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U.S. EPA Region 3 403(c) Determination Of Bethany Beach, DE And Ocean City, MD Ocean Outfalls

U.S. EPA REGION III 403(C) DETERMINATION

OF BETHANY BEACH, DE AND OCEAN CITY, MD OCEAN OUTFALLS

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A. Purpose

The purpose of this document is to determine that the 402 requirements of the Clean Water Act (CWA) are being met at two of Region III's ocean outfalls. The Ocean Discharge Criteria, Section 403(c), of the CWA states:

> No permit under section 402 of this Act for a discharge into the territorial sea, the waters of the contiguous zone, or the oceans shall be issued, after promulgation of guidelines established under section (c) of this section, except in compliance with such guidelines.

The determination is based on U. S. Environmental Protection Agency (EPA), Region III's five year Ocean Outfall Study and the findings of the 1992 follow-up study. The determination is intended to assist both the state and the public in assessing impacts and compliance of the permit with regards to the guidelines prescribed by 403(c) of the CWA.

B. Background

Under the authority of the Clean Water Act, the U.S. Environmental Protection Agency or delegated states issue National Pollution Discharge Elimination System (NPDES) permits to discharge into navigable waters if the effluent meets all applicable requirements of the law. Section 403(c) of the Federal Water Pollution Control Act establishes criteria to assess the impact of ocean discharge on surrounding biological communities in the territorial seas, the contiguous zone, and the ocean. The permit issued by the Agency, in addition to other applicable requirements, must satisfy the ocean discharge guidelines as set out in 40 CFR 125.120-124 (see Table 1) from which EPA must determine whether a discharge will, or will not, cause "unreasonable degradation" on the marine environment. (U.S. EPA_E, 1991, p.5). Unreasonable degradation is defined in the 403 regulations as:

> * Significant adverse changes in ecosystem diversity, productivity, and stability of the biological community within the area of discharge and surrounding biological communities,
>
> * Threat to human health through direct exposure to pollutants or through consumption of exposed aquatic organisms, or
>
> * Loss of aesthetic, recreational, scientific, or economic values which is unreasonable in relation to the benefit derived from the discharge (ibid, p.5).

"If technology-based and water-quality based limitations are met by the discharger, but it is determined that the discharge will cause unreasonable degradation of the marine environment, then additional restrictions must be imposed on the discharge to ensure that unreasonable degradation does not occur" (U.S. EPA_I, 1992, p. 2).

TABLE 1: OCEAN DISCHARGE GUIDELINES[1]

(1) Quantities, composition, and potential bioaccumulation or persistence of the pollutants to be discharged;

(2) Potential transport of the pollutants by biological, physical, or chemical processes;

(3) Composition and vulnerability of potentially exposed biological communities including
* unique species or communities,
* endangered or threatened species,
* species critical to the structure or function of the ecosystem;

(4) Importance of the receiving water area to the surrounding biological community, e.g.;
* spawning sites,
* nursery/forage areas,
* migratory pathways,
* areas necessary for critical life stages/functions of an organism;

(5) The existence of special aquatic sites, including (but not limited to)
* marine sanctuaries/refuges,
* parks,
* monuments,
* national seashores,
* wilderness areas,
* coral reefs/seagrass beds;

(6) Potential direct or indirect impacts on human health;

(7) Existing or potential recreational and commercial fishing;

(8) Any applicable requirements of an approved Coastal Zone Management Plan (CZMP);

(9) Such other factors relating to the effects of the discharge as may be appropriate;

(10) Marine water quality criteria.

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[1]U.S. EPA_E, 1991, p.6.

"If sufficient information is unavailable to make a determination that "no unreasonable degradation" will result, the Regional Administrator, or State Director in a delegated state, may issue a permit if s/he determines that the discharge will not cause "irreparable harm" to the marine environment. Irreparable harm is defined in the Clean Water Act as 'significant impacts occurring after the date of permit issuance that will not be reversed after cessation or modification of the discharge.' The permit, however, must require an ongoing monitoring program to allow a determination of whether unreasonable degradation may occur" (U.S. EPA_A, 1992, p. 2).

Region III conducts near coastal monitoring to fulfill EPA's mandated responsibilities under the Marine Protection, Research, and Sanctuaries Act of 1972 and the various statutes of the Water Pollution Control Acts Amendments of 1972, 1977, and 1987 (CWA). The near coastal waters of Region III have been monitored since the 1970's. The programs have adapted to the changing utilizations of and stresses on these waters, primarily concerning sewage outfalls. The phasing out of industrial waste and municipal sludge dumping has diminished some of the stress forced upon these waters. Yet increased recreational use of the Delmarva peninsula and its coastal waters as well as increased concerns over water quality prompted the EPA to conduct an in depth study of the ocean outfalls in the Mid-Atlantic Bight. (U.S. EPA_B, 1992, p. 3). The three outfalls in Region III are located off the coast of Bethany Beach, DE, Ocean City, MD, and Virginia Beach, VA (see Table 2).

The multipurpose design of the five year Ocean Outfall study had been to determine whether the discharges are a public health threat and whether they have impact on the surrounding benthic environment. The study found that the discharges are not a public health threat but the benthic ecology has been impacted. The recently released report, The Mid-Atlantic Bight, *Monograph Series*: Report of Sediment Quality Near Ocean Outfalls FY87-91 (February, 1992), on the monitoring program suggests that although the three facilities meet their NPDES permit requirements, the criteria of "no unreasonable degradation" may not be met at Region III's ocean outfall locations. The report makes recommendations for action including continued sediment quality monitoring, additional field studies to determine benthic infaunal condition, and more sophisticated analyses on existing and future data. (ibid, p. 3). The follow-up, July, 1992 study is designed to determine whether the impact on the benthic environment is statistically significant and eco-relevant. As with this report, the survey will study the Bethany Beach, DE and Ocean City, MD sewage outfalls for 403(c) determination.

C. Near Coastal Initiative

The recent, EPA adopted National Coastal and Marine Policy strongly emphasizes the government's commitment to the protection, restoration, and maintenance of the nation's coastal and marine waters. Specific goals had been proposed for recovery of full recreational use of shore, beaches, and waters;

TABLE 2: REGION III WASTEWATER FACILITIES

Name	NPDES NO.	Permit Expiration Date	Flow(MGD)[2]
South Coastal Regional Wastewater Facility Bethany Beach, DE	DE 0050008	9/30/95	3.0
Ocean City Wastewater Treatment Plant Ocean City, MD	MD 0020044	6/30/95	10.79 max
HRSD Atlantic Sewage Treatment Plant Virginia Beach, VA	VA 0081248	8/01/95	31.0

[2]An average annual flow rate is used here unless otherwise noted.

restoration of the nation's shell fisheries and salt water fisheries; strict limitations on ocean disposal of wastes; and, a better understanding of pollution effects through scientific research and monitoring (U.S. EPA_A, 1988, p. 2). EPA Region III has implemented the Near Coastal Initiative to rationally and effectively address the demands of this policy. The Near Coastal Initiative involves various programs including water quality and sediment quality analysis, which the above study addressed. An aerial surveillance component has been designed to provide an overview of the activities of the near coastal waters of the Mid-Atlantic Bight.

D. Facility and Outfall Characteristics

The South Coastal Regional Wastewater Facility is located in Sussex County, DE, south of Ocean View and the Bethany Beach Area. The facility currently services domestic wastewater from Fenwick Island and North and South Bethany Beach. There are no industrial facilities within the wastewater facility's jurisdiction. The flow design capacity is 6.0 million gallons per day (mgd). The current peak flow averages about 3.0 mgd during the summer months and .7 mgd during the winter months. The treatment begins with a hydrogen peroxide pretreatment at the two pumping stations. Preliminary treatment follows with a barminutor/barscreen followed by an aerated grit chamber and surge tank. Biological treatment consists of three parallel systems using activated sludge, clarification and aerobic digestion. After clarification, the wastewater is filtered through microstrainers and chlorinated before being pumped to the Atlantic Ocean for disposal. The outfall pipe extends approximately one mile out from the coast. (NPDES Permit # DE 0050008).

The Ocean City Wastewater Treatment Plant treats exclusively domestic wastewater from Ocean City, MD and the surrounding area. The flow design capacity is 14.0 mgd with an average flow of about 4.78 mgd and a maximum summertime flow of 10.79 mgd. The treatment consists of a primary clarifier with bar screens and grit chambers followed by pure oxygen activated sludge and a secondary clarifier. Chlorination and dechlorination complete the process before the water is pumped into the Atlantic Ocean for disposal. The outfall pipe extends approximately two miles out from the coast. (NPDES Permit # MD 0020044).

E. Regulatory Requirements

Both the South Coastal Regional Wastewater Facility in Sussex County, DE and the Ocean City Wastewater Treatment Plant in Ocean City, MD are in compliance with the NPDES permit requirements. The characteristics of the two outfalls are reviewed below in terms of the ten guidelines delineated in Table 1.

1. *Quantities, composition, and potential bioaccumulation or persistence of the pollutants to be discharged;*

Discharge pollutants do not vary significantly from limits set forth in NPDES discharge permits. Monitoring is the primary means of determining whether effluent limitations contained in the NPDES permit are met. The NPDES permit specifies discharge parameters to be measured, measurement frequency, sample type, and sample location. The permittee is self-monitoring and sends the records to EPA, Region III Water Permits and Enforcement Branch as well as to the respective state programs each month. Monitoring data are reviewed for permit compliance and entered into the Permit Compliance System (PCS) data base. (U.S. EPA$_I$, 1992, p. 8) Neither the Bethany Beach, DE, nor the Ocean City, MD facility process and discharge industrial waste; both facilities service domestic waste water exclusively. Monthly NPDES discharge monitoring reports, therefore, track the discharge of the required marine water criteria: total suspended solids, BOD_5, Fecal Coliforms, total residual chlorine, dissolved oxygen, pH, and temperature. Heavy metals and other toxics are not anticipated in the waste stream or discharged from either of these facilities. (Barath, M. pers.com., 1992; U.S. EPA, 1976.)

