FINAL
JAMES ISLAND HABITAT RESTORATION EXISTING ENVIRONMENTAL CONDITIONS:

Fall 2001 and Summer 2002 Surveys

Prepared for

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EXECUTIVE SUMMARY

James Island and the waters surrounding it were investigated over two seasons. The purpose of the sampling efforts was to document the existing terrestrial and aquatic resources present in and around the James Island remnants. This report documents the site reconnaissance efforts of Fall 2001 and the first season of sampling for feasibility-level evaluations (Summer 2002). Components of the investigation are detailed in Table ES-1.

TABLE ES-1. COMPONENTS OF SITE RECONNAISSANCE AND SAMPLING EFFORTS BY SEASON AT JAMES ISLAND

Season of Sampling	Type of Study Conducted
Fall 2001	– Benthic Community – *In Situ* Water Quality – Sediment Quality – Wildlife and Avian Observations
Summer 2002	– Benthic Community – *In Situ* Water Quality – Fisheries Studies (trawl & seine collections) – Plankton Collections – Wildlife and Avian Observations – Timed Bird Observations – Submerged Aquatic Vegetation (SAV) Mapping and Field Ground-Truthing

These data will support reconnaissance and feasibility-level studies of James Island (Dorchester County, Maryland) as a potential island habitat restoration project using dredged material. This study was conducted by EA Engineering, Science, and Technology, Inc. (EA) for the Maryland Port Administration (MPA) under contract to Maryland Environmental Service (MES).

James Island currently consists of three eroding island remnants. The northern two remnants are joined by a sand beach/spit that terminates in high and low marsh complexes. Mixed forest stands of loblolly pine dominate the interior of the islands. Small remnants of high marsh can be found on all three remnants and the southern remnant has a fairly extensive marsh complex in the center. There was evidence of a fairly recent fire that killed many trees and impacted some of the marsh areas on the northern and southern remnants. The northern and western shorelines of each remnant show the heaviest erosion and there are many downed trees in the water in these areas.

Avian utilization of the island was typical for this area of the Bay, although numbers of species for Summer 2002 were low relative to expectations since the survey may have missed the period of abundance during the Spring migration. No large bird colonies (e.g., gulls, egrets, pelican, etc.) were found on the island. The island provides nesting habitat for a variety of songbirds and raptors. A total of 42 avian species were observed utilizing it in some capacity, during the Fall

2001 and Summer 2002 surveys. There was also evidence that common wildlife species such as sika deer, raccoon, diamondback terrapin, and several snake species also utilize the island remnants.

The island remnants currently support submerged aquatic vegetation (SAV) growth along their eastern shorelines. It is primarily a monotypic bed of widgeon grass (*Ruppia maritima*) with some small pockets of the macroalgae, sea lettuce (*Ulva lactuca*). Fisheries investigations of the shorelines indicated that the remnants support a fairly diverse fish community, including juveniles of commercially important species. All species were typical of the region. There were no differences in the number of fish species collected inside and outside of the SAV beds in Summer 2002. Trawling yielded few species. This is likely due to a lack of habitat features outside of the shorezone of the island and because of this, most fish utilizing the area trawled are probably transients to the study area.

Ichthyoplantkton densities were relatively high for the Summer 2002 collection effort and were dominated by the bay anchovy. Zooplankton were typical of the region. In general, the benthic community is typical of this area of the Bay but was dominated by a single species, the gem clam (*Gemma gemma*), at most stations. The majority of the species collected were stress-tolerant, resulting in low Benthic Index of Biotic Integrity (B-IBI) scores at most locations in both Fall 2001 and Summer 2002. Although the *in situ* water quality was typical for the region, lower than normal precipitation could have affected benthic distributions in the area in Summer 2002.

Results of the physical analyses indicated that the sediment around James Island was predominately comprised of sand (97.5 to 98.8%) at all sample stations except JAM-010, which was predominately comprised of silt-clay (82.8%). Of the five James Island sediment samples, location JAM-007 had the highest proportion of sand (98.9%), although both stations JAM-002 and JAM-005 also had high proportions of sand (98.4%).

Of the 155 chemical constituents tested in the sediment, 57 were detected in the James Island sediments. The majority of these detected constituents were found in low concentrations and were representative of background concentrations. Semivolatile organic compounds (SVOCs), volatile organic compounds (VOCs), and organophosphorus pesticides were not detected in any of the sediment samples. One polynuclear aromatic hydrocarbon (PAH), acenaphthylene, exceeded the threshold effects level (TEL) value at one sampling station (JAM-002) by a factor of approximately 2.6 but did not exceed probable effects level (PEL) values. None of the other detected chemical constituents exceeded TEL values.

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1.0 INTRODUCTION

1.1 PURPOSE OF STUDY

The purpose of the James Island environmental sampling effort is to document the existing terrestrial and aquatic resources present in and around the James Island remnants. This report documents the site reconnaissance efforts of Fall 2001 and a season of sampling (Summer 2002) to support feasibility-level evaluations. Components of the investigation are included in Table 1-1 below.

TABLE 1-1. COMPONENTS OF SITE RECONNAISSANCE AND SAMPLING EFFORTS BY SEASON AT JAMES ISLAND

Season of Sampling	Type of Study Conducted
Fall 2001	– Benthic Community – *In Situ* Water Quality – Sediment Quality – Wildlife and avian observations
Summer 2002	– Benthic Community – *In Situ* Water Quality – Fisheries Studies (trawl & seine collections) – Plankton Collections – Wildlife and Avian Observations – Timed bird observations – Submerged Aquatic Vegetation (SAV) Mapping and Field Ground-Truthing

These data will support reconnaissance and feasibility-level studies of James Island (Dorchester County, Maryland) as a potential island habitat restoration project using dredged material.

This study was conducted by EA Engineering, Science, and Technology, Inc. (EA) for the Maryland Port Administration (MPA), under contract to Maryland Environmental Service (MES).

1.2 STUDY AREA DESCRIPTION

James Island is located in Dorchester County (Maryland) at the mouth of the Little Choptank River in the Chesapeake Bay (Figure 1-1). Historic and current mapping of the island indicated that over 800 acres of the island has eroded since 1847. James Island currently consists of three remnants and is less than 100 acres in size. It lies approximately one mile north-northwest of Taylor Island. James Island is currently being considered for an island restoration project. Five potential dike alignments are being considered at this phase of study (Figure 1-2). The alignments include a 50/50 upland to wetland ratio using 40 to 80 million cubic yards (mcy) of suitable dredged material. The alignments range in size from 979 to 2,202 acres and all lie predominantly west of the remnants of James Island.

Sampling was conducted within and adjacent to the alignments of the proposed project and on and around the three island remnants (northern, middle, and southern remnants). Details of sampling and observation areas are included with the methods for each discipline (Section 2), and a photographic record of the terrestrial resources documented on James Island during the Fall 2001 and Summer 2002 surveys is included as Appendix A.

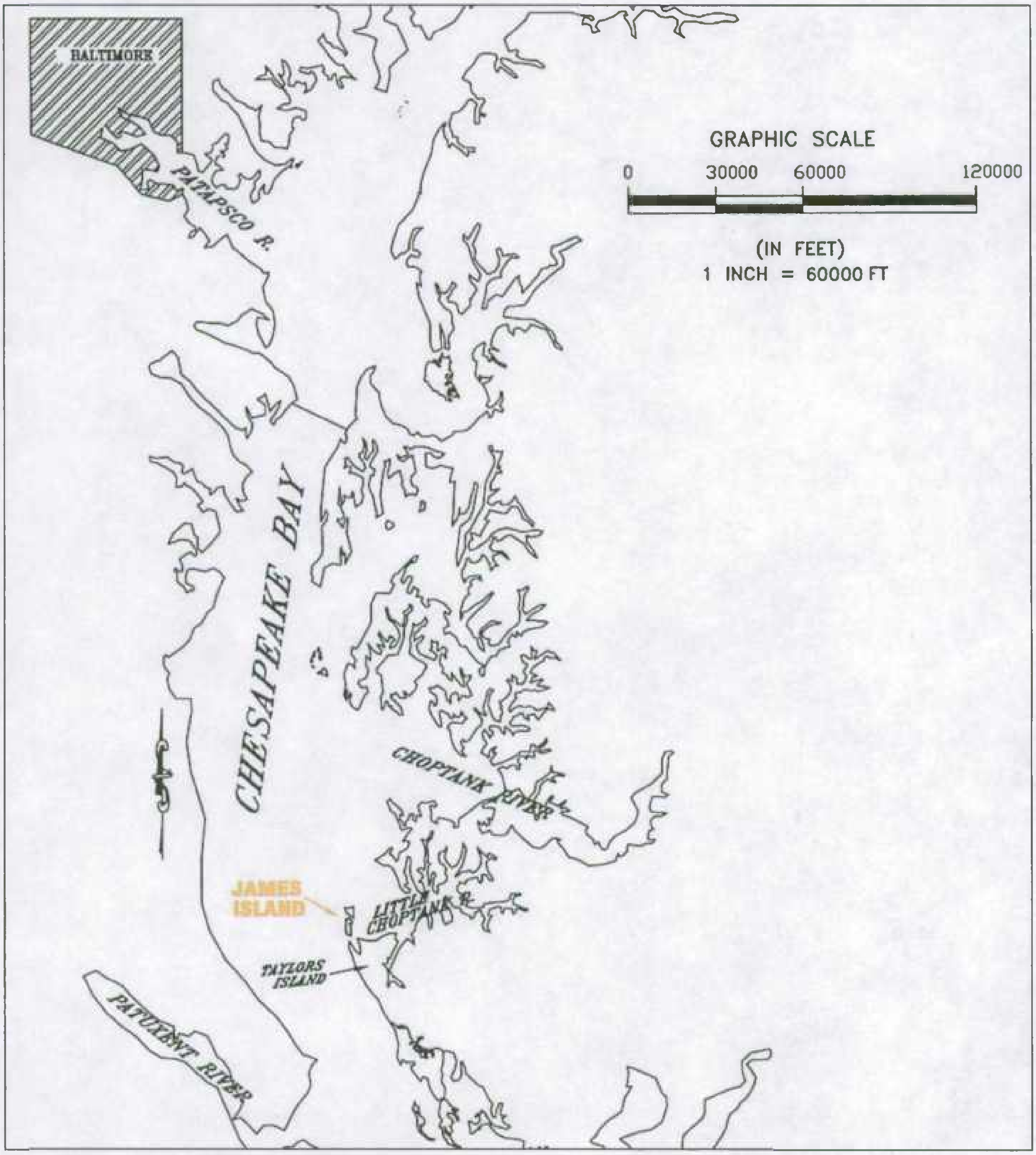


Figure 1-1. Location of James Island, Dorchester County, MD

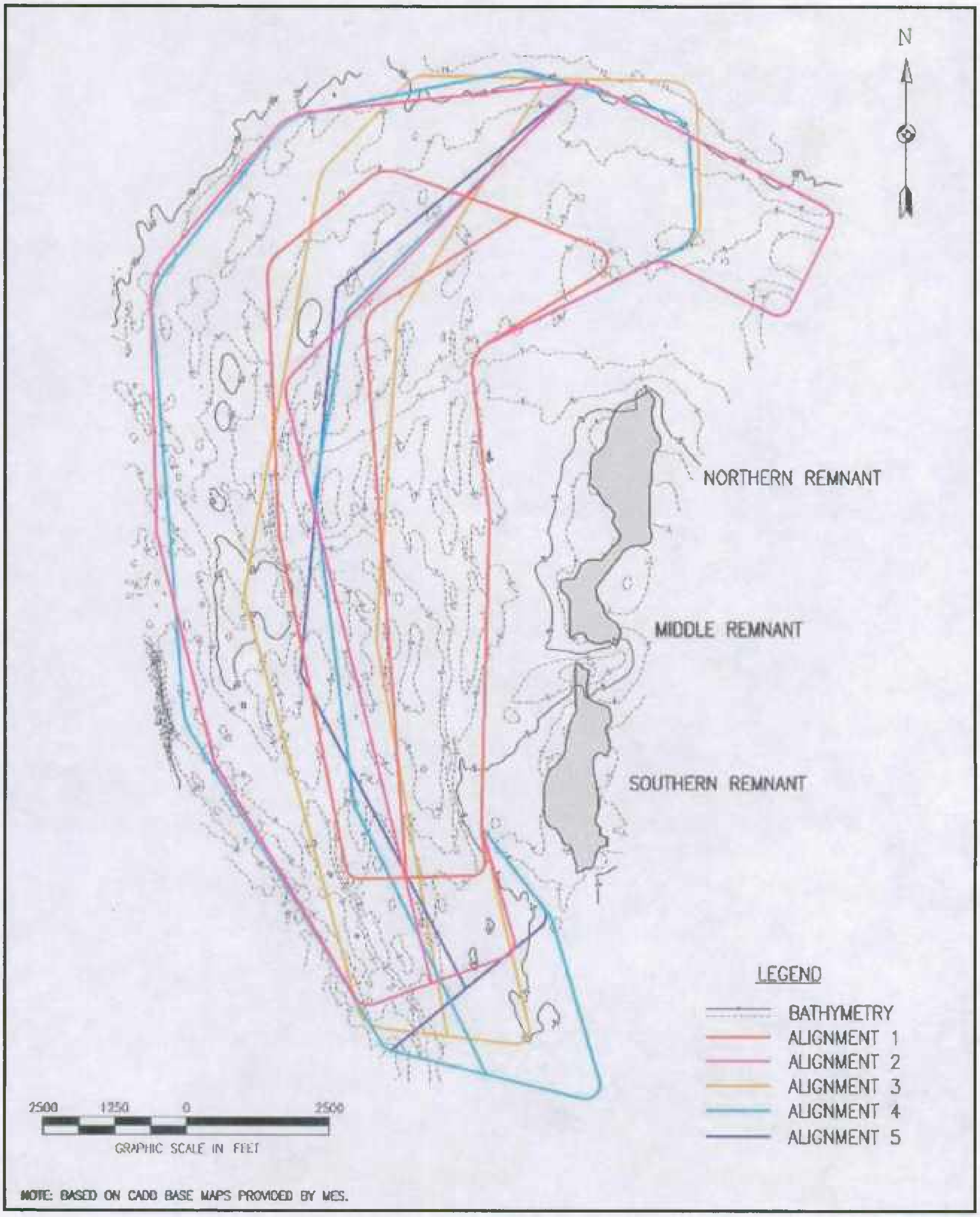


Figure 1-2. Proposed Placement Areas at James Island

2.0 METHODS

2.1 AQUATIC SURVEYS

2.1.1 Benthic Community

Benthic sampling was conducted in the Fall (October) 2001 and Summer (June) 2002 seasons.

Sampling Methods

Triplicate grab samples were collected at 10 locations around James Island (Figure 2-1) using a standard 9-in. × 9-in. Ponar grab sampler. Differential global positioning system (DGPS) coordinates were recorded at each of the ten benthic sampling stations and are included in Appendix B. One additional grab was collected at five locations for analysis of grain size and total organic carbon (TOC). Each replicate benthic sample was sieved in the field through a 500-micron screen to remove fine sediment particles. Individual replicates were transferred to labeled bottles and preserved in the field using buffered 10 percent formaldehyde solution stained with rose bengal.

Sediment Sampling for Grain Size and Total Organic Carbon (TOC)

Separate sediment samples were collected for grain size and TOC analysis from five benthic stations (JAM-002, JAM-005, JAM-007, JAM-009, and JAM-010). The sediment samples were stored in certified clean containers and refrigerated at 4°C during storage. Samples were obtained using a standard 9-in. × 9-in. Ponar grab sampler. Samples were transported to Severn-Trent Laboratories–Baltimore (STL–Baltimore) in Sparks, Maryland for physical testing of the sediment for grain size distribution and TOC analysis. Grain size analyses were conducted according to American Society for Testing and Materials (ASTM) standard methods (ASTM 1995). TOC analyses were conducted according to American Public Health Association (APHA) guidelines (APHA 1992). In addition, the substrate was characterized visually at each sampling station.

In Situ Water Quality Measurements

In situ water quality measurements were obtained in the field at mid-depth at the benthic infaunal sampling locations using YSI 3800 instrumentation. The *in situ* water quality measurements included temperature, pH, salinity, dissolved oxygen, and turbidity.

Sample Storage and Transport

Benthic samples collected over a two-day work period were preserved in a buffered 10 percent formaldehyde solution in the field and stored in appropriate containers out of direct sunlight on the work boat. Grain size and TOC samples were stored on ice in cooled, insulated containers at 4°C on the work boat. After completion of benthic sampling, the samples were transported to EA in Sparks, Maryland, where they were logged and stored until laboratory processing.

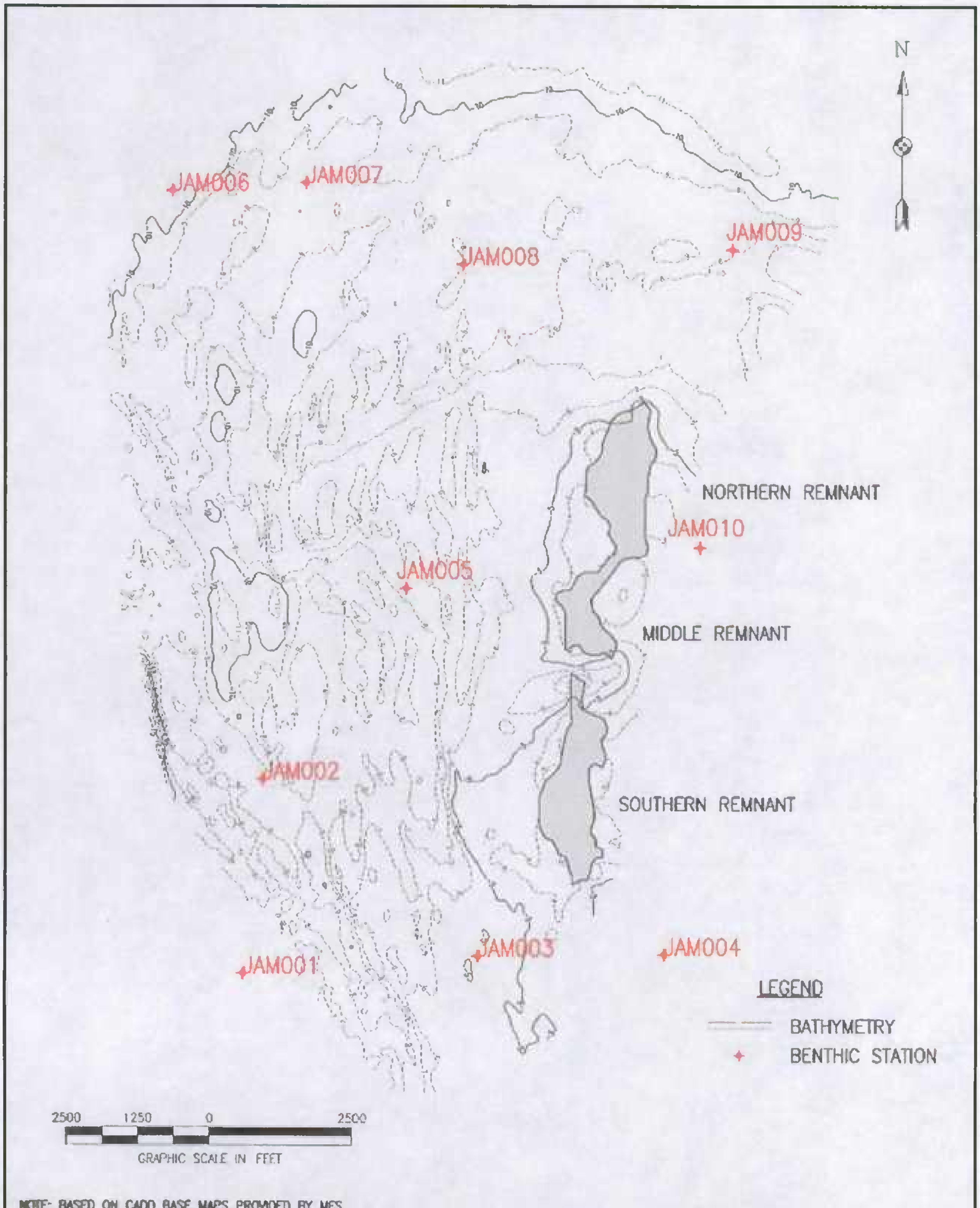


Figure 2-1. Benthic Stations in Vicinity of James Island, October 2001 and June 2002

Samples were sorted and sub-sampled in EA's Biology Laboratory, and sent to Cove Corporation for taxonomic identification to the lowest practical taxonomic level. Grain size and TOC samples were transported to EA in Sparks, Maryland, logged and stored in a refrigeration unit (maintained at 4°C) until delivered to STL–Baltimore for processing and analysis. Before the samples were sent to the laboratories, appropriate chain-of-custody (COC) documentation was completed.

Laboratory Processing

In the laboratory, each benthic infaunal sample was washed with tap water through a 0.5-mm sieve to remove the preservative in preparation for lab processing. Due to the large number of organisms in the samples, the samples were sub-sampled. The sub-samples were placed in a shallow white pan and the organisms were separated from other sample material and placed in vials. The samples were sorted by major taxonomic groups and were submitted to Cove Corporation for identification to the lowest practical taxonomic level.

Data Analysis for the Benthic Index of Biotic Integrity (B-IBI)

Benthic invertebrates are used extensively as indicators of estuarine environmental status and trends because numerous studies have demonstrated that benthos respond predictably to many kinds of natural and anthropogenic stress (Weisberg et al. 1997). The Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI) developed by Weisberg et al. (1997) was used to evaluate the benthic community. The metrics were designed to characterize the response of the benthic community to stresses. The B-IBI combines individual metrics and assigns a score to each of the metrics to describe the benthic community and to provide an assessment of benthic community condition. Methodology followed guidance provided in both Weisberg et al. (1997) and Interstate Commission on the Potomac River Basin (ICPRB 1999).

In order to calculate the B-IBI, each station must be classified by salinity and substrate type. Salinity at the James Island benthic stations in both October 2001 and June 2002 ranged from 12 to 18 parts per thousand (ppt), classifying the stations as high mesohaline (Weisberg et al. 1997). All benthic stations (except JAM-004 and JAM-010) had a silt/clay content of less than 40 percent and would be classified as sand habitat. JAM-004 had a silt/clay content of 90 percent and JAM-010 had a silt/clay content of 82.8 percent, which would classify them as mud. According to the ICPRB, substrate habitat is defined as sand if the average silt/clay value is between 0 and 40 percent and as mud if it is greater than 40 percent (ICPRB 1999). Therefore, all of the James Island benthic infaunal stations were classified as high mesohaline sand, except for JAM-004 and JAM-010, which were classified as high mesohaline mud. The metrics included in the B-IBI for the high mesohaline sand and high mesohaline mud classification are as follows:

- Shannon-Weiner Diversity Index $\overline{H}$ – This index has probably been the most widely used index in community ecology. It is based on information theory and is a measure of the average degree of "uncertainty" in predicting the species of an individual chosen at random from a collection of S species and N individuals (Weisberg et al. 1997). This metric is influenced by species richness and the distribution of individuals among the species (Weber 1973). This metric is included in both the high mesohaline sand and high mesohaline mud classification for the B-IBI. The Shannon-Weiner Diversity Index is calculated using the following equation:

$$\overline{H} = -\sum \left(\frac{ni}{N}\right) \log_e \left(\frac{ni}{N}\right)$$

where:

ni = importance[(a)] value for each species

N = Total of importance values

(a) Importance = number of individuals of a given species

- Abundance – Total abundance was calculated as total number of organisms per square meter. This metric is included in both the high mesohaline sand and high mesohaline mud classification for the B-IBI.

- Stress-Indicative Taxa Abundance – This metric was calculated as the percentage of total abundance represented by stress-indicative taxa. This metric is included only in the high mesohaline sand classification for the B-IBI.

- Stress-Sensitive Taxa Abundance – This metric was calculated as the percentage of total abundance represented by stress-sensitive taxa. This metric is included only in the high mesohaline sand classification for the B-IBI.

- Carnivore/Omnivore Abundance – This metric was calculated as the percentage of total abundance represented by carnivore/omnivore taxa. This metric is included in both the high mesohaline sand and high mesohaline mud classification for the B-IBI.

Table 2-1 presents the metrics and the thresholds used to score each metric of the B-IBI. The Index of Biotic Integrity (IBI) approach involves scoring each metric as 5, 3, or 1, depending on whether its value at a site approximates, deviates slightly, or deviates greatly from conditions at reference sites (Weisberg et al. 1997). The final IBI score is derived by summing individual scores for each metric and calculating an average score (IBI value). The B-IBI is an extension of an effort to establish benthic restoration goals for the Chesapeake Bay (Weisberg et al. 1997). The Chesapeake Bay Restoration Goal Index (RGI) (Ranasinghe et al. 1994) was patterned after the same approach used to develop the IBI for freshwater systems (Karr et al. 1986). A Chesapeake Bay RGI value of 3 represents the minimum restoration goal. RGI values of less than 3 are indicative of a stressed community. Values of three or more indicate habitats that meet or exceed the restoration goals (Ranasinghe et al. 1994).

In order to calculate the B-IBI, feeding guilds and life histories of the benthic fauna were assigned to each species. Feeding guilds were derived from the ICPRB and life histories were derived from Weisberg (Weisberg et al. 1997). A summary of the feeding guilds and life histories of the benthic fauna collected at James Island is presented in Table 2-2.

TABLE 2-1. THRESHOLD VALUES FOR METRICS USED TO SCORE THE CHESAPEAKE BAY B-IBI AT JAMES ISLAND FOR HIGH MESOHALINE SAND AND MUD

Metric	Scoring Criteria for High Mesohaline Sand		
	5 (Exceeds RGI)	**3 (Meets RGI)**	**1 (Below RGI-Stressed)**
Shannon-Weiner Diversity[a]	≥2.2	1.7-2.2	<1.7
Abundance (#/m^2)	≥1500-3000	1000-1500 or ≥3000-5000	<1000 or ≥5000
Stress-Indicative Taxa Abundance (%)	≤10	10-25	>25
Stress-Sensitive Taxa Abundance (%)	≥40	10-40	<10
Carnivore/Omnivore Abundance (%)	≥35	20-35	<20
Metric	**Scoring Criteria for High Mesohaline Mud**		
	5 (Exceeds RGI)	**3 (Meets RGI)**	**1 (Below RGI-Stressed)**
Shannon-Weiner Diversity[a]	≥2.1	1.4-2.1	<1.4
Abundance (#/m^2)	≥1500-2500	1000-1500 or ≥2500-5000	<1000 or ≥5000
Carnivore/Omnivore Abundance (%)	≥25	10-25	<10

[a] Converted to log base e

Source: Weisberg et al. 1997 and ICPRB 1999

TABLE 2-2. FEEDING GUILD AND LIFE HISTORY INFORMATION FOR BENTHIC MACROINVERTEBRATES COLLECTED FROM JAMES ISLAND, OCTOBER 2001 AND JUNE 2002

Taxa	Feeding Guild[a]	Life History[b]
CNIDARIA (sea anemones)		
Edwardsia elegans	Carnivore/omnivore	--
PLATYHELMINTHES (flatworms)		
Stylochus ellipticus[e]	Not assigned	--
Planariidae[e]	Not assigned	--
Turbellaria sp.A[e]	Not assigned	--
NEMERTINEA (unsegmented worms)	Carnivore/omnivore	--
Amphiporidae sp.	Not assigned	--
Amphiporus bioculatus	Not assigned	--
Micrura leidyi	Carnivore/omnivore	--
Carinoma tremaphorus	Carnivore/omnivore	--
GASTROPODA (snails)		
Acteocina canaliculata	Carnivore/omnivore	--
Sayella chesapeakea	Carnivore/omnivore	--
Haminoea solitaria	Carnivore/omnivore	--
Boonea impressa[c]	Carnivore/omnivore	--
Hydrobia truncata	Carnivore/omnivore	
BIVALVIA (clams and mussels)		
Gemma gemma	Suspension	--
Macoma mitchelli	Interface	--
Macoma balthica	Interface	Stress-sensitive
Mulinia lateralis	Suspension	Stress-sensitive
Mya arenaria	Suspension	Stress-sensitive
Tagelus divisus	Suspension	--
Petricola pholadiformis	Suspension	--
ANNELIDA (segmented worms)		
POLYCHAETA (bristle worms)		
Glycinde solitaria	Carnivore/omnivore	Stress-sensitive
Heteromastus filiformis	Deep deposit	--
Polydora cornuta	Interface	--
Polydora websteri[e]	Interface	--
Paraonis fulgens	Interface	--
Pectinaria gouldii	Deep deposit	--
Neanthes succinea	Carnivore/omnivore	--
Glycera dibranchiata	Carnivore/omnivore	--

(a) Feeding guides taken from Ranasinghe et al. (1993) and the ICPRB (1999).
(b) Life histories taken from Weisberg et al. (1997).
(c) Feeding guild for *Unciola* spp. was used; same family, Corophiidae.
(d) Feeding guild for *Monoculodes* sp. was used; same family, Oedicerotidae.
(e) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999 and Ranasinghe et al. 1993).

