The
Midnight Pass
SOCIETY, INC. "MIDNIGHT PASS – PASS IT ON!"

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MIDNIGHT PASS POSITION PAPER

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WATER QUALITY OF LITTLE SARASOTA BAY

SYNOPSIS

The term "water quality" would appear to be easy to define. But it means different things to different people. In the natural environment it means different things as well. The qualities found in brackish back bay waters would not be considered qualities in a coastal lagoon.

We most often associate, and rightfully so, the **absence** of water quality with the activities of "Man" that have degraded an environment. The dumping of industrial wastes or sewage effluent are obvious examples. Directing stormwater runoff from our buildings, drives and roads into our bays is another example. Yet another example would be the interruption of historic tidal circulation. It makes little difference to the marine community whether you put too many pollutants in or allow too few pollutants out; the devastating effects are identical.

And that's the case in Little Sarasota Bay. Closing Midnight Pass has cut off tidal flow to a large part of the Bay, throwing the balance of nature out of balance. We have initiated a chain of events that, if not reversed, will lead to the "death" of this body of water as an historic, productive, estuarine coastal lagoon.

The **biological indicators** of water quality begin to tell their tale once water quality degradation has already begun. Several chapters of this report are devoted to these indicators. All of the indicators point down. The marine plant and animal life in Little Sarasota Bay has been significantly impacted. Unless action is soon taken, there is every indication the bad situation will get worse.

The **scientific indicators** are a bit harder to pin down, especially since there is so little reliable data in the years prior to Pass closure. However, our **Salinity/Rainfall** chapter chronicles the change in salinity regimes since, and due to, the closure of Midnight Pass and relates those changes back to the evident biological trends. An ongoing Society monitoring program reports Secchi depth readings that are measurably lower than County readings. This is especially relevant as Society stations more closely monitor benthic community conditions.

Degraded water quality conditions in Little Sarasota Bay are episodic in nature, triggered by the combination of heavy rainfall events and the absence of historic tidal circulation. The only way to reverse the downward trend is to restore the inlet function of Midnight Pass.

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INTRODUCTION

The term water quality, like environmental quality and quality of life, is quite difficult to define. It means different things to different people. It means different things in the natural environment as well. What is high quality water to some, may be intolerable water to others.

Water quality can also be a function of volume, time and/or place. Fresh water flowing into an embayment is an essential element of the estuarine "cocktail." But excessive amounts directed into a bay (or insufficient amounts let out) can result in an ecological disaster. Many juvenile fishes need the brackish waters of the back bay environment to survive... those conditions are appropriate for that time and place.

While natural events may lead to declines in water quality, we are concerned solely with the activities of "Man" that result in water quality degradation. If left unchecked, the pollution of a body of water **from those activities** can lead to widespread mortality of species, decline in the diversity of "desirable" species, lowered primary and secondary biological productivity and the increasing occurrence of overtly unpleasant symptoms.

In the course of evolution or successional changes associated with such declines in water quality, there may be an initial decrease in diversity of clean water organisms plus an increase in biological production (eutrophication) that is then followed by a decrease in production and further decrease in biological diversity. The body of water "dies." While we're a long way from the wrong end of this chain of events, the closing of Midnight Pass has initiated this successional process with respect to Little Sarasota Bay.

The measurement of water quality is most often thought of in terms of the chemical analysis of the water column and scientific evaluation of its physical characteristics. Unfortunately, there is little such data available for the Midnight Pass/Little Sarasota Bay area, especially for the years prior to Pass closure.

However, another way to assess the condition of a body of water is to review the **biological indicators** of water quality. These factors are quite reliable, especially in assessing the degree to which a particular body of water has already degraded. We have a wealth of such data on the Midnight Pass/Jim Neville Preserve/Little Sarasota Bay area... and it all tells the same sorry tale. Since, and due to, the closure of Midnight Pass there has been a significant diminution in the established environmental conditions that has resulted in a severe reduction in both numbers and diversity of marine plant and animal life. See the **Clams** paper for the effect on most bivalves. Refer to the **Seagrasses** papers for a chronicle on the damage done to the rooted plants of the Bay... the foundation of the marine community. The **Doorways** paper sets forth the common sense problems that closing the doorway has had on the migratory marine animals. The **Fish Kills** paper ties that 1987 disaster to the fresh water trapped in Little Sarasota Bay in July of that year... a year of just average rainfall! The

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Benthic Animals paper traces the reduction in numbers and species diversity of the bottom dwellers since Pass closure. It also reports on the near total absence of "high water quality" indicator species and the abundance of "low water quality" indicator species. The **Gracilaria** papers reveal the increase and accumulation of drift algae in Little Sarasota Bay... another indicator of poor water quality. The biological message is clear: the seagrass community is breaking down in favor of algal species more tolerant of the altered environment; many of the marine animals that historically inhabited this embayment were forced to migrate or they died.

HYDROGRAPHY

Little Sarasota Bay is a coastal lagoon that is considered to extend from Stickney Point South to Blackburn Point. It is approximately 5.8 miles long and a maximum of 0.9 miles wide. In the 1985 study on the status of Little Sarasota Bay, the Bay was divided into six geographic zones relative to tidal circulation and water quality patterns. We have added to this base map the locations and names of historic tidal creeks, peripheral lagoons, one major dead end upland canal system and segments of the shoreline that have been "hardened" with seawalls (**Exhibit #1**).

Historically and currently, the Bay has received freshwater runoff-discharges from seven coastal tidal creeks: Phillippi Creek, 1.3 miles north of Stickney Point; Matheny Creek; Elligraw Bayou; Holiday Creek; Clower Creek; Catfish/North Creeks; and South Creek, 1 mile south of Blackburn Point. The northern most Zone I of the Bay was and is markedly influenced by discharges from Phillippi Creek on flood tides. It is also affected by tidal exchange between the Bay and Heron Lagoon, Siesta Key, via a series of shallow waterways. Along the eastern shore of Zone I, major stormwater discharges include those in a dead end canal system, Matheny Creek and Elligraw Bayou whose tidal portions west of U.S. 41 are channelized and seawalled.

Zone II receives stormwater discharges from Holiday Creek and Clower Creek whose tidal sections have been channelized east to U.S. 41. In addition, near the mouth of Clower Creek is the Bay's major roost and rookery for pelicans, cormorants, great American egret and great blue heron.

Zone IIIE, east of the ICW, receives freshwater discharges from Catfish and North Creeks. The historic natural tidal aspects of these creeks extend east to U.S. 41. In Zone IIIW, west of the ICW, there is Blind Pass Lagoon which operationally is equivalent to a ½ mile long dead end canal. The public park at the end of this "lagoon," is Turtle Beach County Park where children still are allowed to play and swim in the shallows of the lagoon.

Zones IV and V in the southern third of the Bay, have no major source of freshwater discharge. There are also no major stormwater discharge points along the entire western side of the Bay. Other than the relatively natural North Creek, surface water discharges via the

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urbanized drainage basins of the other creeks and subdivisions along the eastern shore of the north half of the Bay occur via 82 outfalls whose discharge pipes range in size from 4 inches to 4 feet in diameter. The outfall data is as determined by a Midnight Pass Society Outfall Analysis Survey conducted during 1989.

