

11-16-1989

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City of Tampa Department of Sanitary Sewers

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CITY OF TAMPA SURFACE WATER MONITORING PLAN
OF HILLSBOROUGH BAY

by

The City of Tampa
Department of Sanitary Sewers
Bay Study Group

submitted to
the Florida Dept. of Environmental Regulation
Tampa Office

November 16, 1989

CITY OF TAMPA SURFACE WATER MONITORING PLAN
OF HILLSBOROUGH BAY

INTRODUCTION

This plan of study will outline all aspects of our proposed monitoring program to satisfy requirements set forth in specific condition #6 of construction permit DC29-152799 issued by the Florida Department of Environmental Regulation.

As part of our surface water compliance monitoring plan, we will sample three new stations and assess trends of various water quality parameters collected by the Environmental Protection Commission of Hillsborough County (EPC) and the City of Tampa (COT). In addition, we will continue our ongoing long-term multidisciplinary approach of evaluating water quality in Hillsborough Bay.

Three new stations, located relatively close to the Hooker's Point wastewater treatment plant (WWTP) discharge point, will be monitored monthly for dissolved oxygen (DO), CBOD₅, chlorophyll-a, total phosphorus (TP), ortho-phosphorus (OP), total nitrogen (TN), and total Kjeldahl nitrogen (TKN). These three new COT stations, geographically placed to evaluate potential impacts of increased flow from the Hooker's Point WWTP, should provide supplementary information to existing EPC stations (52, 70, 6 and 2; see Figure 1) in northern Hillsborough Bay.

Trend analyses of EPC data will be based on overall Hillsborough Bay averaged values as well as averaging stations from bay subunits. Trends of COT data will include analyses of measured parameters from the three new stations, the phytoplankton production stations, and the seagrass and Caulerpa study sites.

Our ongoing monitoring program of water quality and biological indicators will not change. The present study includes monthly phytoplankton production and macroalgae sampling, and spring, summer and fall surveys of seagrasses and the attached benthic algae Caulerpa prolifera.

Each year two annual reports will be submitted to the Tampa office of the Department of Environmental Regulation. A seagrass and Caulerpa report will be submitted by March 1, and a report covering all the remaining projects outlined in this plan will be submitted May 1.

