BIOLOGICAL INVENTORY AND HABITAT CHARACTERIZATION REPORT

ALLOWAY CREEK SITE

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Prepared for:

PUBLIC SERVICE ELECTRIC AND GAS COMPANY
Estuary Enhancement Program
Hancocks Bridge, NJ 08038

Prepared by:

Woodward-Clyde

Woodward-Clyde Consultants
201 Willowbrook Boulevard
Wayne, New Jersey 04470

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4

TABLE OF CONTENTS

5

LIST OF TABLES

6

LIST OF FIGURES

7

1.0
INTRODUCTION

In July 1994, the New Jersey Department of Environmental Protection (NJDEP) issued the Final New Jersey Pollutant Discharge Elimination System (NJPDES) Permit No. 0005622 (the Permit) to Public Service Electric and Gas Company (PSE&G) for the Salem Generating Station. This Permit, which became effective September 1, 1994, contains a number of innovative Special Conditions that address concerns about loss of aquatic organisms resulting from the station's operations. Collectively, these Special Conditions are being implemented under PSE&G's Estuary Enhancement Program (EEP). Among the elements of the EEP is the implementation of a program to restore, enhance, and preserve a minimum of 8,000 acres of wetlands along the Delaware Estuary.

Among the lands along the Delaware Estuary identified by PSE&G as suitable areas for wetland restoration and enhancement are wetlands dominated by common reed (*Phragmites australis*). These wetlands contribute little to the detrital production of the estuary, and have been identified by PSE&G as suitable areas for wetland restoration through the removal of *Phragmites* and natural reestablishment of cordgrass *(Spartina* species) and other naturally occurring marsh grasses. PSE&G proposes to control *Phragmites* through the implementation of a spray and burn program and/or the development of improved tidal exchange The purpose for removing *Phragmites*, an undesirable plant species, from these sites is to enhance the habitat value for aquatic species and birds and to increase detrital exchange with the Delaware Estuary.

PSE&G has initiated studies related to the restoration of *Phragmites* dominated tidal wetlands at five Areas in Elsinboro and Lower Alloways Creek Townships, Salem County, hereafter referred to as the Alloway Creek Site. PSE&G issued an EEP purchase order release (P.O. B3-0737626, Release 21) to Woodward-Clyde Consultants (WCC) to implement the Wetlands Restoration Site Design Detail Specification (SPEC #EEP-S001, Rev.2) for these Areas. Preparation of this Biological Inventory and Habitat Characterization Report is a component of this specification. The five Areas investigated (Alloways Creek, Harmersville, Elsinboro, Mason's Point and Mill Creek) are located along Alloway Creek and the shoreline of the Delaware River (Figure 1). The Areas are described below in order from east to west.

8

Alloways Creek Area

The Alloways Creek Area is comprised primarily of *Phragmites*-dominated, non-impounded coastal marsh and encompasses approximately 273 acres. The Area is bordered by Alloway Creek to the south, Salem-Hancocks Bridge Road to the east, Abbot's Farm Road to the west, and Fort Elfsborg-Hancocks Bridge Road and agricultural fields to the north.

The Alloways Creek Area is subject to tidal influence from Delaware River via Alloway Creek. A network of tidal channels allows dispersion of tidal flow throughout the southern portion of the Area, while the drainage pattern is less developed in the northern portion of the site. The southern marsh area, which is dominated by smooth cordgrass, appears to have ground surface elevations in the range of 0.5 to three feet NAVD. A dike with a crest elevation of approximately 7.5 feet NAVD separates the tidal marsh areas from the agricultural fields in the northwest portion of the Area.

Harmersville Area

The Harmersville Area is a *Phragmites*-dominated, non-impounded coastal marsh encompassing approximately 64 acres. The Area is bounded to the north, east, and west by Alloway Creek. Poplar Street and adjacent agricultural fields are located to the south.

The Harmersville Area is subject to tidal influence from Delaware River via Alloway Creek. A network of channels allows dispersion of tidal flow throughout the northern portion of the Area. The northwest portion of the Area bordering Alloway Creek appears to have an earthen berm along the creek bank. The crest elevation of the berm is approximately four feet NAVD. The berm is in relatively poor condition and is breached in a number of locations. The interior portion of the Area contains a number of small tributaries to two main channels traversing the center of the Area. In the southern portion of the Harmersville Area there is a Y-shaped dike (in plan view) separating the marsh area from the adjoining agricultural fields. The northern branch of the dike, which protrudes into the marsh area, has a crest elevation of about seven feet NAVD. The southern branch of the dike, which traverses the Area and separates the marsh from the agricultural fields, has a crest elevation ranging between six and eight feet NAVD.