Under its Near Coastal Initiative introduced in 1987 and in compliance with the 1989 National Coastal and Marine Policy, U.S. EPA Region III has been conducting intensive monitoring of its near coastal waters (U.S. EPA$_A$, 1988). The long term, intensive study provides an historical record, and thus a better understanding, of the status and trends of the coastal waters. Subsequently, any influences resulting from ocean outfalls will be detected more easily. The conditions present in the near coastal waters are determined by a number of factors including seasonal changes, meteorological events, as well as the estuarine influx from the Delaware and Chesapeake Bays. The interactions of these changing variables are complicated, and yet the general status and trends of the near coastal waters has emerged. (U.S. EPA$_F$, 1990, pp. 25-26.) *p234X

In general, the water quality has been found to be within acceptable levels with no noted areas of stress. Temperature, salinity, and dissolved oxygen values has been within expected ranges. Bacteria levels did not exceed the 200 cells/100 ml shellfish and bathing beach standards. Although nutrient values have been generally low, elevated dissolved inorganic nitrogen concentrations, primarily Ammonium-nitrogen, have been found just south of the Delaware and Chesapeake Bays. The near coastal waters adjacent to the bays have been distinguished statistically as separate water masses. This decisively points to the two bays as strong point dischargers of dissolved inorganic nitrogen to the near coastal waters. The Delaware Bay, just north of the two outfall pipes under study, is the largest contributor of nutrients to the near coastal waters of Region III. Thus, any potential influence on the water column nutrient levels by the discharge from these two outfalls is minimal in comparison. (U.S. EPA$_D$, 1987, pp. 32-41; U.S. EPA$_F$, 1990, pp. 25-34; Barath. M. and Muir, W., pers. com., 1992.)

An additional aspect of their Near Coastal Initiative, Region III has assessed the potential transport and subsequent impact of the pollutants using sediment impact. The water column is fluid and will dilute, spread out and remove pollutants from the point of discharge. The benthic environment, on the other hand, tends to be more stable and static. (U.S. EPA_8, 1992, p. 9). Any long term negative and cumulative impact from the ocean discharges is likely to manifest itself on the benthic environment. The final report of the five year study, The Mid-Atlantic Bight, *Monograph Series*: Report of Sediment Quality Near Ocean Outfalls FY87-91 (February, 1992), summarizes the findings on pollutant impact and transport from the outfall effluent. Five parameters of sediment quality have been used to determine effluent influence:

* Most Probable Number (MPN) of Enterococci
* MPN of *Clostridium Perfringens*
* Presence of Acanthamoebae
* Number of Antibiotic Resistances found in the Enterobacteria Isolates
* Visual Observation of Sediment Modification (p. 12).

Since the individual parameters all measure sewage effluent influence, the study had adopted a more powerful determination of the degree of this influence by combining all the parameters into a single metric called the Sediment Quality Index (SQI). These parameters have been examined for each of the 14 to 16 stations in the vicinity of the two outfalls (the sample grid), four months during each of the five years. The parameters then have been assessed for monthly and yearly averages and trends. For the purpose of this discussion, annual metrics will be used (ibid, p. 13).

Overall, sediment quality parameter values have been very high at Bethany Beach compared to the other outfalls studied. The yearly trends at Bethany Beach indicates increasing influence during the five year monitoring period. This trend is most pronounced in Enterococci, C.*perfringens*, and sediment modification. The annual SQI shows a relatively sharp increase in influence in 1991 after a flat trend in preceding years. Perhaps more significantly, fairly wide ranges in SQI exists among stations in the Bethany Beach sample grid, a finding consistent with the ridge and swale topography found in the area. Also, one station consistently has ranked among the highest (most influenced) in SQI; this station is in close proximity to the outfall pipe. (ibid, pp. 21-23.)

Values at the Ocean City sampling grid have been consistently lower than at Bethany Beach. Ocean City, however, experiences a great change in population, from 10,000 in winter to 300,000 during the summer weekends. The yearly trend for the bacteria and for the SQI shows peak values in 1988 and 1989 and decreases in both 1990 and 1991. SQI ranking among the stations for each parameter show a wide range of values between the most influenced and the least influenced stations. The latter indicates a core group of stations that exhibit little or no sewage effluent

influence; these stations are located along a ridge that runs diagonally across the sampling grid. In contrast, stations located in depressions exhibit higher SQI values. In particular, one station located furthest from the outfall pipe and yet at the deepest point in the sample grid experienced the greatest degree of influence. It appears that relative depth is more important than distance from the pollution source. (ibid, pp. 30-32.)

No bioaccumulation studies have been conducted as there is no evidence that bioaccumulation occurs in the flora or fauna of the near coastal waters near these outfalls (Barath, M. and Muir, W., pers. com., 1992).

2. *Potential transport of the pollutants by biological, physical, or chemical processes;*

Due to its fluidity, water quality analysis is not a sufficient indicator of pollution transport. On the other hand, sediment quality analysis often provides insight to the transport and impact of discharged pollutants. Sediments can be a sink for many pollutants deposited in the ocean. These pollutants can be easily transported within the ocean environment and to non-marine organisms. Sand fauna tend to be mobile and adept at burial and recovery from moving sediment. Water and sediment oxygen levels are high and suspended food is abundant (Pratt, 1973, pp. 5-9). The degree of activity in this ecosystem varies with the substrate. Both outfalls are known to emerge in areas with a ridge and swale topography (U.S. EPA_B, 1992, p.4). Swales and other depressions may, and often do, provide a reservoir of concentrated, residual pollutants which may affect the surrounding area long after the loading has concluded or diminished. The recently completed five year study of the Mid-Atlantic Bight suggests that areas of greater depth exhibit greater impact from the outfall (ibid, p.32). Thus, despite of the mobility of both the sediment and fauna of the surrounding area, evidence suggests that the benthic environment has been impacted, especially in the deeper regions around the outfalls.

An additional study in July, 1992, had been designed to examine further the extent of the influence in terms of distance from the outfall as well as the degree of influence within the benthic environment. Core samples from nine stations at or around the two outfalls will be analyzed for species composition and diversity, grain size, total organic carbons, and total sulfides. The cores will be subsampled for public health bacteriology, similar to the above, including total coliform, E.coli, enterococci, and C.*perfringens*. A bioassay will also performed on dredge samples from five of the nine stations to determine toxicity. The BOSS plume tracking system will be implemented to detect salinity, density, temperature, sigma t, oxygen, transmissivity, and chlorophyll a of the effluent. (Please see Appendix A: Cruise Plan; Operation SOWE, July, 1992.)

3. *Composition and vulnerability of potentially exposed biological communities, including:*

* *unique species or communities,*
* *endangered or threatened species,*
* *species critical to the structure or function of the ecosystem;*

According to the National Marine Fisheries Service, the near coastal waters of the Middle Atlantic Bight are the occasional home to several endangered and threatened species. The migratory patterns of the Humpback whale, Fin whale, and the Right whale, all of which are endangered species, include the near coastal waters along the Delmarva peninsula. These waters are also home to the Green turtle and the Ridley turtle, which are also endangered, as well as the Loggerhead turtle, which is a threatened species. To the degree that these species are affected by the sewage effluent, a section 7 consultation needs to be done. (Beach, D., pers. com., 1992.)

The aerial surveillance program, part of Region III's Near Coastal Initiative, has been designed to collect data on living species within the near coastal waters of the Mid-Atlantic Bight. During the four years since the program has commenced, occasional turtle sightings have been made, including 2 in the area of the outfalls during the summer of 1991. No whale sightings have been recorded. Though not endangered, dolphins are sighted throughout the summer near these ocean outfalls. (U.S. EPA_H, 1992, pp. 17-19; Barath, M., pers. com., 1992.)

4. *Importance of the receiving water area to the surrounding biological community, e.g.,*

* *spawning sites,*
* *nursery/forage areas,*
* *migratory pathways,*
* *areas necessary for critical life stages/functions of an organism;*

According to the National Marine Fisheries Service, there are no special aquatic sites, spawning or nursery areas in the area of the ocean outfall pipes. The near coastal waters of Delaware and Maryland are a migratory pathway for several marine fish including juvenile sea trout, summer flounder, and croakers. (Goodger, T., pers. com., 1992.)

The upcoming survey will sample the outfall areas to assess the nature of the community structure. Measures of community structure will include species composition and diversity, biomass, dominance, abundance of pollution sensitive species, and the abundance of pollution tolerant and opportunistic species. Measures of community structure within the areas of effect will be compared with similar communities in unaffected (reference) areas to assess the effects of sewage effluent. (See Appendix A.)

5. *The existence of special aquatic sites, including (but not limited to)*
   * *marine sanctuaries/refuges,*
   * *parks or monuments,*
   * *national seashores,*
   * *wilderness areas,*
   * *coral reefs/seagrass beds;*

The two outfall pipes in question are located in the near coastal waters of the Mid-Atlantic Bight. The Bethany Beach outfall pipe is located approximately 1 mile off shore; the Ocean City, MD outfall pipe is approximately 2 miles off shore. Because of the outfall locations, expected influence on special aquatic sites is negligible. (NPDES permit # DE 0050008, MD 0030044.)