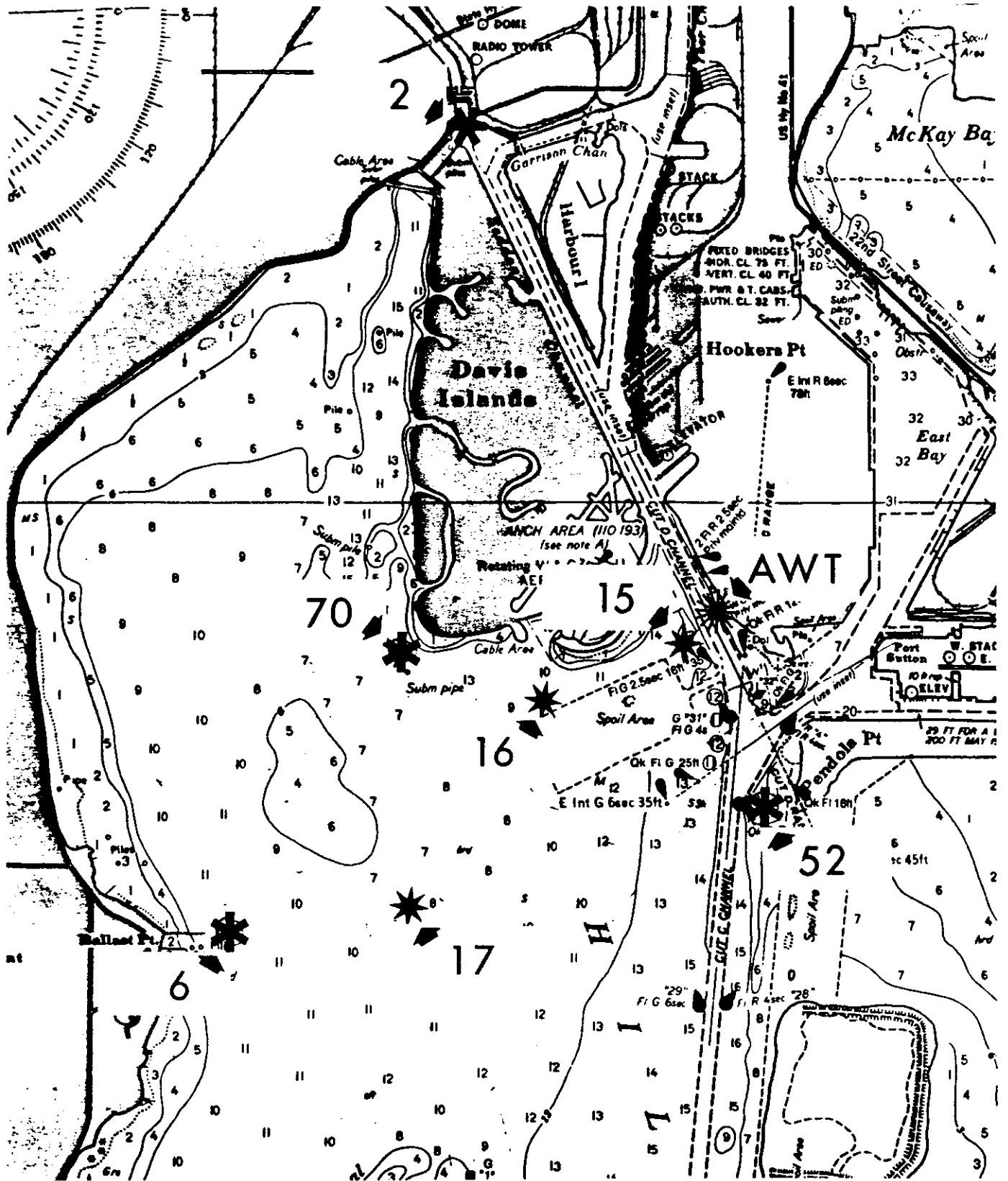


Figure 1. Hooker's Point outfall (☀), COT compliance monitoring stations (★), and nearby EPC stations (✱) in Hillsborough Bay. AWT = COT Hooker's Point outfall site.

COMPLIANCE MONITORING

Station Locations and Sampling Frequency

Three stations, to be sampled monthly, have been established approximately 0.13 nautical miles (NM) (station 15), 0.71 NM (station 16) and 1.65 NM (station 17) southwest of the Hooker's Point wastewater discharge site (Figure 1) at the following coordinates of longitude and latitude:

STA 15	27° 54' 31" N 82° 26' 33" W
STA 16	27° 54' 15" N 82° 27' 08" W
STA 17	27° 53' 27" N 82° 27' 47" W

Sampling Methods

At each station, water will be collected by the COT at mid-depth with a 5 liter Niskin bottle. Nutrient samples will be acidified (1ml H₂SO₄ per 1000ml sample) in the field, and all samples will be stored on ice during transport. Surface, mid-depth and bottom salinity will be measured with an A/D refractometer. Before 0800 hours, temperature and dissolved oxygen will be measured at 1 meter increments from surface to bottom with a YSI-5739 probe. Water transparency will be estimated from Secchi disk readings.

Parameters and Analytical Methods

NUTRIENTS AND CBODS:

The EPC laboratory will analyze samples for TP, OP, TN, TKN, NH₃-N, NO₃+NO₂ and CBOD₅. The analytical methods for these determinations are described in EPC's biannual Water Quality 1986-1987 report. The EPC has agreed to analyze samples for these parameters for a period of one year. After one year, a renewal of this agreement will be at EPC's discretion.

DO (in-situ):

The COT Bay Study Group (BSG) will measure in-situ DO following method #4500_G (Standard Methods, 17th Ed.)

CHLOROPHYLL-a:

Chlorophyll-a will be determined using the following modification of Strickland and Parsons (1972) method IV.3.1. This method is currently being used for the Bay Study Group's ongoing long-term monitoring project.

Samples are shaded from direct sunlight during transportation to the laboratory and filtered immediately upon return to the laboratory through Whatman GF/C glass fiber filters. Precaution is taken during all laboratory procedures not to expose the pigment samples to bright light. To prevent degradation of chlorophyll-a through acidification, approximately 1ml of magnesium carbonate suspension is added to the filter surface. Filters are wrapped in aluminum foil and stored frozen for up to three weeks. Filters are then ground with a teflon tip tissue grinder in 90% acetone until homogenized. The material is transferred to 15ml centrifuge tubes, then stored overnight in a refrigerator. After being inverted several times, the tubes are centrifuged for 15 minutes and the supernatant is decanted into 1cm pathlength spectrophotometer cells. The extinction of the liquid is measured in a Perkin-Elmer Lambda 3B spectrophotometer at the wavelengths 750, 665, 645, and 630nm and also 750 and 665nm after acidification with 1 drop of 33% HCL.

Chlorophyll-a concentrations are calculated using the equation of Parsons and Strickland (Strickland and Parsons 1972):

$$C = \frac{(11.6 E_{665_e} - 1.31 E_{645_e} - 0.14 E_{630_e}) \times v}{V}$$

where C is the concentration of chlorophyll-a (mg m^{-3}), v is the volume of acetone used for extraction (ml), V is the volume of water filtered (liters), E_{i_e} is the extinction at wavelength i (nm) before acidification.

Quality Assurance/Quality Control

All quality assurance aspects of nutrient analyses will abide by the EPC Quality Assurance Plan documented in Chapter 12 of their Water Quality 1986-1987 biannual report.