TABLE 2-2. (CONTINUED)

Taxa	Feeding Guild[a]	Life History[b]
ANNELIDA (segmented worms)		
POLYCHAETA (bristle worms)		
Eteone heteropoda	Carnivore/omnivore	--
Eteone foliosa	Deep deposit	--
Streblospio benedicti	Interface	Stress-indicative
Marenzellaria viridis	Interface	Stress-sensitive
Mediomastus ambiseta	Deep deposit	Stress-sensitive
Leitoscoloplos spp.	Deep deposit	Stress-indicative
Leitoscoloplos robustus	Deep deposit	Stress-indicative
Podarkeopsis levifuscina	Carnivore/omnivore	--
Paraprionopspio pinnata	Interface	Stress-indicative
Scolelepis (Parascolelepis) Texana	Interface	--
Tharyx sp. A	Interface	--
OLIGOCHAETA (aquatic worms)		
Tubificoides spp.	Deep deposit	Stress-indicative
CRUSTACEA		
AMPHIPODA (beach fleas; scuds)		
Apocorophium lacustre	Interface[c]	--
Ameroculodes spp. Complex	Interface[d]	--
Microprotopus raneyi[e]		
Ampelisca abdita	Suspension	--
Cymadusa compta		
Incisocalliope aestuarius	--	--
Leptocheirus plumulosus	--	Interface
Mucrogammarus mucronatus	--	--
ISOPODA (isopods)		
Edotea triloba[e]		
Cyathura polita	Carnivore/omnivore	Stress-sensitive
Paracereis caudata[e]		
Chiridotea coeca	Carnivore/omnivore	--
CUMACEA (cumacean shrimp)		
Oxyurostylis smithi	Interface	--
BRACHYURA (true crabs)		
Callinectes sapidus	--	--

(a) Feeding guides taken from Ranasinghe et al. (1993) and the ICPRB (1999).
(b) Life histories taken from Weisberg et al. (1997).
(c) Feeding guild for *Unciola* spp. was used; same family, Corophiidae.
(d) Feeding guild for *Monoculodes* sp. was used; same family, Oedicerotidae.
(e) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999 and Ranasinghe et al. 1993).

TABLE 2-2. (CONTINUED)

Taxa	Feeding Guild[a]	Life History[b]
CARIDEA (caridean shrimp)		
Crangon septemspinosa[e]	--	--
BRANCHIURAN (barnacles)		
Balanus improvisus[e]	--	--
MYSIDACEA (mysid shrimp)		
Americamysis almyra[e]	Not assigned	--
Neomysis americana[e]	Not assigned	--
PHORONIDA (horseshoe worms)		
Phoronis sp.	Suspension	--
UROCHORDATA (tunicates)		
Molgula manhattensis[e]	Not assigned	--

(a) Feeding guides taken from Ranasinghe et al. (1993) and the ICPRB (1999).
(b) Life histories taken from Weisberg et al. (1997).
(c) Feeding guild for *Unciola* spp. was used; same family, Corophiidae.
(d) Feeding guild for *Monoculodes* sp. was used; same family, Oedicerotidae.
(e) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999 and Ranasinghe et al. 1993).

Data Analysis for Other Benthic Community Metrics

Four additional metrics were selected to further characterize the benthic community and include total number of taxa, evenness, species richness, and Simpson's dominance index.

- **Total Number of Taxa** is the total number of distinct taxa. This metric reflects the health of the community through a measurement of the variety of taxa present.

- **Evenness (e)** is how the species abundances (e.g., the number of individuals, biomass, etc.) are distributed among the species (Ludwig and Reynolds 1988). Evenness measures the similarities between abundances of different species. When there are similar proportions of all species, evenness is equivalent to one, but when the abundances are very dissimilar (some rare and some common species), the value increases (Geneseo 1996). The equation for Evenness is:

$$e = \frac{\overline{H}}{\log S}$$

where:

$\overline{H}$ = Shannon-Weiner Index value

S = number of species

- **Species richness (d)** is the number of species in the community dependent on the sample size (Ludwig and Reynolds 1988). This index expresses the variety of component of species diversity at each station as a ratio between the total number of species (taxa) and the total number of individuals. It removes the abundance variability among stations so that interstation comparisons are possible. This index expresses variety independent of an evenness index, which is incorporated in general indices of diversity. Diversity indices incorporate both species richness and evenness into a single value. The equation for Species Richness Index is:

$$d = \frac{S-1}{\log N}$$

where:

S = number of species
N = number of individuals

- **Simpson's Dominance Index (c)**, which varies from 0 to 1, gives the probability that two individuals drawn at random from a population belong to the same species (Ludwig and Reynolds 1988). The equation for Simpson's Dominance Index is:

$$c = \sum (ni / N)^2$$

where:

ni = importance value for each species
N = total of importance values

2.1.2 Fisheries Studies

Two sampling techniques, bottom trawl and beach seining, were employed to collect adult and juvenile fish species around James Island in June 2002. Fish and blue crabs were collected at ten locations (four beach seine locations and six bottom trawl) within and adjacent to the proposed dike alignments.

Bottom Trawl

Six bottom trawl locations (JF-001 through JF-006) were identified in the field which reflected the range of bottom conditions within or adjacent to the proposed alignments (Figure 2-2). Two otter trawl tows were conducted at each station, spaced several hundred feet apart. The gear employed was a 16-foot semi-balloon otter trawl with a ¾" liner. While the net was being deployed, DGPS coordinates were recorded at the beginning and end of each tow (Appendix B). Two separate five-minute tows were conducted at each of the six locations at a constant boat speed of 1,300 revolutions per minute (rpm). Longer tows were not possible due to obstructions such as crab pots and downed trees. The two tows at each location were conducted parallel to the prevailing currents, tidal flow or wind, which ever was greater. A 7:1 warp-to-tow ratio was used at all times to ensure that the net was fishing on the bottom. Upon completion of each five-minute tow, the trawl was emptied into a container and processed before conducting the second tow.

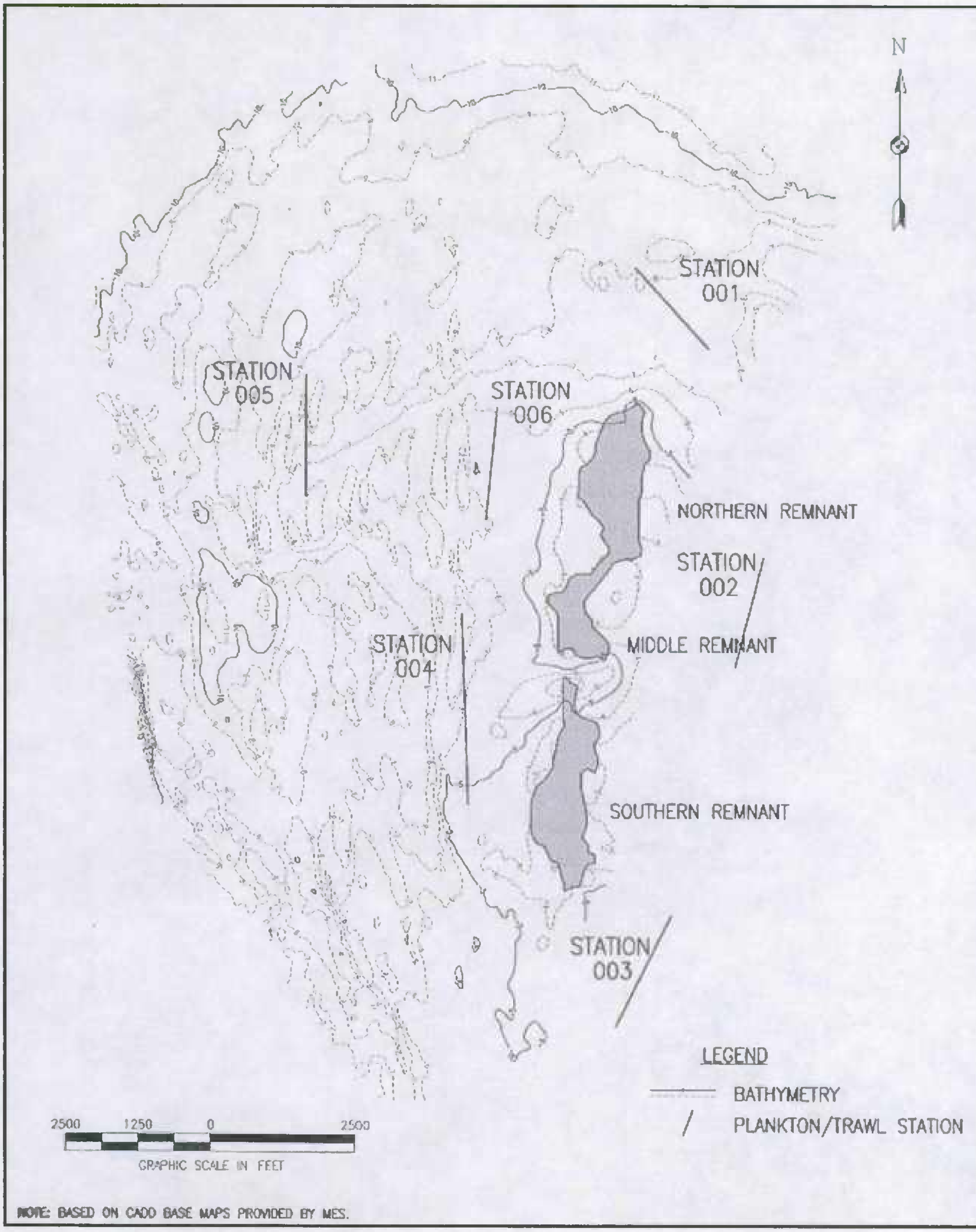


Figure 2-2. Plankton / Trawl Stations in Vicinity of James Island, June 2002

Trawl samples were processed onboard, and organisms were identified, enumerated and returned to the water. A representative subsample of fifty individuals per species from each tow were to be measured to the nearest millimeter, however, no species collected numbered enough to warrant subsampling at any of the six locations. Measurements included total lengths of finfish and carapace widths of blue crabs. Data were recorded on standard fisheries datasheets. Organisms having external parasites, disease, or morphological abnormalities were noted on the datasheet. Organisms collected during the two tows at a single location were numerically combined to represent ten-minutes of total effort for summarization purposes. *In situ* water quality parameters were recorded at each of the six locations.

Beach Seine

Four locations (Seines #1 through #4) were identified in the field, and were chosen to reflect a range of shore conditions within and adjacent to the proposed alignments (Figure 2-2). Because of the many snags and variable bottom conditions around much of the island remnants, the locations chosen were the areas that could be sampled effectively by seining; the locations are shown on Figure 2-3. Seine #1 was located on the eastern side of the south end of the northern remnant. Seine #2 was located on the western side of the north end of the middle remnant. Seine #3 was located in a small cove on the eastern side of the southern remnant. Seine #4 was located on the eastern side of the north end of the middle remnant. Locations were chosen to represent as many types of shore-zone habitat as possible and to distribute the seine sites between the western and eastern sides of the island. Three sites (Seines #1, #3, and #4) were located on the eastern side of the island and one site (Seine #2) was located on the western side of the island. Seine #2 was the only suitable location on the western side of the island to deploy the beach seine.

A 100-foot by 4-foot seine net with ¼ inch mesh was used to sample these locations. The net was deployed in an arc, perpendicular to the shoreline to sample approximately 30 meters of shoreline. Two consecutive and adjacent hauls were conducted at each of the four sites for a combined shoreline distance of approximately 60 meters. All finfish and blue crabs were emptied into a container and processed before conducting the second haul.

Seine samples were processed onshore, and organisms were identified, enumerated and returned to the water. A representative subsample of fifty individuals per species from each haul was measured to the nearest millimeter. Measurements included total lengths of finfish and carapace widths of blue crabs. Data were recorded on standard fisheries datasheets. Organisms having external parasites, disease, or morphological abnormalities were noted on the datasheet. Organisms collected during the two hauls at a single location were numerically combined for summarization purposes. *In situ* water quality parameters were recorded at each of the four locations.

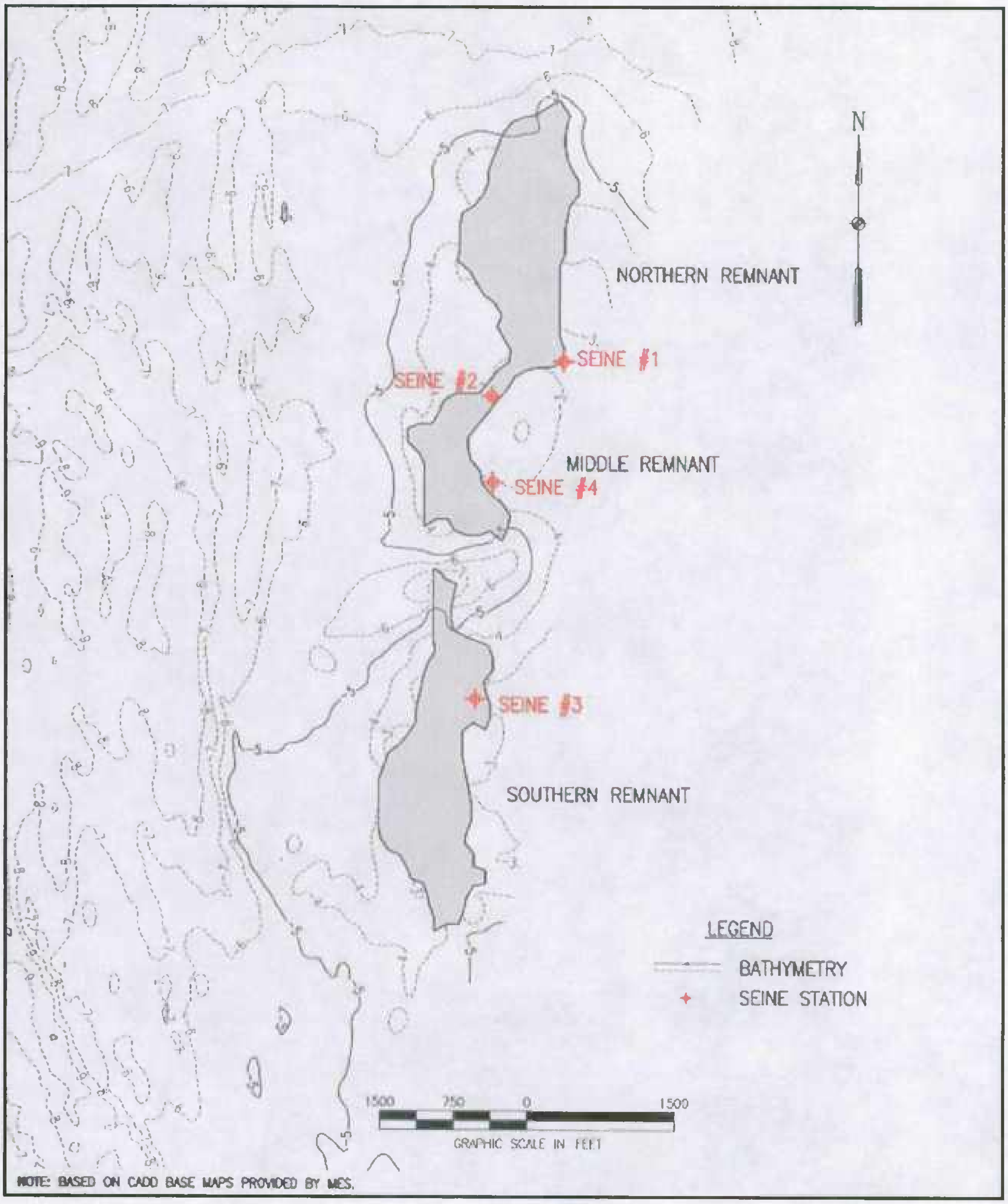


Figure 2-3. Seine Stations in Vicinity of James Island, June 2002

2.1.3 Plankton Studies

Plankton sampling was conducted at six locations, utilizing the same basic stations as the fisheries (trawl) locations (Figure 2-2). Two separate five-minute tows were conducted (one at the surface and one at the bottom). For each tow a constant boat speed of 1100 rpm was maintained. The gear utilized were two 2.5-m long, conical plankton nets with 0.5-m mouth openings, made from 505-micron mesh. These were mounted side-by-side on a rigid metal towing frame and sled, and 1-L plastic collection jars were screwed into the threaded codends. A General Oceanics digital flowmeter was affixed in the mouth of each net to record sample volume. A third flowmeter was attached to the sled frame outside of the nets for the purposes of monitoring net clogging. If substantially lower flowmeter readings were found in-net as compared to outside, the tow was repeated. Before deploying the plankton sled, 6-digit flowmeter readings were recorded from each of the three meters and DGPS beginning positions were recorded. The standard towing period was 5 minutes from the time that the nets were set and the tow was parallel to the prevailing currents. Longer tows were not possible due to jellyfish densities (which clog nets). Separate surface and bottom tows were conducted.

The amount of line deployed was calculated from a nomograph using the water depth and a cable angle. At the end of each tow, the final flowmeter and DGPS readings were recorded. The contents of each net were then rinsed, concentrating the catch into the codend jar. Sample jars were removed from the nets, labeled (inside and out), and preserved with 10 percent buffered formalin solution. At each station, mid-depth *in situ* water quality measurements were recorded.

In the laboratory, samples were rinsed using a 400-micron sieve to remove excess formalin. Detritus and debris were removed prior to sorting. Larger organisms were also removed and recorded. Samples were sorted completely and all fish eggs, larvae, and juveniles encountered were segregated for identification and enumeration. Ichthyoplankton were identified to the lowest practical taxon and enumerated. Macrozooplankton were also removed and enumerated by class. All observations were noted on standard laboratory sorting sheets. The remaining sample was recondensed and represerved for storage.

Plankton are reported as densities per 100 m^3 (#/100m^3). This was done by converting the net (final minus initial) flowmeter reading to a distance and volumes (based upon the net-mouth opening), then extrapolating the catches to the number of organism per 100 m^3.

2.1.4 Sediment Quality

Field Methods

Sediment quality sampling for James Island consisted of physical and chemical characterization of the bulk sediment and water quality measurements from five of the designated benthic locations: JAM-002, -005, -007, -009, and -010 (Figure 2-1, and Section 2.1.1).

Sediment sample collection for James Island was initiated on 12 November 2001 and completed on 13 November 2001. Five stations were successfully sampled using a medium-sized ponar grab (0.5 m^2) and samples were processed in the field following sediment collection. Multiple sediment grabs were collected and composited into one sample for each of the five locations.

Each sample was homogenized until the sediment was thoroughly mixed and of uniform consistency. When compositing and homogenization was complete, sub-samples of sediment were placed into appropriate sample jars and stored in a cooled (4°C) insulated container until submission to the laboratory for analyses.

Laboratory Methods

The analytical testing of sediment was conducted by Severn Trent Laboratories-Pittsburgh (STL-Pittsburgh) located in Pittsburgh, Pennsylvania. The standard methods recommended by the Inland Testing Manual (ITM) were used to analyze the sediment samples (USEPA/USACE 1998). Sediments were tested for the following compounds:

- semivolatile organic compounds (SVOCs),
- chlorinated pesticides,
- organophosphorus pesticides,
- polychlorinated biphenyl (PCB) congeners,
- polynuclear aromatic hydrocarbons (PAHs),
- metals,
- dixon and furan congeners,
- butyltins,
- ammonia (NH_3-N),
- nitrate/nitrite,
- cyanide
- total sulfide,
- total Kjeldahl nitrogen (TKN),
- acid volatile sulfide (AVS),
- simultaneously extracted metals (SEM),
- total organic carbon (TOC),
- total phosphorus,
- biochemical oxygen demand (BOD), and
- chemical oxygen demand (COD).

In addition, the following physical analyses were conducted for the bulk sediment samples:

- grain size determination,
- specific gravity, and
- moisture content.

Calculations for Total PCBs, Total PAHs, and Dioxin TEQs

For each sample, total PCB concentrations were determined by summing the concentrations of the 18 summation congeners (as specified in Table 9-3 of the ITM) and multiplying the total by a factor of 2. Multiplying by a factor of 2 estimated the total PCB concentration and accounted for additional congeners that were not tested as part of this program. These determinations were based upon testing of specific congeners recommended in the ITM and upon the National Oceanic and Atmospheric Administration (NOAA 1993) approach for total PCB determinations.

Total PAH concentrations were determined for each sample by summing the concentrations of the individual PAHs. For both the total PCB and total PAH concentrations, two values are reported, each representing the following methods for treating concentrations below the analytical detection limit:

- Non-detects = 0 (ND=0)
- Non-detects = 1/2 of the detection limit (ND = 1/2DL)

Substituting one-half the detection limit for non-detects (ND=1/2DL) provides a conservative estimate of the concentration. This method, however, tends to produce results that are biased high, especially in data sets where the majority of samples are non-detects. This overestimation is important to consider when comparing the calculated total values to criteria values.

The Toxicity Equivalency Quotients (TEQs) for dioxin were calculated following the U.S. Environmental Protection Agency (USEPA) approach (USEPA 1989). Each congener was multiplied by a Toxicity Equivalency Factor (TEF) (Van den Berg et al. 1998), and the congener concentrations were summed. The dioxin TEQs were calculated using ND=0 and ND=1/2DL.

2.2 TERRESTRIAL SURVEYS

2.2.1 Vegetation Surveys

Vegetative communities and habitat types observed at James Island in November 2001 and June 2002 were categorized by field reconnaissance activities and the documentation of data during field activities to the three island remnants. Additionally, aerial photographs, maps, and field notes from previous investigations of James Island were also used to determine the community types present at James Island (MES 2002). The intent of the vegetation characterization component of this investigation was to identify the distribution and composition of plant communities present such as low marsh, high marsh, upland, open water, and SAV habitats. The plant species composition of these areas were determined in terms of dominant and sub-dominant plants (by visual dominance estimation) determined to the genus and species, where possible. In October 2001, approximately 70 percent of the 3 island remnants was traversed by one EA scientist that made notes on general habitat types. In June 2002, two EA scientists traversed approximately 75 percent of the northern, middle, and southern remnants of James Island and more detailed floristic and habitat observations were recorded. Dominant plant species and vegetative communities encountered during the vegetation survey were documented on data sheets and observations were recorded with a digital camera in the field and downloaded in the office as a photographic record (Appendix A). Observed plant species were identified in the field and characterized by natural resource type and qualitative data was recorded concerning the distribution and extent of plant communities. Details of the botanical species observed within each habitat type or natural resource were recorded on the data sheets. Other general observations including wildlife species and topography characteristics were also noted.

2.2.2 Avian and Other Wildlife

Timed bird survey observations were made during June 2002. Five stations around the perimeter of the three remnants of James Island (Figure 2-4) were established in order to observe the range of habitat types available around the island which included forests, wetlands, open water, SAV, and beaches. At each station, a timed bird survey was conducted covering a 180-degree observation area. Each survey was 15 minutes in length. All species heard and/or observed with binoculars during the 15-minute period were recorded on data sheets. The data sheet consisted of four sections: sample information (e.g., date, time, location, weather conditions), habitat checklist, a bird species checklist and an area for notations. The checklist portion of the field data sheet had been developed for use as a generic field data sheet.

Bird species considered relatively common over a wide diversity of habitat types and seasons were listed in the checklist. Bird species were listed in taxonomic order and broken into categories as follows:

- Loons-Herons
- Geese-Ducks
- Vultures-Hawks
- Game Birds
- Shorebirds
- Gulls
- Doves-Cuckoos
- Owls
- Nightjars-Swifts
- Hummingbirds
- Kingfishers
- Woodpeckers
- Flycatchers
- Shrikes
- Vireos
- Jays-Crows
- Larks
- Swallows
- Titmice-Chickadees
- Creepers-Nuthatches
- Wrens
- Kinglets-Gnatcatchers
- Thrushes
- Mimics
- Starlings-Waxwings
- Warblers
- Tanagers
- Towhees-Sparrows
- Cardinals-Grosbeaks
- Blackbirds
- Finches
- Old World Sparrows

The approach for surveying birds associated with the three remnant portions of James Island was to make observations of a portion of a remnant and adjacent open water. The survey methods were utilized to achieve the desired results of documenting avian utilization of the project area, particularly the tidal marsh, upland habitat, and adjacent tidal waters.

During the 15-minute observation period all avian species seen and/or heard were noted along with the method of observation. Individuals were enumerated when discernible. Evidence of former nesting on the James Island remnants was also noted when observed.

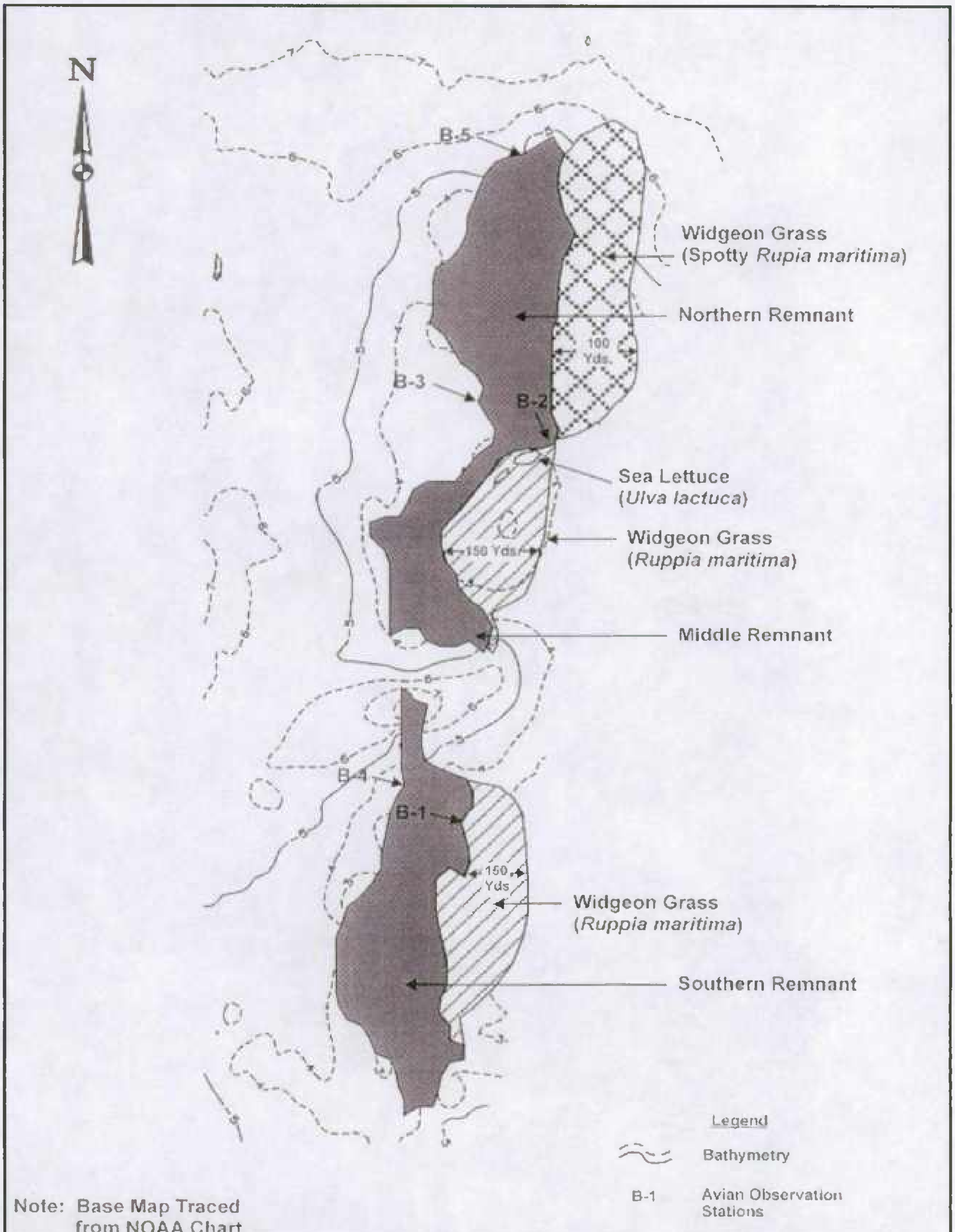


Figure 2-4. Avian Observation Stations and Extent of Submerged Aquatic Vegetation (SAV) on James Island

In addition to the timed avian observations, incidental bird species observed were noted during the James Island habitat characterization surveys in both October 2001 and June 2002. The avian field data form described above was utilized and the recorded observations followed the same methodology. During the vegetation and habitat characterization surveys on each island remnant, wildlife species and signs (e.g., tracks, scat, bones, etc.) observed were recorded. When possible, the total number of individual wildlife species was also noted. The notation box portion of the data sheet used to record any observations of other wildlife species.

2.2.3 Other Resources

During both the October 2001 and June 2002 surveys, observations concerning historical, archeological, and other resources were completed in concurrence with past field investigations and the vegetation, avian, and wildlife observations. The intent of this investigation was to identify the distribution and occurrence of possible historic and archeological resources that were [identified by the Maryland Historic Trust (MHT)] relative to the area proposed for construction. Approximately 70 to 75 percent of the northern, middle, and southern remnants of James Island were traversed by EA scientists and general historic and archeological observations were recorded, when applicable.

2.3 Submerged Aquatic Vegetation (SAV) Mapping

Annual SAV data were downloaded from the Virginia Institute of Marine Science (VIMS) website. The data included SAV mapping for the entire Bay interpreted from annual overflights. The period of record for this data was 1971 to 2000 and resulted in 22 years of data; not all years were flown during the period of record. Data for 2001 and 2002 were not available at the time that this report was prepared. The available data were superimposed on maps of the area and compared to the proposed alignments for James Island Restoration.

In addition, the extent and relative density of SAV existing near James Island during the June 2002 field efforts was also noted in the field (Figure 2-4). EA scientists toured the island by perimeter in a boat to identify the general extent of the existing beds (visually). The boat was then set at the edge of the areas containing SAV and the width of the bed (to the shoreline) was measured using a range finder. All observations were drawn on a map. The SAV mapping was a qualitative survey and total SAV bed acreages were not generated at the feasibility-level of this study.