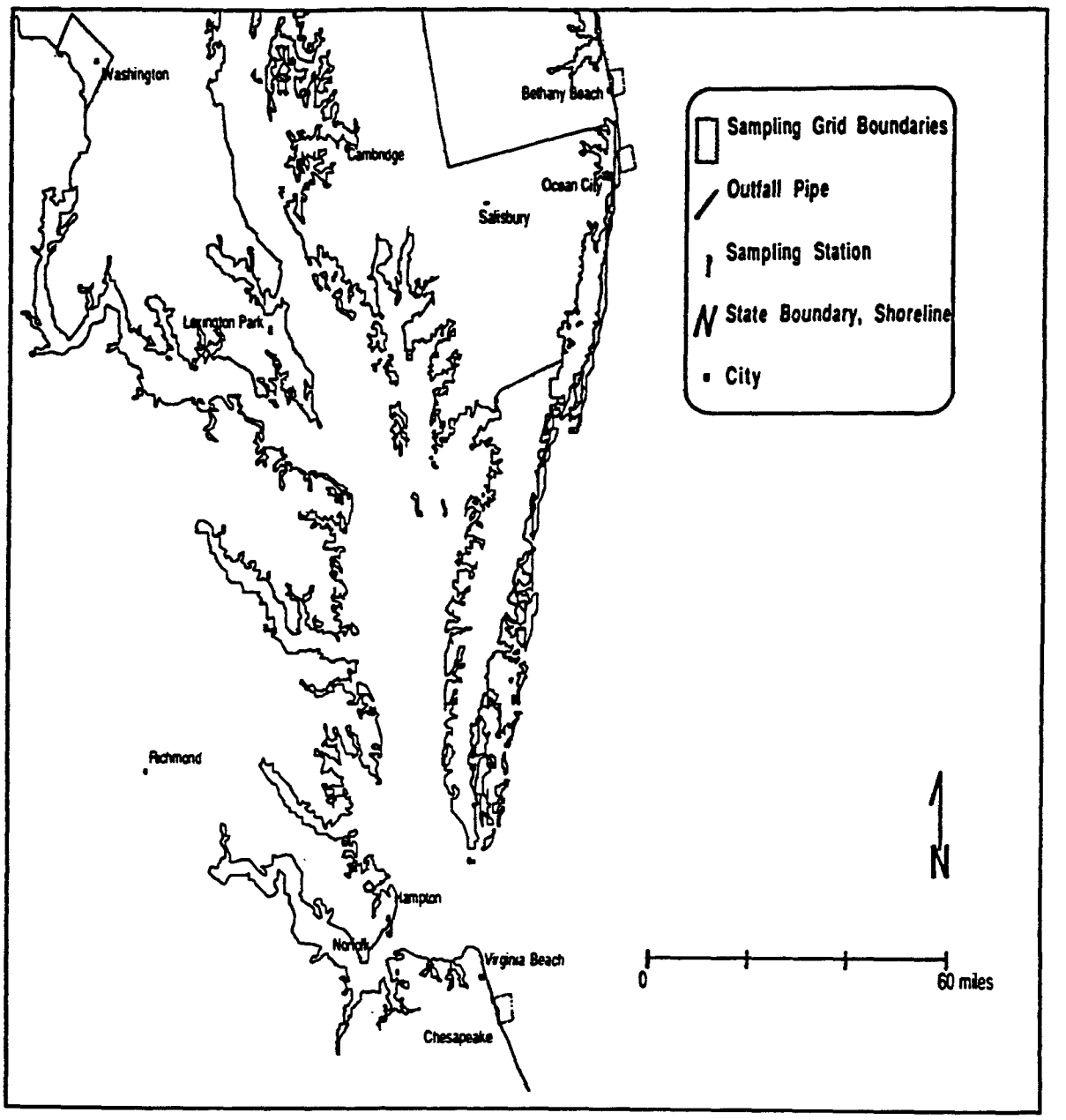
The Norfolk Canyon is the nearest marine sanctuary within the Region, and it is over 100 miles south of the Ocean City outfall pipe. The Assawoman State Wildlife Area is located on shore, in between the two outfall locations. The Primehook National Wildlife Refuge is just north of Bethany Beach along the shore of the Delaware Bay. Assateague State Park and Assateague National Seashore are both south of the Ocean City outfall location. All of these aquatic sites are outside the influence of the outfalls. There are no coral reefs or seagrass beds in the Region's marine waters. (Please see the attached maps.) (Gusey, 1976, p. 33; Muir, W., pers. com., 1992.)

6. *Potential direct or indirect impacts on human health;*

There is negligible health risk involved from effluent dispersion in the water column. Both outfall pipes empty a significant distance from any potential direct contact with swimmers. The sediments, however, are known to be a sink for many contaminants in the marine environment. Contaminants in the sediments are available for transport within the marine community and to non-marine organisms. The public health risk exists in the bacteria from the effluent and in the commercial and sport-valued fauna which are later consumed by the public.

EPA, Region III's recent study of the sediment quality near their ocean outfalls has indicated that there is no public health threat from the outfall effluent. The Mid-Atlantic Bight, *Monograph Series:* Report of Sediment Quality Near Ocean Outfalls FY87-91 (February, 1992), the five year monitoring report, discusses the public health impact of both enteric bacteria and pathogenic amoebae. Although there are various forms of enteric bacteria which are of public health concern, *Clostridium perfringens*, which produce long lived spores, and enterococci, a fecal streptococci, have been documented at both the Bethany Beach and the Ocean City Outfalls. *C. perfringens* produce spores which remain viable for years. They are used to trace the movement and dilution of sewage in the environment. Fecal streptococci, on the other hand,

FIGURE 1: THE NEAR COASTAL WATERS OF EPA REGION III



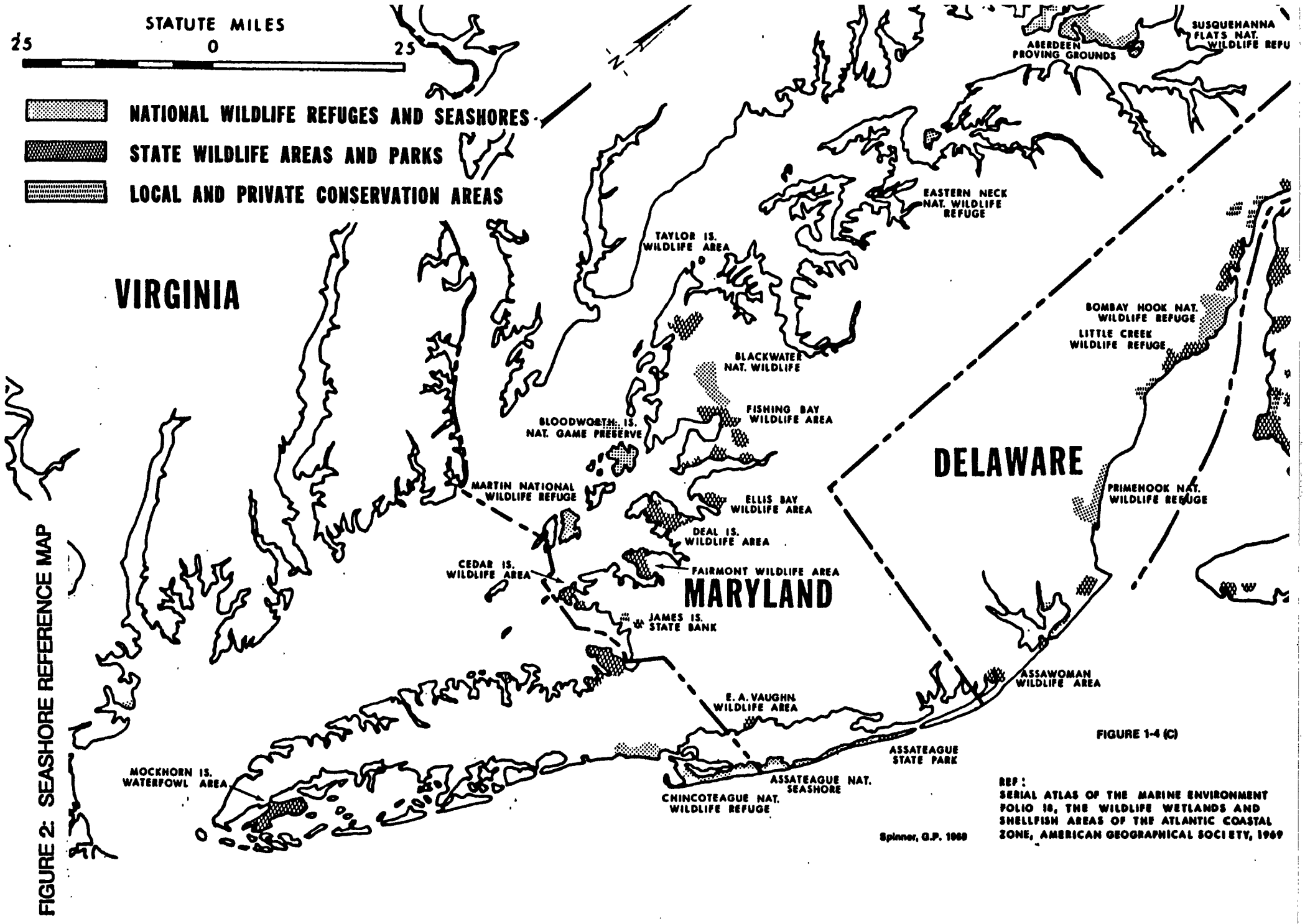


FIGURE 2: SEASHORE REFERENCE MAP

FIGURE 1-4 (C)

REF :
SERIAL ATLAS OF THE MARINE ENVIRONMENT FOLIO 18, THE WILDLIFE WETLANDS AND SHELLFISH AREAS OF THE ATLANTIC COASTAL ZONE, AMERICAN GEOGRAPHICAL SOCIETY, 1969

does not remain viable for a long time period. Their presence is used to indicate recent sewage impact and potential human health risk. Thus, enterococci is an indicator of a public health threat whereas *C.perfringens* is not, although it is a public health concern. (U.S. EPA_B, 1992, p. 10.) The yearly trend for Bethany Beach is increasing for both bacteria; the significant increase of *C.perfringens* suggests that it has become endemic to the area (ibid, p. 21). The yearly trend for Ocean City is remarkably similar for enterococci and *C.perfringens*, peaking in 1988 and 1989 and decreasing in 1990 and again in 1991 (ibid, p. 30).

