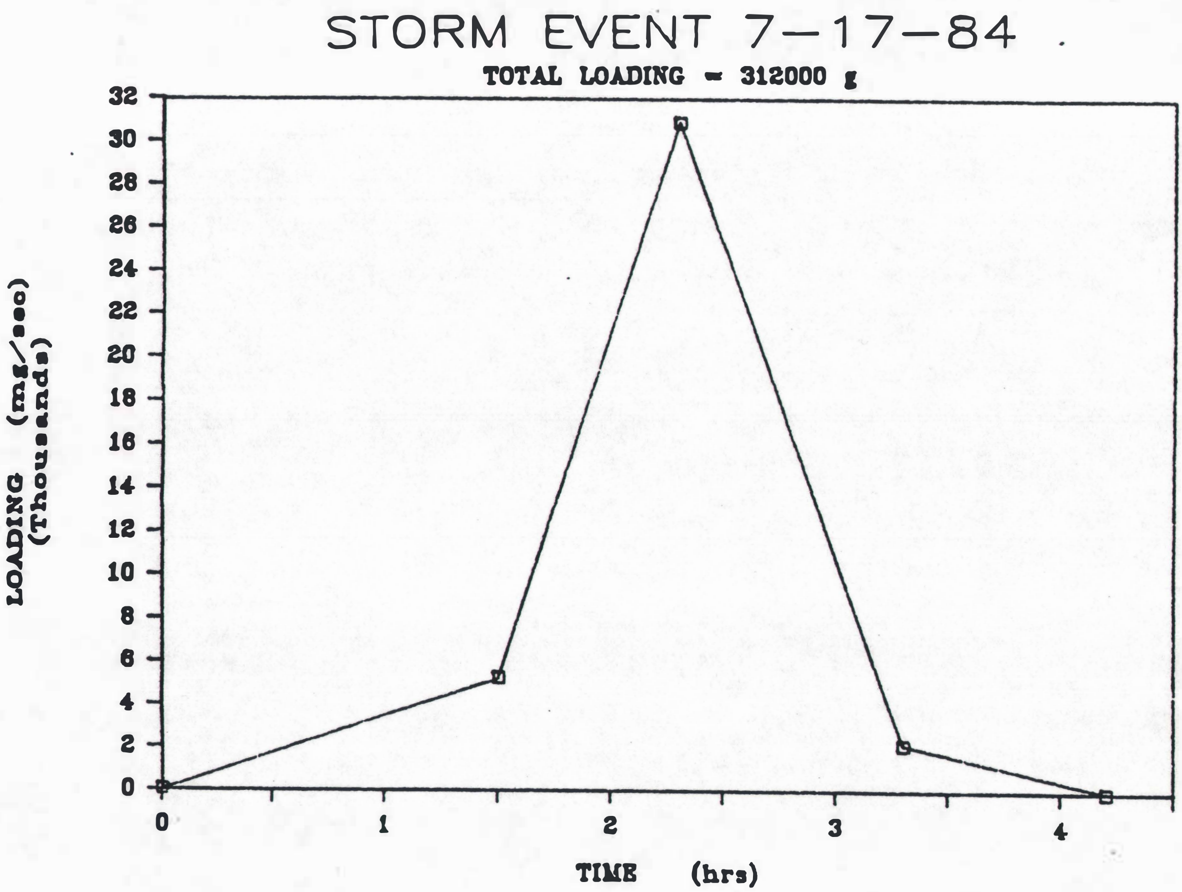


Figure 50. Suspended Solid Loading for Storm Event 7-17-84.

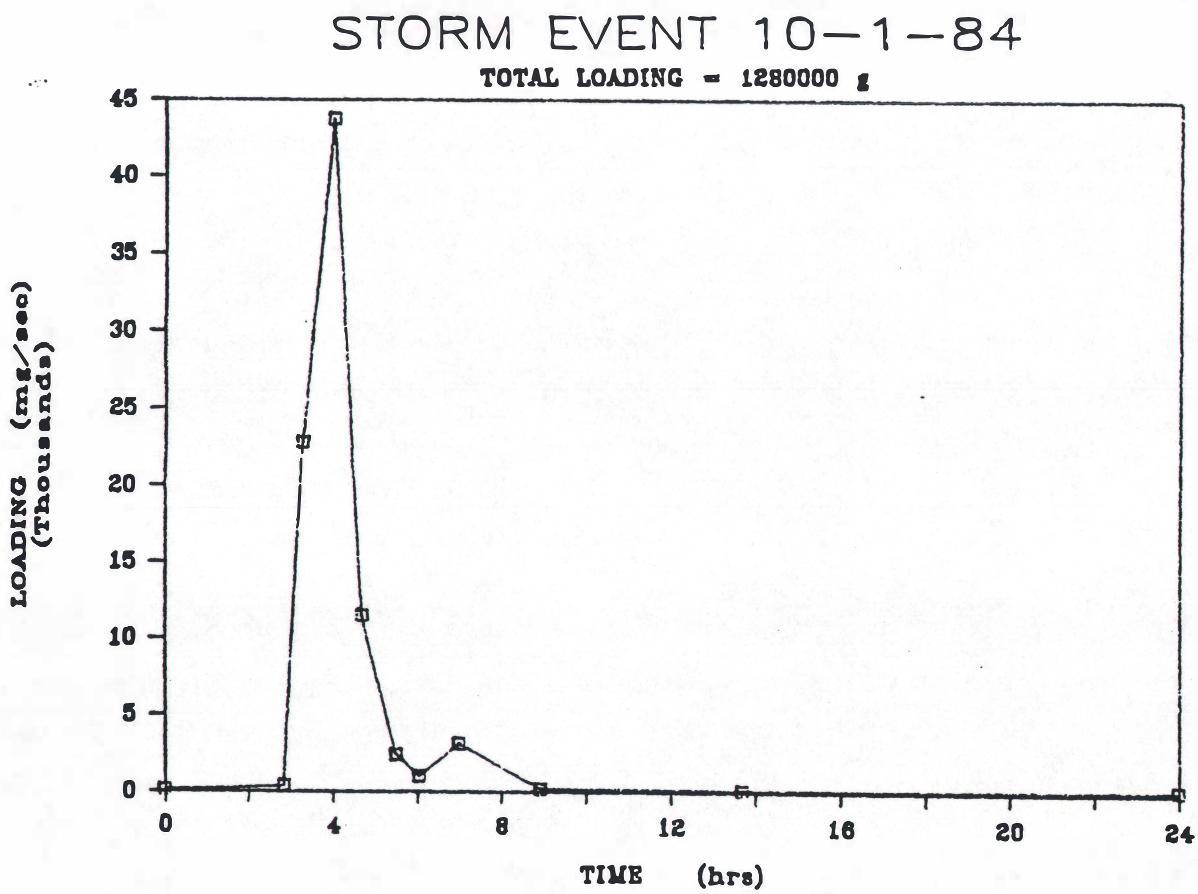


Figure 51. Suspended Solid Loading for Storm Event 10-1-84.

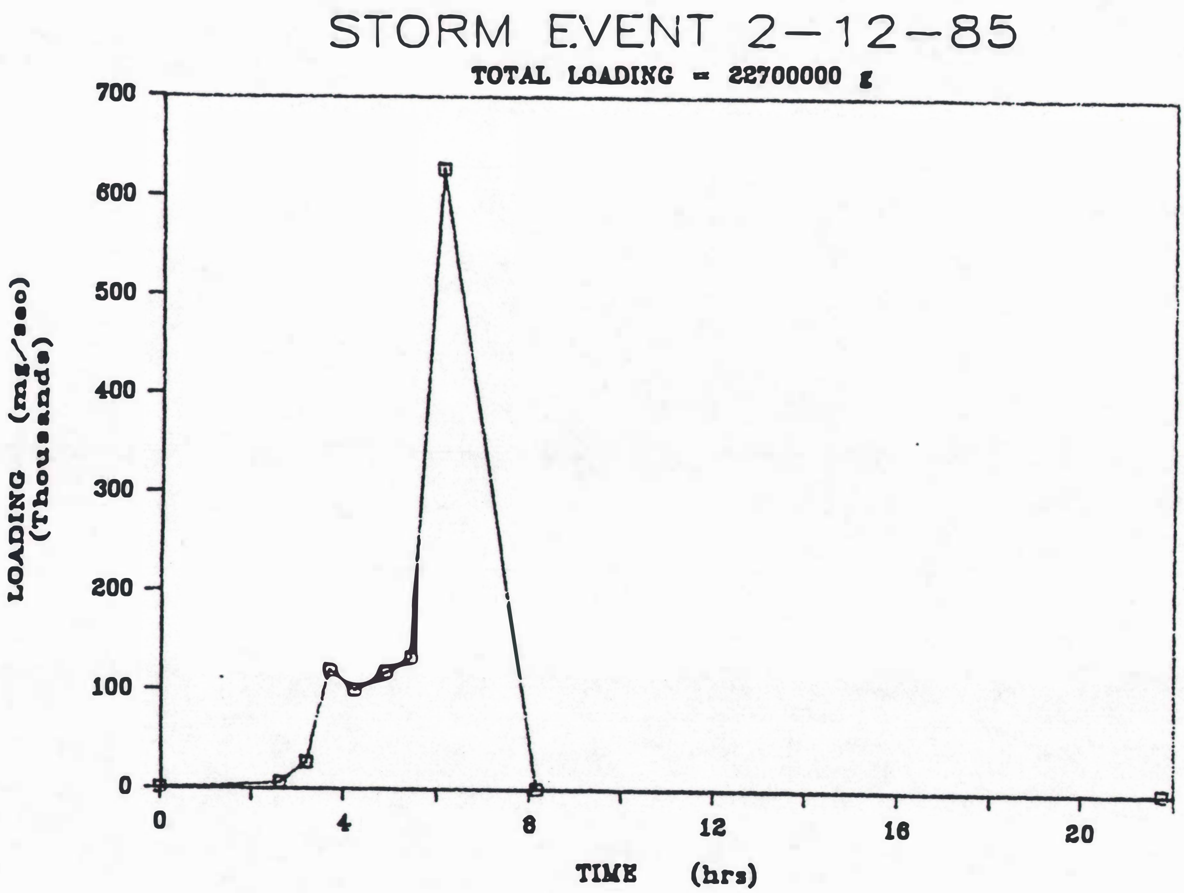


Figure 52. Suspended Solid Loading for Storm Event 2-12-85.

DATE	TOTAL SUSPENDED SOLID LOADING		RAIN AMOUNT	
	(g)	(lb)	(cm)	(in)
7-17-84	312000	687.8	0.79	0.31
10-1-84	1280000	2821.9	1.35	0.53
2-12-85	22700000	50044.9	2.31	0.91

Table 10. Data Points for Linear Relationship of Suspended Solid Loading to Rainfall.

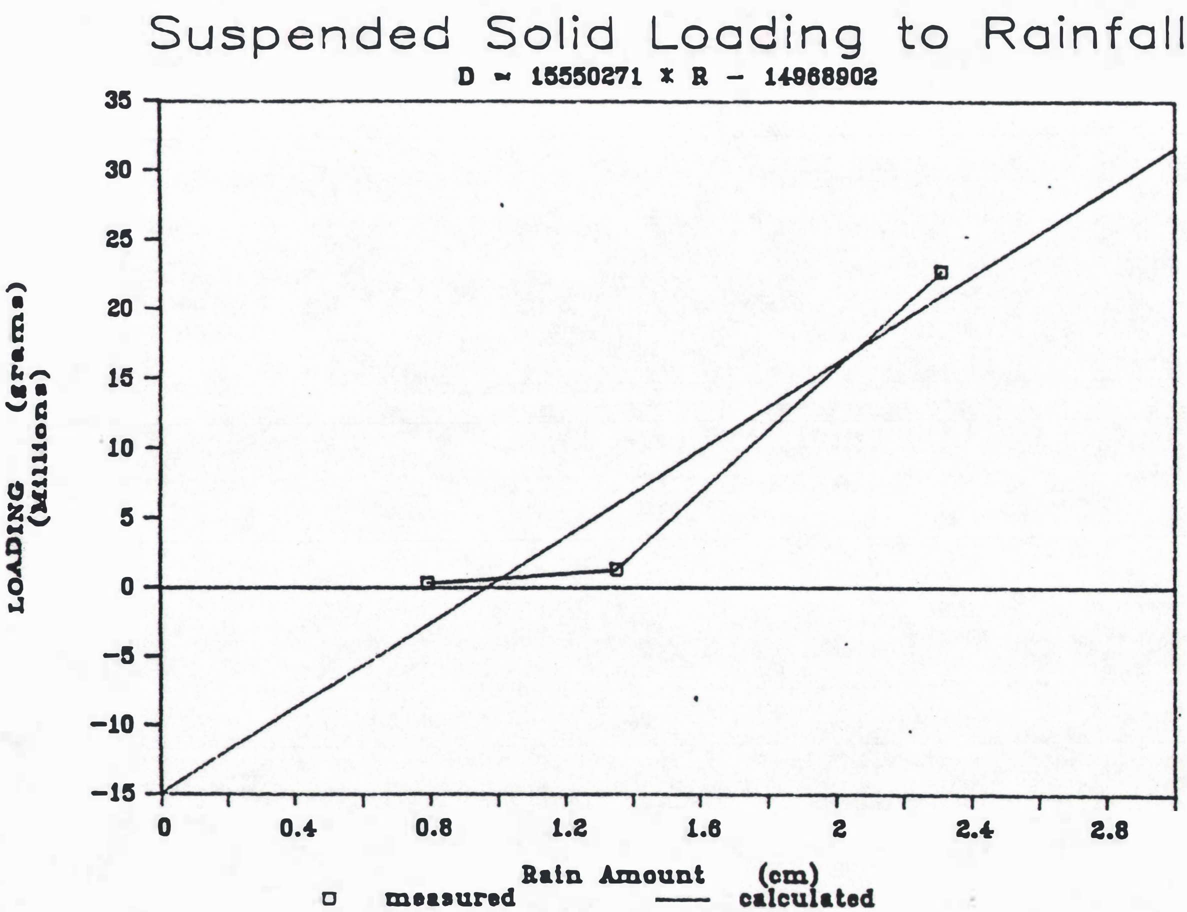


Figure 53. Measured and Calculated Relationship of Suspended Solid Loading to Rainfall.

to the loading of suspended solids to Mill Pond. Most of the suspended solids will remain in the Pond and contribute to the sediment. This sediment load must be considered when determining the fate of the pipe, either in the cost of removing this sediment from the Pond, or in finding a suitable place that can accept this amount of sediment.

Based on the water budget data, it was determined that the pipe contributed only 12% of the water coming into the Pond under normal flow conditions. This data indicated that the pipe did not seem to be a dominaht component in the nutrient dynamics or in the water budget of Mill Pond. From storm event data however, it is clear that the pipe is a significant source of water, nutrients and sediments to the Pond. In only a few hours, the pipe can replace 8.94% of the Pond water with water that is rich in phosphorus and sediments. This phosphorus rich water enters a Pond that is otherwise phosphorus limited, and could supply adequate levels of phosphorus to support heavy algal growth. This water however, has a residence time of only 3.4 days, which does not appear to be sufficient time for algal blooms to develop. This low residence time and the flushing of the hypolimnion by cold inflows appears to be responsible for the failure of anoxic conditions to occur in spite of an apparently high standing crop of rooted aquatic vegetation.

While the effects of water from the pipe do not appear to be manifested in problems commonly associated with nutrient input, deposition of sediments could have substantial long term effects. Sediment loading can result in filling of the Pond basin and pollutants in association with suspended particulate matter may accumulate in the sediments. For this reason, the magnitude of sedimentation rates and possibility of pollutants accumulating in the sediments was attempted to be described.

CHARACTERISTICS OF THE POND SEDIMENTS

In defining the path of the pipe water during storm and non-storm time, different sedimentation areas were described. Directly in front of the pipe, beyond the dredged area, pipe sediments have collected over the past fifteen years. This area was assumed to be sheltered from creek effluent which carried storm sediments before the installation of the pipe. At the mouth of the creek, pipe sediments do not collect presently. Before 1970, storm sediments were carried by the creek and deposited in this area. Using these two sedimentation areas, an estimation of sedimentation with and without the pipe was attempted.

The estimated sedimentation rate at these two sites, does not apply for all parts of the Pond. In order to adjust the sedimentation rates for other parts of the Pond, an estimate of the gradient in sedimentation was made by measuring current sedimentation rates along transects across the area of the storm turbidity plume.

The concentration of heavy metals, the percent organic material and particle sizes were measured in both pipe and non-pipe sediments. These data were used to describe the difference in the type of sediments in the Pond since the installation of the pipe.

5.1 Sediment Core Data

Sediment cores were taken in front of the pipe and at the mouth of the creek to get at the history of Pond sedimentation.

At the pipe site, sediments from storm runoff should overlie sediments not affected by storms. At the creek, pre-1970 sediments should be covered by non-storm sediments that have collected over the past fifteen years. Differences between these sediments were described by chemical and physical analysis of 5cm segments of the core. This information was used to define how much sediment has accumulated in the past fifteen years due to the pipe, how much sediment accumulates in the absence of the pipe, and how the pipe sediment is different from non-pipe sediments in Mill Pond.

Methods

Sediment cores were taken on April 12, 1985. Three cores were taken at each site (see Figure 54) using a 4ft long "Pogo-Stick" corer and 10cm diameter core liners. Of the three cores at each site, two were immediately frozen and one was visually examined.

The frozen cores were cut into 5cm sections. Each section was weighed, dried at 70°C and weighed again to calculate water content. Subsamples from the dried sections of the core were weighed, ashed at 400°C for 24hrs, then reweighed to calculate the organic content. Every other core section was taken and disaggregated using a mortar and pestle. A 3.5g subsample was taken from each of these dissaggregated sections. These samples were heated for 5hrs on a sand bath with a mixture of concentrated nitric and hydrochloric acids. The samples were then filtered and the leachate was analyzed for lead (Pb), copper (Cu) and cadmium (Cd), using an Atomic Absorption Analyzer.

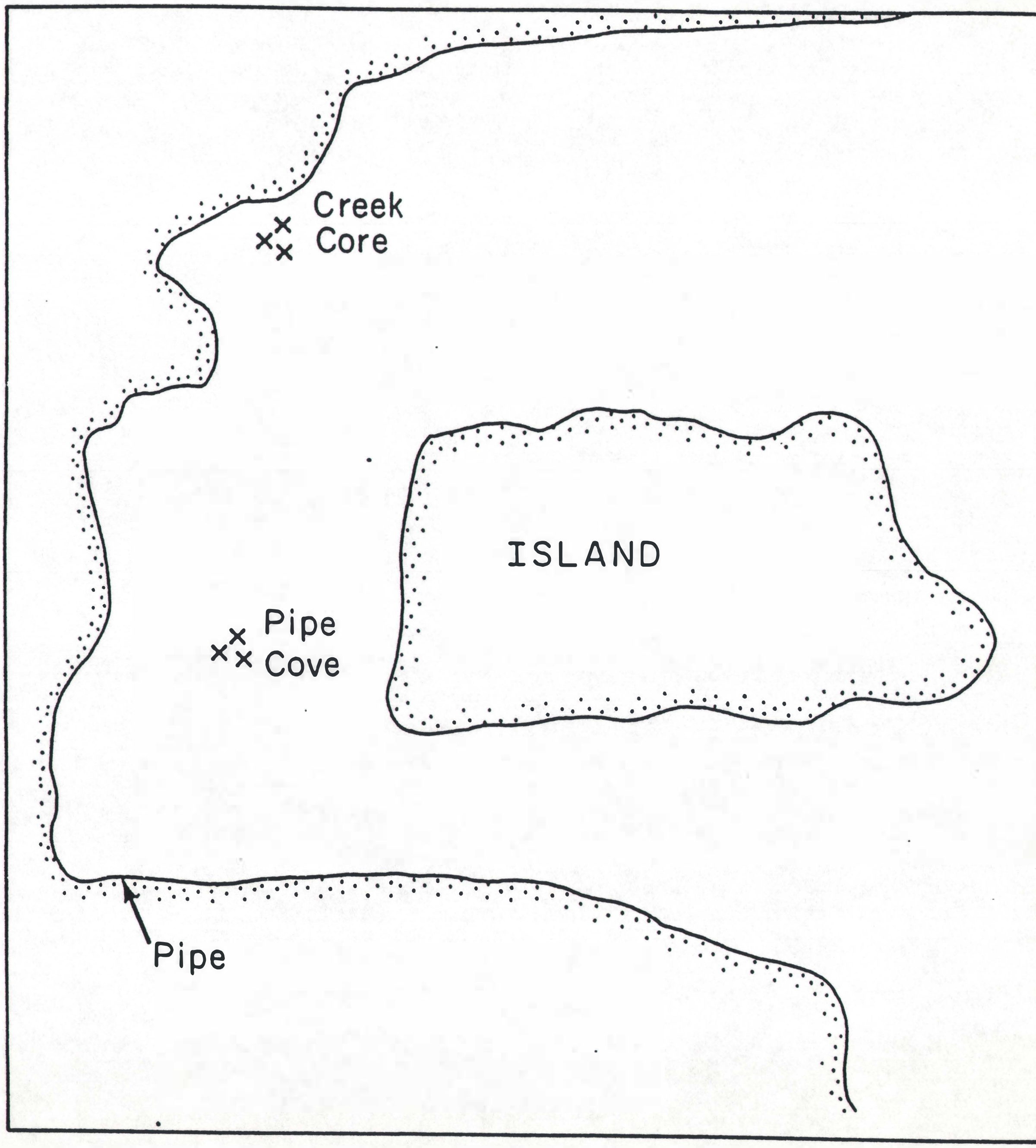


Figure 54. Location of Sediment Cores.

Each sediment segment was passed through a series of three seives with mesh sizes of 590u, 250u, and 125u. This procedure yeilded four size classes of particles respectively: 1) pebbles and coarse sand, 2) medium sand, 3) fine sand and 4) very fine sand, silt and clay. The amount collected on each screen was weighed and compared to the total weight of the sample to describe the particle percent composition for each segment.

Results

Figures 55 and 56 show the percent water content and organic content respectively for the pipe core and Figures 57 and 58 show the same information for the creek core. The water content data shows no real significant variation in either of the cores. In the pipe core, the organic content increases dramatically with depth below the top 10cm. The point at which organic content changes dramatically was interpreted as being the point at which sediment from the pipe began to be deposited in this region of the Pond. The amount of sediment of low organic content above this point should provide an estimate of the rate of sediment accumulation. In the creek core, organic content drops off below the first 5 cm of sediment. This result indicates that the top 5cm have accumulated in the past fifteen years and the sediments deeper than 5cm are from storm runoff typically low in organic content. From this data alone, the sedimentation rate with the pipe is estimated as 10cm/15yrs or 0.67cm/yr, and without the pipe the estimate is 5cm/15yrs (0.33cm/yr).

Figures 59, 60 and 61 show the Cu, Pb, and Cd concentration respectively for the pipe core and Figures 62, 63 and 64 show the

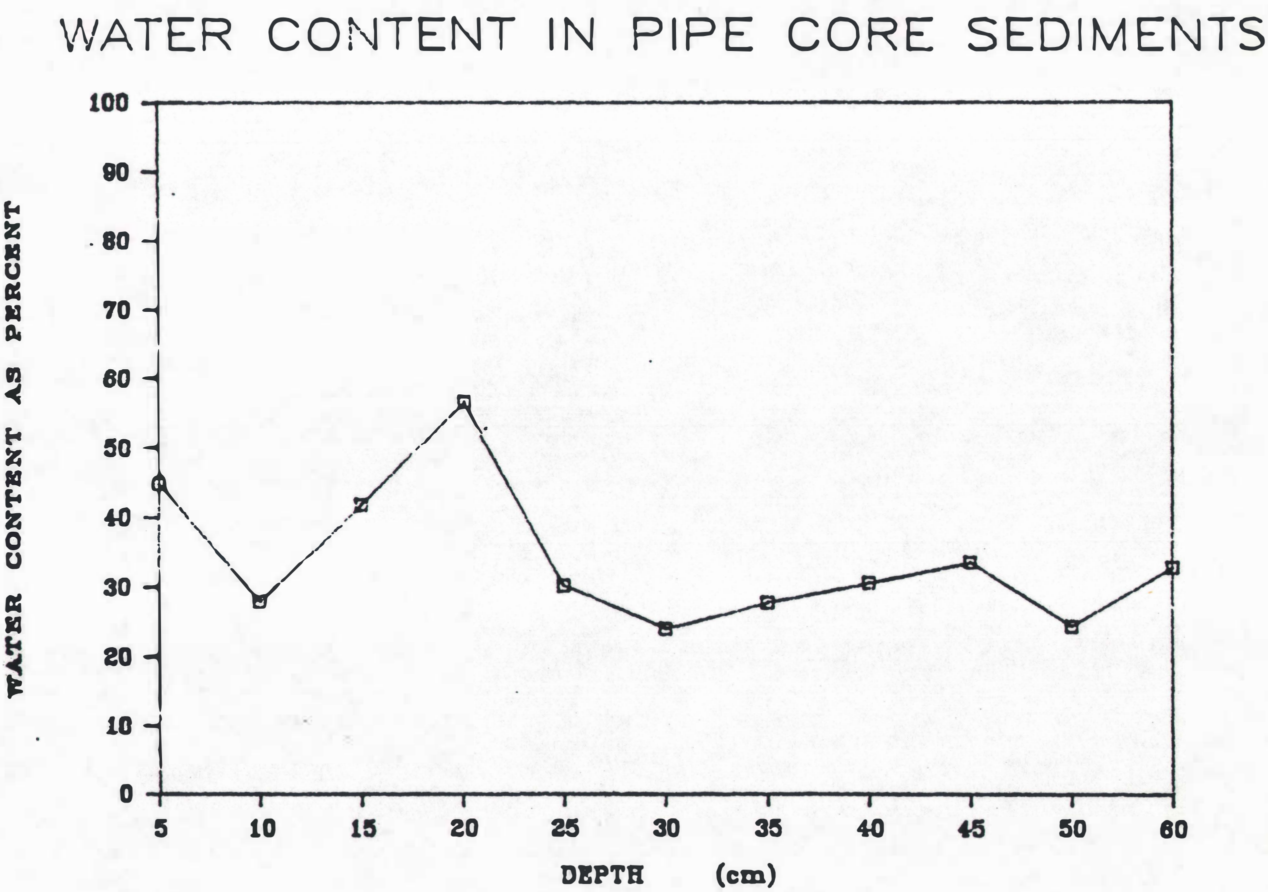


Figure 55. Water content of Pipe Core Sediments With Depth.

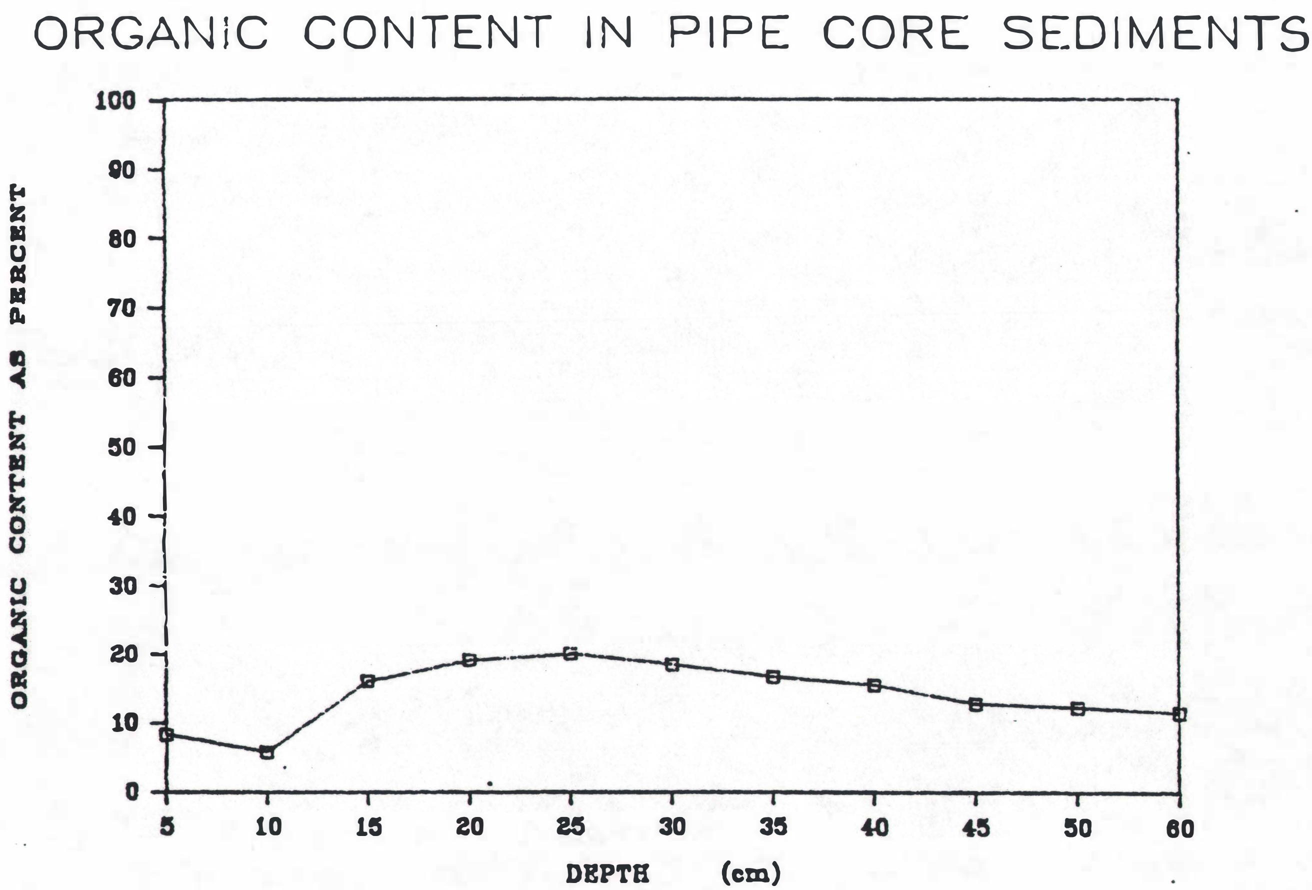


Figure 56. Organic Content of Pipe Core Sediments With Depth.

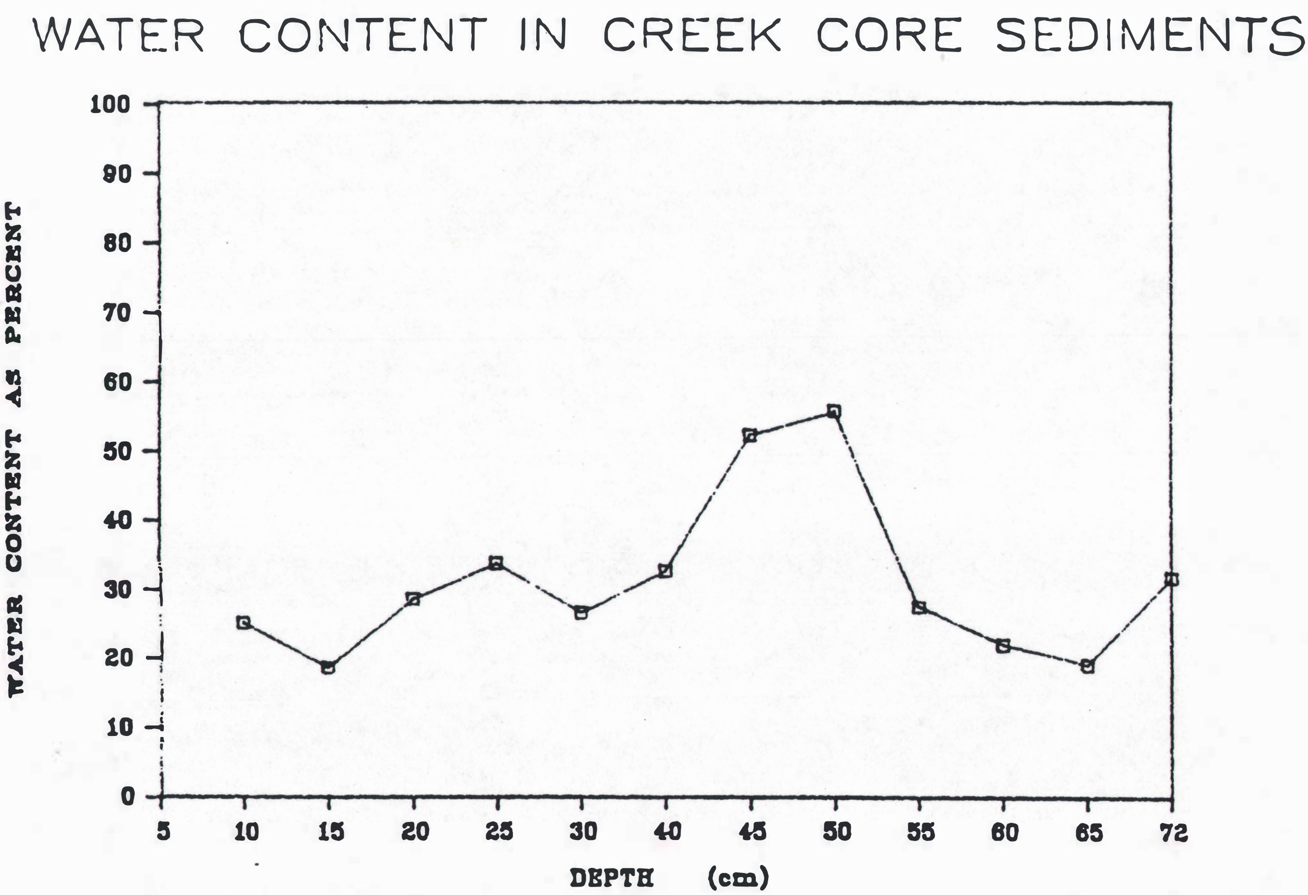


Figure 57. Water Content of Creek Core Sediments With Depth.

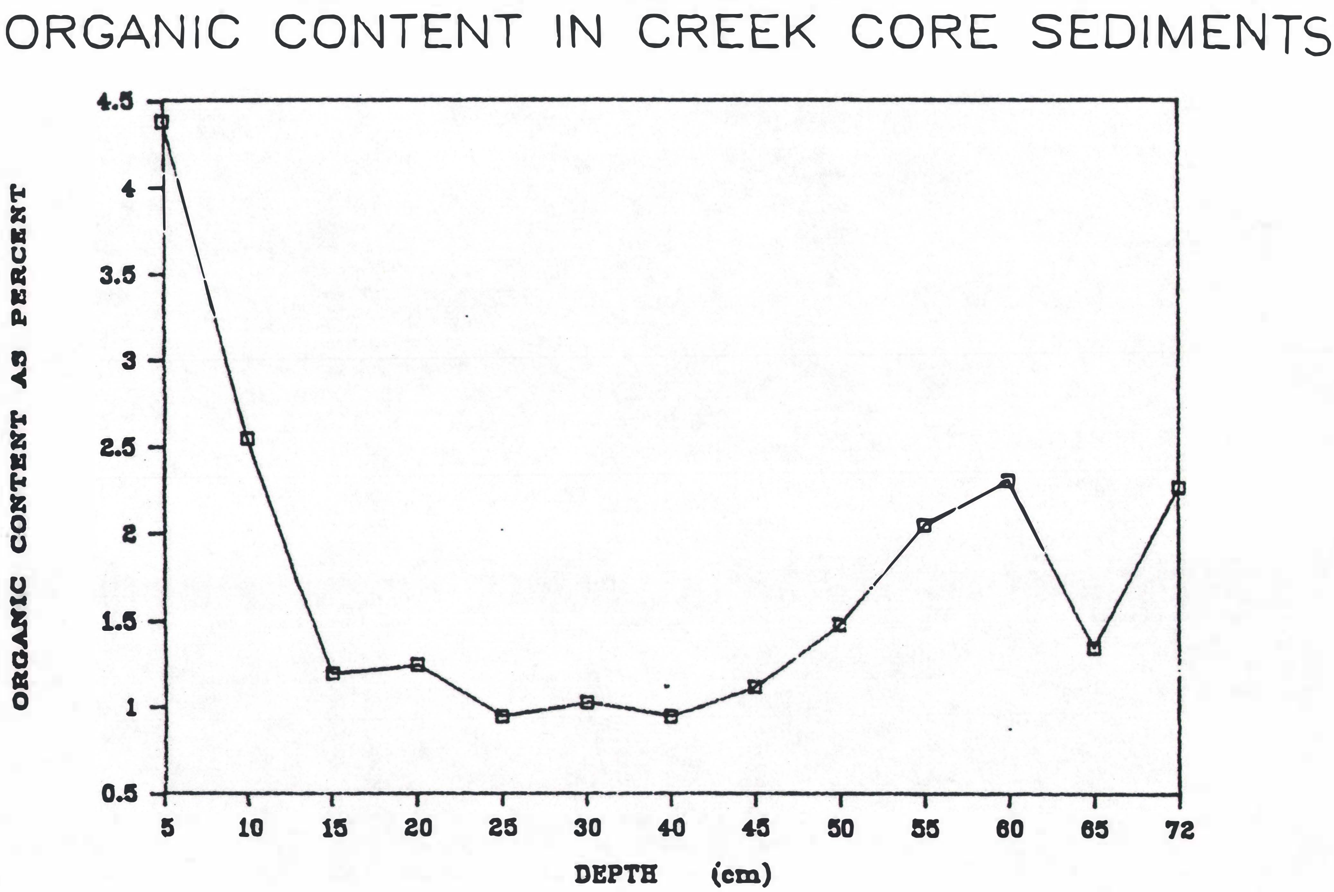


Figure 58. Organic Content of Creek Core Sediments With Depth.

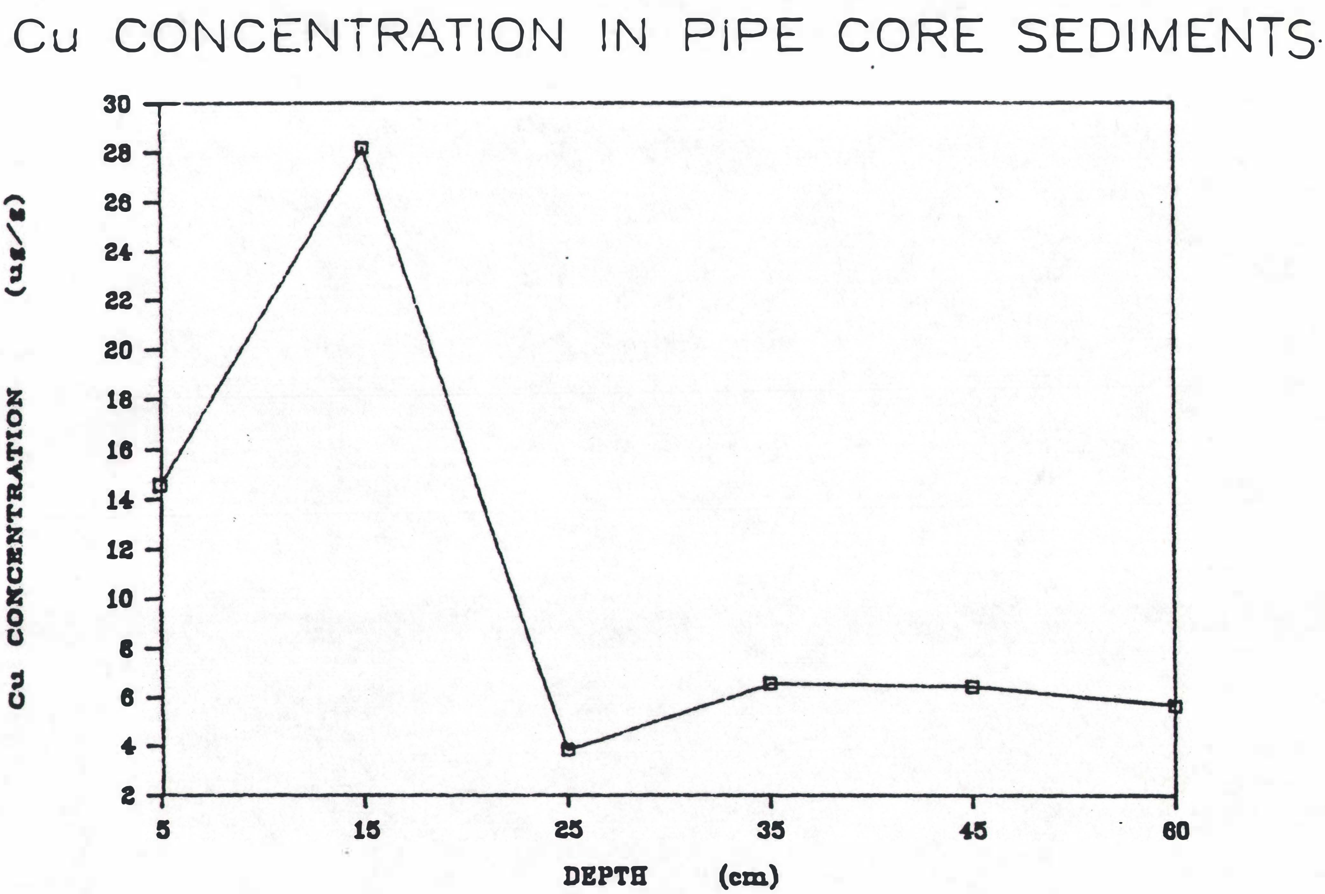


Figure 59. Concentration of Cu in Pipe Core Sediments With Depth.

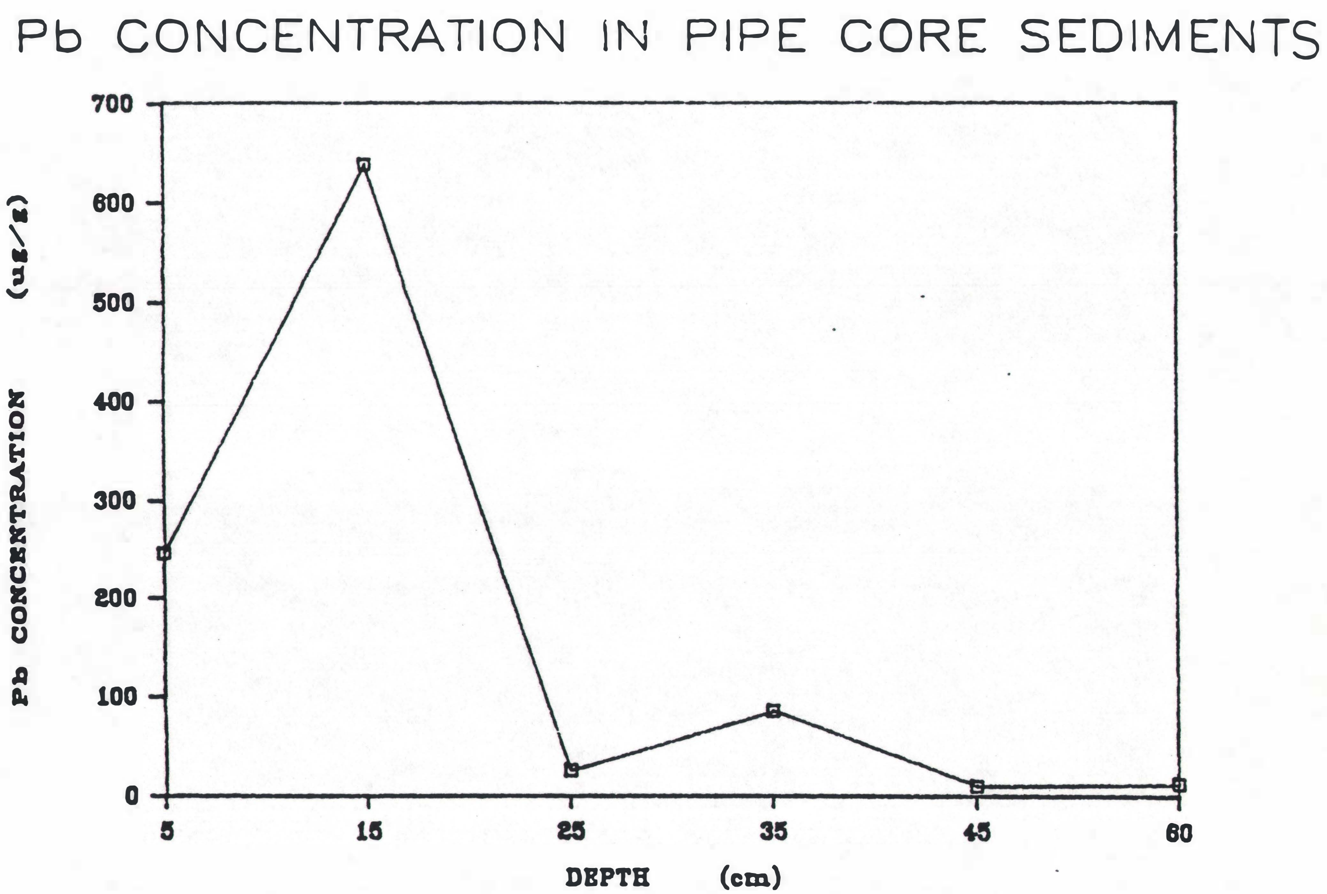


Figure 60. Concentration of Pb in Pipe Core Sediments With Depth.

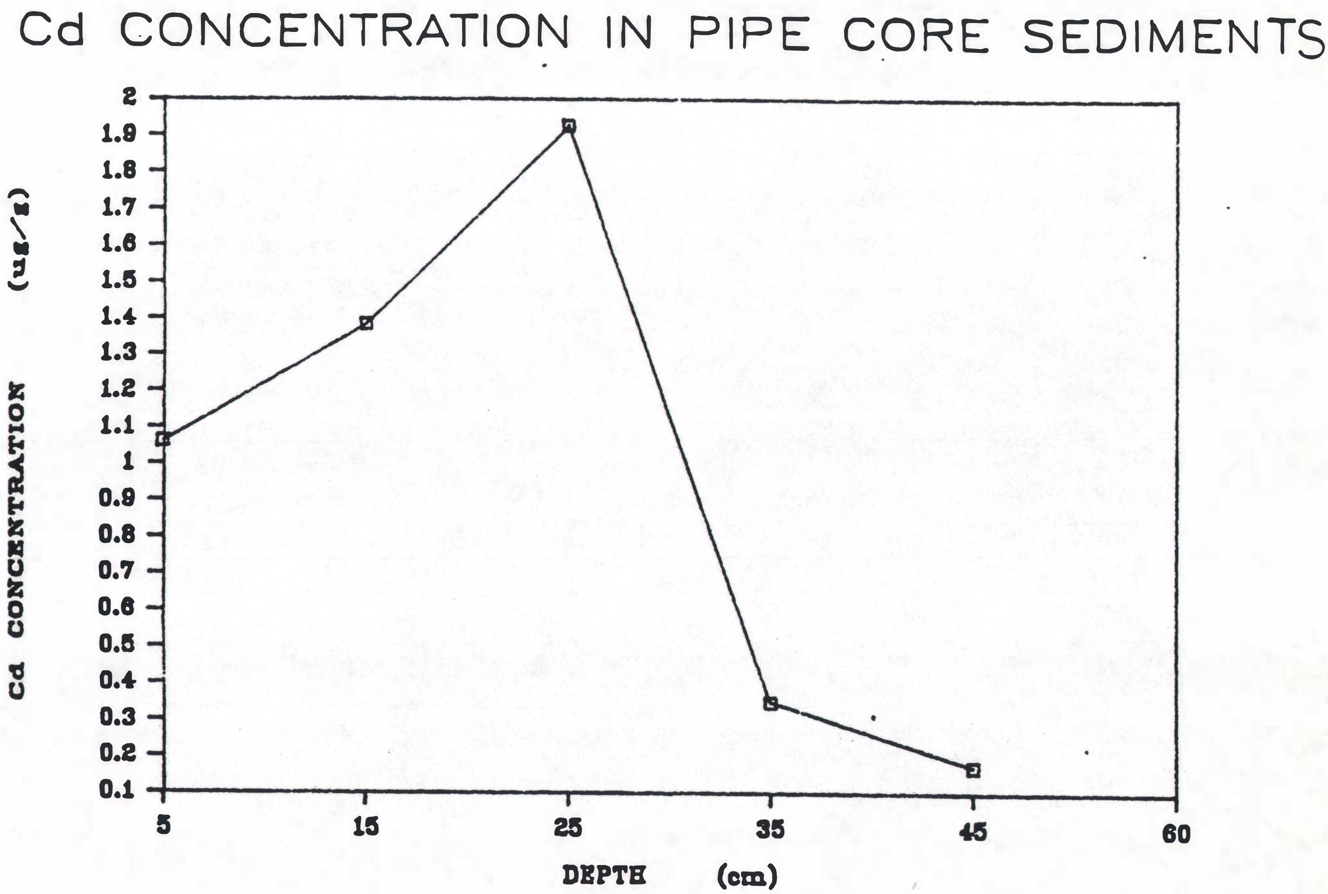


Figure 61. Concentration of Cd in Pipe Core Sediments With Depth.

same data for the creek core. Concentrations of all three of the heavy metals are higher in the top sections of the pipe core. For Cu and Pb, the break between high and low concentrations occurs between 15-20cm, and for Cd, the break occurs between 25-30cm. For the creek core, the highest values of heavy metal concentration were deep within the core (45-50cm). This extremely high data point in all the heavy metal analyses is difficult to interpret and may be the result of sample contamination. The values themselves, do not indicate extraordinary levels of metal contamination. Heavy metals are usually associatd with fine clay-type particles, and from the particle size data, it is clear that mostly large sand-type particles are carried into the Pond by the pipe. This sand is relatively unreactive and will not attract heavy metals, thereby reducing the load of heavy metals that could be accumulated into Pond sediments.

The particle size data is summarized in Figures 65 and 66 for the pipe and creek respectively. Seiving was done on dry sediment and in the drying process, some particles are disaggregated. An accurate picture of the size distribution is therefore not entirely possible using a dried sample. This procedure may not be altogether unappropriate for Mill Pond sediments, however, since this material originated as suspended sediment. Only the general characteristics of the sediment size partitioning are discussed.