3.0 RESULTS AND ANALYSIS

3.1 AQUATIC SURVEYS

The field sampling programs were designed to assess the existing aquatic resources within and adjacent to the proposed alignments at James Island. The proposed design (baseline) area and the resulted total affected acreages are summarized below.

TABLE 3-1. DESIGN AND AFFECTED ACREAGES OF THE JAMES ISLAND ALIGNMENTS*

Alignment Number	Total Design Acreage	Total Upland Acreage	Total Wetland Acreage
1	978	489	489
2	2,126	1,063	1,063
3	1,586	793	793
4	2,200	1,100	1,100
5	2,072	1,036	1,036

*Note: This table presents the design acreages to the centerline of the project. Total site designs of the projects would be approximately one to two acres more to the toe of the dike. totaling 979 to 2.202 acres.

3.1.1 Benthic Community

Results of the benthic community evaluations are included, by season, in the following sections and in detail in Appendix C. Water quality was analyzed at each of the ten benthic stations during both the Fall 2001 and Summer 2002 surveys. Figure 2-1 in Section 2 presents the benthic sampling station locations.

3.1.1.1 October 2001

A taxonomic list of the benthic macroinvertebrates collected from James Island in October 2001 is presented in Table C-1 (Appendix C). Mean densities for each benthic macroinvertebrate collected at each station is presented in Table C-2 (Appendix C).

Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI)

A summary of the benthic community metrics and scores used to calculate the B-IBI for the October 2001 collection at James Island is presented in Table 3-2. Abundance (total number of organisms per square meter) was high at all stations except for JAM-010 (4,304/m^2). The remaining abundances ranged from 32,144/m^2 at JAM-001 to 356,000/m^2 at JAM-008, which resulted in B-IBI scores of 1 at all stations except for JAM-010 which received a score of 3. The Shannon-Weiner Diversity values were low, ranging from 0.025 at JAM-008 to 1.252 at JAM-010. All stations received a B-IBI score of 1 for the Shannon-Weiner Diversity metric. The abundance of stress-sensitive taxa was also low ranging from 0.03 percent at JAM-008 to 1.6 percent at JAM-001, resulting in B-IBI scores of 1 at all stations. The abundance of Stress-indicative taxa was below 1 percent for all stations resulting in all stations receiving a B-IBI

TABLE 3-2. SUMMARY OF BENTHIC COMMUNITY METRICS AND SCORES USED TO CALCULATE THE B-IBI AT JAMES ISLAND, OCTOBER 2001

Type of Metric	Metric Values by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004[c]	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010[c]
Abundance (#/m^2)[a]	32,144	72,216	219,157	49,021	92,350	251,307	98,266	356,000	191,821	4,304
Shannon-Weiner Diversity[a][b]	0.269	0.071	0.068	0.436	0.067	0.051	0.035	0.025	0.073	1.252
Stress-Sensitive Taxa Abundance (%)	1.6	0.1	0.1	--	0.1	0.1	0.1	0.03	0.2	--
Stress –Indicative Taxa Abundance (%)	0.1	0.01	<0.01	--	0.04	<0.01	0.01	<0.01	0.01	--
Carnivore/Omnivore Abundance (%)	2.8	0.6	0.8	4.4	0.6	0.3	0.3	0.1	0.7	37.0

Type of Metric	B-IBI Scores by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004[c]	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010[c]
Abundance (#/m^2)[a]	1	1	1	1	1	1	1	1	1	3
Shannon-Weiner Diversity[a][b]	1	1	1	1	1	1	1	1	1	1
Stress-Sensitive Taxa Abundance (%)	1	1	1	--	1	1	1	1	1	--
Stress –Indicative Taxa Abundance (%)	5	5	5	--	5	5	5	5	5	--
Carnivore/Omnivore Abundance (%)	1	1	1	1	1	1	1	1	1	5
B-IBI[d]	1.8	1.8	1.8	1	1.8	1.8	1.8	1.8	1.8	3

(a) Includes all species collected.
(b) Log used was log base e
(c) JAM-004 and JAM-010 are classified as high mesohaline mud; therefore, stress-sensitive taxa abundance and stress-indicative taxa abundance were not included in the calculation of the B-IBI.
(d) Mean of the metric scores.

score of 5. Stress-sensitive and stress-indicative taxa were not calculated at the high mesohaline mud stations JAM-004 and JAM-010. The abundance of carnivore/omnivore taxa was low at all stations except for JAM-010 (37 percent). The remaining abundances of carnivore/omnivore taxa ranged from 0.1 percent at JAM-008 to 2.8 percent at JAM-001, resulting in scores of 1 for all stations except JAM-010 which received a score of 5. The scores for each of the metrics at each station were averaged to determine the total B-IBI for each station. Scores of 3.0 or greater are considered to meet the Chesapeake Bay Restoration Goal. Total B-IBI scores were low (1.0 – 1.8) for stations JAM001-009 sampled at James Island in October 2001. JAM-010, which had a total B-IBI score of 3.0, was the only station sampled in the proposed alignment areas in October 2001 to meet the Chesapeake Bay Restoration Goal.

Other Benthic Community Metrics

Four additional metrics were calculated to further characterize the benthic community and include the total number of taxa (collected at each station), species richness, evenness, and the Simpson's Dominance Index (Table 3-3).

A total of 35 separate benthic taxa (only species meeting B-IBI macrofaunal criteria were included) were collected in October 2001 at James Island (Table C-2). The annelids comprised the most taxa (16); bivalves (5); crustaceans (5); nemerineans (5); and gastropods (4). The total number of taxa varied at James Island, ranging from 9 taxa at JAM-007 to 23 taxa at JAM-004.

Species richness was similar at all stations ranging from 1.04 at JAM-007 to 2.81 at JAM-004 (Table 3-3). Evenness was low at all stations except for JAM-010 (0.47). The remaining values for evenness ranged from 0.01 at JAM-007 and JAM-008 to 0.13 at JAM-004.

Station JAM-010 had the lowest value for dominance and the highest evenness value. However, total number of taxa was low at this station. Station JAM-007 had the lowest values for evenness and species richness, and one of the highest for dominance. This station also had the lowest total number of taxa.

Simpson's Dominance Index values were high at all stations at James Island in October 2001, except for JAM-010 (0.395). The remaining values ranged from 0.848 at JAM-004 to 0.988 at JAM-006 (Table 6). All stations were dominated by the gem clam.

Abundance Trends

Bivalvia was the most dominant group found at the benthic stations (Table C-2 of Appendix C). Seven stations (JAM-002, JAM-003, JAM-005, JAM-006, JAM-007, JAM-008, JAM-009) had at least 99 percent dominance of bivalves. Bivalves also dominated at the remaining stations, JAM-001 (95.7 percent), JAM-004 (92 percent), and JAM-010 (55.4 percent). The dominant bivalve was the gem clam. Annelids were the second most dominant group found at the benthic stations. They were found at all stations with the highest abundance occurring at JAM-001 (2.5 percent), JAM-004 (7.4 percent), and JAM-010 (34.9 percent). The dominant annelids were the polychaetes *Glycinde solitaria* and *Neanthes succinea*.

TABLE 3-3. SUMMARY OF ADDITIONAL BENTHIC COMMUNITY METRICS[a] AT JAMES ISLAND, OCTOBER 2001,

Type of Metric	**Values by Station Number**									
	JAM-001	**JAM-002**	**JAM-003**	**JAM-004**	**JAM-005**	**JAM-006**	**JAM-007**	**JAM-008**	**JAM-009**	**JAM-010**
Total # of Taxa[b]	19	12	15	23	12	17	9	16	18	11
Species Richness	2.36	1.62	1.64	2.81	1.37	2.0	1.04	1.93	2.24	2.02
Evenness	0.09	0.03	0.02	0.13	0.03	0.02	0.01	0.01	0.02	0.47
Simpson's Dominance Index	0.917	0.982	0.981	0.848	0.983	0.988	0.992	0.995	0.981	0.395

(a) Includes all species collected.
(b) Excludes species not meeting B-IBI macrofaunal criteria.

Water Quality and Precipitation Data

In situ water quality collected during the benthic sampling for Fall 2001 is discussed in Section 3.1.2 and Table 3-7. The months preceding the October 2001 sampling event at James Island exhibited below to well below normal precipitation events. The NOAA reported that the average precipitation in September 2001 was 2.2 in. and in October it was 0.90 in. in the vicinity of James Island (NOAA 2002). September 2001 was classified as below normal (one of the 35 driest such periods on record) and October 2001 was classified as much below normal (one of the 10 driest such periods on record).

Summary of Fall 2001 Benthic Findings

Abundance (total number of organisms per square meter) was high at James Island in the October 2001 collection. Abundance ranged from 4,304/m^2 at JAM-010 to 356,000/m^2 at JAM-008. Bivalvia was the most dominant group found at the benthic stations. Seven stations (JAM-002, JAM-003, JAM-005, JAM-006, JAM-007, JAM-008, and JAM-009) had at least 99 percent dominance of bivalves. Bivalves also dominated at the remaining stations, JAM-001 (95.7 percent), JAM-004 (92 percent), and JAM-010 (55.4 percent). The dominant bivalve was the gem clam.

Overall, the B-IBI metric calculations were low at stations collected near James Island. The Shannon-Weiner Diversity values ranged from 0.025 at JAM-008 to 1.252 at JAM-010. The abundance of stress-sensitive taxa ranged from 0.03 percent at JAM-008 to 1.6 percent at JAM-001 and the abundance of stress-indicative taxa was below 1 percent for all stations. The abundance of carnivore/omnivore taxa was low at all stations (0.1 to 2.8 percent) except for JAM-010 (37 percent).

In conclusion, the total B-IBI scores were also low (ranging from 1.0 to 1.8) for all stations sampled at James Island in October 2001 except for JAM-010, which had a total B-IBI score of 3.0. Scores of 3.0 or greater were considered meeting the Chesapeake Bay Restoration Goal (Ranasinghe et al. 1994). JAM-010 was the only station sampled in October 2001 to meet the Chesapeake Bay Restoration Goal. The mean total B-IBI score for the combined James Island sites was 1.8.

The low B-IBI scores may be related to a combination of factors: below normal precipitation for the months of September and October preceding the 24 – 30 October 2001 sampling event and the predominance of one species (gem clam) at all the stations.

3.1.1.2 June 2002

A taxonomic list of the benthic macroinvertebrates collected from James Island in June 2002 is presented in Table C-1 (Appendix C). Mean densities for each benthic macroinvertebrate collected at each station is presented in Table C-3.

Chesapeake Bay Benthic Index of Biotic Integrity (B-IBI)

A summary of the benthic community metrics and scores used to calculate the B-IBI for the June 2002 collection at James Island is presented in Table 3-4. Overall, low B-IBI scores were encountered at all stations sampled in June 2002. Abundance (total number of organisms per square meter) was high at all stations ranging from 45,906/m^2 at JAM-010 to 351,145/m^2 at JAM-006, which resulted in B-IBI scores of 1 at all stations. The Shannon-Weiner Diversity values were low, ranging from 0.02 at JAM-007 to 0.412 at JAM-010. All stations received a B-IBI score of 1 for the Shannon-Weiner Diversity metric. The abundance of stress-sensitive taxa was also low ranging from 0.002 percent at JAM-006 to 0.049 percent at JAM-009, resulting in B-IBI scores of 1 at all stations. The abundance of stress-indicative taxa was below 2 percent for all stations resulting in all stations receiving a score of 5. Stress-sensitive and stress-indicative taxa were not calculated at the high mesohaline mud stations JAM-004 and JAM-010. The abundance of carnivore/omnivore taxa was low at all stations ranging from 0.112 percent at JAM-007 to 0.816 percent at JAM-004, resulting in scores of 1 for all stations.

The scores for each of the metrics at each station were averaged to determine the total B-IBI for each station. Scores of 3.0 or greater are considered as meeting the Chesapeake Bay Restoration Goal. Total B-IBI scores were low (1.0 to 1.8) for all stations sampled at James Island in June 2002. No stations sampled in June 2002 met the Chesapeake Bay Restoration Goal.

Other Benthic Community Metrics

Four additional metrics were calculated to further characterize the benthic community and include the total number of taxa collected at each station, species richness, evenness, and the Simpson's Dominance Index (Table 3-5).

A total of 41 separate benthic taxa (only species meeting B-IBI macrofaunal criteria were included) were collected in June 2002 at James Island (Table 3). Annelids comprised the most taxa (15); crustaceans (11); bivalves (5); nemerineans (4); and gastropods (4). The total number of taxa varied at James Island, ranging from 11 taxa at JAM-007 to 22 taxa at JAM-005.

Simpson's Dominance Index values were high at all stations at James Island in June 2002. The values ranged from 0.833 at JAM-010 to 0.996 at JAM-007 (Table 3-5). The gem clam dominated all stations.

TABLE 3-4. SUMMARY OF BENTHIC COMMUNITY METRICS AND SCORES USED TO CALCULATE THE B-IBI AT JAMES ISLAND, JUNE 2002

Type of Metric	Metric Values by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004[c]	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010[c]
Abundance (#/m^2)[a]	302,946	148,179	214,961	133,477	222,864	351,145	139,011	205,116	221,293	45,906
Shannon-Weiner Diversity[a][b]	0.142	0.151	0.087	0.249	0.079	0.087	0.020	0.068	0.070	0.412
Stress-Sensitive Taxa Abundance (%)	0.022	0.032	0.012	--	0.034	0.002	0.004	0.003	0.049	--
Stress –Indicative Taxa Abundance (%)	1.327	0.724	0.313	--	0.049	0.433	0.019	0.103	0.267	--
Carnivore/Omnivore Abundance (%)	0.381	0.498	0.274	0.816	0.298	0.269	0.112	0.291	0.213	0.80

Type of Metric	Metric Values by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004[c]	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010[c]
Abundance (#/m^2)[a]	1	1	1	1	1	1	1	1	1	1
Shannon-Weiner Diversity[a][b]	1	1	1	1	1	1	1	1	1	1
Stress-Sensitive Taxa Abundance (%)	1	1	1	--	1	1	1	1	1	--
Stress –Indicative Taxa Abundance (%)	5	5	5	--	5	5	5	5	5	--
Carnivore/Omnivore Abundance (%)	1	1	1	1	1	1	1	1	1	1
B-IBI[d]	1.8	1.8	1.8	1	1.8	1.8	1.8	1.8	1.8	1

(a) Includes all species collected.
(b) Log used was log base e
(c) JAM-004 and JAM-010 are classified as high mesohaline mud; therefore, stress-sensitive taxa abundance and stress-indicative taxa abundance were not included in the calculation of the B-IBI.
(d) Mean of metric scores

TABLE 3-5. SUMMARY OF ADDITIONAL BENTHIC COMMUNITY METRICS[a] AT JAMES ISLAND, JUNE 2002

Type of Metric	Metric Values by Station Number									
	JAM-001	**JAM-002**	**JAM-003**	**JAM-004**	**JAM-005**	**JAM-006**	**JAM-007**	**JAM-008**	**JAM-009**	**JAM-010**
Total # of Taxa[b]	19	20	17	16	22	18	11	17	14	19
Simpson's Dominance Index	0.957	0.958	0.977	0.917	0.980	0.977	0.996	0.983	0.982	0.833
Species Richness	2.06	2.5	1.93	2.02	2.69	2.30	1.21	2.13	1.54	2.27
Evenness	0.05	0.05	0.03	0.08	0.02	0.03	0.01	0.02	0.02	0.14

(a) Includes all species collected.
(b) Excludes species not meeting B-IBI macrofaunal criteria.

Species Richness was similar at all stations ranging from 1.21 at JAM-007 to 2.69 at JAM-005 (Table 3-5). Evenness was low at all stations ranging from 0.01 at JAM-007 to 0.14 at JAM-010.

Station JAM-010 had the lowest value for dominance and the highest evenness value. Station JAM-007 had the lowest values for evenness and species richness, and the highest for dominance. This station also had the lowest total number of taxa.

Abundance Trends

Bivalvia was the most dominant group found at the benthic stations. All stations, except JAM-010, had at least 96 percent dominance of bivalves (Table C-3 of Appendix C). JAM-010 had 91 percent dominance of bivalves. The dominant bivalve was the gem clam; annelids were the second most dominant group found at the benthic stations. Annelids were found at all stations with the highest abundance occurring at JAM-010 (7 percent). The dominant annelid was the polychaete *Streblospio benedicti.*

Water Quality and Precipitation Data

In situ water quality collected during the benthic sampling for Summer 2002 is discussed in Section 3.1.2 and Table 3-7. The June 2002 sampling event at James Island exhibited below normal precipitation. The NOAA reported that the average precipitation in June 2002 was 2.39 inches in the vicinity of James Island (NOAA 2002). June 2002 was classified as below normal (one of the 35 driest such periods on record).

Summary of Summer 2002 Findings

Abundance (total number of organisms per square meter) was high at James Island in the June 2002 collection. Abundance ranged from 45,906/m^2 at JAM-010 to 351,145/m^2 at JAM-006. Bivalves were the most dominant group found at the benthic stations. All stations except JAM-010 (91 percent) had at least 96 percent dominance of bivalves. The dominant bivalve was the gem clam.

Overall, the B-IBI metric calculations were low at stations collected near James Island. The Shannon-Weiner Diversity values ranged from 0.02 at JAM-007 to 0.412 at JAM-010. The abundance of stress-sensitive taxa ranged from 0.002 percent at JAM-006 to 0.049 percent at JAM-009 and the abundance of stress-indicative taxa ranged from 0.019 percent at JAM-007 to 1.3 percent at JAM-010. The abundance of carnivore/omnivore taxa was low at all stations (0.1 to 0.8 percent).

In conclusion, the total B-IBI scores were also low (ranging from 1.0 to 1.8) for all stations sampled at James Island in June 2002. Scores of 3.0 or greater were considered meeting the Chesapeake Bay Restoration Goal (Ranasinghe et al. 1994). No stations sampled in June 2002 met the Chesapeake Bay Restoration Goal. The mean total B-IBI score for the combined James Island sites was 1.6. The low B-IBI scores may be related to a combination of factors: below normal precipitation for the month of June and the predominance of one species (gem clam) at all the stations.

3.1.2 Fisheries Studies

The fisheries results are summarized in the following sections, with more detailed summaries of the data included in Appendix C. A total of twenty finfish species, representing fifteen families and one crab species were collected during the sampling conducted during June 2002. The scientific and common names of all species collected with all gear types are listed in Table C-4 (Appendix C). Summaries of catches by gear type and station are presented in Table 3-6. A summary of the length data for all organisms measured is included as Table C-5 (Appendix C). *In situ* water quality collected during the field effort is included in Table 3-7.

Bottom Trawl

Bottom trawling efforts yielded very few fish at the six locations (Figure 2-2). A total of six species representing six families were collected using bottom trawl gear. Miscellaneous captures of mysid shrimp, mud crabs, crangon shrimp, stinging nettles and comb jellyfish were also captured. Comb jellyfish were very abundant at all six of the trawl stations, with an estimated volume of five to ten gallons collected at each station. Stations JF-001, JF-002, and JF-004 yielded no fish for the two consecutive tows at each of these locations. One Atlantic silverside (*Menidia menidia*) was collected at Station JF-006 and two blue crabs (*Callinectes sapidus*) were collected at Station JF-005. The trawl stations within the proposed alignments (JF-001, JF-004, JF-005, and JF-006) and the station immediately east of James Island (JF-002) had relatively uniform bottoms with little-to-no structural habitat features. Station JF-003 (between James and Taylor islands (Figure 2-2) had the most fish captures of the six bottom trawl locations. Five species were collected in the two consecutive tows, spot (*Leiostomus xanthurus*), bay anchovy (*Anchoa mitchilli*), northern pipefish (*Sygnathus fuscus*), naked goby (*Gobiosoma bosci*), and blue crab. This area had a slightly different bottom character with more variability and probably has better physical habitat features than the other sites.

Based on DGPS estimates of position, each five minute tow covered approximately 15 seconds of latitude, or 300 meters yielding a total of 600 meters of bottom area sampled for both tows at each location. Station depths and thus depth of sampling varied somewhat from station to station and are as follows: JF-001 was 8 feet, JF-002 was 8 feet, JF-003 was 10 feet, JF-004 was 6 feet, JF-005 was 9 to 10 feet and JF-006 was 6 to 7 feet.

TABLE 3-6 SUMMARY OF FISH COLLECTIONS IN THE JAMES ISLAND STUDY AREA, JUNE 2002

Species	Number of Fish Collected at Otter Trawl Stations						Number of Fish Collected at Seine Stations			
	JF-001	JF-002	JF-003	JF-004	JF-005	JF-006	Seine #1	Seine #2	Seine #3	Seine #4
Atlantic menhaden							11	1	1	
Blueback herring							2	1	7	
Bay anchovy			13				26			
Skilletfish							2	17	11	2
Halfbeak								1		
Atlantic needlefish							51	3		2
Mummichog							54		28	
Rainwater killifish								1	12	
Atlantic silverside						1	809	850	270	344
Northern pipefish			1				2	5	1	
Striped bass										1
Atlantic croaker								1		
Red drum									2	
Spot			2				231	114	56	309
Naked goby			2							1
Summer flounder								2	5	
Hogchoker								2		
Blue crab			9		2		8	48	31	45
Sheepshead minnow							12			
Blackcheek tonguefish							1			

Beach Seine

Seining yielded considerably more fish than trawling (Figure 2-3). Nineteen (19) finfish species representing 15 families (total) and one crab species were collected during seining. Atlantic silversides numerically dominated the collections, although spot were also collected in abundance at all stations. Most species collected were forage fish, although juveniles of recreationally important species (summer flounder) and commercially important species (e.g., menhaden, blueback herring, striped bass, and red drum) were also collected. Seine # 4 (on the eastern side of the middle remnant) yielded the least number of species but the most spot taken at any station. Seine # 1 was located adjacent to the marsh along the northeastern end of the spit (between the northern and middle remnants). This station yielded the highest numbers of species and total fish collected of any station. Seine #2, along the western side of the spit was the station in closest proximity to the proposed dike alignments. It was very similar in terms of both total catch and number of species to Seine #1. Seine #3 on the northeastern end of the southern remnant yielded the lowest overall catches but a similar number of species to Seines #1 and #2. SAV was present at all seine stations except Seine #2.

Fisheries Study Conclusions

All of the fish collected in June 2002 were typical of species that occur in mesohaline reaches of the Chesapeake Bay. The different gears employed as part of the fisheries study targeted both bottom dwelling species and those species utilizing shorezone habitats. Based upon the lengths of the fish collected, the seine yielded predominantly juveniles of most species. This is typical of the gear used and indicates that the shore areas of James Island are providing nursery habitat for many species. There did not appear to be a significant difference in collections that were made inside and outside the SAV beds with this gear. Although the otter trawls yielded less individuals, most were larger (adult or subadults) species that are associated with bottom dwelling habitats. The lack of diversity in the trawl collections is probably a result of the lack of diversity of bottom types in the area that were trawled. It is very likely that these areas are used for foraging but lack other habitat features that would cause fish to linger.

James Island is located in an area that may provide essential fish habitat (EFH) to nine fish species that are managed under the Magnuson-Stevens Fisheries Conservation Act. These nine fish species include summer flounder, windowpane flounder (*Scopthalmus aquosus*), bluefish, cobia (*Rachycentron canadum*), red drum (*Sciaenops ocellatus*), king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), Atlantic butterfish (*Perprilus triacanthus*), and black sea bass *(Centropristus striata*). Consultations with the National Marine Fisheries Service (NMFS) have indicated that bluefish, summer flounder, and red drum are the species of particular concern in the vicinity of James Island (Nichols 2002). Two species collected during the Summer 2002 fisheries study around James Island, including summer flounder and red drum, are considered species of concern and are managed under the Magnuson-Stevens Fisheries Conservation Act. The presence of these species of concern indicates that the waters around James Island may provide EFH. The waters around the island remnants support a variety of forage species that are known to be important food sources for the species of concern. Because SAV occurs adjacent to many of the remnants, James Island may also be providing Habitat of Particular Concern (HAPC) for summer flounder and red drum.

In Situ Water Quality

The water quality measurements taken at James Island during biological sampling efforts are summarized in Table 3-7. Depths in the areas sampled (other than at the seine stations) ranged from 4 to 13 feet (Figure 2-1). Salinities over both seasons ranged from 10.8 to 16.8 ppt. This is typical (although 10.8 ppt is somewhat low) for this reach of the Chesapeake Bay. Turbidity was low at all locations but somewhat elevated along the shoreline (seine stations), which is expected. Temperatures were consistent with the expected norms for fall (13.6 to 18.6 °C) and summer (24.1 to 26.9 °C) and pH was typical of waters of this salinity regime. Dissolved oxygen (DO) readings were atypical of shallow, well-mixed waters of the Bay at these salinities and temperatures. Fall readings between 10.2 and 12.9 mg/L are a bit high. The readings over 13 mg/ L are anomalous and reflect a membrane tear over the DO probe. The oxygen readings taken at the seine stations range 5.9 to 8.5 mg/ L and most otter trawl stations (ranges from 4.7 to 8.1 mg/L) are within the range expected at these temperatures, salinities and depths. There was one low (and probably anomalous) reading taken at one bottom trawl station (JF-003). All oxygen readings taken in June 2002 are lower than expected and reflect a meter malfunction due to a membrane tear over the DO probe during benthic and plankton sampling.

TABLE 3-7. *IN SITU* WATER QUALITY MEASUREMENTS TAKEN IN ASSOCIATION WITH BIOLOGICAL COLLECTIONS

Station	Depth (ft)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)	Turbidity (NTU)
Benthic Sampling—October 2001						
JAM-001	12.3	15.3	8.0	10.2	16.8	4.0
JAM-002	9.0	13.6	8.1	10.5	14.9	4.0
JAM-003	6.0	18.3	8.1	11.3	NR	1.6
JAM-004	11.0	18.1	8.1	11.1	NR	1.6
JAM-005	8.5	18.6	8.3	17.2	NR	1.4
JAM-006	13.0	18.5	8.3	13.6	NR	1.6
JAM-007	9.5	18.4	8.1	17.9	NR	2.3
JAM-008	8.0	13.9	8.5	10.3	14.9	4.0
JAM-009	9.5	17.9	8.2	12.9	NR	1.5
JAM-010	5.5	18.0	8.2	11.3	NR	1.4
Benthic Sampling—June 2002						
JAM-001	12.0	24.4	8.2	4.9	12.6	3.6
JAM-002	9.0	24.5	8.2	5.0	12.7	3.6
JAM-003	5.0	24.5	8.0	4.7	13.1	10.2
JAM-004	10.0	24.5	8.2	4.8	12.9	7.8
JAM-005	8.0	24.4	8.1	4.7	12.7	2.9
JAM-006	12.0	23.7	8.1	4.2	12.6	2.7
JAM-007	9.0	23.4	8.1	4.5	12.6	4.4
JAM-008	8.0	23.4	8.2	4.8	12.4	2.2
JAM-009	8.0	23.8	8.2	5.1	12.4	7.1
JAM-010	4.0	23.8	8.2	3.1	12.9	3.6
Plankton Trawl Sampling—June 2002						
JP-001	8.0	26.4	8.2	5.1	12.7	NR
JP-002	7.0	25.9	8.1	5.3	12.9	NR
JP-003	7.0	25.2	8.0	4.2	12.6	NR
JP-004	5.0	25.3	8.3	5.3	12.3	NR
JP-005	9.0	25.4	8.2	4.8	12.3	NR
JP-006	7.0	24.2	8.2	4.5	12.5	NR
Bottom Trawl Sampling—June 2002						
JF-001	8.0	23.8	8.1	4.7	12.5	4.2
JF-002	5.0	24.5	8.2	7.0	12.4	3.6
JF-003	9.0	24.0	8.0	3.6	12.0	6.3
JF-004	5.0	23.8	8.2	7.0	11.3	2.9
JF-005	9.0	24.1	8.4	8.1	10.8	1.4
JF-006	5.0	24.3	8.1	6.0	11.5	2.3

NR = No reading recorded

TABLE 3-7. (CONTINUED)

Station	Depth (ft)	Temperature (°C)	pH	Dissolved Oxygen (mg/L)	Salinity (ppt)	Turbidity (NTU)
Beach Seine Sampling—June 2002						
Seine #1	0 to 3	26.9	8.5	8.5	12.6	68.2
Seine #2	0 to 3	26.6	8.2	8	12.4	35.5
Seine #3	0 to 3	24.3	8	6.9	12.4	39.5
Seine #4	0 to 3	25.7	8.2	5.9	12.3	8.1

NR = No reading recorded

3.1.3 Plankton Studies

Plankton sampling was conducted at the same stations as the trawl locations during the Summer 2002 surveys (Figure 2-2). The results of the ichthyoplankton analysis are summarized in Tables 3-8 (eggs) and Table 3-9 (larvae). Macrozooplankton results are included in Table 3-10. Eggs of four fish species were found in the plankton in the vicinity of James Island (Table 3-8). Collections were dominated numerically by bay anchovy eggs with densities ranging from 95 to 6754.1 eggs per 100m^3 (#/100m^3). The highest densities were found at Station JP-004, immediately west of the gap between the middle and southern remnants and there was little difference between surface and bottom samples at that station. Station JP-002 also yielded very high anchovy egg densities in bottom samples. Stations that yielded significant differences in densities between surface and bottom tows were JP-002 and JP-006. Weakfish eggs were found among the plankton and were the only lifestages of these species recorded in the fisheries field study.