The study also examined the virulence of the bacterial community by measuring whether the isolated species are resistant to antibiotic drugs. "The more drugs that isolated species are resistant to, the greater the virulence of the bacterial community in a given sample" (ibid, p. 10). The yearly trend for drug resistance for the Bethany Beach community exhibited a significant decline from its peak year of resistance in 1989 (ibid, p. 21). The Ocean City bacterial communities have also shown a decline in drug resistance, most significantly from 1990 to 1991 (ibid, p. 30).

The pathogenic amoebae studied was the Amoebida: Acanthamoebae, a cyst forming protozoan which originates exclusively from sources of human origin such as sewage and sewage sludge. Thus, acanthamoebae, like *C.perfringens*, serves as a good tracer of human waste in the environment. It represents a public health concern since it can cause eye lesions and other conditions. "Cases involving wind surfers and bathers who became infected after their eyes were scratched by sand under contact lenses have been documented" (ibid, p. 10). After peaking in 1989, the yearly trend for acanthamoebae for both Bethany Beach and Ocean City outfalls has been decreasing (ibid, p. 21, 30).

7. Existing or potential recreational and commercial fishing;

The area of interest is an important shellfish and finfish habitat. Millions of people annually engage in recreational fishing, although little to no commercial fishing occurs in these immediate waters (ibid, p. 3). Some of the most commonly caught sport fish off the coast of Ocean City, MD--Sea Basses, Billfishes, Cods, Hakes, Pollock, Porgies, Mackerels, tuna, and crabs, to name a few (Gusey, 1976, p. 354-355). Region III's aerial surveillance data shows the presence of fish schools and much recreational fishing pressures in this stretch of the near coastal waters (U.S. EPA_H, 1992, pp. 8-14).

8. *Any applicable requirements of an approved Coastal Zone Management Plan (CZMP);*

Both wastewater treatment facilities have been granted NPDES permits. Upon regular monitoring, they have been found to be in compliance with all NPDES regulations. By virtue of the state regulatory nature, all requirements are consistent with the respective state's CZM Plan. U.S. EPA, Region III's monitoring of these permitted outfalls, also, is consistent with and allowable under the state's CZM Plan. (Cooksey, S. and Ghigiarelli, E., pers. com., 1992.)

9. *Such other factors relating to the effects of the discharge as may be appropriate:*

As described above, Region III is interested primarily in studying the sewage outfall impact on the surrounding benthic environment. If there is any significant, long term influence, it will most likely manifest itself in the local benthic community. Techniques such as sediment chemistry and bioassay will address additional factors such as TOCs, total sulfides, and toxins. Another factor is organic enrichment of the sediment which overloads the natural ability to assimilate. Plume tracking is another technique which provides measurements of salinity, temperature, transmissivity measurements of the effluent plume. The July, 1992 study will take all of these factors into consideration. (Please see Appendix A.)

10. *Marine water quality criteria:*

The NPDES permit process requires continual monitoring of the wastewater effluent prior to disposal. Each state requires that the facilities meet their established specific water quality criteria. Both facilities in question process domestic wastewater only, and not industrial waste; the parameters to be examined for domestic wastewater are as follows (also see Table 3):

* Dissolved Oxygen
* Total Suspended Solids
* Fecal Coliform
* Total Residual Chlorine
* pH

Both facilities meet the state criteria, where applicable, in all but two areas. First, the detected amount of total residual chlorine (TRC) is high, on a magnitude of 10 times greater than the established water quality criteria. However, the potential for chloroamines, the most significant threat resulting from high TRCs, is low because it is not accompanied by a high amount of organic solids in the discharge effluent. Without solids to adhere to, TRCs quickly dissipate into the receiving waters and are

unlikely to accumulate in the sediment. Whether or not the organically enriched sediment at certain stations is found to contain chloroamines and exhibit resulting toxicity will be determined as part of the July, 1992 study. Also, toxicity tests have shown no residual toxicity in the effluent of either treatment facility. (Barath, M. and Muir, W., pers. com., 1992.)

Second, the South Coastal Regional Wastewater Facility in Delaware has an average minimum pH of 6.2 which falls below the minimum criteria of 6.5. This is a measure of the effluent before it is discharged into the ocean. The effluent is quickly diluted upon contact with ocean water, which by its very nature has a high buffering capacity resulting in a rapid return to ambient pH. (ibid.)

F. Summary and Conclusion

The purpose of this document has been to determine that the discharge from the Bethany Beach, DE and the Ocean City, MD outfalls had not caused "unreasonable degradation" of the marine environment as defined by the 403 regulations of the CWA. The two wastewater facilities have been described and characterized according to the ten Ocean Discharge Guidelines delineated in 40 CFR 125.120-124. The primary source of information has been EPA, Region III's five year Ocean Outfall Study which had commenced in 1987. To date, final conclusions cannot be made; a more complete determination is dependent on the data collected during the July, 1992 study.

Some preliminary conclusions, however, can be drawn. First, based on EPA Region III's five year Ocean Outfall Study, the two ocean outfalls do not present a significant public health threat. With the exception of enterococci and *C.perfringens* at Bethany Beach, the yearly trends for enteric bacteria, their virulence, and pathogenic amoebae have been decreasing since 1989 for both outfall locations. Second, that same study indicates that the two ocean outfalls are degrading the surrounding benthic environment. Sediment quality serves as a good indicator of long-term pollutant disposal effects. The Sediment Quality Index[3] shows a sharp increase in 1991 after a flat trend at Bethany Beach (U.S. EPA_B, 1992, p. 21-22). The Sediment Quality Index shows a steady increase of influence through 1990 with a substantial decrease in influence in 1991 at Ocean City, MD (ibid, pp. 30-31). Therefore, an assessment of the ten Ocean Discharge Criteria indicate that three criteria need further study:

1. *Quantities, composition, and potential bioaccumulation or persistence of the pollutants to be discharged;* and

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[3]The five individual parameters used in the five year ocean outfall study as a measure of sewage effluent influence are combined into a single metric called the Sediment Quality Index (SQI). The SQI decreases the type II error, thereby reducing the chance of a false positive result. In addition, the SQI minimizes much of the variability found in the individual parameters.

TABLE 3: WATER QUALITY CRITERIA[4]

CRITERIA	DELAWARE	MARYLAND
BOD 5	AA = 9.8 mg/l max = 13.0 mg/l min = 7.5 mg/l	
Dissolved Oxygen (X > 5.0 mg/l; X > 6.0 mg/l)		min = 6.1 mg/l
Total Suspended Solids	AA = 6.8 mg/l max = 8.4 mg/l min = 4.0 mg/l	13.3 mg/l
Fecal Coliform DE: X < log mean of 200/100 ml MD: X < 14 MPN/ 100 ml	max = 12.5/100ml	max = 4.8 MPN/ 100 ml
Total Residual Chlorine (X < 10 ug/l)	AA = 2.4 mg/l max = 2.7 mg/l min = 2.1 mg/l	max = 1.03mg/l
PH 6.5 < X < 8.5	max = 7.6 min = 6.2	max = 7.15 min = 6.6

NOTE: AA = annual average
max = maximum monthly average
min = minimum monthly average

[4] (U.S. EPA, 1976; NPDES permit #'s DE 0050008, and MD 0020044; Muir, W., pers. com., 1992.)

2. *Potential transport of the pollutants by biological, physical, or chemical processes;*

9. *Such other factors relating to the effects of the discharge as may be appropriate:*

As mentioned above, the July, 1992 study had been designed for just that purpose. The persistence and transport of the pollutants on the benthic environment have been examined. The July, 1992 survey also has investigated the potential toxic effects of the sediment: toxicity studies of the effluent and macrobenthic invertebrate studies have been conducted to ascertain the composition and changing nature of the biological community structure. Third, the July, 1992 study has been conducted to determine the statistical significance as well as the eco-relevance of the conclusions drawn from the five year study. (See Appendix A.) The data and analysis from the July, 1992 survey will provide the basis for a more thorough determination of no unreasonable degradation resulting from two of EPA Region III's ocean outfalls.

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Beach, Douglas. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Habitat and Protected Resources Division. Oxford, MD 21654.

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Ghigiarelli, Elder, Chief. Coastal Zone Consistency Unit, Water Resources Administration. Department of Natural Resources, State of Maryland.

Goodger, E. Timothy, Assistant Coordinator. United States Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service. Habitat and Protected Resources Division. Oxford, MD 21654.

Muir, William C., Regional Oceanographer. U.S. Environmental Protection Agency, Region III. Office of Marine and Estuarine Protection.

APPENDIX A

EPA Contract 68-C8-0105
WA# 3-125-1
WA# 3-131-1
WA# 3-311-1

CRUISE PLAN

OPERATION SOWE

CRUISE 92 - 2

EPA O.S.V. PETER W. ANDERSON

JULY 21 - 25, 1992

William C. Muir
Senior Oceanographer

Mark A. Barath
Work Assignment Manager

George R. Gibson
Criteria Specialist

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Cruise Planner

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Philadelphia, PA 19107
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TABLE OF CONTENTS

SURVEY PLAN

Date:
August 7, 1992

1.0 GENERAL

Project Title: Mid-Atlantic Near Coastal Water Initiative
Survey Title: 403(C) Assessment at Bethany Beach, De and Ocean City, MD and Near Coastal Eutrophication Assessment
Anderson Requested By: William C. Muir
Organization: EPA, Region III

Project/Work Assignment Manager: William C. Muir and George R. Gibson
Organization: EPA, Region III and EPA Headquarters

Survey Chief Scientist: William C. Muir (3ES41)
Organization: EPA, Region III
Organization Address: 841 Chestnut Street, Philadelphia, PA 19107
Organization Telephone No.: (215)597-2541
FAX No.: (215)597-7906

EPA Funding/Contract No.: 68-C8-0105
Work Assignment No.: WA3-311
Work Assignment Leader: William C. Muir

Contractor Organization: Battelle
Contractor Telephone No.: (617)934-0571
FAX No.: (617)934-2124

Comments:

2.0 SCHEDULE OF OPERATIONS

Mobilization Date: July 20, 1992
Location: Cape May, NJ
Departure Date: July 21, 1992
Planned Survey Duration (Days): 4
Allowable Weather/Breakdown Days: 1
Maximum Duration (Days): 5
Demobilization Date: July 25, 1992
Location: Cape May, NJ

2.1 ITINERARY OF JULY 1992 SURVEY

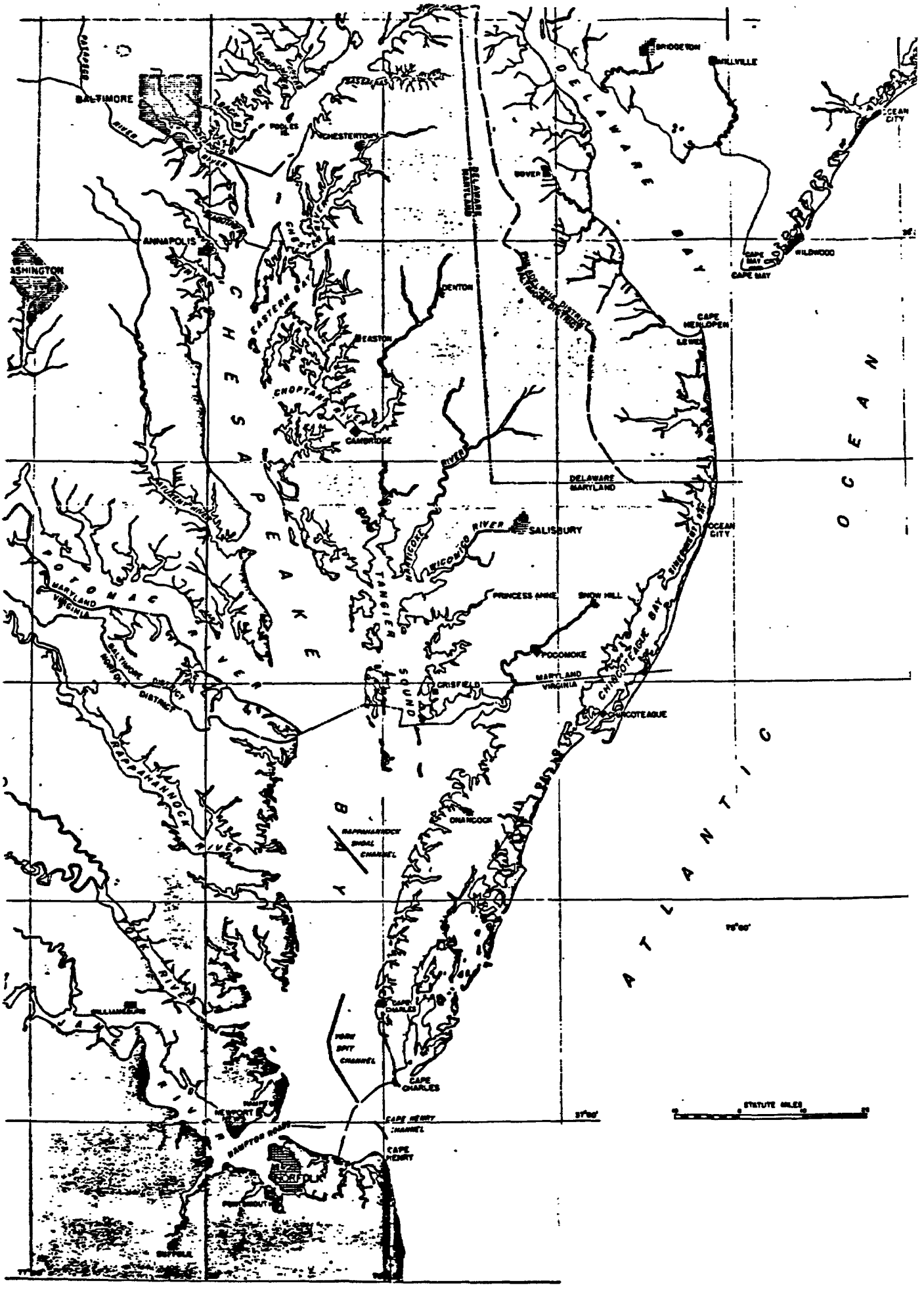
DATE	TIME	ACTIVITY
07-20-92	2200	MOBILIZATION AT CAPE MAY, NJ
07-21-92	0800	DEPART CAPE MAY, NJ FOR COASTAL EUTROPHICATION STUDY SAMPLING AT OCEAN CITY, NJ
	1030	COMMENCE COASTAL EUTROPHICATION STUDY SAMPLING
07-22-92	0400	COMMENCE 403(c) BENTHIC OPERATION AT BETHANY BEACH, DE AND OCEAN CITY, MD
07-22-92	1800	RECOMMENCE COASTAL EUTROPHICATION STUDY AT BO 4
07-23=92	2200	IN TRANSIT TO OCEAN CITY OCEAN OUTFALL
07-24-92	0800	COMMENCE BOSS OPERATION AT OCEAN CITY, MD AND BETHANY BEACH, DE OUTFALLS
07-25-92	1400	RETURN TO CAPE MAY, NJ DEMOBILIZE

3.0 BACKGROUND INFORMATION

Region III of the U.S. Environmental Protection Agency is engaged in a long term monitoring project of the near coastal waters extending from southern New Jersey south to the Virginia/North Carolina border. With this multi-disciplinary survey, EPA Region III is continuing its comprehensive evaluation of the status and trends of water quality and benthic ecology in the Mid-Atlantic near coastal waters. These activities are part of the EPA Near Coastal Initiative for assessing the current status of the Nation's marine environment. See Attachment 3.1 for presentation of the study area.

This oceanographic operation has three primary objectives. First, the proposed survey is designed to assess the cumulative impact of the two sewage outfalls along the Delaware-Maryland Coast on the surrounding benthic ecology. The overall results of a recently completed five year study indicate that the ocean outfalls within Region III are degrading the surrounding benthic environment and the degradation has worsened over the last five years. Second, the survey design and results will be assessed for possible translation into universally applicable criteria for evaluating sewage outfalls and other point source perturbations. The third major objective of this survey is the evaluation of the near coastal waters for the identification of conditions which lead to coastal eutrophication and possible dissolved oxygen depletion.

3.1 EPA Region III Near Coastal Study Area



4.0 SURVEY JUSTIFICATION AND RATIONALE

1. As mandated by the Clean Water Act, the EPA is responsible for determining "no unreasonable degradation" of the marine environment. The data collected in the 403(C) determination study will provide a better understanding of the current status and existing trends of the benthic environment and will allow for the possible identification of developing environmental and public health hazards.

2. In addition, the results of this study will be utilized to develop nationally applicable techniques and criteria for the National Biological Criteria Program and for 403(c) determination.

3. As part of the goals under EPA's Near Coastal Initiatives, the data collected in the Coastal Eutrophication Study will allow for a better understanding of current status and trends, and allow for the possible advance identification of disruptive environmental conditions.

5. The EPA O.S.V. Peter W. Anderson is the most suitable vessel for the conducting of this multi-disciplinary effort for several reasons. First, it provides the most economical method for performing this survey. Second, EPA Region III is able to accomplish a variety of different operations on a single cruise.

5.0 OBJECTIVES

1. The study is designed to statistically quantify the benthic infauna by number of individuals and taxa, TOC's, biomass, and grain size and compare across sites.

A. The benthic infauna will be collected at the nine representative stations arranged in a linear sequence. Four replicates will be taken at each station with a Smith MacIntyre sampler, totaling 36 samples (9 stations X 4 samples/station).

B. In addition, 11 sediment cores will be taken at the two control sites, A and B, totaling 22 core samples. Each core will be approximately 3 inches in diameter and 15 cm deep. Twenty cores (10 samples/station) will be analyzed for species composition and diversity.

C. Infauna analyses will be performed on 27 of the Smith-MacIntyre grab samples (3 per station) as well as on the 20 (10/11) core samples described above. In addition each grab sample and 2 of the 22 (1/11) core samples will be analyzed for TOC's and grain size.

D. A chemical analysis will be performed on the fourth Smith-MacIntyre sample from each of the nine stations. Each sample will be analyzed for total sulfides as well as for public health bacteriology including total coliform, e. coli, enterococci, and clostridium perfringens.

D. A bioassay will be performed on dredge samples from sites A, C, E, G, and I. Rhepoxynius abronious and ampelisca abdita will be used for the bioassay.

E. The BOSS plume tracking system will be used to detect salinity, density, temperature, sigma t, oxygen, transmissivity, and chlorophyll a.

2. Coastal Eutrophication Study

A. A hydrocast will be performed at fifty-four stations in eighteen transects for the determination of physical/chemical water quality characteristics in the water column. A Secchi Disc reading will also be obtained at each station occupied during daylight hours. Data collected will complement and extend the NOAA-NEMP water quality monitoring observations.

B. Surface water samples will be obtained at the forty-nine stations in the thirteen transects J 16-18, CD 11-17, CC 12-13, and C 14 for the determination of nutrients, chlorophyll a, and pheophytin a water quality characteristics. Mid-depth water samples will also be obtained at the thirteen "M" stations located approximately in the middle of the transects. These sample will be analyzed for the determination of nutrients, chlorophyll a, and pheophytin a water quality characteristics. Surface, mid-depth, and bottom water samples will be obtained at five stations (J 19 and 20, and CD 18-20) for the determination of nutrients water quality characteristics.