Additional quality assurance procedures will follow the City of Tampa Department of Sanitary Sewers Generic Quality Assurance Plan as revised on July 12, 1989. Section 6.3 of this plan will be revised to include a plan of study of the three compliance monitoring stations (COT stations 15, 16 and 17). The revised version of Section 6.3 will be submitted to DER Water Quality Assessment and Quality Assurance Section following approval of the City of Tampa Surface Water Quality Monitoring Plan of Hillsborough Bay by the DER Tampa Office.

Trend Analyses

Trends will be analyzed for at least three groups of stations: **Group #1)** COT stations 15, 16 and 17; **Group #2)** EPC stations 70, 52, 6 and 2; and **Group #3)** all 14 EPC Hillsborough Bay stations.

Analyses will be a combination of annually, and in some cases, monthly, averaged parameter values showing trends for specific stations of interest, for the average of a group of stations in a selected bay sub-unit, and for the average of all bay stations. Annual reports will include trends of the following parameters versus time:

DO	TN
CBOD5	TKN
TP	CHLOROPHYLL-a
OP	

Group #1 analyses will reflect monthly and, as data accumulates, annual trends. Group #1 trends will also be compared, and possibly combined, with Group #2 trend results.

Group #2 analyses will consist of annual averaged results from 1974 to the present, and comparisons to Group #1 data as indicated above.

Group #3 analyses will include annual averaged results from 1974 to the present. Specific stations and groups of stations encompassing bay sub-units will be combined and averaged for selected parameters.

LONG-TERM MONITORING OF WATER QUALITY AND BIOLOGICAL INDICATORS

Phytoplankton Production

Summary:

No. of stations:	- 3
Hillsborough Bay	- stations 4 and 12
Middle Tampa Bay	- station 13
Sampling frequency:	- monthly

Parameters:

temperature		Surface & 1m intervals:
salinity		
D.O.		
chlorophyll- <u>a</u>		Surface & 1m intervals to
primary production		3m (sta. 4 & 12) or 4m (sta. 13)
phytoplankton taxonomy		Surface & 3m (sta. 4 & 12)
ammonia-N		or 4m (sta. 13)
extinction coefficient		1/2m intervals to 3m (sta. 4 & 12)
		or 4m (sta. 13)
Secchi disk depth		

Description:

Phytoplankton production and several other supportive parameters are monitored at two Hillsborough Bay stations (4 and 12) and one station (13) in Middle Tampa Bay (Figure 2). Station 13 is distant from the sources of nutrient input and freshwater runoff occurring in Hillsborough Bay, and thus, serves as a semi-control for the phytoplankton community of Hillsborough Bay.

Samples are collected at 1m increments from surface (depth 0m) to 3m at station 4 and 12, and from surface to 4m at station 13. Water from each discrete depth is placed in a large container, stirred well, and then subsampled for determinations of phytoplankton productivity (in situ ¹⁴C incubations) and phytoplankton pigments (chlorophyll-a). Spectrophotometric readings of chlorophyll extracts include optical density reading for phaeopigments and chlorophylls b and c. Water from the surface and the deepest depth of production measurements (3m or 4m) is also subsampled for phytoplankton taxonomy and dissolved

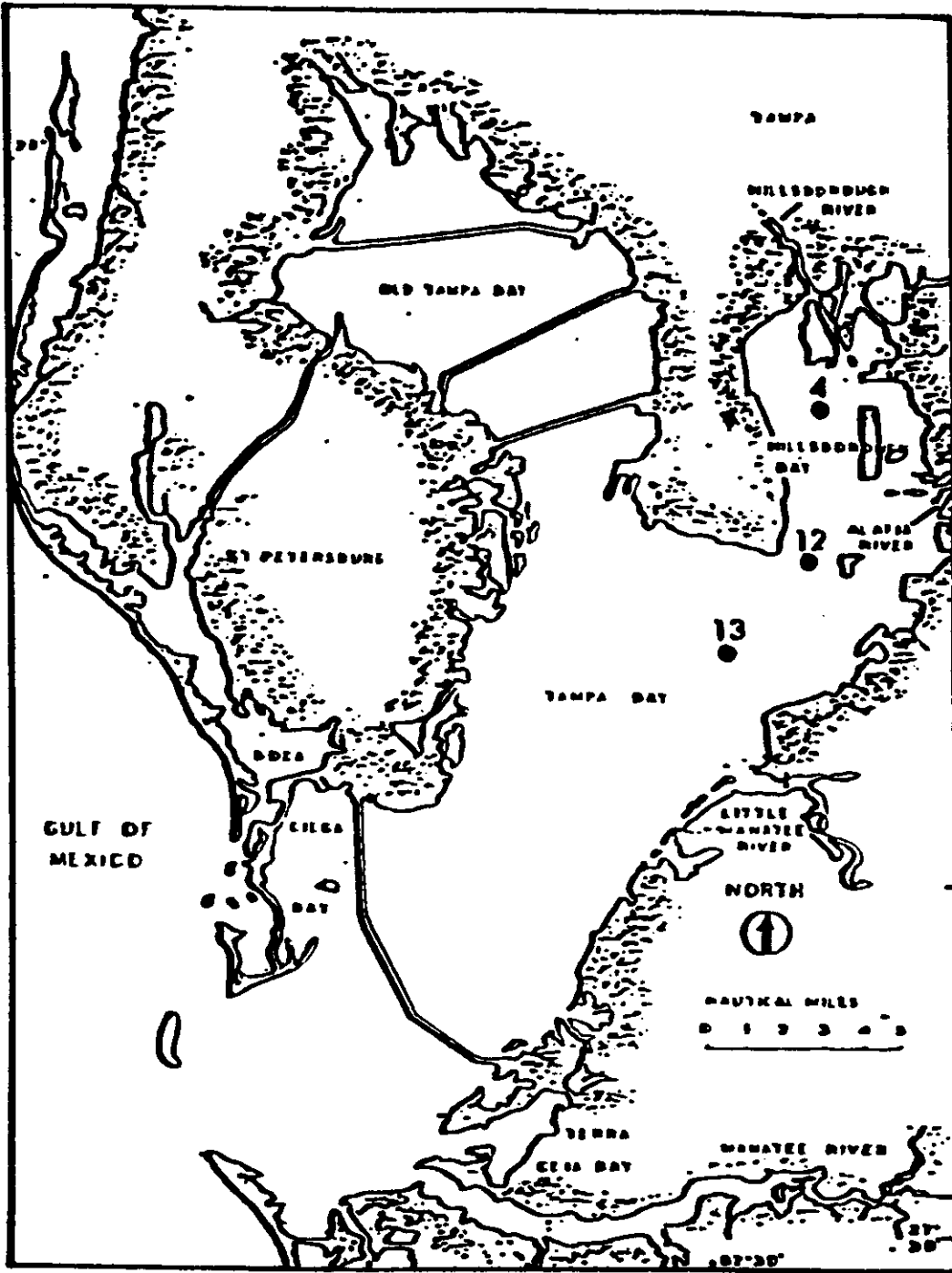


Figure 2. Station locations in the Tampa Bay system.

ammonia-nitrogen. Salinity, water temperature and dissolved oxygen are measured at the surface and each discrete depth (at 1m increments) and at the water column bottom (within 1m of the bottom sediment). Water column light penetration is estimated from Secchi disk readings and is also measured by calculating extinction coefficients (k) using Li-193SA spherical quantum sensors.

Macroalgae

Summary:

No. of stations: - 5 transects (A, B, C, D, & E)

Frequency: - monthly

Parameters: - wet weight
- dry weight
- species composition

Additional information: - aerial photography

Description:

Drift macroalgae is surveyed at least every two months in Hillsborough Bay by oblique aerial photography from helicopter overflights and by monthly field collections at five transects (Figure 3). Macroalgae is collected by pulling a tri-net, with a 12 foot opening, along each transect at approximately 3 knots. The total macroalgae wet weight catch is weighed in the field and a representative subsample is brought back to the laboratory. Laboratory parameters measured from the subsample include total wet weight and the percent species composition in terms of wet and dry weights.

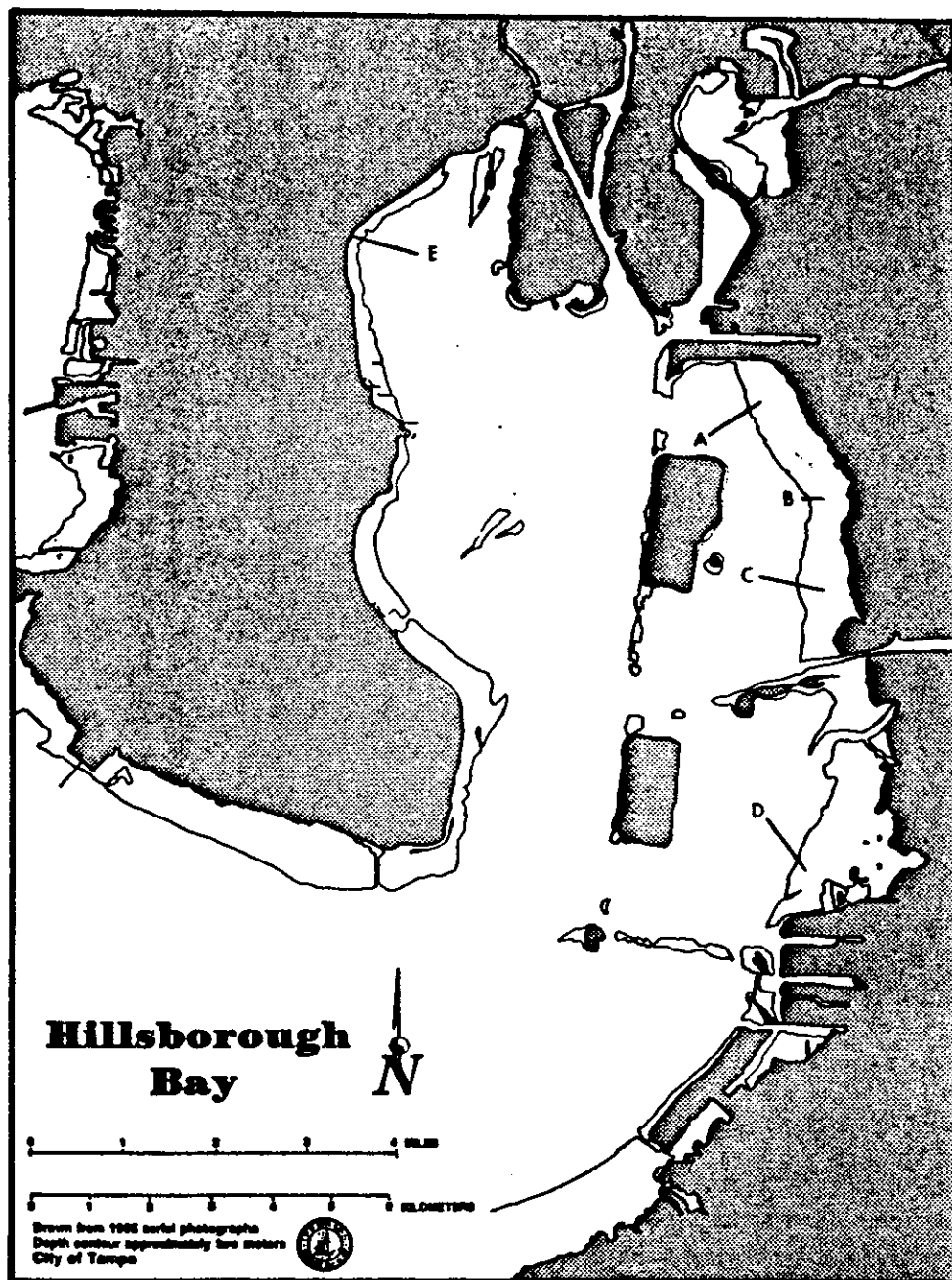


Figure 3. Locations of macroalgae transects A-E in Hillsborough Bay.

SEAGRASS AND CAULERPA MONITORING

Summary:Halodule wrightii (Natural)

- No. of sites: - 7
- Sampling frequency: - Spring, Summer, Fall
- Parameters: - areal coverage
- blade length
- blades per short shoot
- short shoot density
- epiphytic cover
- temp., salinity, depth

Ruppia maritima (Natural)

- No. of sites: - one transect with two 5X20m quadrates
- Sampling frequency: - Spring, Summer, Fall
- Parameters: - % coverage
- short shoot density
- blade length
- inflorescence length (if present)
- temp., salinity, depth

Caulerpa prolifera (Natural)

- No. of sites: - four transects each composed of 5X20m quadrates (3-10 quadrates depending on transect)
- one 1X300m transect
- Sampling frequency: - Spring, Summer, Fall
- Parameters: - % coverage
- frond density
- frond length
- epiphytic cover
- temp., salinity, depth

Halodule wrightii (Introduced)

BARE ROOT UNIT PLANTINGS IN JUNE 1987

No. of units: - 861
 No. of sites: - one 10X20m area

"SOD" PLANTINGS IN JUNE-JULY 1987

No. of "sods:" - 60 (340 originally planted)
 No. of sites: - 4 (7 originally planted)

"SOD" PLANTINGS IN MAY 1989

No. of "sods:" - 66
 No. of sites: - one 10X20m area

MONITORING PROGRAM FOR ALL H. wrightii PLANTINGS

Sampling frequency: - Spring, Summer, Fall
 Parameters: - % survival
 - % plantings having areal expansion
 - areal coverage
 - blade length
 - blades per short shoot
 - short shoot density
 - epiphytic cover
 - temp., salinity, depth

Syringodium filiforme (Introduced)

"SOD" PLANTINGS IN MAY 1989

No. of "sods:" - 66
 No. of sites: - one 10X20m area
 Sampling frequency: - Spring, Summer, Fall
 Parameters: - % survival
 - % plantings having areal expansion
 - areal coverage
 - blade length
 - short shoot density
 - epiphytic cover
 - temp., salinity, depth

Description:

On site surveys of three seagrasses, Halodule wrightii, Syringodium filiforme and Ruppia maritima, and the coenocytic alga, Caulerpa prolifera, are conducted during the spring, summer and fall. Hillsborough Bay is also surveyed for areas of seagrass growth at least every two months by oblique aerial photography from helicopter overflights.

Seven discrete H. wrightii study sites (Fig. 4) were selected to represent various geographical areas and sediment types. Areal expansion, blade length, blades per short shoot, short shoot density, epiphytic cover and water column temperature, salinity and depth are recorded during each survey.

One R. maritima transect (Fig. 4), composed of two 5X20m quadrates, was established in order to monitor seasonal characteristics. Measurements include percent coverage, short shoot density, blade length, and inflorescence length (if present).

Five C. prolifera transects (Fig. 5) are visited. Four transects are comprised of three to ten 5X20m quadrates depending on location. One transect measures 1X300m. All transects are surveyed for percent cover, frond length and density, epiphytic cover and water column temperature, salinity and depth.

Sod blocks and bare root seagrass units have been transplanted to several locations in Hillsborough Bay. Four areas (Fig. 6) contain a total of 60 transplanted H. wrightii sod blocks. A 10X20m site was planted in June 1987 with 861 H. wrightii bare root units on 0.5m centers. In addition, a H. wrightii 10X20m site and a S. filiforme 10X20m site were planted in May 1989 using 66 sod blocks at each site. Spring, summer and fall monitoring of each species include measurements of percent survival, number of units having areal expansion, areal coverage, blade length, short shoot density, epiphytic cover and water column temperature, salinity and depth.

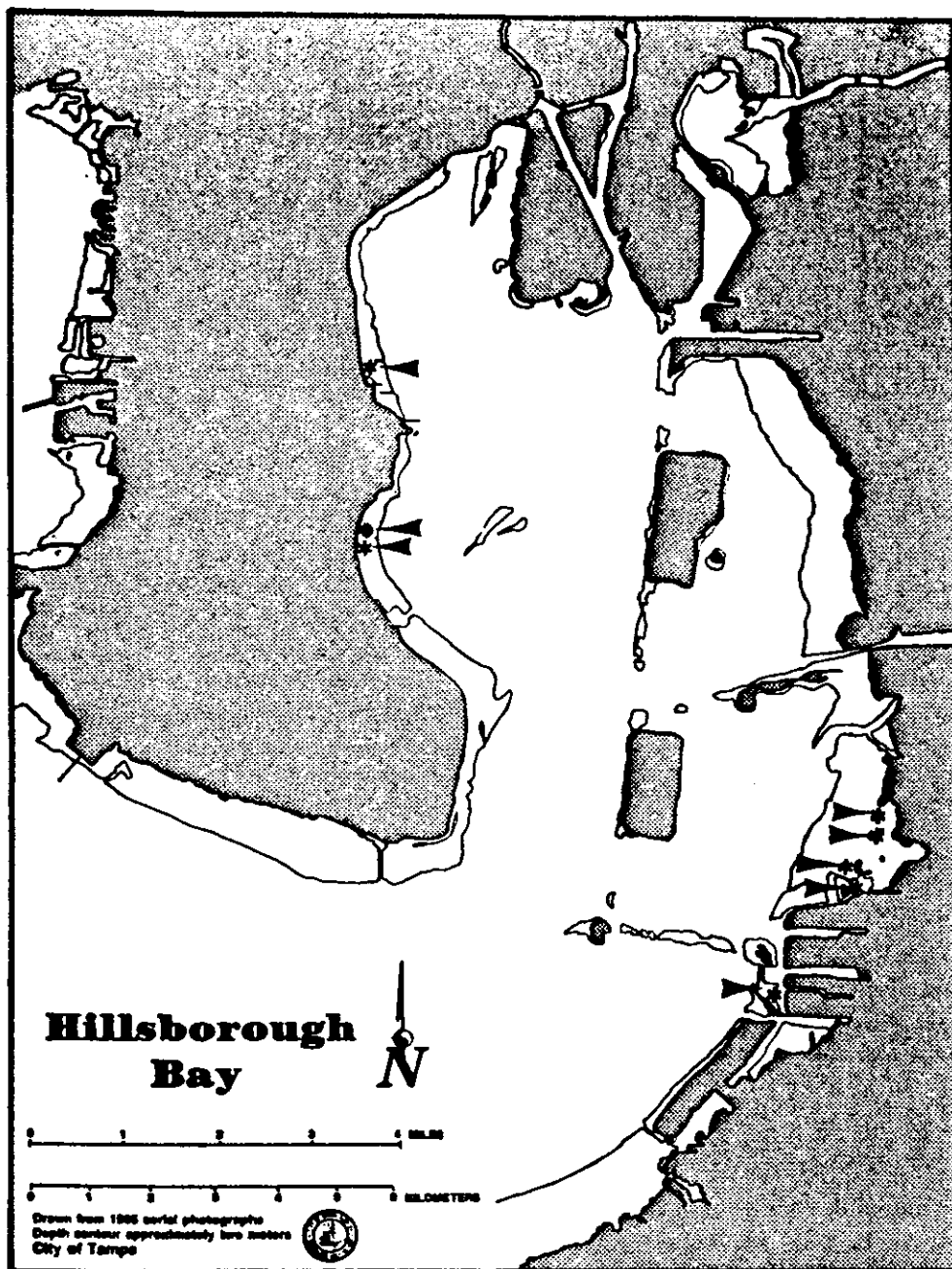


Figure 4. Locations of *H. wrightii* study sites (*) and the *R. maritima* study site (*).

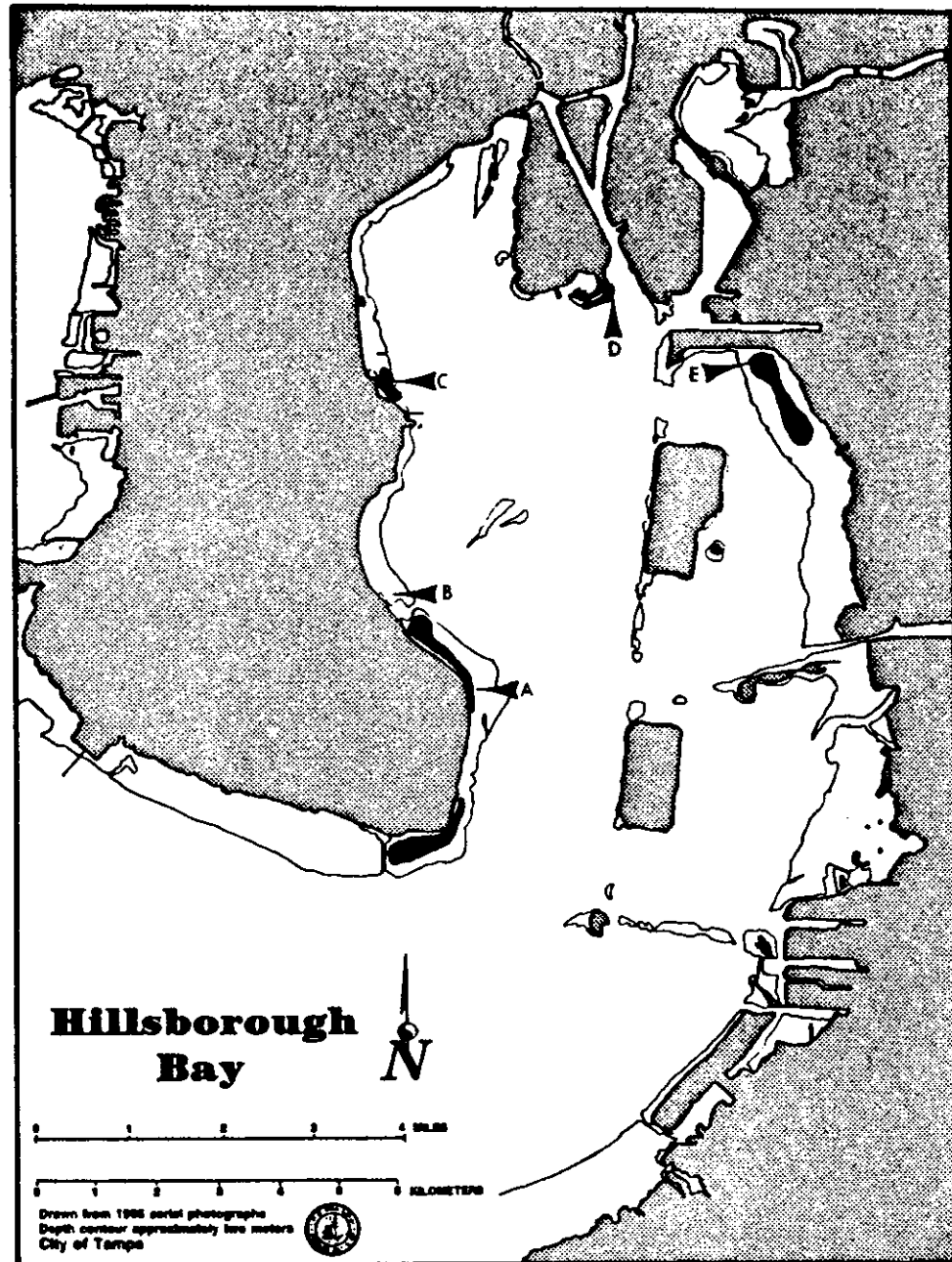


Figure 5. *C. prolifera* areal coverage in summer 1989 and locations of *C. prolifera* transects A-E.

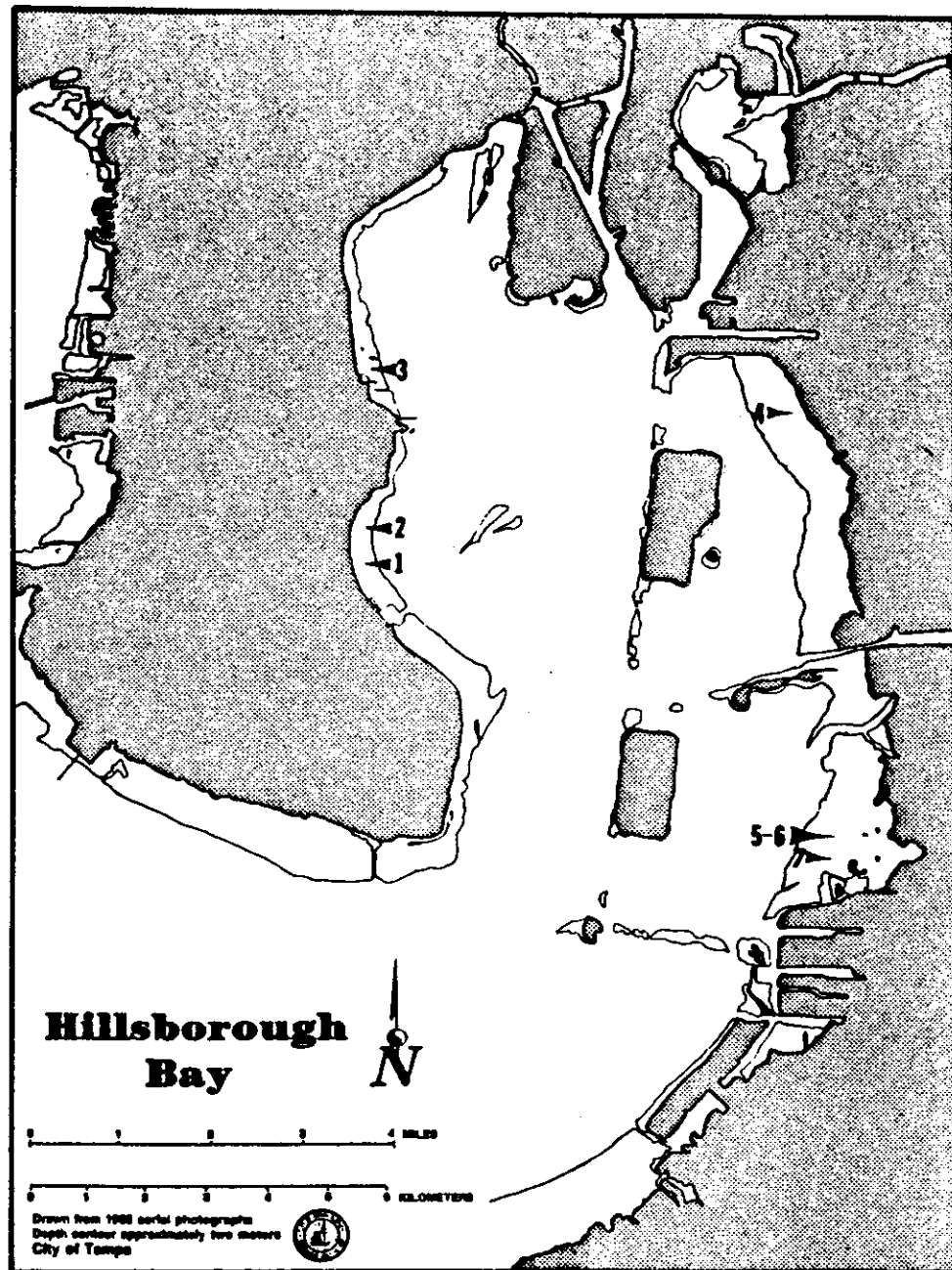


Figure 6. Locations of transplanted seagrass: 1) 861 H. wrightii units; 2) 15 H. wrightii sods; 3) 5 H. wrightii sods; 4) 26 H. wrightii sods; 5) 66 S. filiforme sods; 6) 66 H. wrightii sods; 7) 14 H. wrightii sods.

EPC WATER QUALITY PARAMETERS USED BY THE BAY STUDY GROUPSummary:

Number of Hillsborough
Bay stations: - 14

Frequency: - monthly

Parameters: - Secchi disk depth
- salinity
- D.O.
- total P
- ortho phosphorus
- total N
- Kjeldahl nitrogen
- chlorophyll-a
- water quality index

Description:

The ongoing monitoring program of the Environmental Protection Commission (EPC) of Hillsborough County has provided an excellent comprehensive long-term record of several important water quality parameters that are useful to the Bay Study Group (BSG). EPC information is primarily used to assess general water quality conditions in Hillsborough Bay for short-term and long-term trends. In addition, chlorophyll-a, Secchi disk depth, salinity, D.O. and ammonia-N values are used for comparison to the same parameters measured by the BSG. Presently the BSG reviews monthly reports from the EPC covering all their surface water monitoring data at 14 stations in Hillsborough Bay. The Hillsborough Bay EPC parameters of total-P, total-N, chlorophyll-a, Secchi disk depth, and water quality indices are entered into computer files at the City of Tampa, thereby enabling the BSG to graphically illustrate the trends of selected parameters.

REFERENCES

Strickland, J.D.H., and T.R. Parsons. 1972. A practical handbook of seawater analysis. Bull. Fish. Res. Bd. Canada, 167: 311 p.