Elsinboro Area

The Elsinboro Area is a *Phragmites*-dominated, non-impounded coastal marsh encompassing approximately 1,584 acres. The Area is bounded by Alloway Creek to the south, the Delaware River to the west, Black Ditch and the Mill Creek Area to the northwest, and the Mason's Point Area to the north. Within the Area there are three main sub-regions: Money Island, Central Elsinboro, and Abbots Meadow. Money Island is a *Phragmites*-dominated dredge spoil disposal region encompassing approximately 400 acres immediately adjacent to Delaware River. Abbots Meadow represents the eastern region of the Area and Central Elsinboro refers to the region between Money Island and Abbots Meadow.

The Elsinboro Area is subject to tidal influence from Delaware River via Alloway Creek. The Area is characterized by a network of interconnected higher order channels that appear to have a braided pattern. Remnant diking is present under the transmission power lines within the Area and along one of the main tributaries of Alloway Creek. These dikes have been breached at several locations, but still appear to restrict tidal flows across the marsh in certain portions of the Area. In general, the marsh elevations range between one and three feet NAVD. Crest elevations of the dike that separates this Area from the adjacent impounded Mason's Point Area range from three to almost ten feet NAVD.

Mason's Point Area

The Mason's Point Area is an impounded *Phragmites*-dominated coastal marsh encompassing approximately 1020 acres. This Area is located immediately north of the Elsinboro Area and is separated from it and other tidal areas by a berm with two 30-inch corrugated metal pipes installed. Because of the restricted flow through these pipes, an artificial (muted) tidal regime exists within the Area.

Mill Creek Area

The Mill Creek Area is a *Phragmites*-dominated, non-impounded coastal marsh encompassing approximately 1,375 acres. The area is subject to tidal influence from the Delaware River, Mill Creek, Black Ditch, and Straight Ditch. The Area is generally bounded by the Delaware River to the

west, agricultural fields and Fort Elfsborg-Hancocks Bridge Road to the north, the Elsinboro Area to the south, and Money Island Road to the east. Marsh elevations generally range from one to three feet NAVD.

Several biological and habitat characterization tasks have been conducted by WCC to support construction permitting associated with the wetland restoration effort. Previously completed biological tasks include preparation of a Biological Inventory and Habitat Characterization Sampling Plan and performance of the field surveys described in the plan.

This Biological Inventory and Habitat Characterization Report presents information relating to threatened and endangered species potentially occurring at the Alloway Creek Site (Section 2), and describes the sampling methodologies and results of the biological field investigations conducted by WCC in characterizing the terrestrial and aquatic habitats (Sections 3.0 and 4.0, respectively).

2.0
THREATENED AND ENDANGERED SPECIES

The potential for occurrence of rare, threatened and endangered species and significant natural communities is an important consideration in the assessment of the current and post-restoration habitat values of the Alloway Creek Site. The information used to assess this potential was supplied by the NJDEP Division of Parks and Forestry, Office of Natural Lands Management, Natural Heritage Program (NHP). The NHP maintains a database of known occurrences of rare, threatened, and endangered species and significant natural communities. This information is dependent on the research and observations of many individuals and organizations. Not all of this information is the result of comprehensive or site-specific field surveys. The information supplied by the NHP summarizes existing data known at the time of the data request regarding the biological elements or location in question, and should not be regarded as the final statement on the elements or area being considered.

2.1 SPECIES OCCURRENCE ON OR NEAR THE SITE

The NHP has a record of one threatened species occuring on or near the Alloway Creek Site. An osprey (*Pandion haliaetus*) was sighted on the eastern edge of Money Island, approximately 1,300 feet south of Black Ditch in 1987. The NHP database also contained records of three rare species known from the area around the Site. Sightings of two bald eagles (*Haliaeetus leucocephalus*) and three osprey have been reported from within two miles of the Site. The U. S. Fish and Wildlife Service (F&WS) indicates that the bald eagle is a federally threatened species[1]. The osprey is not listed by the F&WS. The cream-flowered tick-trefoil (*Desmodium ochroleucum*) was also known to occur within two miles of the Restoration Sites. However, the NHP considers this plant to be extirpated from New Jersey, as it was recorded from a single location in 1891.

In addition to the records of rare species and natural communities on or adjacent to the Alloway Creek Site, the NHP provided a general listing of rare species and natural communities which have been documented in Salem County. This list contains records on 17 vertebrates, two

[1] A Final Rule reclassifying the status of the bald eagle from endangered to threatened was published by the U.S. Fish and Wildlife Service in the Federal Register on July 12, 1995. The effective date of this reclassification is August 11, 1995.

12

invertebrates, 58 vascular plants, three ecosystems, and one other type of area (a bald eagle wintering site) tracked by the NHP. Many of the species on this list have no state or federal legal status, but are considered rare or uncommon in New Jersey. A listing of those species that are designated by the NJDEP as either threatened or endangered and that have a potential to occur on the Site is provided in Table 1.