6.0 ENVIRONMENTAL MANAGEMENT QUESTIONS ASKED BY PROJECT/SURVEY

1. Do the total numbers of benthic individuals and of taxa differ across sites within the first 5 cm of sediment?

2. Is there any correlation between grain size, TOC's, and taxa or other metrics?

3. What are the impacts--the physical, chemical, and biological effects of the effluents?

4. Will cores provide equivalent correlation to impacts provided by the Smith-MacIntyre grabs?

5. Can we recognize biological community gradients?

6. Is there a depth gradient within the sediments?

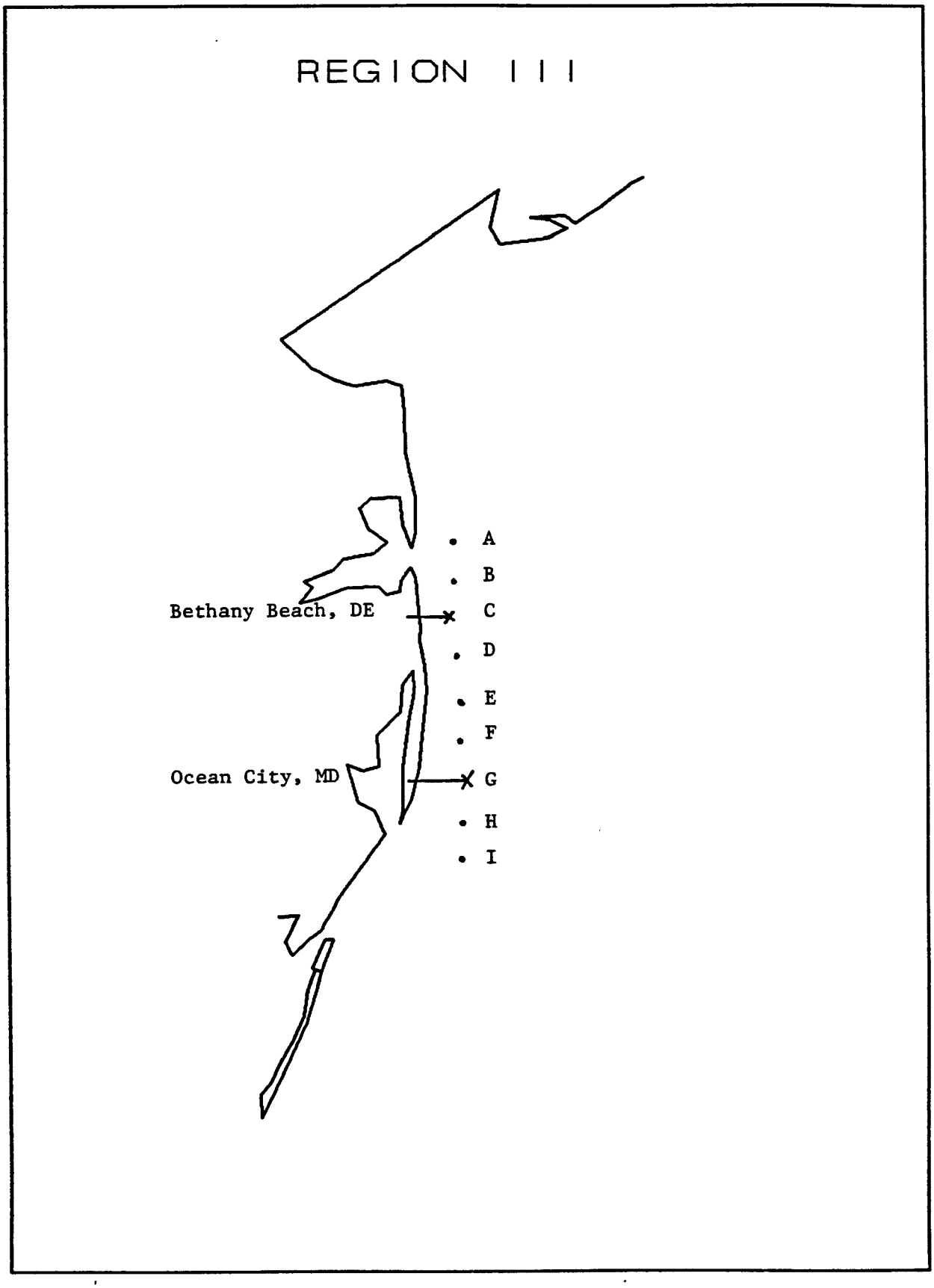
7. What is the status of the coastal water quality?

7.0 SURVEY LOCATION AND DESCRIPTION (Attach detail/tables/figures if needed)

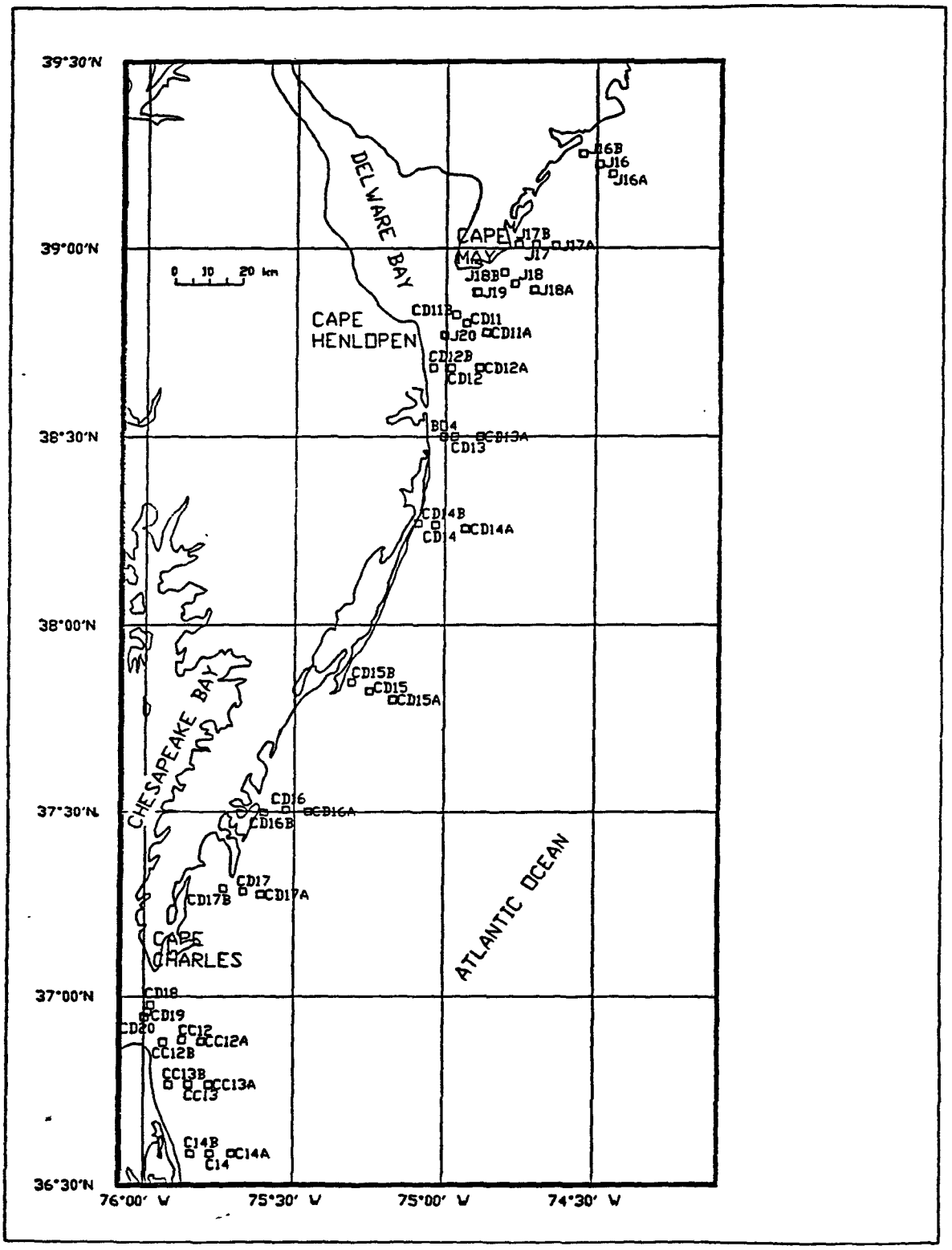
Survey Area(s) Name(s): Bethany Beach, DE and Ocean City, MD sewage outfalls Atlantic Near Coastal Waters from the South Jersey Shore to the VA/NC border

Survey Area Locations (Refer to shore): See Attached Station Tables
Survey Area Boundary Coordinates:
Survey Area Sizes:
Survey Station Types:
Number of Stations by Type:
Survey Station Sizes:
Survey Station Water Depths:
Survey Transect Types/Quantities:
Survey Transect Lengths:
Transect Line Spacings:

7.1 EPA Region III Coastal Outfall Study Location



7.2 EPA RegionIII Eutrophication Study Location



8.0 SURVEY/SAMPLING METHODOLOGIES (Attach detail/tables/figures if needed)

Method Description: All sampling activities will follow standard EPA procedures for insuring acceptable data collection. All activities relating to data and sample collection will be documented on the station log presented in Attachment 8.1. The sampling methodology protocol is presented in section 8.2. The specific sampling procedures for nutrient and chlorophyll sample collection are documented in section 8.3. At the middle stations in the Coastal Eutrophication Study transects, both a surface and at depth sample will be obtained while at the five transects located in the mouth of the bays, surface, mid-depth, and bottom samples will be retrieved.

Method Rationale: The Smith-MacIntyre sampler is efficient and cost effective. Other grab samplers have been tested in the area and are less effective in achieving an adequate sample due to the sediment size and composition.

Diving on Survey: YES: X NO: (If yes, see Sections 15 and 16)

8.1 SAMPLING METHODOLOGY PROTOCOL

A. Hydrographic - At all Coastal Eutrophication and Sewgae Outfall stations: Performed through water column from surface to bottom.

1. Seabird SBE 9/11 utilized for obtained in situ measurements

    a. Temperature in degree Celsius

    b. Conductivity in m-ohms/cm

    c. Dissolved oxygen in mg/l

    d. Salinity in ppt.