In the top 10cm of the pipe core, proportionately more medium and fine sand is found. Deeper in the core, fine sand, silt and clay are the dominant component. These data reinforce

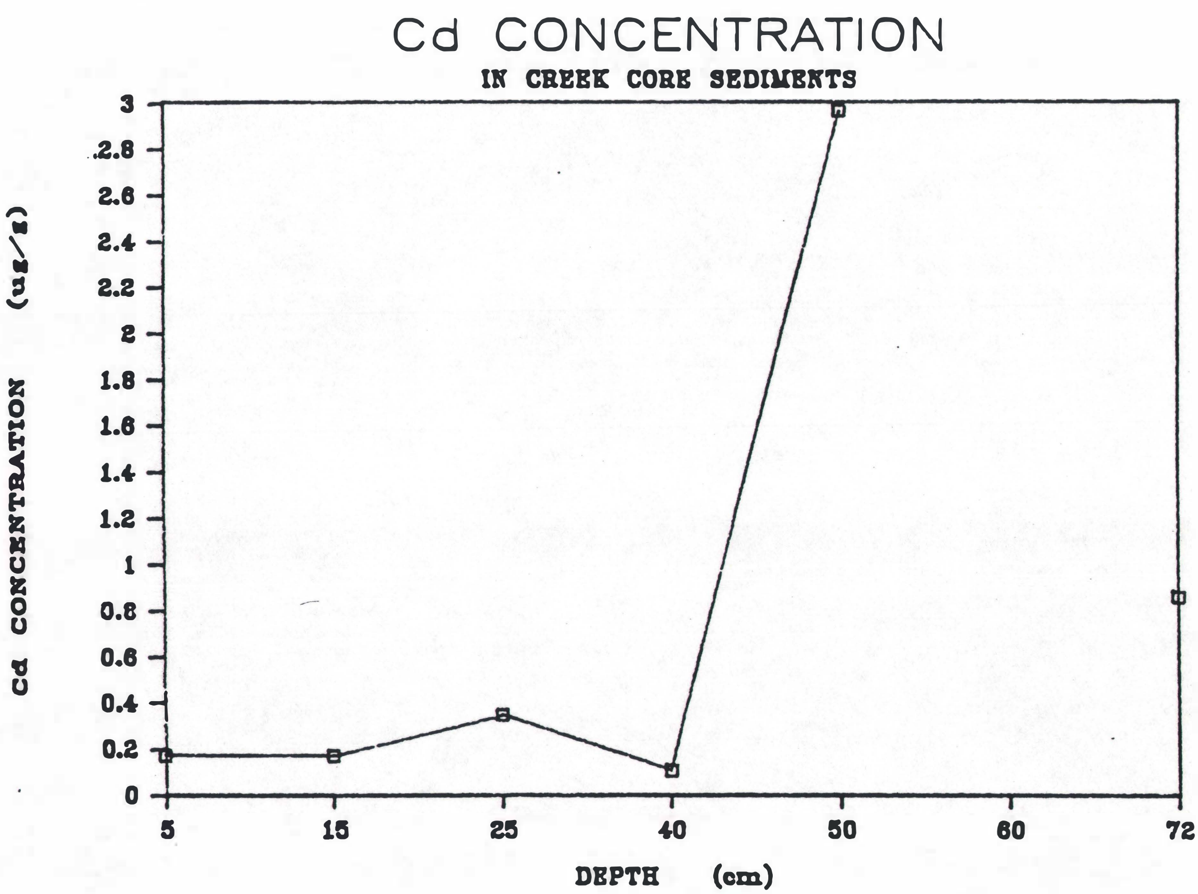


Figure 64. Concentration of Cd in Creek Core Sediments With Depth.

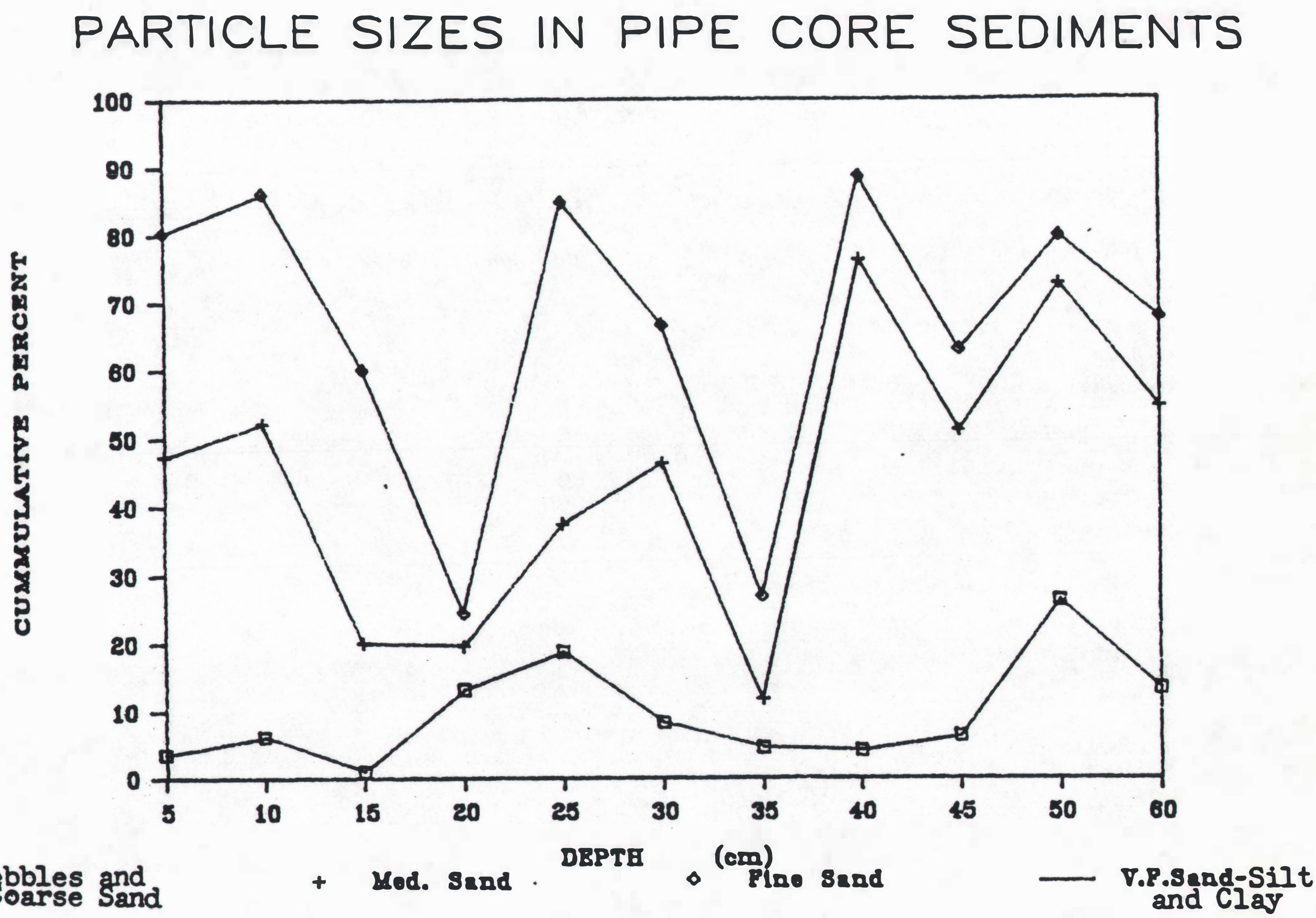


Figure 65. Particle Size Distribution for Pipe Core Sediments With Depth.

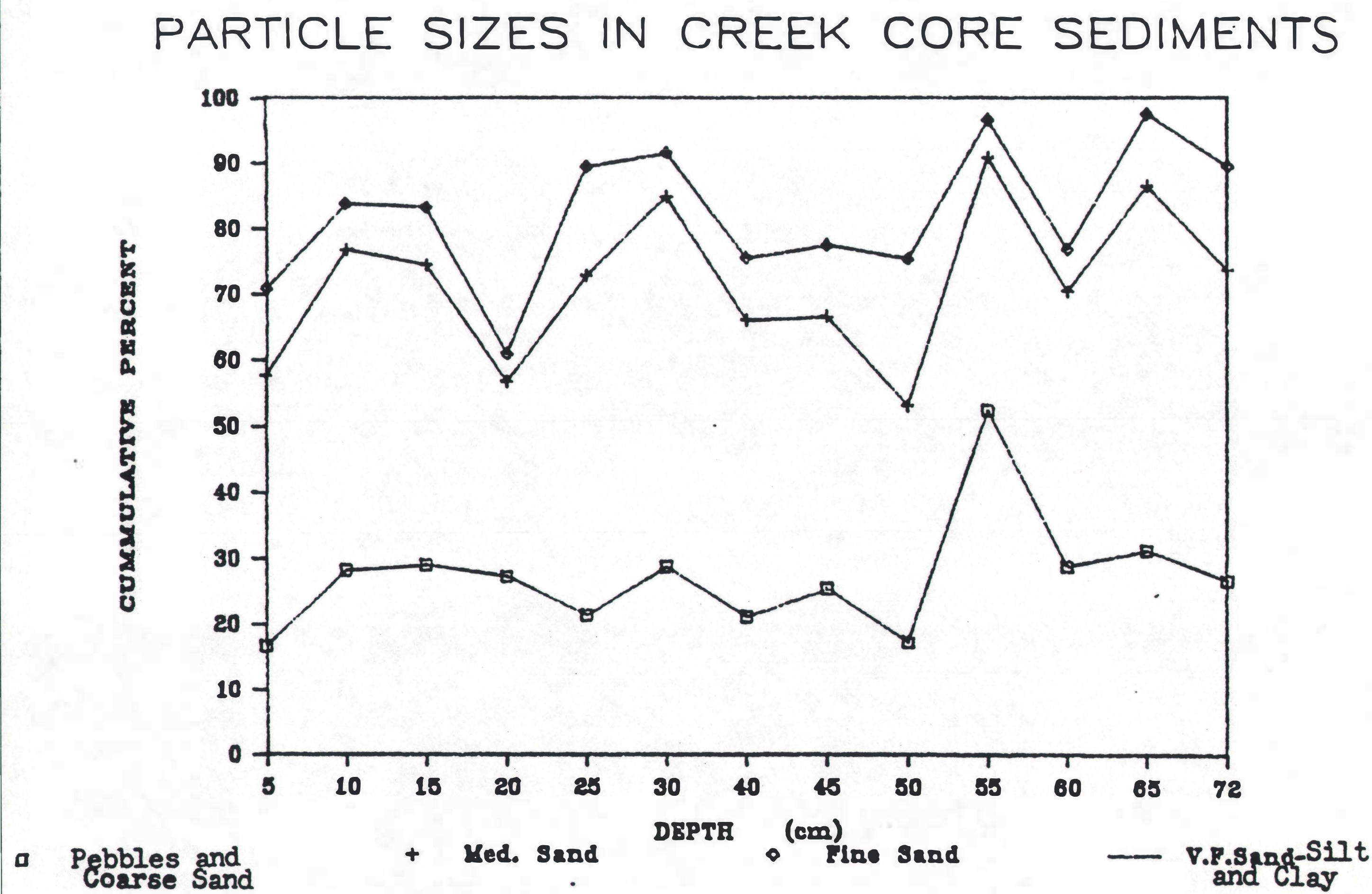


Figure 66. Particle Size Distribution for Creek Core Sediments With Depth.

the organic content data indicating that the top 10cm is sandy, low organic content pipe sediment and below 10cm is sediment of finer sand, silt and clay, high in organic content, deposited before 1970. For the creek core, all segments have proportionately more sediment in the pebbles and coarse sand fraction than is in the top 5cm. In all segments but one, there is less sediment in the fine sand,silt and clay fraction than is in the top segment. These data plus those describing organic content indicate that the upper 5cm of the creek core is composed of fine organic sediments. Below this layer are sediments that are coarser, lower in organic content and,presumably, deposited by storm runoff prior to 1970.

The above data allow a rough estimate to be made of the sedimentation rate with and without storm runoff. Averaging the depths of all the discontinuities in the various parameters for the pipe core, an estimated 16.5cm (1.1cm/yr) has accumulated in the past fifteen years immediately west of the pipe. In the absence of the pipe effects, Pond sediments accumulate at a rate of 0.33cm/yr. These pipe sediments are slightly higher in heavy metal content, lower in organic content and of a coarser composition.

5.2 Sediment Trap Data

The sedimentation rate measured from cores taken immediately west of the pipe gives a maximum sedimentation rate for the Pond. As sediments from storms settle however, a gradient in sedimentation will be apparent moving from this region near the pipe to the outflow. Combining a description of the gradient with a measure of long term sedimentation at some point along the gradient yields a description of sediment accumulation over the entire Pond. Combining the sedimentation gradient with the core data from the pipe core gives an estimate of overall sediment accumulation with the pipe in place. Using the data from the creek core in conjunction with the sedimentation gradient yields an estimate of sedimentation without the pipe. Sediment traps were placed in the Pond to collect sediments over time. These data were used to determine the sedimentation gradient.

Methods

Sediment traps were placed throughout the Pond on March 1, 1985 (see Figure 67). The sediment traps were 14.6mm diameter PVC tubes capped at one end. Three traps were placed at each sampling site. The traps were retrieved on May 16, 1985. The contents of the traps were dried overnight at 70°C and weighed. All samples were ashed at 400°C for 24hrs to determine the organic content of the sediments.

Results

Figure 68 shows the gradient in sedimentation rate moving from the pipe to the outlet, and Figure 69 shows the change in organic content of the sediments throughout the Pond. Applying the measured sedimentation rates to areas around each sampling point, 985,470kg of sediment accumulates in the Pond every year. From the suspended solid data, 787,077.3kg of sediment enter the Pond every year in pipe water. Thus, all this runoff material remains in the Pond plus other organic and inorganic material

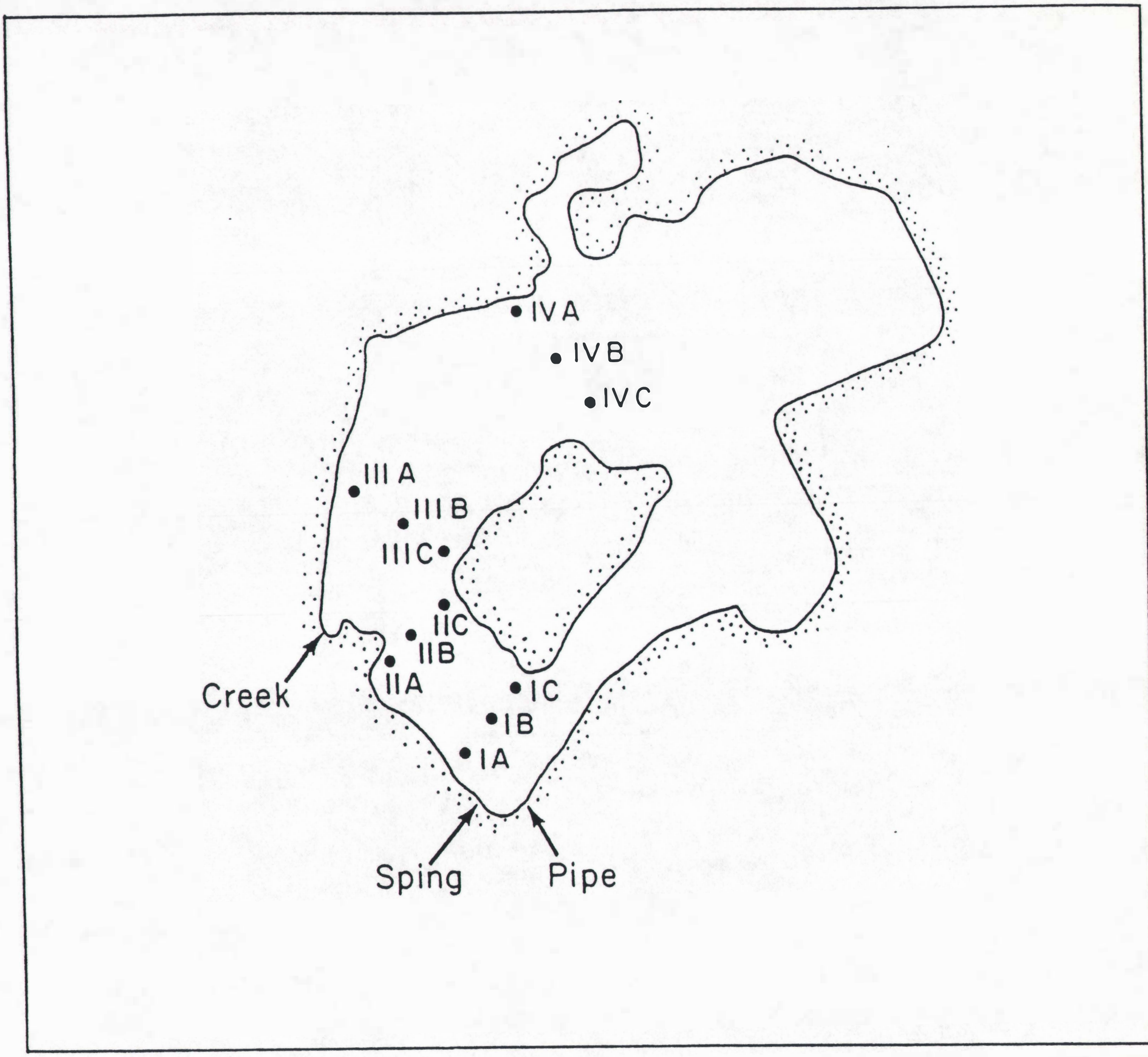


Figure 67. Location of Sediment Traps.

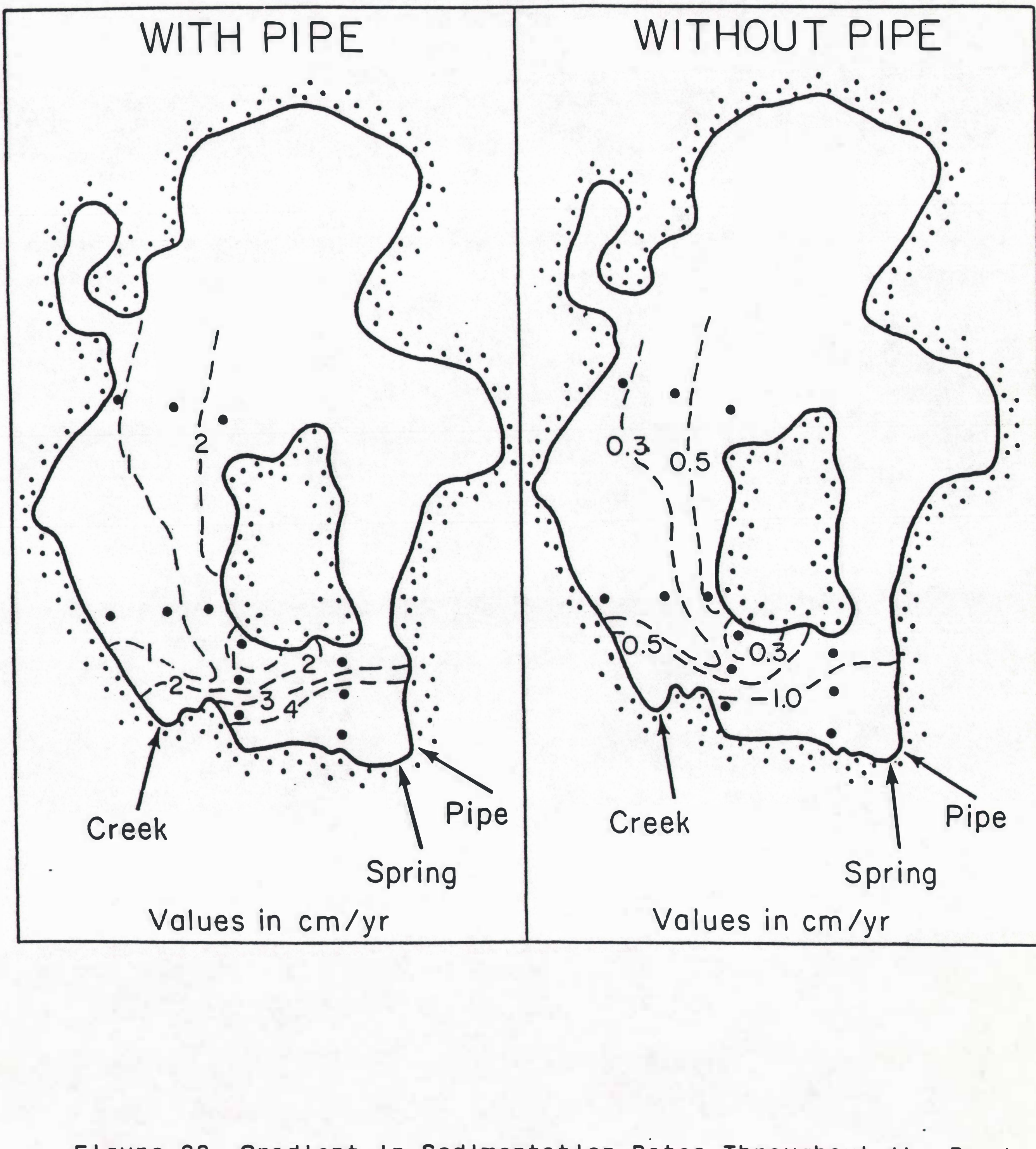


Figure 68. Gradient in Sedimentation Rates Throughout the Pond.

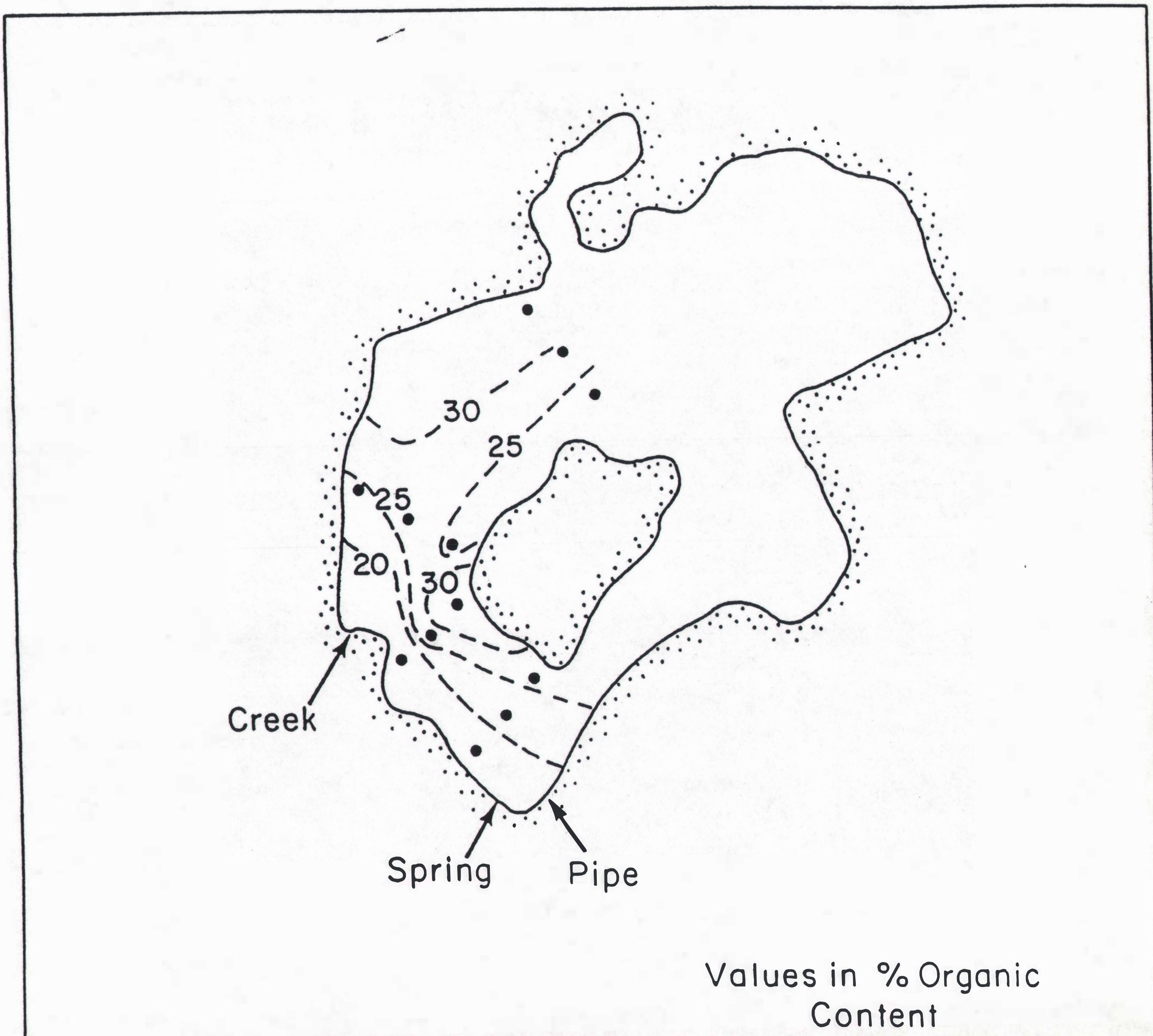


Figure 69. Change in Organic Content of Pond Sediments.

that is deposited. If the pipe is removed, an estimated 198,392.7kg of sediment would accumulate in the Pond every year. This value is only 20% of the present sediment loading to the Pond. Under the present conditions, with the pipe in place, about 1% of the Pond volume (approximately 400 m^3) is replaced each year by sediment. At this rate, the entire Pond would be filled with sediment in approximately 110 years, (assuming no sediment is removed and no compaction). If the pipe was removed, 120 m^3 or 0.3% of the Pond would be replaced annually by sediment. At this rate, the Pond would be filled in approximately 370 years. With the pipe in place then, the Pond is filling about 3.3 times faster than if the pipe was removed.

DISCUSSION

The Stony Brook Community Fund initiated this study of Mill Pond when Community Fund members and Pond residents complained of problems the Pond seemed to develop since the construction of a D.O.T. outfall pipe on the Pond. At the outset of this study, it was expected that the Mill Pond in Stony Brook would show the classic symptoms of eutrophication. For this reason, investigators of the Department of Ecology and Evolution and the Marine Sciences Research Center of SUNY at Stony Brook designed a study to primarily assess the possibility and/or extent of eutrophication of Mill Pond. The results of the study can be categorized as: (1) an assessment of eutrophication, (2) the consequences of sediment loading, and (3) the possible effects of moving the D.O.T. pipe.

6.1 Assessment of Eutrophication

Eutrophication is the overenrichment of a water body with nutrients. These nutrients can either enter the water naturally or due to man's intervention. When nutrient levels are high enough, particularly nitrogen and phosphorus levels, algal growth is stimulated and blooms of noxious alga, often species of blue-green algae, can develop. As these plants die and decompose, oxygen is depleted in deep water. Anoxia (lack of oxygen) can result in fish kills and a release of nutrients from the sediments. These nutrients can be mixed into surface waters where another algal bloom can start.

The conditions for eutrophication seem to be present in Mill

Pond. Nitrogen levels are high at all times in the Pond water. Phosphorus levels are often adequate, with substantial inputs of phosphorus coming into the Pond in storm water from the D.O.T. pipe. However, the classic symptoms of eutrophication probably never occur in the Pond. Dissolved Oxygen (DO) levels measured in the Pond over the year from June, 1984 to May, 1985 never fell below 4.5 mg/liter. Phytoplankton blooms were not observed during this time.

The reason that the symptoms of eutrophication do not develop in Mill Pond is due to the morphology of the Pond and the characteristics of the water coming into it. The Pond is primarily spring fed. This spring water is cold water saturated in oxygen. This water flows into the deep water of the Pond, constantly replacing the deep water with oxygen-rich water. Thus, the Pond never goes anoxic since there is a steady source of oxygen to the deep water. In addition to the springs that seep into the Pond, there is a creek, an above ground spring, and the D.O.T. pipe that supply water to the Pond. Water is supplied at such a rate that 24.4% of the water in the Pond is replaced every day. During the average storm, 8.9% of the Pond water can be replaced in 4 to 5 hours. Water in the Pond therefore, has a residence time of 3 to 4 days. Plankton however, need to be exposed to high concentrations of nutrients for 10 days to 2 weeks for a bloom to develop. Phytoplankton blooms do not develop on Mill Pond then, because of the short residence time of the water.

6.2 Sediment Loading

The sediment loading to Mill Pond through the D.O.T. outfall pipe is substantial. From measurements of suspended solids in the storm water coming out of the pipe, a relationship of suspended solid loading to rainfall was calculated. This calculation was used in conjunction with rain data recorded for Setauket, NY (3.7miles from Stony Brook Mill Pond) to estimate the annual sediment loading. An estmated 787,000 kg (1,735,000 lbs) of suspended solids enter Mill Pond in water carried by the pipe. In the area immediately west of the pipe, this corresponds to a sedimentation rate of 1.1cm/year. Sedimentation estimated in an area away from the influence of the pipe sediments, was found to be approximately 0.33cm/year. These data indicate that the Pond is filling in at a rate more than three times faster with the pipe in place than if it was removed.

In addition to the amount of sediment entering Mill Pond, of concern is also the type of sediment the pipe water carries. It was found that pipe sediments were lower in organic content, slightly higher in heavy metal content (for the metals tested, i.e. Pb, Cu, and Cd), and coarser than Pond sediments. The fact that the pipe sediments were coarse meant that there is less attraction of these sediments for heavy metals, so they carry less heavy metals into the Mill Pond then fine sediments would.

6.3 Posible Effects of Pipe Removal

According to the water budget data, the pipe contributes approximately 10% of the water to the Pond under normal flow conditions. However, due to the peculiar shape of the basin near the pipe, this pipe water may be one of the few sources of water to the surface of the Pond and would therefore contribute significantly to the circulation of surface waters. If the pipe is removed, the surface waters could be greatly altered.

Suspended solid data, along with sediment core and sediment trap data have indicated that the pipe is a prime source of sediments to the Mill Pond. This additional load of sediments will fill in the Pond at a much greater rate than if the pipe was removed. If the pipe is removed, the cost of removing sediments from the Pond will be eliminated.

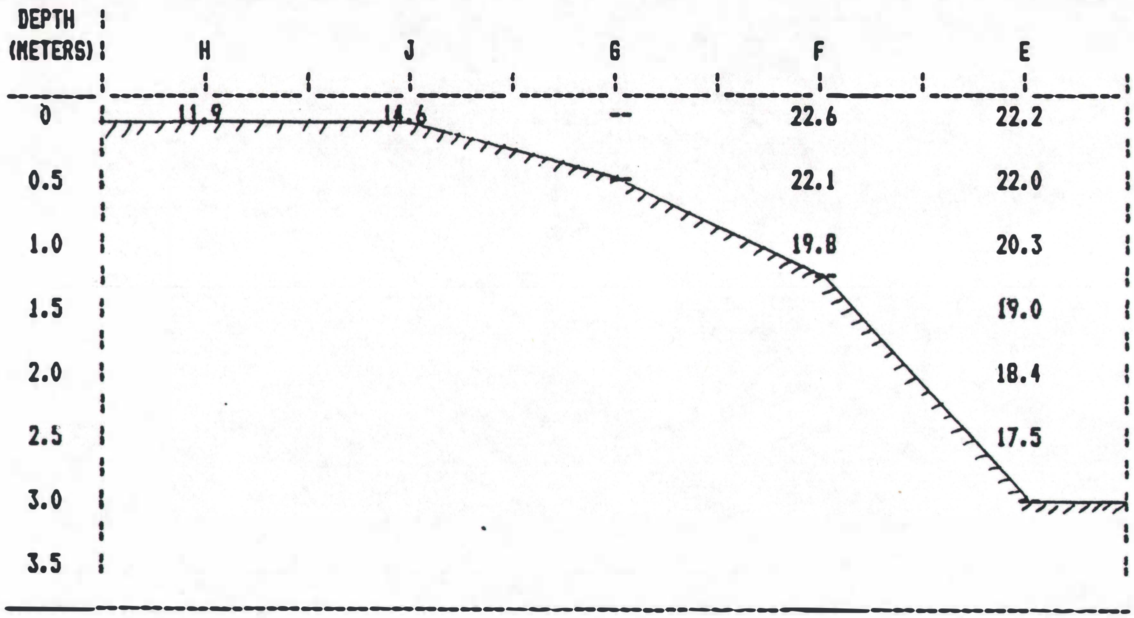
6.4 Recommendation

One recommendation to help control water flow through Mill Pond would be the construction of a new gate at the outlet. This new gate should have both a surface and bottom outlet. These outlets should operate simultaneously with the surface outlet drawing about 80% and the bottom outlet drawing 20% of the water.

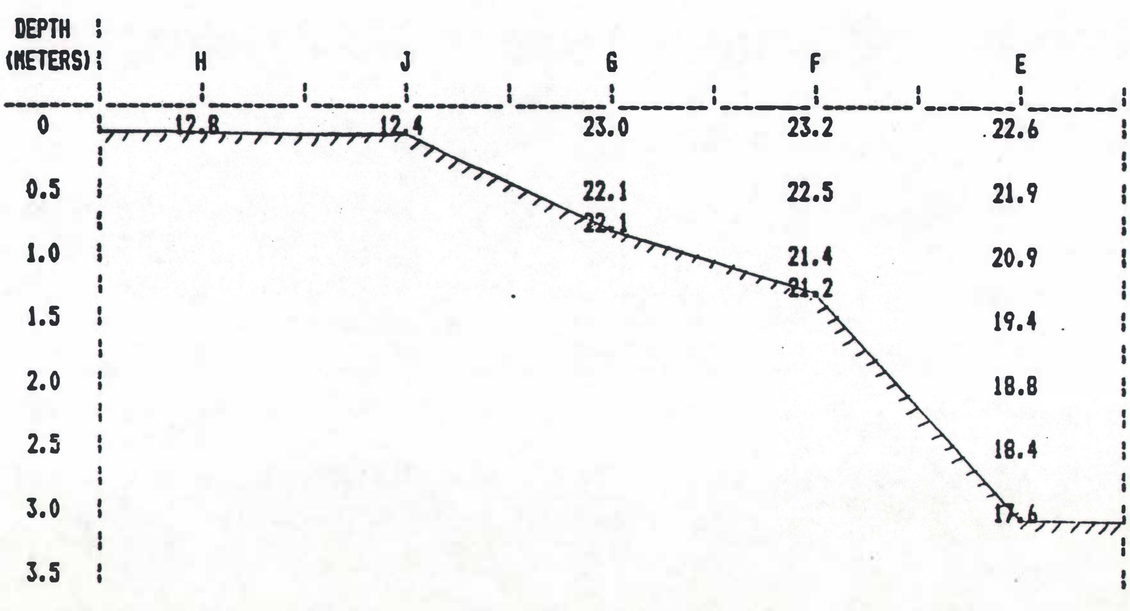
APPENDIX A:

Temperature Data

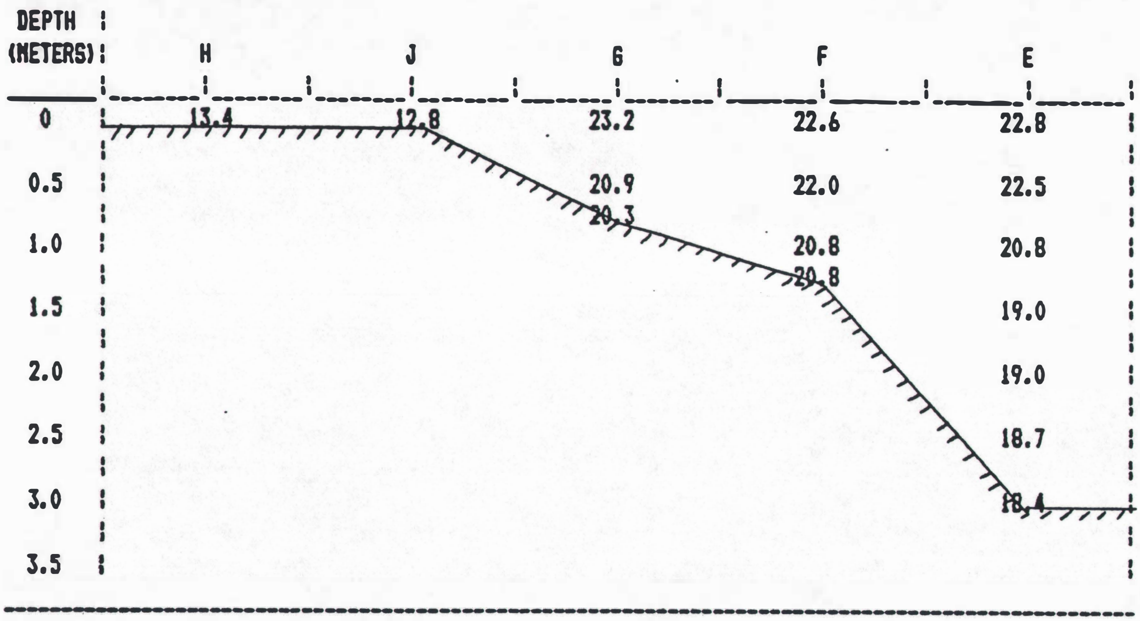
SAMPLING DATE 6-14-84
EAST SIDE TRANSECT
TEMPERATURE (C)



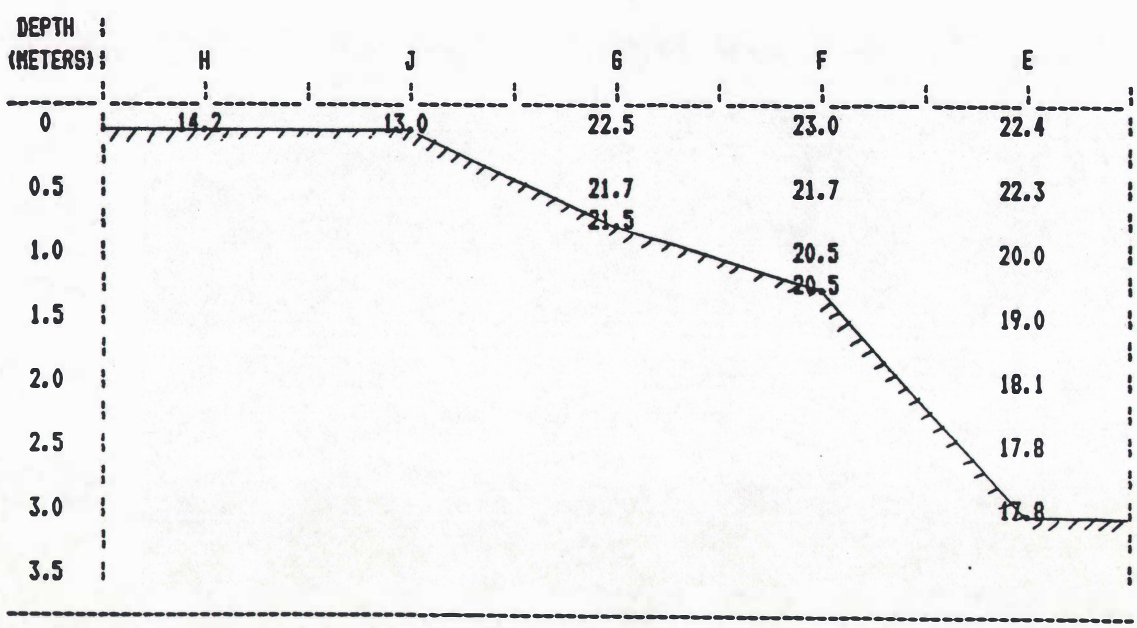
SAMPLING DATE 6-21-84
EAST SIDE TRANSECT
TEMPERATURE (C)



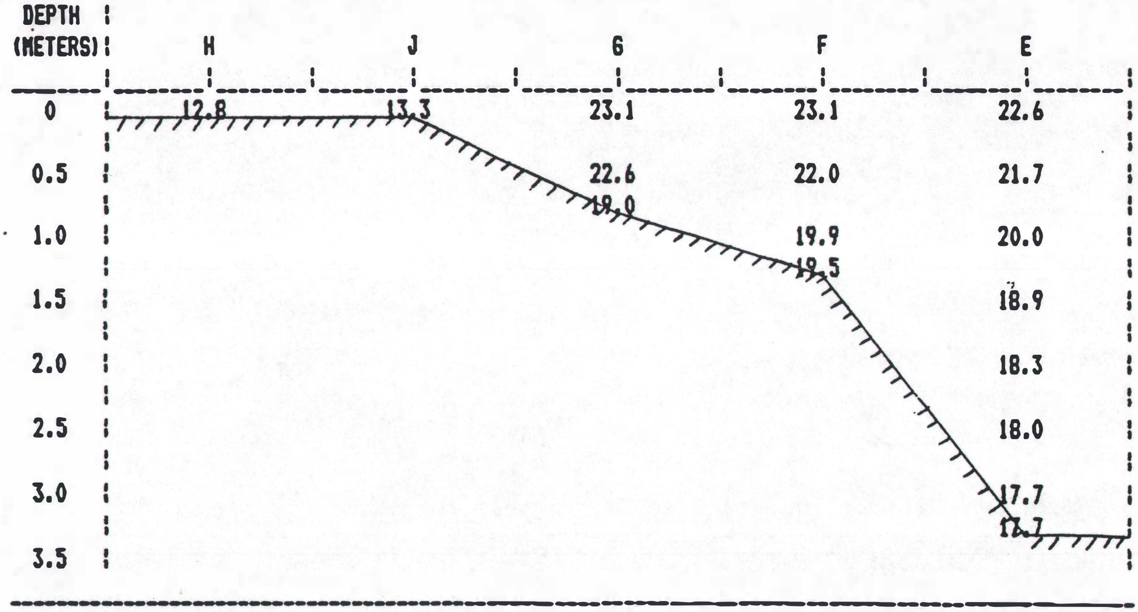
SAMPLING DATE 6-28-84
EAST SIDE TRANSECT
TEMPERATURE (C)



SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
TEMPERATURE (C)



SAMPLING DATE 7-24-84
EAST SIDE TRANSECT
TEMPERATURE (C)



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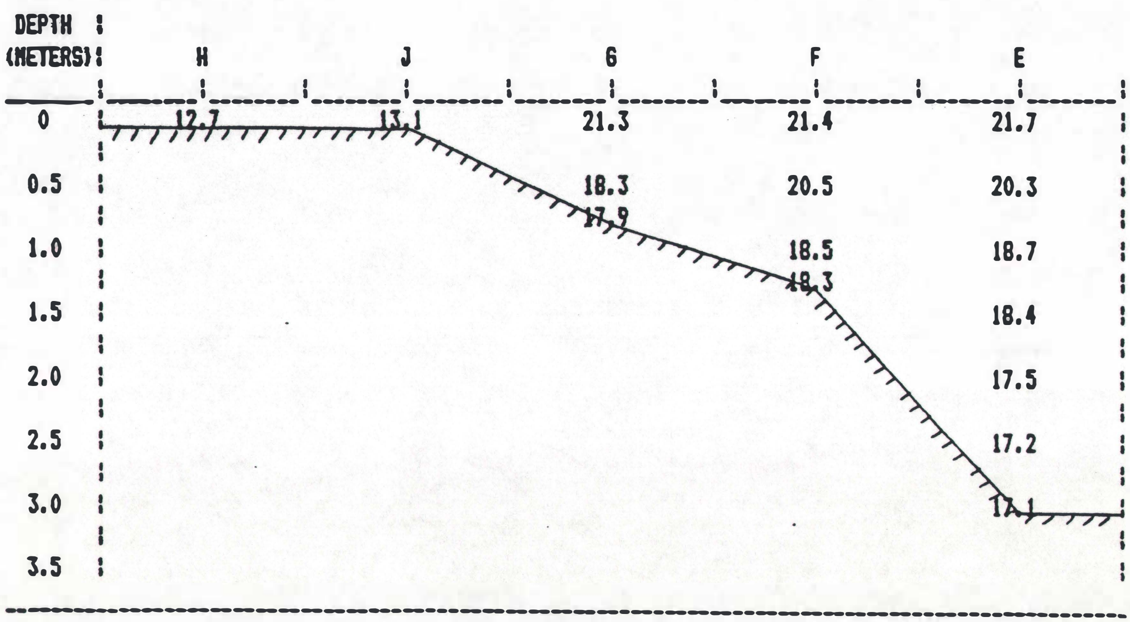

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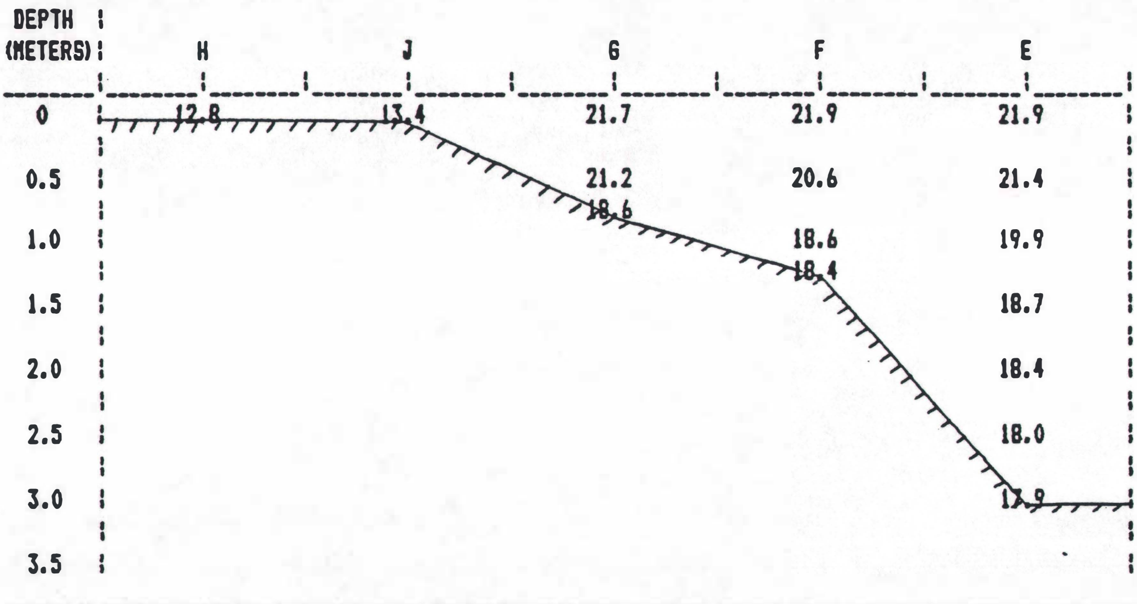
TEMPERATURE (C)



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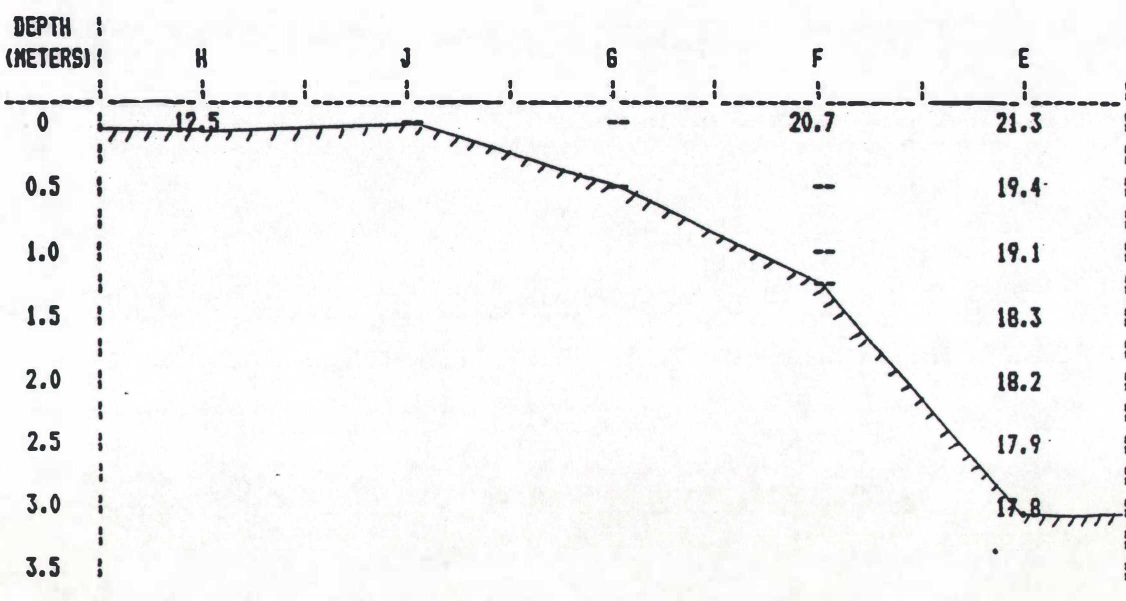
TEMPERATURE (C)



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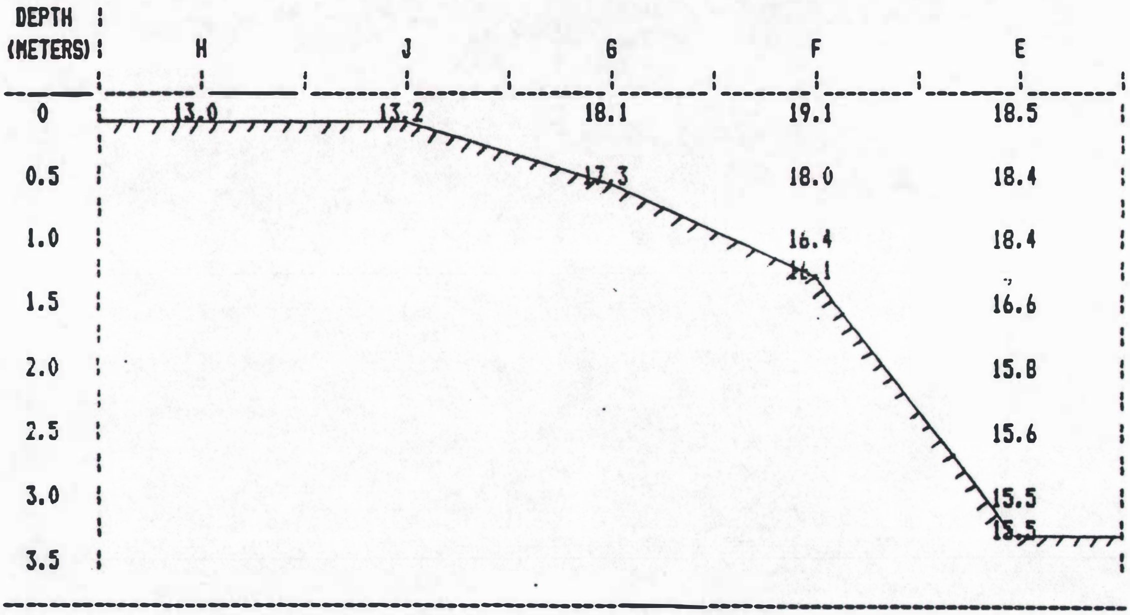
EAST SIDE TRANSECT
TEMPERATURE (C)