2.2 PRIORITY SITES

The NHP also identifies "priority sites" for natural diversity in New Jersey. Priority sites represent the State's best habitats for rare and endangered species and natural communities. There are no priority sites located within or adjacent to the boundaries of the Alloway Creek Site. The closest priority site, the Mannington Meadow macrosite, is located approximately four miles northeast of the Site. The Mannington Meadow macrosite includes brackish marshes and some forested edge that provide resting and feeding habitat for wintering bald eagles, and also includes Mannington Creek to include a bald eagle nest site.

2.3 SPECIES OBSERVED AT THE ALLOWAY CREEK SITE

Other species observed at the Alloways Creek Site that are listed by the NJDEP as threatened or endangered include the great blue heron (*Ardea herodias*), red shouldered hawk (*Buteo lineatus*), northern harrier (*Circus cyaneus*), bald eagle, osprey, and the Savannah sparrow (*Passerculus sandwichensis*). The black-crowned night heron (*Nycticorax nycticorax*), a declining species, and several Northern diamondback terrapins (*Malaclemys terrapin*), a former Federal C2 species, were also seen using the Site during the autumn 1995 field surveys.

3.0
CHARACTERIZATION OF TERRESTRIAL HABITAT

Terrestrial field investigations were performed during 16 to 20 October, 1995 to characterize the terrestrial communities that occur within or adjacent to the Alloway Creek Site. These field investigations were designed to acquire data describing the vegetation, bird, and small mammal communities present. Biological sampling locations are shown in Figure 1. In addition to the focused field studies, general observations were also made regarding the presence of reptiles, amphibians and large mammals. The methods used to acquire site specific data of each component of the terrestrial ecosystem and the results of the investigations are described in the following sections. Supporting data are on file at WCC and will be provided to PSE&G in electronic format for inclusion in the EEP database.

3.1 VEGETATION

3.1.1 Methodology

Vegetation community maps prepared by CH2M Hill were used as the primary basis for characterizing the vegetative cover types within the Alloway Creek Site. These maps were spot checked using recent true color aerial photographs (April 1995) and ground truthed by collecting field vegetation data at selected locations. The vegetation community maps were then revised as necessary to reflect the review of the true color aerial photographs and field data obtained during the ground truthing.

Selected plots were established to document the vegetative cover present within the Alloway Creek Site. The center of each plot location was staked and located by GPS. A five foot radius plot was sampled for herbaceous species and a 30 foot radius plot was sampled for trees ($\geq$ 5.0 inches dbh and 20 feet or taller), saplings (0.4 to $<$ 5.0 inches dbh and 20 feet or taller), and shrubs (3 to 20 feet tall, including multi-stemmed, bushy shrubs and small trees and saplings).

For herbaceous species, the percent coverage of all taxa within the plot was estimated and summed to provide a total cover value for the plot. The dominance of individual taxa was determined by

calculating a "relative percent cover" value for each (i.e., the individual taxon cover value divided by the total cover for the plot).

For trees, saplings, and shrubs the stem density of each species was determined and summed to provide a total stem count for the plot. The dominance of the individual species was determined by calculating a "relative density" value for each (i.e., the number of stems for the individual species divided by the total number of stems in the plot).

3.1.2 Results

Eight vegetative communities were identified at the Alloway Creek Site (Figures 2 through 6), with various degrees of intergradation between them. Each community is identified by the species name, or vegetation type, that is dominant in that area. In some areas where two species, or vegetation types, are common they are both listed (e.g., PH/SS indicates *Phragmites*/scrub-shrub community). In addition to the vegetated communities agricultural land, fallow fields, mud flats, developed land and open water areas were also identified. Vegetation data collected during the ground truthing are presented in Table 2. The approximate acreage of each cover type for the five individual Areas as well as the entire Site are presented in Table 3. The following is a general description of each community.

Common Reed (*Phragmites australis*) Community

The *Phragmites* community (designated as PH) is the predominant vegetation type present at the Alloway Creek Site. This community type is found in large monotypic stands scattered throughout the five individual Areas. The *Phragmites* community at the time of the aerial photographs occurred over approximately 2,236 acres or about 62 percent of the total vegetated area (i.e., the total site area minus the area of open water). As can be seen from Table 3 the percent cover of *Phragmites* community is greater at the Mill Creek and Elsinboro Areas (81 and 69 percent, respectively) than at the Hammersville, Alloways Creek and Mason's Point Areas (52, 35 and 35 percent, respectively).