2. Secchi Disc readings in meters of visibility

B. Chlorophyll and nutrients

1. Grab samples obtained using discrete surface sampler and/or Niskin bottle for at-depth sample

8.1 STATION LOG SHEET

Secchi Disc_____m STATION LOG LORAN C X_____ Y_____

Station_____ Date_____ Time_____Depth_____
Wind Dir._____ Vel._____ Sea state_____Wire angle_____

Depth

Meter	Corrected	Cond.	Salinity	Temp.	D.O.	pH
Sur.						
5						
10						
15						
20						
25						
30						
35						
40						

Bottom grab description
Smith-Mc drop_____

Shipek drop 1_____

Shipek drop 2_____

Shipek drop 3_____

Samples

Smith-McIntyre		Benthic Tow		Core		Surface Water	
	Bacti		Dredge type		Depth of penetration		TPC
	Amoeba		Tow time		Depth of banding(cm)		PHYTO-PLANKTON
	3 TOC		Note:		Width of banding(cm)		CHLOROPHYLL
	Depth of sediments				Sediment type		NUTRIENT
	Depth of banding (cm)						
	Width of banding (cm)						

a. Chlorophyll samples (2) collected on filter paper

b. Nutrients samples (4) collected from filtrate water of chlorophyll sampling

C. Sediment Sample

1. 4 sediment samples obtained using a Smith-MacIntyre grab sampler at each of the nine designated stations

a. Measure depth of the Smith-MacIntyre sample in centimeters at the center of the sample and note on log sheet. Any sample with a depth reading of less than 5 cm must be discarded and a new sample must be obtained.

b. Provide a good physical description of sediment, noting color and sediment consistency, on station log sheet before subsampling

c. Infaunal Analysis - Triplicate Grabs

1. Samples collected from 27 of the 36 Smith-MacIntyre grab samples (3/station) obtained on a linear transect as shown in Figure 7.1.

2. Using a 3" diameter coring tube, obtain a sample core from the center of the grab sample. Carefully cover the bottom of the tube with proscribed instrument for removal. Note depth of core sample in centimeters on log sheet. Place core sample in Whirlpack, label appropriately, and store with other infauna samples as determined by contractor

3. With 1" diameter coring tube, take a 50-100g representative subsample for sediment analysis and drop in Whirlpak. Label containers appropriately and store grain samples in refrigerator.

4. With a 1" diameter coring tube, take a representative 50-100g subsample for TOC analysis and drop in Whirlpack. Label container appropriately and store with other TOC samples in dark refrigerator.

5. Save the remaining Smith-McIntyre sample for a comparative analysis with the corresponding core smaples. The contractor will provide proper storage protocol. Stow with other infaunal samples

d. Sulfides and Bacteria - Replicate samples

1. Samples obtained from 9 of the 36 Smith-McIntyre grab samples (1/station) described above (c.1.).

2. Using a sterile spatula, collect three 25-100g samples of sediment from top 2 cm of the grab sample for bacterial analysis and place in individual Whirlpaks. Label containers appropriately. Stow with other TOC samples in refrigerator.

3. With 1" diameter coring tube, take a 35-50g subsample for sulfide analysis and drop in Whirlpak. Preserve with zinc acetate. Label containers appropriately. Stow with other TOC samples in refrigerator.

e. Samples also collected from an anchor dredge obtained from five of the nine stations (the two control stations, the two impacted stations, and the centrally located transitional station). Collection and storage procedurees will be provided by contractor.

8.3 PROCEDURES FOR CHLOROPHYLL AND NUTRIENT COLLECTION

A. Chlorophyll sample collection

1. Set up: Use a double flask vacuum filter set-up. Connect vacuum pump to manifold rig. Trap flask goes between filter flask and pump. System will filter when stopcorks are parallel to tubing and pump is turned on.

2. Rinse funnel and flask with distilled water before each sample. If nutrients are to be collected from filtrate, discard rinse water

3. Place filter pad (GF/F) gridded side down onto filter holder

4. Transfer part of well mixed sample into graduate cylinder to one liter level

5. Pour well mixed surface water through pre-wetted zooplankton filter and through phytoplankton filter until filter turns an olive green color (usually around 1 - 2 liters for off shore stations and 0.5 liters for near shore stations)

6. Using forceps, remove filter paper, fold in half green side in, wrap with Al foil, wrap with time tape, label outside with date, station, and amount filtered. Place in labelled storage bag and place in freezer

7. Repeat procedure. Label as chlorophyll "B" sample

B. Nutrient sample collection

1. Fill four prelabeled, triple rinsed (using filtrate water) analyzer cups, then fill 2/3 full with filtrate water from "B" operations

2. Cap and freeze upright immediately

3. Rinse funnel, holder, and flask with distilled water between sample sites

9.0 SEQUENCE OF SURVEY TASKS/EVENTS

9.1 SAMPLING LOCATION PROTOCAL FOR OCEAN OUTFALL STUDY

STATIONS	SAMPLE TYPES			
	Smith-MacIntyre	Diver Cores	Dredge Samples	Plume Tracking
A	4	11	X	
B	4			
C	4		X	X
D	4			
E	4		X	
F	4			
G	4		X	X
H	4			
I	4	11	X	

9.2 SAMPLING LOCATION PROTOCOL FOR EUTROPHICATION STUDY

STATIONS	SAMPLE TYPES				
	Hydrocast:	Water Grab:			Sediment:
		Surface	M-depth	Bottom	Smith-MacIntyre
J 16	X	X	X		
J 16(a)	X	X			
J 16(b)	X	X			
J 17	X	X	X		
J 17(a)	X	X			
J 17(b)	X	X			
J 17(y)	X	X			
J 18	X	X	X		
J 18(a)	X	X			
J 18(b)	X	X			
J 18(y)	X	X			
J 18(z)	X	X			
J 19	X (NUTRIENTS ONLY)	X	X	X	
CD 11	X	X	X		
CD 11(a)	X	X			
CD 11(b)	X	X			
CD 11(y)	X	X			
CD 11(z)	X	X			
J 20	X (NUTRIENTS ONLY)	X	X	X	
CD 12	X	X	X		
CD 12(a)	X	X			
CD 12(b)	X	X			
CD 12(y)	X	X			
CD 13	X	X	X		
CD 13(a)	X	X			
BO 4	X	X			

STATIONS	SAMPLE TYPES				
	Hydrocast:	Water Grab:			Sediment:
		Surface	M-depth	Bottom	Smith-MacIntyre
CD 13(y)	X	X			
CD 13(z)	X	X			
CD 14	X	X	X		
CD 14(a)	X	X			
CD 14(b)	X	X			
CD 14(y)	X	X			
CD 14(z)	X	X			
CD 15	X	X	X		
CD 15(a)	X	X			
CD 15(b)	X	X			
CD 16	X	X	X		
CD 16(a)	X	X			
CD 16(b)	X	X			
CD 17	X	X	X		
CD 17(a)	X	X			
CD 17(b)	X	X			
CD 18	X (NUTRIENTS ONLY)	X	X	X	
CD 19	X (NUTRIENTS ONLY)	X	X	X	
CD 20	X (NUTRIENTS ONLY)	X	X	X	
CC 12	X	X	X		
CC 12(a)	X	X			
CC 12(b)	X	X			
CC 13	X	X	X		
CC 13(a)	X	X			
CC 13(b)	X	X			
C 14	X	X	X		
C 14(a)	X	X			
C 14(b)	X	X			

10.0 NAVIGATION AND POSITIONING CONTROL

10.1 COASTAL OUTFALL STATIONS LATITUDE/LONGITUDE COORDINATES

Station	Latitude	Longitude
A	38° 35.4'	75° 01.3'
B	38° 33.63'	75° 01.57'
C	38° 31.87'	75° 01.86'
D	38° 29.65'	75° 01.9'
E	38° 27.35'	75° 02.2'
F	38° 25.28'	75° 02.54'
G	38° 23.26'	75° 03.13'/03.20'
H	38° 21.7'	75° 03.7"
I	38° 20.3'	75° 04.3'

10.1.A INSTRUCTIONS TO BRIDGE REGARDING REPLICATE SAMPLING

The exact location and depth of the two outfall stations, **C & G** must be verified before any sampling has commenced. Although all stations should be located at the proper lat/long coordinates indicated above, every effort must be made to match the depth shown at station **C** for stations **A, B, & D** and at station **G** for stations **F, H, & I.** The deck crew will make the drop at the direction of the bridge when the ships fathometer indicates a depth reading equivalent to either stations **C** or **G**, respectively, plus or minus (±) 5 feet. The drops at station **E** should be at an average depth between those recorded at stations **C & G.**

10.2 COASTAL EUTROPHICATION STATIONS LATITUDE/LONGITUDE COORDINATES

Station	Latitude	Longitude
J 16(m)	39° 13.3'	74° 29.4'
J 16(a)	39° 11.8'	74° 26.7'
J 16(b)	39° 15.1'	74° 32.7'
J 17(m)	39° 00.6'	74° 42.2'
J 17(a)	39° 00.4'	74° 38.2'
J 17(b)	39° 00.6'	74° 45.6'
J 17(y)	39° 00'	74° 28.9'
J 18(m)	38° 54.4'	74° 46.3'
J 18(a)	38° 53.4'	74° 42.4'
J 18(b)	38° 56.2'	74° 48.5'
J 18(y)	38° 50.4'	74° 37.4'
J 18(z)	38° 45.4'	74° 28.8'
J 19	38° 53'	74° 53.8'
CD 11(m)	38° 48.1'	74° 56'
CD 11(a)	38° 46.6'	74° 52'
CD 11(b)	38° 49.5'	74° 58'
CD 11(y)	38° 44.6'	74° 48.4'
CD 11(z)	38° 40.5'	74° 39.3'