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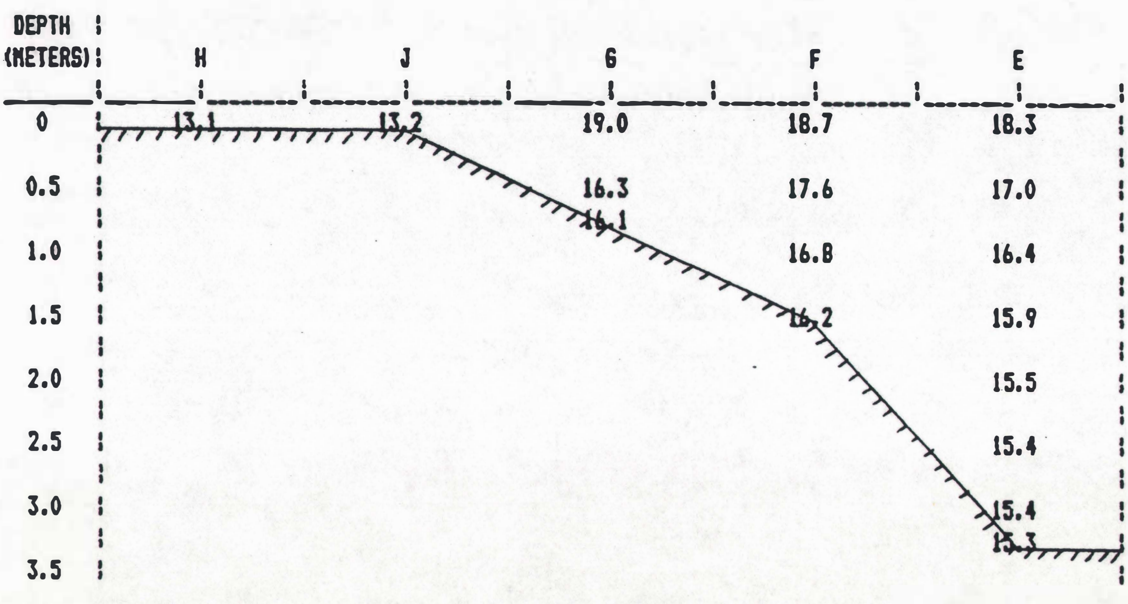

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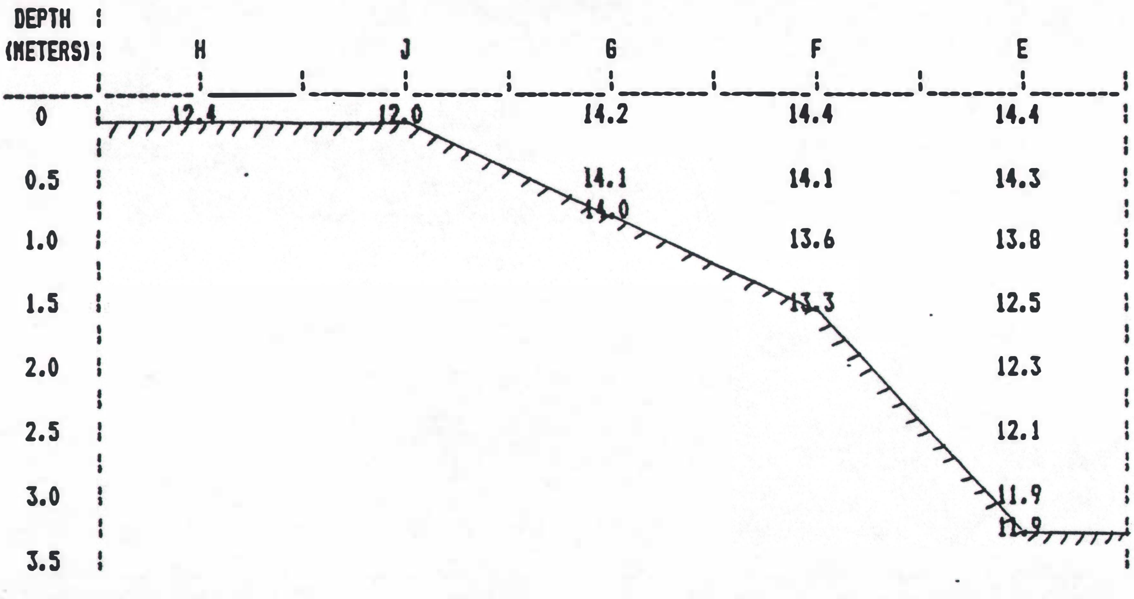

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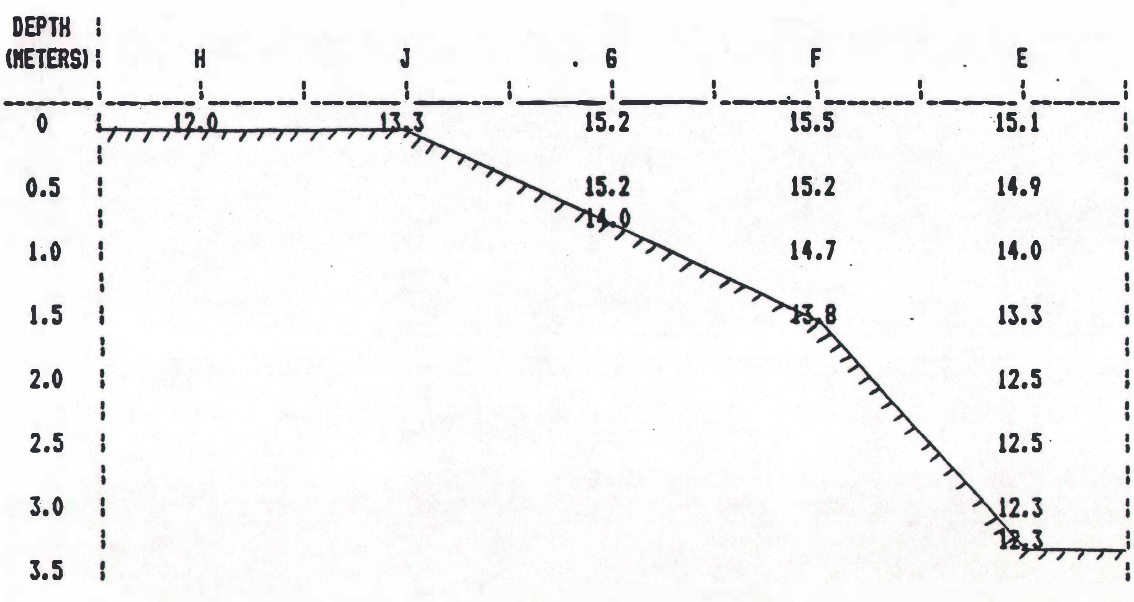

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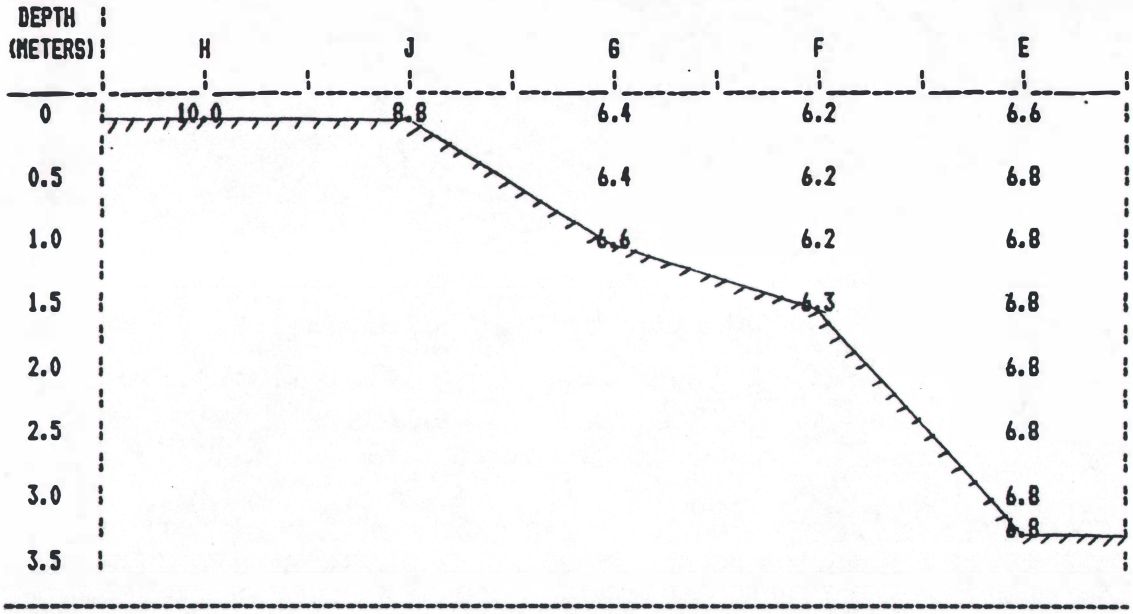
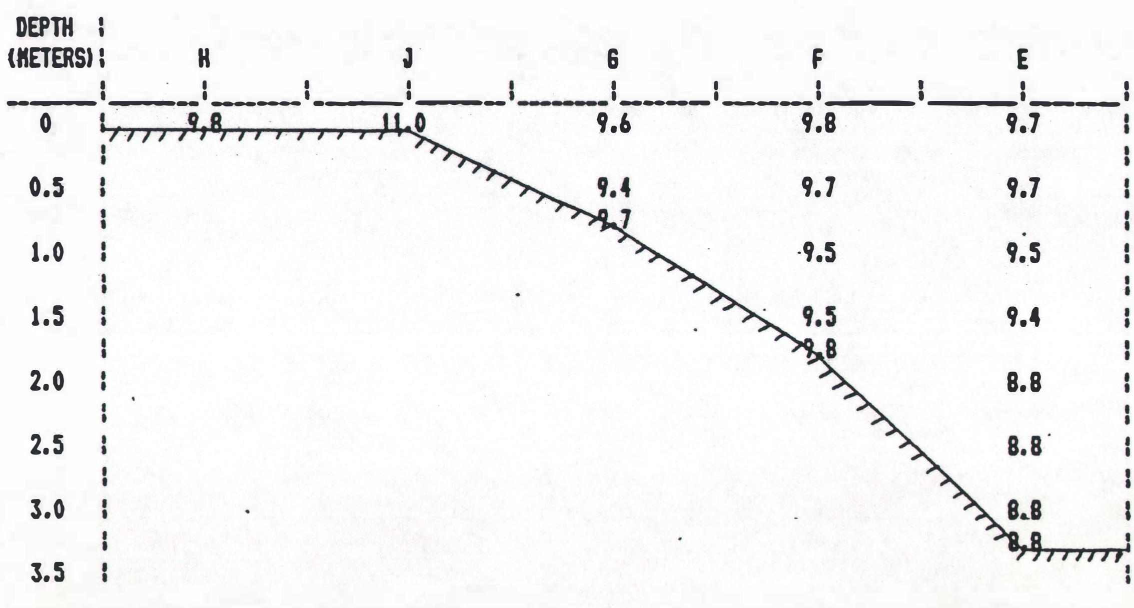
TEMPERATURE (C)



SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
TEMPERATURE (C)



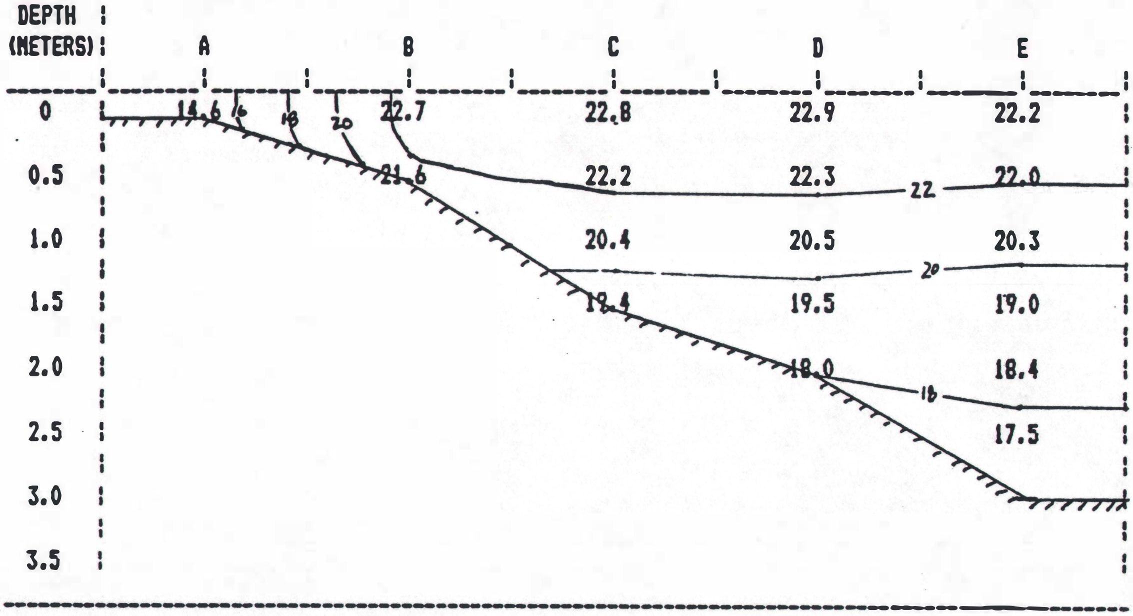
SAMPLING DATE 4-3-85
EAST SIDE TRANSECT
TEMPERATURE (C)

DEPTH (METERS)	H	J	S	F	E
0	10.1	9.9	8.7	8.9	9.3
0.5			8.5	9.1	9.3
			8.8		
1.0				8.3	9.3
1.5				8.7	9.3
				9.4	
2.0					9.3
2.5					9.3
3.0					9.1
3.5					9.0

SAMPLING DATE 5-16-85
EAST SIDE TRANSECT
TEMPERATURE (C)

DEPTH (METERS)	H	J	S	F	E
0	14.0	11.5	19.7	19.8	18.7
0.5			18.8	19.0	18.7
			8.8		
1.0				17.8	18.6
1.5				16.5	17.1
				16.3	
2.0					16.3
2.5					16.2
3.0					15.8
					15.6
3.5					

SAMPLING DATE 6-14-84
WEST SIDE TRANSECT
TEMPERATURE (C)



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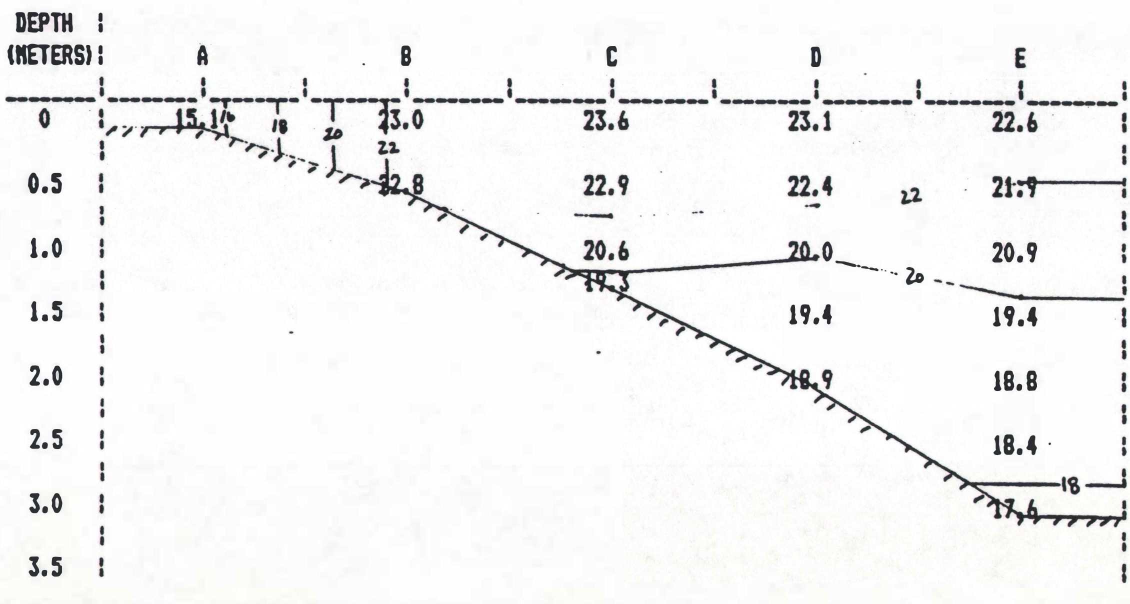
TEMPERATURE (C)



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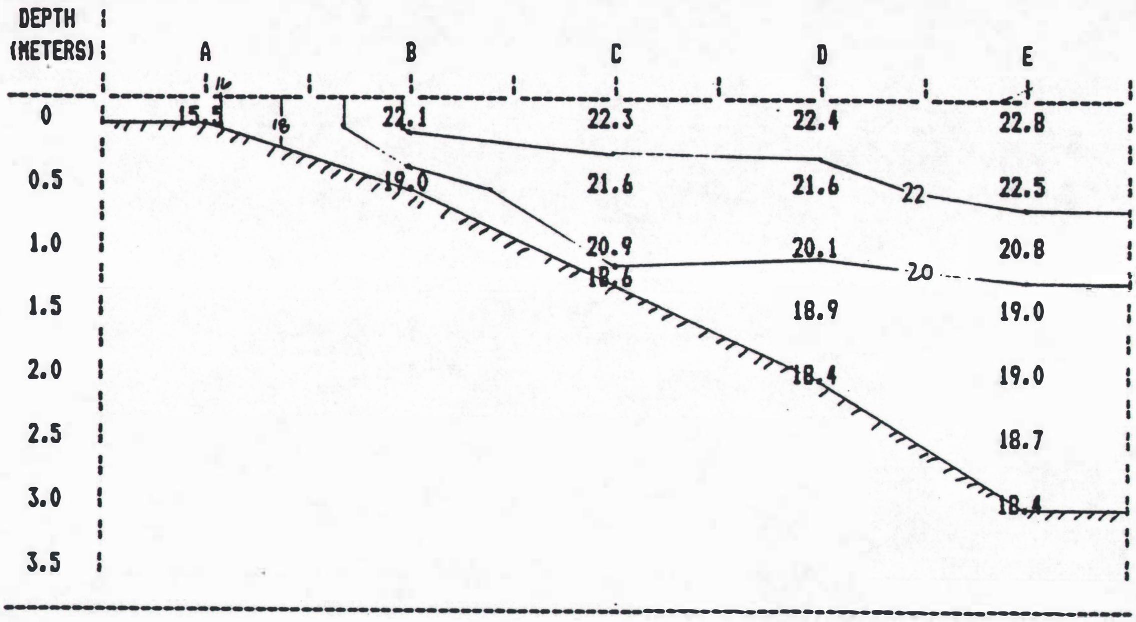

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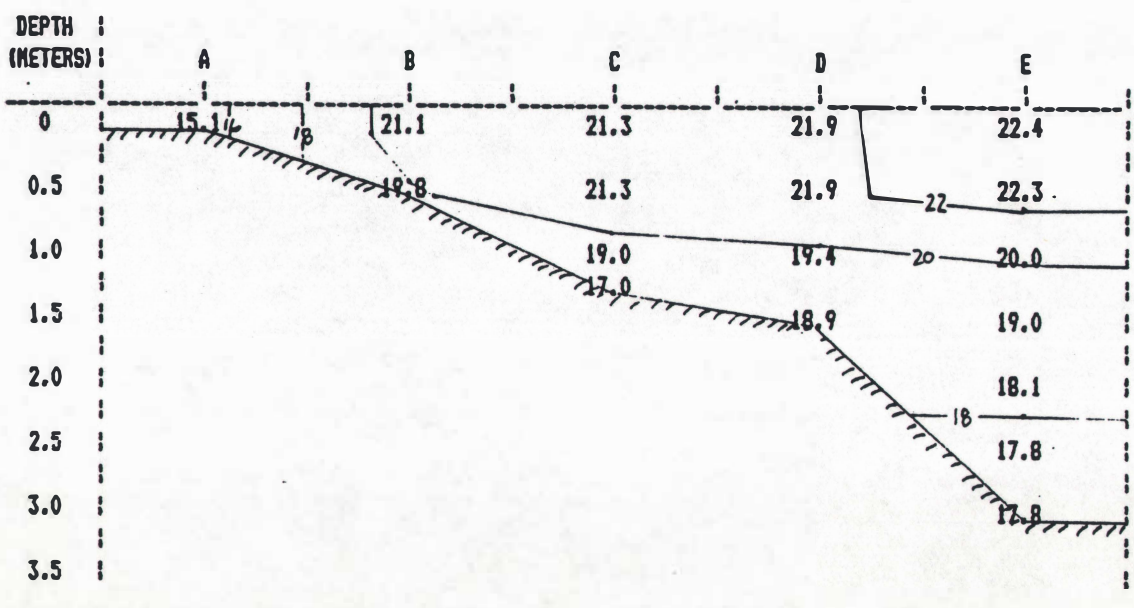
TEMPERATURE (C)



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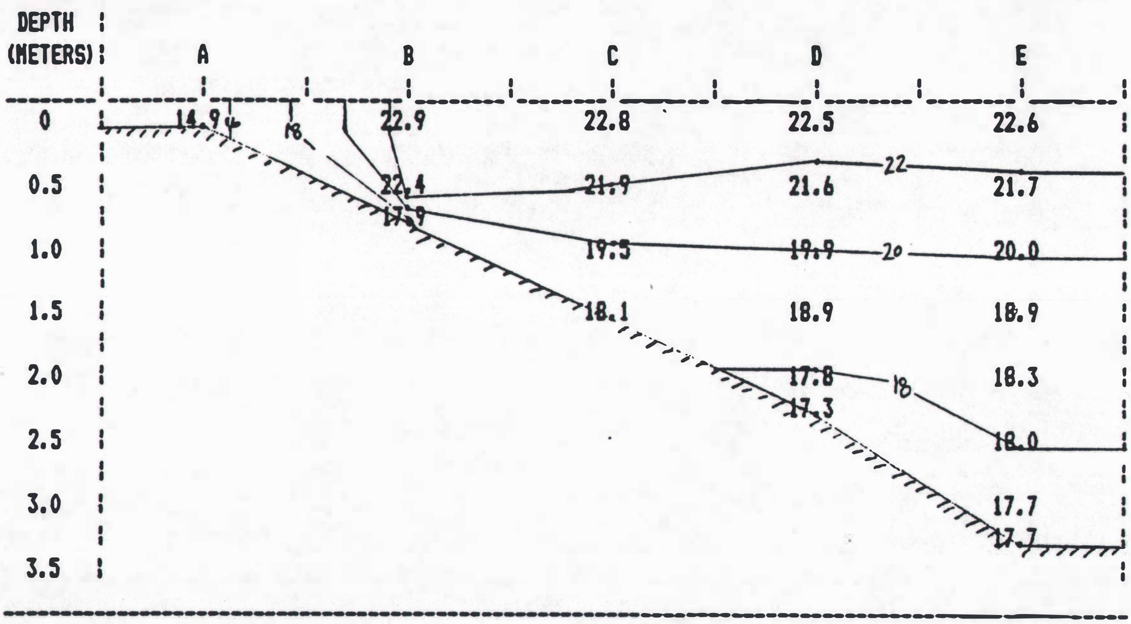

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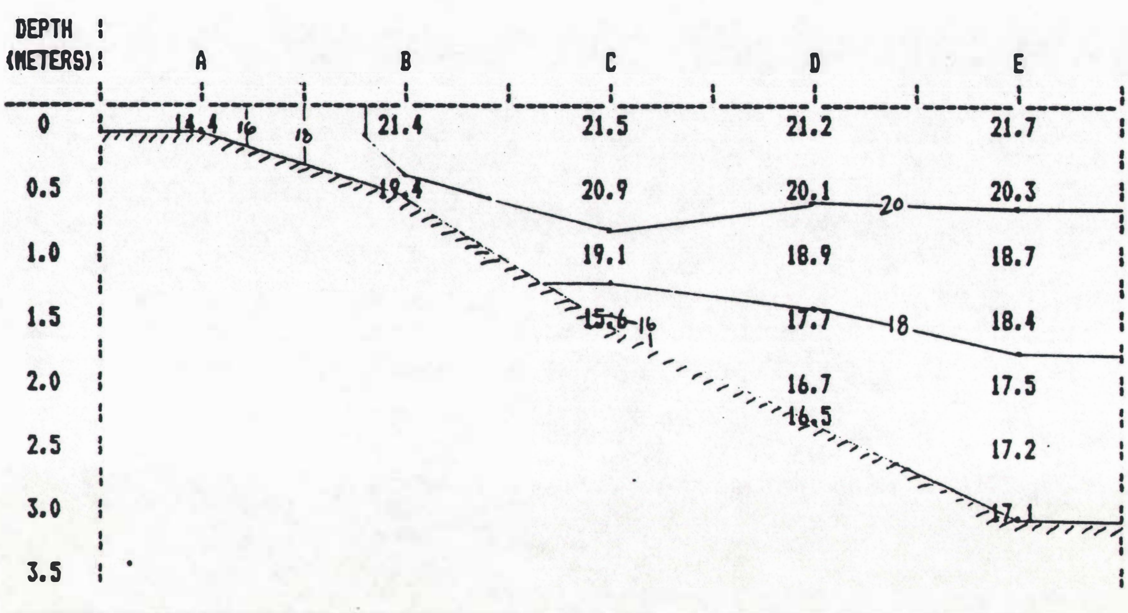

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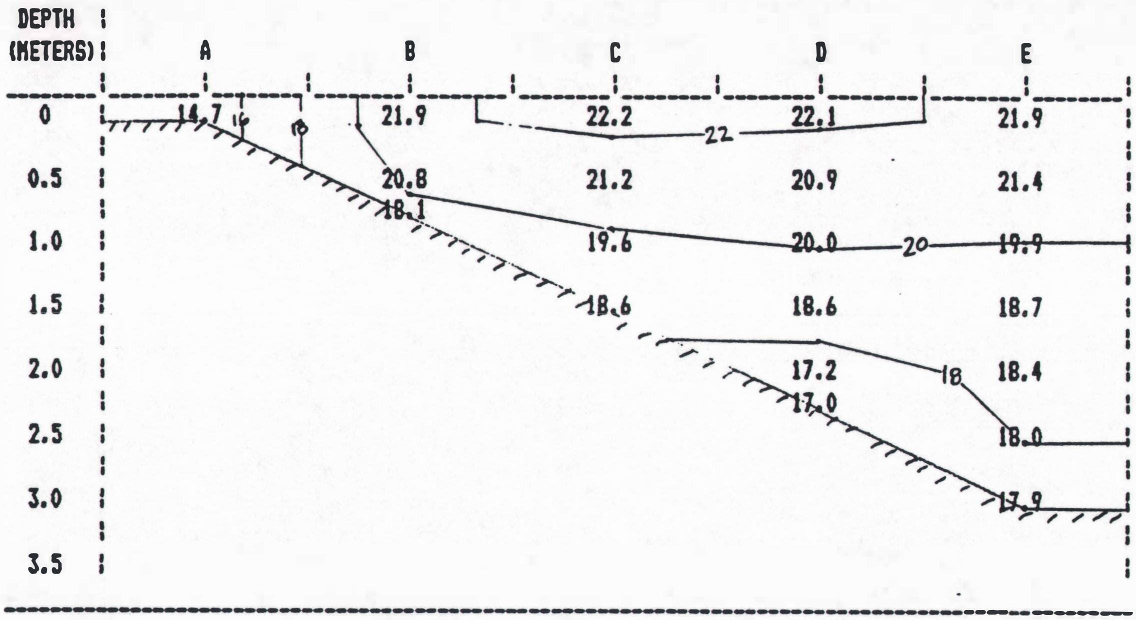
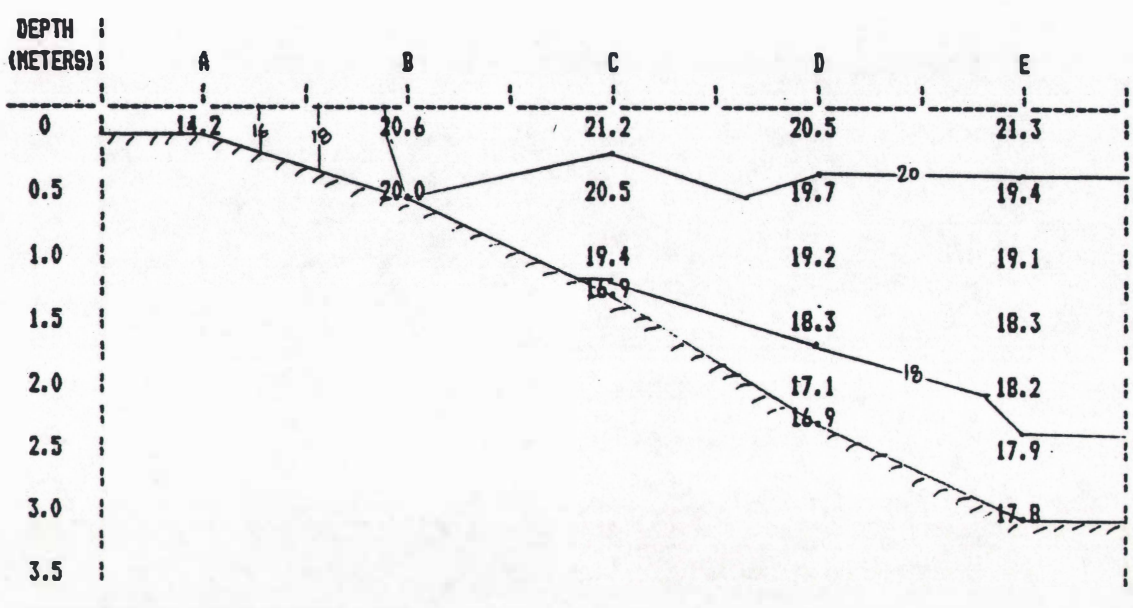
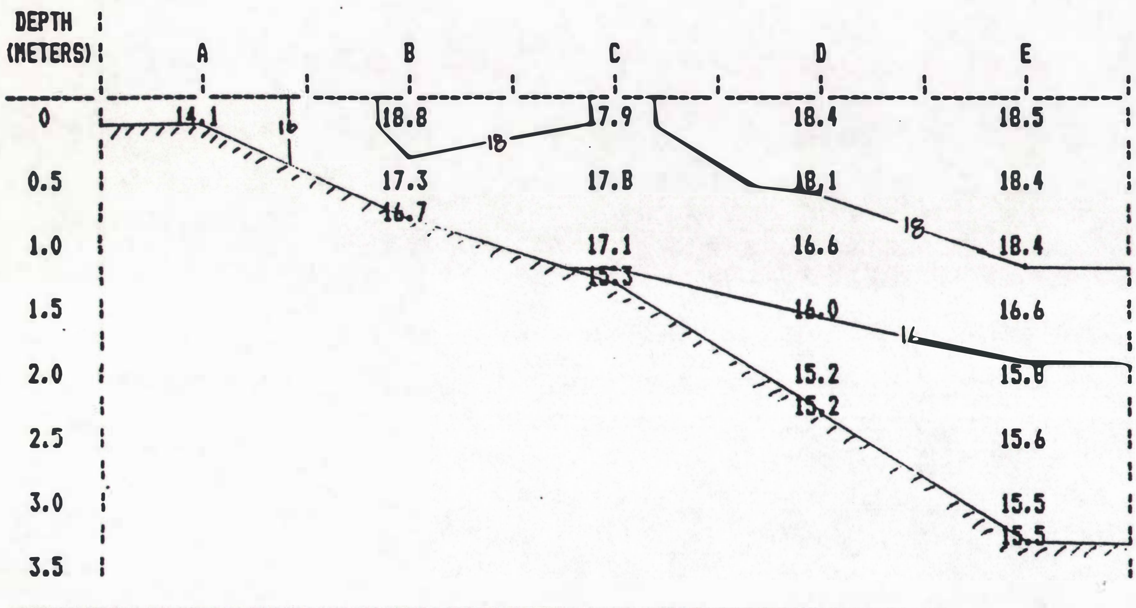
WEST SIDE TRANSECT
TEMPERATURE (C)



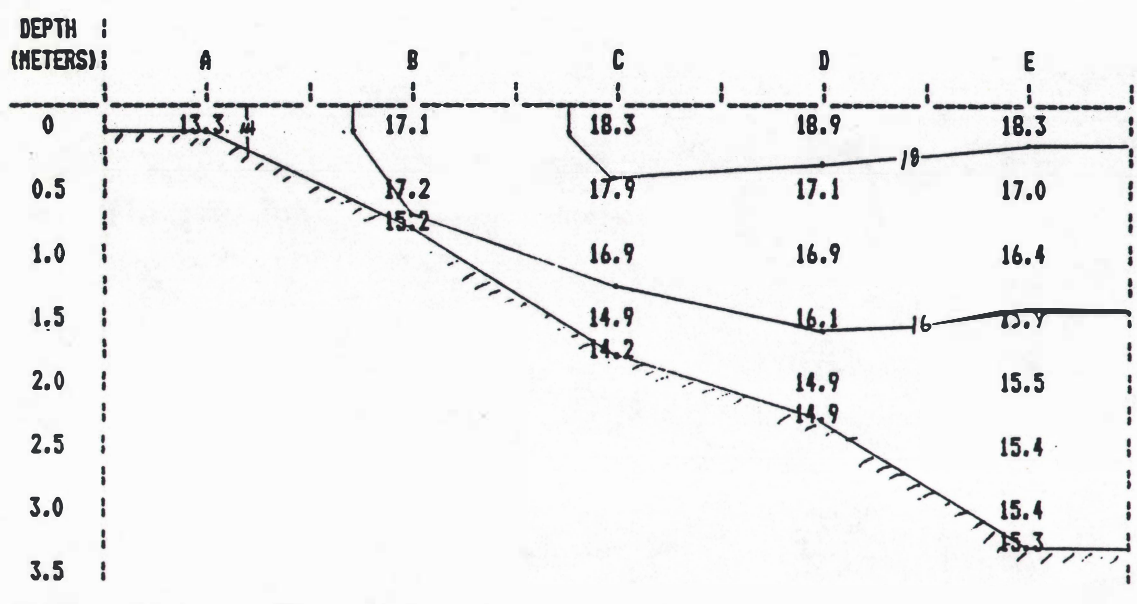
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
TEMPERATURE (C)



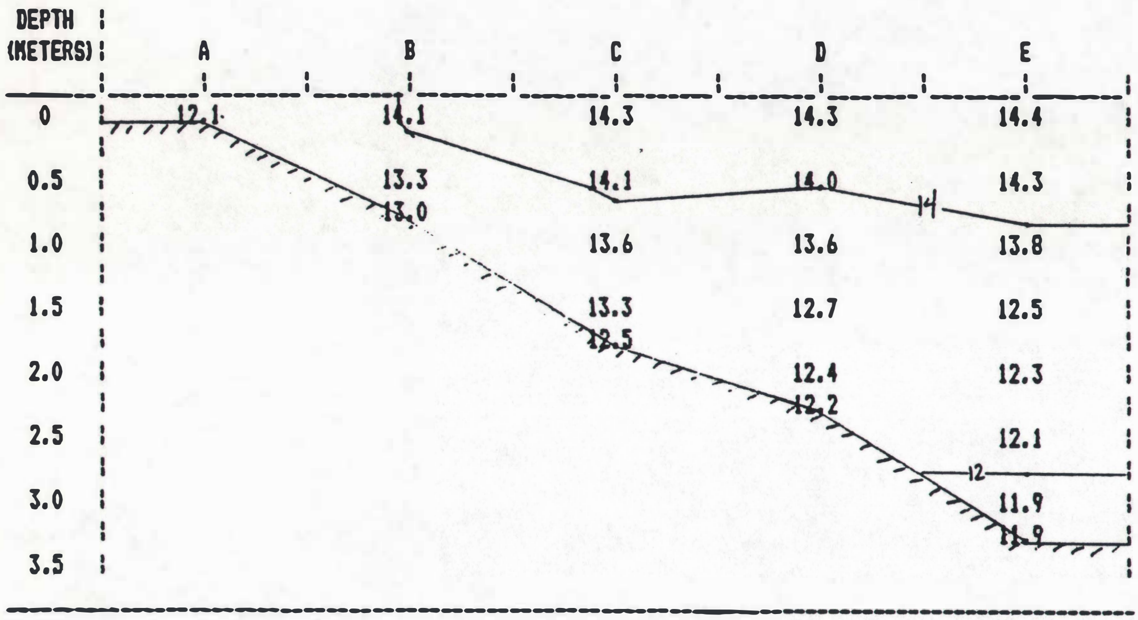
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
TEMPERATURE (C)



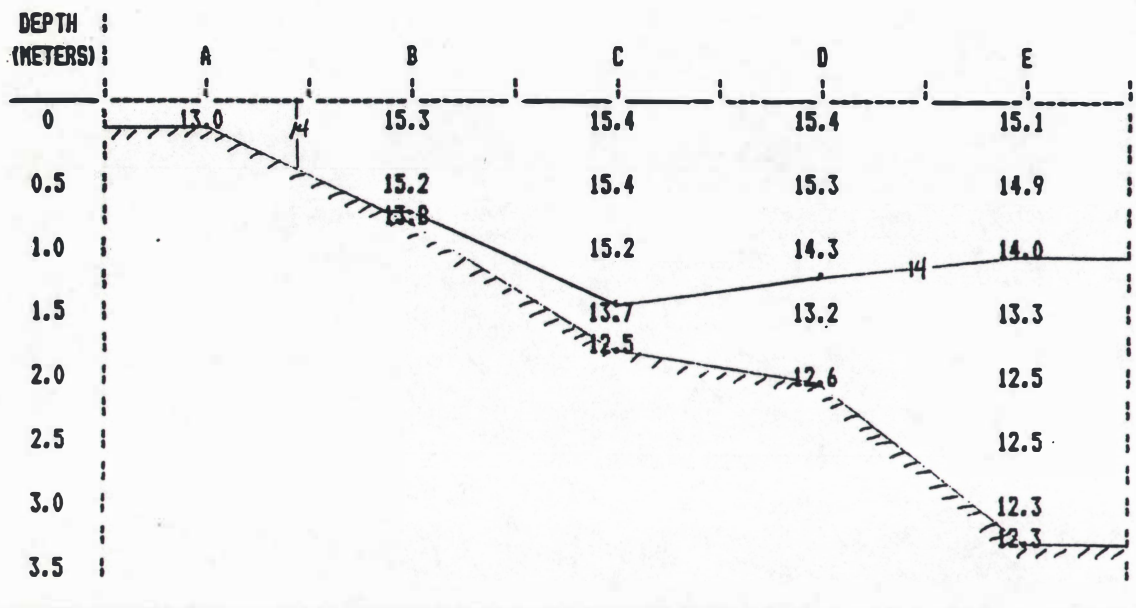
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
TEMPERATURE (C)



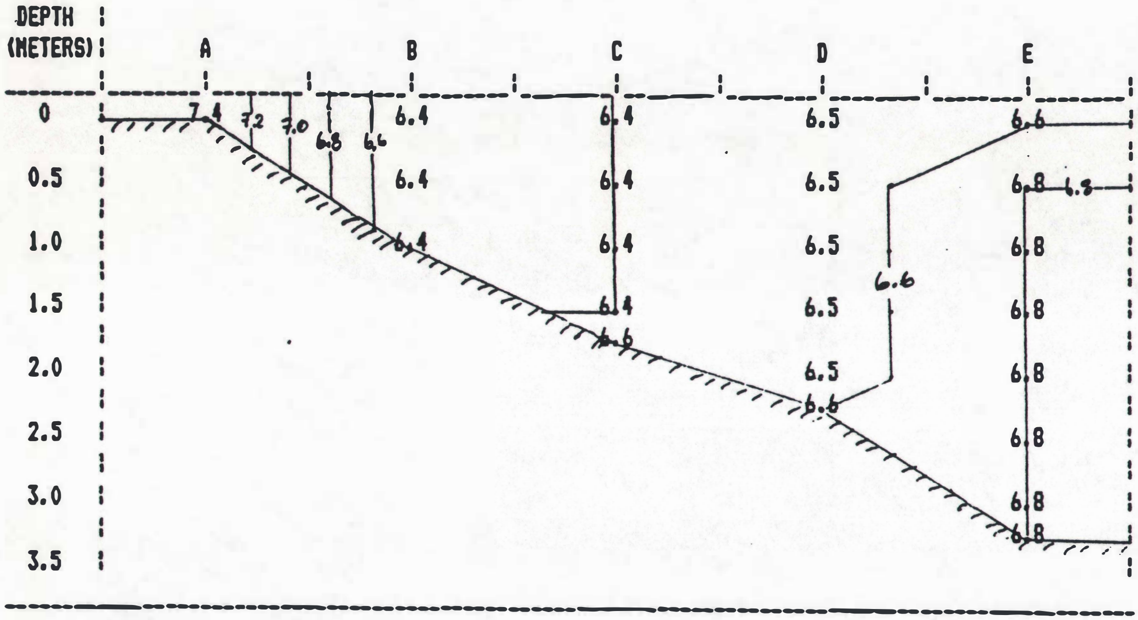
SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
TEMPERATURE (C)



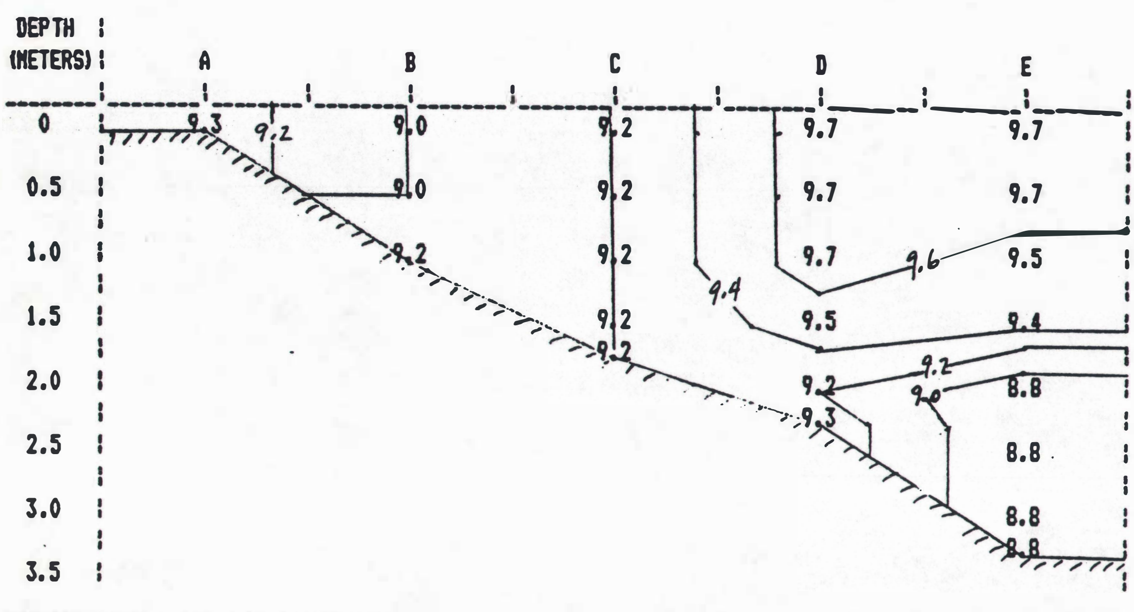
SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
TEMPERATURE (C)



SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
TEMPERATURE (C)



SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
TEMPERATURE (C)



SAMPLING DATE 4-3-85
WEST SIDE TRANSECT
TEMPERATURE (C)

DEPTH (METERS)	A	B	C	D	E
0	10.3	9.0	9.1	9.2	9.3
0.5		8.9	9.1	9.1	9.3
		8.7			
1.0			9.0	9.1	9.3
1.5			8.8	9.1	9.3
			8.9		
2.0				8.8	9.3
				9.2	
2.5					9.3
3.0					9.1
3.5					9.0

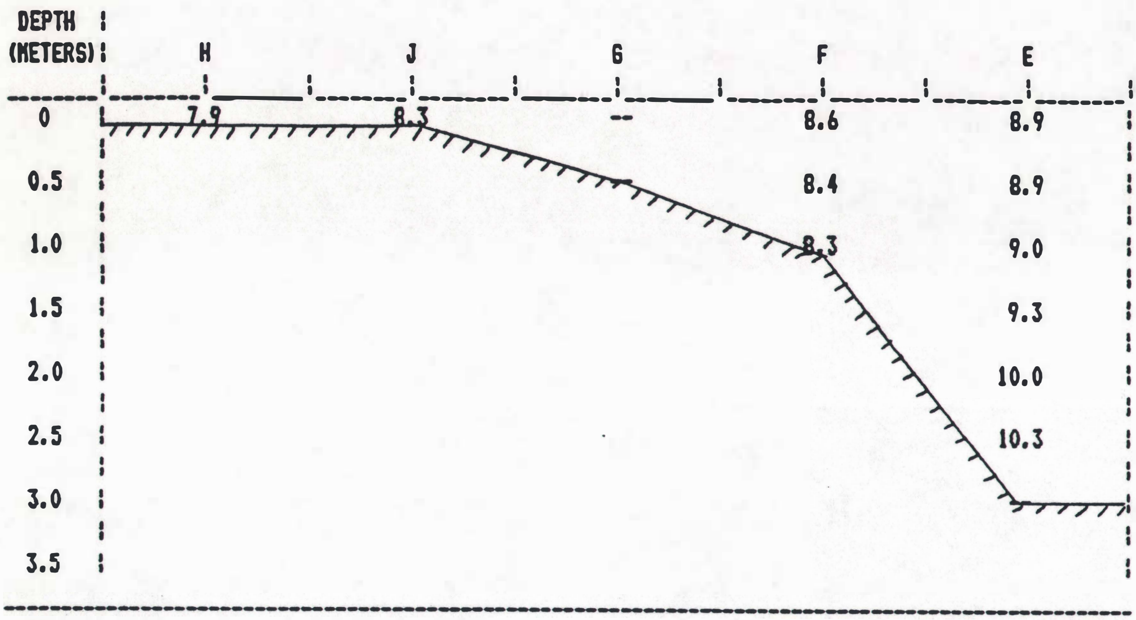
SAMPLING DATE 5-16-85
WEST SIDE TRANSECT
TEMPERATURE (C)

DEPTH (METERS)	A	B	C	D	E
0	14.1	18.6	18.6	18.8	16.7
0.5		18.1	18.6	18.6	18.7
1.0		17.2	17.7	17.9	18.6
1.5			16.9	17.4	17.1
			16.9		
2.0				16.1	16.3
				16.2	
2.5					16.2
3.0					15.8
					15.6
3.5					

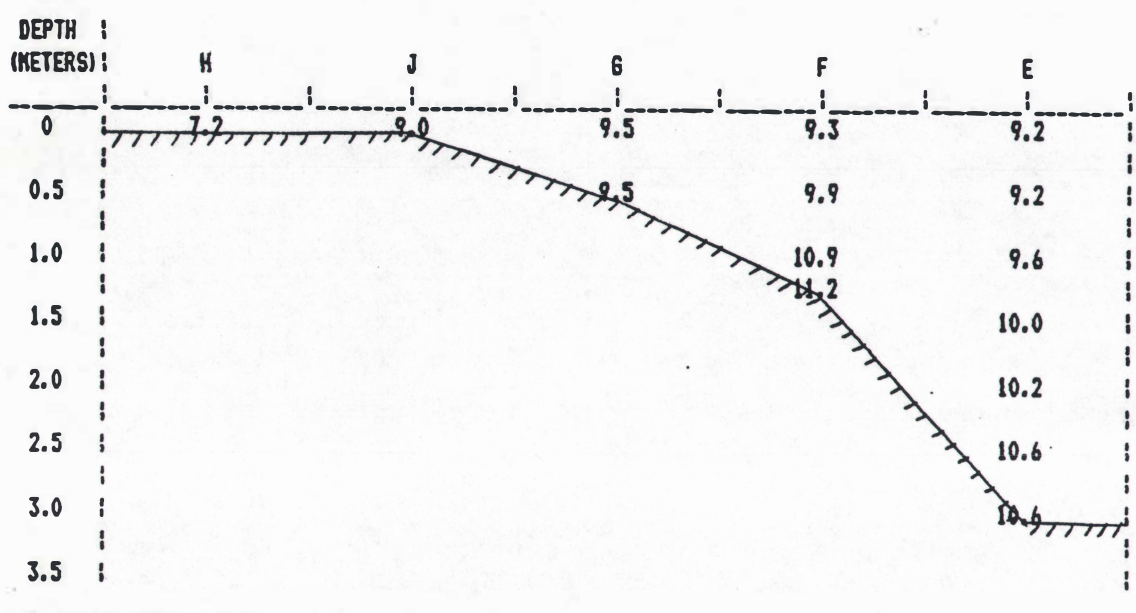
APPENDIX B:

Dissolved Oxygen Data

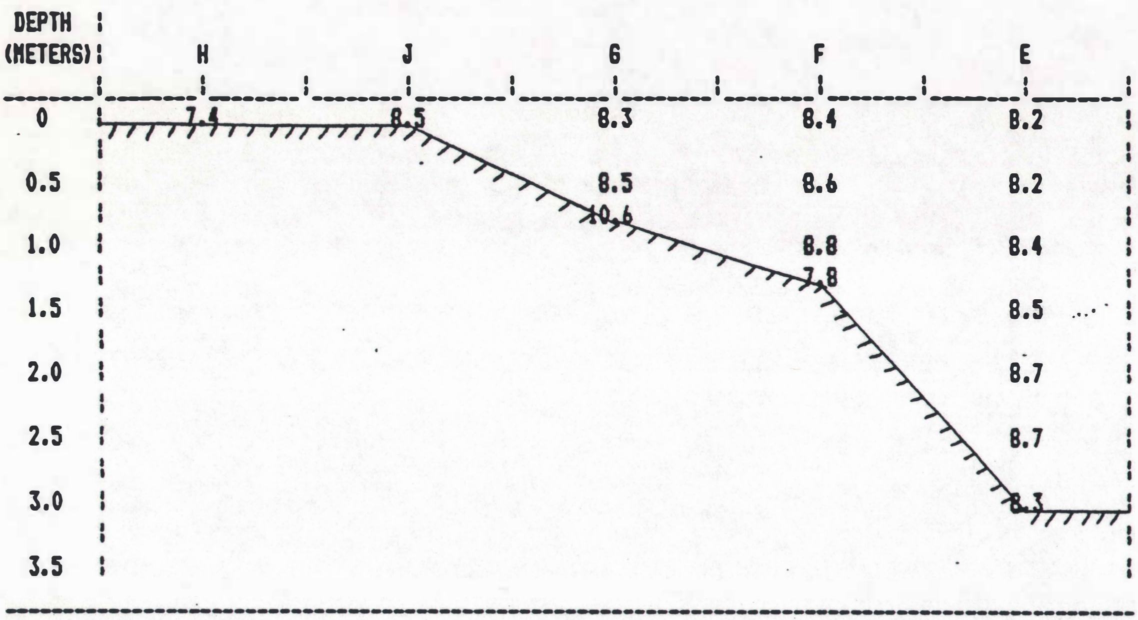
SAMPLING DATE 6-14-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



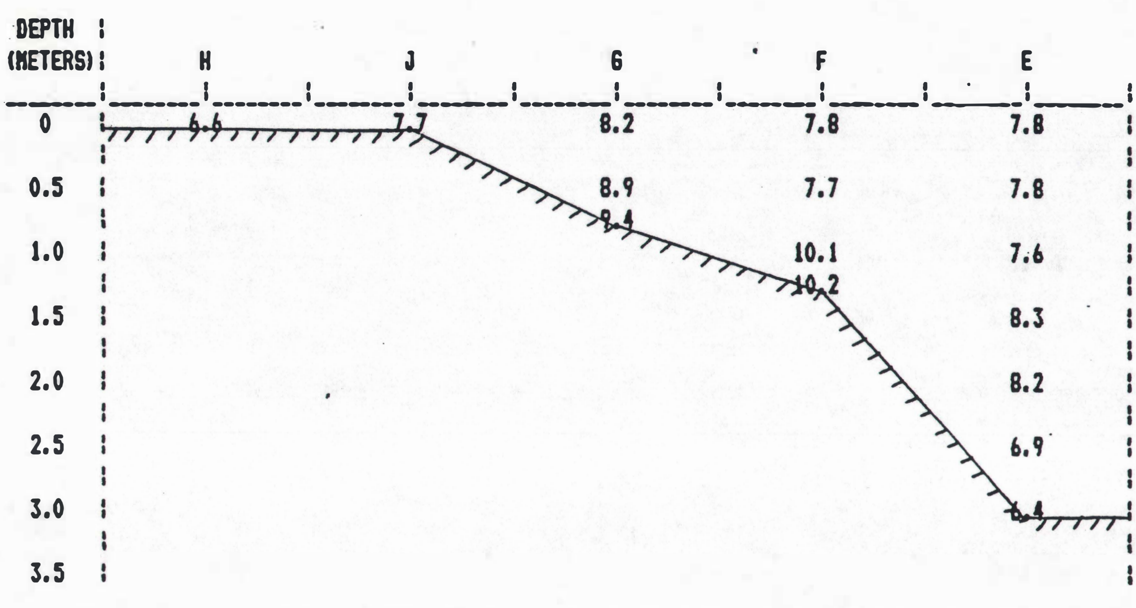
SAMPLING DATE 6-21-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



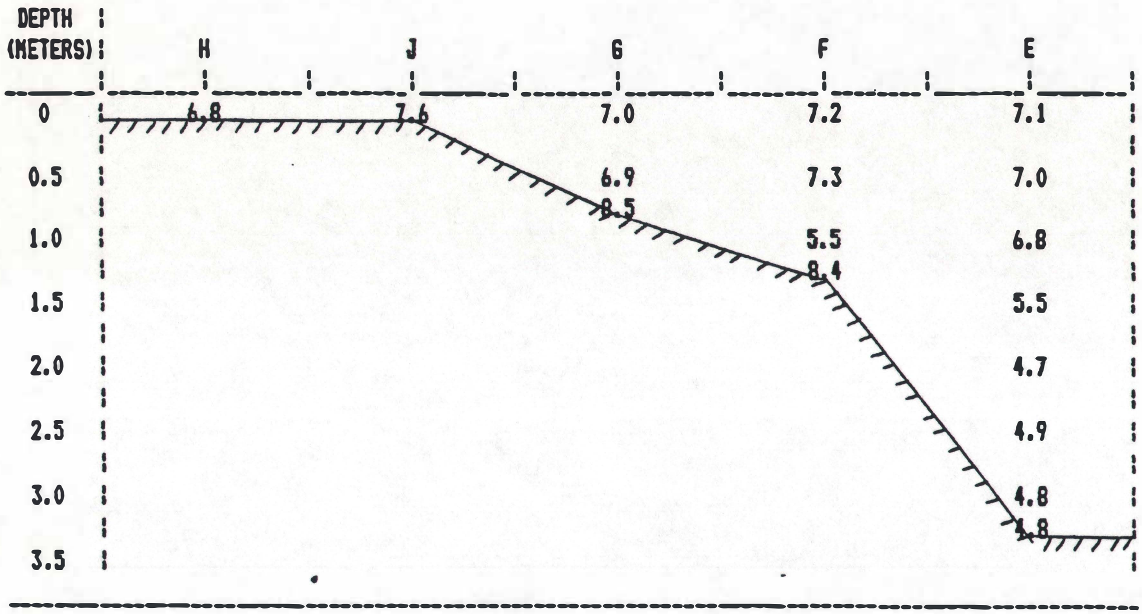
SAMPLING DATE 6-28-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



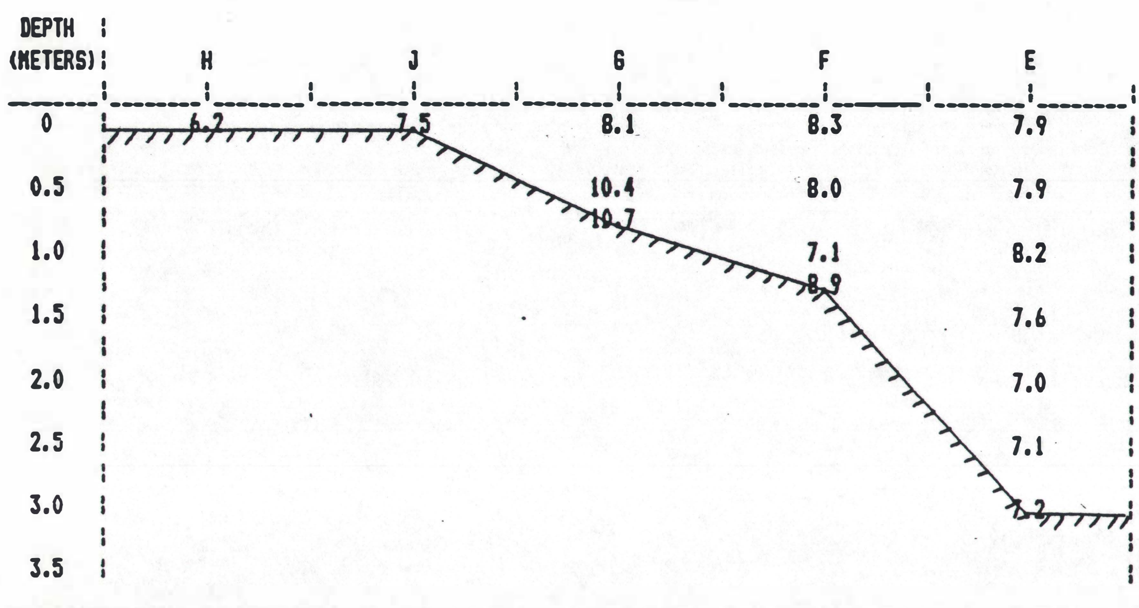
SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



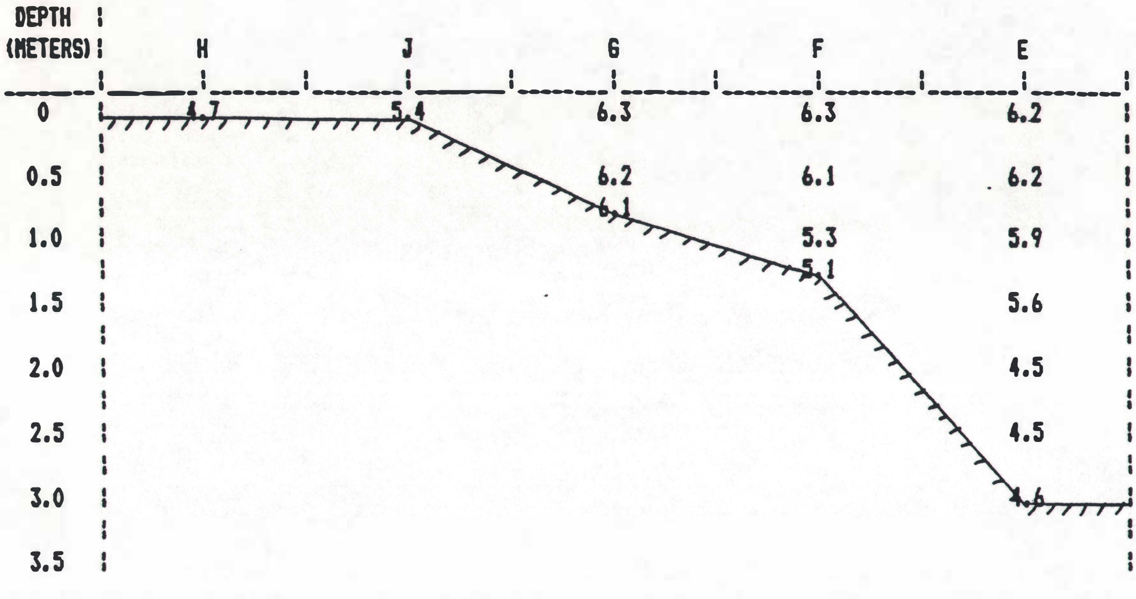
SAMPLING DATE 7-24-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



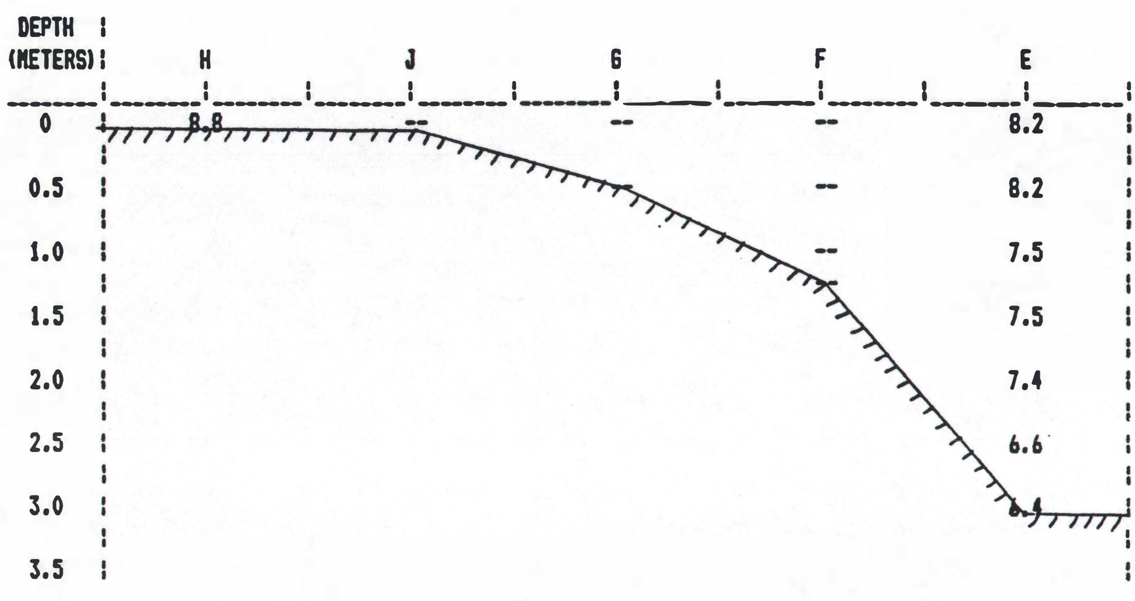
SAMPLING DATE 7-30-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



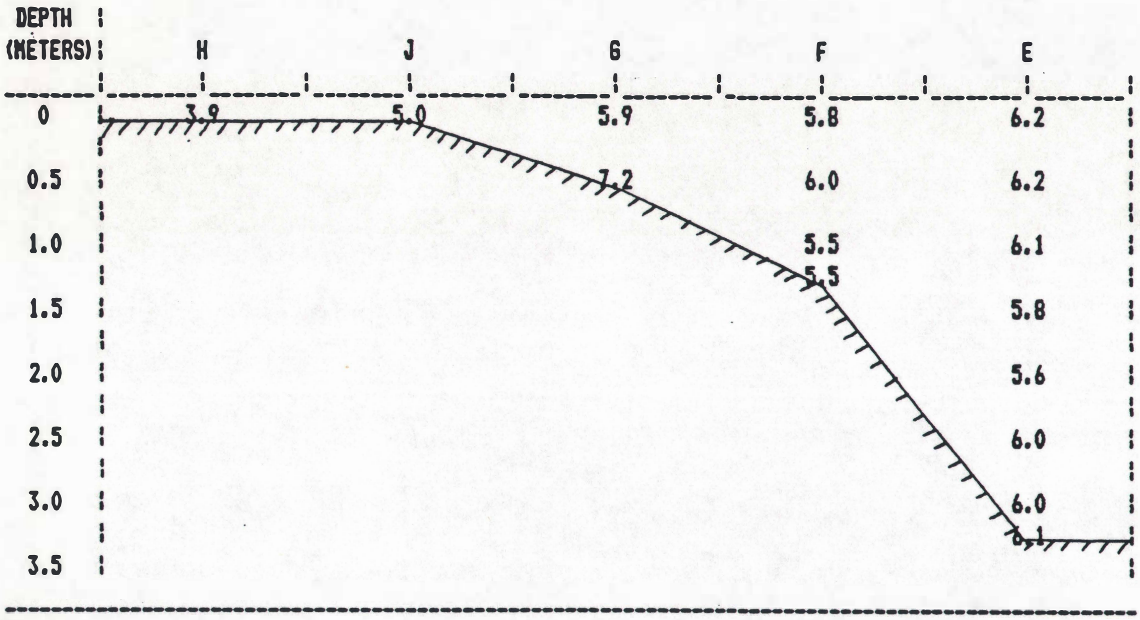
SAMPLING DATE 8-13-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



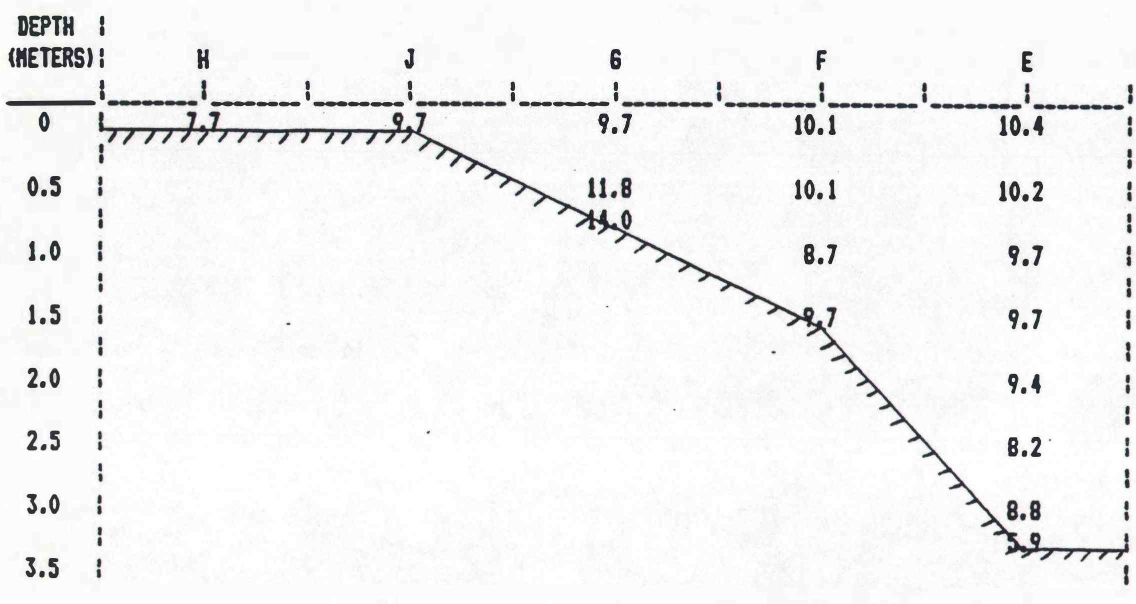
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



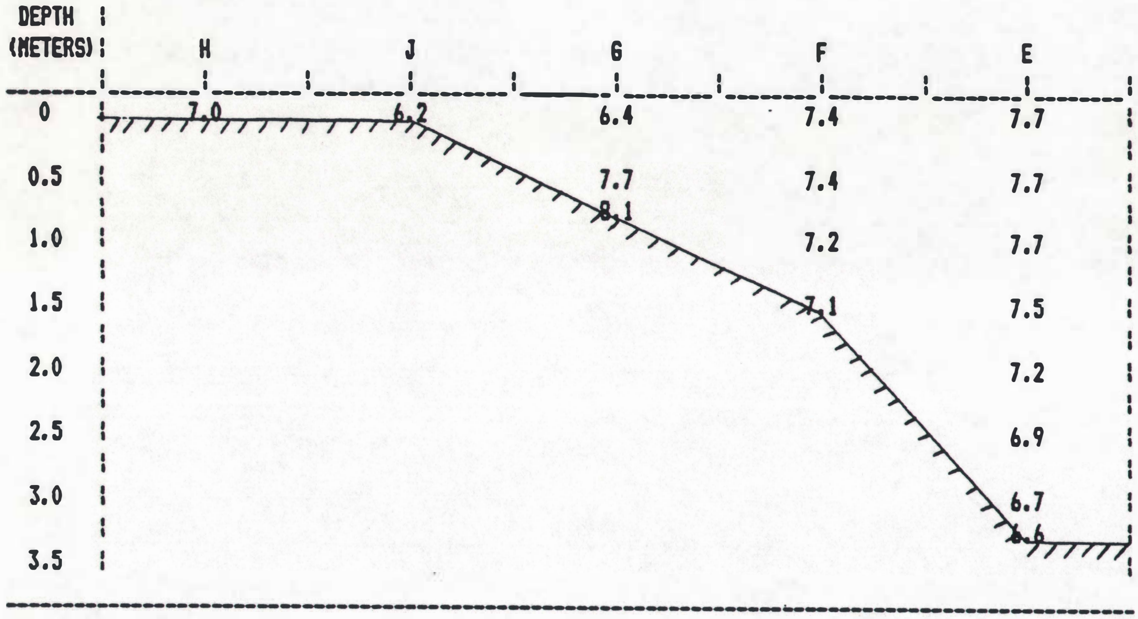
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



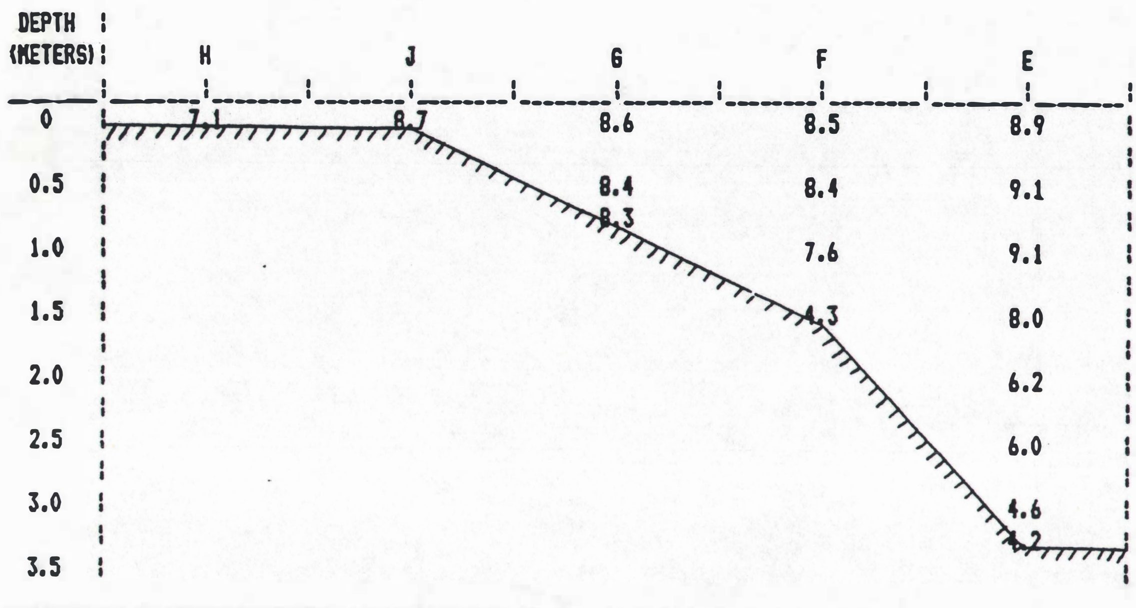
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



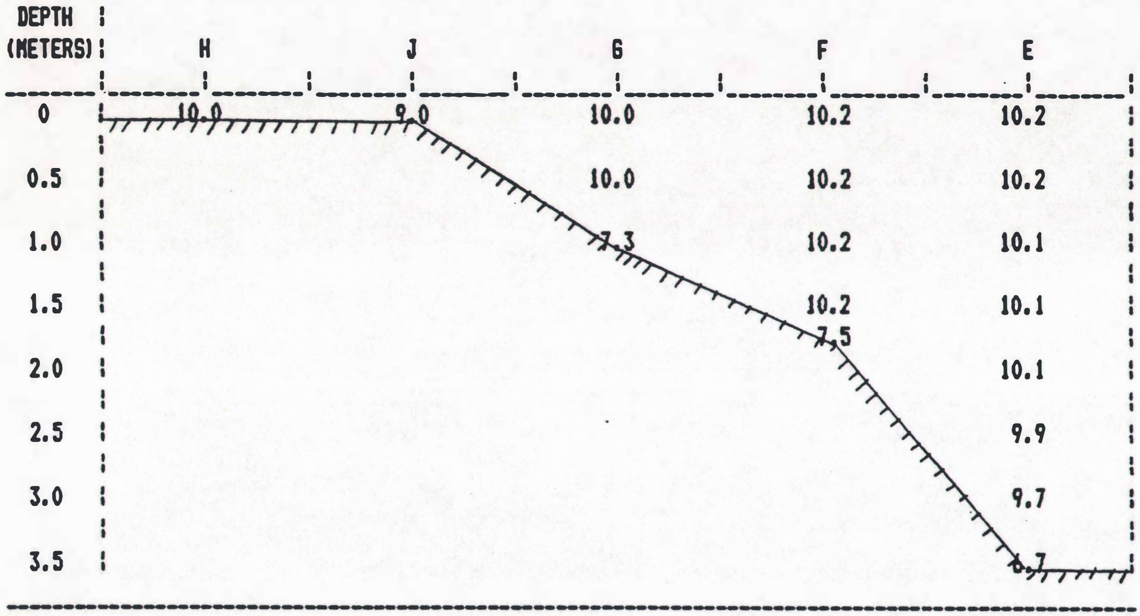
SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



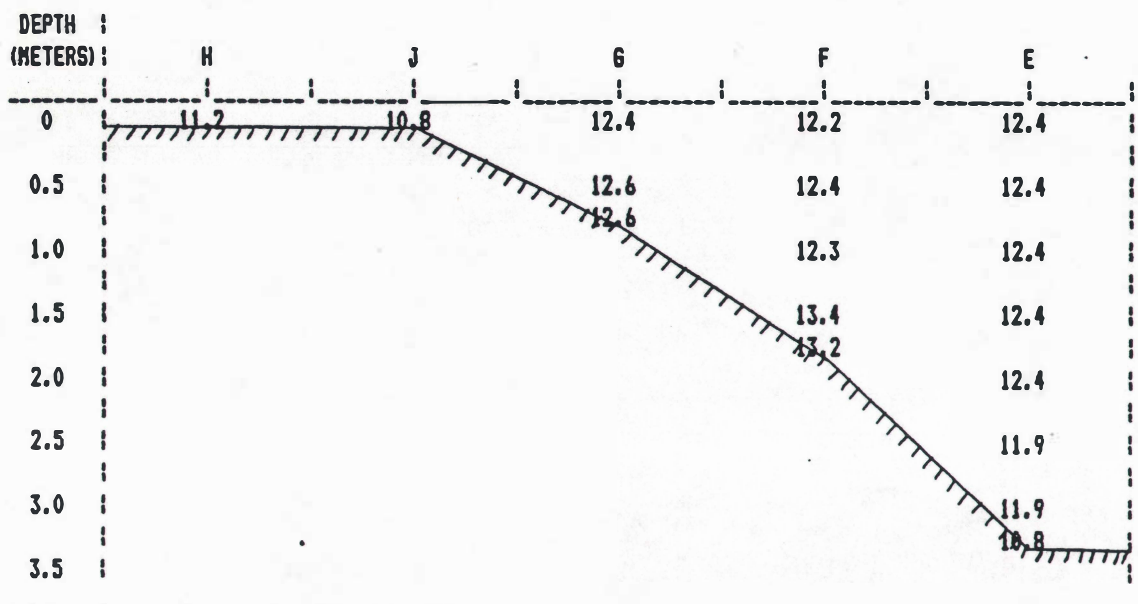
SAMPLING DATE 10-23-84
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 4-3-85
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	H	J	G	F	E
0	9.3	10.1	11.0	11.0	11.1
0.5			11.0	11.0	11.2
			11.2		
1.0				11.8	11.2
1.5				12.0	11.2
				10.8	
2.0					11.2
2.5					11.2
3.0					11.2
3.5					10.3

SAMPLING DATE 5-16-85
EAST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	H	J	G	F	E
0	7.8	9.4	11.8	11.3	10.8
0.5			11.8	11.8	11.0
			> 17		
1.0				11.9	11.0
1.5				> 17	11.5
				> 18	
2.0					11.3
2.5					10.8
3.0					10.0
					8.9
3.5					

SAMPLING DATE 6-14-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	8.3	9.0	8.8	8.9	8.9
0.5		8.1	8.6	8.5	8.9
1.0			8.3	8.0	9.0
1.5			8.3	7.7	9.3
2.0				6.9	10.0
2.5					10.3
3.0					
3.5					

SAMPLING DATE 6-21-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	10.8	10.4	9.5	9.3	9.2
0.5		10.0	9.3	9.9	9.2
1.0			11.8	9.3	9.6
1.5			10.0	10.5	10.0
2.0				11.2	10.2
2.5					10.6
3.0					10.6
3.5					

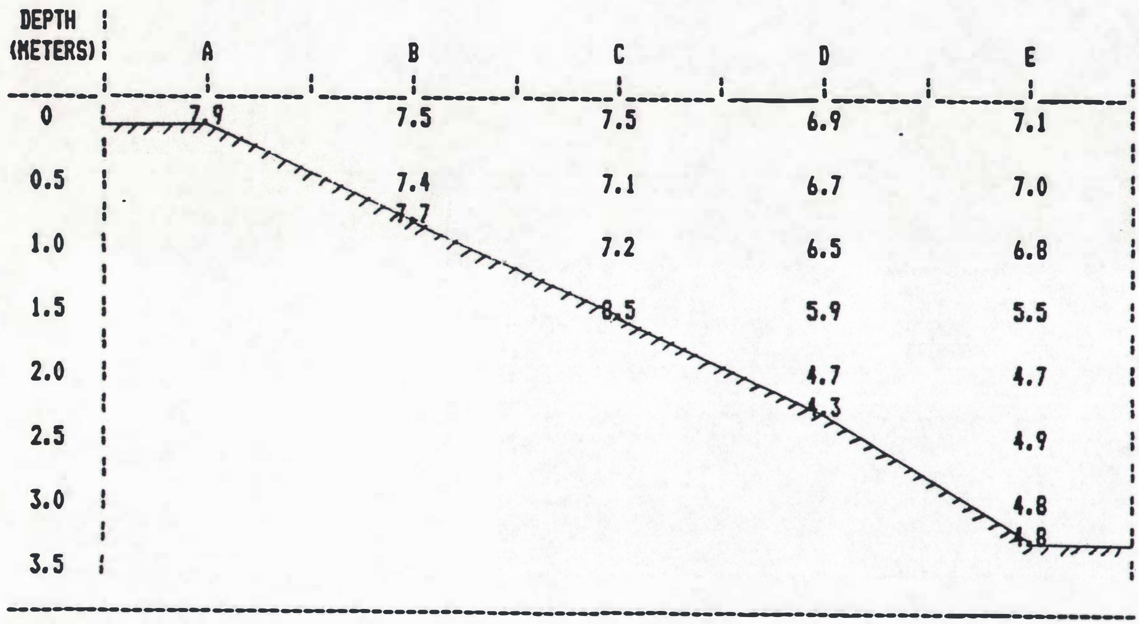
SAMPLING DATE 6-28-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	7.4	8.6	8.3	8.1	8.2
0.5		10.5	8.5	7.9	8.2
1.0			8.9	7.8	8.4
			8.6		
1.5				8.3	8.5
2.0				6.5	8.7
2.5					8.7
3.0					8.3
3.5					

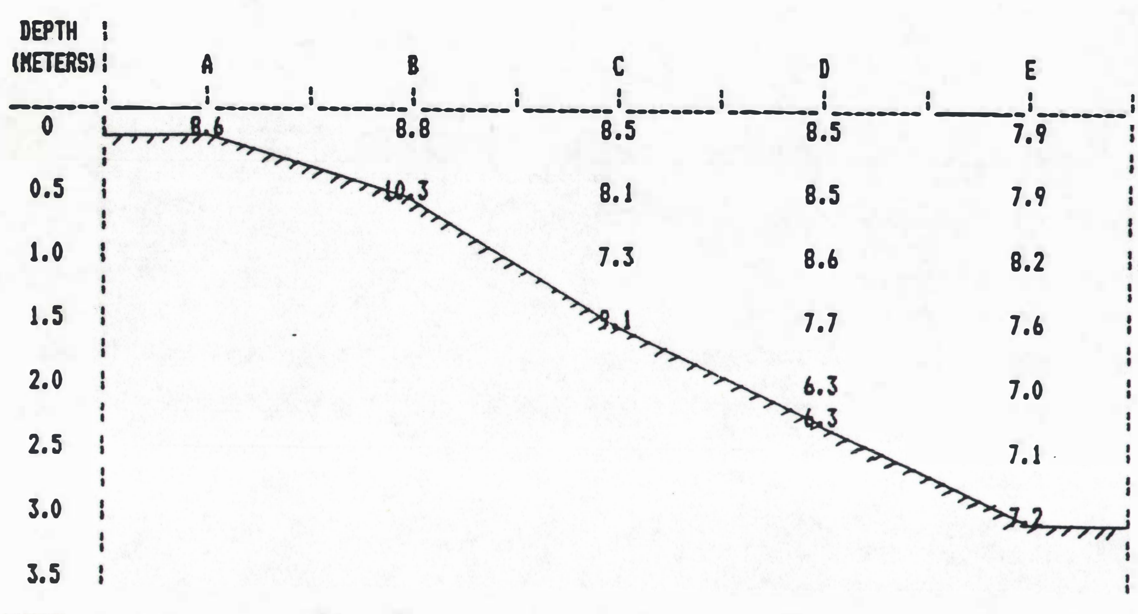
SAMPLING DATE 7-5-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	7.9	8.0	8.0	7.8	7.8
0.5		8.0	8.0	7.8	7.8
1.0			7.8	7.9	7.6
			8.7		
1.5				8.3	8.3
2.0					8.2
2.5					6.9
3.0					6.4
3.5					

SAMPLING DATE 7-24-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 7-30-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	5.8	6.6	6.0	6.2	6.2
0.5		6.4	6.0	6.2	6.2
		6.2			
1.0			5.7	6.2	5.9
1.5			5.6	5.1	5.6
2.0				3.9	4.5
				3.8	
2.5					4.5
3.0					4.6
3.5					

SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	8.0	9.0	8.6	8.4	8.2
0.5		9.0	8.7	8.2	8.2
1.0			8.2	8.0	7.5
			7.9		
1.5				7.6	7.5
2.0				7.1	7.4
				6.9	
2.5					6.6
3.0					6.4
3.5					

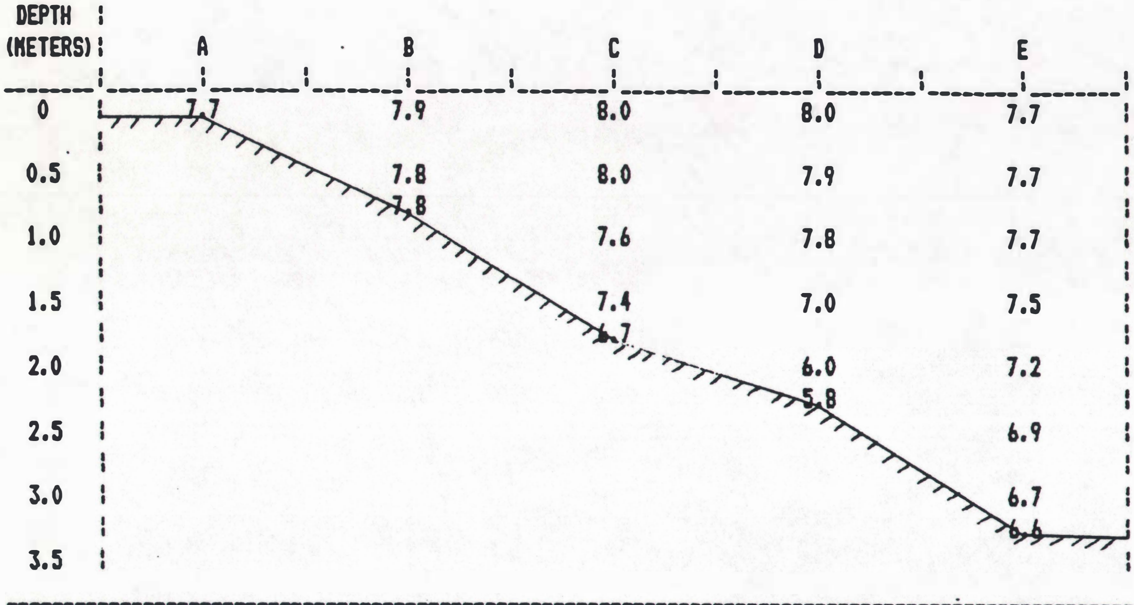
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	7.1	7.6	7.0	6.6	6.2
0.5		7.9	7.0	6.6	6.2
		8.6			
1.0			7.0	6.3	6.1
			6.5		
1.5				6.4	5.8
2.0				7.0	5.6
				6.5	
2.5					6.0
3.0					6.0
					6.1
3.5					

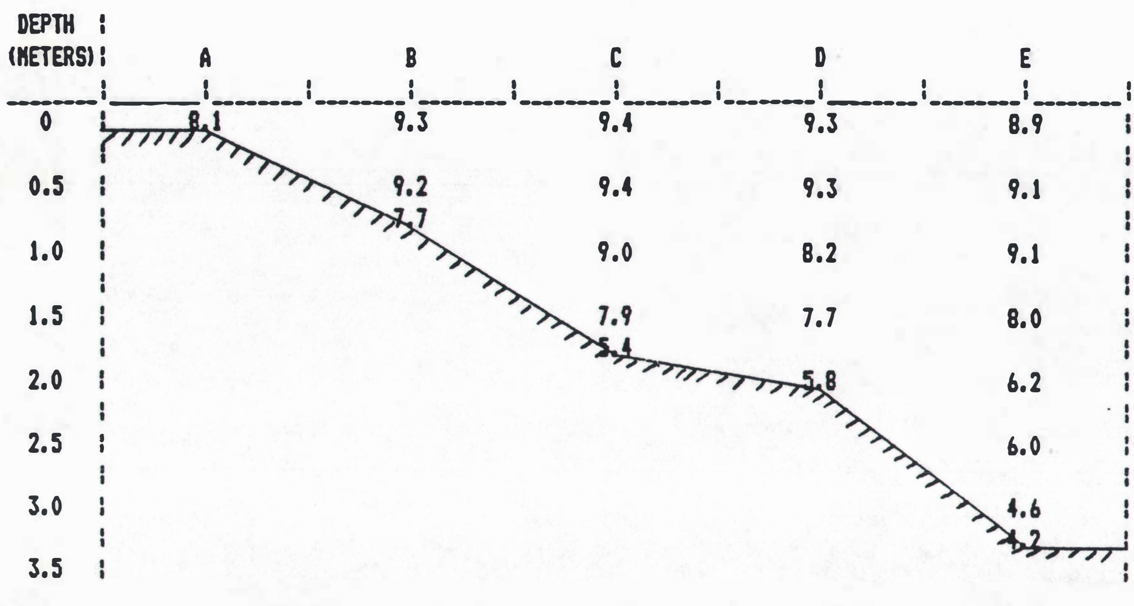
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	9.8	9.8	9.8	9.8	10.4
0.5		9.8	9.8	9.8	10.2
		10.4			
1.0			9.3	9.8	9.7
1.5			8.1	9.4	9.7
			3.2		
2.0				8.1	9.4
				8.3	
2.5					8.2
3.0					8.8
					5.9
3.5					

SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)



SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	9.9	10.6	10.5	10.6	10.2
0.5		10.6	10.4	10.4	10.2
1.0		10.0	10.0	10.4	10.1
1.5			10.0 8.2	10.2	10.1
2.0				10.2	10.1
2.5				7.8	9.9
3.0					9.7
3.5					6.7

SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	10.9	12.1	13.3	12.6	12.4
0.5		12.1	13.1	12.8	12.4
1.0		10.0	11.8	12.7	12.4
1.5			11.8 11.0	12.6	12.4
2.0				12.6	12.4
2.5				12.6	11.9
3.0					11.9 10.8
3.5					

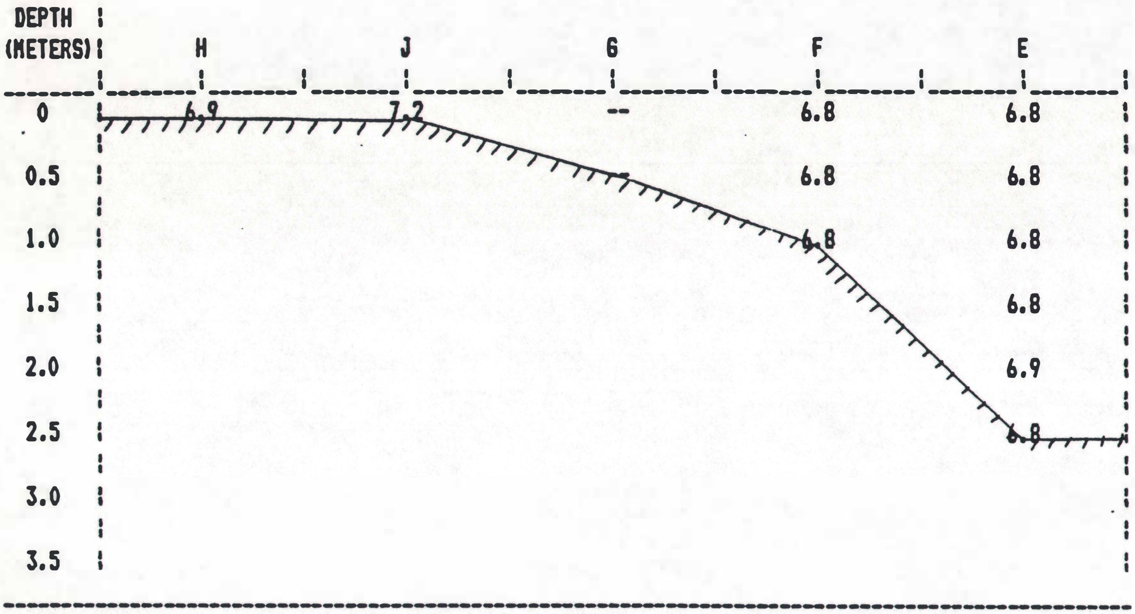
SAMPLING DATE 4-3-85
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	10.5	10.5	11.0	10.3	11.1
0.5		10.5	10.8	10.8	11.2
		11.8			
1.0			11.2	10.8	11.2
1.5			11.2	10.8	11.2
			12.2		
2.0				11.2	11.2
2.5				12.4	11.2
3.0					11.2
3.5					10.3

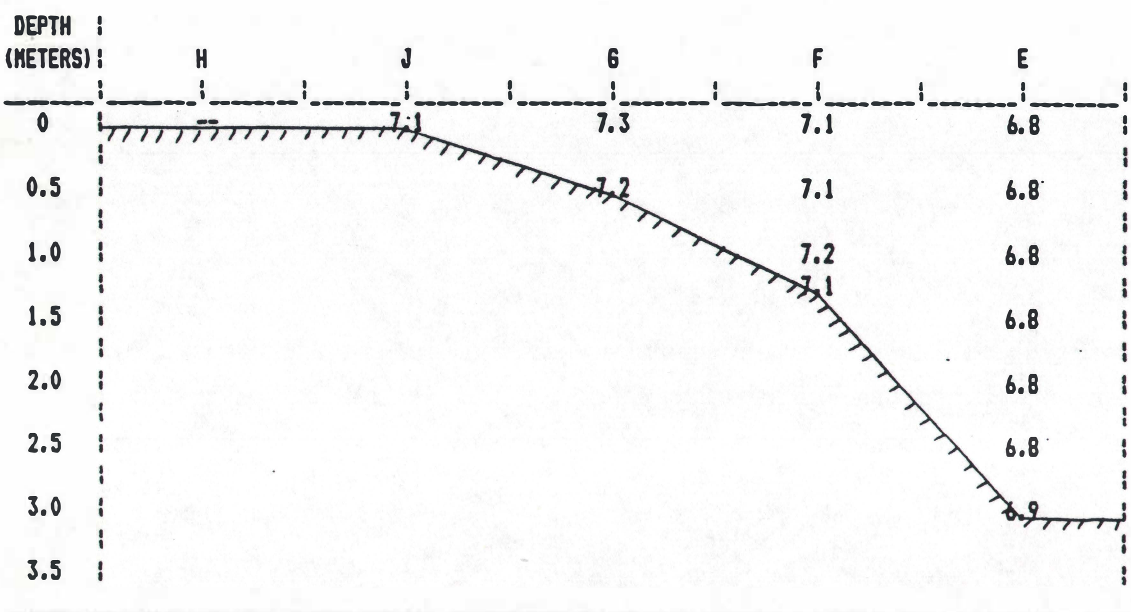
SAMPLING DATE 5-16-85
WEST SIDE TRANSECT
DISSOLVED OXYGEN CONCENTRATION (mg/l)

DEPTH (METERS)	A	B	C	D	E
0	8.8	12.2	11.0	11.0	10.8
0.5		12.0	11.0	11.0	11.0
		> 20			
1.0			11.2	11.5	11.0
1.5			14.5	11.5	11.5
			> 16		
2.0				> 20	11.3
2.5				> 20	10.8
3.0					10.0
					8.9
3.5					

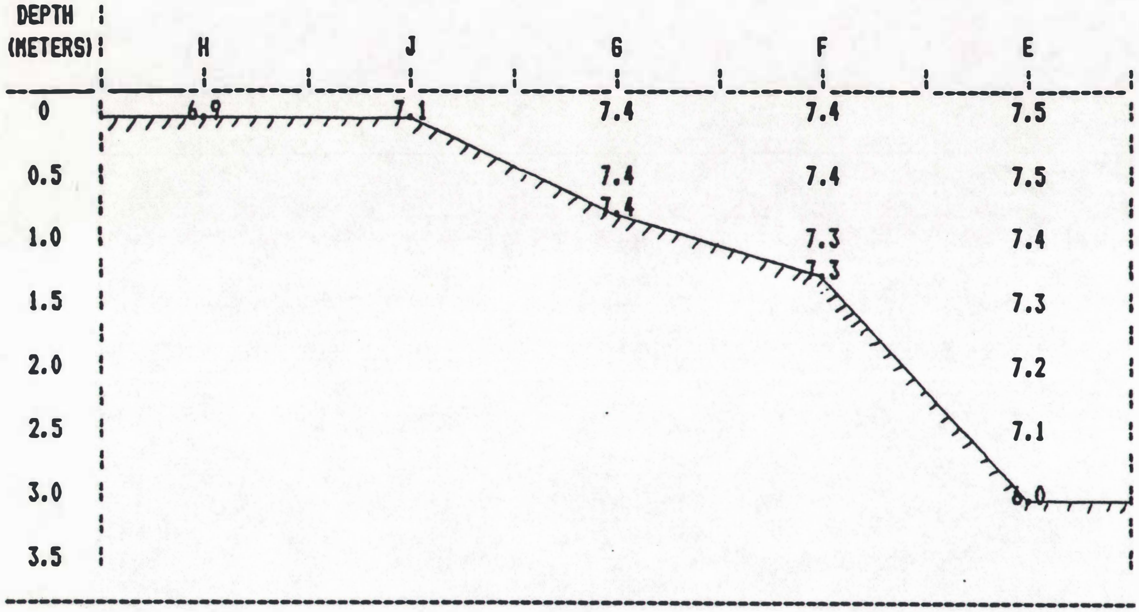
SAMPLING DATE 6-14-84
EAST SIDE TRANSECT
pH



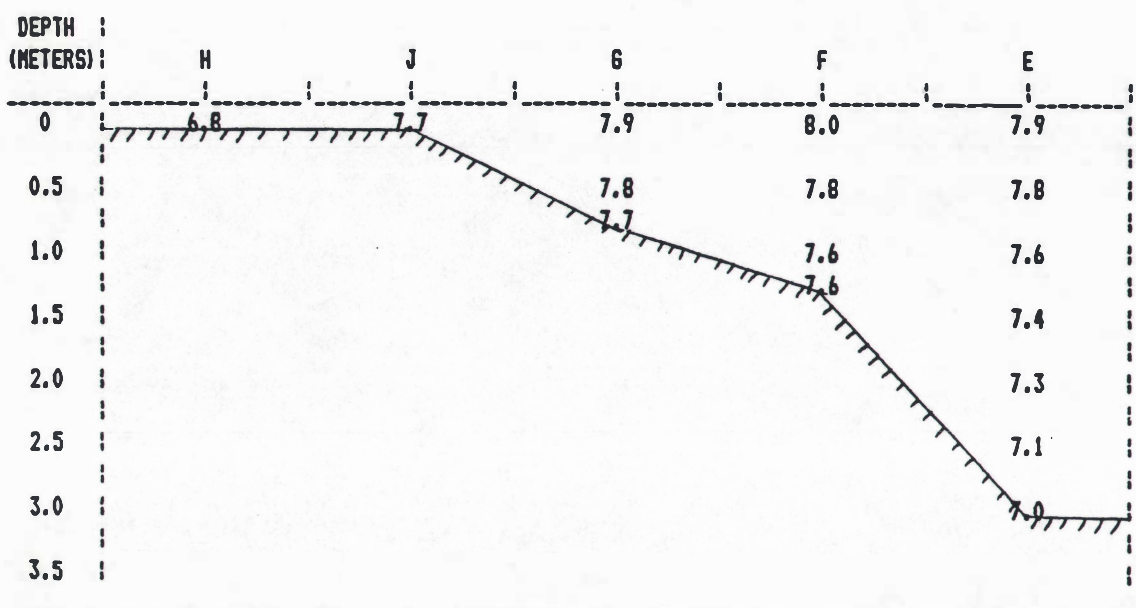
SAMPLING DATE 6-21-84
EAST SIDE TRANSECT
pH



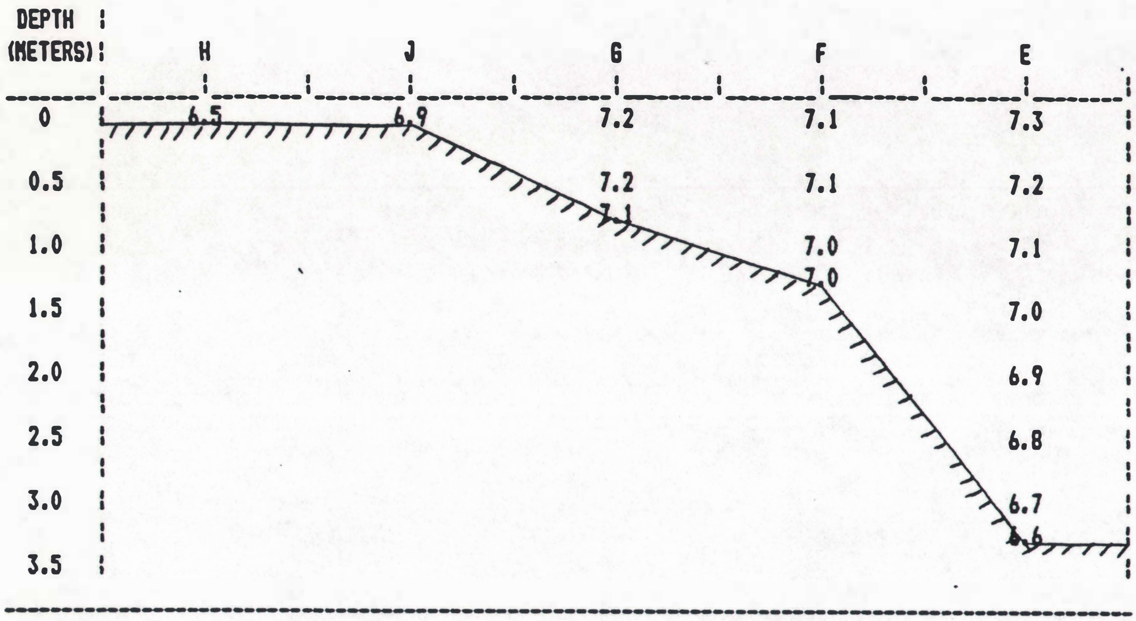
SAMPLING DATE 6-28-84
EAST SIDE TRANSECT
pH



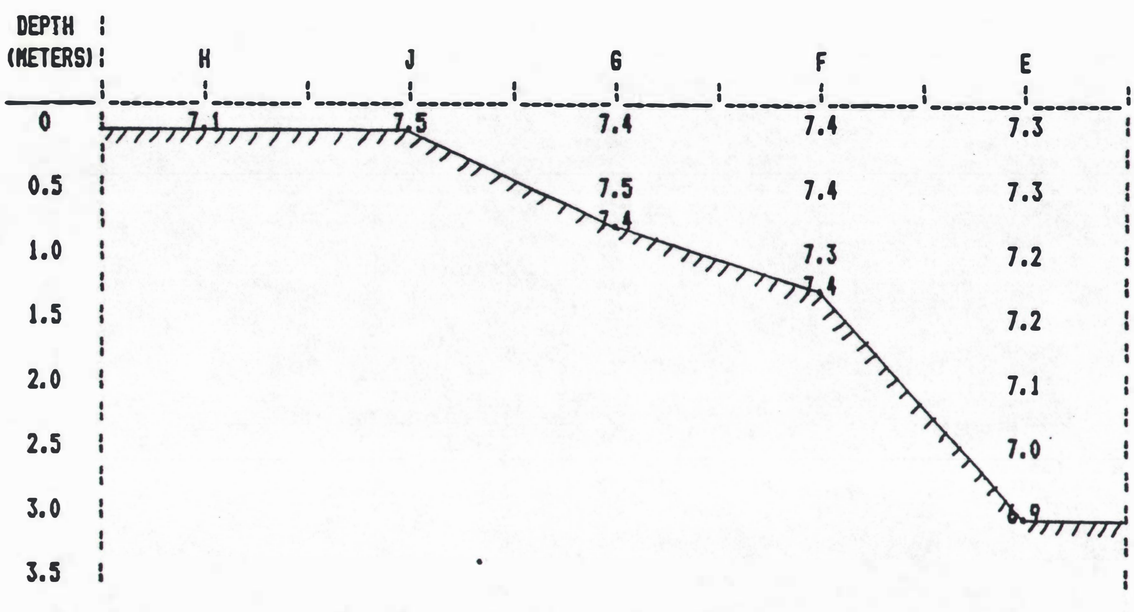
SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
pH



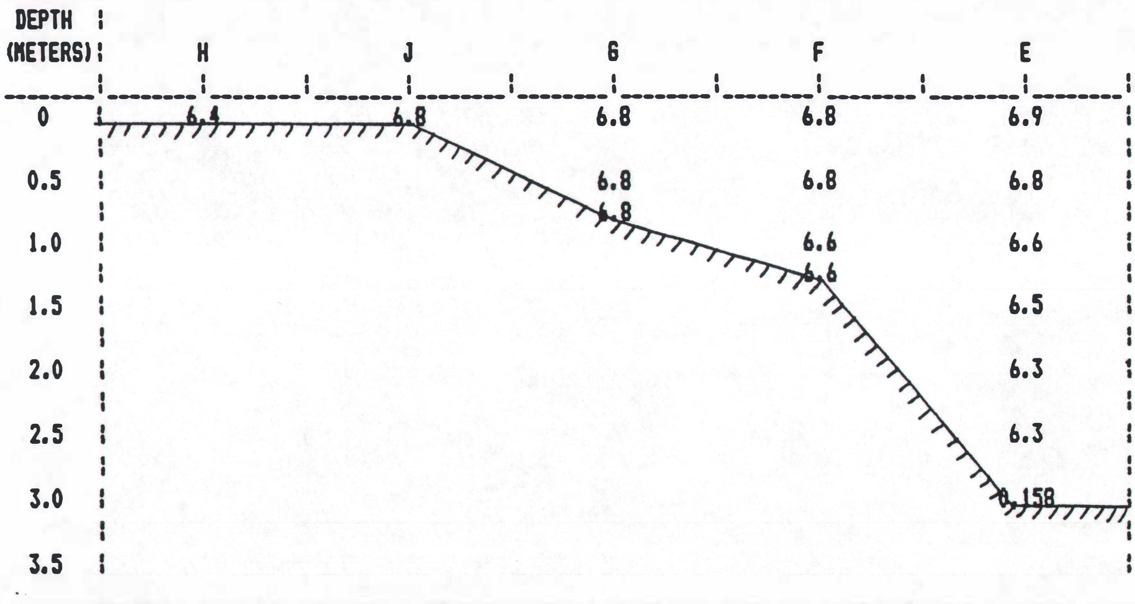
SAMPLING DATE 7-24-84
EAST SIDE TRANSECT
pH



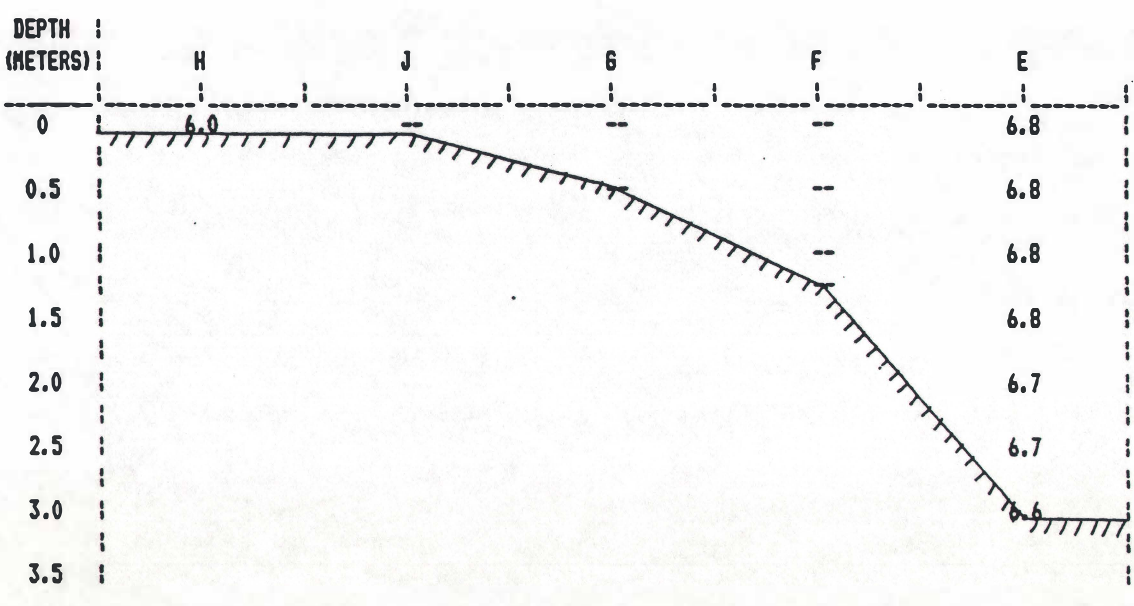
SAMPLING DATE 7-30-84
EAST SIDE TRANSECT
pH



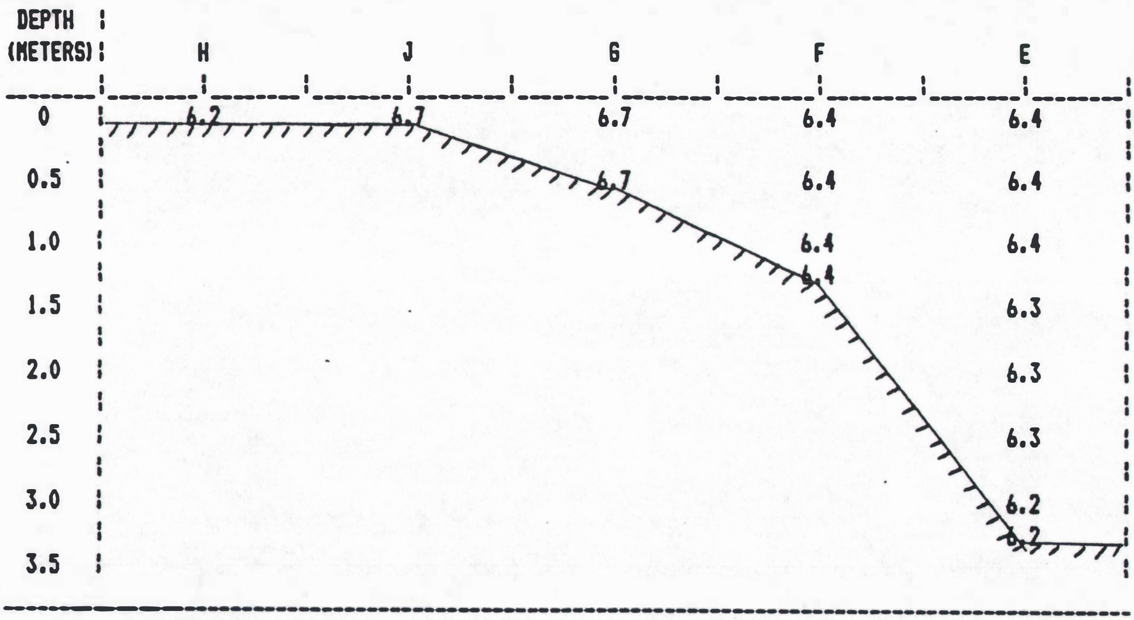
SAMPLING DATE 8-13-84
EAST SIDE TRANSECT
pH



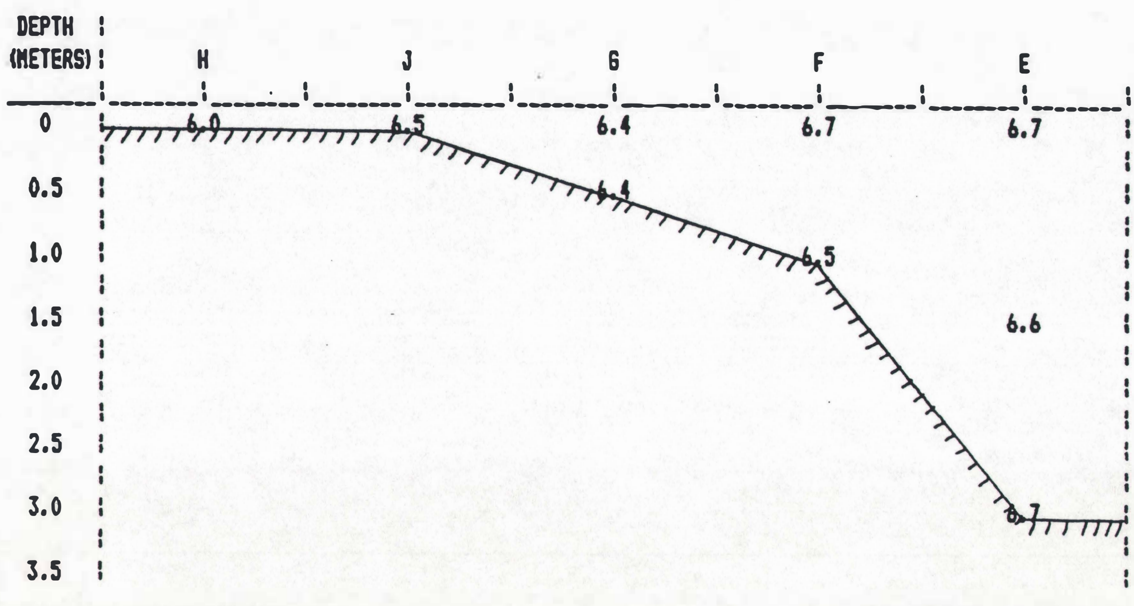
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
pH



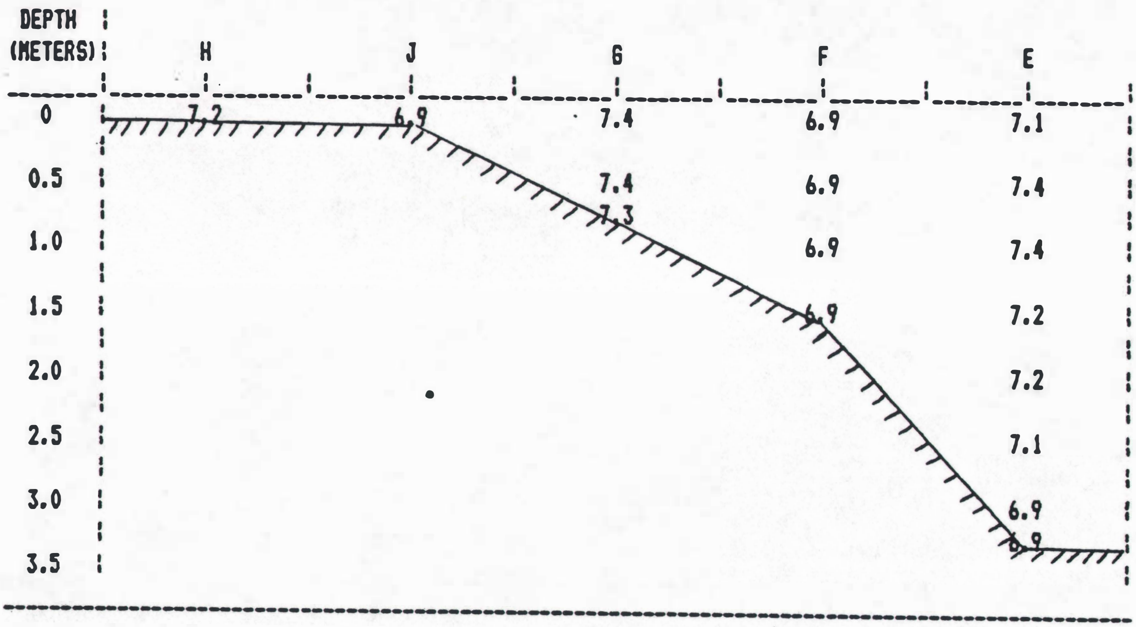
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
pH



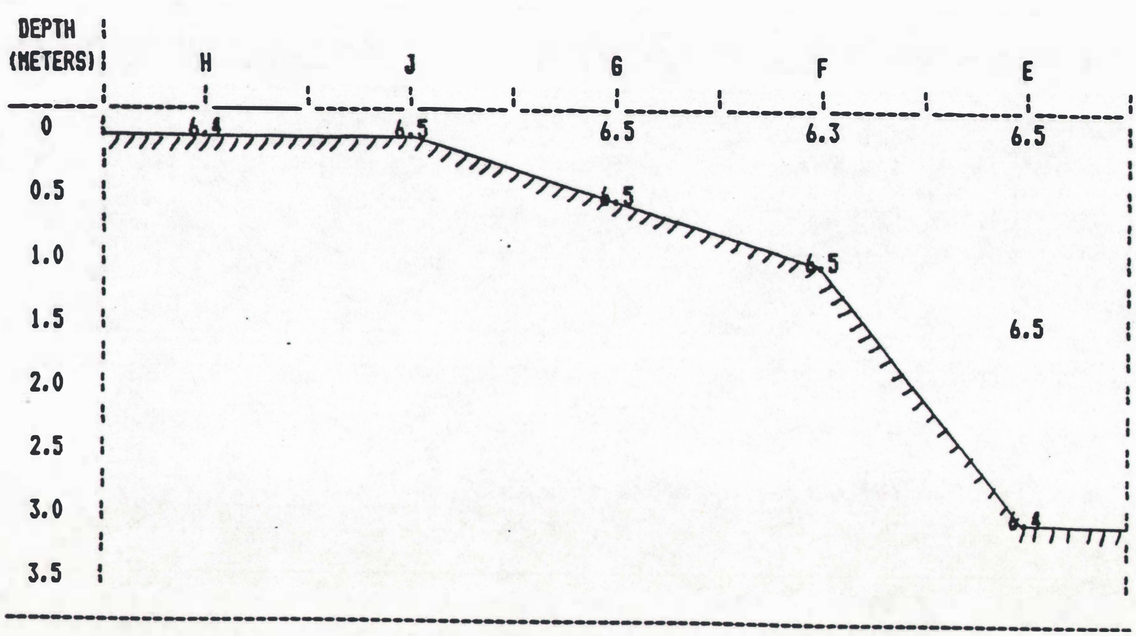
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
pH



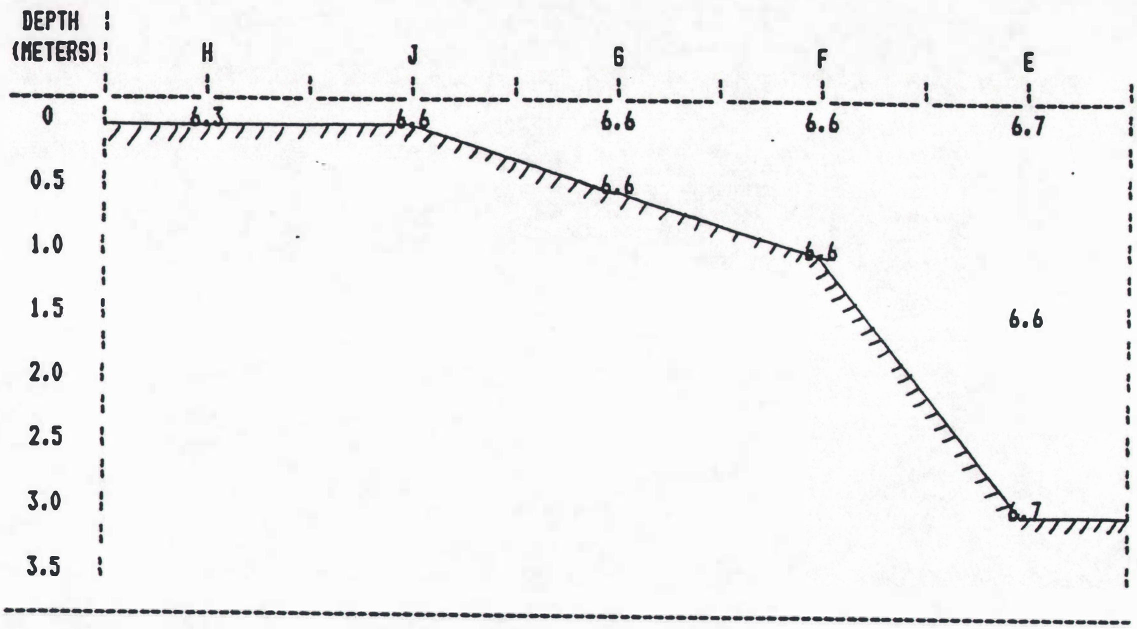
SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
pH



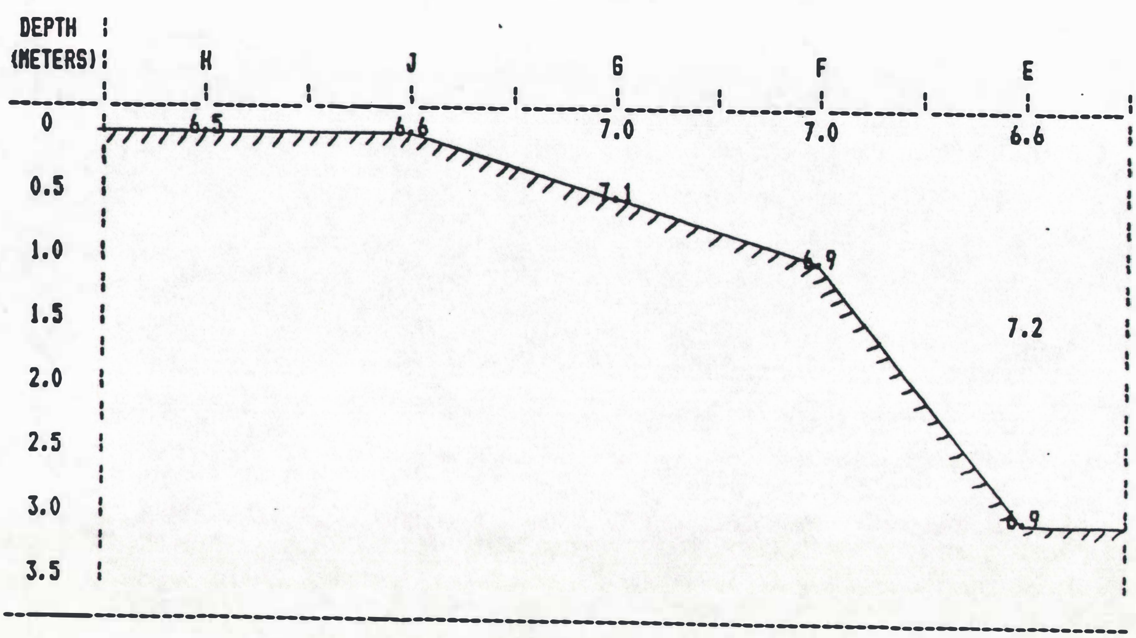
SAMPLING DATE 10-23-84
EAST SIDE TRANSECT
pH



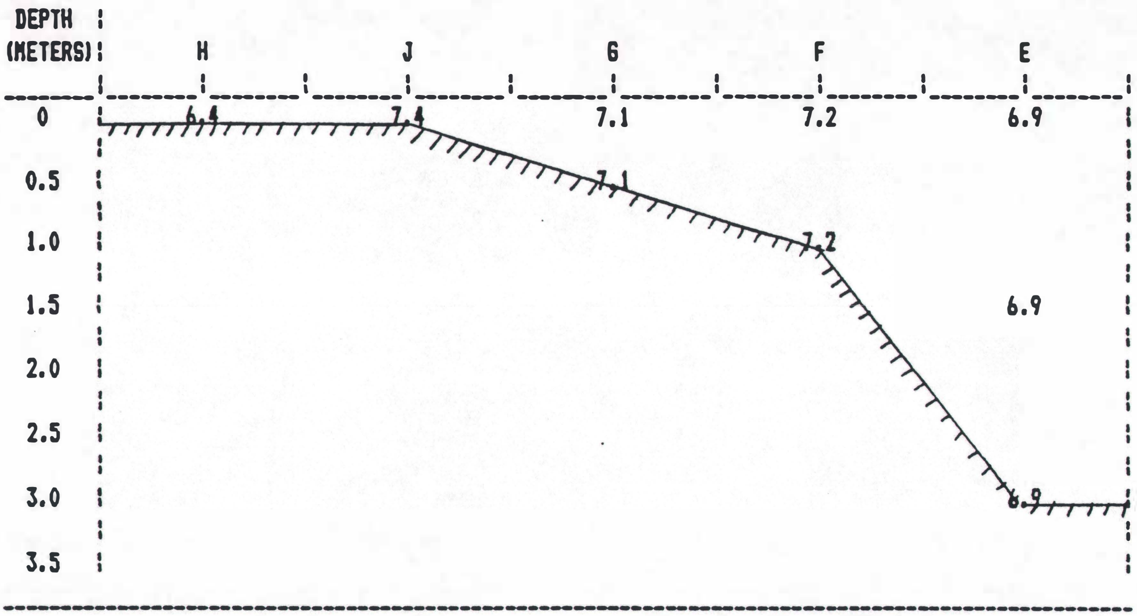
SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
pH



SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
pH



SAMPLING DATE 4-3-85
EAST SIDE TRANSECT
pH



APRIL, 1985

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN AMOUNT INCHES (IN)	CMS (CM)	DURATION (HR)	STORM DSCHARGE (1)	NH LOADING (6)	NO -NO LOADING (6)	SRP LOADING (6)	TP LOADING (6)	S. SOLID LOADING (6)
1	4	0.64	1.6256	5.5	13796206	3912.933	15687.20	617.3205	5393.820	10309618
2	4		0							
3	4	0.66	1.6764	3	14589792	4464.022	16189.46	660.5452	5785.445	11099572
4	4		0							
5	4		0							
6	4		0							
7	4		0							
8	4	0.27	0.6858	3						
9	4	0.07	0.1778							
10	4		0							
11	4	0.03	0.0762	2.5						
12	4		0							
13	4		0							
14	4		0							
15	4	0.1	0.254							
16	4	0.07	0.1778							
17	4		0							
18	4		0							
19	4	0.04	0.1016							
20	4	0.02	0.0508	3						
21	4		0							
22	4	0.1	0.254	5.5						
23	4	0.09	0.2286							
24	4		0							
25	4		0							
26	4		0							
27	4		0							
28	4		0							
29	4		0							
30	4		0							
TOTAL		2.09	5.3086	22.5	28385998	8376.956	31876.67	1277.865	11179.26	21409190

MAY, 1985

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (I)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	5		0							
2	5	0.4	1.016	11.5	4273170.		9660.092	98.62408	694.3165	830173.3
3	5	1.98	5.0292	16.5	66966489	40835.86	49338.60	3513.375	31632.71	63236520
4	5		0							
5	5		0							
6	5	0.07	0.1778	2.5						
7	5	0.27	0.6858	3						
8	5		0							
9	5		0							
10	5		0							
11	5		0							
12	5		0							
13	5	0.06	0.1524	2						
14	5		0							
15	5		0							
16	5		0							
17	5		0							
18	5	0.14	0.3556	4.5						
19	5		0							
20	5		0							
21	5	0.21	0.5334	2						
22	5	0.89	2.2606	4	23716035	10801.54	21965.45	1157.629	10289.13	20184040
23	5		0							
24	5		0							
25	5		0							
26	5		0							
27	5		0							
28	5	0.2	0.508	9						
29	5	0.46	1.1684	7	6653929.		11166.87	228.2981	1869.192	3200034.
30	5		0							
31	5		0							
TOTAL		4.68	11.8872	62	1.0E+08	51637.40	92131.01	4997.927	44485.36	87450769

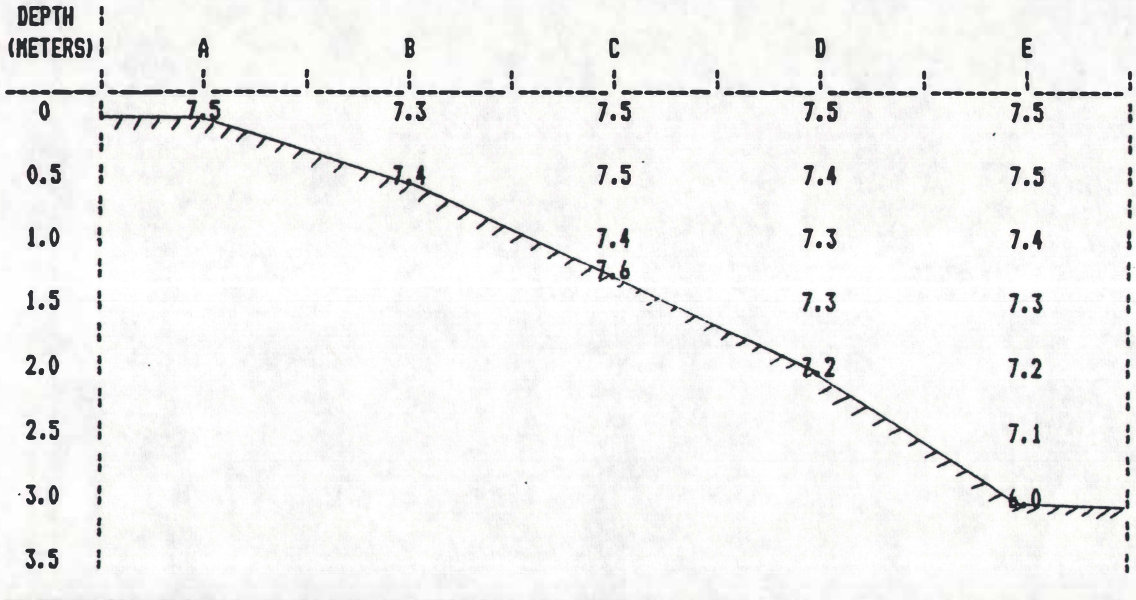
SAMPLING DATE 6-14-84
WEST SIDE TRANSECT
pH

DEPTH (METERS)	A	B	C	D	E
0	7.2	6.9	6.9	6.9	6.8
0.5		7.0	6.9	6.9	6.8
1.0			6.9	6.9	6.8
1.5			6.9	6.9	6.8
2.0				6.9	6.9
2.5					6.8
3.0					
3.5					

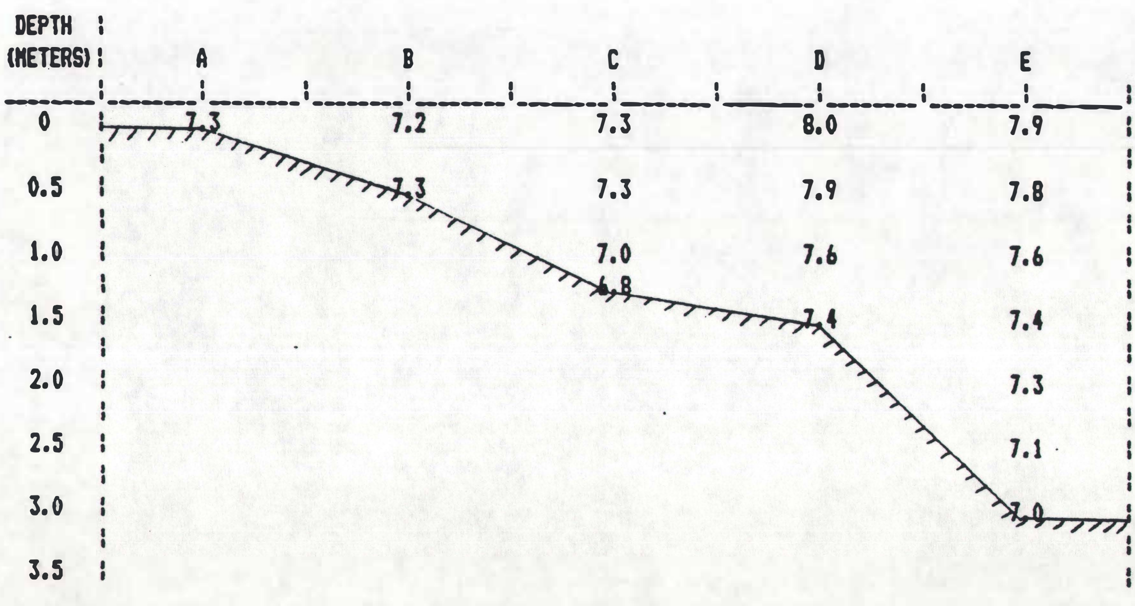
SAMPLING DATE 6-21-84
WEST SIDE TRANSECT
pH

DEPTH (METERS)	A	B	C	D	E
0	--	--	--	--	6.8
0.5		--	--	--	6.8
1.0			--	--	6.8
			--	--	
1.5					6.8
2.0					6.8
2.5					6.8
3.0					6.9
3.5					

SAMPLING DATE 6-28-84
WEST SIDE TRANSECT
pH



SAMPLING DATE 7-5-84
WEST SIDE TRANSECT
pH



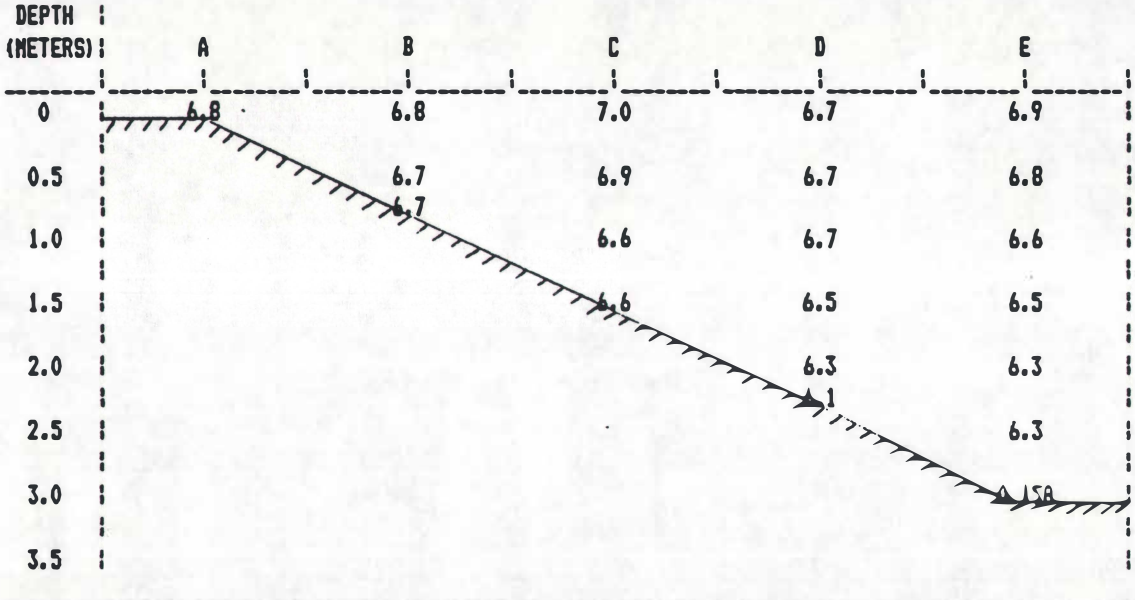
SAMPLING DATE 7-24-84
WEST SIDE TRANSECT
pH

DEPTH (METERS)	A	B	C	D	E
0	7.0	7.1	7.2	7.1	7.3
0.5		7.1	7.1	7.0	7.2
		7.2			
1.0			7.0	6.8	7.1
1.5			6.9	6.8	7.0
2.0				6.7	6.9
				6.6	
2.5					6.8
3.0					6.7
					6.6
3.5					

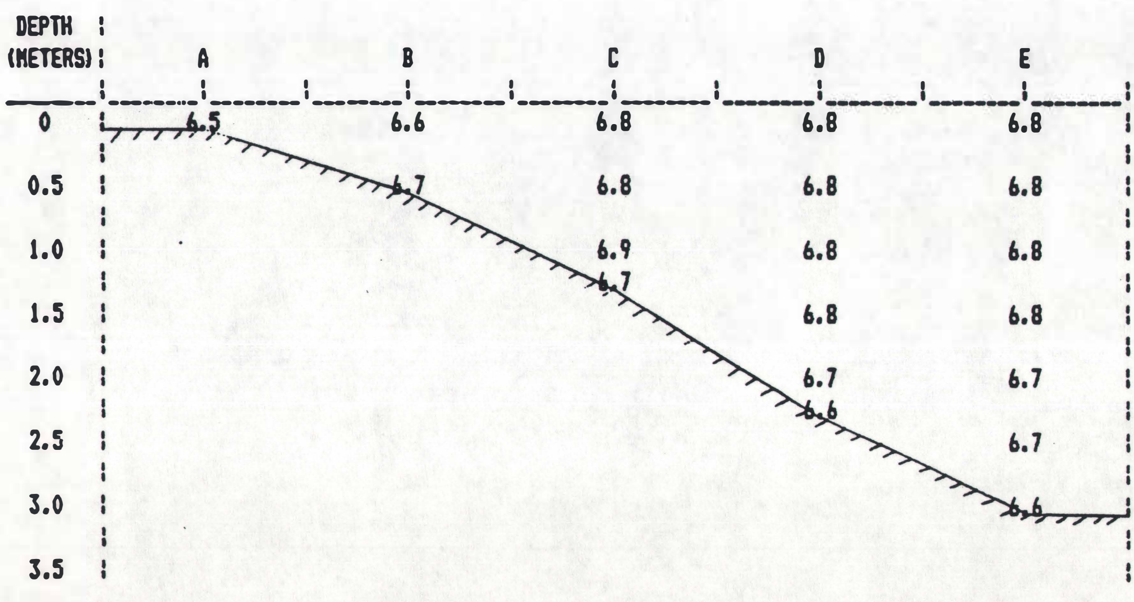
SAMPLING DATE 7-30-84
WEST SIDE TRANSECT
pH

DEPTH (METERS)	A	B	C	D	E
0	7.2	7.2	7.5	7.5	7.3
0.5		7.4	7.4	7.5	7.3
1.0			7.4	7.4	7.2
1.5			7.3	7.4	7.2
2.0				6.9	7.1
				6.8	
2.5					7.0
3.0					6.9
3.5					

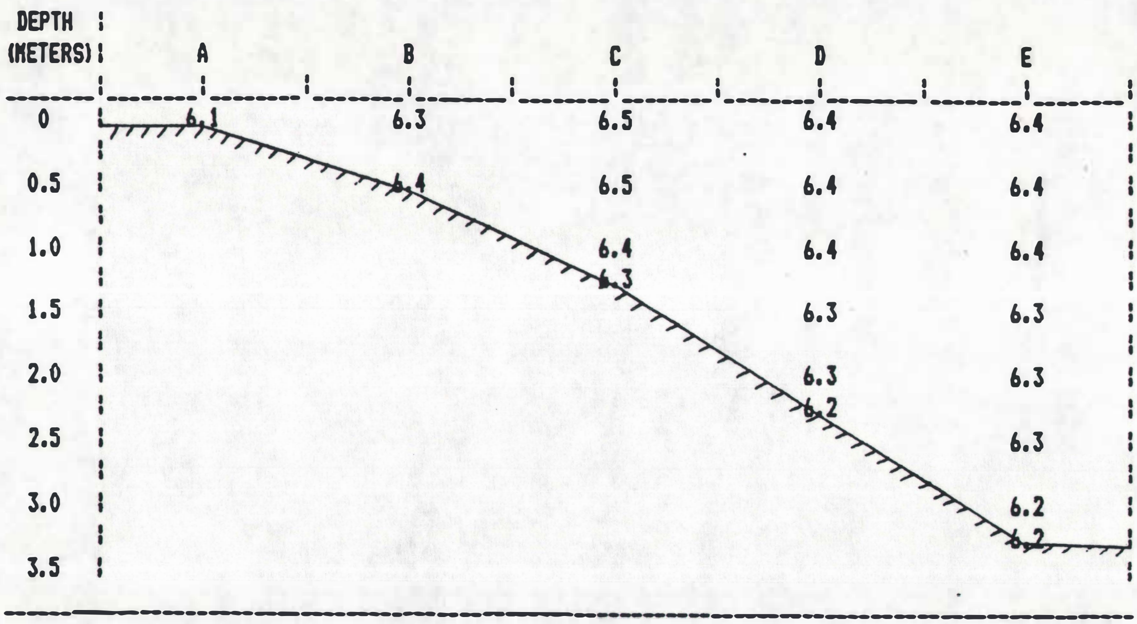
SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
pH



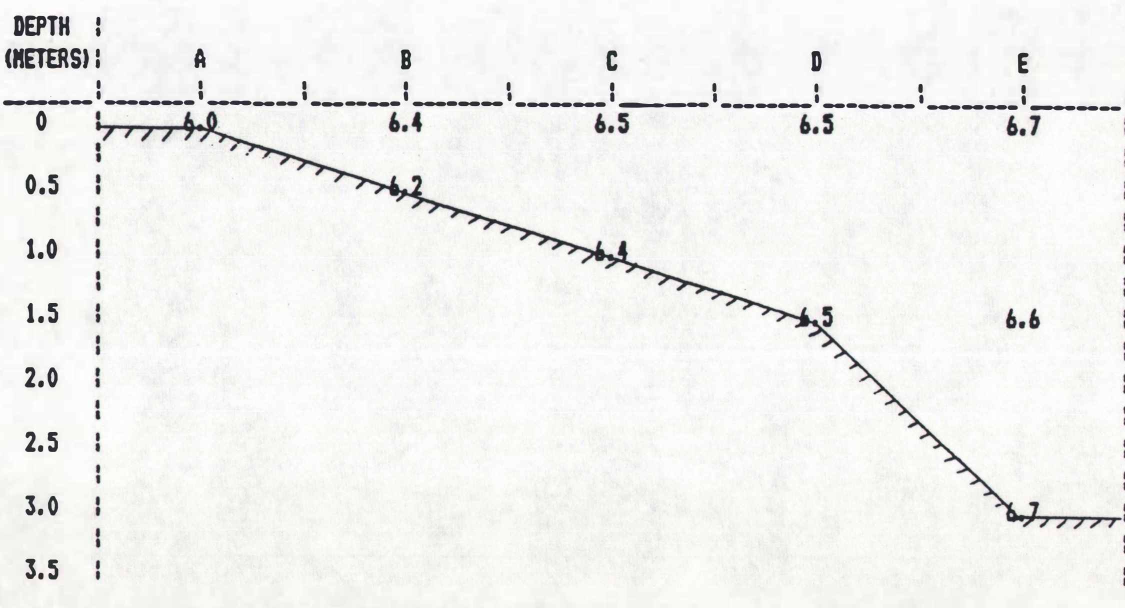
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
pH



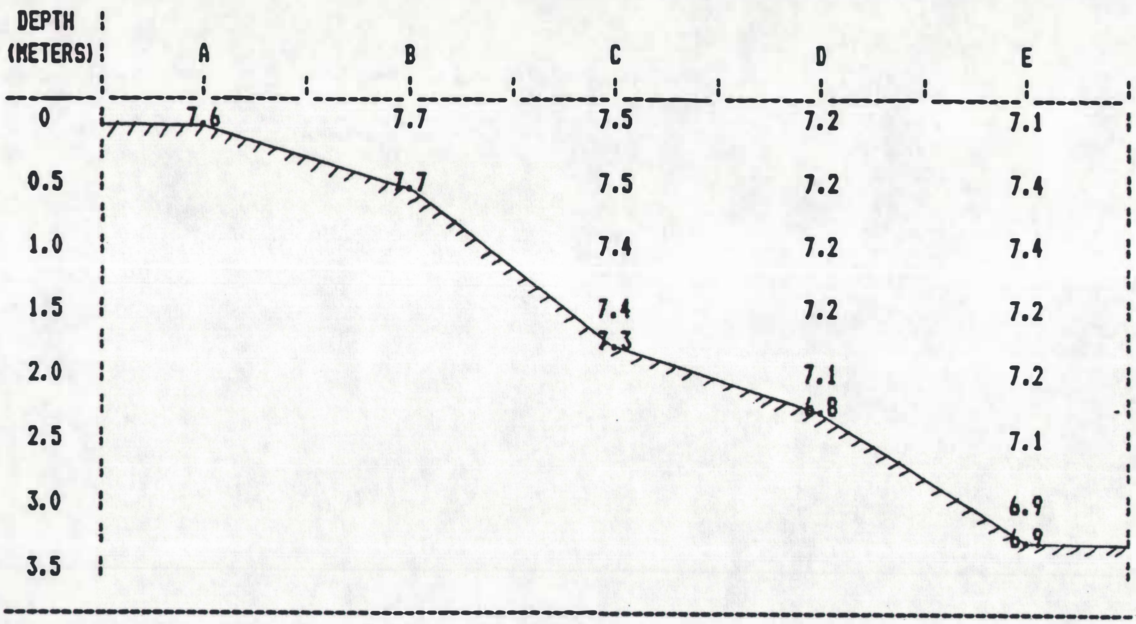
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
pH



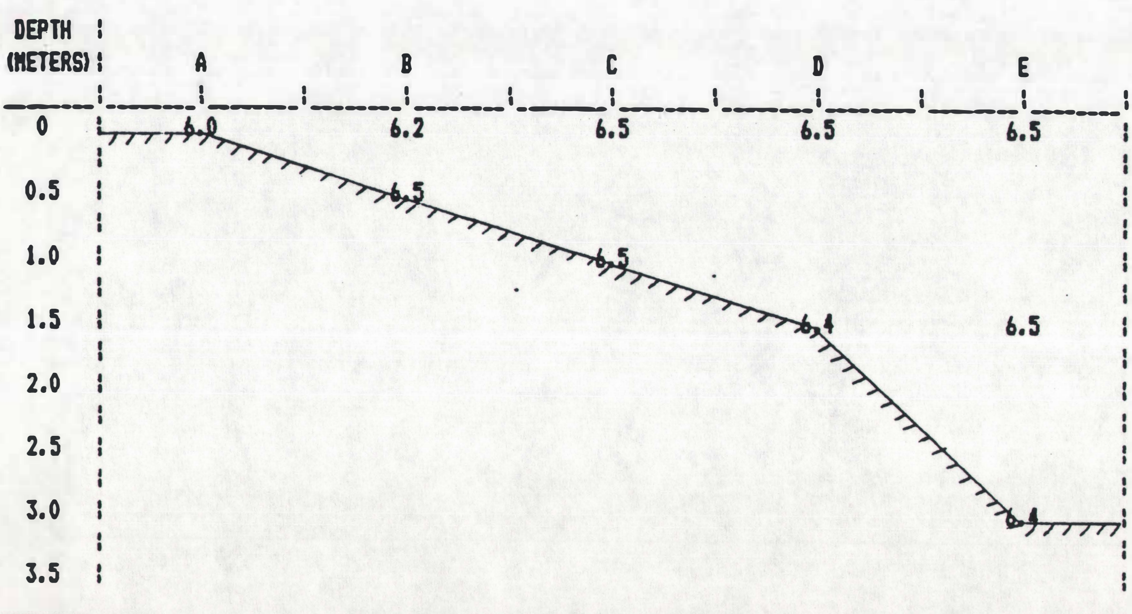
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
pH



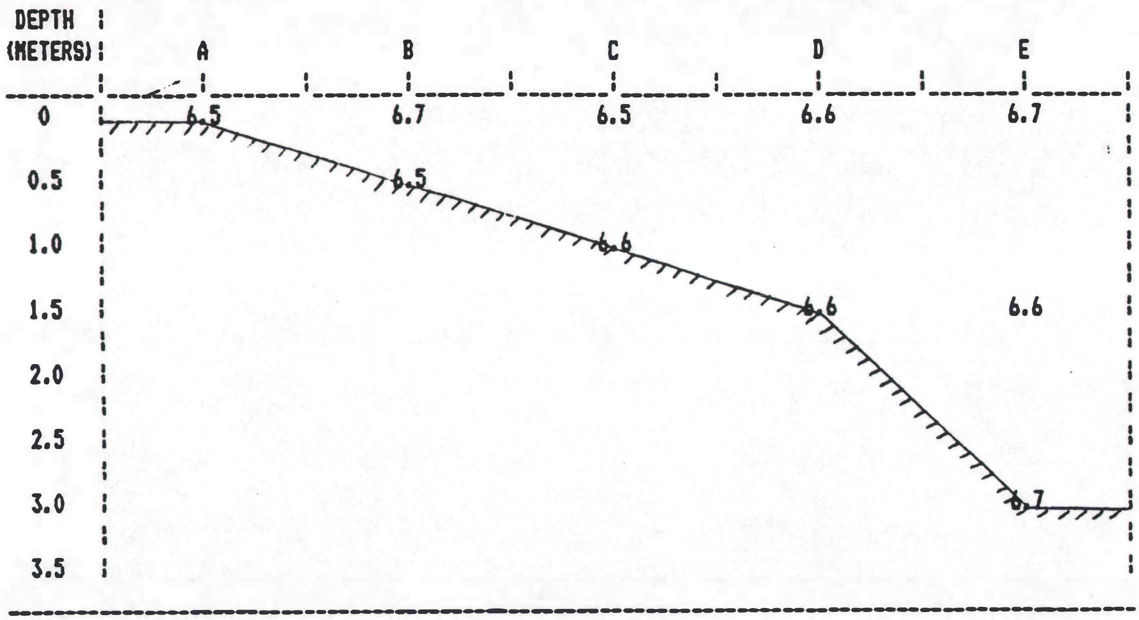
SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
pH



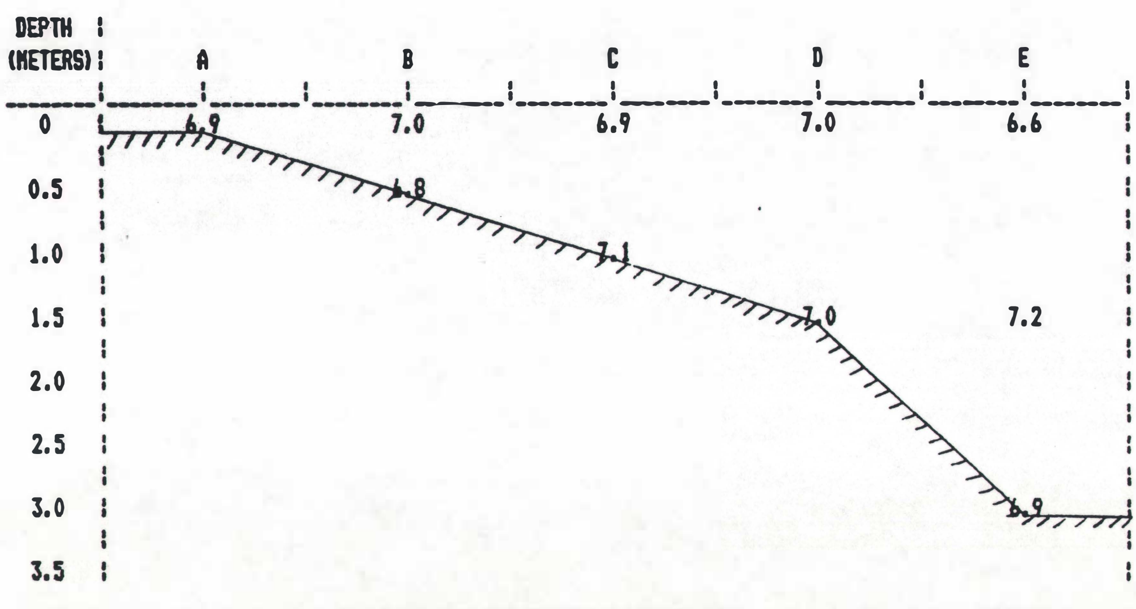
SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
pH



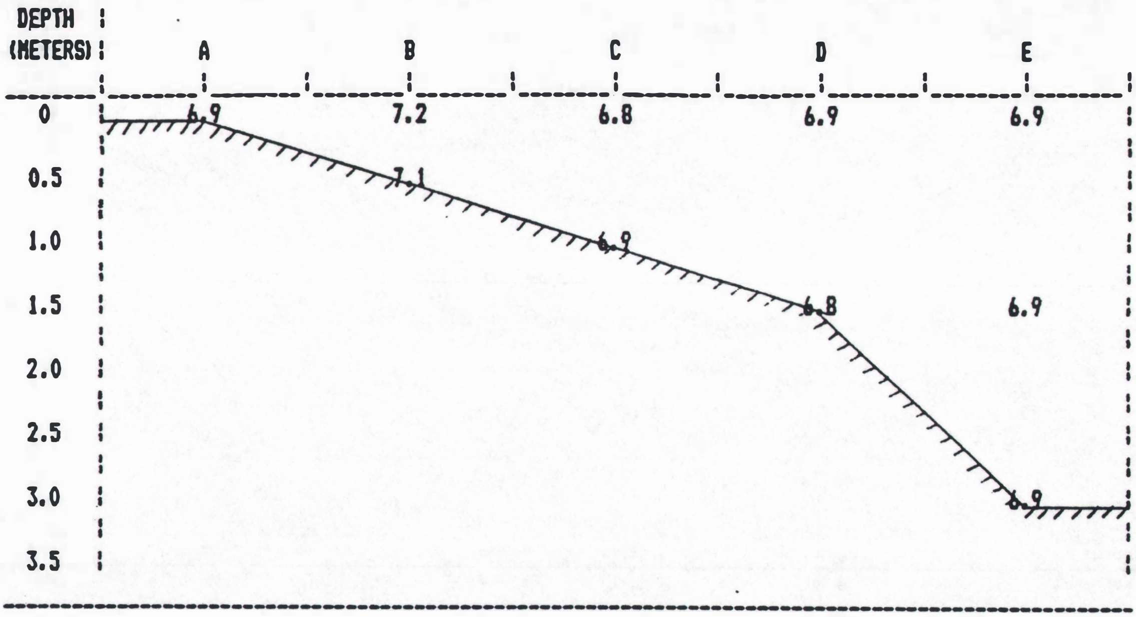
SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
pH



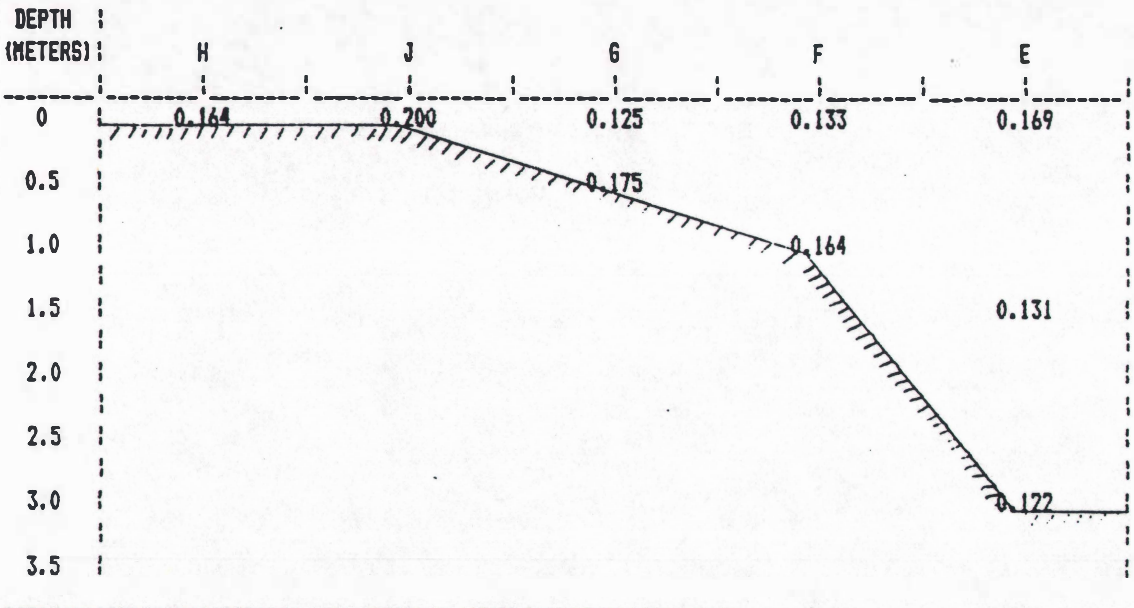
SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
pH



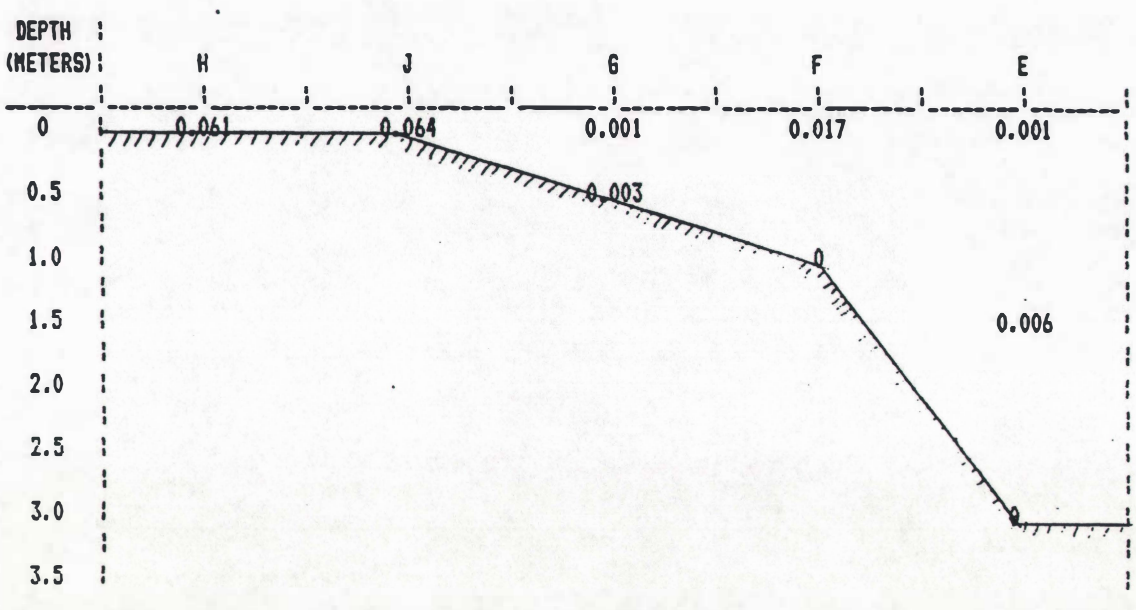
SAMPLING DATE 4-3-85
WEST SIDE TRANSECT
pH



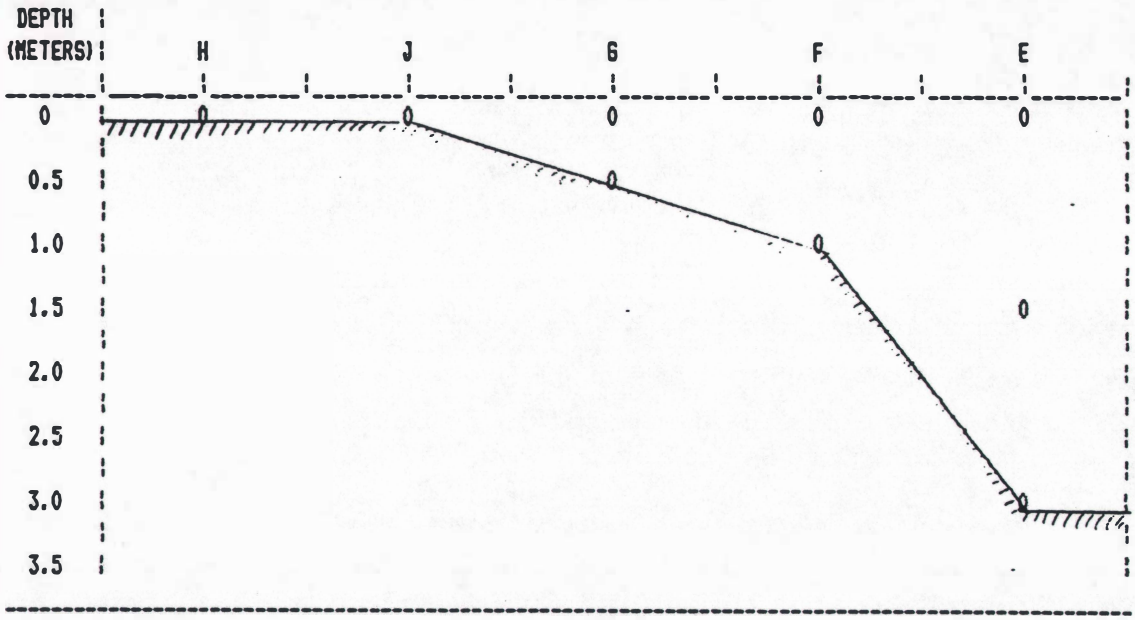
SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



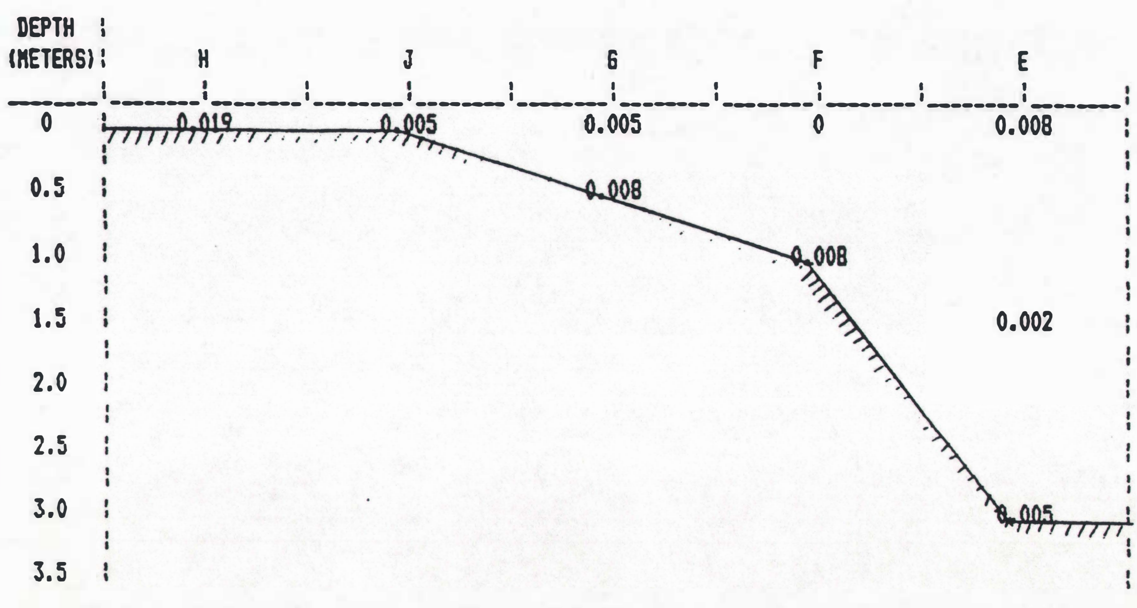
SAMPLING DATE 7-30-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



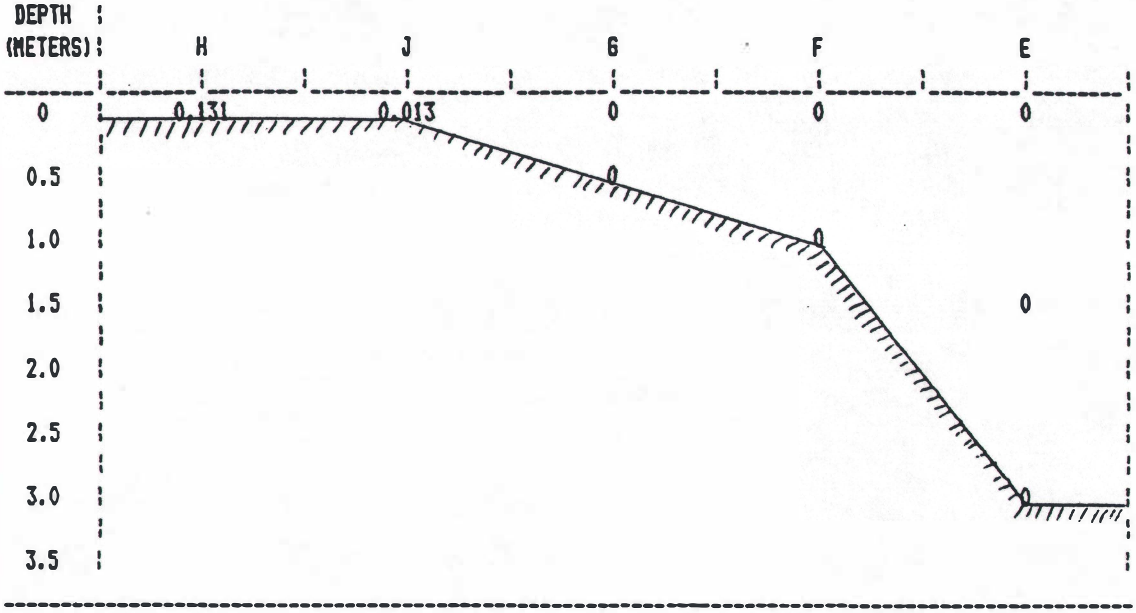
SAMPLING DATE 8-13-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



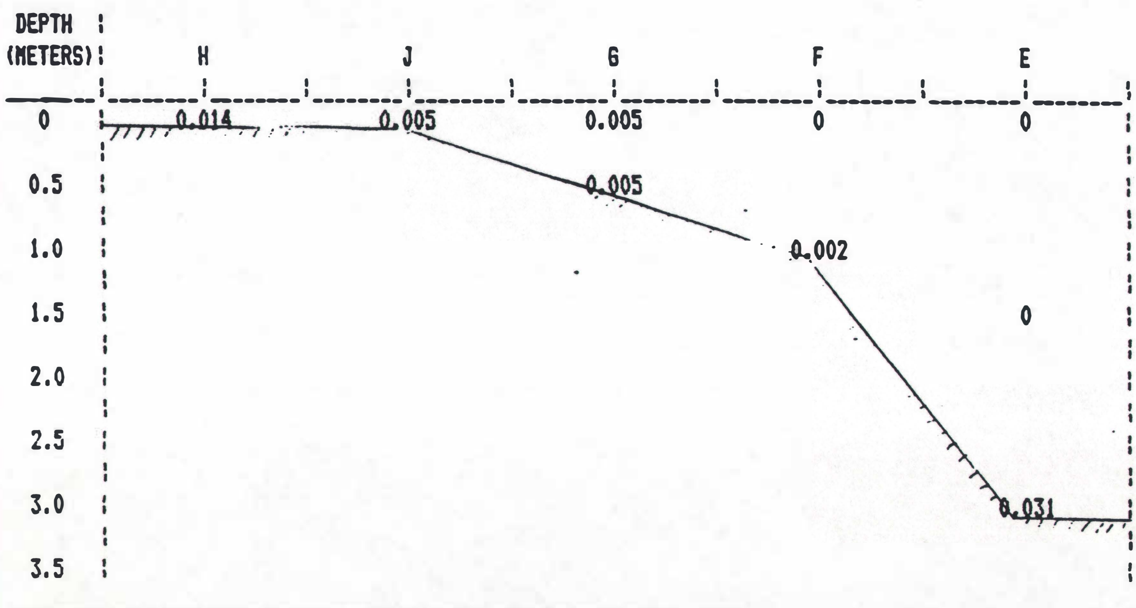
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



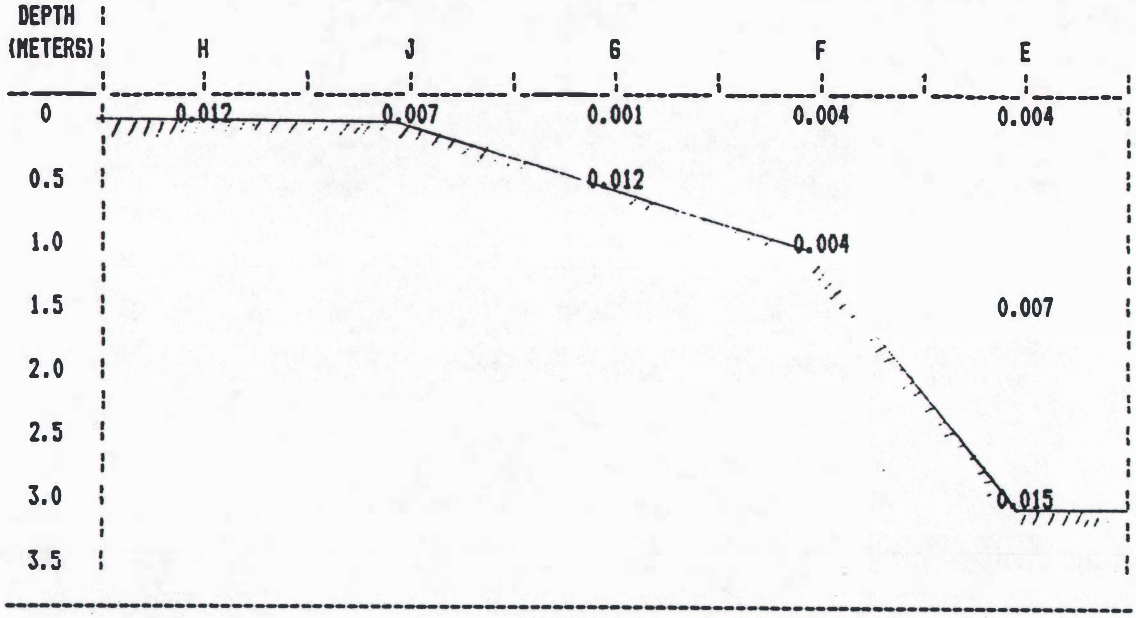
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



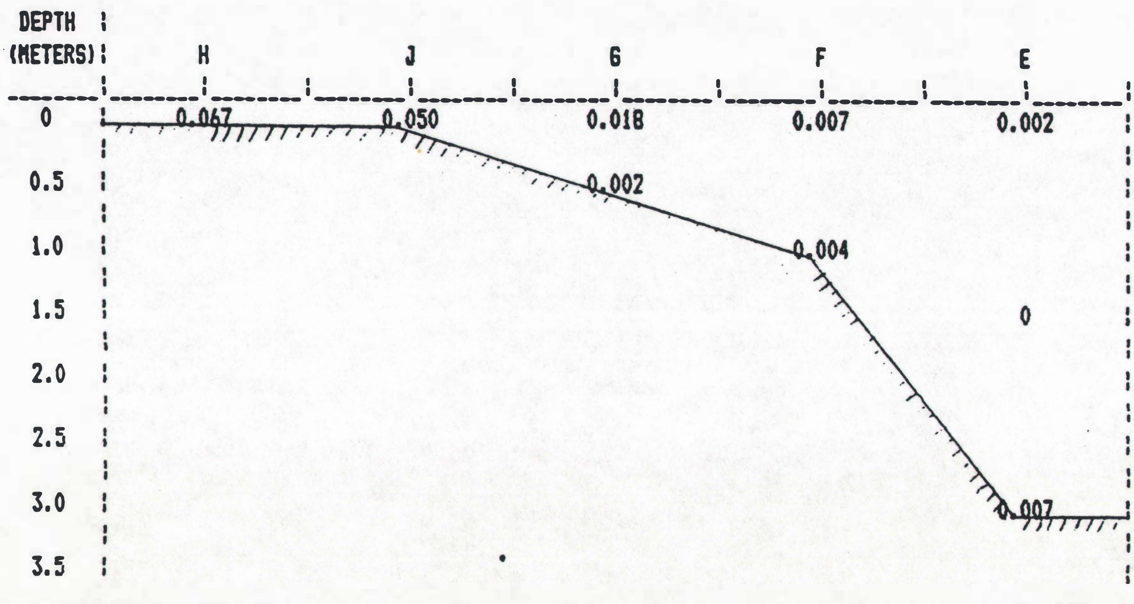
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-23-84
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



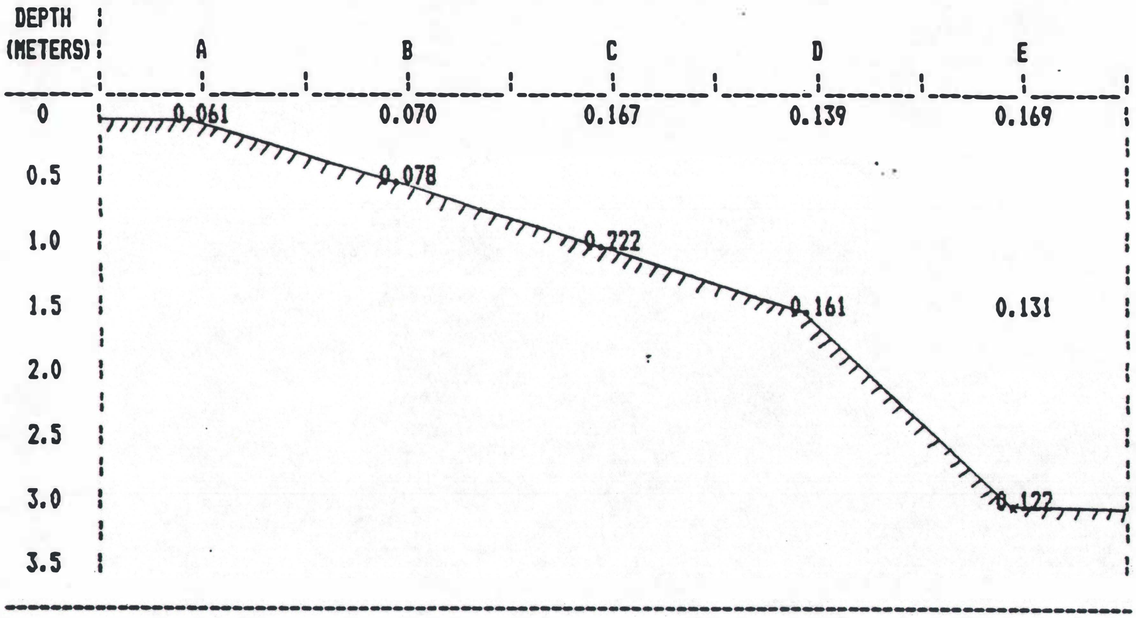
SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)

DEPTH (METERS)	H	J	G	F	E
0	0.045	0.005	0	0	0.005
0.5			0.008		
1.0				0.002	
1.5					0
2.0					
2.5					
3.0					0.002
3.5					

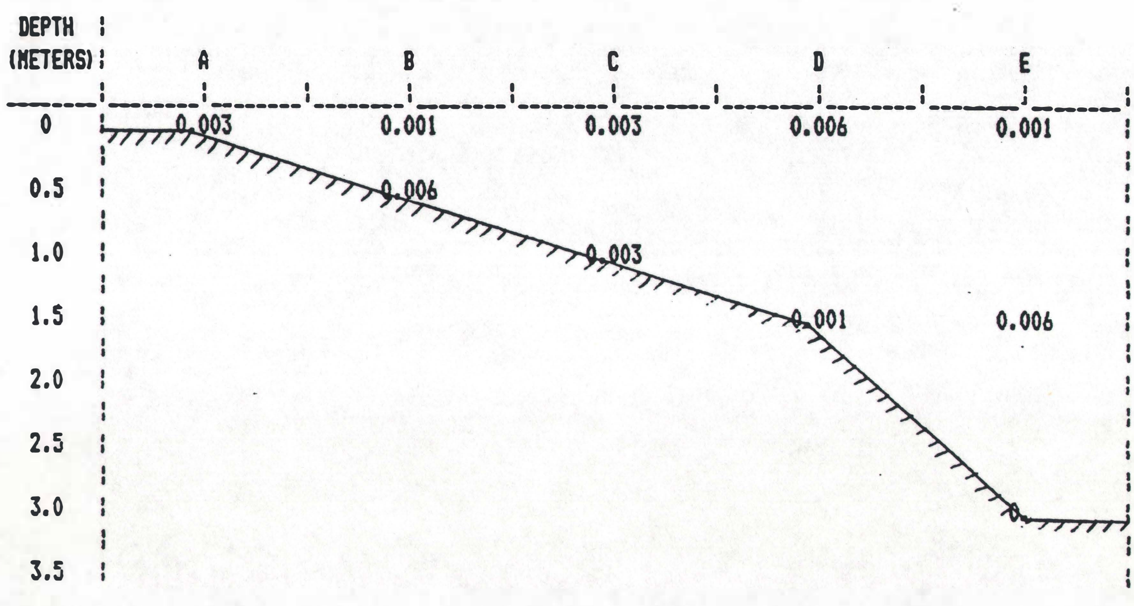
SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)

DEPTH (METERS)	H	J	G	F	E
0	0.01	0.04	0.01	0.01	0.06
0.5			0.01		
1.0				0.01	
1.5					--
2.0					
2.5					
3.0					0.02
3.5					

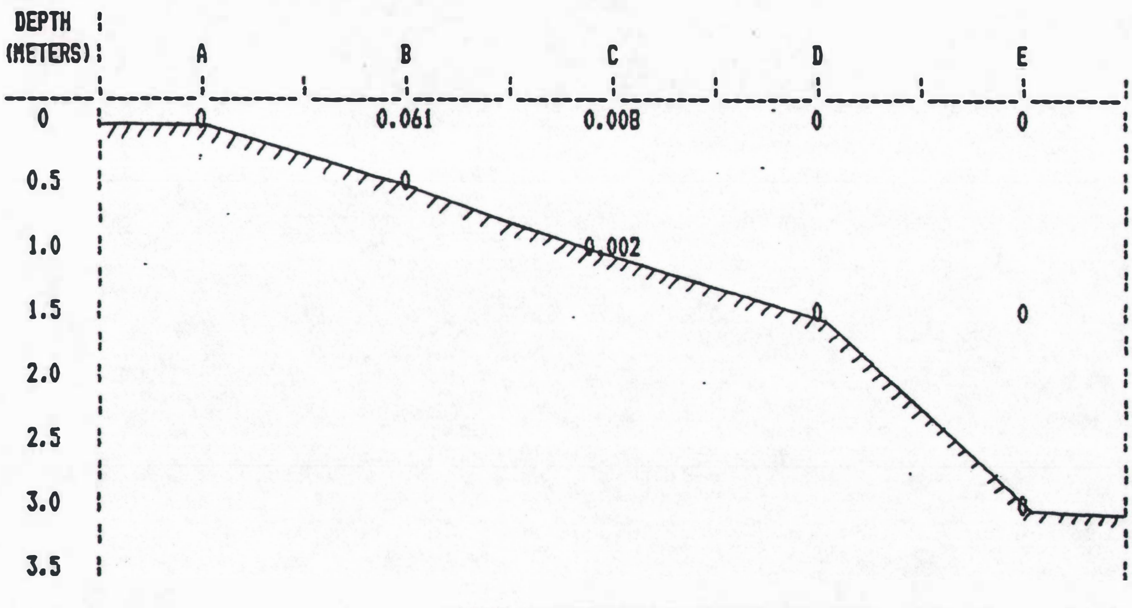
SAMPLING DATE 7-5-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



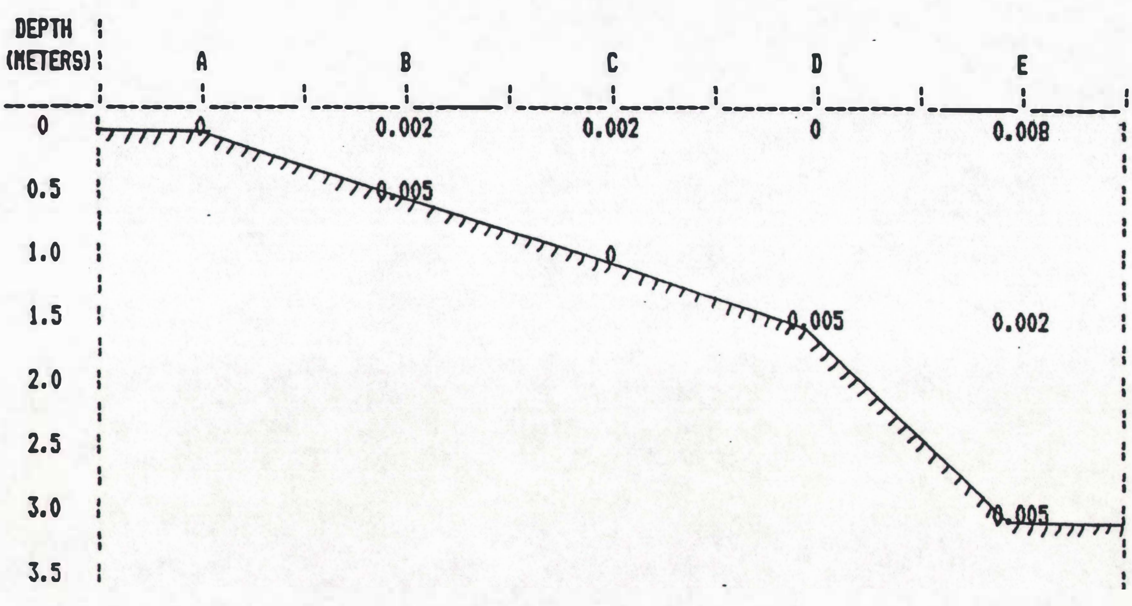
SAMPLING DATE 7-30-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



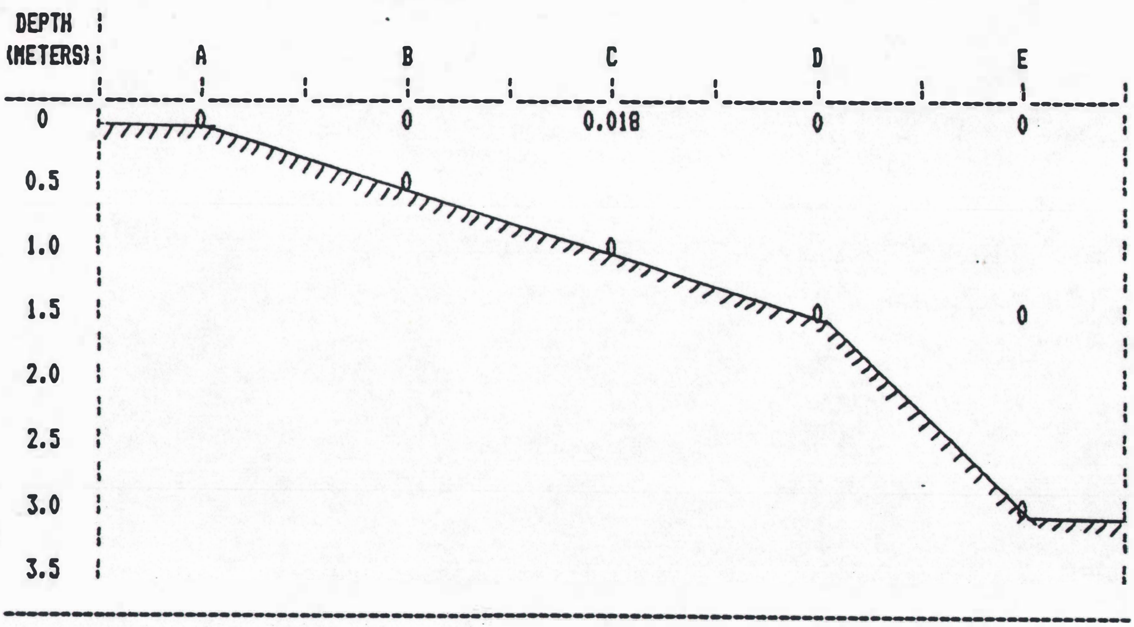
SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



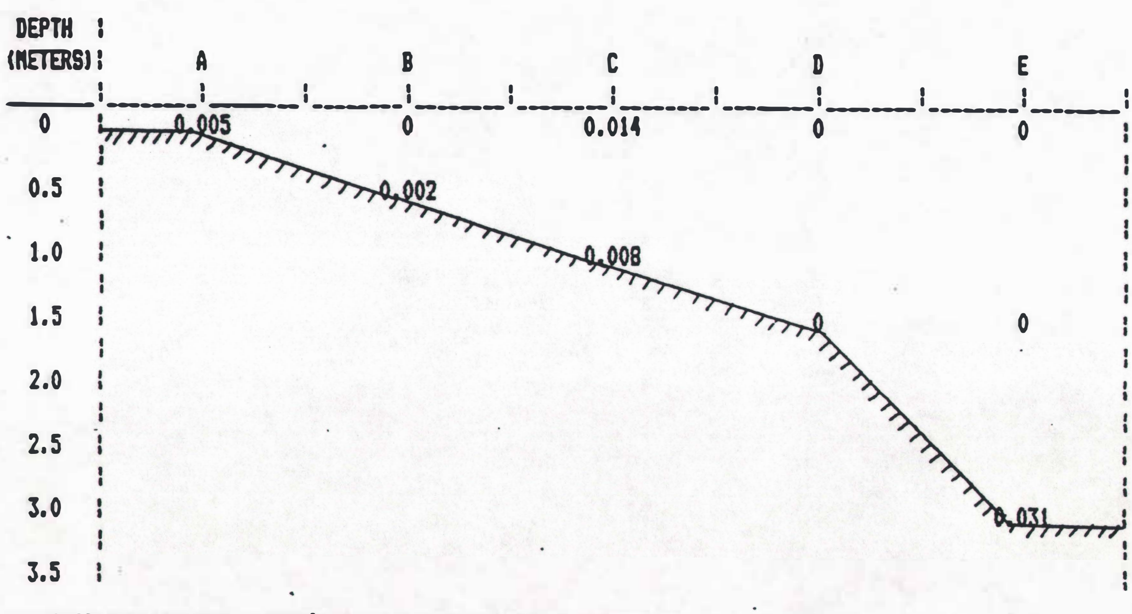
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



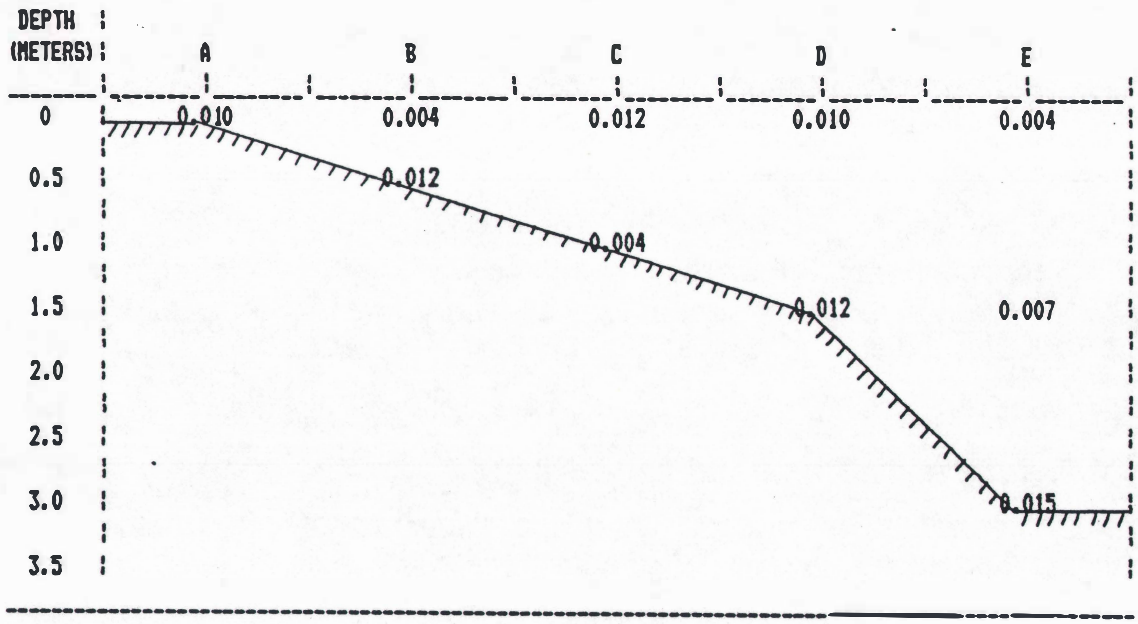
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



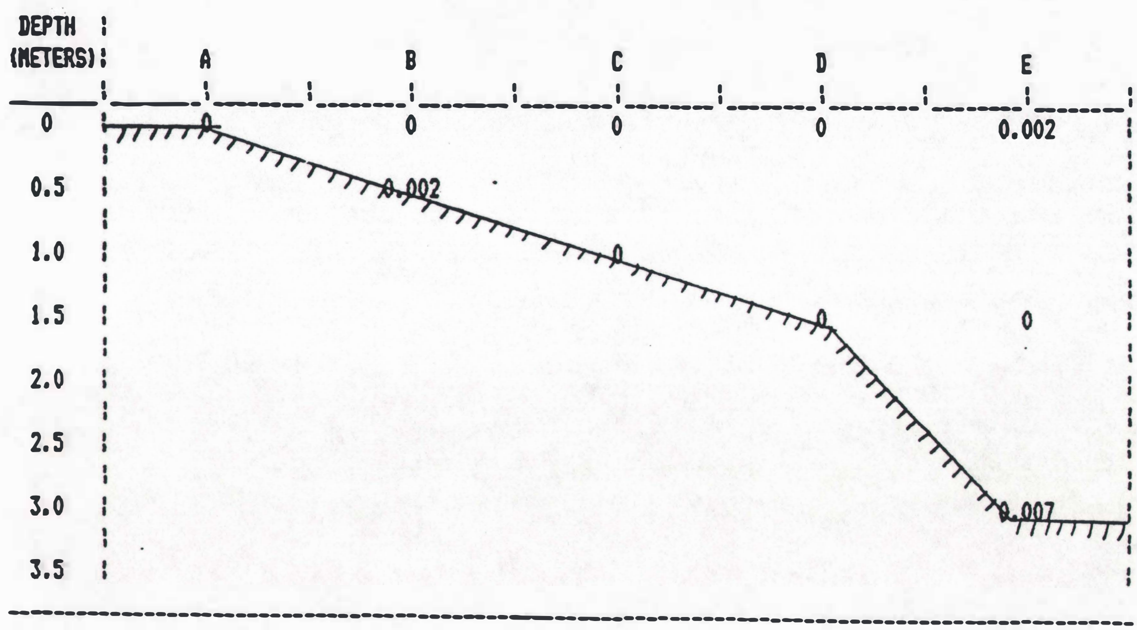
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)



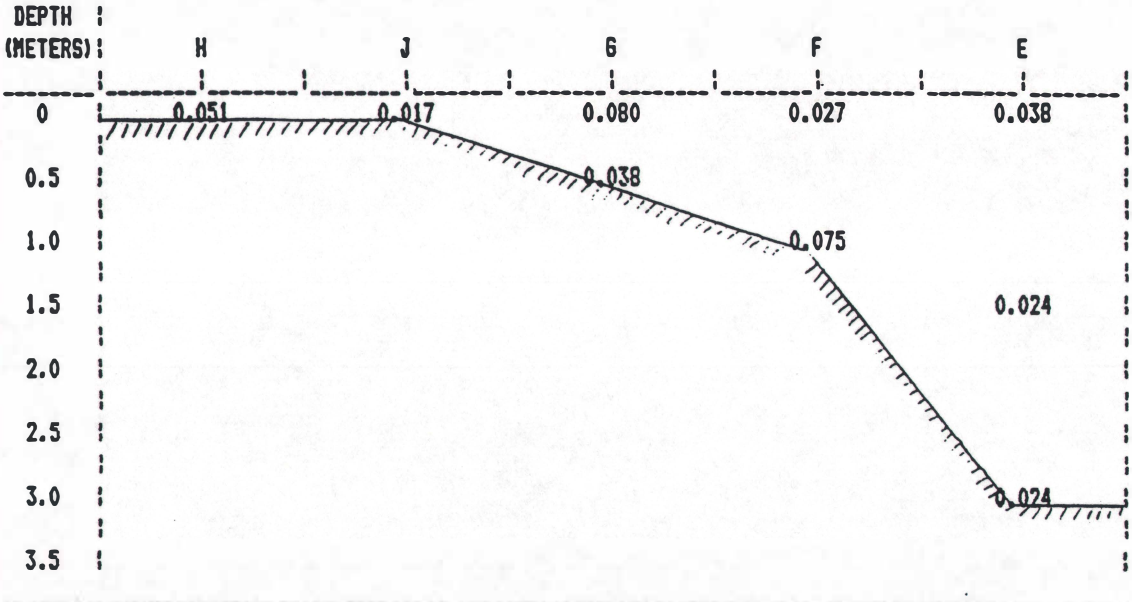
SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)

DEPTH (METERS)	A	B	C	D	E
0	0	0	0	0	0.005
0.5		0			
1.0			0.002		
1.5				0.002	0
2.0					
2.5					
3.0					0.002
3.5					

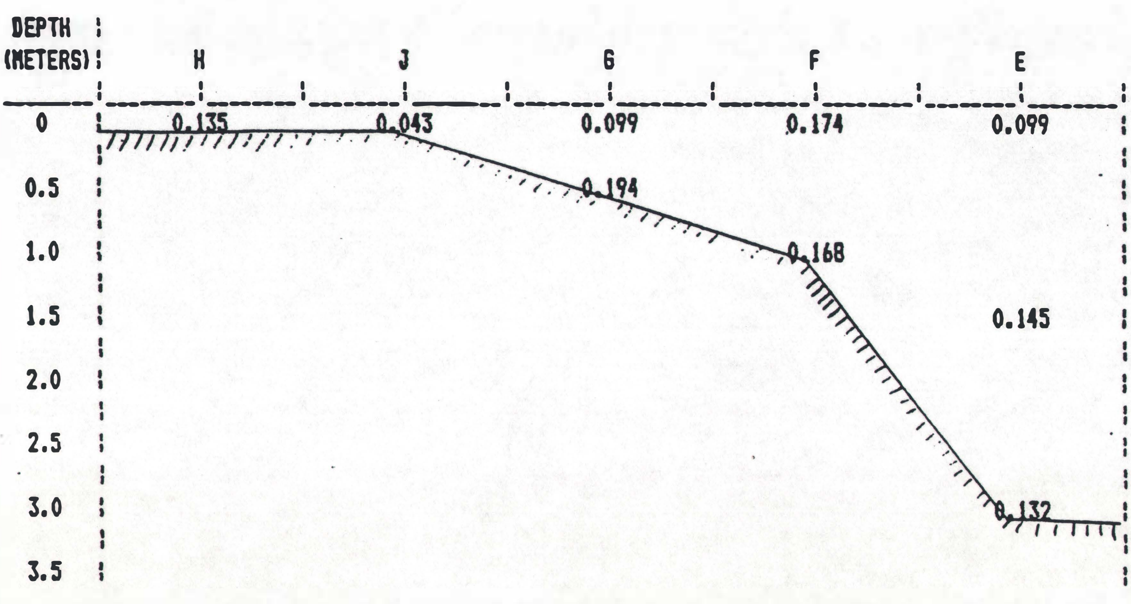
SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
SOLUBLE REACTIVE PHOSPHORUS CONCENTRATIONS (in ppm-P)

DEPTH (METERS)	A	B	C	D	E
0	0.01	0.01	0.02	0.01	0.06
0.5		0.01			
1.0			0.01		
1.5				0.02	--
2.0					
2.5					
3.0					0.02
3.5					

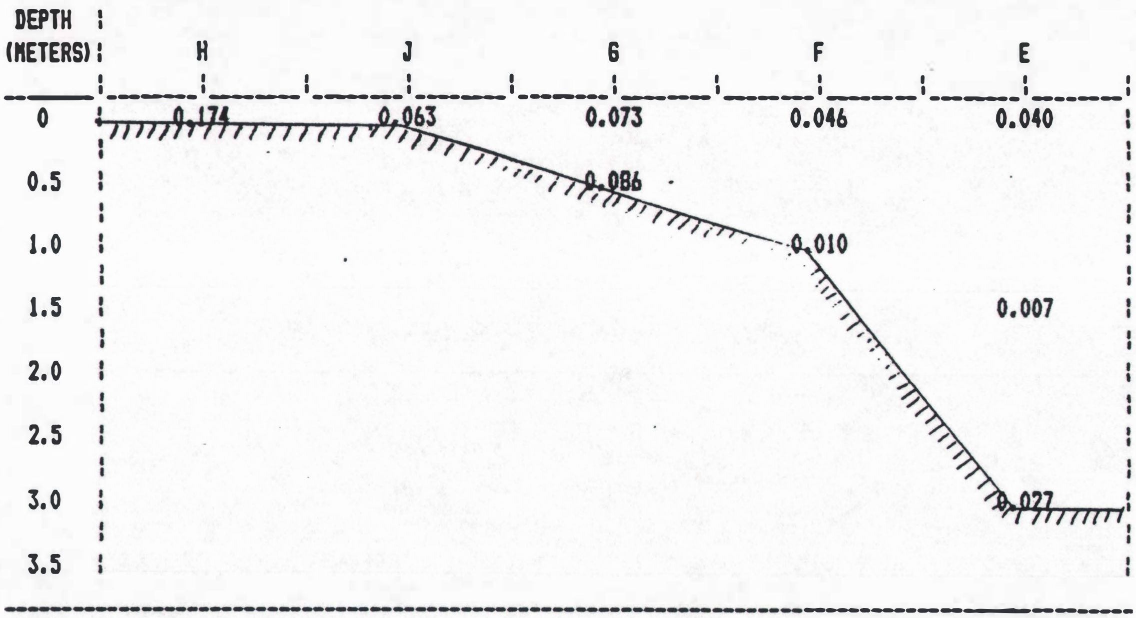
SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



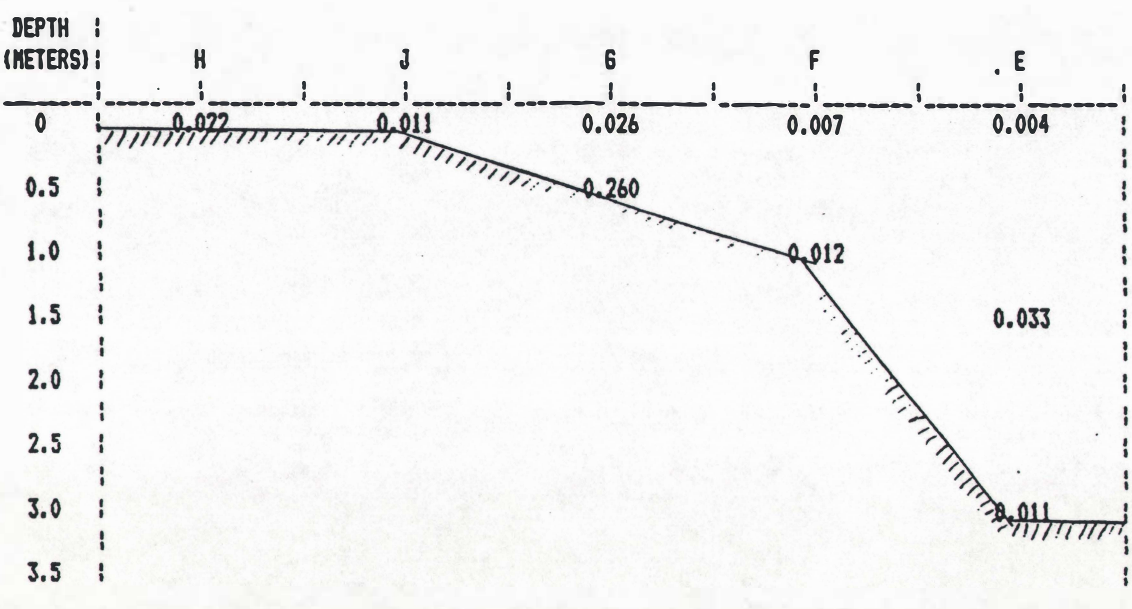
SAMPLING DATE 7-30-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



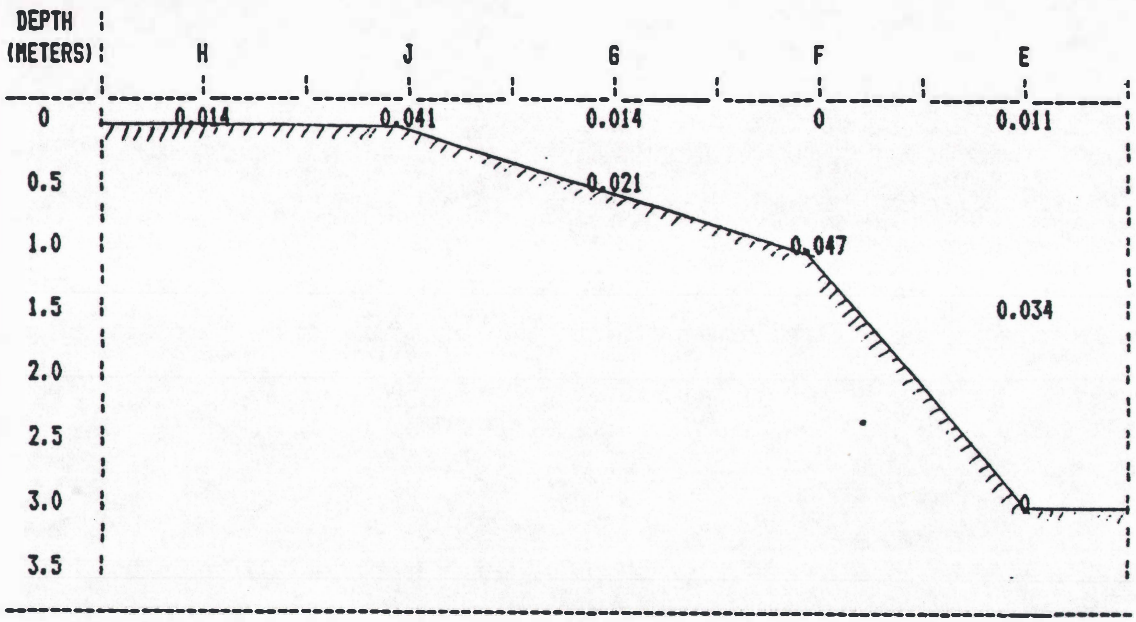
SAMPLING DATE 8-13-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



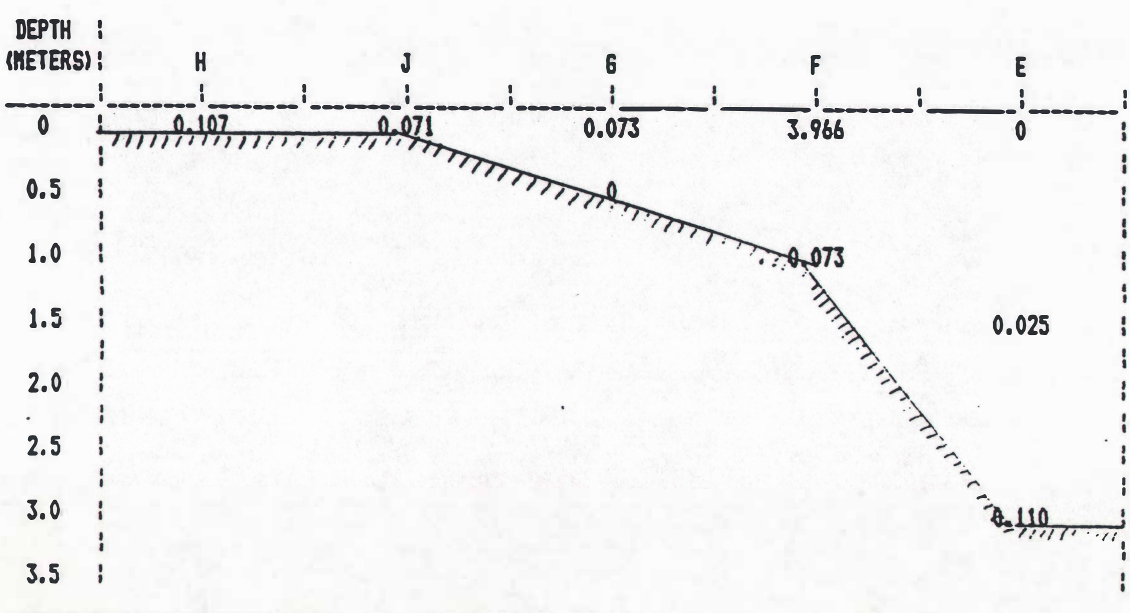
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



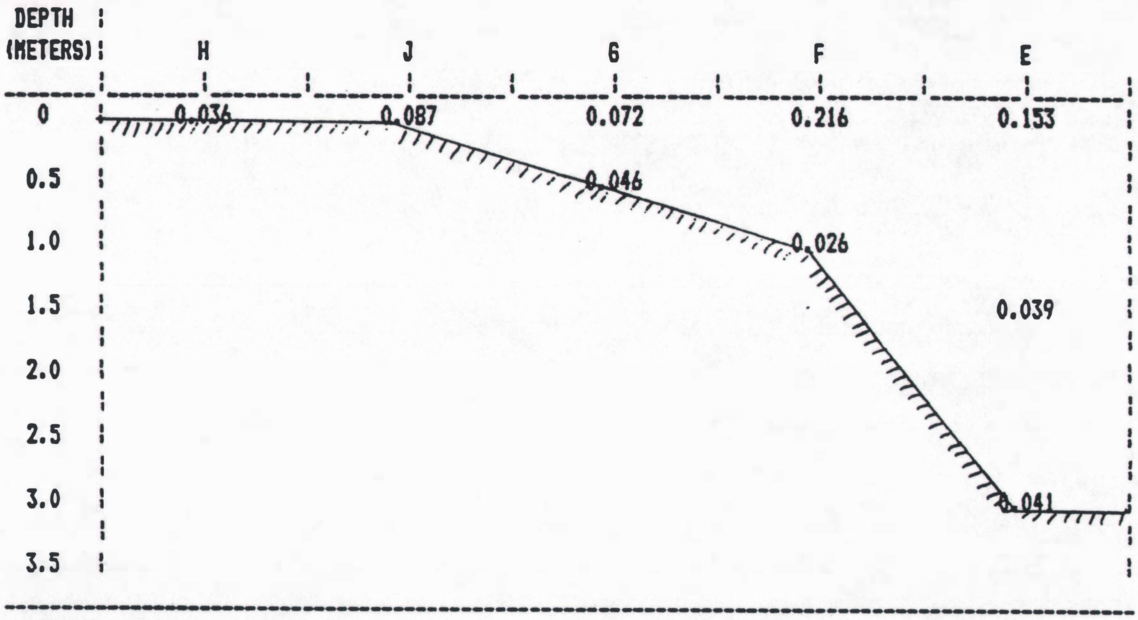
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



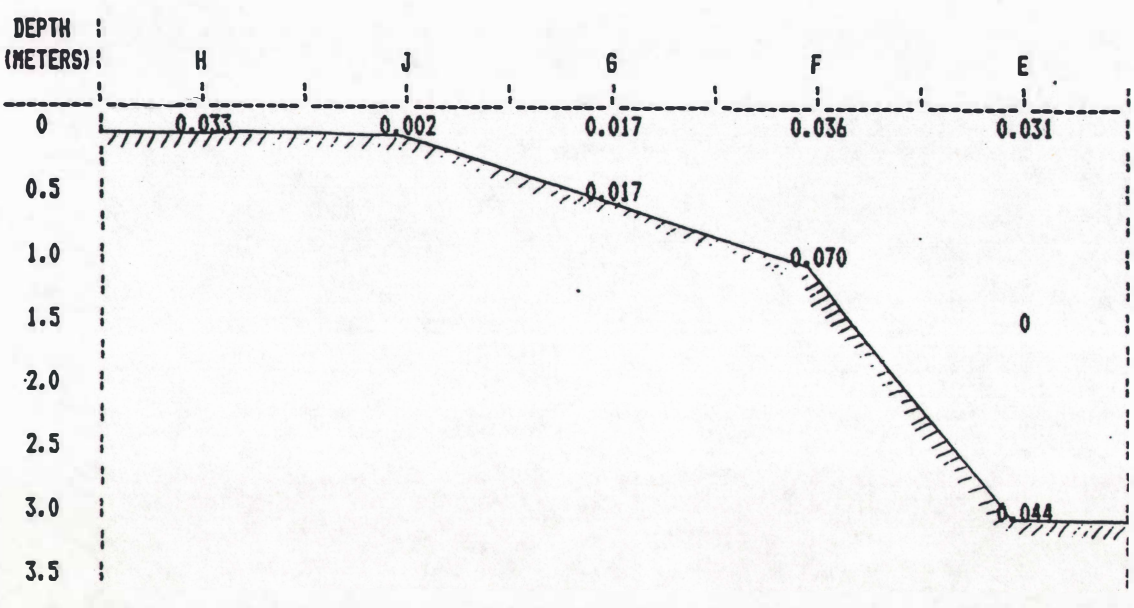
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



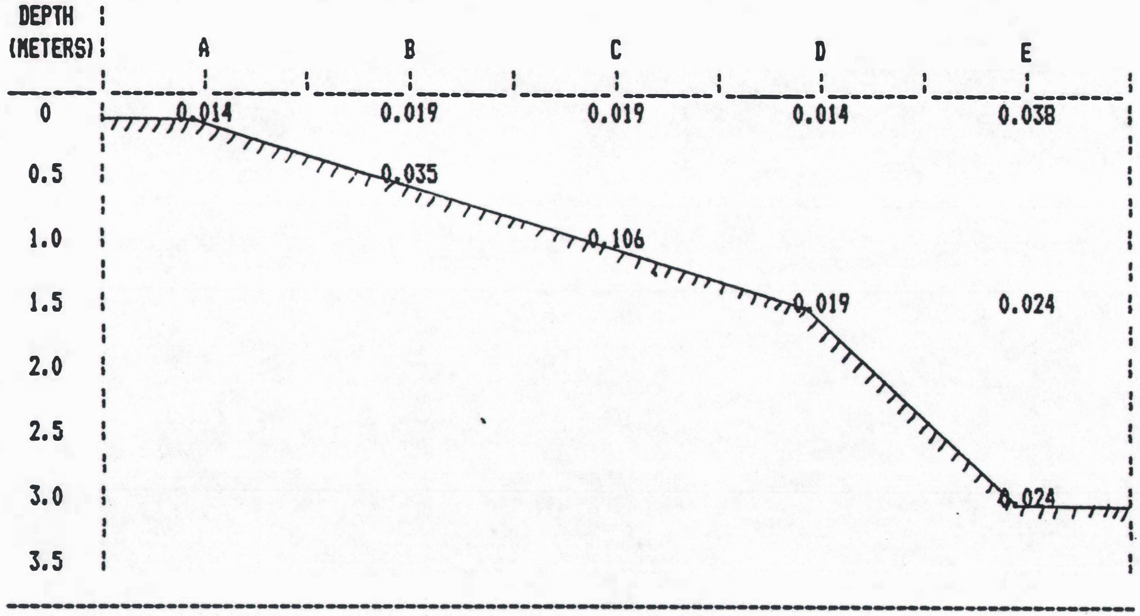
SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



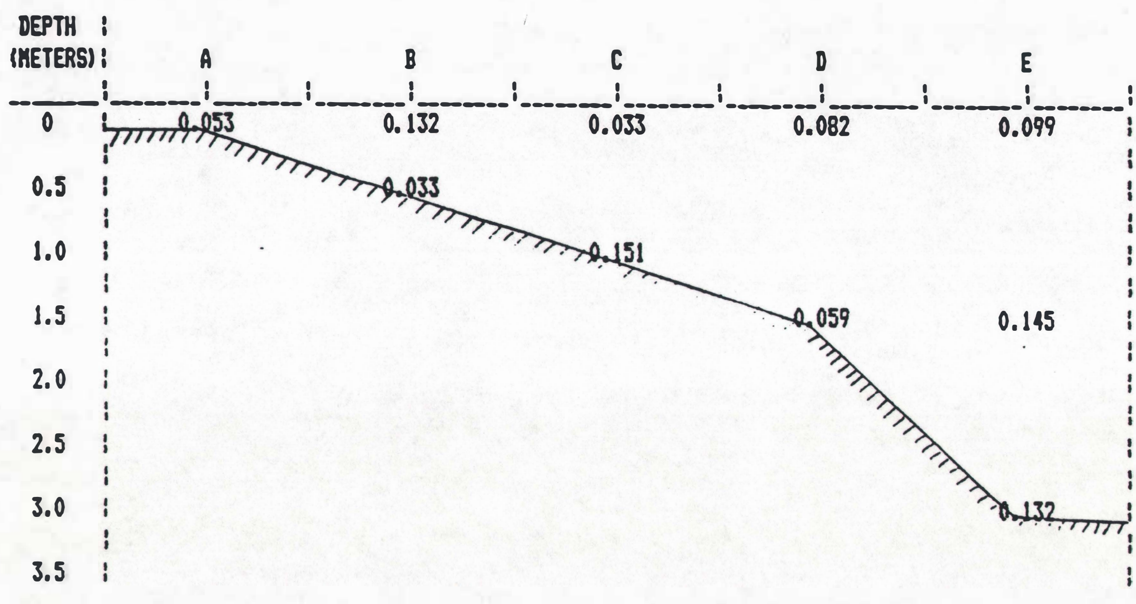
[illegible]
[illegible]
[illegible]

DEPTH METERS	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]	0.03	[illegible]	[illegible]
[illegible]			0.13		
[illegible]				0.07	
[illegible]					0.04
[illegible]					
[illegible]					
[illegible]					0.04
[illegible]					

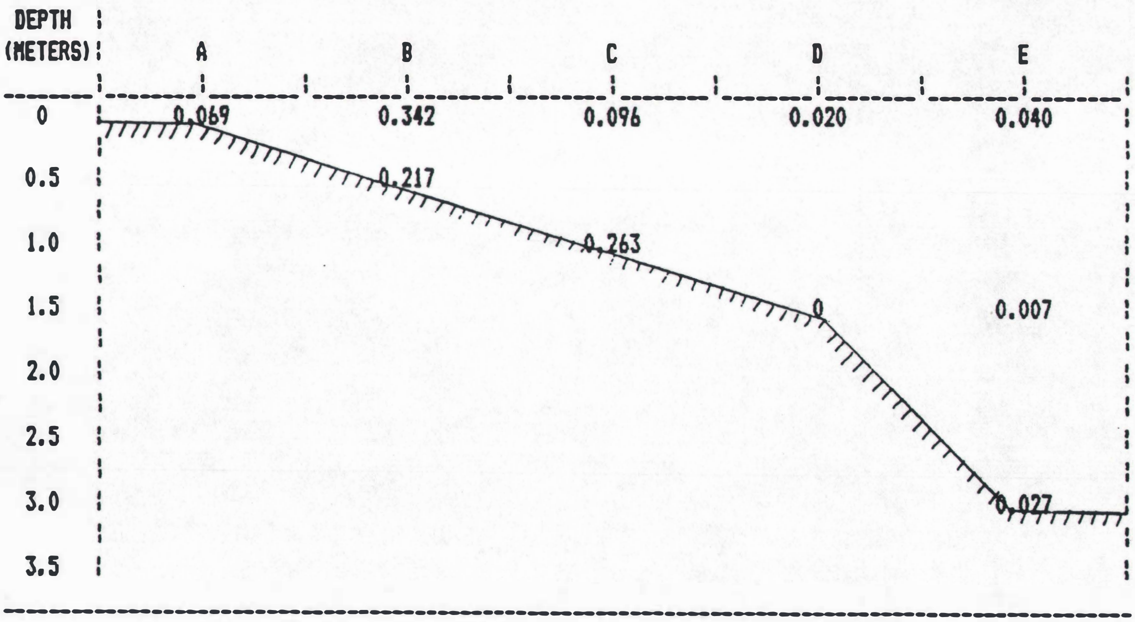
SAMPLING DATE 7-5-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



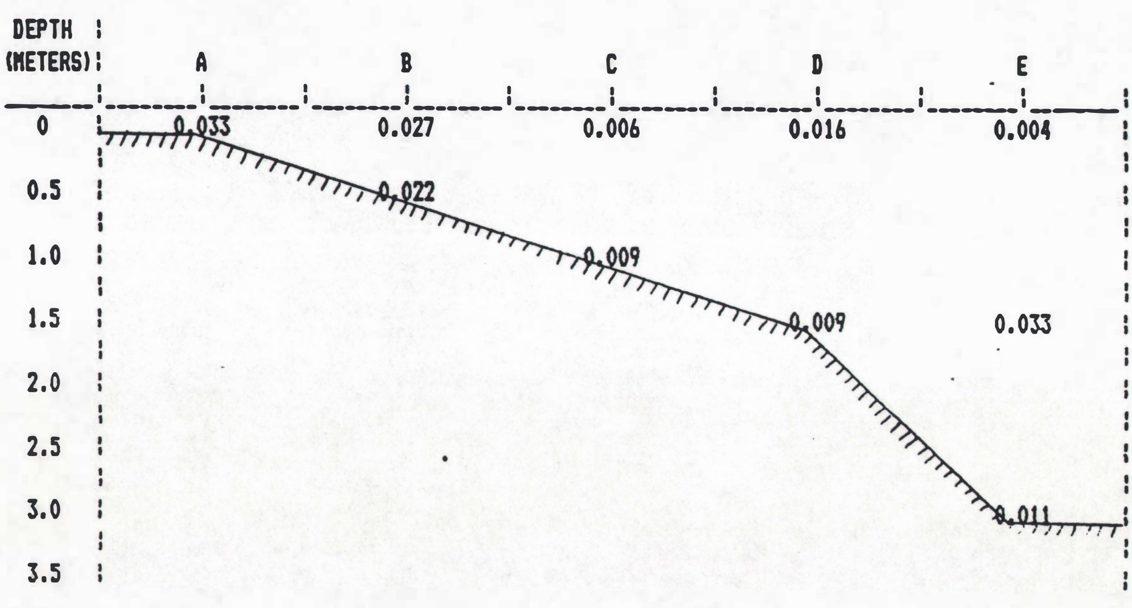
SAMPLING DATE 7-30-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



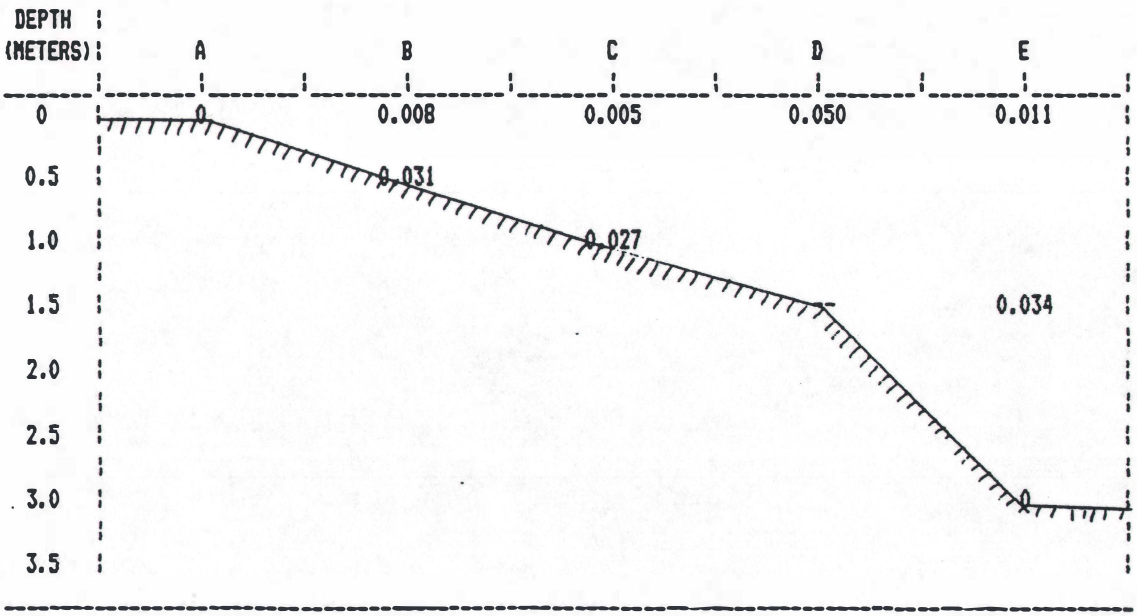
SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



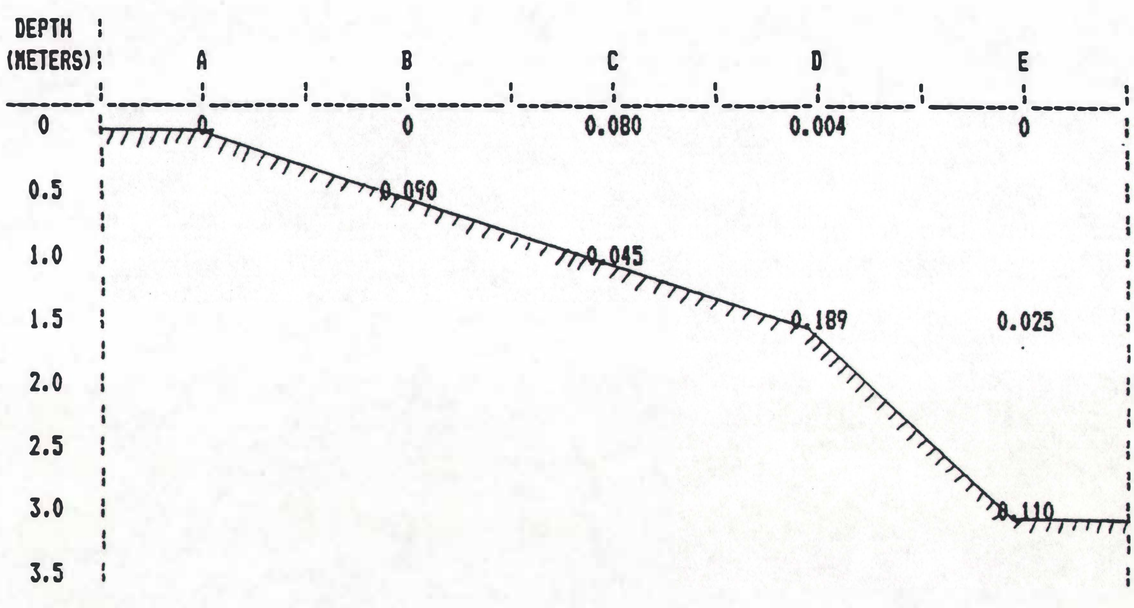
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



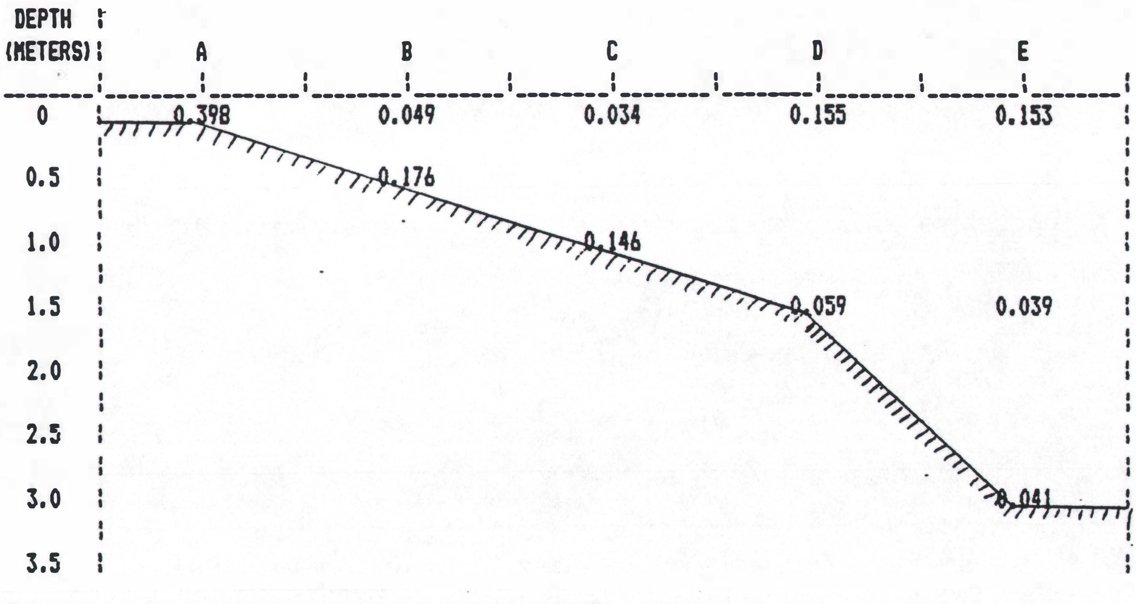
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



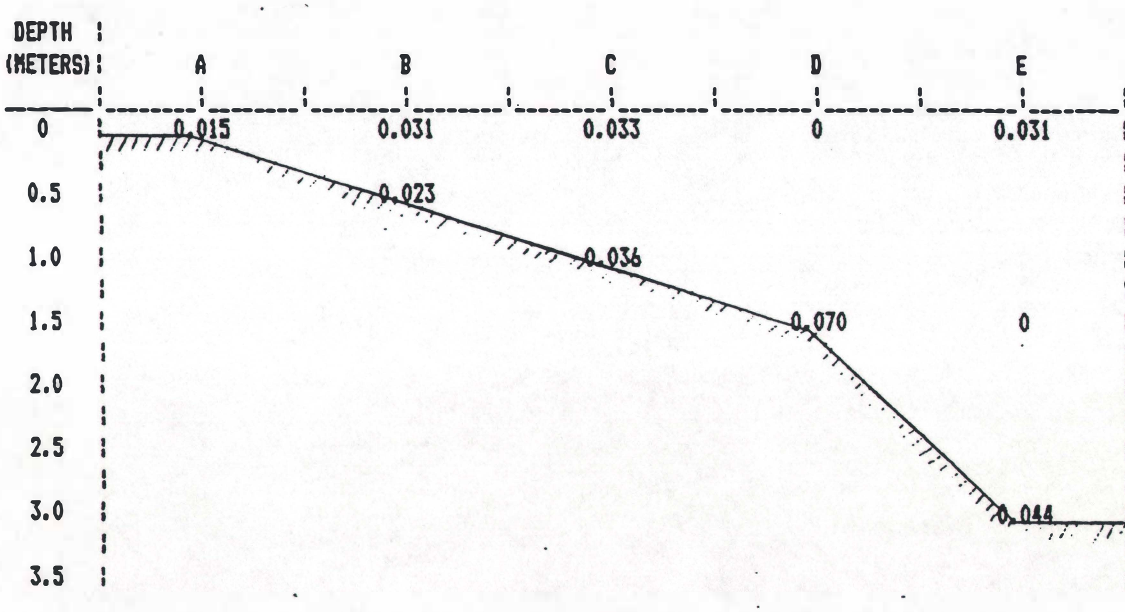
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



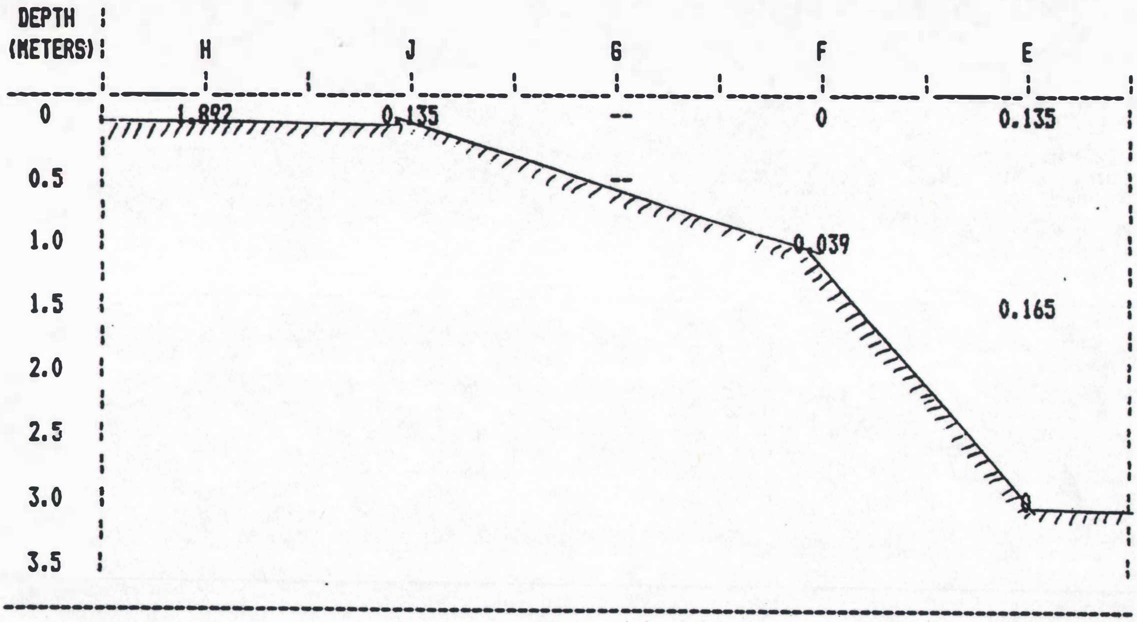
SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)



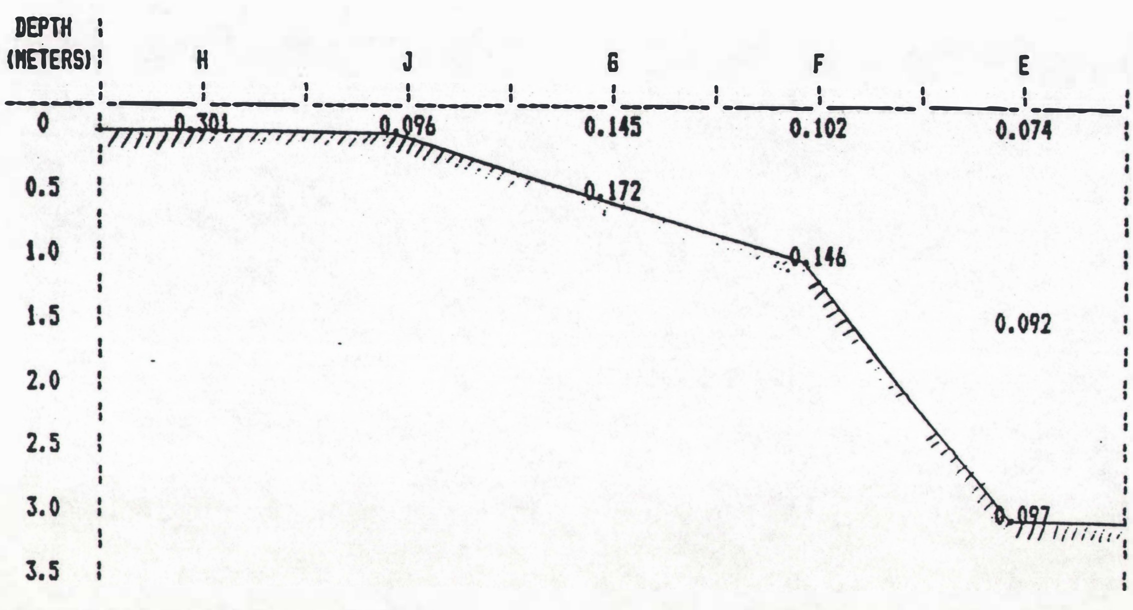
SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
TOTAL PHOSPHORUS CONCENTRATIONS (in ppm-P)

DEPTH (METERS)	A	B	C	D	E
0	0.03	0.05	0.03	0.03	0.05
0.5		0.06			
1.0			0.03		
1.5				0.03	0.04
2.0					
2.5					
3.0					0.04
3.5					

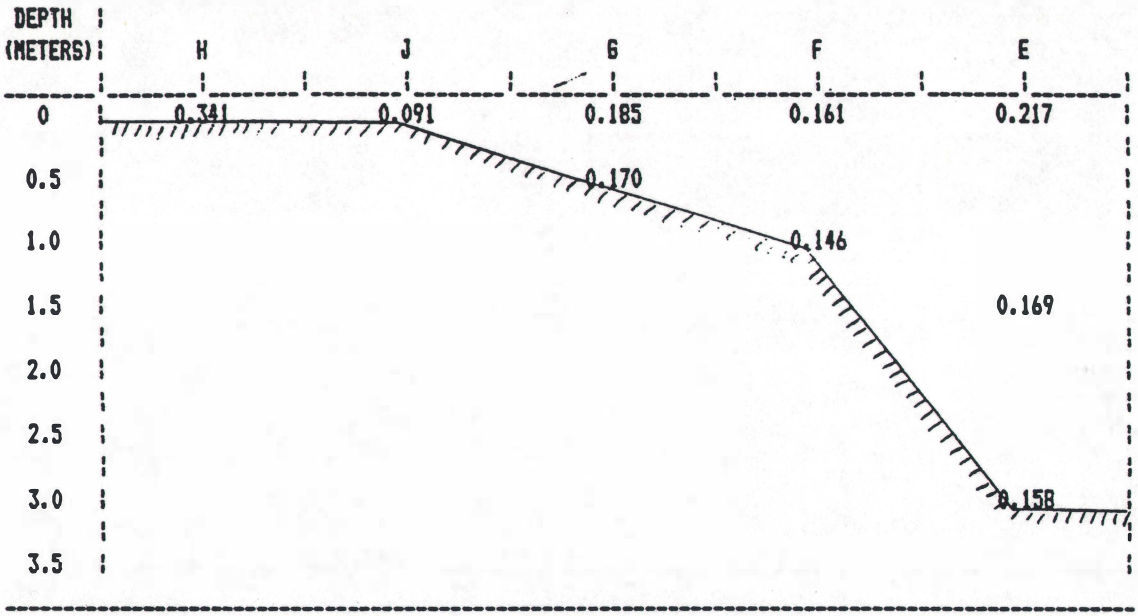
SAMPLING DATE 8-13-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



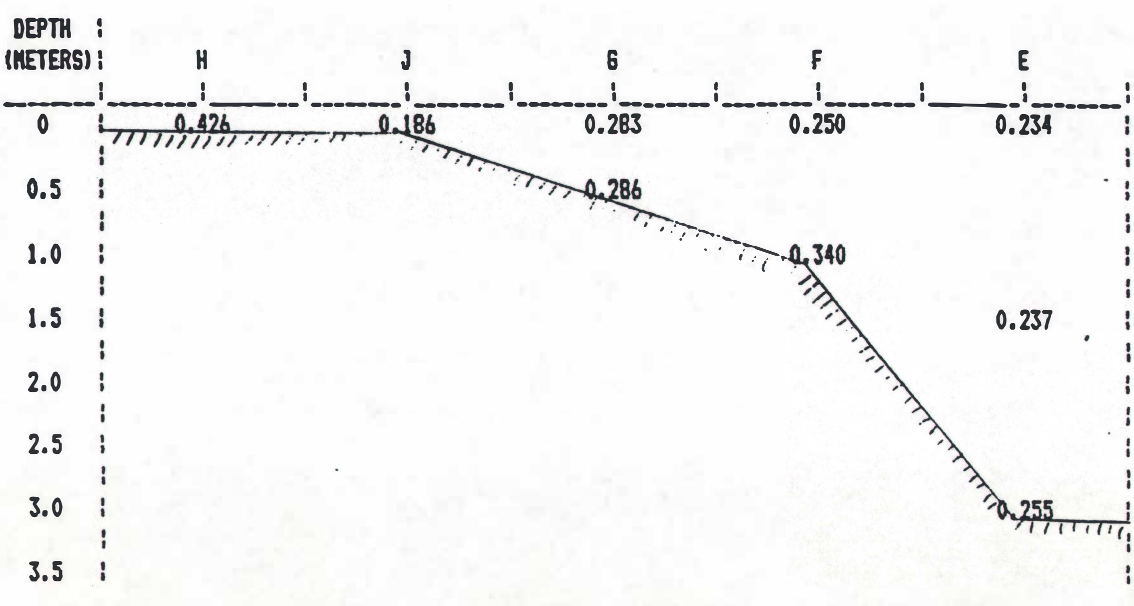
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



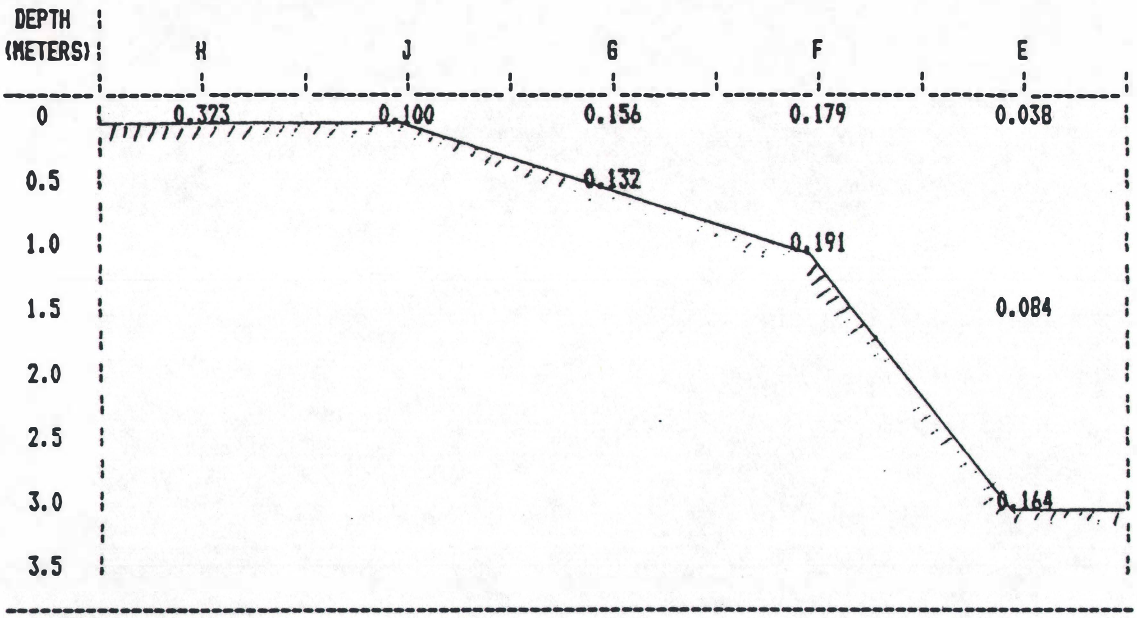
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



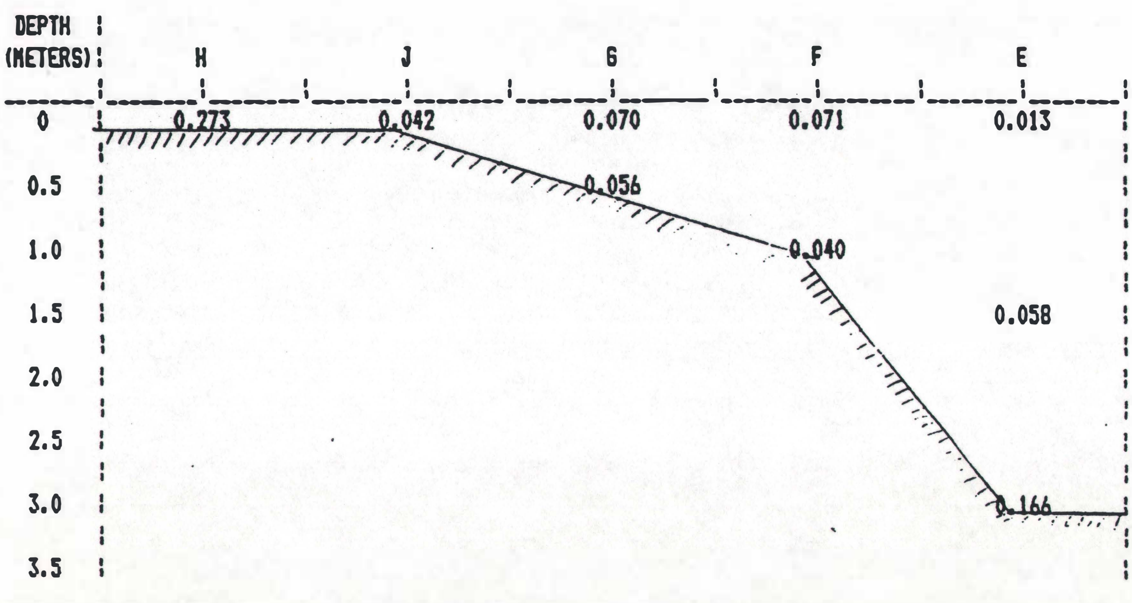
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-23-84
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



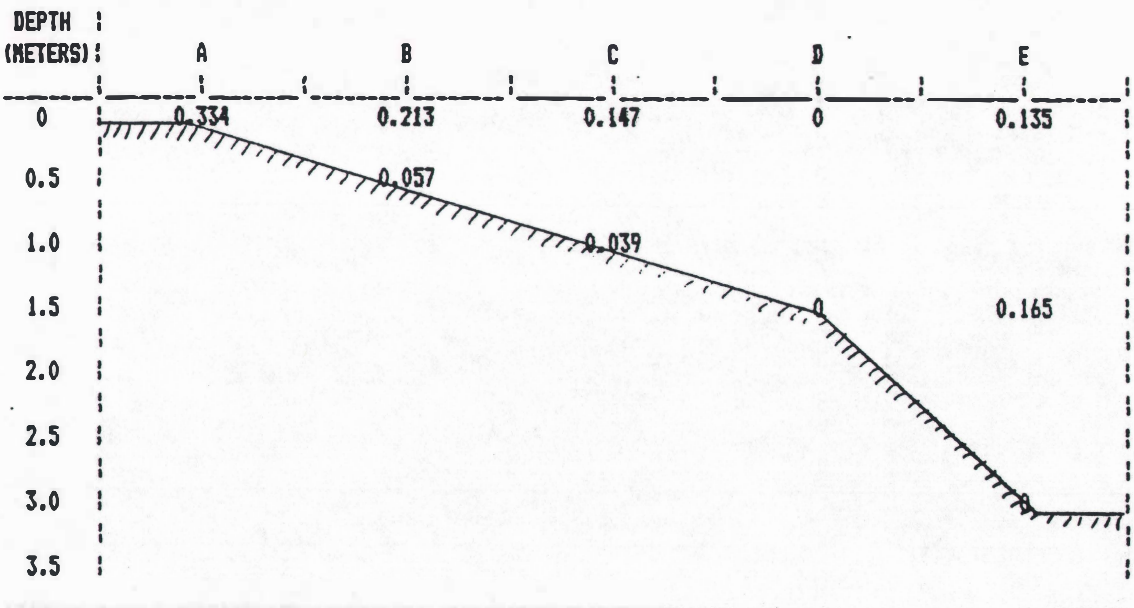
SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	H	J	G	F	E
0	0.168	0.067	0.054	0.041	0.063
0.5			0.087		
1.0				0.067	
1.5					0.061
2.0					
2.5					
3.0					0.081
3.5					

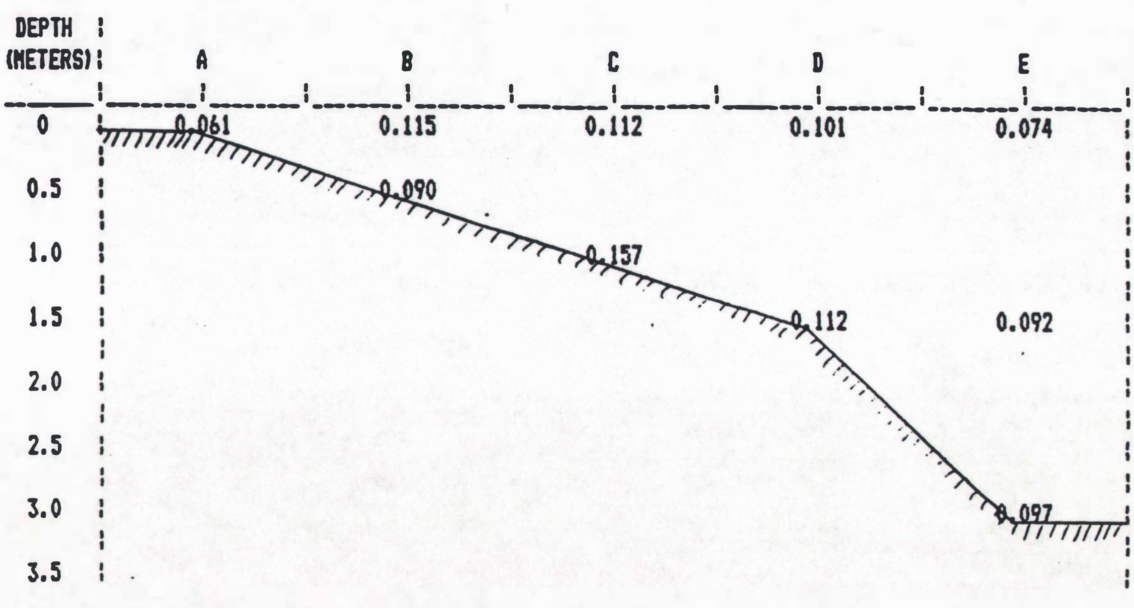
SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	H	J	G	F	E
0	0.19	0.19	0.05	0.02	0.04
0.5			0.05		
1.0				0.02	
1.5					0.06
2.0					
2.5					
3.0					0.05
3.5					

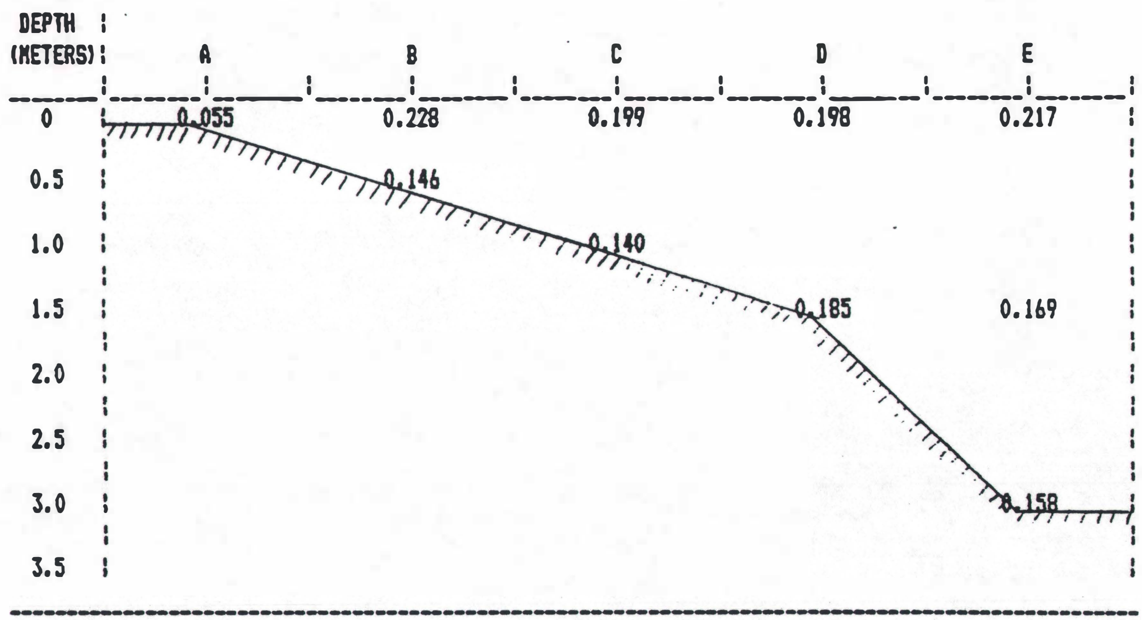
SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



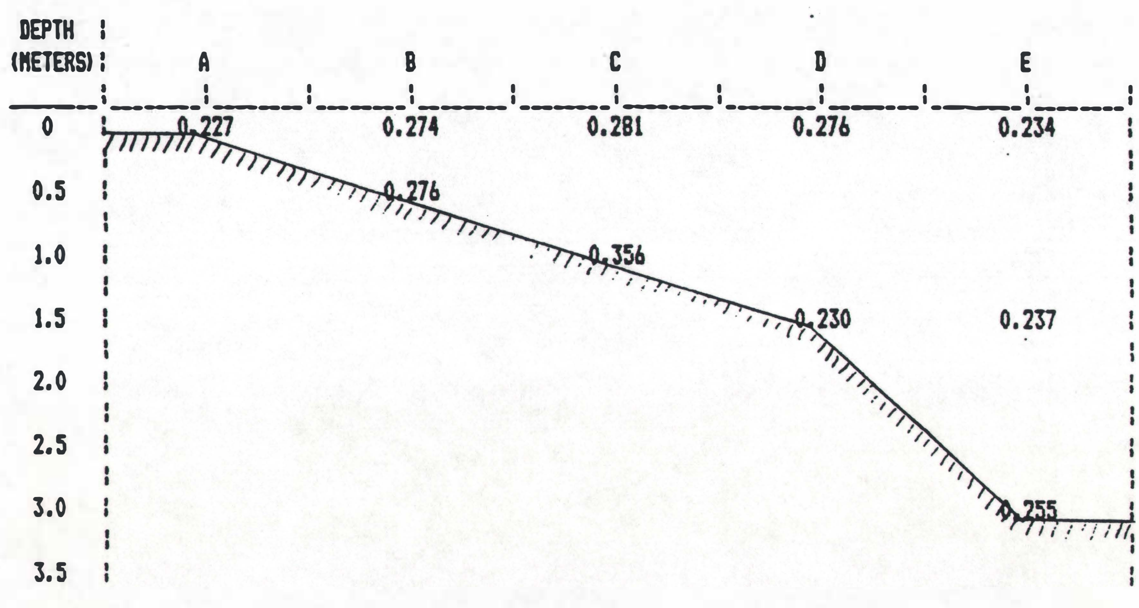
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



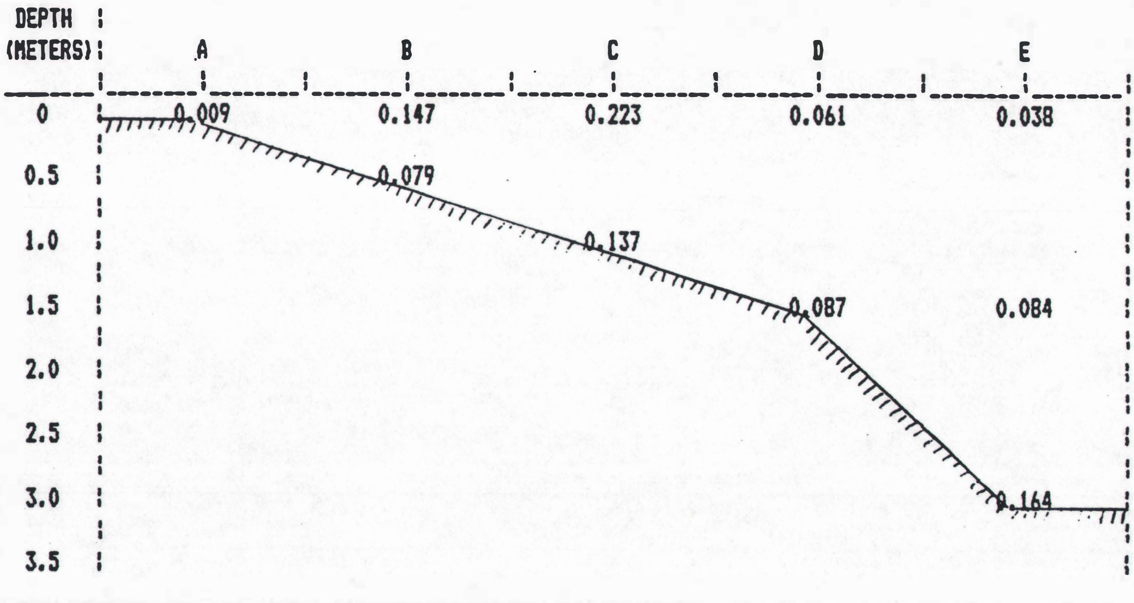
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



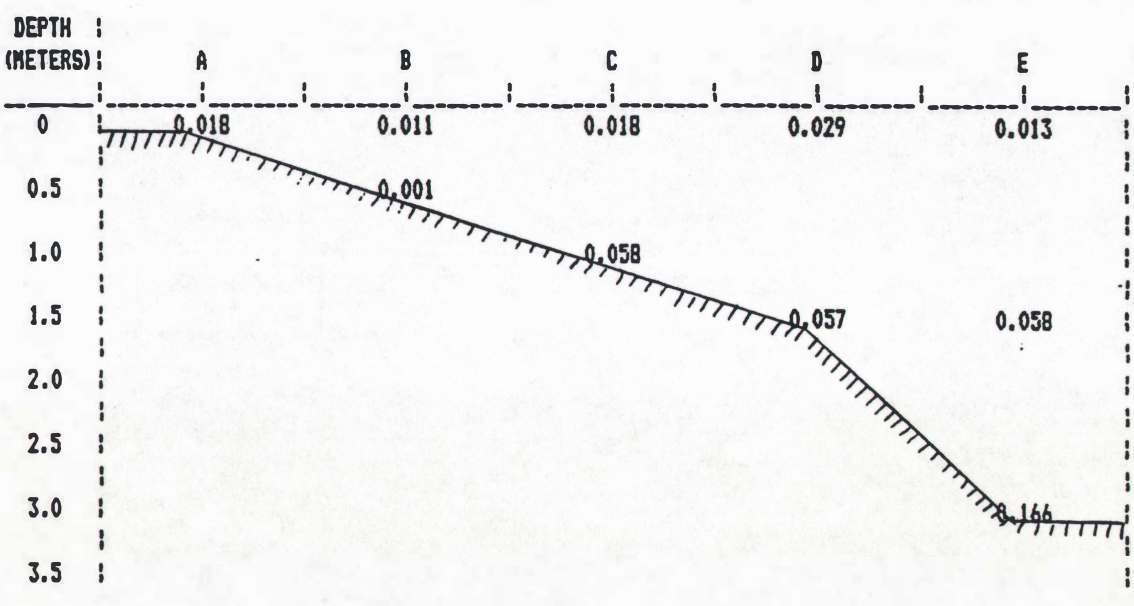
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)



SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	A	B	C	D	E
0	0.046	0.037	0.032	0.037	0.063
0.5		0.046			
1.0			0.032		
1.5				0.045	0.061
2.0					
2.5					
3.0					0.081
3.5					

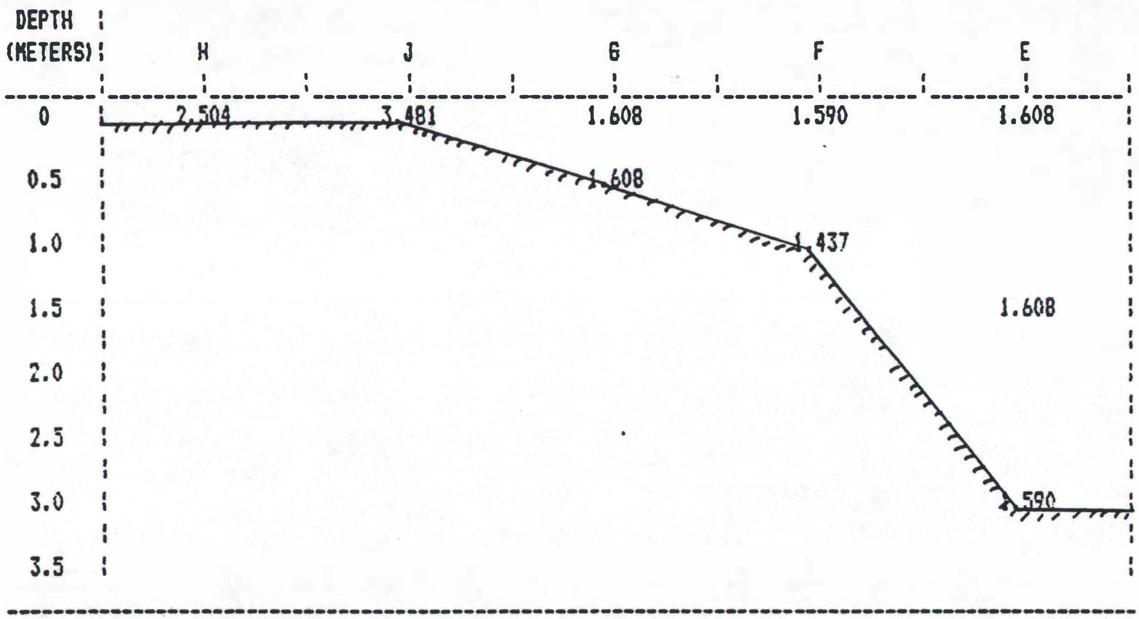
SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
NH CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	A	B	C	D	E
0	0.06	0.02	0.03	0.02	0.04
0.5		0.02			
1.0			0.02		
1.5				0.03	0.06
2.0					
2.5					
3.0					0.05
3.5					

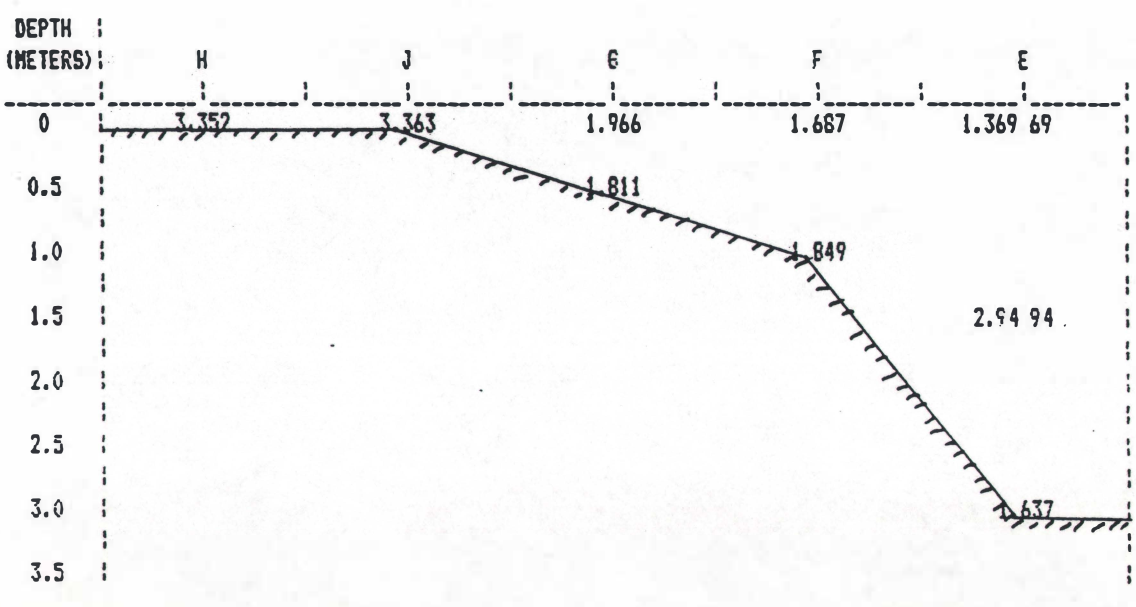
APPENDIX G:

NO_3^--NO_2^- Data

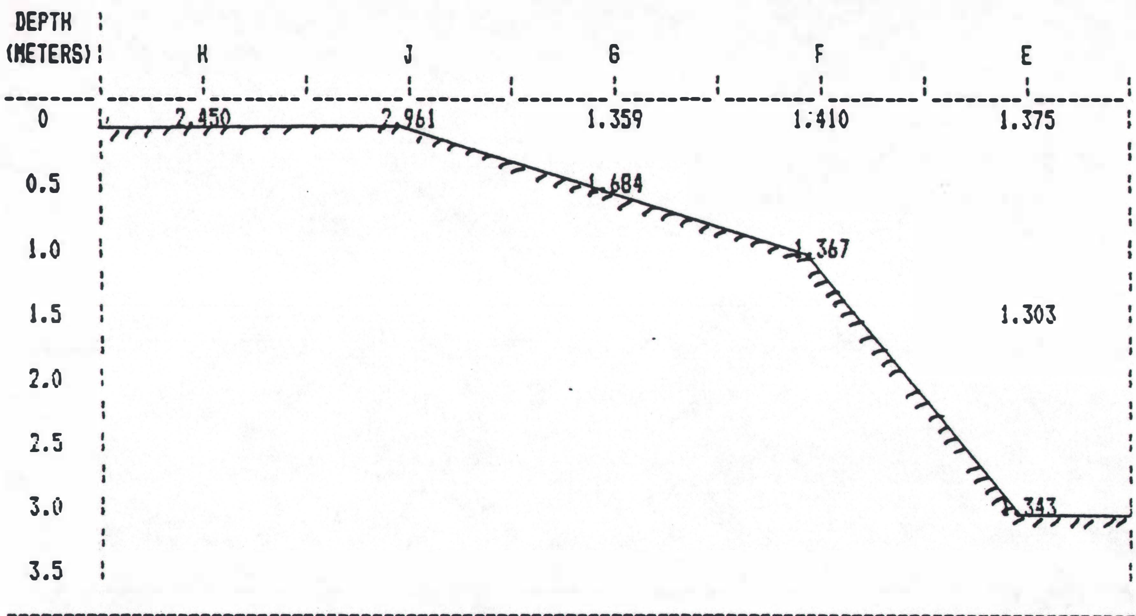
SAMPLING DATE 7-5-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



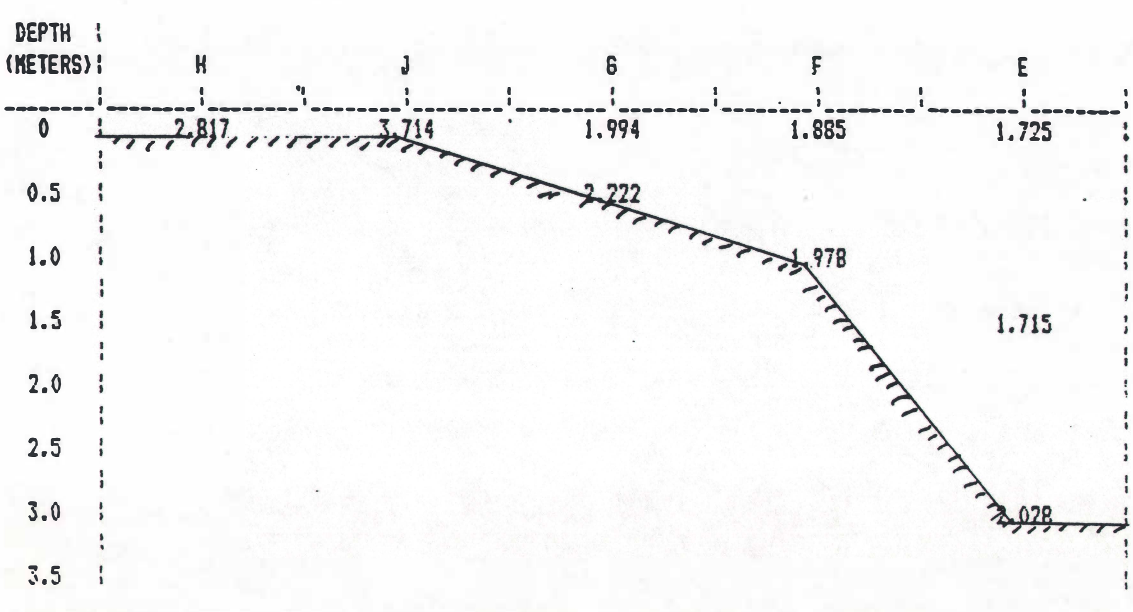
SAMPLING DATE 7-30-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



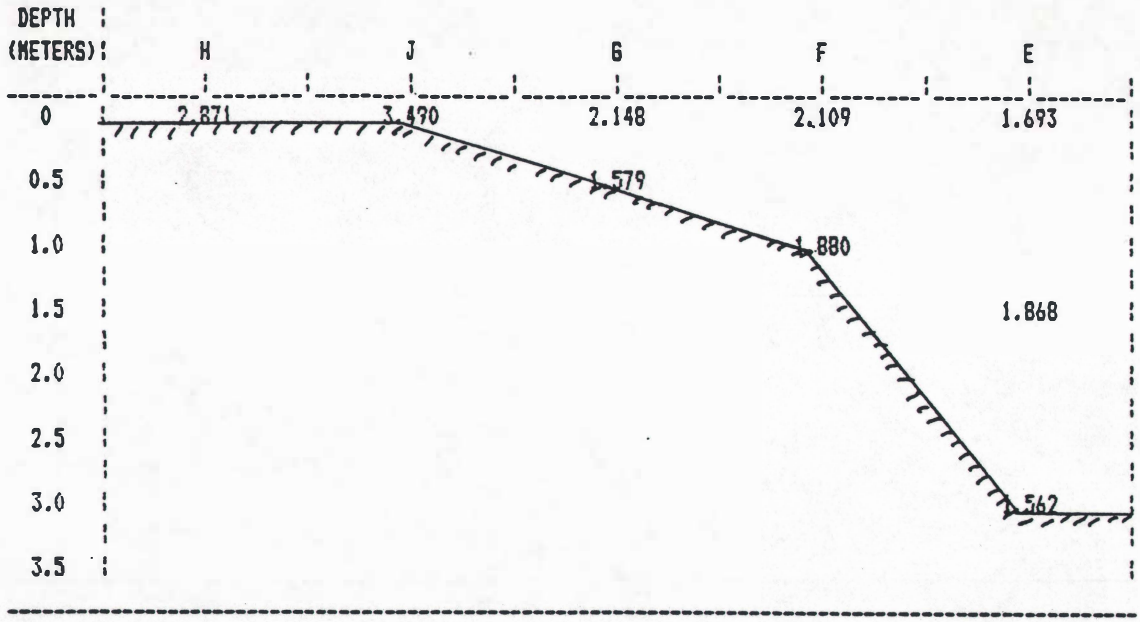
SAMPLING DATE 6-13-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



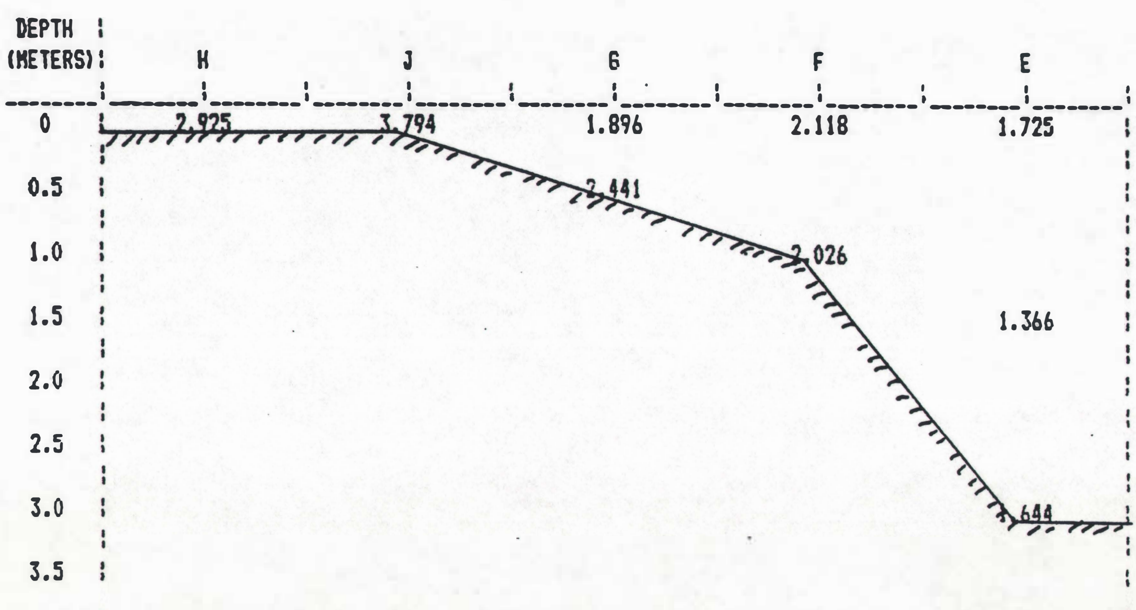
SAMPLING DATE 8-27-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



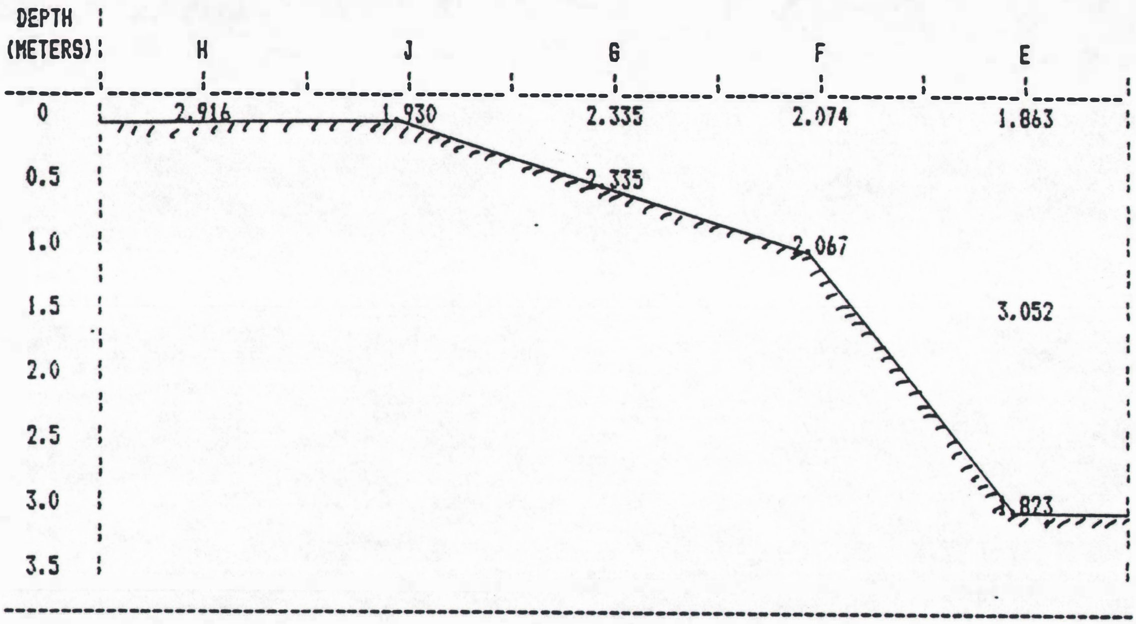
SAMPLING DATE 9-10-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



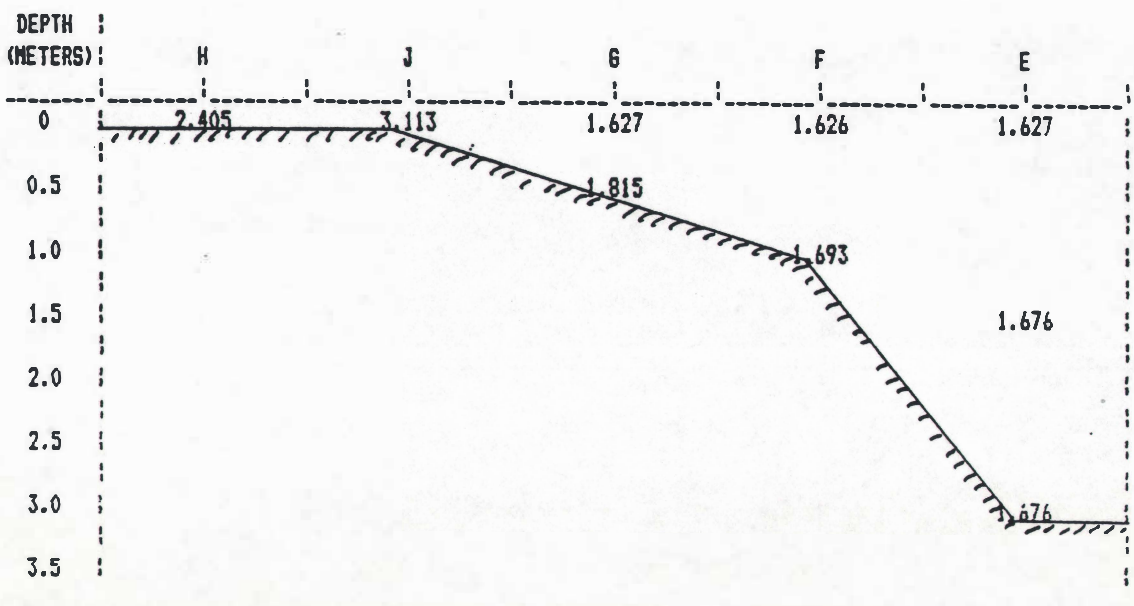
SAMPLING DATE 9-24-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-10-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-23-84
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



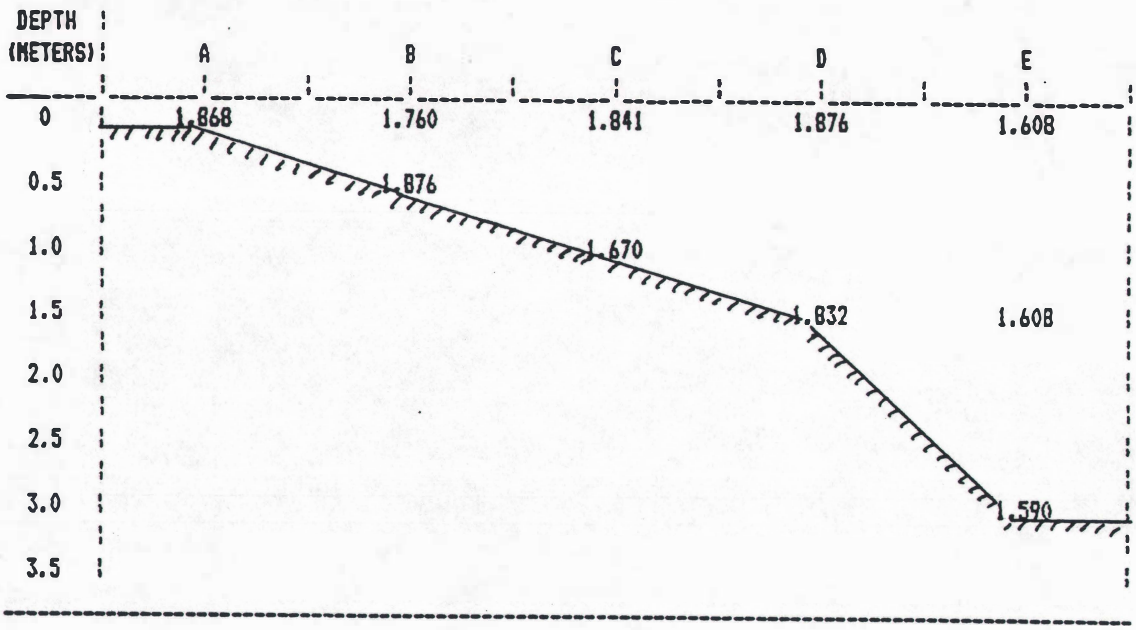
SAMPLING DATE 1-3-85
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	H	J	G	F	E
0	3.632	3.214	2.401	2.116	2.962
0.5			3.158		
1.0				1.969	
1.5					1.961
2.0					
2.5					
3.0					1.961
3.5					

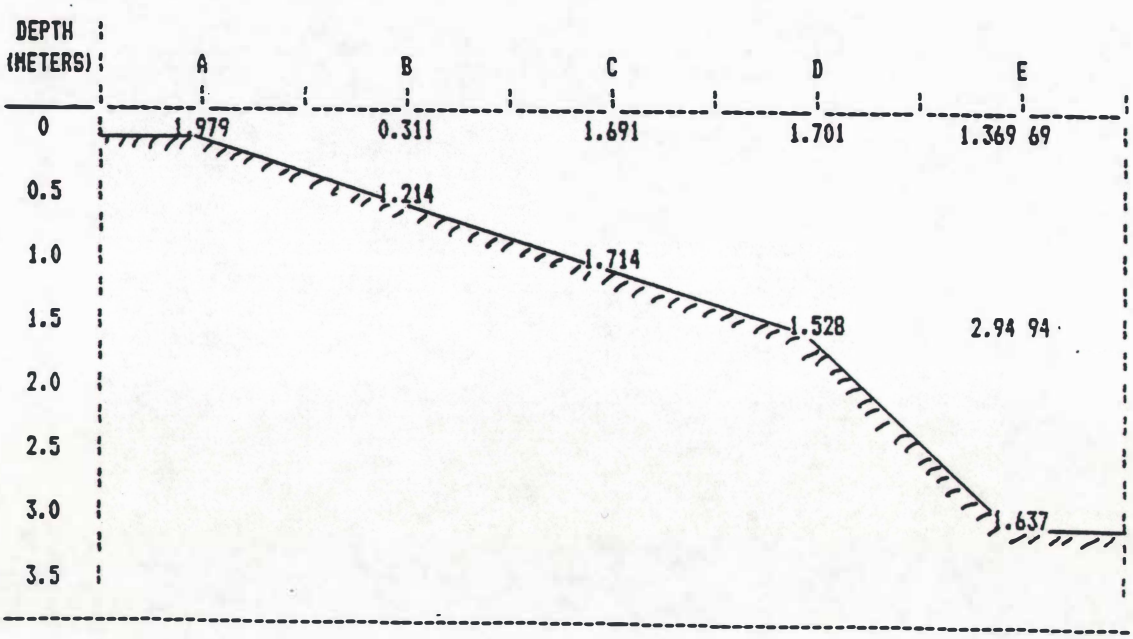
SAMPLING DATE 4-1-85
EAST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	H	J	G	F	E
0	3.4	4.5	2.7	3.6	4.1
0.5			2.7		
1.0				3.6	
1.5					2.8
2.0					
2.5					
3.0					3.5
3.5					

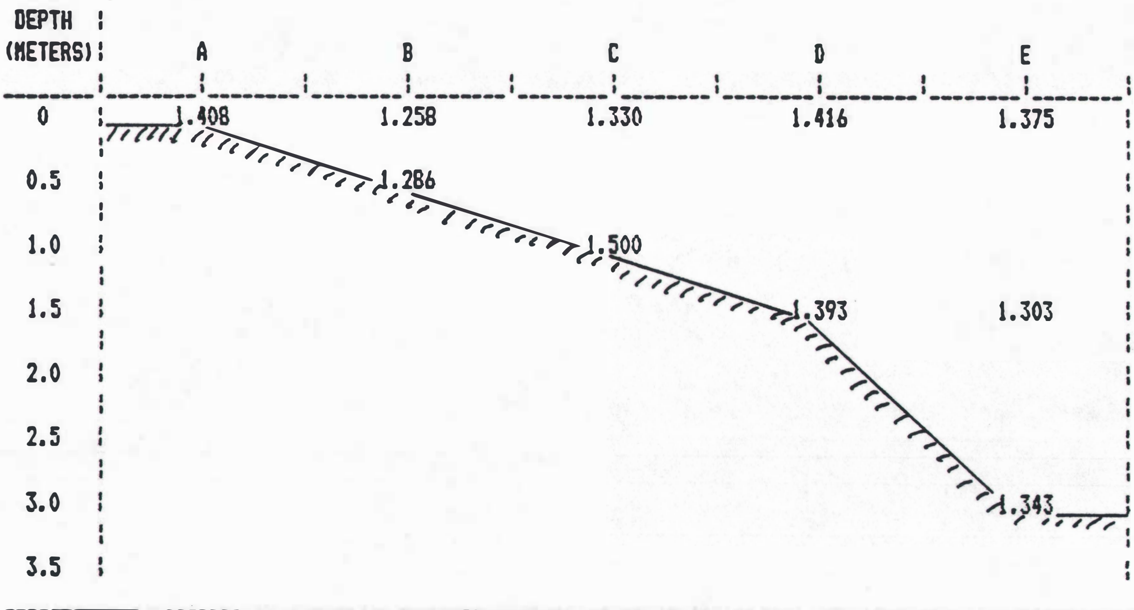
SAMPLING DATE 7-5-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



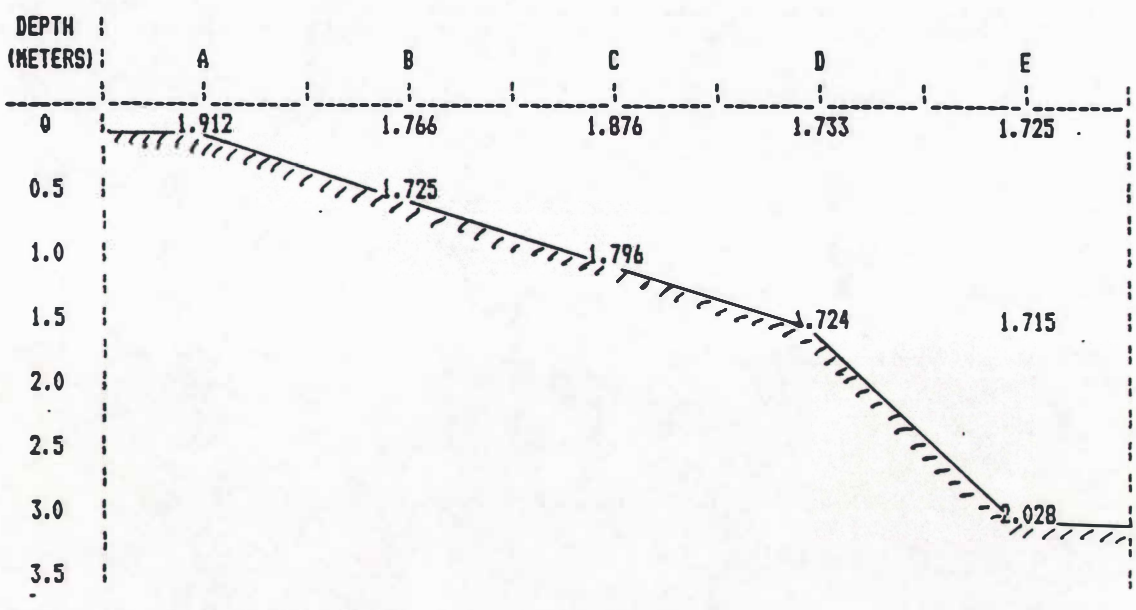
SAMPLING DATE 7-30-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



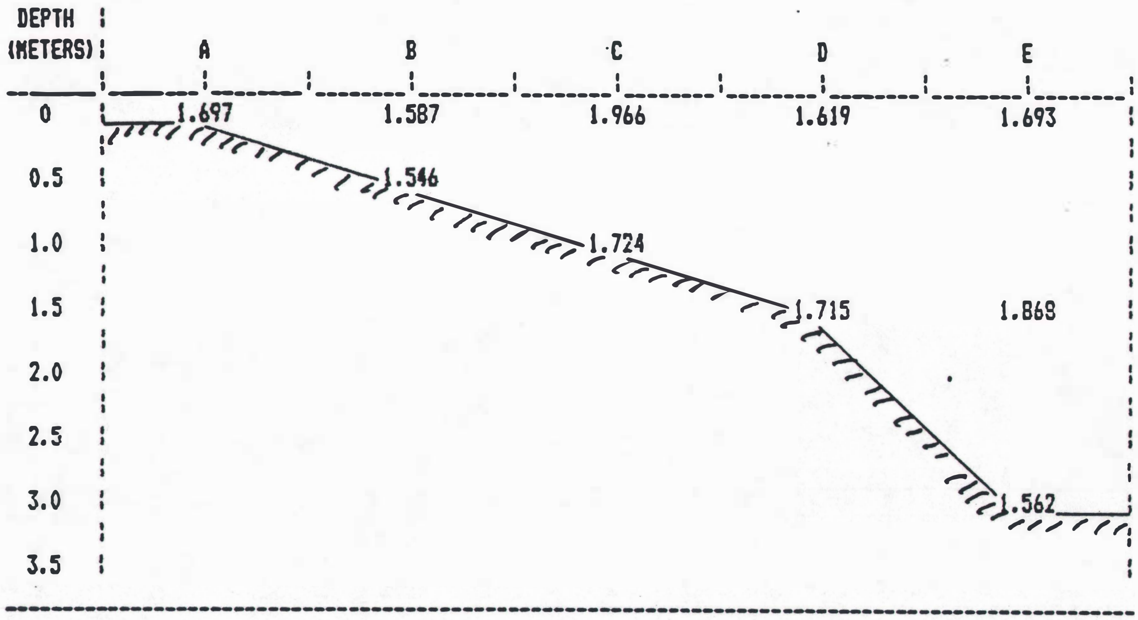
SAMPLING DATE 8-13-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



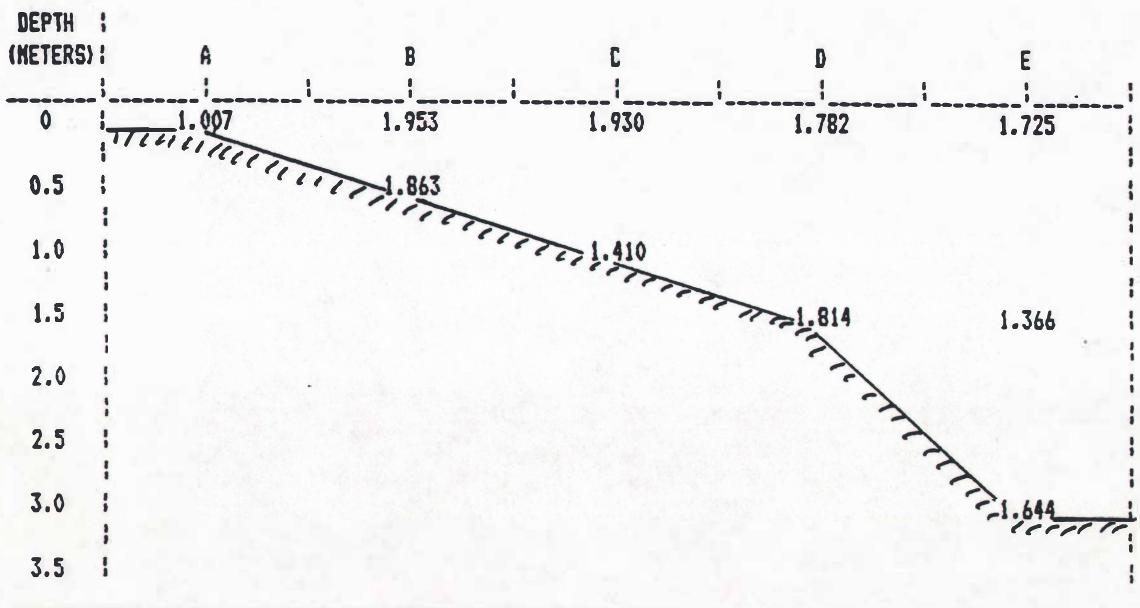
SAMPLING DATE 8-27-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



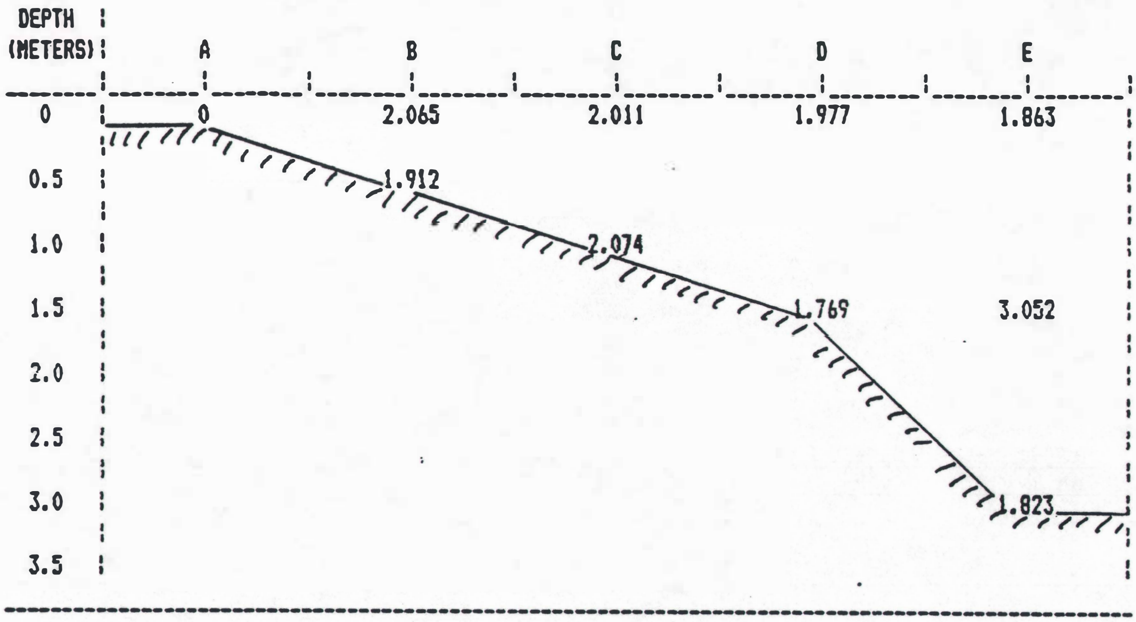
SAMPLING DATE 9-10-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



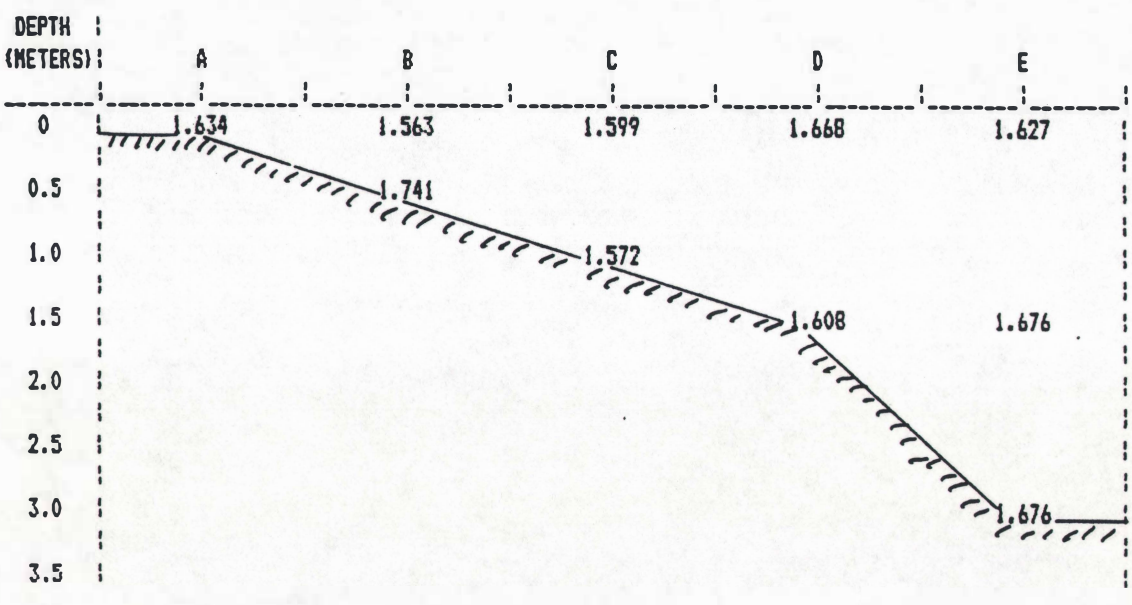
SAMPLING DATE 9-24-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-10-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



SAMPLING DATE 10-23-84
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)



SAMPLING DATE 1-3-85
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	A	B	C	D	E
0	1.725	3.150	2.938	2.995	2.962
0.5		2.995			
1.0			2.042		
1.5				2.848	1.961
2.0					
2.5					
3.0					1.961
3.5					

SAMPLING DATE 4-1-85
WEST SIDE TRANSECT
NO -NO CONCENTRATIONS (in ppm-N)

DEPTH (METERS)	A	B	C	D	E
0	2.2	2.6	3.3	3.3	4.1
0.5		3.8			
1.0			2.2		
1.5				4.1	4.1
2.0					
2.5					
3.0					2.8
3.5					

APPENDIX H:

Multiple Regression Statistics

MULTIPLE REGRESSION FOR NITRATE
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 1 VARIABLE SPRING ENTERED R SQUARE = 0.77017205 C(P) = 0.93705767

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	1.77824168	1.77824168	23.46	0.0019
ERROR	7	0.53064721	0.07580674		
TOTAL	8	2.30888889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.04175127				
SPRING	1.61946239	0.33437161	1.77824168	23.46	0.0019

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.
EQUATION: [Po] = 1.6195*[S] + 0.04175

MULTIPLE REGRESSION FOR NITRATE
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 2 VARIABLE CREEK ENTERED R SQUARE = 0.79494521 C(P) = 2.29710207

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	1.83544016	0.91772008	11.63	0.0086
ERROR	6	0.47344873	0.07890812		
TOTAL	8	2.30888889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.11868905				
CREEK	0.28016160	0.32906163	0.05719848	0.72	0.4272
SPRING	0.28016160	0.66870063	0.22524571	2.85	0.1421

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.28016*[C] + 1.1298*[S] + 0.11869

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

MULTIPLE REGRESSION FOR NITRATE
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 3 VARIABLE PIPE ENTERED R SQUARE = 0.80644625 C(P) = 4.00000000

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	1.86199479	0.62066493	6.94	0.0312
ERROR	5	0.44689410	0.08937882		
TOTAL	8	2.30888889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.00868825				
CREEK	0.29331210	0.35104420	0.06239804	0.70	0.4415
SPRING	0.88509557	0.84144743	0.09889196	1.11	0.3410
PIPE	0.34440713	0.63185771	0.02655463	0.30	0.6091

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.29331*[C] + 0.88510*[S] + 0.34441*[Pi] + 0.00869

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

MULTIPLE REGRESSION FOR AMMONIA
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 1 VARIABLE PIPE ENTERED R SQUARE = 0.22668214 C(P) = 2.64310309

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	0.01325807	0.01325807	1.76	0.2330
ERROR	6	0.04522943	0.00753824		
TOTAL	7	0.05848750			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.02149972				
PIPE	2.09394454	1.57891925	0.01325807	1.76	0.2330

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.
EQUATION: [Po] = 2.0939*[Pi] + 0.02150

MULTIPLE REGRESSION FOR AMMONIA
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 2 VARIABLE SPRING ENTERED R SQUARE = 0.28924999 C(P) = 4.10562074

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	0.01691751	0.00845875	1.02	0.4259
ERROR	5	0.04156999	0.00831400		
TOTAL	7	0.05848750			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.03414821				
SPRING	-0.09170462	0.13822577	0.00365944	0.44	0.5364
PIPE	2.25194035	1.67518738	0.01502439	1.81	0.2366

EQUATION: [Po] = -0.09170[S] + 2.2519[Pi] + 0.03415

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

MULTIPLE REGRESSION FOR AMMONIA
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 3 VARIABLE PIPE REPLACED BY CREEK   R SQUARE = 0.53434976   C(P) = 2.00011778

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	0.03125278	0.01562639	2.87	0.1480
ERROR	5	0.02723472	0.00544694		
TOTAL	7	0.05848750			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.10152649				
CREEK	1.00431186	0.43258304	0.02935966	5.39	0.0679
SPRING	-0.43532890	0.19408361	0.02740376	5.03	0.0749

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.
EQUATION: [Po] = 1.0043*[C] - 0.43533*[S] + 0.10153

MULTIPLE REGRESSION FOR AMMONIA
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 3 VARIABLE PIPE ENTERED   R SQUARE = 0.53436347   C(P) = 4.00000000

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	0.03125358	0.01041786	1.53	0.3365
ERROR	4	0.02723392	0.00680848		
TOTAL	7	0.05848750			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.10065178				
CREEK	0.99899454	0.68845100	0.01433607	2.11	0.2204
SPRING	-0.43364444	0.26678728	0.01798819	2.64	0.1794
PIPE	0.02341910	2.15793532	0.00000080	0.00	0.9919

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.99899*[C] - 0.43364*[S] + 0.02341*[Pi] + 0.10065

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

MULTIPLE REGRESSION FOR TOTAL PHOSPHORUS
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 1 VARIABLE CREEK ENTERED R SQUARE = 0.47665593 C(P) = 0.34110974

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	1	0.00252098	0.00252098	6.38	0.0395
ERROR	7	0.00276791	0.00039542		
TOTAL	8	0.00528889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.04026442				
CREEK	0.15745192	0.06235770	0.00252098	6.38	0.0395

THE ABOVE MODEL IS THE BEST 1 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.15745*[C] + 0.04026

MULTIPLE REGRESSION FOR TOTAL PHOSPHORUS
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 2 VARIABLE PIPE ENTERED R SQUARE = 0.50605960 C(P) = 2.04102374

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	2	0.00267649	0.00133825	3.07	0.1205
ERROR	6	0.00261240	0.00043540		
TOTAL	8	0.00528889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.04473968				
CREEK	0.20635983	0.10477917	0.00168884	3.88	0.0964
PIPE	-0.63603769	1.06425018	0.00015551	0.36	0.5719

THE ABOVE MODEL IS THE BEST 2 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.20636*[C] - 0.63604*[Pi] + 0.04474

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

MULTIPLE REGRESSION FOR TOTAL PHOSPHORUS
MAXIMUM R-SQUARE IMPROVEMENT FOR DEPENDENT VARIABLE POND

STEP 3 VARIABLE SPRING ENTERED R SQUARE = 0.51007927 C(P) = 4.00000000

	DF	SUM OF SQUARES	MEAN SQUARE	F	PROB>F
REGRESSION	3	0.00269775	0.00089925	1.74	0.2751
ERROR	5	0.00259114	0.00051823		
TOTAL	8	0.00528889			

	B VALUE	STD ERROR	TYPE II SS	F	PROB>F
INTERCEPT	0.04409015				
CREEK	0.21356766	0.11972303	0.00164906	3.18	0.1345
SPRING	0.02545088	0.12565658	0.00002126	0.04	0.8475
PIPE	-0.72754631	1.24587914	0.00017672	0.34	0.5846

THE ABOVE MODEL IS THE BEST 3 VARIABLE MODEL FOUND.
EQUATION: [Po] = 0.21357*[C] + 0.02545*[S] - 0.72755*[Pi] + 0.04409

[Po] = concentration in Pond
[S] = concentration in Spring
[C] = concentration in Creek
[Pi] = concentration in Pipe

APPENDIX I:

Annual Rain Data for Setauket, NY

JUNE, 1984

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN AMOUNT INCHES (IN)	RAIN AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (I)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	6		0							
2	6	1.74	4.4196	17	57443454	34222.80	43311.48	2994.679	26933.21	53757075
3	6	0.02	0.0508							
4	6		0							
5	6		0							
6	6	0.05	0.127	1						
7	6		0							
8	6		0							
9	6		0							
10	6		0							
11	6		0							
12	6		0							
13	6		0							
14	6	0.15	0.381	1						
15	6		0							
16	6		0							
17	6		0							
18	6	0.05	0.127	1.5						
19	6	0.76	1.9304	2	18557724	7219.465	18700.76	876.6687	7743.572	15049341
20	6		0							
21	6		0							
22	6		0							
23	6		0							
24	6		0							
25	6	1.61	4.0894	2.5	52285142	30640.72	40046.79	2713.718	24387.64	48622376
26	6	0.02	0.0508	1						
27	6		0							
28	6		0							
29	6	0.04	0.1016	2						
30	6	0.7	1.778	6.5	16176965	5566.199	17193.98	746.9946	6568.696	12679479
TOTAL		5.14	13.0556	34.5	1.4E+08	77649.19	119253.0	7332.061	65633.13	1.3E+08

JULY, 1984
RAIN AMOUNT AND DURATION: SETAUKET, NY
STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN AMOUNT INCHES (IN)	CMS (CM)	DURATION (HR)	STORM DSCHARGE (l)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	7	1.12	2.8448	6.5	32842278	17139.05	27741.43	1654.713	14792.82	29268508
2	7	0.02	0.0508							
3	7		0							
4	7	0.05	0.127	0.5						
5	7		0							
6	7	0.24	0.6096	2.5						
7	7	1.79	4.5466	15	59427419	35600.52	44567.13	3102.741	27912.27	55731960
8	7		0							
9	7		0							
10	7		0							
11	7		0							
12	7	0.07	0.1778	2						
13	7		0							
14	7		0							
15	7		0							
16	7	0.31	0.7874	2	702031.9		7399.923			
17	7		0							
18	7	0.8	2.032	4.5	20144896	8321.642	19705.28	963.1181	8526.823	16629248
19	7		0							
20	7		0							
21	7	3.45	8.763	6.5	1.3E+08	81340.87	86254.68	6690.391	60417.17	1.2E+08
22	7		0							
23	7		0							
24	7	0.06	0.1524							
25	7		0							
26	7		0							
27	7	1.35	3.429	8	41968520	23476.57	33517.42	2151.797	19296.51	38352977
28	7	0.05	0.127							
29	7		0							
30	7	0.03	0.0762	1						
31	7		0							
TOTAL		9.34	23.7236	48.5	2.8E+08	165878.6	219185.8	14562.76	130945.6	2.6E+08

AUGUST, 1984

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (1)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	8		0							
2	8		0							
3	8	0.02	0.0508							
4	8		0							
5	8	0.22	0.5588	2.5						
6	8		0							
7	8	0.02	0.0508	1						
8	8		0							
9	8		0							
10	8		0							
11	8		0							
12	8		0							
13	8		0							
14	8		0							
15	8		0							
16	8		0							
17	8		0							
18	8		0							
19	8		0							
20	8		0							
21	8		0							
22	8		0							
23	8	0.06	0.1524	1						
24	8		0							
25	8		0							
26	8		0							
27	8		0							
28	8		0							
29	8		0							
30	8		0							
31	8	0.23	0.5842	1						
TOTAL		0.55	1.397	5.5	0	0	0	0	0	0

SEPTEMBER, 1984
RAIN AMOUNT AND DURATION: SETAUKET, NY
STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN AMOUNT INCHES (IN)	CMS (CM)	DURATION (HR)	STORM DSCHARGE (1)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	9		0							
2	9		0							
3	9		0							
4	9	1.45	3.683	7	45936452	26232.02	36028.72	2367.921	21254.64	42302746
5	9	0.11	0.2794	2.5						
6	9		0							
7	9		0							
8	9		0							
9	9		0							
10	9		0							
11	9	trace	0	1						
12	9		0							
13	9		0							
14	9		0							
15	9	0.79	2.0066	15	19748103	8046.098	19454.15	941.5058	8331.010	16234271
16	9	0.03	0.0762	1.5						
17	9		0							
18	9		0							
19	9		0							
20	9		0							
21	9		0							
22	9		0							
23	9		0							
24	9	0.03	0.0762	0.5						
25	9		0							
26	9	0.06	0.1524	1						
27	9		0							
28	9	0.4	1.016	6.5	4273170.	-2700.12	9660.092	98.62408	694.3165	830173.3
29	9		0							
30	9		0							
TOTAL		2.87	7.2898	35	69957726	31577.98	65142.96	3408.050	30279.97	59367191

OCTOBER, 1984

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN AMOUNT INCHES (IN)	RAIN AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (1)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	10	0.53	1.3462	8.5	9431481.	881.9468	12924.77	379.5846	3239.881	5964872.
2	10		0							
3	10		0							
4	10		0							
5	10		0							
6	10		0							
7	10		0							
8	10		0							
9	10	0.13	0.3302	3.5						
10	10		0							
11	10		0							
12	10		0							
13	10		0							
14	10		0							
15	10		0							
16	10		0							
17	10		0							
18	10		0							
19	10		0							
20	10		0							
21	10		0							
22	10		0							
23	10	0.67	1.7018	2.5	14986585	4739.566	16440.59	682.1575	5981.258	11494549
24	10	0.16	0.4064	4						
25	10		0							
26	10	0.35	0.889	4.5	2289204.		8404.443			
27	10	0.06	0.1524							
28	10		0							
29	10	0.7	1.778	4	16176965	5566.199	17193.98	746.9946	6568.696	12679479
30	10	0.11	0.2794	2.5						
31	10		0							
TOTAL		2.71	6.8834	29.5	42884237	11187.71	54963.80	1808.736	15789.83	30138901

NOVEMBER, 1984

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (l)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	11		0							
2	11	trace	0							
3	11		0							
4	11		0							
5	11	0.41	1.0414	3.5	4669963.		9911.221	120.2364	890.1292	1225150.
6	11	0.05	0.127	2.5						
7	11		0							
8	11		0							
9	11		0							
10	11	0.07	0.1778	3.5						
11	11	1.28	3.2512	13.5	39190968	21547.76	31759.51	2000.511	17925.83	35588139
12	11	0.4	1.016	3	4273170.		9660.092	98.62408	694.3165	830173.3
13	11	0.02	0.0508	2						
14	11		0							
15	11		0							
16	11	0.8	2.032	2	20144896	8321.642	19705.28	963.1181	8526.823	16629248
17	11		0							
18	11		0							
19	11	0.06	0.1524	2.5						
20	11		0							
21	11		0							
22	11		0							
23	11		0							
24	11		0							
25	11		0							
26	11		0							
27	11		0							
28	11		0							
29	11	0.25	0.635	4.5						
30	11		0							
TOTAL		3.34	8.4836	37	68278999	29869.41	71036.11	3182.489	28037.09	54272711

DECEMBER, 1984

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (l)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	12		0							
2	12		0							
3	12	0.35	0.889	3	2289204.		8404.443			
4	12		0							
5	12		0							
6	12	1.28	3.2512	8	39190968	21547.76	31759.51	2000.511	17925.83	35588139
7	12		0							
8	12		0							
9	12		0							
10	12		0							
11	12		0							
12	12		0							
13	12		0							
14	12		0							
15	12	0.09	0.2286	5.5						
16	12		0							
17	12		0							
18	12		0							
19	12	0.11	0.2794	5.5						
20	12	0.05	0.127	2						
21	12		0							
22	12	0.42	1.0668	5	5066756.		10162.35	141.8487	1085.941	1620127.
23	12		0							
24	12		0							
25	12	0.14	0.3556	3						
26	12		0							
27	12	2	5.08	11.5	67760076	41386.95	49840.86	3556.600	32024.34	64026474
28	12	0.04	0.1016	3						
29	12		0							
30	12		0							
31	12	0.04	0.1016	5						
TOTAL		4.52	11.4808	51.5	1.1E+08	62934.72	100167.1	5698.960	51036.11	1.0E+08

JANUARY, 1985
RAIN AMOUNT AND DURATION: SETAUKET, NY
STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (L)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADINS (G)	S. SOLID LOADING (G)
1	1	0.08	0.2032	11						
2	1	0.2	0.508	9						
3	1		0							
4	1		0							
5	1	0.29	0.7366	4			6897.664			
6	1		0							
7	1		0							
8	1		0							
9	1		0							
10	1		0							
11	1	0.03	0.0762	4						
12	1		0							
13	1		0							
14	1		0							
15	1	0.08	0.2032	6						
16	1		0							
17	1	0.31	0.7874	9	702031.9		7399.923			
18	1		0							
19	1		0							
20	1	0.02	0.0508	4.5						
21	1		0							
22	1		0							
23	1		0							
24	1		0							
25	1		0							
26	1		0							
27	1		0							
28	1		0							
29	1		0							
30	1		0							
31	1	0.07	0.1778	8.5						
TOTAL		1.08	2:7432	56	702031.9	0	14297.58	0	0	0

FEBRUARY, 1985

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (1)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	2	0.33	0.8382	9	1495618.		7902.183			
2	2	0.43	1.0922	12	5463549.		10413.48	163.4611	1281.754	2015103.
3	2	0.18	0.4572	6						
4	2		0							
5	2		0							
6	2	0.43	1.0922	11	5463549.		10413.48	163.4611	1281.754	2015103.
7	2		0							
8	2		0							
9	2		0							
10	2		0							
11	2		0							
12	2	0.91	2.3114	4	24509621	11352.62	22467.71	1200.854	10680.76	20973994
13	2	0.14	0.3556	1						
14	2		0							
15	2		0							
16	2		0							
17	2		0							
18	2		0							
19	2		0							
20	2		0							
21	2		0							
22	2		0							
23	2		0							
24	2		0							
25	2		0							
26	2	0.02	0.0508							
27	2		0							
28	2		0							
TOTAL		2.44	6.1976	43	36932339	11352.62	51196.85	1527.776	13244.27	25004202

MARCH, 1985

RAIN AMOUNT AND DURATION: SETAUKET, NY

STORM WATER, NUTRIENT AND SEDIMENT LOADING: MILL POND, STONY BROOK, NY

DAY (D)	MONTH (M)	RAIN INCHES (IN)	AMOUNT CMS (CM)	DURATION (HR)	STORM DSCHARGE (l)	NH LOADING (G)	NO -NO LOADING (G)	SRP LOADING (G)	TP LOADING (G)	S. SOLID LOADING (G)
1	3		0							
2	3		0							
3	3		0							
4	3	0.38	0.9652	6.5	3479584.		9157.832	55.39937	302.6912	40219.56
5	3		0							
6	3		0							
7	3		0							
8	3	0.31	0.7874	11.5	702031.9		7399.923			
9	3		0							
10	3		0							
11	3		0							
12	3	0.87	2.2098	8	22922449	10250.45	21463.19	1114.404	9897.511	19394086
13	3		0							
14	3		0							
15	3		0							
16	3		0							
17	3		0							
18	3		0							
19	3		0							
20	3		0							
21	3	0.06	0.1524							
22	3		0							
23	3		0							
24	3		0							
25	3		0							
26	3		0							
27	3		0							
28	3		0							
29	3		0							
30	3	0.02	0.0508	1						
31	3	0.07	0.1778							
TOTAL		1.71	4.3434	27	27104065	10250.45	38020.94	1169.804	10200.20	19434306