Also present in combination with *Phragmites* are areas of scrub-shrub, forest and broad-leaf cattail (*Typha latifolia*). *Phragmites*/scrub-shrub communities (designated as PH/SS) are present in small areas on the Alloways Creek (six acres), Harmersville (two acres) and Mill Creek (one acre) Areas while this community type comprises approximately 21 percent (186 acres) of the Mason's Point Area. Shrub species common in this community type are sea myrtle (*Baccharis halimifolia*) and sand blackberry (*Rubus cuneifolius*). The *Phragmites*/forested community type (designated as PH/FO) occurs on the Elsinboro Area (eight acres) where red maple (*Acer rubrum*) and black cherry (*Prunus serotina*) are common trees present. The *Phragmites*/broad-leaf cattail community (designated as PH/TL) only occurs on the Mill Creek Area (two acres).

Smooth Cordgrass (*Spartina alterniflora*) Community

Smooth cordgrass community (designated as AL) is found in monotypic stands throughout the Alloway Creek Site. Occurring along with smooth cordgrass in several areas of the sites, particularly along the edges of channels, are big cordgrass (*Spartina cynosuroides*) and salt marsh bulrush (*Scirpus robustus*). This community type comprises approximately 478 acres or about 13 percent of the total Alloway Creek Site. The smooth cordgrass community type covers 25 percent, or greater, of the Alloways Creek, Harmersville and Elsinboro Areas while the Mill Creek and Mason's Point Areas are covered by less than five percent of this community type. In combination with smooth cordgrass (designated as AL/CY) are small areas (about four acres) on the Alloways Creek restoration site where big cordgrass is also dominant.

Agricultural Land/Fallow Fields

Areas of agricultural lands (designated as AG) occur on the Mason's Point, Mill Creek, Alloways Creek and Elsinboro Areas (about 165, 129, 74 and 12 acres, respectively). Fallow fields (designated as FF) occur in small areas (about 21 and four acres, respectively) on the Mason's Point and Mill Creek Areas.

Forest Community

Small areas totaling about 36 acres of forest (designated as FO) occur on the Alloways Creek, Elsinboro and Mill Creek Areas. The forested areas occur along the perimeter of marsh and

16

agricultural areas or as isolated "islands" within *Phragmites*-dominated areas on the Alloway Creek Site. Larger areas of forest are found on the Mason's Point Area where this cover type comprises approximately 106 acres of this Area. Dominant trees and shrubs found in the forest communities include: red maple, persimmon (*Diospyros virginiana*), black cherry, sea myrtle and northern bayberry (*Myrica pensylvanica*).

Switchgrass (*Panicum virgatum*) Community

Switchgrass community (designated as PV) is only found on Money Island on the Elsinboro Area. About 17 acres of this community type was present. Microstegium (*Eulalia viminea*) was also present in this community type.

Scrub-shrub Community

The scrub-shrub community (designated as SS) is present in approximately 18 acres of the Mason's Point Area. The scrub-shrub community type is also present in combination with the fallow field community type (designated as FF/SS) in approximately 38 acres on this Area. Small areas (about one acre on each Area) of scrub-shrub community are also located on the Alloways Creek and Mill Creek Areas. Sea myrtle is a common species found in this community type.

Mud Flat

Areas of mud flats (designated as MF) are exposed at low tide along the edges of many of the creeks and drainage ditches at the Alloway Creek Site. The only significant area of mudflat mapped is located on the Elsinboro Area (approximately 41 acres).

Developed Land

Developed land (designated as DEV) includes areas around residences present on the Alloway Creek Site. Only about three acres of developed land was present on the Mill Creek and Mason's Point Areas.

(7

Open Water

Areas of open water (designated as OW) include the creeks and drainage ditches that are present throughout the Alloway Creek Site. The open water areas are about 717 acres and comprise about 17 percent of the total Site area.

3.2 REPTILES AND AMPHIBIANS

Four species of turtles were collected as incidental catches during the autumn 1995 aquatic sampling at the Alloway Creek Site. Several northern diamondback terrapins (*Malaclemys terrapin*) and one snapping turtle (*Chelydra serpentina*) were caught at the Elsinboro and Mill Creek Areas. One eastern painted turtle (*Chrysemys picta*) and one red bellied turtle (*Chrysemys rubriventris*) were captured at the Mason's Point Area. One eastern painted turtle was also found crossing a road at the Mill Creek Area. A snapping turtle and an eastern painted turtle were observed in one of the two freshwater ponds located in the southeastern corner of the Mason's Point Area. Tadpoles (*Rana sp.*) also were observed in these ponds. The only other evidence of reptiles found at the Alloway Creek Site were two black rat snakes (*Elaphe obsoleta*) that were found in upland portions of the restoration areas.

3.3 BIRDS

The tidal marshes of Delaware Bay are well known as excellent habitat for resident and migrant birds, which use these areas for breeding, feeding, and resting. The use of the shoreline areas by aggregations of migrating shorebirds in the spring is well known. However, migrating shorebirds also use the beaches, mudflats, tidal creeks and marshes during their fall migrations. Wintering waterfowl and raptors also use the marshes and surrounding habitat.