Station	Latitude	Longitude
J 20	38° 46.2'	75° 00.3'
CD 12(m)	38° 41'	74° 58.9'
CD 12(a)	38° 41'	74° 53.3'
CD 12(b)	38° 41'	75° 02.5'
CD 12(y)	38° 41'	74° 48.8'
CD 12(z)	38° 40.5'	74° 39.3'
CD 13(m)	38° 30'	74° 58.2'
CD 13(a)	38° 30'	74° 53.1'
BO 4	38° 30'	75° 00.3'
CD 13(y)	38° 30'	74° 47.7
CD 13(z)	38° 30'	74° 37.5
CD 14(m)	38° 15.9'	75° 01.9'
CD 14(a)	38° 15.3'	74° 55.9'
CD 14(b)	38° 16.2'	75° 05.3'
CD 14(y)	38° 14.5'	74° 51.4'
CD 14(z)	38° 13.8'	74° 41.1'
CD 15(m)	37° 47.4'	75° 15'
CD 15(a)	37° 48'	75° 10.3'
CD 15(b)	37° 50.8'	75° 18.6'
CD 16(m)	37° 30.4'	75° 31.6'
CD 16(a)	37° 30.1'	75° 27.2'

Station	Latitude	Longitude
CD 16(b)	37° 29.9'	75° 36'
CD 17(m)	37° 17'	75° 40'
CD 17(a)	37° 16.5'	75° 36.5'
CD 17(b)	37° 17.5'	75° 44'
CD 18	36° 58.66'	75° 58.68'
CD 19	36° 57.58'	75° 59.39'
CD 20	36° 56.76'	75° 59.95'
CC 12(m)	36° 53.1'	75° 52.2'
CC 12(a)	36° 52.9'	75° 48.3'
CC 12(b)	36° 52.7'	75° 56'
CC 13(m)	36° 46'	75° 51'
CC 13(a)	36° 46'	75° 46.9'
CC 13(b)	36° 46'	75° 55'
C 14(m)	36° 35'	75° 46.6'
C 14(a)	36° 35'	75° 42.2'
C 14(b)	36° 35'	75° 50.5'

11.0 EQUIPMENT AND SUPPLIES

Equipment from *Anderson* (Attach *Anderson* check list if appropriate):

The O.S.V. Anderson will provide the necessary refrigerators, freezers, and laboratory space. The Anderson will have ready for use their Seabird SBE 9/11 and all support units. In addition, the Anderson will have ready backup hydrocast equipment(Surveyor II probe and control box). The O.S.V. Anderson will supply the Smith-MacIntyre sampler and the necessary dive tanks. As needed, the crew of the O.S.V. Anderson will be utilized to assist in the setting up and tearing down of sampling equipment.

The U.S. EPA Region III will supply the Secchi Discs and personal dive equipment. All charts, log sheets, and portable computer capabilities will also be furnished by the EPA Region III.

Equipment from Other Sources:

Battelle, one contractor, will supply the anchor dredge and associated equipment as well as the BOSS plume tracking system. Battelle will also provide one diver and the needed diving gear to complete the required tasks.

Cove, a second contractor, will be required to provide for all of the necessary equipment and supplies for the preparation, preservation, and transport of all samples. The contractors should be present to ensure the delivery of all necessary supplies and equipment, the proper handling of all samples, and the timely pick-up, delivery, and analyses of these samples. If the contractor(s) is unable to be present, an acceptable alternate method of activity disposition must be arranged.

Expendable Supplies from *Anderson* (Attach *Anderson* check list if appropriate):

Expendable Supplies from Other Sources:

11.1 SAMPLING ACTIVITIES' EQUIPMENT PROTOCOL

Sampling Activity	Sampling Method	Parameters	Containers	Preservation Technique	Analyst
Hydrocast	Seabird SBE 9/11	D.O., Cond., Salinity Temp.	N.A.	Computer Disc	Survey Crew
	Secchi Disc	Light Extinction	N.A.	Log Reading	Survey Crew
Water Grab	Niskin Bottle or Discrete Grab Sampler	Chlorophyll	Filter, Al foil	No Light and Freeze	Contract
		Nutrient (NH4, PO4 NO2, NO3)	Auto Analyzer Cup	Freeze	Contract
Sediment	Smith-McIntyre	Benthic Macrofaunal Invertebrates	2 liter PE Jug	Rose Bengal tinted Formalin	Contract
		Physical Appearance	N.A.	Log Observation	Survey Crew
		Grain Size	Small coring tube in Whirlpak	Refrigerate	Contrac
		TOC	Whirlpak	Freeze	Contrac
		Heavy Metals	40 dram vials in Whirlpak	Freeze	Contrac

12.0 QA/QC PROCEDURES (Attach detail/tables/figures if needed)

QA/QC Procedures for Collection Equipment:

The activities outlined in previous sections covers the quality assurance of sampling procedures. All standard EPA procedures will be followed to ensure this quality assurance.The Seabird SBE 9/11 will be prepared prior to the survey by the Anderson crew. All sampling activities will be documented on the station log and on the survey vessel's activity log. The hydrocast activities will be recorded by the Anderson's computer with both a hard copy and floppy disc provided at the end of the survey.

QA/QC Procedures for Collection Methods:

All samples will be prepared, preserved, and stored using identified standard procedures. Upon completion of the survey, these samples will be properly transported to the laboratories performing the analysis per previous arrangement made by the respective contractors. Each laboratory will provide Quality Assurance/Quality Control for the specified analytical procedures.

QA/QC Procedures for Analytical Equipment/Methods:

With the exception of the hydrocast activities, no on board analysis work will be performed. The Seabird SBE 9/11 probe will be assembled and used per the manufacture's

13.0 SCIENTIFIC PARTY

NAME	SURVEY RESPONSIBILITY	ORGANIZATION
1) William C. Muir	Chief Scientist/Watch Captain/Diver	EPA, RegionIII
2) George R. Gibson	Sediment QA	EPA, HQ
3) Mark Barath	Watch Captain	EPA, Region III
4) Peggy Prevoznik	Sediment QA	EPA, Region III
5) Todd Frazier		EPA, Region III
6) Tim Morris		Cove Corp.
7) Jeff Shaw		Cove Corp.
8) Wayne Trulli	Sediment QA	Battelle
9) Anne Spellacy	Diver	Battelle
10) Don Lear	Watch Captain	Contractor
11) Bill Hoffman	Diver	EPA, Region III
12) Rachel Fineberg		EPA, Region III
13) Julie Frieder		EPA, Region III
14) Chuck		Battelle
15) Ed Mclean	Diver	EPA, HQ

13.1 Watch Assignments

Watch 1	Watch 2	Watch 3	Dogged Watches
William Muir	**Mark Barath**	**Don Lear**	**Watch Captains**
Wayne Trulli	Peggy Prevoznik	George Gibson	Sediment QA
Tim Morris	Anne Spellacy	Bill Hoffman	
Rachel Fineberg	Jeff Shaw	Todd Frazier	
	Chuck (Battelle)	Julie Frieder	

14.0 PROPOSED REPORTING REQUIREMENTS

Debriefing Telephone Call: YES: NO: X

No. of Days After Demob:

Survey Report Due Date (20 Days after demob): August 14, 1992

Final Report/Other Document Description: 403(C) Report

Final Report Due Date: September 30, 1992

Project Summary/Status Report Due Date: September 1, 1992

15.0 DIVING OPERATIONS

Locations: Two control sites north of Bethany Beach, DE and south of Ocean City, MD
(see station location table)
Potential Hazards: None anticipated
Depth Range: 35-45 feet
Maximum Depth: 50 feet

Dive Master: William C. Muir (3ES41)
Organization: EPA, Region III
841 Chestnut Street, Philadelphia, PA 19107

Diver #1: William C. Muir
Organization: EPA, Region III

Diver #2: William Hoffman
Organization: EPA, Region III

Diver #3: Anne Spellacy
Organization: Battelle

Diver #4: Ed McLean
Organization: EPA, HQ

PURPOSE:

The purpose of this dive operation is two fold: to perform a comparative analysis between the Smith-MacIntyre grab samples and the diver core samples; and to determine the variation in benthic community with depth of the sediment.

Divers' Tasks:

Collect 11 sediment cores from each of the two control sites designated prior to the survey for infauna analysis and sediment chemsitry.

REQUIREMENTS REMINDER:

OXYGEN WILL BE ON SITE ON BOTH THE *ANDERSON* AND TENDER BOAT.

(Oxygen will be provided by the *Anderson*.)

STANDBY DIVER WILL BE SUITED UP IN THE TENDER BOAT READY TO DIVE.

(Dive team scheduling and bottom time planning must allow for this.)

Anderson Anchored: YES: NO: X

Tender Boat Anchored: YES: NO: X

Communications: VHF Radio

Tender Boat: Special

Equipment Needed: 15 cm deep core tubes

16.0 DIVER EMERGENCY AID LIST

DIVERS ALERT NETWORK (DAN) 24-Hour Telephone No.: (919) 684-8111

NEAREST RECOMPRESSION CHAMBER (Facility name and address):

Telephone No.: University of Pennsylvania Chamber, 3400 Spruce Street, Philadelphia, PA 19104 [(215)662-4000]

24-Hour Telephone No.: 215-898-9095

Telephone Call On Day of Initial Diving Operations To Be Made By:

Hyperbaric Physician(s): Dr. Thomas

Telephone No.:

NEAREST HOSPITAL (Facility name and address):

Telephone No.: 302-645-3300 Beebe Medical Center

24-Hour Telephone No.: same 424 Savannah Road

Hyperbaric Physician(s): Lewes, DE 19958

Telephone No.:

NEAREST COAST GUARD STATION (Facility name and address):

VHF Channel: ch. 16 (Group Cape May)
Telephone No.: 302-227-2440/2121

USCG
Indian River Inlet Station
800 Inlet Road
Rehoboth, DE, 19971

Telephone Number: 609-884-6995
Emergency Response: 609-884-1700

USCG
Station Cape May
c/o Tracen
Cape May, NJ 08204

FIRST AID EQUIPMENT:
Location: wet lab
Oxygen Location: wet lab

DIVER MEDIC (Name if planned):
SPECIAL CONSIDERATIONS: