Tampa Bay Estuary Program
Technical Publication # 12-02

PINEY POINT AND BISHOP HARBOR MONITORING PROGRAM DESIGN

FINAL REPORT

AUGUST 2002

Tampa Bay Estuary Program
Technical Memorandum

Piney Point and Bishop Harbor
Monitoring Program Design

August 8, 2002

Prepared for:
Tampa Bay Estuary Program
100 8th Avenue S.E.
Mail Station I-1/NEP
St. Petersburg, Florida 33701

Prepared by:
Janicki Environmental, Inc.
1155 Eden Isle Dr. N.E.
St. Petersburg, Florida 33704

Estuary Program

For Additional Copies or Information Regarding this Document
Please Contact the Tampa Bay Estuary Program, St. Petersburg, Florida

Piney Point and Bishop Harbor Monitoring Program

The Piney Point and Bishop Harbor monitoring program consists of a two phase design to assess the potential effects of releases of treatment water from the Piney Point phosphate facility on water quality in Bishop's Harbor and nearby Tampa Bay.

Study Goals: Determine in relatively real-time operation whether potential water quality or sediment quality problems occur in Bishop Harbor during the releases of treated water from the Piney Point phosphate facility.

Study Objective: Monitor and test for statistically significant and ecologically significant differences in several water quality and sediment quality parameters between pre-discharge and during discharge conditions.

Water Quality Indicators of Interest: Dissolved oxygen, pH, alkalinity, total Kjeldahl nitrogen,NO2 + NO3, NH3 + NH4, Total P, ortho P, color, chloride, turbidity, TSS, TVS, conductivity, salinity, temperature, silica, inorganic carbon, total organic carbon, dissolved organic carbon, chlorophyll a.

Sediment Indicators of Interest: Sand/Silt/Clay content, enumeration of benthic organisms, silver, arsenic, cadmium, chromium, copper, nickel, lead, zinc.

Important Constraints: Sampling effort limited to the dates and times that field crews are present on-site,
one sampling crew,
shallow waters in portions of the study area,
dense mangrove cover in portions of the study area,
three fixed-location stations have already been established.

Population Of Interest: All geographic sampling locations in Bishop Harbor. Where Bishop Harbor was operationally defined as the submerged areas located within the stratum boundaries (see figure presented in spatial sampling strata section). The "Hells Half Acre" portion of Bishop Harbor to the north was excluded from sampling because its shallow depth would constrain vessel operation.

Sampling Unit: A geographic location in the population of interest at a particular time.

List Frame: Geographic locations in Bishop Harbor defined as submerged habitat in the Southwest Florida Water Management District 1999 seagrass mapping database.

Spatial Sampling Strata:

The spatial sampling strata were defined to meet the following objectives:

- allocate samples across the surface extent of Bishop Harbor, Tampa Bay near the mouth of Bishop Harbor, and in a reference area (Terra Ceia Bay).
- accommodate two samples per stratum,
- primarily stratify along the expected axis of variation in water quality extending from the canal entry point into Bishop Harbor to the mouth of Bishop Harbor,
- secondarily stratify along the potential lateral axis of variation perpendicular to the primary axis of variation, and
- encompass the existing fixed station locations into the sampling strata design.

Three sets of sampling strata were defined to meet these objectives as follows:

- Six Bishop Harbor strata (1A,1B,1C, 2A,2B,2C,3A,3B,3C) are presented in Figure 1. The random station locations for two samples per each Bishop Harbor stratum are also presented in Figure 1.

- Two Tampa Bay strata (4A,4B) near the mouth of Bishop Harbor are presented in Figure 2. The random station locations for two samples per each Tampa Bay stratum are also presented in Figure 2, and the locations of alternate stations (stations 3,4,5,6) for each stratum are also presented.

- Eight Terra Ceia Bay strata (5A,5B,6A,6B,7A,7B,8A,8B) are presented in Figure 3. The random station locations for two samples per each Terra Ceia Bay stratum are also presented in Figure 3, and the locations of alternate stations (stations 3,4,5,6) for each stratum are also presented.

Sample Selection and Allocation:

Samples were selected using stratified random sampling with sample inclusion probabilities varying inversely with the geographic area of submerged habitat of each stratum. Two samples were allocated per stratum, and additional alternate samples were allocated per stratum.

Table 1 presents the geographic coordinates of the stations in the Bishop Harbor strata, Table 2 presents the geographic coordinates of the stations in Tampa Bay, and Table 3 presents the geographic coordinates of the stations in Terra Ceia Bay.

Geographic Sampling Exclusionary Criteria

Alternate sample locations will be visited where the primary sample locations are found to occur in less than 1.5 meters of water depth at the time of the sampling event.

Reporting Units

Prior to discharge and during discharge, population parameters of the indicators of interest will be estimated with confidence limits for Bishop Harbor as a whole, Tampa Bay near the mouth of Bishop Harbor as a whole, and Terra Ceia Bay as a whole. The data from the nine Bishop Harbor strata will also be post-stratified into three larger strata in order to allow comparisons with observations from the three existing fixed stations. The statistical power of the inferences made for these comparisons will be determined by the variation in the observed data. The Bishop Harbor sample size of 20 was previously identified as a constraint of this design.

Prior and Concomittant Data Collection Activities:

Prior to discharge:

- FDEP will collect and report water quality data from the stations defined by this monitoring design,
- FDEP previously collected benthic data in Bishop Harbor in 2000,
- USGS conducted a synoptic bathymetry survey in Bishop Harbor,
- FDEP will conduct a pre-discharge vegetation survey to record extent and locations of seagrass and macro algae, and
- FDEP will visit and conduct a vegetation survey transect through the saltern habitat along the north-eastern shoreline of Bishop Harbor.

Concomittant with discharge:

- FDEP will operate a flow meter at the Piney Point outfall.
- FDEP will monitor continuous Piney Point discharge for conductivity, pH, total dissolved solids for first month. After the first month, the sampling frequency will be reduced, but will occur at least on a daily basis during discharge periods.
- FDEP will collect Bishop Harbor water samples during discharge periods for bioassays.
- USGS employ an Acoustic Doppler Profiler at the mouth for at least one tidal cycle.
- Environmental Protection Commission of Hillsborough County will monitor water quality at long-term monthly monitoring stations in Tampa Bay near the mouth of Bishop Harbor.
- Manatee County to deploy three continuous conductivity recorders at existing fixed stations.

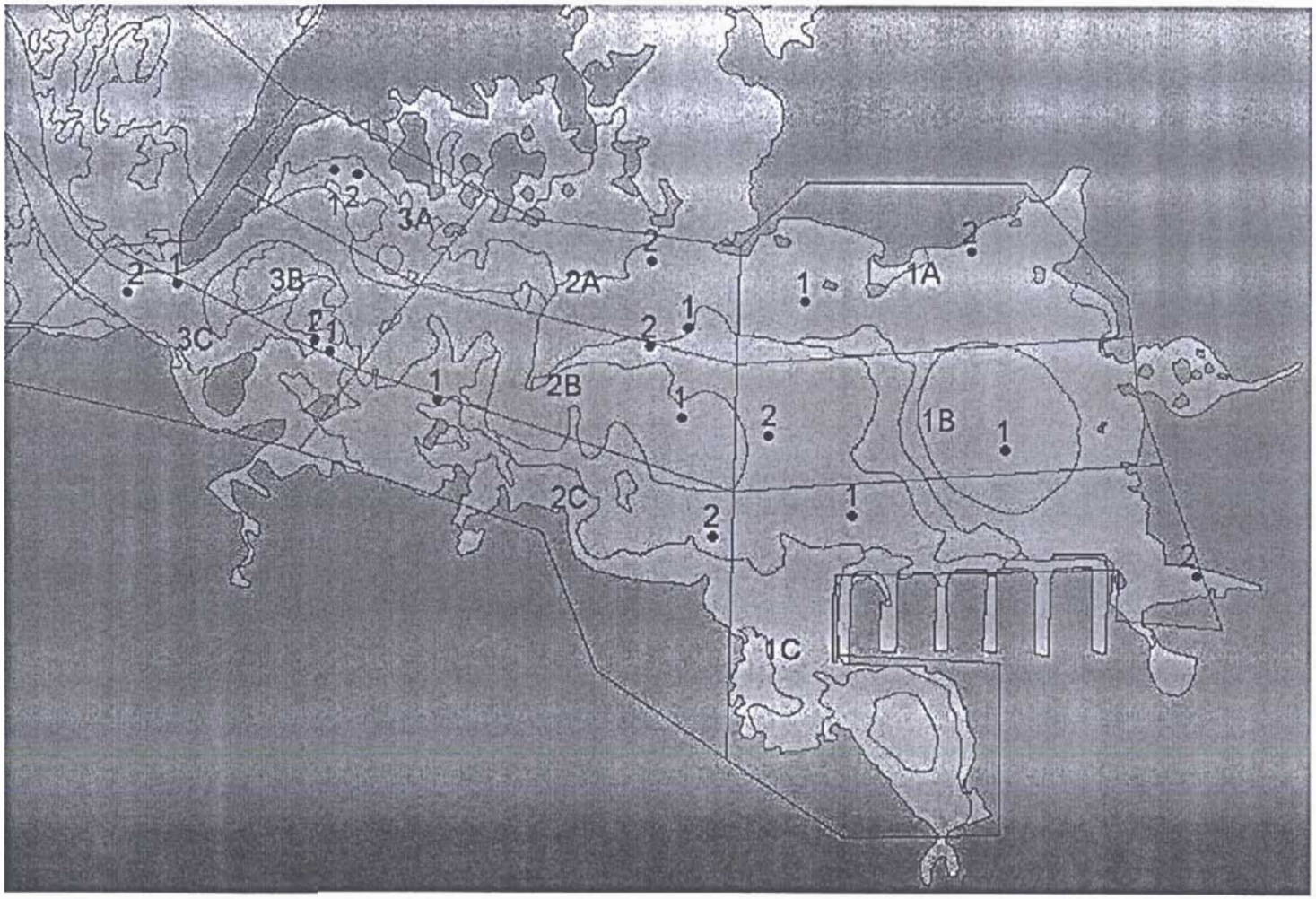

Figure 1 Bishop Harbor Strata and two station locations per stratum. SWFWMD 1999 seagrass study shoreline and habitat polygons are presented for geographic reference.

Figure 2 Tampa Bay Strata and two station locations (1,2) per stratum (alternate station locations 3,4,5 and 6 also presented). SWFWMD 1999 seagrass study shoreline and habitat polygons are presented for geographic reference.

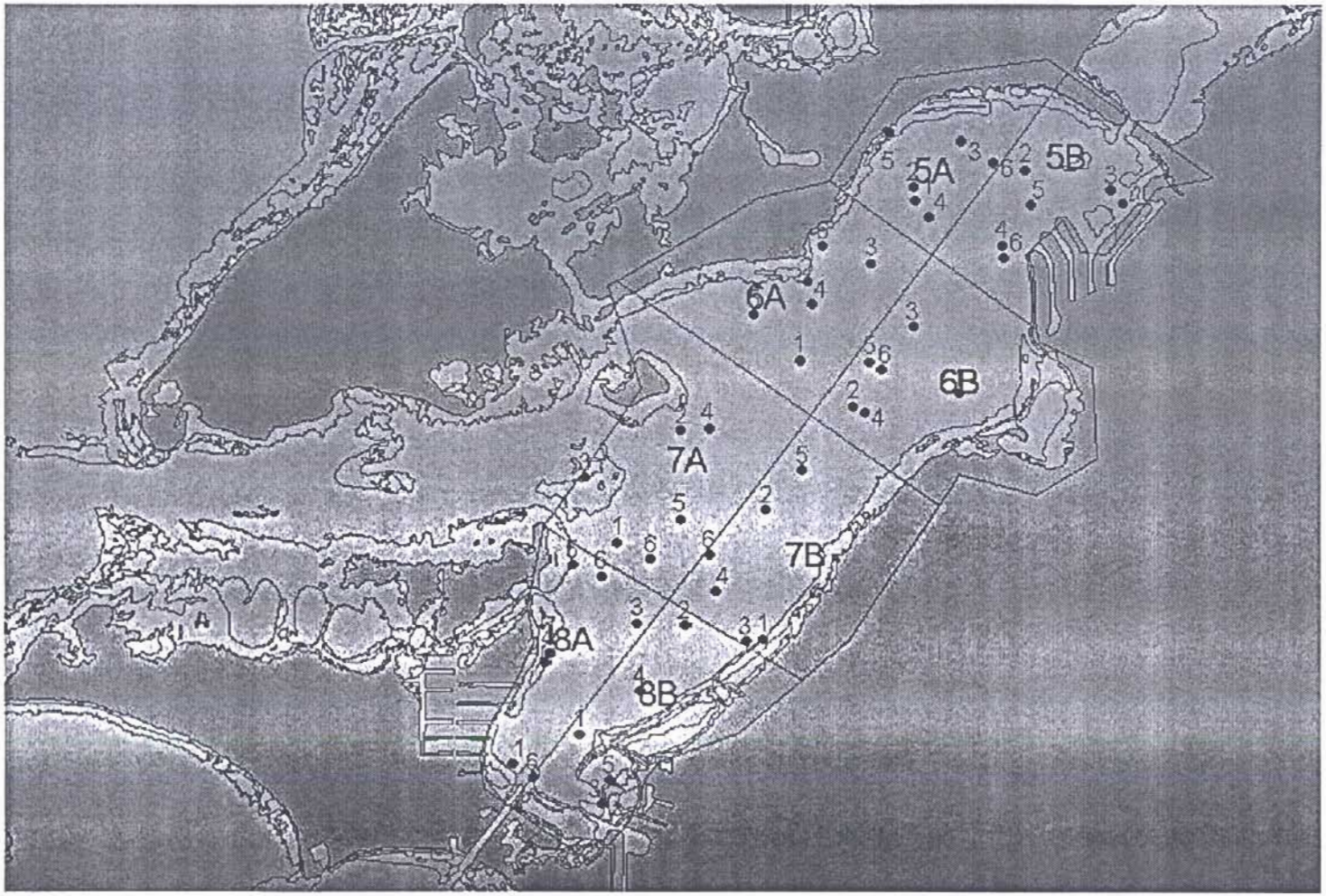

Figure 3 Terra Ceia Bay Strata and two station locations (1,2) per stratum (alternate station locations 3,4,5 and 6 also presented). SWFWMD 1999 seagrass study shoreline and habitat polygons are presented for geographic reference.

Table 1 Bishop Harbor Sampling Event
Stratified Random Sample Locations and Alternate Locations

Randomization Number	Stratum	Sampling Priority	Longitude (Deg West)	Lattitude (Deg North)
9	1A	1	82.556854	27.608034
97	1A	2	82.553312	27.609049
98	1A	3	82.554489	27.607700
148	1A	4	82.556350	27.607516
167	1A	5	82.551062	27.607530
180	1A	6	82.554882	27.608255
29	1B	1	82.552519	27.605240
121	1B	2	82.557568	27.605463
124	1B	3	82.550703	27.607264
131	1B	4	82.554161	27.605988
135	1B	5	82.551050	27.605969
164	1B	6	82.553369	27.606593
3	1C	1	82.555773	27.603958
15	1C	2	82.548393	27.602930
42	1C	3	82.553998	27.603797
50	1C	4	82.557711	27.600578
71	1C	5	82.554133	27.598290
76	1C	6	82.553044	27.603681
233	2A	1	82.559299	27.607510
239	2A	2	82.560137	27.608783
291	2A	3	82.561712	27.607646
361	2A	4	82.559552	27.608257
380	2A	5	82.561463	27.609345
408	2A	6	82.559177	27.607539
40	2B	1	82.559416	27.605776
41	2B	2	82.560145	27.607140
74	2B	3	82.559728	27.607036
103	2B	4	82.561650	27.605435
147	2B	5	82.565072	27.607373
169	2B	6	82.560311	27.606768
16	2C	1	82.564688	27.606051
36	2C	2	82.558756	27.603518
60	2C	3	82.560250	27.603176
62	2C	4	82.560957	27.604387
163	2C	5	82.564931	27.606030
179	2C	6	82.561292	27.603038
85	3A	1	82.566950	27.610457
125	3A	2	82.566452	27.610372

Table 1 continued Bishop Harbor Sampling Event
Stratified Random Sample Locations and Alternate Locations

Randomization Number	Stratum	Sampling Priority	Longitude (Deg West)	Lattitude (Deg North)
152	3A	3	82.565523	27.609173
166	3A	4	82.567494	27.610234
227	3A	5	82.564697	27.609526
331	3A	6	82.565113	27.609566
23	3B	1	82.567011	27.606954
159	3B	2	82.567318	27.607176
254	3B	3	82.567135	27.609209
269	3B	4	82.569981	27.608419
352	3B	5	82.568676	27.609327
412	3B	6	82.567810	27.607541
53	3C	1	82.570322	27.608225
81	3C	2	82.571353	27.608051
228	3C	3	82.570810	27.608328
321	3C	4	82.572244	27.607969
337	3C	5	82.570899	27.607434
511	3C	6	82.569561	27.606691

Table 2 Tampa Bay Sampling Event
Stratified Random Sample Locations and Alternate Locations

Randomization Number	Stratum	Sampling Priority	Longitude (Deg West)	Lattitude (Deg North)
53	4A	1	82.573665	27.611013
115	4A	2	82.573049	27.613953
159	4A	3	82.570263	27.609715
166	4A	4	82.570458	27.613486
254	4A	5	82.570055	27.612218
269	4A	6	82.573283	27.611243
49	4B	1	82.575013	27.608912
81	4B	2	82.574837	27.610792
84	4B	3	82.576171	27.607726
106	4B	4	82.574059	27.608788
228	4B	5	82.574214	27.611142
263	4B	6	82.576493	27.611107

Table 3 Terra Ceia Bay Sampling Event
Stratified Random Sample Locations and Alternate Locations

Randomization Number	Stratum	Sampling Priority	Longitude (Deg West)	Lattitude (Deg North)
61	5A	1	82.582434	27.563347
337	5A	2	82.582527	27.564167
391	5A	3	82.579506	27.566828
394	5A	4	82.581459	27.562428
474	5A	5	82.584122	27.567317
505	5A	6	82.577453	27.565615
79	5B	1	82.569035	27.563381
162	5B	2	82.575371	27.565223
284	5B	3	82.569755	27.564113
286	5B	4	82.576777	27.560857
307	5B	5	82.574917	27.563170
316	5B	6	82.576665	27.560082
7	6A	1	82.589713	27.553985
33	6A	2	82.589323	27.558584
44	6A	3	82.585167	27.559705
48	6A	4	82.588980	27.557243
112	6A	5	82.592748	27.556631
149	6A	6	82.588290	27.560689
6	6B	1	82.579427	27.552126
9	6B	2	82.586231	27.551317
23	6B	3	82.582430	27.556000
39	6B	4	82.585446	27.550965
60	6B	5	82.585165	27.553947
82	6B	6	82.584409	27.553486
25	7A	1	82.601372	27.543038
53	7A	2	82.597358	27.549727
74	7A	3	82.603453	27.546904
89	7A	4	82.595538	27.549911
107	7A	5	82.597292	27.544475
119	7A	6	82.599181	27.542070
1	7B	1	82.591863	27.537389
10	7B	2	82.591782	27.545125
13	7B	3	82.592996	27.537258
19	7B	4	82.594941	27.540179
40	7B	5	82.589477	27.547480
54	7B	6	82.595419	27.542384
18	8A	1	82.607922	27.529740
24	8A	2	82.605915	27.535828

Table 3 Terra Ceia Bay Sampling Event
Stratified Random Sample Locations and Alternate Locations

Randomization Number	Stratum	Sampling Priority	Longitude (Deg West)	Lattitude (Deg North)
96	8A	3	82.600027	27.538261
115	8A	4	82.605619	27.536364
118	8A	5	82.604208	27.541661
185	8A	6	82.602355	27.541023
14	8B	1	82.603626	27.531567
17	8B	2	82.596937	27.538170
64	8B	3	82.602189	27.527459
81	8B	4	82.599776	27.534211
88	8B	5	82.601673	27.528846
90	8B	6	82.606585	27.528997