3.3.1 Methodology

Documentation of bird species occurrence within the study area was obtained from observations made along five belt transects and at one fixed observation point in representative habitats (Figure 1).

Transects

Transects were walked on three consecutive days and all birds seen/heard within the study area were identified and counted to yield an index of species abundance. The purpose of the belt transect surveys was primarily to document the occurrence of songbirds with restricted home ranges. However, observations of wading birds, waterfowl and other more wide ranging species were also recorded when observed within (or flying over) the transect. Descriptions of the habitats sampled by each of the transects are provided below.

Bird Transect 1 (MC-BT1) is located along a cultivated field/*Phragmites* edge in the northern portion of the Mill Creek Area. Scattered trees and shrubs are located along this edge, increasing the diversity of the habitat.

Bird Transect 2 (MC-BT2) is located along the alignment of an access drive that traverses *Phragmites* and smooth cordgrass estuarine wetlands as well as shrub dominated successional areas in the vicinity of an unoccupied homesite on the Mill Creek Area. This homesite is essentially surrounded by *Phragmites*-dominated wetlands.

Bird Transect 3 (MP-BT3) is located along the alignment of a wooded strip that is adjoined by cultivated fields and *Phragmites*-dominated wetlands on the Mason's Point Area. A wide range of habitat types occur along the transect, ranging from emergent wetlands to mature upland forest.

Bird Transect 4 (MP-BT4) is located along the alignment of the perimeter dike that separates the Mason's Point Area from the Elsinboro Area. A wide variety of habitat types occur along this transect, including wooded uplands and *Phragmites*-dominated wetlands.

Bird Transect 5 (AC-BT5) is located along a cultivated field/*Phragmites* edge within the Alloways Creek Area.

Observation Stations

Point observations were made from a centrally located vantage point on three days. The observer counted and recorded all birds identified from each observation station during a one hour period

on each day. These observations were primarily to document the occurrence of raptors, waterfowl, gulls, and wading birds. The Bird Observation Station (MP-BP1) is located at a point along the dike separating the Mason's Point Area from the Elsinboro Area where views of each Area are provided.

3.3.2 Results

Transects

The birds observed along Bird Transect 1 (MC-BT1) (Table 4) are representative of the edge habitat that occurs along its length. Because of the close proximity to cultivated areas, the mourning dove (*Zenaida macroura*) was a predominant species, as well as resident perching birds such as the song sparrow (*Melospiza melodia*). Also observed were migrants such as the yellow-rumped warbler (*Dendroica coronata*) and ruby-crowned kinglet (*Regulus calendula*). In total eight species of perching birds were observed along this transect. Several species of woodpeckers were also observed in the trees along this edge, including the downy woodpecker (*Picoides pubescens*), common flicker (*Colaptes auratus*) and red-bellied woodpecker (*Melanerpes carolinus*). The raptors observed were the red-tailed hawk (*Buteo jamaicensis*) and American kestrel (*Falco sparverius*).

The birds observed along Bird Transect 2 (MC-BT2) were comprised primarily of migrating yellow-rumped warblers, ruby-crowned kinglets and American robins (*Turdus migratorius*). Because of the diversity of habitats, a number of other perching birds were also observed. These included the red-winged blackbird (*Agelaius phoeniceus*), swamp sparrow (*Melospiza georgiana*), gray catbird (*Dumetella carolinensis*) rufous-sided towhee (*Pipilo erythrophthalmus*) and tufted titmouse (*Parus bicolor*). Raptors observed along this transect included the American kestrel, northern harrier (*Circus cyaneus*) and red-shouldered hawk (*Buteo lineatus*).

As was observed along Bird Transect 2, migrating yellow-rumped warblers, American robins and ruby-crowned kinglets were predominant along Bird Transect 3 (MP-BT3). Blue jays (*Cyanocitta cristata*) were also observed foraging for acorns in the wooded areas along the transect on each survey date. Other perching bird observed included the swamp sparrow, gray catbird, rufous-

20

sided towhee and Carolina wren (*Thryothorus lubovicianus*). The only raptor observed was the red-tailed hawk.

Bird Transect 4 (MP-BT4) traverses more habitat types than any of the other transects surveyed. As a result, the species observed along this transect include marsh-associated species such as the greater yellowlegs (*Tringa melanoleuca*), tree swallow (*Iridoprocne bicolor*), northern harrier and red-winged blackbird as well as perching birds more associated with the wooded areas along the transect. As observed along other transects, these included the yellow-rumped warbler and ruby-crowned kinglet.

The number of bird species observed along Bird Transect 5 (AC-BT5) was the least of the transects surveyed. The predominant species observed were the red-winged blackbird, song sparrow, swamp sparrow and yellow-rumped warbler.

Observation Stations

The birds observed at Bird Observation Point 1 (MP-BP1) were predominated by marsh-associated species such as the tree swallow, mallard (*Anas platyrhynchos*), Canada goose (*Branta canadensis*) and greater yellowlegs. Other marsh species observed included the northern harrier, red-winged blackbird, clapper rail (*Rallus longirostris*), black-crowned night heron (*Nycticorax nycticorax*) and great blue heron (*Ardea herodias*).

3.4 MAMMALS

The number of mammal species occurring on the Alloways Creek Site is limited by the relatively low diversity of terrestrial habitats present. Mammal studies were not conducted on the Elsinboro and Harmersville Areas because of their coastal marsh dominance and lack of upland/wetland boundary. Raccoon (*Proyon lotor*), muskrat (*Ondatra zibethica*), white-tailed deer (*Odocoileus virginianus*), Eastern cottontail (*Sylvilagus floridanus*), coyote (*Canis latrans*), and virginia opossum (*Didelphis virginiana*) foraging, scats or tracks were present throughout the Site. Those mammals observed on the Site were eastern cottontail, muskrat and white-tailed deer. The most abundant group of mammals present are small mammals, represented by several species that occur in open herbaceous habitats or various ecotones.

21

3.4.1 Methodology

Small mammal occurrence on the Alloway Creek Site was documented by trapping. Seven transects with fifteen trap locations each were established along selected linear habitats/ecotones (e.g., field edges). The beginning and ending points of the transects are shown in Figure 1. During the small mammal trapping both Sherman live traps and Museum Special snap traps were set and baited with a peanut butter/oatmeal mixture. Fifteen Sherman traps were set at each transect site at a spacing of 50 feet, for a transect length of 700 feet. Five pitfall traps were also set at evenly spaced locations along the transects. The small mammal trapping program was conducted for four consecutive nights (October 16 to 20, 1995). On the first night Museum Special snap traps were not used, so as to reduce unnecessary mortality. On the second day, snap traps were set at evenly spaced locations along transects with a poor catch. All small mammals captured were identified, weighed, and measured.

Mammal Transect 1 (AC-SMT1) was located on the Alloways Creek Area on the edge of a cornfield and *Phragmites*-dominated area, west of Salem-Hancocks Bridge Road, and north of Hancocks Bridge (crossing Alloway Creek). The vegetation present on this transect is dominated by *Phragmites* and sea myrtle bordering a cornfield. A small farm pond is also present along the transect.

Mammal Transect 2 (MP-SMT2) was located on the Mason's Point Area west of the historic Harbeson house on the edge of a fallow field and forested area. The vegetation present on this transect is dominated by foxtail grass and switch grass in the fallow field area and Eastern red cedar and persimmon trees, along with trumpet creeper vines in the forested area.

Mammal Transect 3 (MP-SMT3) was located on the Mason's Point Area, south of Mason's Point Road, along an edge of *Phragmites*/scrub-shrub and a mowed roadway. The vegetation present on this transect was dominated by *Phragmites* and sea myrtle.

Mammal Transect 4 (MP-SMT4) was located on the Mason's Point Area at the southeast end of Money Island Road along the edge of an open field and scrub-shrub area. The vegetation present on this transect is dominated by *Phragmites*, sea myrtle, and Japanese honeysuckle.

22

Mammals Transect 5 (MC-SMT5) was located on the Mill Creek Area at the southwest end of Money Island Road. Traps were placed along a cut path of *Phragmites* bordering an unnamed channel of Mill Creek. The vegetation present on this transect is dominated by *Phragmites* and pokeweed with some various woody vines also present.

Mammals Transect 6 (MC-SMT6) was located on the Mill Creek Area along the edge of an open mowed grass (red fescue) field and scrub-shrub/saplings west of Money Island Road. The vegetation present on this transect was dominated by a mix of *Phragmites*, Northern arrow-wood, black cherry and Japanese honeysuckle.

Mammals Transect 7 (MC-SMT7) was located on the Mill Creek Area at the edge of a plowed farm field and *Phragmites*/scrub-shrub and forested area. The vegetation present on this transect was dominated by *Phragmites* and sea myrtle with some trees and saplings also present.

3.4.2 Results

A total of 124 individual small mammals representing four species were captured at the Alloway Creek Site (Table 6). With 114 individuals captured, the white-footed mouse (*Peromyscus leucopus*) was by far the most common species, making up 92 percent of the catch. The white-footed mouse was the most common catch on the edge of agricultural fields and *Phragmites*/scrub-shrub dominated areas, such as in transects MP-SMT4 and MC-SMT6. The house mouse (*Mus musculus)* was the second most abundant small mammal, with eight captures (six percent of the total catch). House mice were caught in the predominantly *Phragmites* areas, such as that found along transect AC-SMT1. The masked shrew (*Sorex cinereus*) and meadow vole (*Microtus pennsylvanicus*) had one capture each and together make up about one percent of the catch.

4.0
CHARACTERIZATION OF AQUATIC HABITAT

Field investigations were performed during 26 September to 4 October 1995 to characterize the aquatic invertebrate (zooplankton and benthic macroinvertebrate) and vertebrate (fish) communities that occur within the Alloway Creek Site. Twelve primary aquatic sampling locations were within channels that are tidally influenced, and were fished for three consecutive days using fixed gear. Additional secondary aquatic sampling locations were sampled using minnow traps, seines and dip nets. Secondary locations were located in tidally influenced channels, and in smaller ditches and/or ponds. The distribution of the primary aquatic sampling locations are shown on Figure 1. Two locations were within the Alloways Creek Area (AC-AS1 and AC-AS2), one location was within the Harmersville Area (H-AS3), four locations were within the Elsinboro Area (E-AS4, E-AS5, E-AS6, and E-AS9), two were within the Mason's Point Area (MP-AS8 and E-AS9), and three were within the Mill Creek Area (MC-AS10, MC-AS11, MC-AS12). Location E-AS9 was located in Black Ditch, which separates a portion of the Elsinboro Area from the Mill Creek Area. Supporting data are on file at WCC and will be provided to PSE&G in electronic format for inclusion in the EEP database.

4.1 PHYSICAL/CHEMICAL PARAMETERS

A suite of physical and chemical field data measurements were collected at each aquatic sampling station. Physical data included channel width and depth, tidal stage (flood or ebb), and sediment type. Water quality data included dissolved oxygen, temperature, pH, turbidity, conductivity, and salinity.

4.1.1 Methodology

Channel width was visually estimated, while channel depth was measured using a graduated surveyors pole. The tidal stage was determined based on the stage of the tide at each particular sampling location. Sediment type was assigned based on the sediment retrieved during the benthic invertebrate sampling, and by probing the substrate with the surveyors pole.

Water quality data was collected prior to sample collection using a Horiba U-10 multimeter. Turbidity was measured using an eight-inch secchi disk.

4.1.2 Results

Physical Parameters

The channels and ditches sampled ranged from about 20 feet to 350 feet wide. Several of the channels sampled did not contain water during low tide, while others held about one to two feet of water at low tide. Maximum depth of the stations at high tide ranged from five feet to seven feet. The substrate at the sampling locations ranged from soupy mud containing organic detritus to more firmer clayey mud with a thin layer of soft mud on top. With the exception of the two sampling locations at the Mason's Point Area, all primary sampling locations were tidally influenced.

Water Chemistry

The results of the field water quality measurements are shown in Table 7. Water temperatures ranged from 17.4 °C to 23.0 °C. Salinities ranged from 7.5 to 12.0 parts per thousand. Specific conductivity ranged from 12.7 to 20.4 μS/cm. Dissolved oxygen ranged from 5.0 to 14.5 mg/l. pH ranged from 7.1 to 9.05, and secchi depth ranged from 6 to 18 inches.

4.2 ZOOPLANKTON

4.2.1 Methodology

Zooplankton sampling was performed at the twelve primary locations shown on Figure 1. These locations were also sampled for fish and benthic macroinvertebrates. Zooplankton were collected using a standard eight-inch diameter plankton net with a 80 micron mesh, fitted with a sample bottle at the cod end. Twenty liters of water were collected at each station, from the surface to mid-depth, and were filtered through the net. The samples were immediately preserved using a 10 percent formalin solution. Two zooplankton replicates were collected at each sampling location.

The samples were delivered to Dr. Michael Kubik of Lehigh University. Each sample was concentrated to a measured volume, and one milliliter aliquots were removed from the well mixed sample using a Hensen-Stempel pipette. Each aliquot was transferred to a Sedgewick-Rafter counting chamber and the zooplankton were identified and enumerated using a compound microscope. Subsamples were examined until at least 100 organisms were counted, or until the entire sample was processed, whichever came first.

4.2.2 Results

The zooplankton collected (Table 8) at the Site are typical of a low salinity estuarine habitat. In addition to typical zooplankters, nematodes and harpacticoid copepods were noted in many of the samples. These typically benthic organisms were found more often in those samples that contained a significant amount of detritus, which may have been due to benthic sediments being suspended in the water column during collection, given the shallow water depths at some sampling locations.