In addition to these non-point surface water discharge points, the Bay receives "sheetflow" runoff and subsurface groundwater seepage discharges from lands along the eastern shore as far east as U.S. 41 and along the western shore between Midnight Pass Road on Siesta Key and the north Casey Key road on Casey Key. Such freshwaters are nutrient-enriched, if not pollutant-laden. Groundwater discharges have only recently begun to be studied and evaluated in other coastal marine systems (i.e., Long Island Sound).

SCIENTIFIC WATER QUALITY

GENERAL.

The above commentary on biological indicators of water quality notwithstanding, the assessment of relative quality of the water of embayments like Little Sarasota Bay has come to be measured by physical and chemical parameters as compared to standard values for these parameters as well as those such as bacteria that may directly result in waterborne human diseases.

Operationally, samples of water are collected at intervals of time and concentrations of various parameters are analyzed. Low quality water is high in color, turbidity, ammonia, nitrate, phosphates, B.O.D., total coliform and fecal coliform bacteria. It is low in dissolved oxygen and depth of transparency (Secchi disc depths).

The collection of water quality data available has prescription or recipe simplicity. However, analyses of the data beyond a first level of measured values relative to standards is complex and fraught with the potential for false conclusions and the effects of unknown relationships such as occur in Little Sarasota Bay.

The official water quality data for Little Sarasota Bay and its tributaries recorded in the FDER STORET data bank is, at best, spotty in terms of numbers of sampling dates and parameters measured, particularly for the years prior to the closure of Midnight Pass. Thus, the recent analysis of the raw STORET data by FDER personnel netted the rational conclusion that there had been no overt change in the values of several of the water quality parameters since the closure of Midnight Pass... and, accordingly, no trend in decline or change of water quality.

On the other hand, the public that frequent Little Sarasota Bay report a most definite trend of declination in water quality since the closing of Midnight Pass. They indicate that the Bay is, aesthetically, far less pleasing than it used to be and that the fish and shellfish populations have dramatically declined. They also report an increased incidence of rashes and other skin conditions.

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Faced with this dichotomy of perceptions with respect to Little Sarasota Bay, we undertook to conduct our own review of the STORET data. We also obtained and reviewed other water quality data related to the Little Sarasota Bay system. We provide these additional sources of information as well as our own analysis of the inter-relationships between various water quality parameters.

REVIEW OF STORET DATA

We reviewed the raw data and the FDER analysis of trends or changes in Secchi disc depths, turbidity, D.O., total phosphorous and total nitrogen at Sarasota County Bay Monitoring Stations #539 and #609 for the three years before and after closure of Midnight Pass. In so doing, we noted that there might be changes or trends in one or another of these parameters on a seasonal as well as an annual basis and that other factors might well be involved in the apparent lack of "trends."

Our analysis disclosed several factors that tend to throw into question the reliability of the data in question to assess the condition of Little Sarasota Bay with respect to the closure of Midnight Pass:

1. # OF SAMPLES. The few samples retained in the data bank will tend to exaggerate the effects of tides, sampling error or other anomalies. Tidal influence could especially impact Monitoring Station #609, south of Midnight Pass.
2. LOCATION OF SAMPLES. The stations reviewed are both in the Intracoastal Waterway. As such, they aren't representative of the broader, shallower areas of the embayment. It's in these **shallow, seagrass habitat areas** where the preponderance of marine life will be found.
3. TIME OF SAMPLING. Usually taken between 9:00AM and noon, these samples are likely not capturing the "worst case scenario" of environmental conditions in the Bay.
4. FAIR WEATHER SAMPLING. Samples are taken in nice weather, seldom during or immediately after high winds, tides, storms or heavy rainfall events. As such, they're "fair weather statistics."
5. MISSED EVENTS. In reviewing Mote Marine Laboratory sampling data from 1972-1975 which was taken at frequent intervals, large storms and rainfall events were reflected in their statistics. We compared the STORET data to a list of 26 major rainfall events that occurred in the Little Sarasota Bay area between 1972 and 1989 (see the **Salinity/Rainfall** paper). The STORET data reflected only 4 of the 26 listed events. Hurricane Agnes never happened. The no-name storm of 1982 never happened. The fish kills of 1987 never happened. The conditions that killed all the clams in the Jim Neville Marine Preserve were never reflected in the STORET data... yet all these events took place.
6. EPISODIC NATURE. The degradation of the Little Sarasota Bay area has, thus far, been related to episodes of "poor water quality." While these episodes last longer in this vicinity due to the absence of tidal circulation, nature does exert its influence to bring the system back into balance. The spotty STORET data is just not set up to reflect these episodes.

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7. PRE-POST PASS CONDITIONS. Midnight Pass was not closed overnight. The activities that initiated the process trace back to the early 1960's. **At least** two years prior to Pass closure, tidal flow was sufficiently constricted to alter environmental conditions in the Bay (see the **Salinity/Rainfall paper**). Subsequent to the actual closing of the Pass in 1983, annual rainfalls have been well below average. The combination of these two conditions tends to mask water quality trends... especially if the study is confined to three years before and three years after Pass closure!

One further observation has to do with the application of mean averages to assess water quality in the Midnight Pass area, especially when you consider the limiting factors enumerated above. "Means" by design eliminate the outside values and tend to reflect a better state of affairs than may actually exist. It's the fluctuations that are important... the outside ranges that can spell trouble for the marine community. Pulling all of this together into one example, say a mid-day sample is taken on a sunny day in August. The dissolved oxygen reading is 5.0 mg/l. That **could** reflect a high of 6.0 mg/l and a low of 4.0 mg/l... a relatively balanced system. But it could **also** reflect an embayment where the high was 10.0 mg/l and the low 0.0 mg/l... a situation where, near dawn there may be no dissolved oxygen at all for the marine community!

While the Society dissolved oxygen testing program just began late last year, our initial test runs at dusk one day followed by a run just before dawn on the day following disclosed some interesting maximum-minimum ranges. The highest reading obtained was 9.0 mg/l. The lowest measurement was 2.0 mg/l, a critical point. In just a few test runs at the end of the 1989 rainy season, **eight (8)** of our minimum measurements were below 4.0 mg/l. That's eight out of twenty... 40% of the minimums fell **below** the recognized minimum values. The dissolved oxygen test results are included in the **Water Monitoring** section of the presentation.

In no event should this section be considered a criticism of the Sarasota County sampling program... it most assuredly does not. The water monitoring program serves a most valid and valuable purpose. A wealth of data is obtained for a modest financial investment. Our caution is only limited to the use to which this data is put and the conclusions drawn therefrom.

Following are our observations with respect to specific criteria reported in the STORET data:

SALINITY. As reviewed in our **Salinity/Rainfall** paper, there has been an overall reduction in average Bay salinity (despite below average rainfall). More significantly, we documented greater salinity depressions since the closure of Midnight Pass and found that it took far longer for the embayment to recover to established salinity levels...even the lowered values evident since Pass closure.