Seven species of larval fish were identified in the plankton (Table 3-9). No larval form of any species dominated the plankton over all stations and depths. Gobies and skilletfish dominated the bottom tows at several locations (JP-002, JP-003, and JP-006). Blennies were ubiquitous, occurring throughout the water column at most stations. Atlantic silversides were more prevalent in surface tows at most stations and bay anchovy tended to be more prevalent in bottom tows. JP-003 yielded the highest overall larval fish densities and the high numbers of gobies in that area caused this phenomenon. This observation is consistent with the otter trawl collections in that area. Stations JP-002 (east of James Island) and JP-006 (immediately west of the northern remnant) also yielded fairly high densities, driven by the presence of gobies.

The fish eggs and larvae found in the plankton near James Island in June 2002 were typical of this reach of the Bay in summer. The relatively high densities of some species indicate that the waters surrounding the island remnants are providing relatively good fish habitat, which is consistent with the results of the seine investigation.

The macroinvertebrates found in the plankton near James Island during the Summer 2002 sampling effort are summarized in Table 3-10. Crab zoea numerically dominated collections at most stations at both the surface and bottom, although shrimp larvae and amphipods were very abundant in some places. Similar to the fish egg results, the highest zooplankton densities were found at JP-004. The lowest overall densities were found at station JP-001 and JP-003. Zooplankton distributions showed a much clearer trend of higher overall densities at the bottom at most sites. This is consistent with zooplankton diel trends. The plankton found near James are typical of those found in the plankton throughout mesohaline portions of the Bay and are helping to support the fisheries community near James Island and in adjacent areas of the Bay.

TABLE 3-8. SUMMARY OF FISH EGG DENSITIES (#/100m^3) IN THE VICINITY OF JAMES ISLAND, JUNE 2002

Species Collected	Station Number											
	JP-001				JP-002				JP-003			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Bay anchovy	1138.5	1604.5	1586.4	1642.5	471.8	359.4	4426.7	4270.6	998.6	1340.0	719.4	688.1
Naked goby	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	3.9
Weakfish	0.0	1.5	0.0	0.0	0.0	0.0	0.0	0.0	27.3	11.0	9.4	3.9
Hogchoker	3.0	5.9	2.4	1.2	0.0	3.7	2.9	3.5	12.4	17.1	6.7	15.6

Species Collected	Station Number											
	JP-004				JP-005				JP-006			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Bay anchovy	5913.6	6754.1	5399.9	5018.4	1688.3	1808.4	1930.1	1772.5	153.6	95.0	2605.4	3114.5
Naked goby	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Weakfish	1.3	1.3	1.4	1.4	0.0	0.0	0.0	2.5	25.6	17.2	52.1	33.7
Hogchoker	0.0	0.0	1.4	1.4	0.0	0.0	0.0	2.5	1.3	4.0	41.4	71.4

TABLE 3-9. SUMMARY OF LARVAL FISH DENSITIES (#/100m^3) IN THE VICINITY OF JAMES ISLAND, JUNE 2002

Species Collected	Station Number											
	JP-001				JP-002				JP-003			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Blenny	1.48	2.94	1.19	5.76	0.00	0.00	2.93	0.00	2.48	2.44	4.02	0.00
Bay anchovy	0.00	1.47	0.00	1.15	0.00	0.00	1.46	4.72	0.00	0.00	6.70	3.90
Skilletfish	0.00	0.00	0.00	6.92	2.52	1.25	13.18	2.36	0.00	1.22	4.02	1.30
Atlantic silverside	0.00	1.47	0.00	0.00	1.26	8.73	1.46	0.00	3.72	0.00	0.00	0.00
Northern pipefish	0.00	0.00	2.37	1.15	1.26	0.00	2.93	2.36	2.48	2.44	2.68	0.00
Seahorse	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Naked goby	0.00	0.00	0.00	1.15	0.00	2.50	80.54	70.76	3.72	0.00	274.61	190.86

Species Collected	Station Number											
	JP-004				JP-005				JP-006			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Blenny	25.72	33.12	16.81	15.00	2.54	2.53	1.48	1.27	4.04	17.16	0.00	3.89
Bay anchovy	0.00	0.00	16.81	5.46	0.00	0.00	1.48	5.09	0.00	0.00	17.35	29.85
Skilletfish	1.29	1.32	2.80	1.36	0.00	1.27	7.40	15.27	1.35	1.32	2.67	1.30
Atlantic silverside	3.86	5.30	0.00	1.36	0.00	0.00	0.00	0.00	21.56	17.16	0.00	0.00
Northern pipefish	1.29	0.00	1.40	9.55	0.00	0.00	5.92	0.00	0.00	2.64	0.00	0.00
Seahorse	1.29	0.00	0.00	1.36	0.00	0.00	0.00	0.00	0.00	1.32	0.00	0.00
Naked goby	6.43	1.32	21.01	9.55	0.00	2.53	2.96	3.82	1.35	1.32	96.10	90.84

TABLE 3-10. SUMMARY OF MACROZOOPLANKTON DENSITIES (#/100m^3) IN THE VICINITY OF JAMES ISLAND, JUNE 2002

Species Collected	Station Number											
	JP-001				JP-002				JP-003			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Crab zoea	19.2	58.8	61.7	263.9	36.5	51.2	578.4	443.4	42.2	29.2	65.6	68.8
Shrimp larvae	3.0	5.9	8.3	27.7	6.3	5.0	29.3	31.8	63.3	32.9	54.9	67.5
Amphipoda	0.0	0.0	0.0	1.2	1.3	0.0	0.0	1.2	3.7	0.0	38.8	9.1
Isopoda	0.0	0.0	2.4	1.2	1.3	1.2	2.9	0.0	1.2	1.2	9.4	9.1
Polychaeta	0.0	0.0	0.0	0.0	0.0	0.0	1.5	0.0	1.2	3.7	0.0	7.8
Syngnathidae	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Nematoda	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0

Species Collected	Station Number											
	JP-004				JP-005				JP-006			
	Surface		Bottom		Surface		Bottom		Surface		Bottom	
	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left	Right
Crab zoea	297.0	727.3	785.8	1257.7	88.9	234.4	42.9	67.4	99.7	141.2	48.1	150.5
Shrimp larvae	27.0	60.9	30.8	19.1	7.6	11.4	72.5	44.5	40.4	43.6	61.4	62.3
Amphipoda	2.6	5.3	140.1	0.0	5.1	34.2	153.9	25.4	67.4	72.6	25.4	250.5
Isopoda	2.6	4.0	2.8	0.0	1.3	0.0	1.5	2.5	0.0	0.0	2.7	3.9
Polychaeta	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.3	0.0
Syngnathidae	0.0	0.0	7.0	0.0	0.0	0.0	5.9	7.6	0.0	4.0	0.0	3.9
Nematoda	0.0	0.0	1.4	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	3.9

3.1.4 Sediment Quality

Sediment quality results from the Fall 2001 sampling are detailed in Appendix D. An analysis of the results is included below.

Comparison to Sediment Quality Guidelines (SQGs)

Concentrations of detected analytes in sediment samples were compared to SQGs (Buchman 1999) for marine sediments to assess the sediment quality of on-site sediments. SQGs are used to identify potential adverse biological effects associated with contaminated sediments. Probable Effects Levels (PELs) and Threshold Effects Levels (TELs) are biological effects-based SQGs that have been applied to contaminated sediments in Florida and other areas of the southeastern United States (Buchman 1999; MacDonald et al. 1996). TELs represent contaminant concentrations below which adverse biological effects rarely occur. PELs represent contaminant concentrations above which adverse biological effects frequently occur. Contaminant values that fall between the TEL and PEL represent the concentrations at which adverse biological effects occasionally occur. TEL and PEL values are provided in Table 3-11.

Recent evaluations of large chemical and toxicity data sets (O'Connor et al. 1998; O'Connor and Paul 1999) have indicated that TEL/PEL screening is not a reliable method for predicting sample toxicity or for screening samples out as non-toxic. The studies indicate that:

- Not exceeding a TEL should reliably predict the absence of whole-sediment toxicity,
- Exceeding a PEL (much less a TEL) does not reliably indicate toxicity, and
- Many, perhaps even most, sediments that exceed one or more PELs are not toxic.

Since TELs/PELs are widely used despite their recently demonstrated over-sensitivity in predicting toxicity, the concentrations of contaminants in the sediments sampled in this project were compared to the TEL and PEL values for all chemical constituents for which TEL/PEL values have been developed. For dredged material evaluations, SQGs are used as a tool to assist with identification of constituents of potential concern (COPCs) and to provide additional weight of evidence in the evaluation [USACE–Waterways Experiment Station (WES) 1998].

TABLE 3-11. MARINE SEDIMENT QUALITY GUIDELINES (SQGs)

Chemical Name	Units	Threshold Effects Level (TEL)	Probable Effects Level (PEL)
METALS			
ARSENIC	MG/KG	7.24	41.6
CADMIUM	MG/KG	0.676	4.21
CHROMIUM	MG/KG	52.3	160.4
COPPER	MG/KG	18.7	108.2
LEAD	MG/KG	30.24	112.18
MERCURY	MG/KG	0.13	0.696
NICKEL	MG/KG	15.9	42.8
SILVER	MG/KG	0.73	1.77
ZINC	MG/KG	124	271
CHLORINATED PESTICIDES			
CHLORDANE	UG/KG	2.26	4.79
4,4-DDD	UG/KG	1.22	7.81
4,4-DDE	UG/KG	2.07	374.17
4,4-DDT	UG/KG	1.19	4.77
DIELDRIN	UG/KG	0.715	4.3
GAMMA-BHC	UG/KG	0.32	0.99
PAHs			
2-METHYLNAPHTHALENE	UG/KG	20.21	201.28
ACENAPHTHENE	UG/KG	6.71	88.9
ACENAPHTHYLENE	UG/KG	5.87	127.87
ANTHRACENE	UG/KG	46.85	245
BENZO(A)PYRENE	UG/KG	88.81	763.22
BENZO[A]ANTHRACENE	UG/KG	74.83	692.53
CHRYSENE	UG/KG	107.77	845.98
DIBENZ(A,H)ANTHRACENE	UG/KG	6.22	134.61
FLUORANTHENE	UG/KG	112.82	1493.54
FLUORENE	UG/KG	21.17	144.35
NAPHTHALENE	UG/KG	34.57	390.64
PHENANTHRENE	UG/KG	86.68	543.53
PYRENE	UG/KG	152.66	1397.6
PAHs, TOTAL	UG/KG	1684.06	16770.4
PCBs			
PCBs,TOTAL	UG/KG	21.55	188.79
SEMIVOLATILE ORGANIC COMPOUNDS			
BIS(2-ETHYLHEXYL)PHTHALATE	UG/KG	182.16	2646.51

Source: Buchman 1999

Bulk Sediment Results

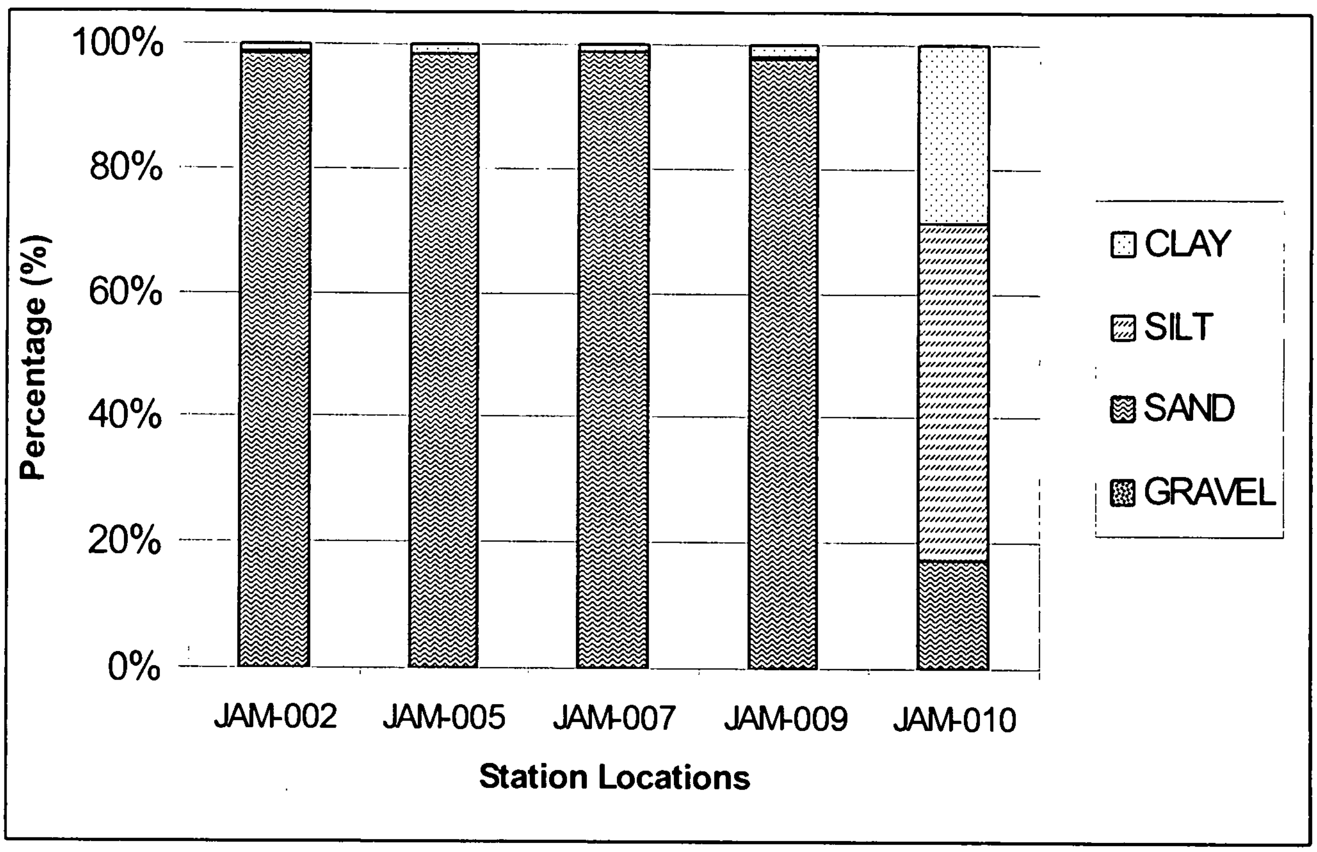
Results of the bulk sediment chemistry analyses for James Island sediment samples collected in November 2001 are presented in the following sub-sections. Bulk sediments were analyzed for target analytes and sample weights were adjusted for percent moisture (up to 50 percent moisture) prior to analysis to achieve the lowest possible detection limits. Analytical results are reported on a dry weight basis. Definitions of organic, inorganic, and dioxin and furan data qualifiers are presented in Tables D-1, D-2, and D-3, respectively.

Analytical results are provided in Tables D-4 through D-14. Values for detected chemical constituents are shaded and bolded in the data tables. Detection limits are presented for non-detected chemical constituents.

Physical Analyses

Results of the physical analyses are provided in Table D-4. Grain-size test results (Figure 3-1) indicated that the sediment around James Island was predominately comprised of sand (97.5 to 98.8 %) at all locations except for JAM-010, which was predominately comprised of silt-clay (82.8 %). Of the five James Island sediment samples, location JAM-007 had the highest proportion of sand (98.9 %), although both stations JAM-002 and JAM-005 also had high proportions of sand (98.4 %).

FIGURE 3-1. GRAIN SIZE DISTRIBUTION FOR BULK SEDIMENTS FROM JAMES ISLAND, FALL 2001



Nutrients and General Chemistry Parameters

Results of the nutrients and general chemistry parameters analyses are provided in Table D-5. Total organic carbon (TOC) concentrations ranged from 0.013 to 1.1 percent in the James Island sediments. The ammonia-nitrogen (NH_3-N) concentrations ranged from 2.4 to 28.4 mg/kg and total Kjeldahl nitrogen (TKN) concentrations ranged from 57.34 to 830 mg/kg. Nitrate and nitrite were detected at only one location, JAM-02, with a concentration of 0.005 mg/L. Biochemical oxygen demand (BOD) ranged from 155.8 to 753 mg/kg and chemical oxygen demand (COD) was only detected at location, JAM-002, with a concentration of 6.9 mg/L. Total phosphorus concentrations ranged from 12.92 to 98.2 mg/kg, total sulfide concentrations ranged from 0.768 to 85.8 mg/kg, and total cyanide concentrations ranged from 0.102 to 0.39 mg/kg.

Metals

Results of the metals analyses are provided in Table D-6. Of the 18 tested metals, thirteen were detected in the James Island sediments. Metals were detected in 59 of 90 cases (66 percent). Aluminum, arsenic, beryllium, chromium, cobalt, iron, lead, manganese, nickel, and zinc were detected in each of the samples. The majority of detected metals are naturally occurring and were measured at low concentrations. None of the detected metals had concentrations that exceeded TEL or PEL values.

The acid volatile sulfide (AVS)/ simultaneously extracted metals (SEM) ratio was greater than 1 at all locations (Table D-6). An AVS/SEM ratio greater than 1 indicates a high degree of probability that the metals are bound to organic material and not bioavailable to aquatic organisms. If the AVS/SEM is less than 1, then the metals in sediment exceed the binding ability and have a higher probability of being bioavailable to aquatic organisms. Therefore, most of the metals detected in James Island sediments would most likely not be available to aquatic organisms.

Polynuclear Aromatic Hydrocarbons (PAHs)

Results of the PAH analyses are presented in Table D-7. Of the 18 tested PAHs, two were detected in James Island sediments. PAHs were detected in 2 of 90 cases (2 percent). Benzo(a)pyrene was detected at low concentrations at location JAM010 and acenaphthylene was detected at location JAM002. Acenaphthylene exceeded the TEL value of 5.87 µg/kg by a factor of approximately 2.6. None of the tested PAHs were detected in sediment samples from locations JAM005, JAM007, and JAM009. None of the detected concentrations of PAHs exceeded PEL values.

Concentrations of total PAHs ranged from 0 to 15 µg/kg for ND=0 and 5.44 to 19.78 µg/kg for ND=1/2DL. Total PAH concentrations were below the TEL value of 1,684.06 µg/kg at all locations.

Polychlorinated Biphenyl (PCB) Congeners

Results of the PCB congener analyses are presented in Table D-8. Of the 26 tested individual PCB congeners, 10 were detected at low concentrations in James Island sediments. Individual PCB congeners were detected in 10 of 130 cases (8 percent). PCBs were detected only at sampling location JAM009. There are no TEL or PEL values for individual PCB congeners. The highest calculated total PCB concentration was approximately 3 times lower than the TEL of 21.55 μg/kg for total PCBs

Chlorinated and Organophosphorus Pesticides

Results of the chlorinated and organophosphorus pesticide analyses are presented in Tables C-9 and C-10, respectively. Of the 22 tested chlorinated pesticides, one was detected in the James Island sediments. Heptachlor was detected in low concentrations in sediments at all five sampling locations.

None of the five tested organophosphorus pesticides were detected in the James Island sediment samples.

Semivolatile Organic Compounds (SVOCs)

Results from the SVOC analyses are provided in Table D-11. Of the 41 tested SVOCs, none were detected in the James Island sediments.

Volatile Organic Compounds (VOCs)

Results from the VOC analyses are provided in Table D-12. Of the 34 tested VOCs, none were detected in the James Island sediments.

Dioxin and Furan Congeners

Results of the dioxin and furan analyses and associated Toxicity Equivalent Factors (TEFs) and Toxicity Equivalent Quotients (TEQs) are provided in Table D-13. The TEFs represent the toxicity of each congener relative to 2,3,7,8-TCDD (the most toxic congener). TEQs represent a weighted summation of all dioxin and furan congeners based on the toxicity of each congener relative to 2,3,7,8-TCDD.

Of the 17 tested dioxins, 16 were detected in the James Island sediment. Dioxins were detected in 73 of 85 cases (86%). OCDD, the least toxic dioxin congener, was detected at the highest concentration at all sampling locations. Dioxin TEQs for ND=0 ranged from 0.173 to 0.475 ng/kg and from 0.25 to 0.576 ng/kg for ND=1/2DL.

Butyltins

Results of the butyltin analyses are provided in Table D-14. Of the 4 tested butyltins, one was detected in the James Island sediment. Butyltins were detected in 1 of 20 cases (5 percent).

Dibutyltin was detected at low concentrations at sampling location JAM009. There are no TEL or PEL values for butyltins.

Summary of Sediment Quality Results

Results of the physical analyses indicated that the sediment around James Island was predominately comprised of sand (97.5-98.8%) at all locations except JAM-010, which was predominately comprised of silt-clay (82.8%). Of the five James Island sediment samples, location JAM-007 had the highest proportion of sand (98.9%), although both stations JAM-002 and JAM-005 also had high proportions of sand (98.4%).

Of the 155 chemical constituents tested in the sediment, 57 were detected in James Island sediments. The majority of these detected constituents were found in low concentrations, and were representative of background concentrations. SVOCs, VOCs, and organophosphorus pesticides were not detected in any of the sediment samples. One PAH, acenaphthylene, exceeded the TEL value at sampling location JAM-002 by a factor of approximately 2.6 but did not exceed PEL values. None of the other detected chemical constituents exceeded TEL values.

3.2 TERRESTRIAL SURVEYS

Terrestrial surveys were conducted concurrently with the avian surveys to map the existing vegetation during the Fall 2001 and Summer 2002 surveys. A photographic record of both the Fall 2001 and Summer 2002 terrestrial surveys are included as Appendix A of this report.

3.2.1 Vegetation Surveys

The northern, middle, and southern remnants of James Island consisted of high and low marsh areas, upland forest areas, open water habitats, sandy beaches, and pockets of SAV (Figure 3-1). All of the remnants are eroding (particularly along the nothern and western shorelines) which is resulting in bare ground, fallen trees, and compromised marshes. Erosion is exacerbated in some portions of the islands due to an apparently recent fire that has killed vegetation on both the northern and southern remnants. The low marshes are dominated by saltmarsh cordgrass (*Spartina alterniflora*) and the high marshes are dominated by saltmeadow cordgrass (*Spartina patens*) interspersed with saltgrass (*Distichlis spicata*) and the dominant shrub, marsh elder (*Iva frutescens*). The low marsh areas were often associated around the island remnants in a fringe fashion. Upland forest areas were evident in the central portions of all three island remnants and are dominated by almost monotypic stands of loblolly pine (*Pinus taeda*), although deciduous plant species including sycamore (*Platanus occidentalis*) and willow oak (*Quercus phellos*) also inhabit the upland areas. The majority of the wooded portions of the island remnants appear to be relatively mature and evidence of fairly recent fires on the island was observed.

James Island Northern Remnant

The northern remnant of James Island consists of natural resources that include open water habitats, wetland habitats (both high, low, and freshwater marshes), upland forest habitats, and SAV along the shorelines. Table 3-12 includes a cumulative list of plant species observed during the Fall 2001 and Summer 2002 surveys. A freshwater wetland with a surrounding berm was observed in the northern portion of the northern remnant with surface water and freshwater wetland plant species in the area. Loblolly pine is the dominant tree species in the northern remnant and monotypic stands were observed in the northern and middle portions of the northern remnant. Sycamore, aspen (*Populus* sp.), black cherry (*Prunus serotina*), and willow oak were observed as sub-dominant deciduous tree species among the non-monotypic loblolly pine stands, and American holly (*Ilex opaca*) was also observed interspersed with the loblolly pines. Loblolly pines that appeared to have been historically scorched by fire (trunks were burned) were observed along the western bank and also along the very turbid northern bank, where significant erosion is occurring.

Figure 3-2. Location of marshes on James Island

TABLE 3-12. PLANT SPECIES OBSERVED ON THE NORTHERN AND MIDDLE REMNANTS OF JAMES ISLAND, FALL 2001 AND SUMMER 2002

Plant Group	Scientific Name	Common Name
Vines	*Lonicera japonica*	Japanese Honeysuckle
	Parthenocissus quinquefolia	Virginia Creeper
	Smilax rotundifolia	Greenbriar
	Toxicodendron radicans	Poison Ivy
Herbaceous plants	*Asclepias syriaca*	Common Milkweed
	Carex sp.	Sedge
	Distichlis spicata	Salt grass
	Juncus effusus	Soft Rush
	Liquidambar styraciflua	Sweet Gum
	Luzula sp.	Wood Rush
	Mitchella repens	Partridge-berry
	Myrica pensylvanica	Bayberry
	Panicum virgatum	Switch grass
	Phragmites communis	Common reed
	Phytolacca americana	Pokeweed
	Polygonum pensylvanicum	Pennsylvania Smartweed
	Rubus sp.	Raspberry
	Spartina alterniflora	Saltmarsh Cordgrass
	Spartina patens	Saltmeadow Cordgrass
Ferns	*Dennstaedtia punctilobala*	Hay Scented Fern
	Onoclea sensibilis	Sensitive Fern
Trees	*Ilex opaca*	American Holly
	Pinus taeda	Loblolly Pine
	Platanus occidentalis	Sycamore
	Populus sp.	Aspen
	Prunus serotina	Black Cherry
	Quercus phellos	Willow Oak
Shrubs	*Aralia racemosa*	Hercules' club
	Iva frutescens	Marsh-elder

An approximately 5-foot high clay bank was observed in the areas of severe erosion along the northern shoreline. Adjacent to the eroding clay bank, a small, monotypic stand of common reed (*Phragmites australis*) persists. A meadow area of rushes and saltmeadow cordgrass (high marsh) exists south of the eroding northern bank, adjacent to the loblolly pine stands. Another high marsh habitat of saltmeadow cordgrass and salt grass exists along the southern area of the northern remnant and is continuous with a low marsh of saltmarsh cordgrass. A salt pan and a sandy beach are located adjacent to the marsh edges on the western area of the southern tip of the northern remnant. The northern island remnant is connected with the middle island remnant by a low marsh area (approximately 50 feet wide by 300 feet long) and a sand spit littered with relic oyster shells.

James Island Middle Remnant

The middle remnant of James Island consists of natural resources that include open water habitats, wetland habitats (both upper and lower marshes), upland forest habitats, and SAV. Because it is contiguous with the northern remnant (due to the spit), observed species were included in Table 3-12. The central portion of the middle remnant is composed of an upland habitat of thick loblolly pine saplings with a mature pine canopy and, moving southeast, a less thick loblolly pine canopy with a pocket of deciduous trees. A low marsh of saltmarsh cordgrass exists along the northern shore area of the middle remnant and a high marsh of saltmeadow cordgrass is congruent with the low marsh along the same shore. The southwestern shoreline is an eroded bare bank with remnants of the dominant high marsh shrub, marsh elder. An emergent marsh area of saltmarsh cordgrass, saltmeadow cordgrass, and marsh elder persists along the southern shore. The southern shoreline is a clay shelf and the water depth along this shoreline possessed abrupt drops. A large bed of SAV was observed along the eastern side of the sand spit that connects the middle and northern island remnants.

James Island Southern Remnant

The southern remnant of James Island consists of wetland habitats (both high and low marshes) and upland forest habitats. The species found are detailed on Table 3-13. The upland areas of the southern remnant are dominated by mature loblolly pines with a thick understory. Pockets of mixed deciduous trees, including willow oak, persimmon (*Diospyros virginiana*) and sycamore, occur within the loblolly pine stands. A remnant high marsh of saltmeadow cordgrass and burned loblolly pines persists along the northern area of southern remnant and a high marsh interspersed with saltgrass is located adjacent to the cove on the eastern shore. Bare and eroded shorelines with evidence of scorched pines by historic fires occur along the eastern and western shorelines and clay shelves range from one to four feet in height. The southernmost tip of the remnant supports a high marsh dominated by marsh elder.

TABLE 3-13. PLANT SPECIES OBSERVED ON THE SOUTHERN REMNANT OF JAMES ISLAND, FALL 2001 AND SUMMER 2002

Plant Group	Scientific Name	Common Name
Vines	*Toxicodendrun radicans*	Poison Ivy
Herbaceous plant	*Carex* sp.	Sedge species
	Distichlis spicata	Salt Grass
	Festuca sp.	Fescue
	Juncus roemerianus	Needlegrass Rush
	Phytolacca americana	Pokeweed
	Polygonum pensylvanica	Pennsylvania Smartweed
	Spartina patens	Saltmeadow Cordgrass
Trees	*Diospyros virginiana*	Persimmon
	Pinus taeda	Loblolly Pine
	Platanus occidentalis	Sycamore
	Quercus phellos	Willow Oak
Shrubs	*Iva frutescens*	Marsh-elder
	Myrica pensylvanica	Bayberry

3.2.2 Avian and Other Wildlife

A total of 42 species of birds were identified during visits to the James Island site in November 2001 and June 2002 (Table 3-14). The results of the timed bird observations are included in Table 3-15 (Figure 2-4). Several brown pelicans (*Pelecanus occidentalis*) were seen foraging in the waters adjacent to the remnants in June. It is likely these individuals are part of a small nesting population in the middle Chesapeake Bay. Double-crested cormorant (*Phalacrocorax auritus*), great blue heron (*Ardea herodias*) and green heron (*Butorides virescens*) were observed around the perimeter of the island remnants during the June surveys. Piscivorous species such as brown pelican, double-crested cormorant, green heron and great blue heron, were foraging for fish in the adjacent waters. Great blue heron was the only species of wader also observed in November and is probably a permanent resident in the vicinity of James Island. No evidence of colonial nesting for these three species was observed.

Wintering waterfowl utilized the waters surrounding the James Island remnants as evidenced by seven species of waterfowl observed in November. In June, only resident Canada geese (*Branta canadensis*) and mute swan (*Cygnus olor*) were observed. The tidal waters around James Island would provide food and shelter to wintering ducks and geese. Although not observed, the middle remnant could provide nesting habitat for the resident Canada geese and mute swan in the grassy upland area between the tidal marsh and the upland wooded area.