TURBIDITY VS. SECCHI DISC DEPTH. These two parameters are seemingly related to one another even though each has inherent instrumental

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errors that are not always appreciated. When we plotted the values for these parameters on 2-D scatter diagrams for Stations #539 and #609 (**Exhibit #2**), we observed that the pre-closure data points were more tightly clustered than the post-closure data points. Had flood vs. ebb tide data been included, even more information might have been obtained. For the present we conclude that there have been much greater fluctuations in both turbidity and transparency since the closure of Midnight Pass. One possible explanation is greater phytoplankton blooms. Another is fine, flocculent organic matter suspended and resuspended in the water column in the Bay's present null zone.

PHOSPHORUS AND NITROGEN. We next examined values for total phosphorus, total nitrogen and organic nitrogen for pre and post rainfall periods in the spring and late summer-early fall, since these are the two major seasons of phytoplankton blooms. See **Exhibit #3.** Unfortunately, there was no consistency in the data.

SOCIETY SECCHI DISC MONITORING

Beginning in August, 1988 (and continuing through to the present), the Midnight Pass Society began to take and record Secchi disc readings at four of its dockside water quality stations in conjunction with its salinity monitoring program. The raw data are included in the **Water Monitoring** section of this report. The Secchi depth data are graphed in **Exhibits #4-7.** The graphs are incomplete because during certain times of the year the transparency of the water was good... at times the Bay bottom could be seen at the station. Nevertheless, the graphs reveal the following:

1. There was a marked decrease in Secchi depths in September and October of 1988 and 1989, during and following the late summer rainy season when phytoplankton blooms are locally prevalent.
2. For the mid-Bay Station #1, decrease in secchi depths paralleled and followed major rainfall events and paralleled decreases in salinity recorded at this station. Similar positive correlations between salinity depressions and decrease in Secchi depths occurred at the other stations.
3. Comparison of Secchi readings for mid-Bay Station #1 (Zone #1) with those for Station #4 (Zone IIIE) and Station #5 (Zone IIIW) for July, 1989-January, 1990, shows markedly different Secchi depth profiles for this time period.
4. The **least transparent** waters occurred at Stations #4 and #5 in the middle of the present null zone. Here, Secchi depths of 75 cm or less were most frequent and depths less than 55 cm were recorded on more than one occasion.
5. Between November, 1988 and May, 1989, Secchi depths greater than 2 meters were recorded at Stations #1 and #2 on several occasions. Similar values may have been obtained at Stations #4 and #5 had there been sufficient water depth.

Of considerable significance is the fact that the Secchi depths at these nearshore/onshore stations five and six years after the closure

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of Midnight Pass are **measurably lower** than the Secchi depths of either of the County's mid-Bay Stations #539 and #609 during the 3 years before and the 3 years after the closure of the Pass as well as during 1988-1989. While Secchi depths at stations in the deepest mid-Bay regions may reflect open water phytoplankton conditions, the nearshore Secchi depths reflect the degree of light attenuation conditions along with lowered salinities that the benthic subtidal plants are subjected to at regular intervals.

In July, 1989, the Midnight Pass society established a water quality station (Station #7) at a dock in the South Bay Marina, ¼ mile south of Blackburn Point and two thirds of a mile north of the mouth of South Creek in Blackburn Bay. We include the Secchi depth data from this station (**Exhibit #8**) partly because the Secchi profile differs so dramatically from the profiles for Stations #1, #2, #4 and #5 in Little Sarasota Bay. Several of the depressions in Secchi depths at this station correspond with rainfall events. Moreover, the peaks and valleys in Secchi depth considering time of measurement, closely correspond to the tides; the greatest depths registered on flood tides and the least depths coming on ebb tides. We take this to mean that the waters in the vicinity of northern Blackburn Bay are regularly subjected to tidal exchange and mixing with Gulf waters via the Venice Inlet 4.8 miles to the south. On strong spring flood tides this influence may extend as far north as Zone V in Little Sarasota Bay... possibly to Sarasota County Station #609.

It must also be reported that the volunteer for this station joined the program due to his observations that the water quality in this area had markedly degraded since Pass closure.

ONE TIDE CYCLE. While Secchi depths are one of the simplest water quality parameters to measure and have been used in numerous studies as a water quality index along with dissolved oxygen, we realize that most Secchi readings are taken at a permanent station at one point in time on different sampling dates. Since, at a tidally influenced station the water is always moving, we wondered to what extent the Secchi depth would vary at a station during flood vs. ebb tide. So, on November 11, 1989, we took Secchi readings at Station #2 at ½ hour intervals between 0950 on a rising tide until 1530, one hour before low slack water on ebb tide. Our initial reading of 108cm increased to 128cm at 1240 high slack water just before the tide began to ebb and then decreased to 91cm at 1530. Throughout this period the wind was less than 5mph from the east. Thus, within a single tide cycle there was a 37cm variation in Secchi depth.

At this same station on March 11, 1990, the Secchi depth at 0930 on a rising tide was 2 meters and at 1600 on ebb tide it was only 84cm, more than a meter difference! However, on this date the boat traffic in the ICW was excessive and strong 10-15mph northwest afternoon winds effectively helped to "stir" the waters.

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OTHER WATER QUALITY DATA

While the water quality data for Little Sarasota Bay in STORET is rather limited especially for the years prior to the closure of Midnight Pass, there are other data for the time period 1972 through 1982 that are relevant to pre-closure water quality in Little Sarasota Bay as well as the post-closure data of 1984 in the Sauers and Serviss Report (1985). Of great interest are the data from the MML Red Tide Study (1972-1975), especially the Station #21 data taken right at the MML site in the vicinity of Midnight Pass. We also suggest the studies of Foster (1974) and Morrill et al. (1974). Other studies for this time period are listed in our annotated bibliography on Water Quality. At least one other study that has important information on seasonal and rainfall event fluctuations of water quality in Zone I of Little Sarasota Bay is the Phillippi Creek 208 Water Quality Study of 1976-1977. This all but forgotten report is also important for its conclusions and recommendations regarding management of non-point freshwater runoff and discharges from tidal creek drainage basins.

CORRELATIONS BETWEEN WATER QUALITY PARAMETERS

From our review of various water quality studies and sets of tabulated data from the Little Sarasota Bay region and other segments of the Sarasota Bay System, the following general relationships appear:

1. Rainfall and salinity vary inversely.
2. Rainfall and color show a positive correlation.
3. Color and salinity show a negative correlation.
4. The log of pH and the log of CO_2 show a high positive correlation.
5. Dissolved oxygen and CO_2 show a negative correlation.
6. In open waters of the bays, there is a positive correlation between Chlorophylla, turbidity and particulate matter.
7. Salinity and inorganic phosphate tend to vary inversely but can be positively correlated with rainfall events.
8. Highest nitrate and phosphate values tend to occur at stations directly influenced by runoff.
9. Dissolved silicates tend to vary inversely with phytoplankton blooms and often are positively correlated with rainfall-runoff events.
10. Nitrate/nitrite values for open bay and other stations may vary markedly between dawn and dusk sampling. As an aside, accumulations of red drift algae may take up significant amounts of nitrates, thus masking the readings in nutrient-enriched waters.
11. Fluctuations in water quality parameters in the vicinity of tidal inlets are markedly less than in bay segments located some distance from inlets.