TABLE 3-14. CUMULATIVE LIST OF AVIAN SPECIES OBSERVED AT JAMES ISLAND, FALL 2001 AND SUMMER 2002

Common Name	Scientific Name	Date Observed		
		13 Nov 01	25 June 02	26 June 02
Brown Pelican	*Pelecanus occidentalis*		•	•
Double Crested Cormorant	*Phalacrocorax auritus*			•
Great Blue Heron	*Ardea herodias*	•	•	•
Great Egret	*Ardea alba*		•	
Green Heron	*Butorides virescens*		•	
Mute Swan	*Cygnus olor*		•	•
Canada Goose	*Branta canadensis*	•		•
Mallard	*Anas platyryhnchos*	•		
American Black Duck	*Anas rubripes*	•		
Canvasback	*Aythya valisineria*	•		
Greater Scaup	*Aythya marila*	•		
Long-tailed Duck	*Clangula hyemalis*	•		
Bufflehead	*Bucephala albeola*	•		
Northern Harrier	*Circus cyaneus*	•		
Bald Eagle	*Haliaeetus leucocephalus*	•	•	•
Osprey	*Pandion haliaetus*		•	•
Killdeer	*Charadrius vociferus*		•	
Dunlin	*Calidris alpina*	•		
Laughing Gull	*Larus atricilla*	•		•
Herring Gull	*Larus argentatus*	•		
Great Black-backed Gull	*Larus marinus*	•		•
Common Tern	*Sterna hirundo*			•
Forster's Tern	*Sterna forsteri*	•	•	•
Yellow-bellied Sapsucker	*Sphyrapicus varius*	•		
Great Crested Flycatcher	*Myiarchus crinitus*			•
Eastern Kingbird	*Tyrannus tyrannus*		•	•
American Crow	*Corvus brachyrhynchos*		•	•
Fish Crow	*Corvus ossifragus*	•		
Barn Swallow	*Hirundo rustica*		•	•
Tufted Titmouse	*Baeolophus bicolor*	•		
Carolina Chickadee	*Poecile carolinensis*	•	•	•
White-breasted Nuthatch	*Sitta carolinensis*	•		
Wren (family) species	Troglodytidae	•		
Carolina Wren	*Thryothorus ludovicianus*		•	•
Eastern Bluebird	*Sialia sialis*			•
Pine Warbler	*Dendroica pinus*		•	•

TABLE 3-14. (CONTINUED)

Common Name	Scientific Name	Date Observed		
		13 Nov 01	25 June 02	26 June 02
Northern Cardinal	*Cardinalis cardinalis*		•	•
Sparrow sp.	*Emberizidae*	•		
Dark-eyed Junco	*Junco hyemalis*	•		
Red-winged Blackbird	*Agelaius phoeniceus*	•	•	•
Common Grackle	*Quiscalus quiscula*		•	•
American Goldfinch	*Carduelis tristis*			•

TABLE 3-15. TOTAL NUMBER OF AVIAN SPECIES OBSERVED AT TIMED SURVEY SITES AT JAMES ISLAND, 25-26 JUNE 2002

Common Name	**Scientific Name**	**Avian Station Location**				
		B-1	**B-2**	**B-3**	**B-4**	**B-5**
Brown Pelican	*Pelecanus occidentalis*	3				
Great Blue Heron	*Ardea herodias*		1			
Great Egret	*Ardea alba*	1				
Mute Swan	*Cygnus olor*			2		
Bald Eagle	*Haliaeetus leucocephalus*	1		1		
Osprey	*Pandion haliaetus*	3	3	3		1
Laughing Gull	*Larus atricilla*				1	
Great Black-backed Gull	*Larus marinus*				1	
Common Tern	*Sterna hirundo*			1		
Forster's Tern	*Sterna forsteri*				2	
American Crow	*Corvus brachyrhynchos*	1	1			
Barn Swallow	*Hirundo rustica*			1		
Carolina Chickadee	*Poecile carolinensis*	1				
Eastern Bluebird	*Sialis sialis*			1		
Pine Warbler	*Dendroica pinus*	2				1
Northern Cardinal	*Cardinalis cardinalis*	1				
Red-winged Blackbird	*Agelaius phoeniceus*		1	3		
Common Grackle	*Quiscalus quiscula*		2	1		
TOTALS		**13**	**8**	**13**	**4**	**2**

One species of shorebird, the dunlin (*Calidris alpina*), was observed in November 2001 and one species of shorebird, the killdeer (*Charadrius vociferus*), was observed in June 2002. Although the low flat sandy beach area between the north and middle remnants of James Island provided excellent habitat for shorebirds only these two species were observed during the field surveys. Surveys in November would result in only those shorebird species that winter in the Chesapeake Bay region; dunlin is a common wintering shorebird in the Bay. In June, the surveys were conducted when migrating shorebirds have already passed through the area on their way to northern breeding grounds.

Raptors in the vicinity of James Island remnants in November included northern harrier (*Circus cyaneus*) and bald eagle (*Haliaeetus leucocephalus*). Bald eagles were also observed on site visits in June. Observations included an active bald eagle nest on the middle remnant containing an immature bird near fledging stage. In addition to the immature bird still in the nest, several adults and 1-2 other immature bald eagles were seen in June usually perched in loblolly pines, on dead snags or flying along the edges of all three remnants. One adult bald eagle was found dead on the southern remnant during the June site visit; the bird had been dead for a while and there was no observable indication of how it died. The bald eagle is a federal and Maryland State-listed threatened species. Osprey nests were seen offshore of the northern and southern remnants; one had been constructed on a duck blind; the other on a platform. Adult birds were observed flying back and forth to the nests. In one case an adult osprey was observed hunched in the nest mantling during the heat of the day. No immature birds were visible, but it is likely given the behavior of the adult that young were present in the nest.

Other species utilizing the open water habitats around the James Island remnants were three species of gulls and two species of terns. Similar to the brown pelican, double-crested cormorant and herons previously discussed, the gulls and terns utilized the adjacent waters offshore of James Island to forage for fish. No evidence of nesting on the island remnants was noted for any gull or tern species.

The upland area of the remnants provides habitat for a number of species to either spend the winter and/or breed. Wintering or late migrant species observed in November included yellow-bellied sapsucker (*Sphyrapicus varius*) and dark-eyed junco (*Junco hyemalis*). Birds using the upland habitat as summer resident/breeding species included great crested flycatcher (*Myiarchus crinitus*), eastern kingbird (*Tyrannus tyrannus*), and pine warbler (*Dendroica pinus*). Permanent residents of the upland area include Carolina chickadee (*Poecile carolinensis*), tufted titmouse (*Baeolophus bicolor*), white-breasted nuthatch (*Sitta carolinensis*), Carolina wren (*Thryothorus ludovicianus*), and northern cardinal (*Cardinalis cardinalis*). Several of these species were only observed during November however, species such as white-breasted nuthatch and tufted titmouse often become more secretive during and immediately after the nesting season.

Only a few species of birds were observed in the open marsh habitat. Eastern kingbird (*Tyrannus tyrannus*) and barn swallow (*Hirundo rustica*) foraged for insects over the open area; Common grackle (*Quiscalus quiscula*), red-winged blackbird (*Agelaius phoenicus*), and American goldfinch (*Carduelis tristis*) foraged among the shrubs and marsh grasses.

Some differences were noted in utilization of the area around the islands in the timed bird observations. The area off of the northern end of the northern remnant (associated with station B-5) was quite exposed and only 2 birds were observed utilizing it (Table 3-15). Similarly, the exposed shoreline along the western side of the southern remnant (Station B-4) supported few birds. The stations to the east of James Island (B-1 and B-2) as well as the cove and marsh near Station B-3 supported the most species during the timed observations. These areas provide protection from prevailing northwestern winds and habitat features such as emergent grasses and SAV that support a variety of bird species.

In addition to timed bird surveys, the site investigations of the James Island remnants also considered the potential use of the present habitats by other birds, mammals, reptiles and amphibians. Wildlife and wildlife sign (e.g., tracks, scat, bones, etc.) encountered were noted and are included in Table 3-16.

TABLE 3-16. WILDLIFE SPECIES OBSERVED AT JAMES ISLAND, SUMMER 2002

Common Name	Scientific Name
Invertebrates	
Horseshoe Crab	*Limulus polyphemus*
Blue Crab	*Callinectes sapidus*
Fiddler Crab	*Uca pugnax*
Fish	
Cownosed Ray	*Rhinoptera bonasus*
Croaker	*Micropogonias undulatus*
Reptiles	
Diamond-backed Terrapin	*Malaclemys terrapin*
Box Turtle	*Terrapene carolina*
Northern Brown Water Snake	*Nerodia sipedon*
Garter Snake	*Thamnophis sirtalis*
Mammals	
Raccoon	*Procyon lotor*
Sika Deer	*Cervus nippon*

Remnant (dead) horseshoe crabs (*Limulus polyphemus*) were found along the tide lines and low marsh areas of the remnants where waves had deposited them after their spring spawning. Fiddler crabs (*Uca pugnax*) were actively scuttling about in the salt pan and burrows in the clay banks of the lower marsh. Blue crabs (*Callinectes sapidus*) were noted in the SAV areas in the shallow waters around the remnants. Of the fish observed, numerous cownosed rays (*Rhinoptera bonasus*) were seen during both site visits in June foraging or swimming singly and in small groups in the shallow waters on both the east and west sides of the remnants. Croakers (*Micropogonias undulatus*) were also observed in the shallows. Several diamond-backed terrapin were noted and a dead northern water snake and garter snake were found along the shoreline during the habitat characterization visit in June 2002. Mammals (sika deer and raccoon) were identified by their tracks as seen in the sand and clay areas. Shells of ribbed mussel, American oyster, razor clams, and soft clams were also found along the beach (spit) in the Fall 2001 survey.

Except for the federally threatened bald eagle, no rare, threatened or endangered species were observed during the site visits.

3.2.3 Other Resources

The southern remnant of James Island showed evidence of the historic use of the island and possible archeological resources. The northern and middle remnants of James Island showed no evidence of historic or archeological resources. A shell midden is evident along the northeastern shore and pieces of brick and pottery were discovered along the southeastern shore of the southern remnant. In addition, ruins of a foundation for a home dwelling were observed on the southern island remnant.

3.3 Submerged Aquatic Vegetation (SAV) Mapping

Annual SAV data were downloaded from the VIMS website. The data included VIMS SAV mapping for the entire Bay interpreted from annual overflights. The period of record for this data was from 1971 to 2000 and resulted in 22 years of data; not all years were flown during the period of record. Data for 2001 and 2002 were not available at the time that this report was prepared. The available data were superimposed on maps of the area and compared to the proposed alignments for the James Island restoration project. Mapping of the existing VIMS SAV overflight data in the vicinity of James Island revealed that SAV was apparent adjacent to the island remnants in six years. The six years included 1989, 1990, 1991, 1992, 1993, and 1999. The data from these years have been downloaded, printed, and are presented as Figures E-1 through E-6 (Appendix E). Table 3-16 summarizes the areas of SAV of the beds immediately adjacent to James Island from 1971 to 2000. In addition to the acreages, the outside perimeter of the beds has been calculated in an attempt to estimate the summer flounder foraging habitat area. SAV covered an area of one to 18 acres in the years it was present, with perimeter (fringe habitat) lengths of 776.5 to 4,803.8 feet. The acreages reflected in Table 3-17 are for total SAV distributions in the area, however, no SAV has occurred within any of the proposed dike alignments since 1971.

In addition to the mapping effort, EA scientists mapped the existing areas of SAV adjacent to James Island during June 2002 field surveys (as discussed in Section 2.3). The areas of SAV are mapped on Figure 2-4 and were among the habitats used to select the seine and bird observation stations. Widgeon grass was the dominant SAV species identified in the beds and three individual areas of widgeon grass were located along the eastern shoreline of the island remnants. The SAV beds ranged from 100 to 150 yards from the eastern shoreline of the northern, middle, and southern remnants. In addition, small pockets of sea lettuce, which is considered a macroalgae and not a true SAV, were located in one of the beds of widgeon grass. The SAV mapping was a qualitative survey and therefore total SAV bed acreages were not generated at the feasibility-level of this study.

TABLE 3-17. EXTENT OF HISTORICAL SUBMERGED AQUATIC VEGETATION (SAV) IN THE VICINITY OF JAMES ISLAND AS DETERMINED BY VIRGINIA INSTITUTE OF MARINE SCIENCES (VIMS)

Year of SAV Survey	Acres of SAV*	Perimeter (ft) of SAV*
1971	0.0	0.0
1972	Area not flown during this year	
1973	Area not flown during this year	
1974	0.0	0.0
1975	Area not flown during this year	
1976	Area not flown during this year	
1977	Area not flown during this year	
1978	0.0	0.0
1979	0.0	0.0
1980	0.0	0.0
1981	0.0	0.0
1982	Area not flown during this year	
1983	Area not flown during this year	
1984	0.0	0.0
1985	0.0	0.0
1986	0.0	0.0
1987	0.0	0.0
1988	Area not flown during this year	
1989	1.0	776.5
1990	12.1	4198.0
1991	5.6	3414.4
1992	10.0	3633.6
1993	12.1	2834.9
1994	0.0	0.0
1995	0.0	0.0
1996	0.0	0.0
1997	0.0	0.0
1998	0.0	0.0
1999	18.1	4803.8
2000	0.0	0.0
2001	Data not available	
2002	Data not available	

*0.0 = no viable SAV observed in vicinity of James Island

4.0 CONCLUSIONS AND RECOMMENDATIONS

4.1 Conclusions

James Island currently consists of three eroding island remnants. The northern two remnants are joined by a sand beach/spit that terminates in high-low marsh complexes on each end. Mixed forest stands of loblolly pine dominate the interior of the islands. Small remnants of high marsh can be found on all three remnants and the southern remnant has a fairly extensive marsh complex in the center. There was evidence of a fairly recent fire that killed many trees and impacted some of the marsh areas. The northern and western shorelines of each remnant show the heaviest erosion and there are many downed trees in the water in these areas.

Avian utilization of the island was typical for this area of the Bay, although total numbers of species for Summer 2002 were low relative to expectations and the survey may have missed the period of abundance during the spring migration. No large bird colonies (e.g. gulls, egrets, pelican, etc.) were found on the island. The island provides nesting habitat for a variety of song birds and raptors; 42 avian species were observed utilizing the vicinity in some capacity during the Fall 2001 and Summer 2002 surveys. There was also evidence that sika deer, raccoon, diamondback terrapin, and several snake species are also utilizing the island remnants.

The island remnants currently support SAV growth along their eastern shorelines. It is a monotypic bed of widgeon grass. Fisheries investigations of the shorelines indicated that remnants support a fairly diverse fish community, including juveniles of commercially important species. All species were typical of the region. There were no differences in the number of fish species collected inside and outside of the SAV beds in Summer 2002. Trawling yielded few species. This is likely due to a lack of habitat features outside of the shorezone of the island and most fish utilizing the area trawled are probably transients to the study area.

Ichthyoplantkton was sampled during the Summer 2002 collection, and densities were relatively high, dominated by bay anchovy. Zooplankton were typical of the region. Benthic samples were collected during both the Fall 2001 and Summer 2002 surveys. In general, the benthic community was typical of this area of the Bay and was dominated by a single species (gem clam) at most stations. The majority of the species found were stress-tolerant, resulting in low B-IBI scores at most locations in both Fall 2001 and Summer 2002. Although *in situ* water quality was typical for the region, lower than normal precipitation could have been affecting benthic distributions in the area in Summer 2002.

Results of the physical analyses indicated that the sediment around James Island was predominately comprised of sand (97.5-98.8%) at all sample stations except JAM-010, which was predominately comprised of silt-clay (82.8%). Of the five James Island sediment samples, location JAM-007 had the highest proportion of sand (98.9 %), although both stations JAM-002 and JAM-005 also had high proportions of sand (98.4%).

Of the 155 chemical constituents tested in the sediment, 57 were detected in James Island sediments. The majority of these detected constituents were found in low concentrations, and were representative of background concentrations. SVOCs, VOCs, and organophosphorus pesticides were not detected in any of the sediment samples. One PAH, acenaphthylene, exceeded the TEL value at sampling location JAM-002 by a factor of approximately 2.6 but did not exceed PEL values. None of the other detected chemical constituents exceeded TEL values.

4.2 Recommendations

Based upon the current studies and consultations with the Baltimore District USACE and NMFS, recommendations for future studies are included below.

- *In situ* sediment quality results and analyses indicate that there is very low possibility for potential effects to biota and therefore, no further sediment quality investigations are needed at the feasibility-level of this study.

- Fisheries studies would benefit from addition of gillnet collections to capture the transient species in the areas outside of the shore-zone. Therefore, it is recommended that fisheries studies be conducted during four seasons. All other fisheries and plankton sampling should be conducted as a quarterly collection effort since these resources change significantly with season.

- Nutrient sampling and analysis are recommended to be conducted at all benthic locations.

- Benthic sampling is not required for Fall 2003 since data previously exists from a fall period. At a minimum, benthic sampling is recommended to be conducted again during the spring. Winter sampling would probably not yield results that differ significantly from fall sampling, so winter sampling is not recommended.

- Bird observations are recommended during all seasons because avian utilization of various habitats can change dramatically with season.

- Terrestrial and vegetation resources are recommended to be monitored for changes but additional in-depth studies are not recommended at the feasibility-level of study because the proposed project will not directly impact these resources.

- Quantitative SAV surveys are recommended to be conducted during the spring and summer.

5.0 REFERENCES

American Public Health Association (APHA). 1992. Standard methods for the examination of water and wastewater. 18th ed. American Public Health Association, Washington, DC.

American Society for Testing and Materials (ASTM). 1995. *Annual Book of ASTM Standards.* Volume 4.08. ASTM, Philadelphia, PA.

Buchman, M.F. 1999. *NOAA Screening Quick Reference Table*, NOAA HAZMAT Report 99-1, Seattle, WA, Coastal Protection and Restoration Division, National Oceanic and Atmospheric Administration. 12 pages.

Geneseo. 1996. Geneseo State University of New York. Ecology, Biology 203, Measuring Biodiversity. October. Accessed on 22 February 2001. http://darwin.bio.geneseo.edu/sugg/classes/ecology/lectures/lectures_22.htm.

Interstate Commission on the Potomac River Basin (ICPRB). 1999. *Methodology Applied in the Calculation of Chesapeake Bay Program Benthic Index of Biotic Integrity (B-IBI) Values.* Prepared for U.S. Environmental Protection Agency, Chesapeake Bay Program, Annapolis, Maryland. 30 December.

Karr, J.R., K.D. Fausch, P.L. Angermeier, P.R. Yant, and I.J. Schlosser. 1986. *Assessing Biological Integrity in Running Waters: A Method and its Rationale.* Special Publication 5, Illinois Natural History Survey. Champaign, Illinois.

Ludwig, J.A., and J.F. Reynolds. 1998. *Statistical Ecology - A Primer on Methods and Computing.* John Wiley & Sons. 337 pp.

MacDonald, D.D., R.S. Carr, F.D. Calder, E.R. Long, and C.G. Ingersoll. 1996. Development and evaluation of sediment quality guidelines for Florida coastal waters. *Ecotoxicology* 5:253-278.

Maryland Environmental Service (MES). 2002. *James Island Beneficial Use of Dredged Material Conceptual Report.* November.

National Oceanic and Atmospheric Administration (NOAA). 1993. *Sampling and Analytical Methods of the National Status and Trends Program: National Benthic Surveillance and Mussel Watch Projects 1984-1992. Volume 1: Overview and Summary of Methods.* NOAA Tech. Memo. NOS ORCA 71. Silver Spring, MD.

National Oceanic Atmospheric and Administration (NOAA). 2002. Climate at a Glance. http://ncdc.noaa.gov/cgi-bin/cag3/state_map_display.pl.

Nichols, John. 2002. National Marine Fisheries Service. Personal Communication.

O'Connor, T.P., K.D. Daskalakis, J.L. Hyland, J.F. Paul, and J.K. Summers. 1998. Comparisons of measured sediment toxicity with predictions based on chemical guidelines. *Environ. Toxicol. Chem.* 17:468:471.

O'Connor, T.P., and J.F. Paul. 1999. Misfit between sediment toxicity and chemistry. *Marine Pollution Bulletin* 40:59-64.

Ranasinghe, J.A., S.B. Weisberg, D.M. Dauer, L.C. Schaffner, R.J. Diaz, and J.B. Frithsen. 1994. *Chesapeake Bay Benthic Community Restoration Goals.* Prepared for U.S. Environmental Protection Agency, Chesapeake Bay Program Office, Annapolis, MD and The Governor's Council on Chesapeake Bay Research Fund, Chesapeake Bay Research and Monitoring Division, Tidewater Admin., Maryland Dept. of Natural Resources, Annapolis, MD. December.

U.S. Army Corps of Engineers (USACE), Waterways Experiment Station (WES). 1998. *Use of Sediment Quality Guidelines (SQGs) in Dredged Material Management.* Dredging Research Technical Note EEDP-04-29.

U.S. Environmental Protection Agency (USEPA). 1989. Interim procedures for estimating risks with exposures to mixtures of chlorinated dibenzo-p-dioxins and dibenzofurans (CDDs and CDFs) and 1989 update. EPA/625/3-89/016. Risk Assessment Forum, Washington D.C.

U.S. Environmental Protection Agency (USEPA)/U.S. Army Corps of Engineers (USACE). 1998. *Evaluation of Dredged Material Proposed for Discharge in Waters of the U.S.- Inland Testing Manual (ITM).* EPA-823-B-98-004.

Van den Berg, M., L. Birnbaum, A.T.C Bosveld, B. Brunström, P. Cook, M. Feeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, et al. 1998. Toxic equivalency factors (TEFs) for PCBs, PCDDs, PCDFs for humans and wildlife. Environ Health Perspect 106(12):775-792.

Virginia Institute of Marine Science (VIMS). 2002. Bay Grasses (SAV) in Chesapeake Bay and Delmarva Peninsula Coastal Bays. Downloaded data from website. <http://www.vims.edu/bio/sav/>

Weber, C.I., Ed. 1973. *Biological Field and Laboratory Methods for Measuring the Quality of Surface Waters and Effluents.* EPA-600/73-001.

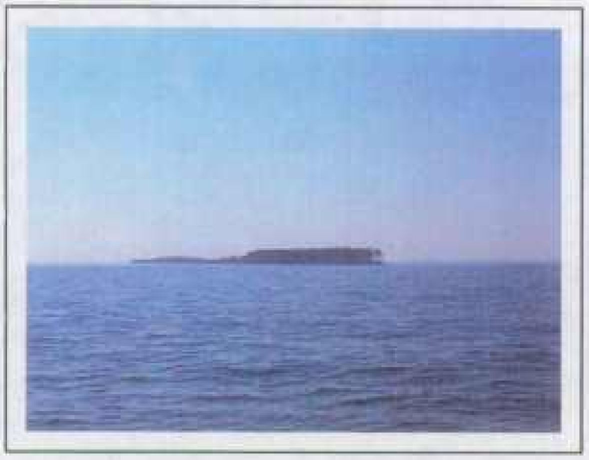
Weisberg, S.B., D.M. Dauer, L.C. Schaffner, and J.B. Frithsen. 1997. An estuarine Benthic Index of Biotic Integrity (B-IBI) for Chesapeake Bay. *Estuaries* 20(1):149-158. March.

Appendix A:

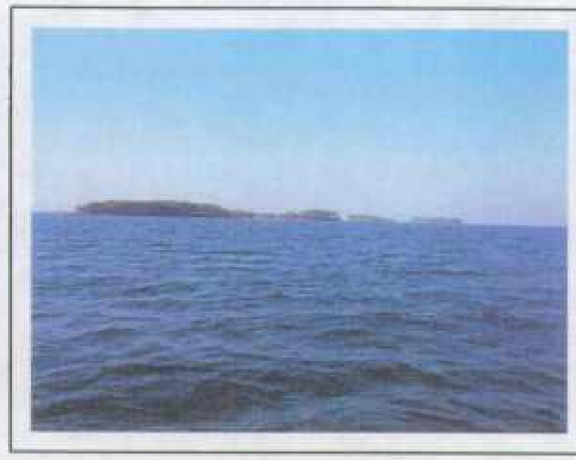
Photographic Records From Fall 2001 and Summer 2002 Surveys

Photographic Record

James Island
Chesapeake Bay, MD
Fall 2001



Looking southwest at James Island from station JAM-009.



Looking northeast at James Island from station JAM-004.

Benthic collection effort at station JAM-004.

Sediment collection effort at station JAM-010.

Sediment collection effort from station JAM-003.

Looking east at James Island from JAM-005.

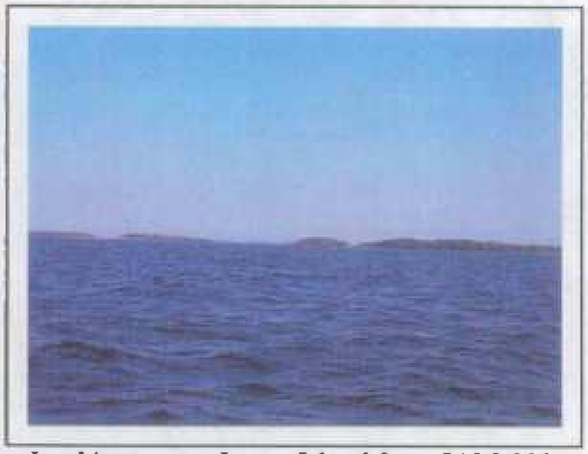
Photographic Record

James Island
Chesapeake Bay, MD
Fall 2001

Looking southeast at James Island from JAM-007.

Sediment collection effort at station JAM-007.

Looking southeast at James Island from JAM-006.



Looking east at James Island from JAM-001.

Looking west at the northern remnant of James Island.

Spartina marsh at north end of southern remnant.

Photographic Record

James Island
Chesapeake Bay, MD
Fall 2001

Western facing shoreline, looking northwest.

Western facing shoreline looking south.

Western-facing shoreline looking to the south.

Looking north at the sand spit that connects the middle and northern remnant.

Looking south at the middle remnant from sand spit.

Looking at the eastern side of the northern remnant.

Photographic Record

James Island
Chesapeake Bay, MD
Fall 2001

Looking north at the northwestern shoreline of the middle remnant.

Looking south at the southwestern shoreline of the middle remnant.

Looking south at the eastern shoreline of the southern remnant.

Looking south at the marsh at the south end of the northern remnant.

Looking south at the shoreline of the southern remnant.

The western shoreline of the southern remnant.

Photographic Record

James Island
Chesapeake Bay, MD
Fall 2001

Inundated marsh on middle remnant.

Raccoon, opossum and sika deer tracks.

Forested area on western side of southern remnant.

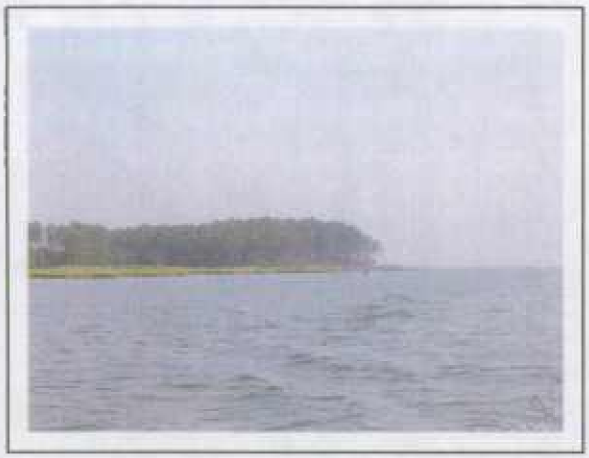
Eastern facing shoreline of middle remnant.

Looking at the northern remnant from the sand spit.

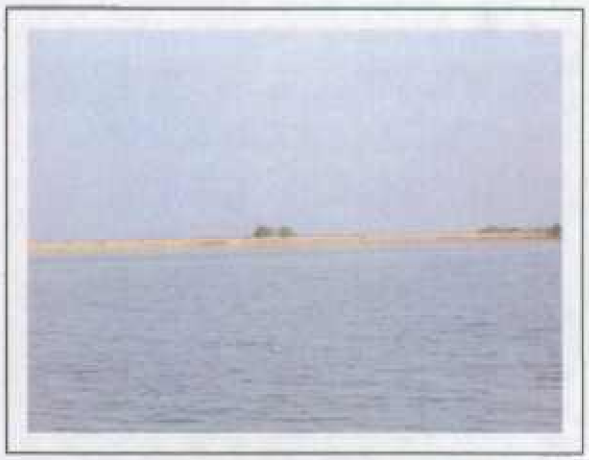
Erosion on the western facing shoreline.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002



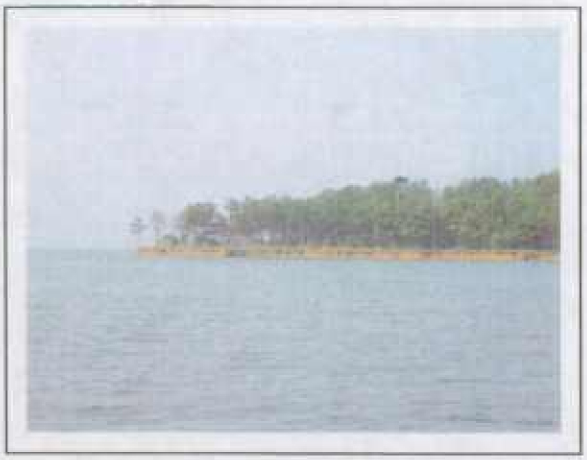
Eastern side of northern remnant of James Island.



Eastern side of northern remnant of James Island.

Eastern side of northern remnant of James Island.

Eastern side of northern remnant of James Island.



Eastern side of northern remnant of James Island.

Eastern side of northern remnant of James Island.

EA Engineering, Science, and Technology, Inc.

Photographic Record

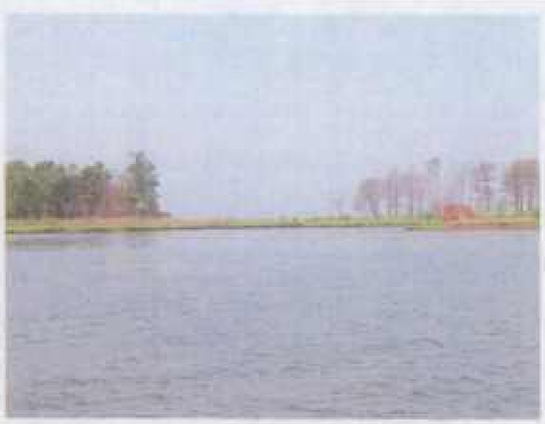
James Island
Chesapeake Bay, MD
Summer 2002

Southern tip of northern remnant of James Island on the eastern side.

Northern tip of southern remnant of James Island on the eastern side of the island.

Southern remnant of James Island on the eastern side of the island.

Southern remnant of James Island on the eastern side of the island.



Southern remnant of James Island on the eastern side of the island.

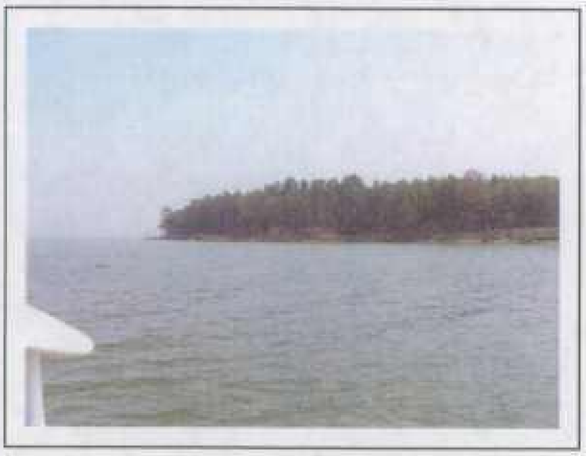
Southern remnant of James Island on the eastern side of the island.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002

Southern remnant of James Island on the eastern side of the island.

Southern tip of the southern remnant of James Island



Southern tip of the southern remnant of James Island.

Southern tip of the southern remnant of James Island.

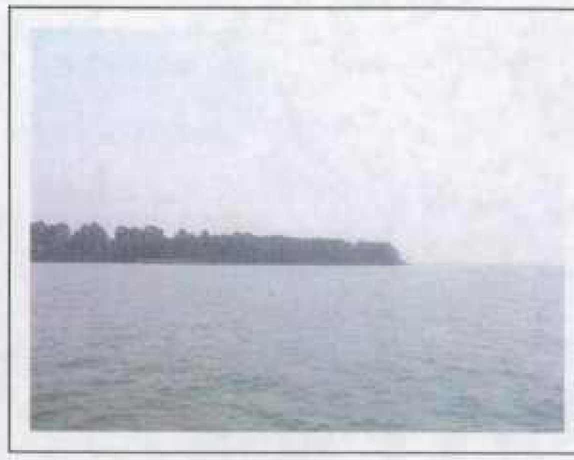
Southern remnant of James Island on the western side of the island.

Southern remnant of James Island on the western side of the island.

Photographic Record

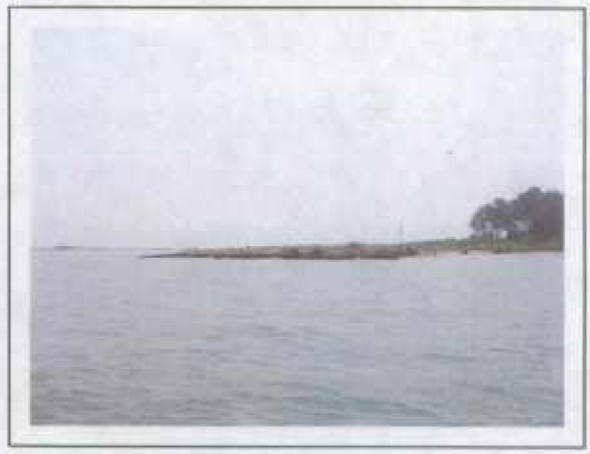
James Island
Chesapeake Bay, MD
Summer 2002

Southern remnant of James Island on the northern tip of the western side.

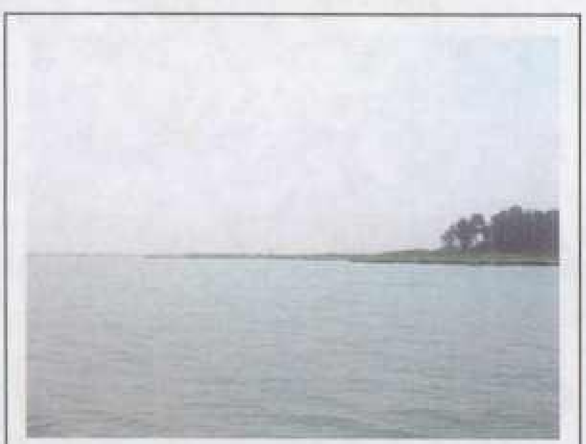


Northern remnant of James Island of the southern tip on the western side.

Northern remnant of James Island on the western side of the island.



Northern remnant of James Island on the western side of the island.



Northern remnant of James Island on the western side of the cove.

Northern remnant of James Island on the western side of the cove.

Photographic Record

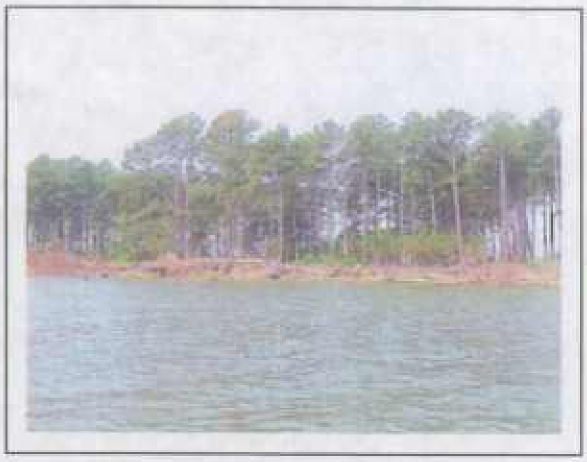
James Island
Chesapeake Bay, MD
Summer 2002

Northern remnant of James Island on the western side of the cove.

Northern remnant of James Island on the western side of the cove.

North remnant of James Island on the northern tip of the island.

Northern remnant of James Island on the northern tip of the island.

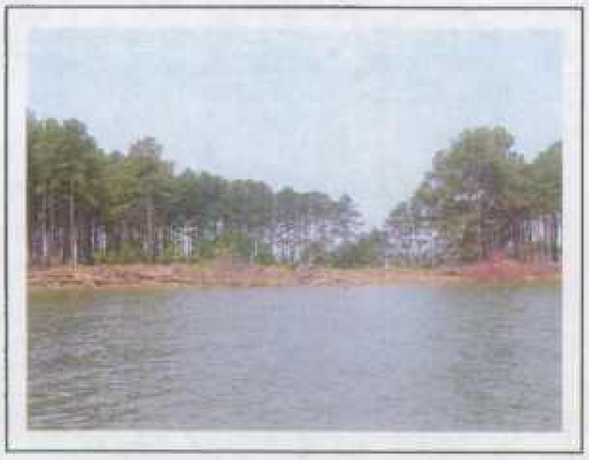


Northern remnant of James Island on the eastern side of the island.

Northern remnant of James Island on the eastern side of the island.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002



Northern remnant of James Island on the eastern side of the island.

Marsh on the northern remnant of James Island.

Sand spit on northern remnant of James Island.

SAV in cove on the eastern side of the northern remnant

Open water on the northern remnant of James Island.

Loblolly pine stand in the central portion of the northern remnant.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002

Bald eagle in nest on southern end of northern remnant of James Island.

Bald eagle in nest on southern end of northern remnant of James Island.

Bald eagle feathers found on the southern end of the northern remnant of James Island.

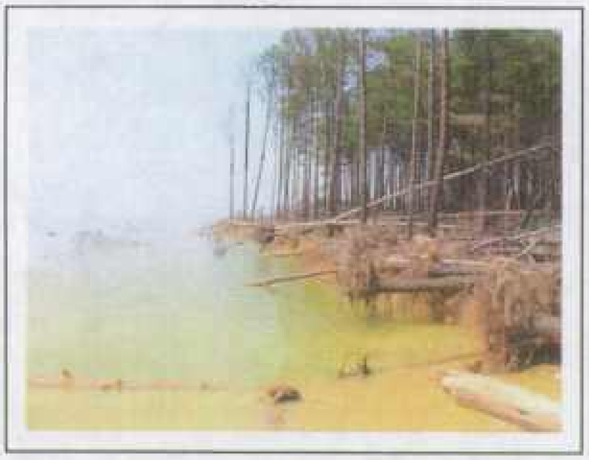
Southern shoreline of northern remnant of James Island.

Northern tip of the southern remnant of James Island from the northern remnant.

Workboat off of the northern remnant shoreline of James Island.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002



Northwest shoreline of the northern remnant of James Island.

Northwest shoreline of the northern remnant of James Island.

Northwest shoreline of the northern remnant of James Island.

Looking to the north at a loblolly pine stand in the northern end of the northern remnant.

Looking south at thick loblolly pine saplings at the northern end of the northern remnant.

Scorched pine trunks at the northern end of the northern remnant.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002

The northern tip of the southern remnant of James Island.

Scorched pine trunks from fairly recent fires.

Small cove with eroded bank on north tip of southern remnant of James Island.

Small cove with eroded bank on north tip of southern remnant of James Island.

Emergent *Spartina* marsh located on north end of southern remnant of James Island.

Emergent marsh looking north at the southern remnant of James Island.

EA Engineering, Science, and Technology, Inc.

Photographic Record

James Island
Chesapeake Bay, MD
Summer 2002

Burned under-story at the southern remnant of James Island.

Dead eagle on ground on the southern remnant of James Island.

Northern, middle, and southern remnants of James Island.

Looking north from sand spit between northern and middle remnants.

Sand spit and marsh between north and middle remnants of James Island.

Northern remnant of James Island.

Appendix B:

Differential Global Positioning System (DGPS) Coordinates for Fall 2001 and Summer 2002 Aquatic Surveys

TABLE B-1. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) COORDINATES FOR BENTHIC COLLECTIONS AT JAMES ISLAND, FALL 2001

Benthic Station Number	Coordinates (NAD83)	
	Northing	Easting
JAM-001	303428.405	1495676.313
JAM-002	306841.230	1496022.495
JAM-003	303737.612	1499790.808
JAM-004	303765.510	1503056.752
JAM-005	310215.480	1498532.696
JAM-006	317143.280	1494435.375
JAM-007	317282.214	1496775.516
JAM-008	315868.251	1499520.410
JAM-009	316127.302	1504239.179
JAM-010	310916.952	1503678.259

TABLE B-2. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) COORDINATES FOR BENTHIC COLLECTIONS AT JAMES ISLAND, SUMMER 2002

Benthic Station Number	**Coordinates (NAD83)**	
	Northing	**Easting**
JAM-001	303428.41	1495676.31
JAM-002	306841.23	1496022.50
JAM-003	303737.61	1499790.81
JAM-004	303765.51	1503056.75
JAM-005	310215.48	1498532.70
JAM-006	317143.28	1494435.38
JAM-007	317282.21	1496775.52
JAM-008	315868.25	1495520.41
JAM-009	316127.30	1504239.18
JAM-010	310916.95	1503678.26

TABLE B-3. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) COORDINATES FOR FISH AND PLANKTON TRAWL COLLECTIONS AT JAMES ISLAND, SUMMER 2002

Station Number	Start Coordinate (NAD83)		End Coordinate (NAD83)	
	Northing	Easting	Northing	Easting
Fish Trawl[1]				
JF001A	314531.52	1503956.22	315936.21	1502909.94
JF001B	314350.18	1503726.26	315460.12	1502582.95
JF002A	310550.13	1504844.80	309007.77	1504468.80
JF002B	310473.65	1504580.35	308973.25	1504221.98
JF003A	302700.33	1502275.72	304504.29	1503156.86
JF003B	302753.01	1502572.04	304137.61	1503610.96
JF004A	308083.61	1499924.79	309779.77	1499913.65
JF004B	307582.70	1499648.57	309796.41	1499311.83
JF005A	311957.93	1496386.46	313924.88	1496454.81
JF005B	312130.22	1497467.44	313496.91	1497517.06
JF006A	311618.51	1499972.92	313319.96	1500414.72
JF006B	311583.32	1500302.10	312919.60	1500237.51
Plankton Trawl[2]				
JP001S/B	314736.83	1503832.69	315306.19	1502767.03
JP002S/B	309307.54	1504800.20	310688.53	1505072.31
JP003S/B	304608.83	1502909.78	302800.24	1502202.12
JP004S/B	307942.21	1499779.62	306486.33	1499804.78
JP005S/B	313413.95	1496946.16	312012.84	1496965.86
JP006S/B	313194.16	1500039.12	311572.34	1499875.87

[1] A = Initial trawl; B = Second trawl parallel with initial trawl
[2] S/B = Surface and bottom trawls were collected concurrently

TABLE B-4. DIFFERENTIAL GLOBAL POSITIONING SYSTEM (DGPS) COORDINATES FOR SEINE COLLECTIONS AT JAMES ISLAND, SUMMER 2002

Seine Station Number	**Coordinates (NAD83)**	
	Northing	**Easting**
Seine Site #1	310699.01	1502554.35
Seine Site #2	310354.60	1502316.03
Seine Site #3	307118.80	1502001.39
Seine Site #4	309580.91	1502035.13

Appendix C:

Benthic Macroinvertebrate and Fisheries Results

TABLE C-1. TAXONOMIC LIST OF BENTHIC MACROINVERTEBRATES COLLECTED WITH A PONAR FROM JAMES ISLAND, OCTOBER 2001 AND JUNE 2002[a]

CNIDARIA (sea anemones)
- *Edwardsia elegans*

PLATYHELMINTHES (flatworms)
- Planariidae[b]
- *Stylochus ellipticus*[b] (oyster flatworm)
- *Turbellaria sp. A*[b]

NEMERINEA (unsegmented worms)
- Nemertinea
- Amphiporidae sp.
- *Amphiporus bioculatus*
- *Micrura leidyi* (red ribbon worm)
- *Carinoma tremaphorus*

GASTROPDA (snails)
- *Acteocina canaliculata* (barrel bubble snail)
- *Sayella chesapeakea*
- *Haminoea solitaria* (solitary bubble snail)
- *Boonea impressa*[b]
- *Hydrobia truncata*

BIVALVIA (clams and mussels)
- *Gemma gemma* (gem clam)
- *Macoma mitchelli*
- *Macoma balthica* (baltic clam)
- *Petricola pholadiformis* (false angel wing)
- *Mulinia lateralis* (coot clam)
- *Mya arenaria*
- *Tagelus divisus*

ANNELIDA (segmented worms)
- POLYCHAETA (bristle worms)
  - *Glycinde solitaria* (chevron worm)
  - *Heteromastus filiformis* (capitellid thread worm)
  - *Polydora cornuta* (mud worm)
  - *Polydora websteri*[b] (oyster mud worm)
  - *Neanthes succinea*
  - *Pectinaria gouldii* (trumpet worm)
  - *Eteone heteropoda* (freckled paddle worm)
  - *Eteone foliosa*
  - *Glycera dibranchiata*

(a) Common names taken from Chesapeake Bay Program (CBP) (CBP 1992).
(b) Species not rated or assigned feeding guild or life history groupings for B-IBI (ICPRB 1999 and Ranasinghe et al. 1993).

TABLE C-1. (CONTINUED)

Streblospio benedicti (barred-gilled mud worm)
Marenzellaria viridis
Mediomastus ambiseta
Leitoscoloplos spp.
Leitoscoloplos robustus
Scolelepis (Parascolelepis) texana
Podarkeopsis levifuscina
Paraprionospio pinnata (fringe-grilled mud worm)
Paraonis fulgens
Tharyx sp. A Scolelepis (Parascolelepis) texana

OLIGOCHAETA (aquatic worms)
Tubificoides spp.

CRUSTACEA
AMPHIPODA (beach fleas; scuds)
Apocorophium lacustre
Ampelisca abdita (four-eyed amphipod)
Ameroculodes spp. complex
Cymadusa compta
Incisocalliope aestuarius
Leptocheirus plumulosus
Microprotopus raneyi[b]
Mucrogammarus mucronatus
ISOPODA (isopods)
Edotea triloba [b] (mounded-back isopod)
Chiridotea coceca
Cyathura polita (slender isopod)
Paracereis caudata[b] (eelgrass pill bug)
BRACHYURA (true crabs)
Callinectes sapidus
CARIDEA (caridean shrimp)
Crangon septemspinosa
CUMACEA (cumacean shrimp)
Oxyurostylis smithi
BRANCHIURAN (barnacles)
Balanus improvisus[b] (bay barnacle)
MYSIDAE (mysid shrimp)
Neomysis americana[b] (opposum shrimp)
Americamysis almyra[b]

PHORONIDA (horseshoe worms)
Phoronis sp.

UROCHORDATA (tunicates)
Molgula manhattensis[b] (sea grapes)

[a] Common names taken from Chesapeake Bay Program (CBP) (CBP 1992).
[b] Species not rated or assigned feeding guild or life history groupings for B-IBI (ICPRB 1999 and Ranasinghe et al. 1993).

TABLE C-2. MEAN DENSITIES (#/m^2) OF BENTHIC MACROINVERTEBRATES COLLECTED WITH A PONAR AT JAMES ISLAND, OCTOBER 2001

Taxon	Mean Density (#/m^2) by Station Number									
	JAM-001	**JAM-002**	**JAM-003**	**JAM-004**	**JAM-005**	**JAM-006**	**JAM-007**	**JAM-008**	**JAM-009**	**JAM-010**
PLATYHELMINTHES (flatworms)										
Planariidae [(a)]		14.3						6.1		
Stylochus ellipticus [(a)]	142.8	87.7	40.8		20.4	224.4	20.4	6.1	55.1	
NEMERTINEA (unsegmented worms)										
Amphiporus biocalatus	14.3				26.5	34.7		55.1	6.1	
Amphiporidae sp.				6.1						6.1
Carinoma tremaphorus				14.3						
Micrura leidyi (red ribbon worm)	14.3	20.4	14.3	6.1		6.1		20.4	20.4	
Nemertinea						6.1				
GASTROPDA (snails)										
Acteocina canaliculata (barrel bubble snail)	210.1	177.5	1,332.1	61.2	61.2	183.6	87.7	67.3	638.5	
Boonea impressa[(a)]				14.3						
Epitonium rupicola										
Gastropoda										
Haminoea solitaria (solitary bubble snail)	102.0	26.5	108.1			26.5		6.1	14.3	
Hydrobia truncata					87.7			67.3		299.9
Rictaxis punctostriatus										
Sayella chesapeakea			20.4	6.1						
BIVALVIA (clams and mussels)										
Gemma gemma (gem clam)	30,769.3	71,589.7	217,056.0	45,118.7	91,581.7	249,804.1	97,864.9	355,096.7	190,019.9	2,386.8
Lyonsia hyalina										
Macoma balthica				6.1						
Macoma mitchelli			14.3	14.3					20.4	
Mulinia lateralis (coot clam)	6.1	6.1	20.4	14.3	6.1	14.3			14.3	6.1
Mya arenaria										
Petricola pholadiformis				20.4						

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-2. (CONTINUED)

Taxon	Mean Density (#/m^2) by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010
ANNELIDA (segmented worms)										
POLYCHAETA (bristle worms)										
Eteone foliosa							6.1			
Etone heteropoda (freckled paddle worm)	26.5	55.1	102.0	6.1	157.1	189.7	34.7	95.9	157.1	
Glycinde solitaria (chevron worm)	489.6	102.0	238.7	1,013.9	75.5	238.7	67.3	102.0	291.7	75.5
Heteromastus filiformis (capitellid thread worm)	116.3	46.9	148.9	626.3	55.1	26.5	108.1	75.5	148.9	177.5
Leitoscoloplos robustus				20.4						
Leitoscoloplos spp.	14.3			26.5		6.1		6.1	6.1	
Marenzellaria viridis									6.1	
Mediomastus ambiseta	20.4			463.1						
Neanthes succinea	55.1	34.7	20.4	1,066.9	136.7	189.7	67.3	81.6	265.2	1,217.9
Paraprionospio pinnata	6.1			14.3						
Pectinaria gouldii (trumpet worm)	75.5	26.5	6.1	20.4	20.4	34.7	6.1	34.7	40.8	
Podarkeopsis levifuscina	6.1					14.3		14.3		
Polydora cornuta				6.1				6.1		6.1
Polydora websteri[(a)]				6.1						
Scolelepis (Parascolelepis) texana			6.1							
Streblospio benedicti (barred-gilled mud worm)	6.1	6.1		55.1		6.1			6.1	20.4
OLIGOCHAETA (aquatic worms)							6.1			
Tubificoides spp.	6.1		6.1	320.3	40.8		6.1		6.1	6.1
CRUSTACEA										
AMPHIPODA (beach fleas; scuds)										
Microprotopus raneyi [(a)]					61.2	95.9		14.3	6.1	
Ameroculodes spp. Complex	20.4	6.1	6.1		20.4	14.3		67.3	26.5	6.1
Ampelisca abdita				67.3						
Apocorophium lacustre								6.1		

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-2. (CONTINUED)

Taxon	Mean Density (#/m^2) by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010
ISOPODA (isopods)										
Paracereis caudata		6.1				169.3		163.2	6.1	
Edotea triloba (mounded-back isopod) [a]	6.1	20.4	6.1	34.7		14.3			14.3	40.8
Cyathura polita (slender isopod)									6.1	
CUMACEA (cumacean shrimp)										
Oxyurostylis smithi	34.7					6.1				
BRANCHIURAN (barnacles)										
Balanus improvisus (bay barnacle) [a]			6.1			14.3		14.3		6.1
MYSIDACEA (mysid shrimp)										
Americamysis almyra [a]									26.5	46.9
Neomysis americana [a]									20.4	
UROCHORDATA (tunicates)										
Molgula manhattensis [a]								6.1		
TOTALS	**32,142.2**	**72,226.2**	**219,153.1**	**49,029.4**	**92,350.8**	**251,319.8**	**98,275.0**	**356,012.6**	**191,823.2**	**4,302.4**

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-3. MEAN DENSITIES (#/m^2) OF BENTHIC MACROINVERTEBRATES COLLECTED WITH A PONAR AT JAMES ISLAND, JUNE 2002

Taxon	Mean Density (#/m^2) by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010
CNIDARIA (sea anemones)										
Edwardsia elegans						6.12				
PLATYHELMINTHES (flatworms)										
Stylochus ellipticus [(a)]	61.2	14.28	20.4		6.12	136.68		26.52		
Turbellaria sp. A [(a)]		6.12			26.52	40.8				
NEMERTINEA (unsegmented worms)										
Amphiporus biocalatus		20.4	14.28		81.6	40.8		34.68	34.68	
Amphiporidae sp.						6.12		6.12		
Carinoma tremaphorus				14.28						
Micrura leidyi (red ribbon worm)				14.28	6.12	14.28		14.28		
Nemertinea								14.28		
GASTROPODA (snails)										
Acteocina canaliculata (barrel bubble snail)	524.28	87.72	285.6		102	142.8	14.28		224.4	
Haminoea solitaria (solitary bubble snail)		67.32	61.2		55.08	14.28			95.88	
Hydrobia truncata		6.12			142.8					6.12
Sayella chesapeakea	6.12				6.12					6.12
BIVALVIA (clams and mussels)										
Gemma gemma (gem clam)	296,263.1	144,988.9	212,486.4	127,759.1	220,564.8	347,099.9	138,705.7	203,347.2	219,340.8	41,793.5
Macoma mitchelli				6.12	6.12					
Mulinia lateralis (coot clam)				34.68					6.12	40.8
Mya arenaria				14.28						14.28
Tagelus divisus										6.12

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-3. (CONTINUED)

Taxon	Mean Density (#/m^2) by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010
ANNELIDA (segmented worms)										
POLYCHAETA (bristle worms)										
Eteone foliosa					6.12	26.52		6.12	14.28	
Etone heteropoda (freckled paddle worm)	142.8	55.08	6.12	20.4	6.12	87.72	6.12	6.12		6.12
Glycera dibranchiata	6.12	6.12								
Glycinde solitaria (chevron worm)	67.32	40.8	20.4	469.2	75.48	6.12	6.12	46.92	95.88	40.8
Heteromastus filiformis (capitellid thread worm)	61.2	75.48	136.68	224.4	87.72	81.6	6.12	332.52	136.68	55.08
Leitoscoloplos robustus					6.12					
Leitoscoloplos spp.		20.4	6.12	46.92		6.12	6.12			
Marenzellaria viridis		6.12						6.12	6.12	
Mediomastus ambiseta				340.68						
Neanthes succinea	401.88	475.32	210.12	571.2	271.32	673.2	128.52	516.12	55.08	291.72
Paraonis fulgens			20.4							
Polydora cornuta	55.08	55.08	40.8	20.4	34.68	122.4		34.68		
Scolelepis (Parascolelepis) texana	6.12									
Streblospio benedicti (barred-gilled mud worm)	4012.68	1046.52	652.8	2998.8	95.88	1515.72	6.12	157.08	591.6	2890.68
Tharyx sp. A	20.4	14.28			6.12					
OLIGOCHAETA (aquatic worms)										
Oligochaeta		128.52				87.72		6.12	61.2	
Tubificoides spp.	6.12	6.12	1.428		6.12		14.28	55.08		
CRUSTACEA										
AMPHIPODA (beach fleas; scuds)										
Ameroculodes spp. complex	571.2	291.72	667.08	81.6	1075.08	516.12	46.92	340.68	346.8	128.52
Ampelisca abdita	122.4	26.52	20.4	679.32	40.8	20.4	6.12	95.88	128.52	401.88
Cymadusa compta					6.12					
Incisocalliope aestuarius										6.12
Leptocheirus plumulosus										6.12
Microprotopus raneyi [(a)]					14.28	6.12				
Mucrogammarus mucronatus	6.12	34.68			40.8	6.12		6.12	14.28	20.4

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-3. (CONTINUED)

Taxon	Mean Density (#/m²) by Station Number									
	JAM-001	JAM-002	JAM-003	JAM-004	JAM-005	JAM-006	JAM-007	JAM-008	JAM-009	JAM-010
ISOPODA (isopods)										
Chiridotea coeca	6.12									
Cyathura polita (slender isopod)			6.12							14.28
Edotea triloba (mounded-back isopod) [(a)]	148.92	55.08		102	6.12	34.68		14.28	14.28	61.2
Paracereis caudata						20.4	6.12	20.4		
BRACHYURA (true crabs)										
Callinectes sapidus				6.12						
CARIDEA (caridean shrimp)										
Crangon septemspinosa			6.12							
CUMACEA (cumacean shrimp)										
Oxyurostylis smithi	67.32	6.12	14.28		20.4					14.28
BRANCHIURAN (barnacles)										
Balanus improvisus (bay barnacle) [(a)]	244.8	40.8	61.2	55.08	46.92	422.28	55.08	20.4	128.52	14.28
MYSIDACEA (mysid shrimp)										
Neomysis americana [(a)]	136.68	597.72	210.12	14.28	14.28	6.12		6.12	-	87.72
PHORONIDA										
Phoronis sp.	6.12									
TOTAL	**302,944.1**	**148,173.4**	**214,948.1**	**133,473.1**	**222,857.8**	**351,141.1**	**139,007.6**	**205,113.8**	**221,295.1**	**45,906.1**

(a) Species not meeting B-IBI macrofaunal criteria (ICPRB 1999; Ranasinghe et al. 1993).

TABLE C-4. FISHES AND CRABS COLLECTED DURING FISHERIES STUDIES NEAR JAMES ISLAND, JUNE 2002

Common Name		Scientific Name	
Family	**Species**	**Family**	**Species**
Herrings	Blueback herring	Clupeidae	*Alosa aestivalis*
	Atlantic menhaden		*Brevoortia tyrannus*
Anchovies	Bay anchovy	Engraulidae	*Anchoa mitchilli*
Clingfishes	Skilletfish	Gobiesocidae	*Gobiesox strumosus*
Flyingfishes	Halfbeak	Exocoetidae	*Hyporhamphus unifasiatus*
Needlefishes	Atlantic needlefish	Belonidae	*Strongylura marina*
Killifish	Sheepshead minnow	Cyprinodontidae	*Cyprinodon variegatus*
	Mummichog		*Fundulus heteroclitus*
	Rainwater killifish		*Lucania parva*
Silversides	Atlantic silverside	Atherinidae	*Menidia menidia*
Pipefishes	Northern pipefish	Syngnathidae	*Sygnathus fuscus*
Temperate basses	Striped bass	Moronidae	*Morone saxatilus*
Drums	Atlantic croaker	Sciaenidae	*Micropogonias undulatus*
	Red drum		*Sciaenops ocellatus*
	Spot		*Leiostomus xanthurus*
Gobies	Naked goby	Gobiidae	*Gobiosoma bosci*
Lefteye flounders	Summer flounder	Bothidae	*Paralichthys dentatus*
Soles	Hogchoker	Soleidae	*Trinectes maculatus*
Tonguefishes	Blackcheek tonguefish	Cynoglossidae	*Symphurus plagiusa*
Swimming crabs	Blue crab	Portunidae	*Callinectes sapidus*

TABLE C-5. SUMMARY OF MEAN TOTAL LENGTH (mm) AND RANGE (mm) OF MEASUREMENTS FOR JAMES ISLAND FISH COLLECTIONS, JUNE 2002

Species	Mean and Range	Mean Length (mm) and Range (mm) For Otter Trawl Stations						Mean Length (mm) and Range (mm) for Seine Stations			
		JF-001	JF-002	JF-003	JF-004	JF-005	JF-006	Seine #1	Seine #2	Seine #3	Seine#4
Atlantic Menhaden	Mean							47	47	42	
	Range							(35-61)	---	---	
Blueback Herring	Mean							34	37	36	
	Range							(31-36)	---	(33-41)	
Bay Anchovy	Mean			76				65	47		
	Range			(70-88)				(52-76)	---		
Skilletfish	Mean							26	28	21	44
	Range							(25-26)	(25-32)	(10-29)	(29-59)
Halfbeak	Mean							178			
	Range							---			
Atlantic Needlefish	Mean							133	124		129
	Range							(76-161)	(120-131)		(122-136)
Mummichog	Mean							46		47	
	Range							(34-86)		(26-86)	
Rainwater Killifish	Mean								34	39	
	Range								---	(35-43)	
Atlantic Silverside	Mean						54	65	95	57	87
	Range						---	(17-129)	(42-132)	(46-136)	(39-138)
Northern Pipefish	Mean			70				67	105	162	
	Range			---				(40-89)	(91-125)	---	
Striped Bass	Mean										160
	Range										---
Atlantic Croaker	Mean								82		
	Range								---		

TABLE C-5. (CONTINUED)

Species	Mean and Range	Mean Length (mm) and Range (mm) For Otter Trawl Stations						Mean Length (mm) and Range (mm) for Seine Stations			
		JF-001	JF-002	JF-003	JF-004	JF-005	JF-006	Seine #1	Seine #2	Seine #3	Seine#4
Red Drum	Mean									169	
	Range									(168-169)	
Spot	Mean			225				71	83	80	82
	Range			(221-229)				(52-108)	(54-127)	(56-121)	(58-150)
Naked Gobie	Mean			33							39
	Range			(32-33)							---
Summer Flounder	Mean								104	97	
	Range								(99-109)	(84-107)	
Hogchoker	Mean								84		
	Range								(64-103)		
Blue Crab	Mean			101		138		66	44	32	41
	Range			(51-142)		(134-141)		(29-129)	(15-95)	(13-72)	(16-116)
Sheepshead Minnow	Mean							30			
	Range							(26-40)			
Blackcheek Tonguefish	Mean							75			
	Range							--			

Appendix D:

Sediment Quality Results

TABLE D-1. ORGANIC DATA QUALIFIERS

Qualifiers other than those listed below may be required to properly define the results. If used, they are given an alphabetic designation not already specified in this table or in a project/program document such as a Quality Assurance Project Plan or a contract Statement of Work. Each additional qualifier was fully described in the Analytical Narrative section of the laboratory report.

U Indicates a target compound was analyzed for but not detected. The sample Reporting Limit (RL) is corrected for dilution and, if a soil sample, for percent moisture, if reported on a dry weight basis.

J Indicates an estimated value. This qualifier is used under the following circumstances:

1) when estimating a concentration for tentatively identified compounds (TICs) in GC/MS analyses, where a 1:1 response is assumed,
2) when the mass spectral and retention time data indicate the presence of a compound that meets the volatile and semivolatile GC/MS identification criteria, and the result is less than the RL but greater than the method detection limit (MDL).

B This qualifier is used when the analyte is found in the associated method blank as well as in the sample. It indicates possible/probable blank contamination and warns the data user to take appropriate action. For GC/MS analyses, this qualifier is used for a TIC, as well as, for a positively identified target compound.

E This qualifier identifies compounds whose concentrations exceed the calibration range of the instrument for that specific analysis.

D When applied, this qualifier identifies all compound concentrations reported from a secondary dilution analysis.

A This qualifier indicates that a TIC is a suspected aldol-condensation product.

N Indicates presumptive evidence of a compound. This qualifier is only used for GC/MS TICs, where the identification is based on a mass spectral library search. For generic characterization of a TIC, such as chlorinated hydrocarbon, the N qualifier is not used.

P When applied, this qualifier indicates a reported value from a GC analysis when there is greater than 25% difference for detected concentrations between the two GC columns.

TABLE D-2. INORGANIC DATA QUALIFIERS

C ***(Concentration) qualifiers:***

B	Reported value is less than the project-specified Reporting Limit (RL), but greater than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).
U	Analyte analyzed for but not detected (concentration is less than the method-specified Instrument Detection Limit (IDL) or Method Detection Limit (MDL).

Q ***(Quality control) qualifiers:***

E	Reported value is estimated because of presence of interference.
M	Duplicate injection precision not met.
N	Spiked sample recovery is not within control limits.
S	Reported value is determined by the method of standard additions (MSA).
W	Postdigestion spike for furnace Atomic Absorption Spectrophotometric (AAS) AAS analysis is out of control limits (85-115%) and sample absorbance is less than 50% of spike absorbance.
*	Duplicate analyses is not within control limits.
+	Correlation coefficient for MSA is less than 0.995.

M ***(Method) qualifiers:***

P	Inductively Coupled Plasma (ICP)
A	Flame AAS
F	Furnace AAS
CV	Cold Vapor AAS
AV	Automated Cold Vapor AAS
AS	Semiautomated Spectrophotometric
C	Manual Spectrophotometric
T	Titrimetric
NR	Analyte is not required to be determined.

TABLE D-3. DIOXIN AND FURAN DATA QUALIFIERS

A	Amount detected is less than the Method Calibration Limit.
E	Amount detected is over the Method Calibration Limit.
DPE	Denotes the presence of possible polychlorinated diphenylesters.
EDL	"Estimated Detection Limit"
EMPC	"Estimated Maximum Possible Concentration"
ppt	Parts-per-trillion (pg/g; ng/L)
Q	Indicated the presence of quantitative interferences. They generally result in an underestimation of the affected total homologue groups.
V	Recovery is lower than 40%. The data has been validated based upon a favorable signal-to-noise and detection limit.

TABLE D-4. PHYSICAL CHARACTERISTICS OF SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
COBBLES	%	--	0	0	0	0	0
GRAVEL	%	--	0	0.1	0	0.1	0
SAND	%	--	98.4	98.4	98.8	97.5	17.2
SILT	%	--	0.6	0	0.2	0.3	54.1
CLAY	%	--	1	1.5	1	2.1	28.7
SILT+CLAY	%	--	1.6	1.5	1.2	2.4	82.8
% MOISTURE	%	--	24.1	26.3	27	29.5	30.9
% SOLIDS	%	0	0	78.2	75.9	76.9	71.8
SPECIFIC GRAVITY	G/ML	--	2.65	2.66	2.67	2.67	2.72

MDL = method detection limit

TABLE D-5. NUTRIENTS AND GENERAL CHEMISTRY PARAMETERS IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	RL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
AMMONIA, as N	MG/KG	2.4	**2.4**	**11.1**	**25.9**	**28.4**	**27.8**
NITRATE/NITRITE, as N	MG/L	0.005	**0.005**	0.005 U	0.005 U	0.005 U	0.005 U
NITROGEN, TOTAL KJELDAHL	MG/KG	57.34	**57.34**	**297**	**379**	**533**	**830**
TOTAL ORGANIC CARBON	%	0.01	**0.013**	**0.136**	**1.1**	**0.326**	**0.447**
BIOCHEMICAL OXYGEN DEMAND	MG/KG	155.8	**155.8**	**318**	**753**	**529**	**543**
CHEMICAL OXYGEN DEMAND	MG/L	6.9	**6.9**	6.9 U	6.9 U	6.9 U	6.9 U
TOTAL CYANIDE	MG/KG	0.102	**0.102**	**0.15 B J**	**0.16 B J**	**0.39 B J**	**0.3 B J**
TOTAL PHOSPHORUS	MG/KG	12.92	**12.92**	**63.6**	**98.2**	**43.1**	**72.2**
TOTAL SULFIDE	MG/KG	0.768	**0.768**	**60**	**66.4**	**21.7**	**85.8**

NOTE: Shaded and bold values represent detected concentrations.

RL = reporting limit

B = value is less than reporting limit, but greater than instrument detection limit or method detection limit

J = value is estimated

U = not detected

TABLE D-6. METAL CONCENTRATIONS (MG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	TEL*	PEL*	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
ALUMINUM	MG/KG	--	--	1.58	**398**	**291**	**193**	**811**	**6840**
ANTIMONY	MG/KG	--	--	0.234	**0.28 B**	0.23 U	**0.37 B**	**2.2 N**	**0.3 B**
ARSENIC	MG/KG	7.24	41.6	0.312	**0.82 B**	**0.45 B**	**0.63 B**	**0.69 B**	**1.3**
BERYLLIUM	MG/KG	--	--	0.0322	**0.33 B**	**0.38 B**	**0.36 B**	**0.31 B**	**0.53**
CADMIUM	MG/KG	0.676	4.21	0.0498	0.049 U	0.05 U	0.05 U	0.049 U	0.051 U
CHROMIUM	MG/KG	52.3	160.4	0.0722	**1**	**0.81**	**0.85**	**1.6**	**8.3**
COBALT	MG/KG	--	--	0.077	**0.37 B**	**0.12 B**	**0.15 B**	**0.72 B**	**2.6 B**
COPPER	MG/KG	18.7	108.2	0.0712	**0.074 B**	**0.098 B**	0.071 U	**0.52 B**	**3.1**
IRON	MG/KG	--	--	3.26	**840**	**671**	**624**	**1320**	**8400**
LEAD	MG/KG	30.24	112.18	0.244	**1.2**	**0.53**	**0.64**	**1.3**	**7.3**
MANGANESE	MG/KG	--	--	0.0262	**10.4**	**9.1**	**5.7**	**21.5**	**40.4**
MERCURY	MG/KG	0.13	0.696	0.0118	0.011 U	0.012 U	0.012 U	0.012 U	**0.013 B**
NICKEL	MG/KG	15.9	42.8	0.224	**0.96 B**	**0.73 B**	**0.6 B**	**2 B**	**7.8**
SELENIUM	MG/KG	--	--	0.322	0.32 U	0.32 U	0.32 U	0.32 U	0.33 U
SILVER	MG/KG	0.73	1.77	0.078	0.076 U	0.078 U	0.078 U	0.078 U	0.08 U
THALLIUM	MG/KG	--	--	0.556	0.54 U	0.56 U	0.56 U	0.55 U	0.57 U
TIN	MG/KG	--	--	3.3	3.2 U	3.3 U	3.3 U	3.3 U	3.4 U
ZINC	MG/KG	124	271	0.262	**4.2**	**4.4**	**2.8**	**6**	**21.6**
AVS/SEM	--	--	--	--	23.88	21.49	22.17	12.7	4.48

**Source*: Buchman 1999

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

TEL = threshold effects level

PEL = probable effects level

B = value is less than reporting limit, but greater than instrument detection limit or method detection limit

U = not detected

TABLE D-7. PAH CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	TEL*	PEL*	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
ACENAPHTHENE	UG/KG	6.71	88.9	1.38	1.3 U	1.4 U	1.3 U	1.3 U	1.4 U
ACENAPHTHYLENE	UG/KG	5.87	127.87	1.06	**15 J**	1.1 U	1.1 U	1 U	1.1 U
ANTHRACENE	UG/KG	46.85	245	0.282	0.2 U	0.2 U	0.2 U	0.2 U	0.21 U
BENZO(A)ANTHRACENE	UG/KG	74.83	692.53	0.212	0.21 U	0.21 U	0.21 U	0.21 U	0.22 U
BENZO(A)PYRENE	UG/KG	88.81	763.22	0.176	0.17 U	0.18 U	0.18 U	0.17 U	**0.35 J P**
BENZO(B)FLUORANTHENE	UG/KG	--	--	0.458	0.45 U	0.46 U	0.46 U	0.45 U	0.47 U
BENZO(K)FLUORANTHENE	UG/KG	--	--	0.152	0.15 U	0.15 U	0.15 U	0.45 U	0.18 U
BENZO(GHI)PERYLENE	UG/KG	--	--	0.458	0.45 U	0.46 U	0.46 U	0.45 U	0.47 U
CHRYSENE	UG/KG	107.77	845.98	0.174	0.17 U	0.17 U	0.18 U	0.17 U	0.18 U
DIBENZO(A,H)ANTHRACENE	UG/KG	6.22	134.61	1.1	1.1 U	1.1 U	1.1 U	1.1 U	1.1 U
FLUORANTHENE	UG/KG	112.82	1493.5	0.348	0.34 U	0.35 U	0.35 U	0.34 U	0.36 U
FLUORENE	UG/KG	21.17	144.35	0.27	0.28 U	0.27 U	0.27 U	0.27 U	0.28 U
INDENO(1,2,3-CD)PYRENE	UG/KG	--	--	0.27	0.28 U	0.27 U	0.27 U	0.27 U	0.28 U
1-METHYLNAPHTHALENE	UG/KG	--	--	1.48	1.4 U	1.5 U	1.5 U	1.5 U	1.5 U
2-METHYLNAPHTHALENE	UG/KG	20.21	201.28	1.3	1.4 U	1.3 U	1.3 U	1.3 U	1.3 U
NAPHTHALENE	UG/KG	34.57	390.64	1.28	1.2 U	1.3 U	1.3 U	1.3 U	1.4 U
PHENANTHRENE	UG/KG	86.68	543.53	0.282	0.28 U	0.28 U	0.28 U	0.28 U	0.28 U
PYRENE	UG/KG	152.66	1397.6	0.328	0.32 U	0.33 U	0.33 U	0.32 U	0.34 U
TOTAL PAHS (ND=0)	UG/KG	1684.1	16770	--	**15**	0	0	0	**0.35**
TOTAL PAHS (ND=1/2DL)	UG/KG	1684.1	16770	--	**19.78**	**5.515**	**5.52**	**5.44**	**5.83**

**Source*: Buchman 1999

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

TEL = threshold effects level

PEL = probable effects level

J = value is estimated

P = greater than 25% difference between two GC column

U = not detected

TABLE D-8. PCB CONGENER CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	TEL**	PEL**	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
PCB 8 (BZ)*	UG/KG	--	--	0.39	0.39 U	0.39 U	0.39 U	0.39 U	0.39 U
PCB 18 (BZ)*	UG/KG	--	--	0.31	0.31 U	0.31 U	0.31 U	0.31 U	0.31 U
PCB 28 (BZ)*	UG/KG	--	--	0.46	0.46 U	0.46 U	0.46 U	**0.67 J**	0.46 U
PCB 44 (BZ)*	UG/KG	--	--	0.13	0.13 U	0.13 U	0.13 U	**0.34 J**	0.13 U
PCB 49 (BZ)	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	**0.28 J**	0.12 U
PCB 52 (BZ)*	UG/KG	--	--	0.16	0.16 U	0.16 U	0.16 U	**0.41 J**	0.16 U
PCB 66 (BZ)*	UG/KG	--	--	0.1	0.1 U	0.1 U	0.1 U	**0.12 J**	0.1 U
PCB 77 (BZ)*	UG/KG	--	--	0.22	0.22 U	0.22 U	0.22 U	0.22 U	0.22 U
PCB 87 (BZ)	UG/KG	--	--	0.18	0.18 U	0.18 U	0.18 U	**0.25 J**	0.16 U
PCB 101 (BZ)*	UG/KG	--	--	0.23	0.23 U	0.23 U	0.23 U	**0.28 J**	0.23 U
PCB 105 (BZ)*	UG/KG	--	--	0.17	0.17 U	0.17 U	0.17 U	0.17 U	0.17 U
PCB 118 (BZ)*	UG/KG	--	--	0.084	0.084 U	0.084 U	0.084 U	**0.24 J**	0.084 U
PCB 126 (BZ)*	UG/KG	--	--	0.21	0.21 U	0.21 U	0.21 U	0.21 U	0.21 U
PCB 128 (BZ)*	UG/KG	--	--	0.11	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
PCB 138 (BZ)*	UG/KG	--	--	0.18	0.18 U	0.18 U	0.18 U	**0.2 J**	0.16 U
PCB 153 (BZ)*	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	**0.22 J**	0.12 U

*PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)
***Source: Buchman 1999*
NOTE: Shaded and bold values represent detected concentrations.
MDL = method detection limit
TEL = threshold effects level
PEL = probable effects level
J = value is estimated
U = not detected

TABLE D-8. (CONTINUED)

ANALYTE	UNITS	TEL**	PEL**	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
PCB 156 (BZ)	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
PCB 169 (BZ)*	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
PCB 170 (BZ)*	UG/KG	--	--	0.24	0.24 U	0.24 U	0.24 U	0.24 U	0.24 U
PCB 180 (BZ)*	UG/KG	--	--	0.58	0.58 U	0.58 U	0.58 U	0.58 U	0.58 U
PCB 183 (BZ)	UG/KG	--	--	0.11	0.11 U	0.11 U	0.11 U	0.11 U	0.11 U
PCB 184 (BZ)	UG/KG	--	--	0.098	0.098 U	0.098 U	0.098 U	0.098 U	0.098 U
PCB 187 (BZ)*	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
PCB 195 (BZ)	UG/KG	--	--	0.23	0.23 U	0.23 U	0.23 U	0.23 U	0.23 U
PCB 206 (BZ)	UG/KG	--	--	0.12	0.12 U	0.12 U	0.12 U	0.12 U	0.12 U
PCB 209 (BZ)	UG/KG	--	--	0.26	0.26 U	0.26 U	0.26 U	0.26 U	0.26 U
TOTAL PCBS (ND=0)	UG/KG	21.55	188.79	--	0	0	0	4.96	0
TOTAL PCBS (ND=1/2DL)	UG/KG	21.55	188.79	--	3.934	3.934	3.934	7.43	3.934

*PCB congeners used for Total PCB summation, as per Table 9-3 of the ITM (USEPA/USACE 1998)
***Source*: Buchman 1999
NOTE: Shaded and bold values represent detected concentrations.
MDL = method detection limit
TEL = threshold effects level
PEL = probable effects level
J = value is estimated
U = not detected

TABLE D-9. CHLORINATED PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	TEL*	PEL*	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
4,4'-DDD	UG/KG	1.22	7.81	0.0798	0.078 U	0.08 U	0.08 U	0.079 U	0.082 U
4,4'-DDE	UG/KG	2.07	374.17	0.0708	0.069 U	0.071 U	0.071 U	0.07 U	0.073 U
4,4'-DDT	UG/KG	1.19	4.77	0.0902	0.088 U	0.09 U	0.09 U	0.09 U	0.093 U
ALDRIN	UG/KG	--	--	0.078	0.076 U	0.078 U	0.078 U	0.078 U	0.09 U
ALPHA-BHC	UG/KG	--	--	0.0644	0.063 U	0.064 U	0.066 U	0.064 U	0.066 U
BETA-BHC	UG/KG	--	--	0.142	0.19 U	0.14 U	0.14 U	0.14 U	0.15 U
CHLORDANE	UG/KG	2.26	4.79	0.584	0.57 U	0.58 U	0.59 U	0.58 U	0.6 U
DELTA-BHC	UG/KG	--	--	0.0594	0.058 U	0.059 U	0.06 U	0.059 U	0.061 U
DIELDRIN	UG/KG	0.715	4.3	0.0712	0.07 U	0.071 U	0.071 U	0.071 U	0.073 U
ENDOSULFAN I	UG/KG	--	--	0.0878	0.086 U	0.088 U	0.088 U	0.087 U	0.09 U
ENDOSULFAN II	UG/KG	--	--	0.0616	0.06 U	0.062 U	0.062 U	0.061 U	0.063 U
ENDOSULFAN SULFATE	UG/KG	--	--	0.0656	0.069 U	0.066 U	0.066 U	0.065 U	0.067 U
ENDRIN	UG/KG	--	--	0.192	0.19 U	0.19 U	0.14 U	0.19 U	0.2 U
ENDRIN ALDEHYDE	UG/KG	--	--	0.0722	0.071 U	0.072 U	0.072 U	0.072 U	0.073 U
GAMMA-BHC	UG/KG	0.32	0.99	0.0684	0.067 U	0.088 U	0.069 U	0.068 U	0.07 U
HEPTACHLOR	UG/KG	--	--	0.0898	**0.11 J P**	**0.15 J P**	**0.16 J P**	**0.17 J P**	**0.16 J P**
HEPTACHLOR EPOXIDE	UG/KG	--	--	0.0868	0.086 U	0.037 U	0.037 U	0.086 U	0.089 U
METHOXYCHLOR	UG/KG	--	--	0.198	0.19 U	0.2 U	0.2 U	0.2 U	0.2 U
MIREX	UG/KG	--	--	0.037	0.036 U	0.037 U	0.037 U	0.037 U	0.038 U
TOXAPHENE	UG/KG	--	--	9.88	9.7 U	9.9 U	9.9 U	9.9 U	10 U

**Source*: Buchman 1999

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

TEL = threshold effects level

PEL = probable effects level

J = value is estimated

P = greater than 25% difference between two GC column

U = not detected

TABLE D-10. ORGANOPHOSPHORUS PESTICIDE CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
AZINPHOS-METHYL	UG/KG	5.62	5.5 U	5.6 U	5.6 U	5.6 U	5.8 U
DEMETON	UG/KG	9.56	9.3 U	9.6 U	9.6 U	9.5 U	9.8 U
ETHYL PARATHION	UG/KG	5.46	5.3 U	5.5 U	5.5 U	5.4 U	5.6 U
MALATHION	UG/KG	6.18	6 U	6.2 U	6.2 U	6.1 U	6.4 U
METHYL PARATHION	UG/KG	4.7	4.6 U	4.7 U	4.7 U	4.7 U	4.8 U

There are no TEL and PEL values for the tested organophosphorus pesticides

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

U = not detected

TABLE D-11. SVOC CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	TEL*	PEL*	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
BENZOIC ACID	UG/KG	--	--	31.6	31 U	32 U	32 U	31 U	32 U
BENZYL ALCOHOL	UG/KG	--	--	27	26 U	27 U	27 U	27 U	28 U
BIS(2-CHLOROETHOXY) METHANE	UG/KG	--	--	31.6	31 U	32 U	32 U	31 U	32 U
BIS(2-CHLOROETHYL) ETHER	UG/KG	--	--	29.2	29 U	29 U	29 U	29 U	30 U
BIS(2-ETHYLHEXYL) PHTHALATE	UG/KG	182.16	2646.51	32	31 U	32 U	32 U	32 U	33 U
4-BROMOPHENYL PHENYL ETHER	UG/KG	--	--	32	31 U	32 U	32 U	32 U	33 U
BUTYL BENZYL PHTHALATE	UG/KG	--	--	32.6	32 U	33 U	33 U	32 U	33 U
4-CHLORO-3-METHYLPHENOL	UG/KG	--	--	37	36 U	37 U	37 U	37 U	38 U
2-CHLORONAPHTHALENE	UG/KG	--	--	27	26 U	27 U	27 U	27 U	28 U
2-CHLOROPHENOL	UG/KG	--	--	27.2	27 U	27 U	27 U	27 U	28 U
4-CHLOROPHENYL PHENYL ETHER	UG/KG	--	--	29.6	29 U	30 U	30 U	29 U	30 U
DIBENZOFURAN	UG/KG	--	--	32	31 U	32 U	32 U	32 U	33 U
DI-N-BUTYL PHTHALATE	UG/KG	--	--	33.4	33 U	33 U	34 U	33 U	34 U
3,3'-DICHLOROBENZIDINE	UG/KG	--	--	23.4	23 U	23 U	24 U	23 U	24 U
2,4-DICHLOROPHENOL	UG/KG	--	--	33.2	33 U	33 U	33 U	33 U	34 U
DIETHYL PHTHALATE	UG/KG	--	--	33	32 U	33 U	33 U	33 U	34 U
4,6-DINITRO-2-METHYLPHENOL	UG/KG	--	--	42.4	41 U	42 U	43 U	42 U	44 U
2,4-DIMETHYLPHENOL	UG/KG	--	--	38	37 U	38 U	38 U	38 U	39 U
2,4-DINITROPHENOL	UG/KG	--	--	50.8	50 U	51 U	51 U	50 U	52 U

**Source*: Buchman 1999

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

TEL = threshold effects level

PEL = probable effects level

U = not detected

TABLE D-11. (CONTINUED)

ANALYTE	UNITS	TEL*	PEL*	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
2,4-DINITROTOLUENE	UG/KG	--	--	31	30 U	31 U	31 U	31 U	32 U
2,6-DINITROTOLUENE	UG/KG	--	--	33.6	33 U	34 U	34 U	33 U	34 U
1,2-DIPHENYLHYDRAZINE	UG/KG	--	--	38	37 U	38 U	38 U	38 U	39 U
DI-N-OCTYL PHTHALATE	UG/KG	--	--	36.8	36 U	37 U	37 U	36 U	38 U
HEXACHLOROBENZENE	UG/KG	--	--	30.4	30 U	30 U	31 U	30 U	31 U
HEXACHLOROBUTADIENE	UG/KG	--	--	26	25 U	26 U	26 U	26 U	27 U
HEXACHLOROCYCLOPENTADIENE	UG/KG	--	--	23	22 U	23 U	23 U	23 U	24 U
HEXACHLOROETHANE	UG/KG	--	--	29	28 U	29 U	29 U	29 U	30 U
ISOPHORONE	UG/KG	--	--	31.4	31 U	31 U	32 U	31 U	32 U
2-METHYLPHENOL	UG/KG	--	--	28.8	28 U	29 U	29 U	29 U	29 U
4-METHYLPHENOL	UG/KG	--	--	68.4	67 U	68 U	69 U	68 U	70 U
NITROBENZENE	UG/KG	--	--	29.6	29 U	30 U	30 U	29 U	30 U
2-NITROPHENOL	UG/KG	--	--	29.2	29 U	29 U	29 U	29 U	30 U
4-NITROPHENOL	UG/KG	--	--	29.2	29 U	29 U	29 U	29 U	30 U
N-NITROSODI-N-PROPYLAMINE	UG/KG	--	--	31.6	31 U	32 U	32 U	31 U	32 U
N-NITROSODIMETHYLAMINE	UG/KG	--	--	25	24 U	25 U	25 U	25 U	26 U
N-NITROSODIPHENYLAMINE	UG/KG	--	--	34.6	34 U	35 U	35 U	34 U	35 U
2,2'-OXYBIS(1-CHLOROPROPANE)	UG/KG	--	--	27.6	27 U	28 U	28 U	27 U	28 U
PENTACHLOROPHENOL	UG/KG	--	--	30.2	30 U	30 U	30 U	30 U	31 U
PHENOL	UG/KG	--	--	27	26 U	27 U	27 U	27 U	28 U
1,2,4-TRICHLOROBENZENE	UG/KG	--	--	28	27 U	28 U	28 U	28 U	29 U
2,4,6-TRICHLOROPHENOL	UG/KG	--	--	26	25 U	26 U	26 U	26 U	27 U

**Source*: Buchman 1999

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

TEL = threshold effects level

PEL = probable effects level

U = not detected

TABLE D-12. VOC CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
ACROLEIN	UG/KG	18.2	18 U	18 U	18 U	18 U	19 U
ACRYLONITRILE	UG/KG	15.8	15 U	16 U	16 U	16 U	16 U
BENZENE	UG/KG	1.24	1.2 U	1.2 U	1.3 U	1.2 U	1.3 U
BROMODICHLOROMETHANE	UG/KG	1.56	1.5 U	1.6 U	1.6 U	1.5 U	1.6 U
BROMOFORM	UG/KG	0.648	0.63 U	0.65 U	0.65 U	0.64 U	0.67 U
BROMOMETHANE	UG/KG	1.42	1.4 U	1.4 U	1.4 U	1.4 U	1.5 U
2-BUTANONE	UG/KG	1.4	1.4 U	1.4 U	1.4 U	1.4 U	1.4 U
CARBON TETRACHLORIDE	UG/KG	1.42	1.4 U	1.4 U	1.4 U	1.4 U	1.5 U
CHLOROETHANE	UG/KG	3.2	3.1 U	3.2 U	3.2 U	3.2 U	3.3 U
2-CHLOROETHYL VINYL ETHER	UG/KG	11	11 U	11 U	11 U	11 U	11 U
CHLOROFORM	UG/KG	1.48	1.4 U	1.5 U	1.5 U	1.5 U	1.5 U
CHLOROMETHANE	UG/KG	1.68	1.6 U	1.7 U	1.7 U	1.7 U	1.7 U
DIBROMOCHLOROMETHANE	UG/KG	0.996	0.98 U	1 U	1 U	1 U	1 U
1,2-DICHLOROBENZENE	UG/KG	0.966	0.94 U	0.97 U	0.97 U	0.96 U	0.99 U
1,3-DICHLOROBENZENE	UG/KG	1.12	1.1 U	1.1 U	1.1 U	1.1 U	1.2 U
1,4-DICHLOROBENZENE	UG/KG	0.758	0.74 U	0.76 U	0.76 U	0.75 U	0.78 U
TRANS-1,2-DICHLOROETHENE	UG/KG	1.2	1.2 U	1.2 U	1.2 U	1.2 U	1.2 U
DICHLORODIFLUOROMETHANE	UG/KG	2.72	2.7 U	2.7 U	2.7 U	2.7 U	2.8 U
1,1-DICHLOROETHANE	UG/KG	1.66	1.6 U	1.7 U	1.7 U	1.6 U	1.7 U
1,2-DICHLOROETHANE	UG/KG	0.908	0.89 U	0.91 U	0.91 U	0.9 U	0.93 U
1,1-DICHLOROETHENE	UG/KG	1.56	1.5 U	1.6 U	1.6 U	1.5 U	1.6 U
1,2-DICHLOROPROPANE	UG/KG	1.5	1.5 U	1.5 U	1.5 U	1.5 U	1.5 U
CIS-1,3-DICHLOROPROPENE	UG/KG	1.18	1.1 U	1.2 U	1.2 U	1.2 U	1.2 U
TRANS-1,3-DICHLOROPROPENE	UG/KG	0.966	0.94 U	0.97 U	0.97 U	0.96 U	0.99 U
ETHYLBENZENE	UG/KG	1.02	1 U	1 U	1 U	1 U	1.1 U
METHYLENE CHLORIDE	UG/KG	6.36	6.2 U	6.4 U	6.4 U	6.3 U	6.5 U

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

U = not detected

TABLE D-12. (CONTINUED)

ANALYTE	UNITS	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
1,1,2,2-TETRACHLOROETHANE	UG/KG	0.682	0.67 U	0.68 U	0.68 U	0.68 U	0.7 U
TETRACHLOROETHENE	UG/KG	1.28	1.2 U	1.3 U	1.3 U	1.3 U	1.3 U
TOLUENE	UG/KG	1.14	1.1 U	1.1 U	1.2 U	1.1 U	1.2 U
1,1,1-TRICHLOROETHANE	UG/KG	1.58	1.5 U	1.6 U	1.6 U	1.6 U	1.6 U
1,1,2-TRICHLOROETHANE	UG/KG	0.854	0.83 U	0.85 U	0.86 U	0.85 U	0.88 U
TRICHLOROETHENE	UG/KG	1.42	1.4 U	1.4 U	1.4 U	1.4 U	1.5 U
TRICHLOROFLUOROMETHANE	UG/KG	2.9	2.8 U	2.9 U	2.9 U	2.9 U	3 U
VINYL CHLORIDE	UG/KG	1.58	1.5 U	1.6 U	1.6 U	1.6 U	1.6 U

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

U = not detected

TABLE D-13. DIOXIN AND FURAN CONGENER CONCENTRATIONS (NG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	RL	TEF*	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
2,3,7,8-TCDD	NG/KG	0.158	1	0.154 U	0.116 U	0.152 U	0.132 U	0.236 U
1,2,3,7,8-PECDD	NG/KG	0.063	1	**0.116 EMPC**	**0.0928**	**0.215**	**0.142**	**0.143**
1,2,3,4,7,8-HXCDD	NG/KG	0.044	0.1	**0.174 EMPC**	**0.161**	**0.219 EMPC**	**0.32 EMPC**	**0.29 EMPC**
1,2,3,6,7,8-HXCDD	NG/KG	0.094	0.1	**0.158**	**0.174**	**0.303 EMPC**	**0.453**	**0.381**
1,2,3,7,8,9-HXCDD	NG/KG	0.093	0.1	**0.298**	**0.256**	**0.36**	**0.658 EMPC**	**0.979**
1,2,3,4,6,7,8-HPCDD	NG/KG	0.114	0.01	**3.3**	**3.02**	**2.23**	**12.9**	**10**
OCDD	NG/KG	0.387	0.0001	**134**	**125**	**70.4**	**618**	**325**
2,3,7,8-TCDF	NG/KG	0.093	0.1	**0.212**	**0.241**	**0.174**	**0.16 EMPC**	**0.248**
1,2,3,7,8-PECDF	NG/KG	0.044	0.05	**0.0901 EMPC**	**0.0852**	**0.202**	0.048 U	0.0373 U
2,3,4,7,8-PECDF	NG/KG	0.039	0.5	**0.0961**	**0.108 EMPC**	**0.202**	**0.0946**	**0.0766 EMPC**
1,2,3,4,7,8-HXCDF	NG/KG	0.048	0.1	**0.0861 EMPC**	**0.0985 EMPC**	**0.236**	**0.0879**	**0.0911**
1,2,3,6,7,8-HXCDF	NG/KG	0.048	0.1	**0.0881 EMPC**	**0.072**	**0.18 EMPC**	**0.0721 EMPC**	**0.0849**
2,3,4,6,7,8-HXCDF	NG/KG	0.052	0.1	**0.0941 EMPC**	**0.106**	**0.225**	**0.0743 EMPC**	0.0586 U
1,2,3,7,8,9-HXCDF	NG/KG	0.068	0.1	**0.0901**	**0.09 EMPC**	**0.21 EMPC**	0.0678 U	**0.09 EMPC**
1,2,3,4,6,7,8-HPCDF	NG/KG	0.067	0.01	**0.246**	**0.165**	**0.324**	**0.369 EMPC**	**0.323 EMPC**
1,2,3,4,7,8,9-HPCDF	NG/KG	0.099	0.01	0.108 U	**0.134 EMPC**	**0.204**	0.108 U	0.0909 U
OCDF	NG/KG	0.158	0.0001	**0.52**	**0.331**	**0.673**	**0.854**	**0.795**
DIOXIN TEQ (ND=0)	NG/KG	--	--	**0.173**	**0.242**	**0.475**	**0.434**	**0.454**
DIOXIN TEQ (ND=1/2)	NG/KG	--	--	**0.25**	**0.3**	**0.551**	**0.505**	**0.576**

**Source:* Van den Berg, et al. 1998

NOTE: Shaded and bold values represent detected concentrations.

RL = reporting limit

EMPC = estimated maximum possible concentration

TEQ = toxicity equivalency quotient

TEF = toxicity equivalency factor

U = not detected

TABLE D-14. BUTYLTIN CONCENTRATIONS (UG/KG) IN SEDIMENTS FROM JAMES ISLAND, NOVEMBER 2001

ANALYTE	UNITS	MDL	JAM-002	JAM-005	JAM-007	JAM-009	JAM-010
MONOBUTYLTIN	UG/KG	1.34	1.3 U	1.3 U	1.3 U	1.4 U	1.4 U
DIBUTYLTIN	UG/KG	1.74	1.7 U	1.7 U	1.7 U	**2.9**	1.8 U
TRIBUTYLTIN	UG/KG	2	1.9 U	2 U	1.9 U	2.1 U	2.1 U
TETRABUTYLTIN	UG/KG	2.28	2.2 U	2.2 U	2.2 U	2.4 U	2.4 U

NOTE: Shaded and bold values represent detected concentrations.

MDL = method detection limit

U = not detected

Appendix E:

Submerged Aquatic Vegetation (SAV) Mapping

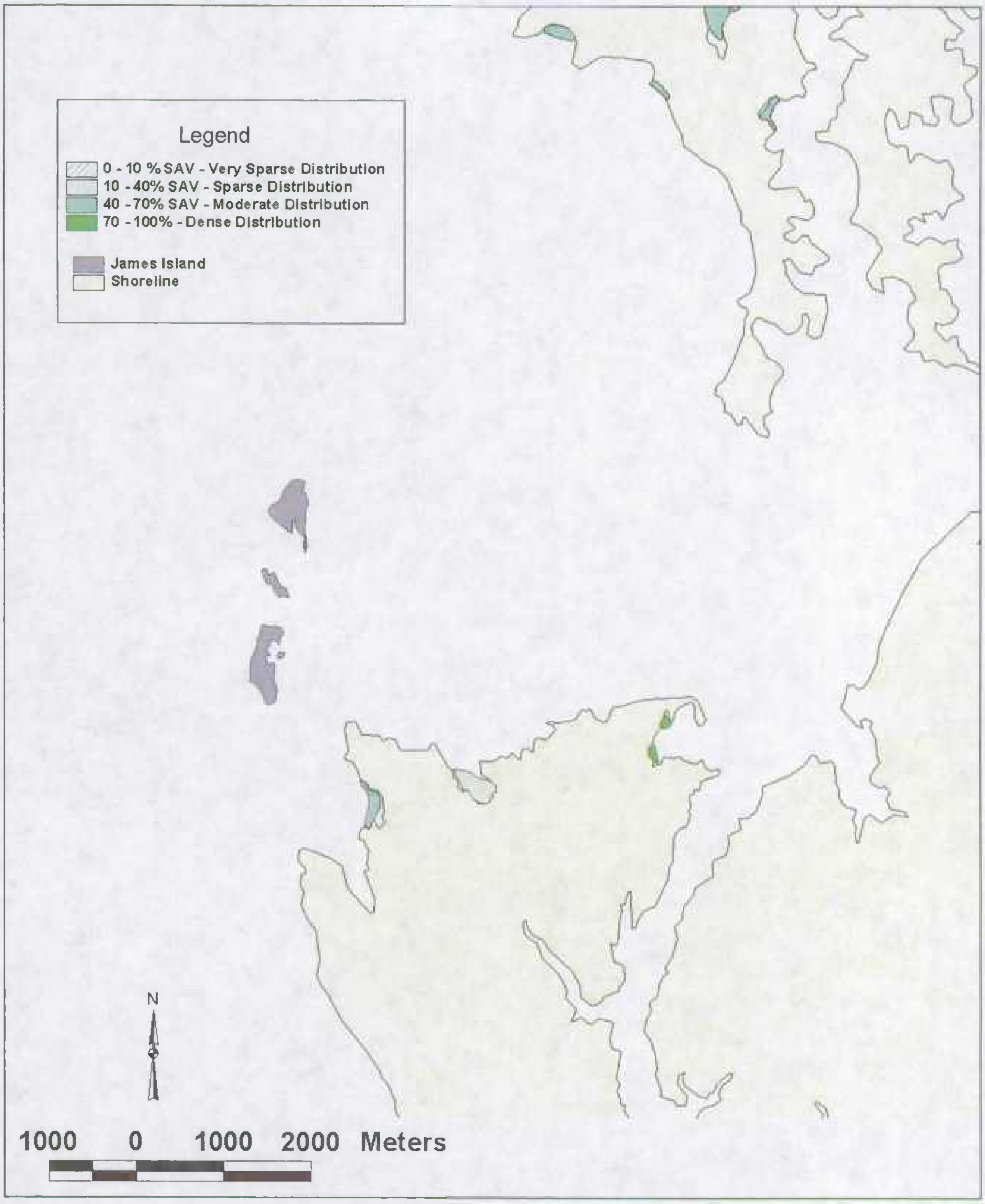


Figure E-1. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1989

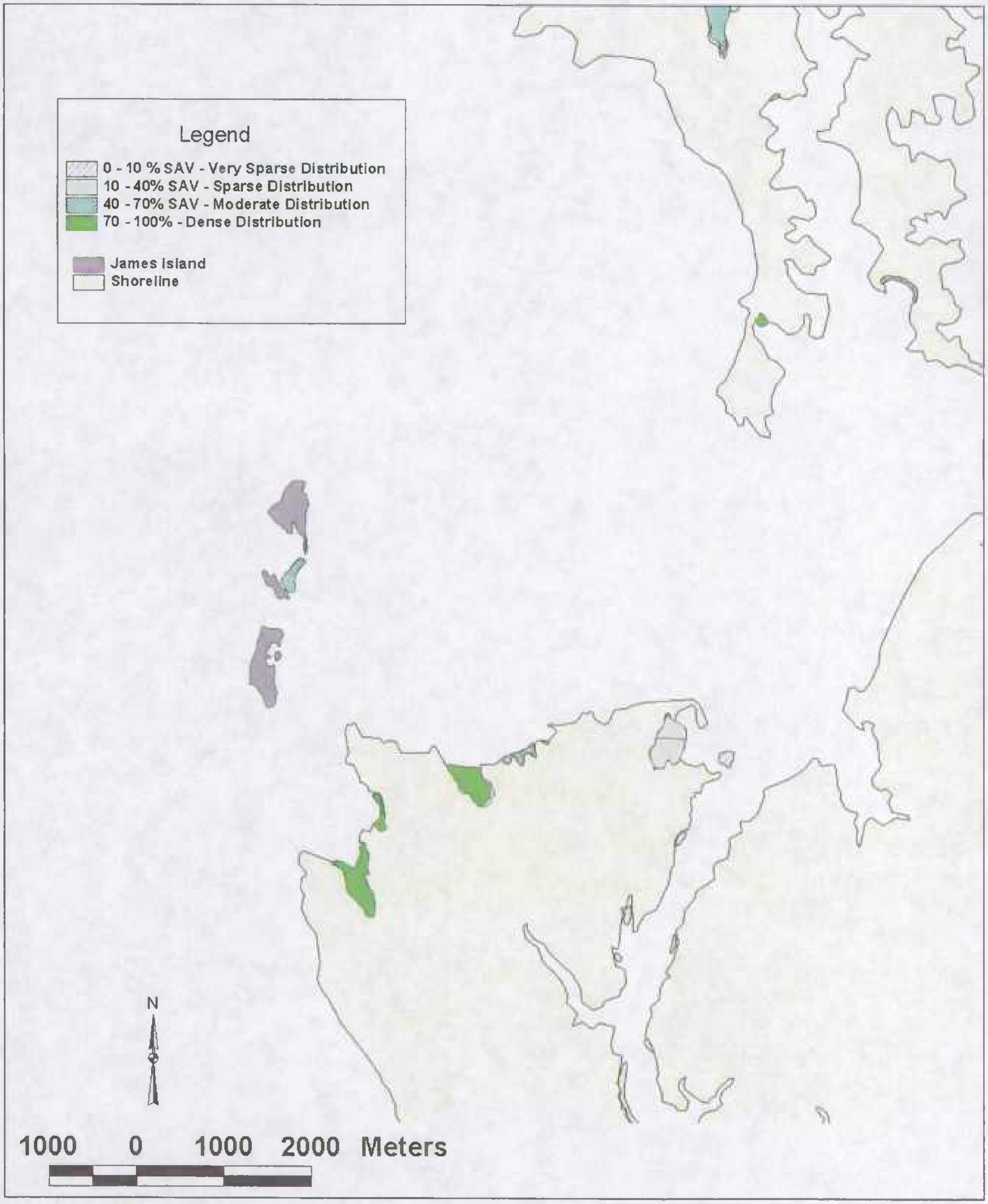


Figure E-2. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1990

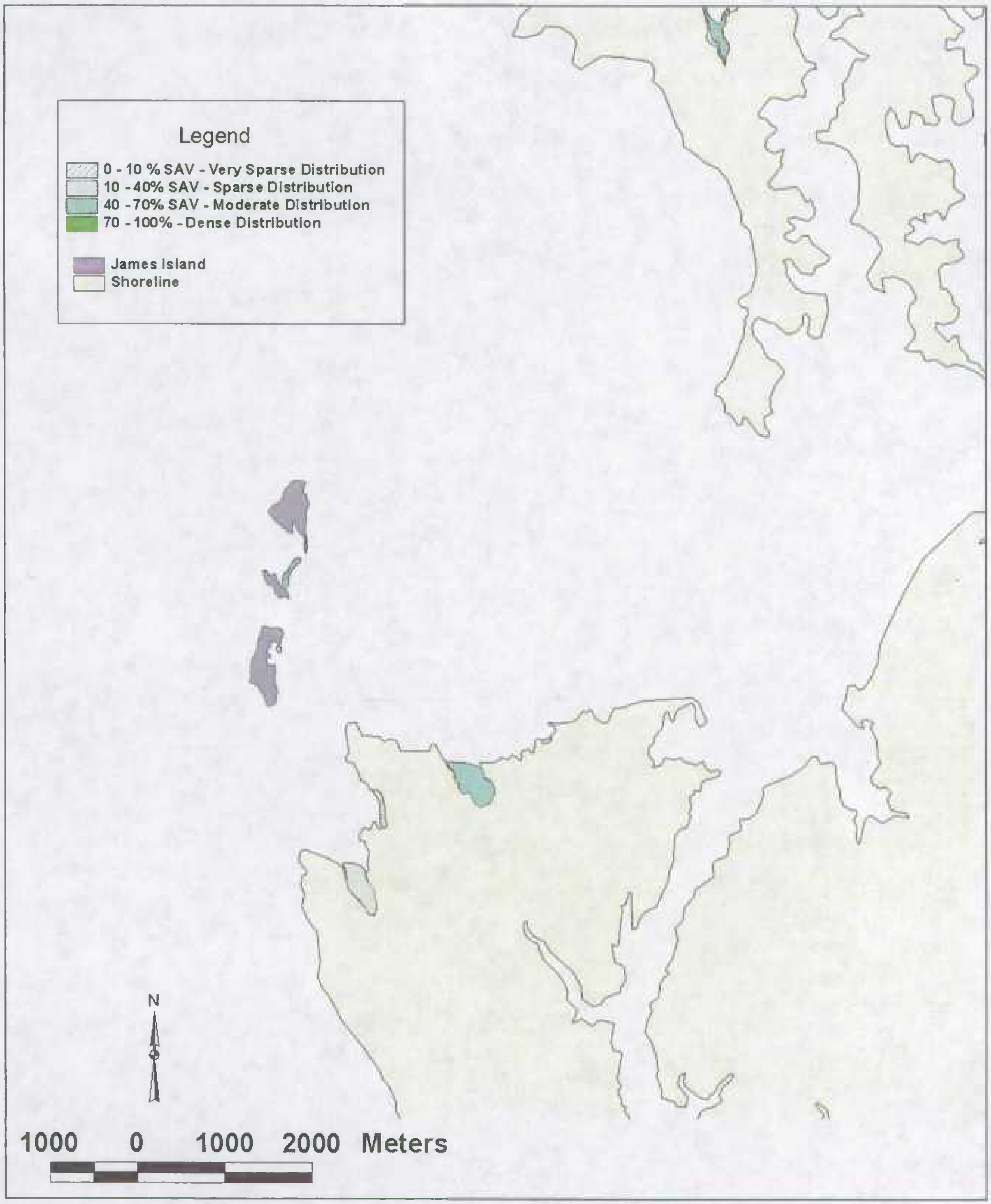


Figure E-3. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1991

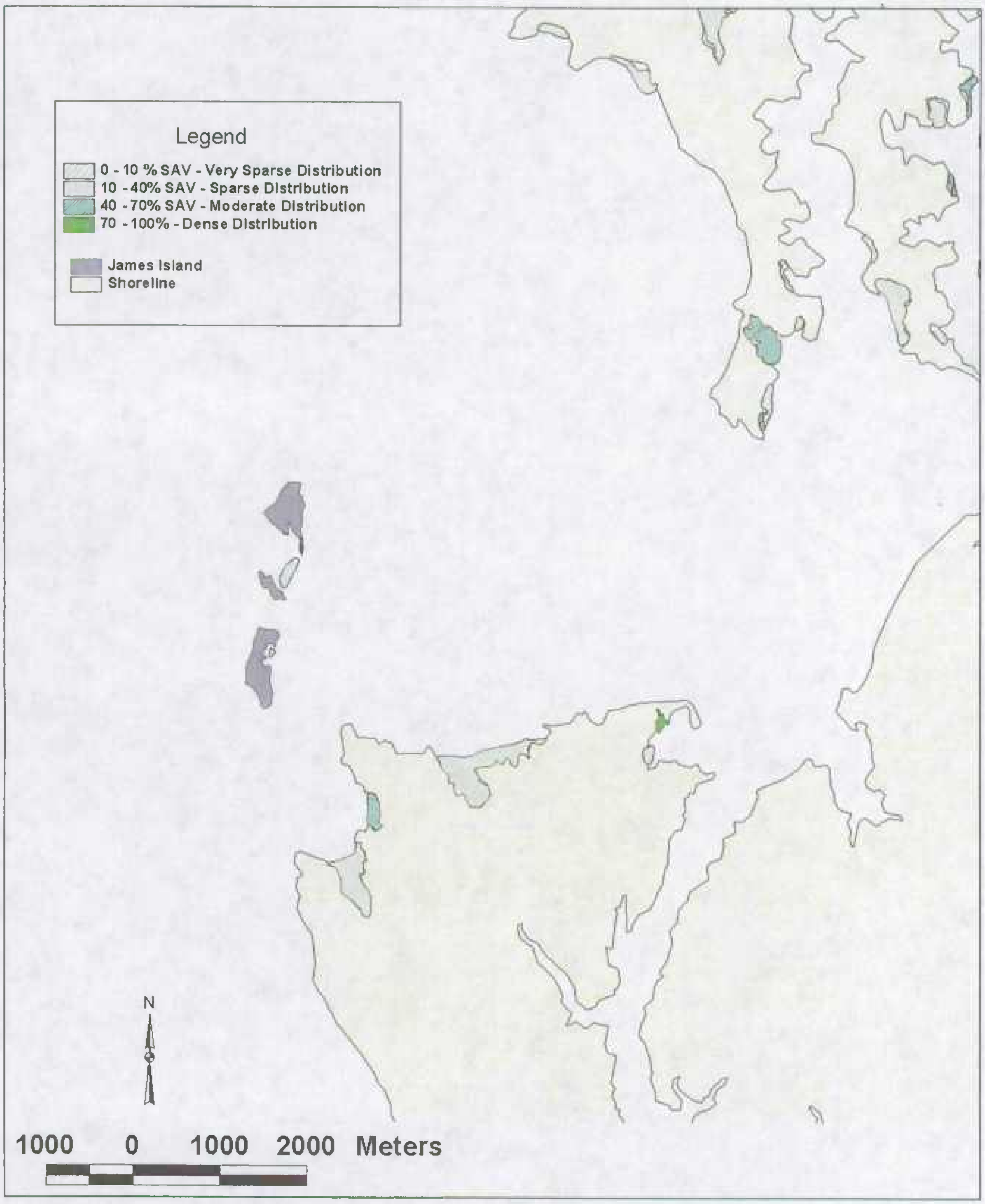


Figure E-4. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1992

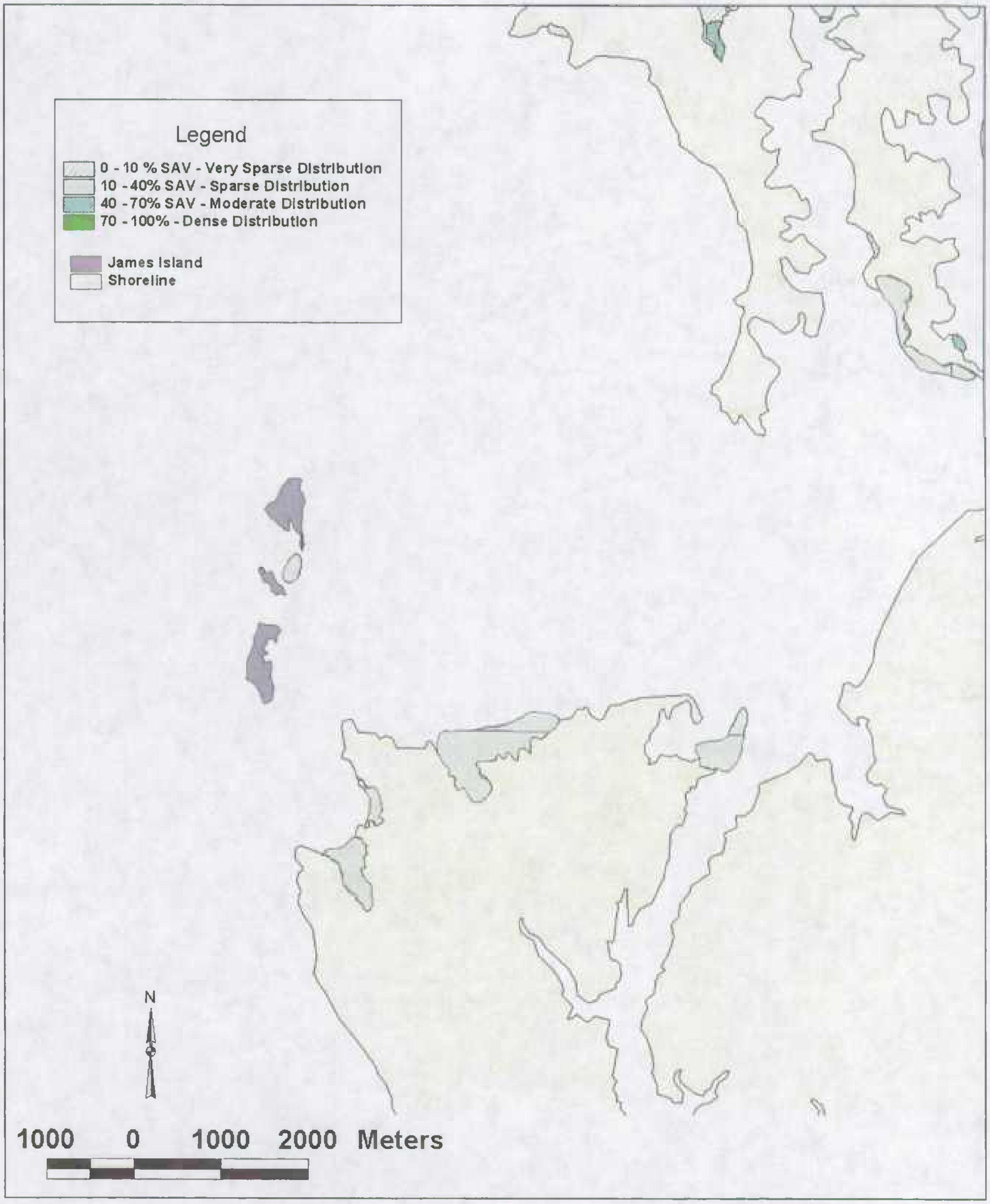


Figure E-5. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1993

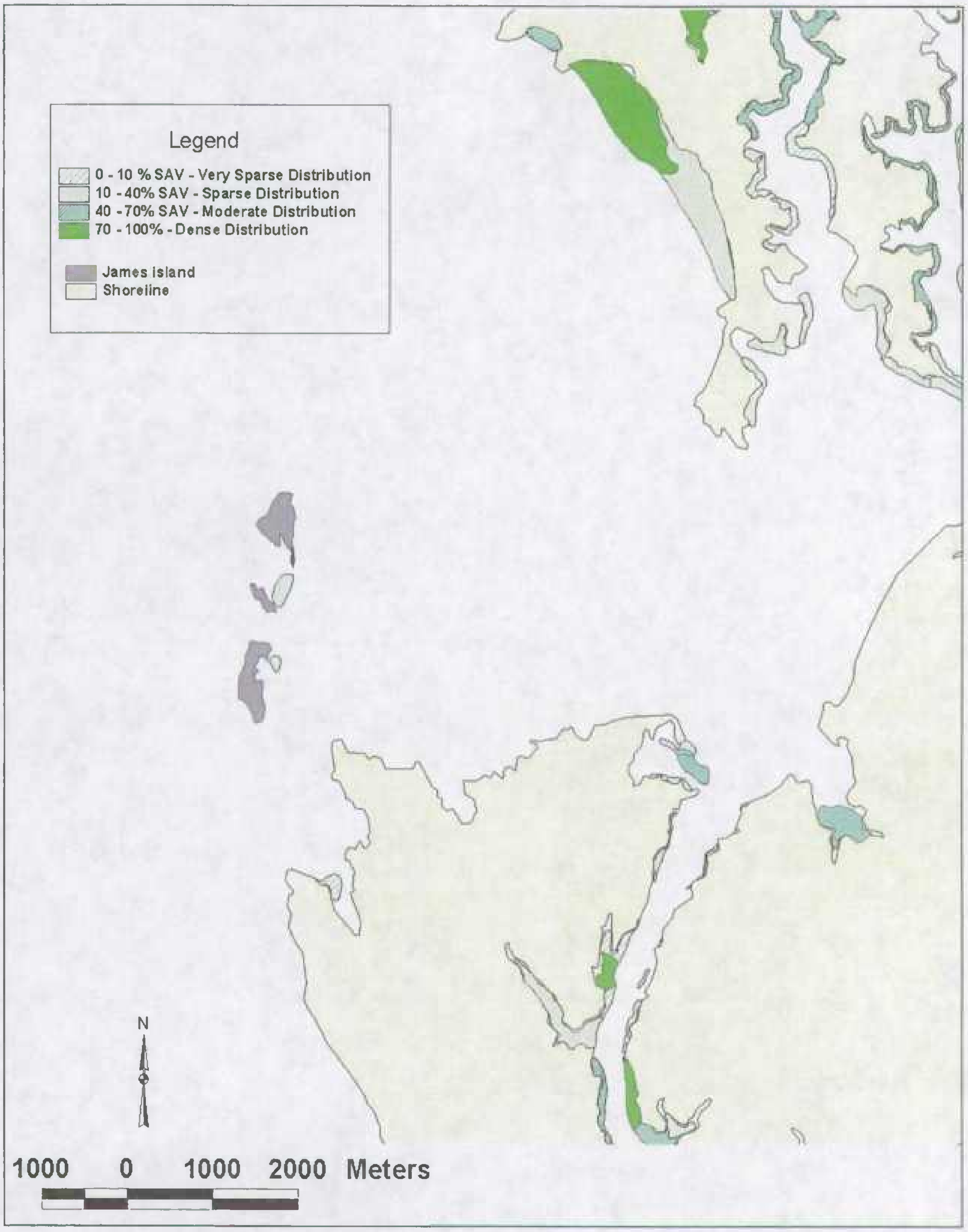


Figure E-6. Submerged Aquatic Vegetation (SAV) Distribution in Vicinity of James Island, 1999