COMPUTER STUDY

In the mid-1970's a computer model study of the then present (1972-1973) and projected (the year 2000) runoff volume and loads for the Tampa Bay region included runoff values for the major "creeks" of Little Sarasota Bay as follows:

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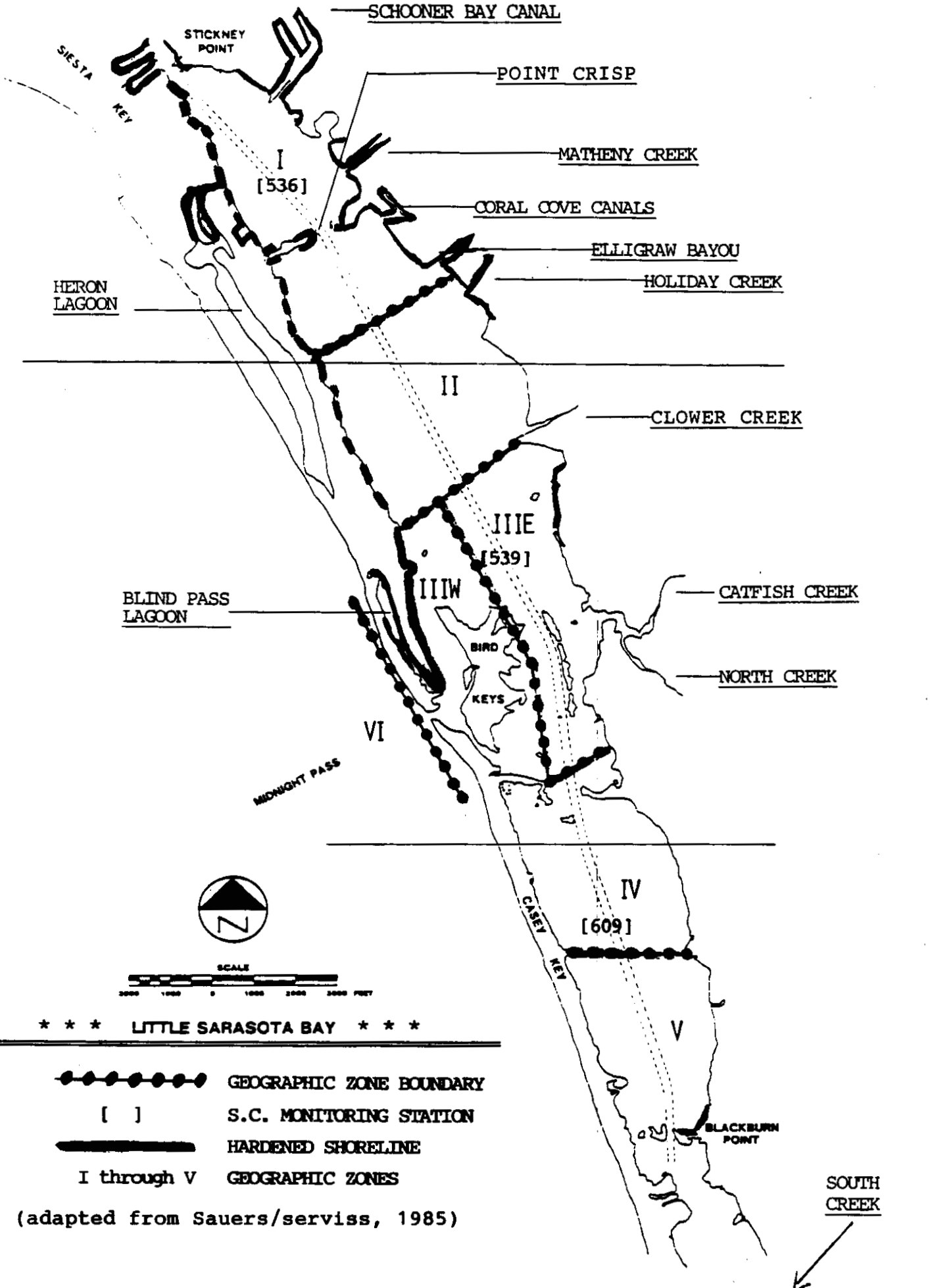
	1972				2000			
		16/d				16/d		
	MGD	BOD	TN	TN	MGD	BOD	TN	TN
Elligraw Creek	3.6	299	37	3	5.9	1,082	76	9
North Creek	3.9	204	33	2	5.0	558	49	5
Catfish Creek	6.8	208	67	2	10.8	1,535	119	11
South Creek	9.1	332	97	3	12.8	1,601	147	11
Phillippi Creek	33.0	1,798	685	25	46.3	5,973	928	64

This computer model predicts at least a doubling of the "waste load" from urban "runoff" just from these four creeks! Clearly, the burden such runoff will place on the health and balance of all our bay systems is major. No comparable computer model exists on how these additional volumes will alter environmental conditions in our bays. Other embayments will be relieved to an extent via the exchange of their waters with the Gulf of Mexico. No such relief presently exists for Little Sarasota Bay; these additional wasteloads will be trapped in the null zone and further degrade its water quality.

CONCLUSIONS

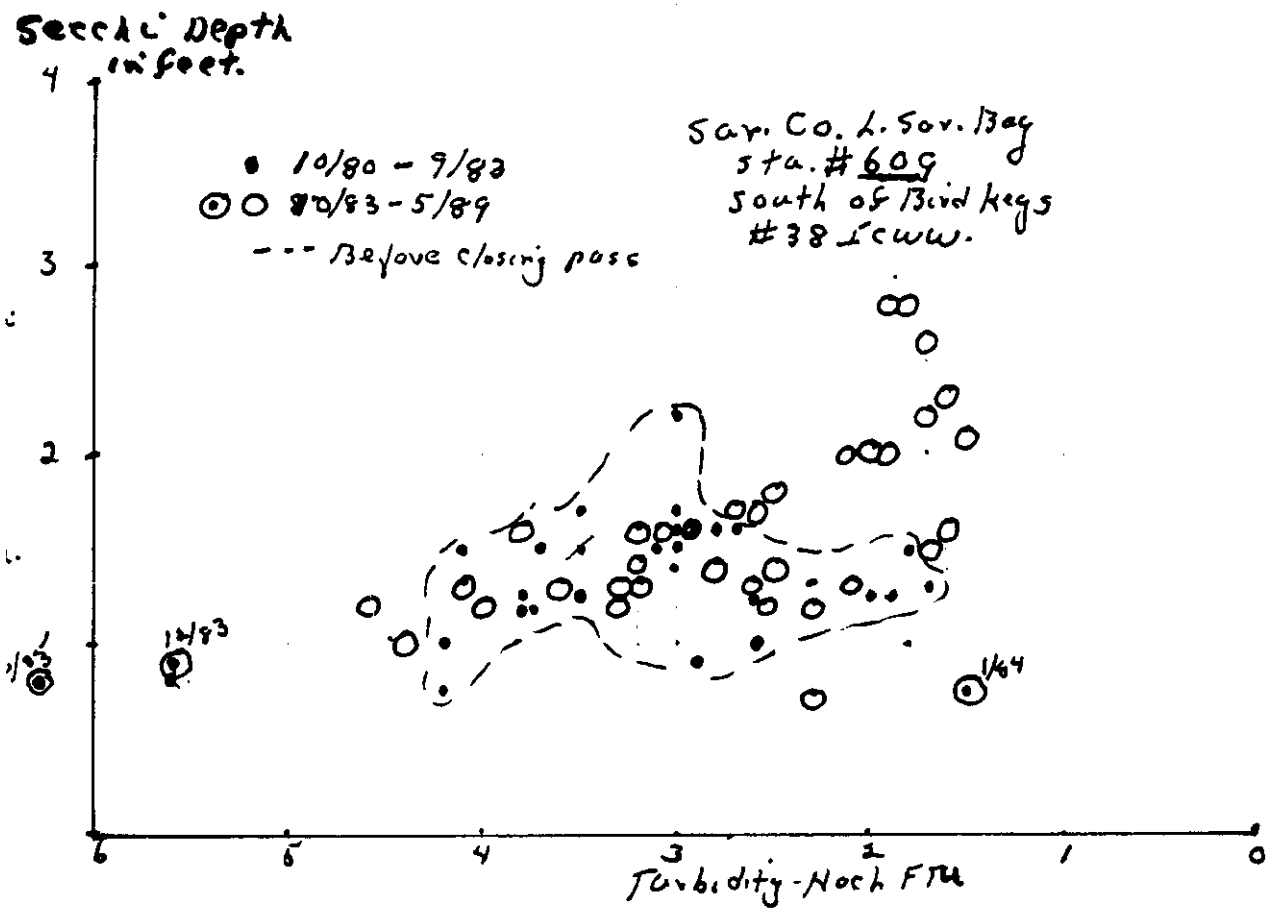
1. The biological indicators of water quality indicate there has been substantial degradation since, and due to, the closure of Midnight Pass.
2. Far more of the shoreline above the Pass vicinity has been seawalled than the shoreline south of the Pass. This tends to exacerbate the water quality problems in this area.
3. The STORET data is of limited use in assessing water quality trends in Little Sarasota Bay. Caution must be exercised to keep from false conclusions... especially as to apparent lack of trends.
4. The degradation of water quality in Little Sarasota Bay is episodic in nature and can be correlated with stormwater runoff and groundwater seepage associated with heavy rainfall events.
5. In the absence of historic tidal circulation, the accumulation of runoff and seepage waters magnifies their adverse impact on environmental conditions in this embayment.
6. Salinity levels for Little Sarasota Bay are below those prevalent when Midnight Pass was open and functioning and are lower than the salinity levels of other embayments with regular tidal circulation.
7. The resultant salinity depressions are greater and last longer than had been the case when Midnight Pass was operational.
8. Secchi depth readings on the nearshore reaches of the Bay are measurably lower than County readings. These measurements are more reflective of subtidal water conditions in the vicinity of the benthic plants and animals.

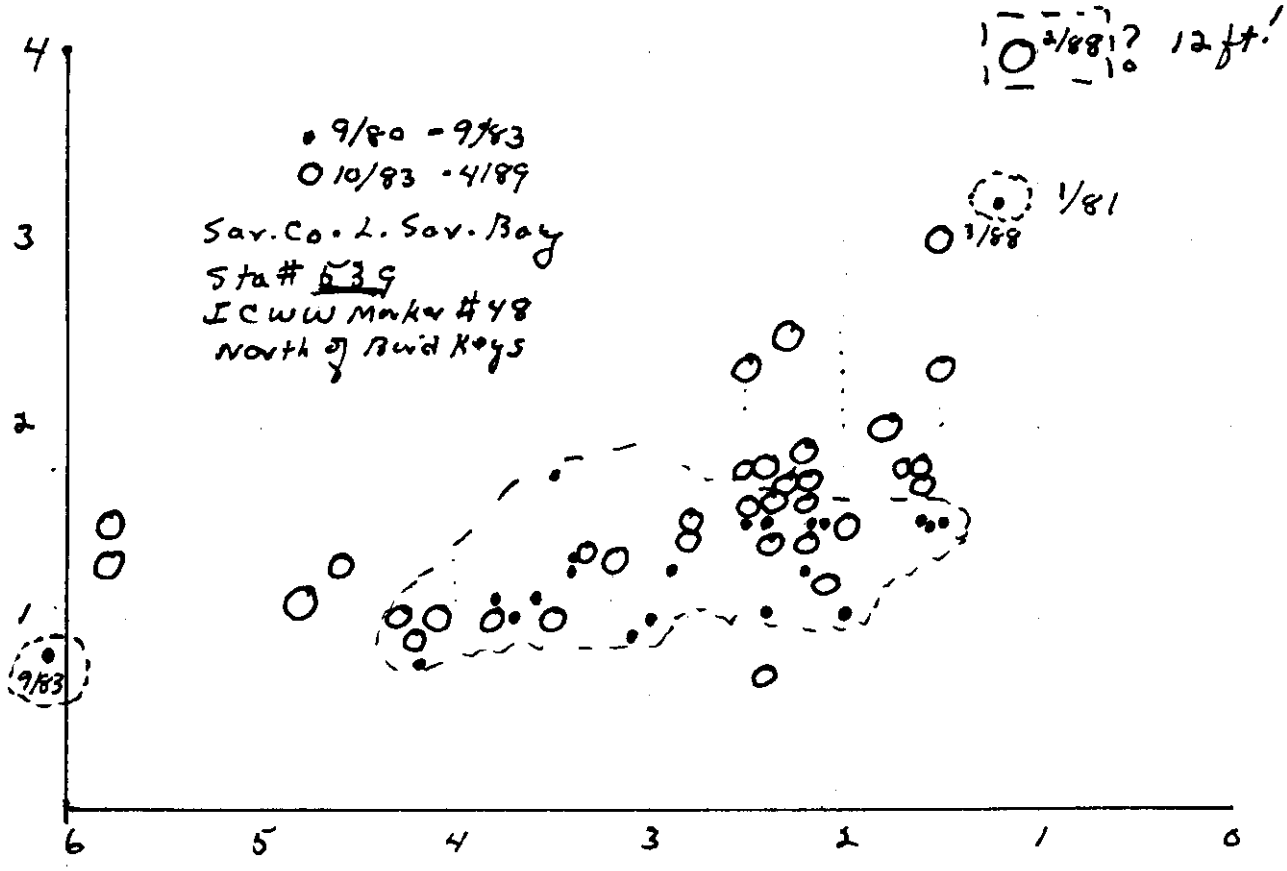
EXHIBIT #1



(adapted from Sauers/serviss, 1985)

SECCHI DEPTH/TURBIDITY 2-D SCATTER DIAGRAMS EXHIBIT #2

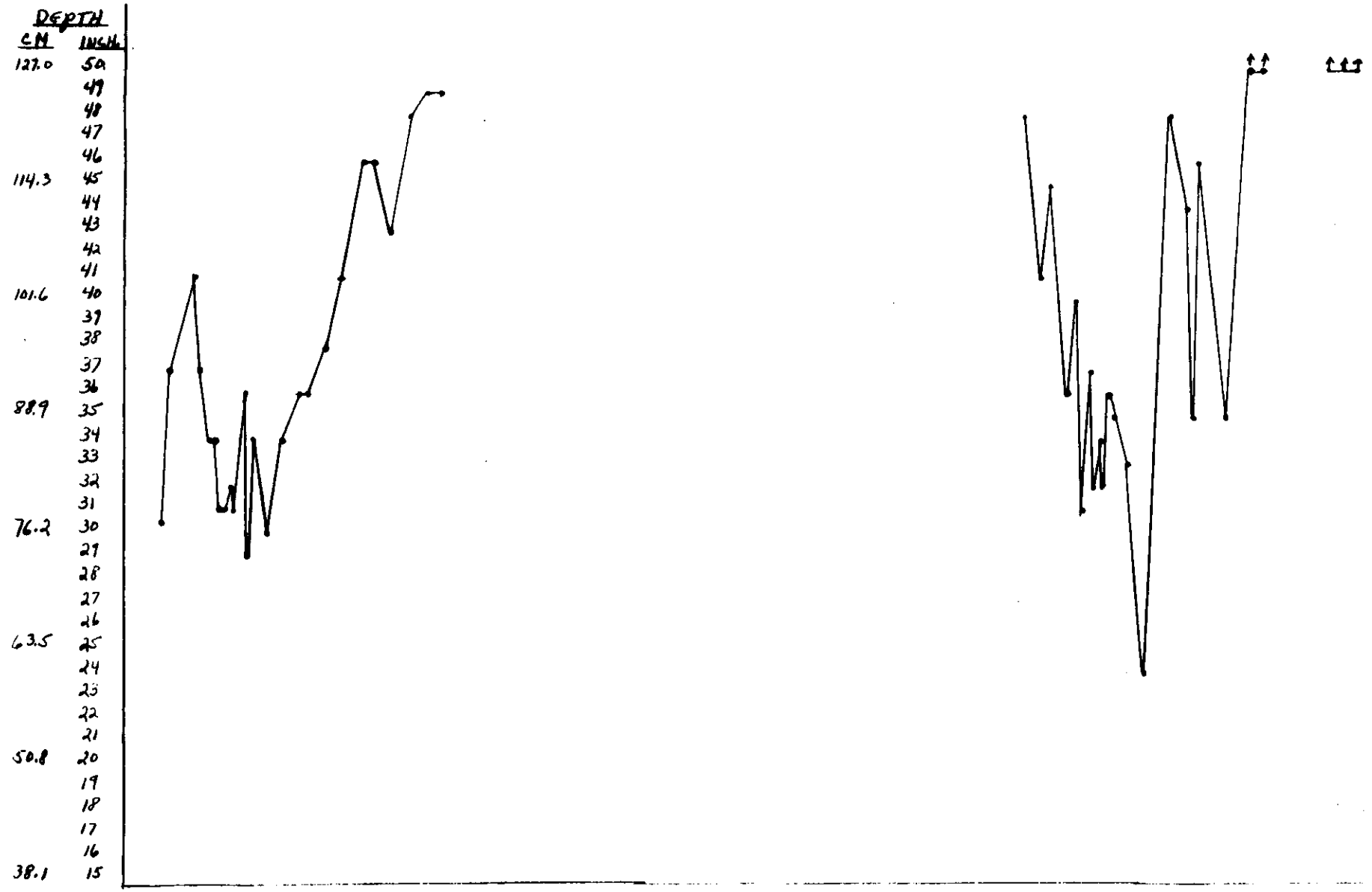




Water Chemistry Values for Sarasota County W.Q. Little Sarasota Bay
Station #539 ~~March~~ April & May vs July-October; Prerainfall vs Postrainfall Samples.

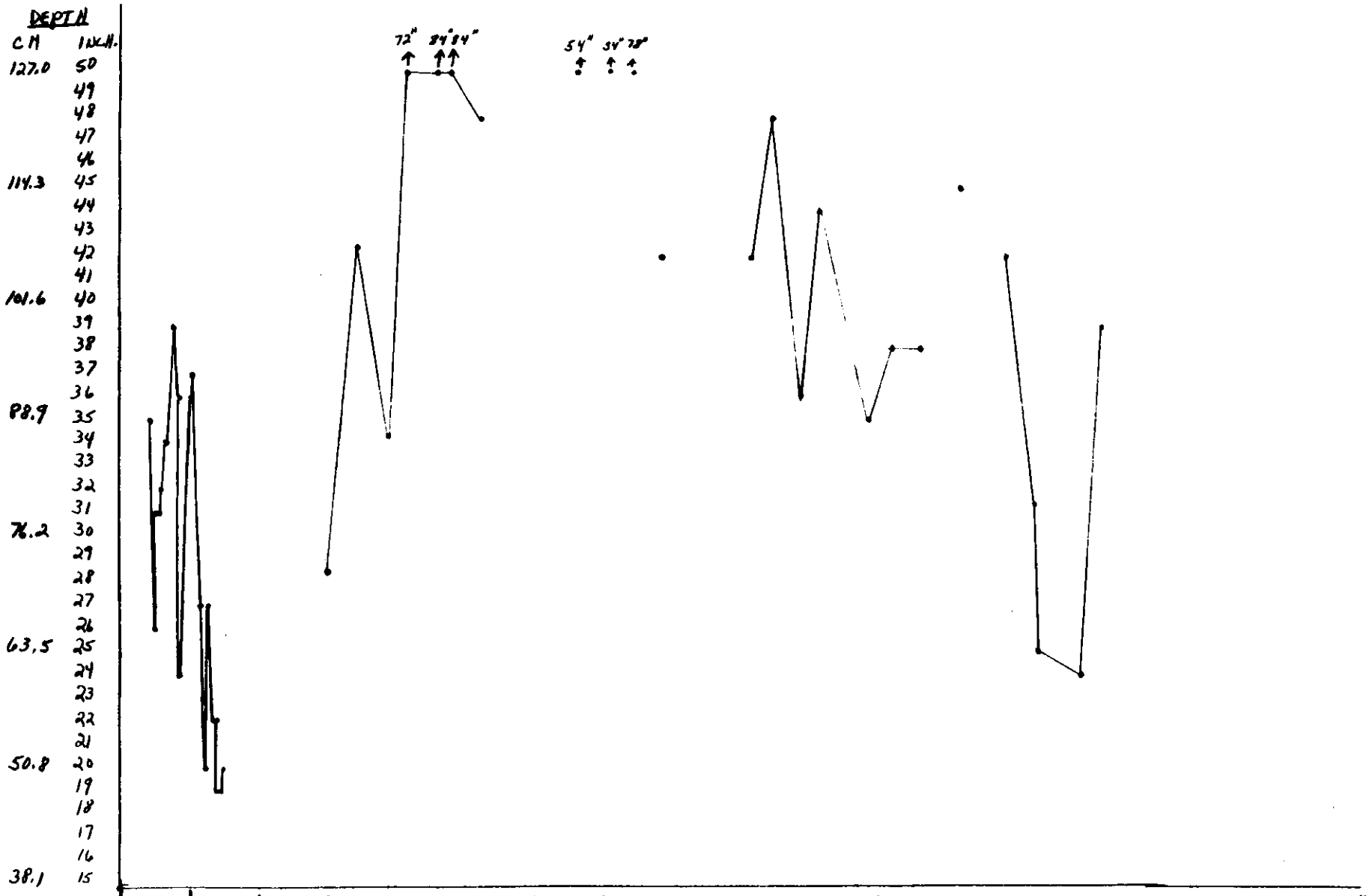
Date	Period Before Sample Days/Total Rainfall		Total N mg/l	Organic N mg/l	Total PO_4 mg/l	Period before sample	Remarks
83/04/11	25	7.68"	1.07	0.971	0.280	Wet	
87/04/13	12	7.9"	0.909	0.020	0.238	Wet	
84/04/24	13	1.27"	0.60	0.548	0.116	Dry	4 rainfall events less than 0.5 inches
86/04/13	29	1.09"	0.77	0.714	0.237	Dry	
88/05/09	49	2.29"	0.77	0.722	0.159	Dry	
84/07/16	5	6.54"	?	0.940	0.220	Wet	6.54" Rain July 10-16
87/08/04	17	9.24"	1.79	1.759	0.435	Wet	Period after Fish kill July 20-24
85/09/09	9	1.07"	1.03	0.911	?	Dry	
88/08/01	10	0.72"	0.97	0.940	0.423	Dry	
88/10/10	20	1.15"	1.57	1.564	0.183	"Dry"	8.54 inches rain Sept. 5-8 w/phytoplankton blooms of Skeletonema 9/14-9/21 followed by dinoflagellate bloom

EXHIBIT #3



MIDNIGHT PASS SOCIETY WATER MONITORING STATION #1 SECCHI DEPTHS LITTLE SARASOTA BAY
(SOUTHPOINTE SHORES - HAINLAND)

EXHIBIT #4
STATION #1



MIDNIGHT PASS SOCIETY WATER MONITORING STATION #2 (STICKNEY PT., SIESTA KEY) SECCHI DEPTHS LITTLE SARASOTA BAY

EXHIBIT #5
STATION #2

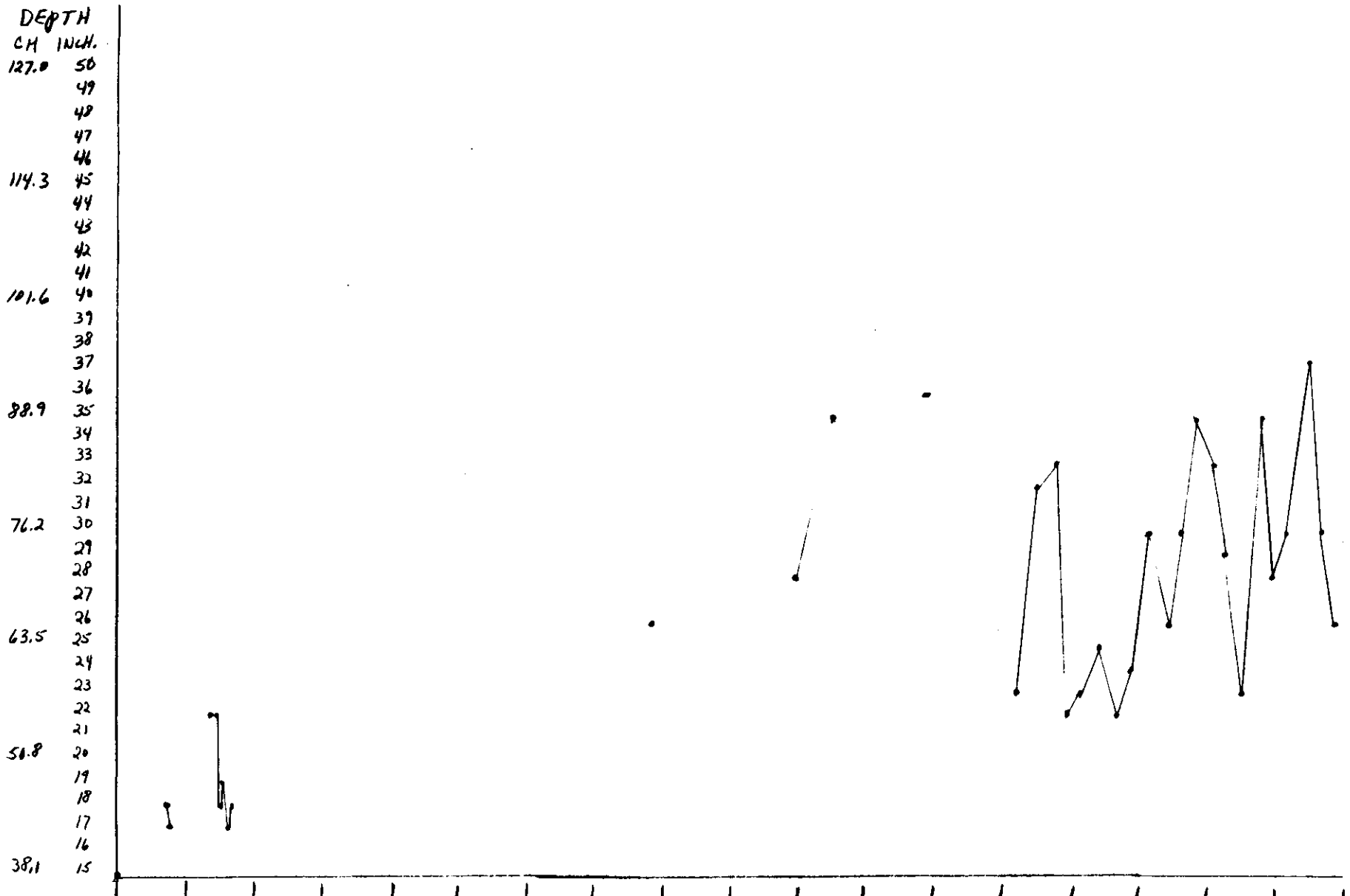
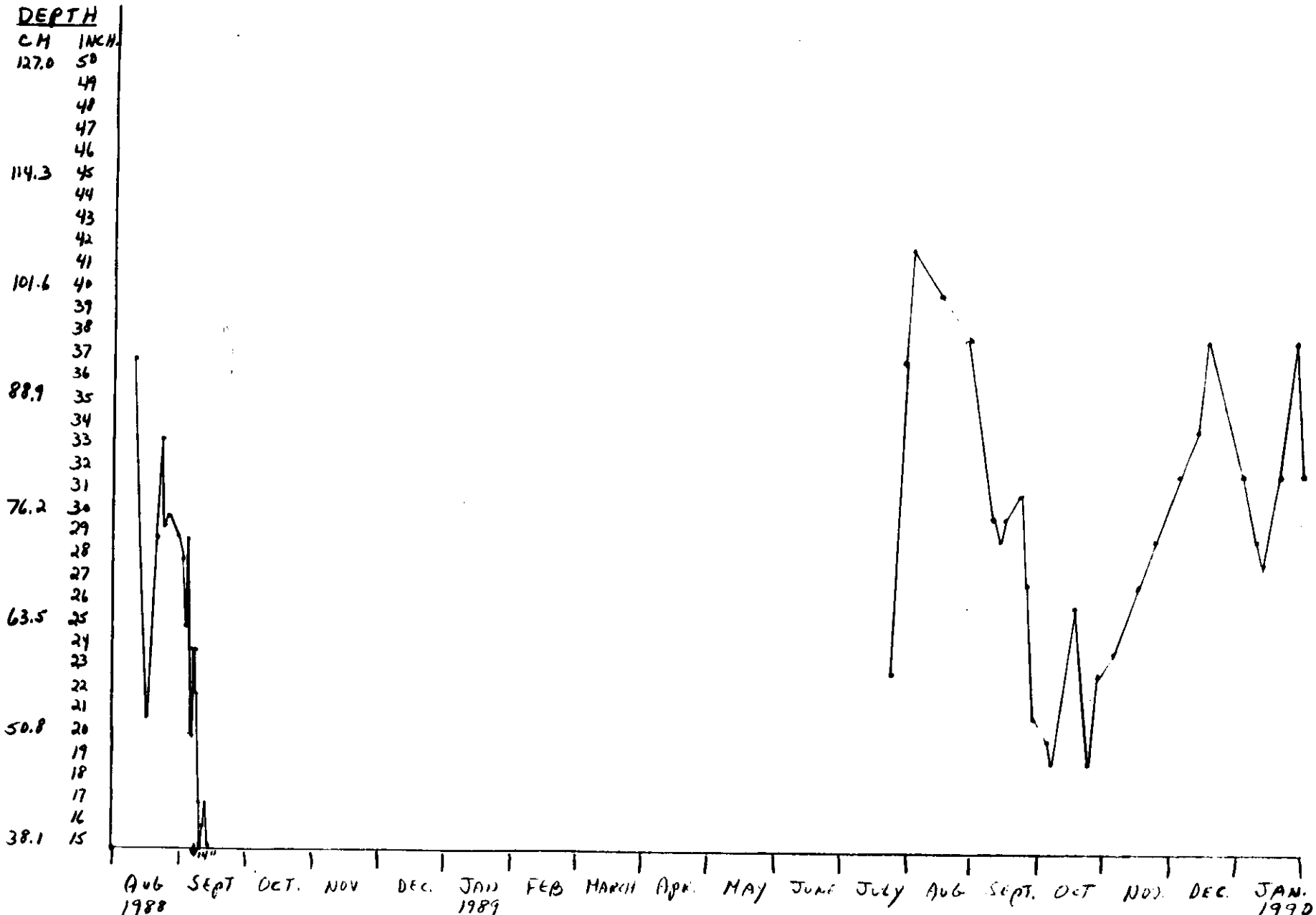


EXHIBIT #6
STATION #4

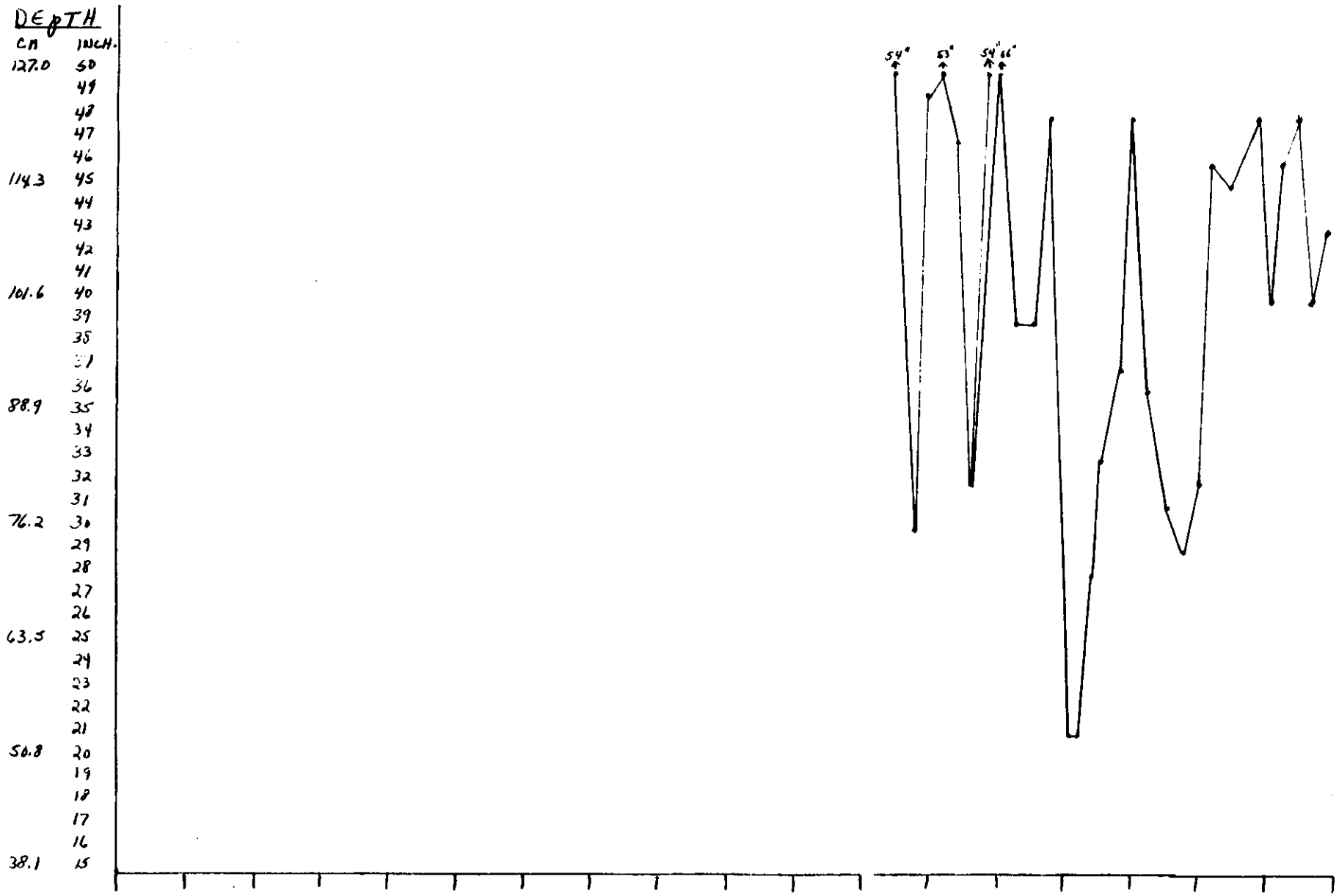
MIDNIGHT PASS SOCIETY WATER MONITORING STATION #4 SECCHI DEPTHS LITTLE SARASOTA BAY
(TROPICAL SHORES DOCK - MAINLAND)
(PLUS WHARF RD. AUG. 21, 1988 - SEPT. 16, 1988)



MIDNIGHT PASS SOCIETY WATER MONITORING STATION #5 SECCHI DEPTHS LITTLE SARASOTA BAY

8407 MIDNIGHT PASS RD.
SIESTA KEY

EXHIBIT #7
STATION #5



MIDNIGHT PASS SOCIETY WATER MONITORING STATION #7 SECCHI DEPTHS LITTLE SARASOTA BAY

SOUTH BAY MAINLAND MARINA, SLIP #5 DOCK

EXHIBIT #8
STATION #7