At locations with free connections with Alloway Creek or Delaware Bay, the most common organisms were the nauplius larvae of copepods and barnacles, which together usually comprised greater than 50 percent of the zooplankton population. The presence of these larval stages, and also of copepodites, indicates actively reproducing populations of barnacles and copepods. Many of the adult calanoid copepods found were identified as *Acartia tonsa*, a species which is very common in euryhaline habitats. Although it was not possible to identify the barnacle nauplii, other studies (RMC, 1988) have found adult *Balanus improvisus* near these locations in the Delaware Estuary.

At the Mason's Point Area, the rotifer *Brachionus* sp. was the dominant zooplankter, and made up 84 percent of the zooplankton collected. Rotifers are generally considered to be fresh-water organisms, although some species have adapted to brackish and marine environments. *Brachionus* sp. dominated rotifer populations, with *Asplanchna* and other genera occasionally present.

The total number of zooplankters in tidally influenced areas ranged from 4 to 279 per liter, with copepods usually predominating. Higher numbers of zooplankton (about 614 individuals per liter) were found in the impoundment (Mason's Point Area), with rotifers comprising 84 percent of the population.

4.3 BENTHIC MACROINVERTEBRATES

4.3.1 Methodology

Benthic macroinvertebrates were collected at the same twelve primary sampling locations that were sampled for zooplankton and fishes (Figure 1), using a petite Ponar grab sampler. Two samples were collected at each sampling location for a total of 24 benthic samples. Each sample was sieved in the field using a 500 micron mesh sieve to remove fine sediments. Any sediment, detritus, and organisms retained by the sieve were transferred to a plastic collection jar and preserved using a 10 percent formalin/Rose Bengal solution.

The samples were delivered to the Philadelphia office of WCC, where organisms were sorted from the sediment/detritus using a stereo dissecting microscope. All organisms were identified to the lowest possible taxon and enumerated.

4.3.2 Results

A total of 23 benthic macroinvertebrate taxa were recovered from the 24 samples (Table 9). The average number of organisms per square meter ranged from 242 at MP-BM7 to 17,710 at MC-BM10.

Oligochaetes dominated the benthic communities at most stations. In general, annelids (oligochaetes and estuarine polychaetes) comprised greater than 50 percent of the benthic macroinvertebrates present at the sampling locations. The most commonly found polychaetes were *Laeonereis culveri* and *Polydora colonia*.

Collectively, the estuarine amphipods (*Leptocheirus plumulosus*, *Corophium* sp., and *Gammarus* sp.) and estuarine isopods (*Cyathura polita* and *Edotea triloba*) comprised from 5 to 57 percent of the total number of organisms at sampling stations where the salinity was greater than 9 parts per thousand. At locations where the salinity was less than 8 parts per thousand (Mill Creek and Mason's Point Areas), amphipods and isopods collectively comprised was less than 1.5 percent of the total number of individuals at each site.

Brachyuran crabs, mainly *Rhithropanopeus harrisii*, were present in samples collected from the Elsinboro and Harmersville Area sampling locations. These locations had salinities that were greater than 9 parts per thousand. Bivalve mollusks were found in only one sample (E-BM4), and were of very small size. A few non-benthic organisms were also present in the samples, including *Argulus* sp. (a copepodid freshwater fish parasite), *Aegathoa medialis* (a parasitic isopod), and Hydrozoa (medusae).

The species which make up the benthic community in the Alloway Creek drainage area are common inhabitants of the Delaware estuary, and are typical of soft-bottomed mesohaline environments. In areas where the salinity is greater than 9 parts per thousand, the benthic communities show a greater richness, with the number of taxa ranging from 7 to 15, with a mean of 10, at each location.

4.4 FISH

4.4.1 Methodology

Qualitative fish sampling was conducted at the twelve primary and several secondary aquatic sampling locations to characterize the fish populations that currently use the Site. Fish collections at primary sampling locations were made using Indiana trap nets, Hoop nets and minnow traps. Sporadic collections at secondary locations were made using dip nets, minnow traps and a 20-foot flat seine.

The trap nets are constructed of two 6 feet wide by 3 feet high steel frames and four 30 inch diameter steel hoops, with an 8 inch throat on the first hoop, and a 50 foot long by 3 feet high leader. The entire net and leader are constructed of 1/2 inch mesh netting. The leader was staked on or near the shoreline, pulled taut, and then the first frame was staked into the substrate. The remainder of the net was pulled taut using an anchor and buoy line tied to the cod end of the net. The trap nets were set during the morning or afternoon, were not baited, and were fished for approximately 24 hour sets for three consecutive days.

The minnow traps are 17-1/2 inches long, 9 inches in diameter, and are constructed of 1/2 inch wire mesh. These traps were baited with menhaden, and were set in conjunction with the trap nets for approximately 24 hour sets for three consecutive days at each sampling location.

A 9-foot otter trawl with 1-1/2 inch body mesh, 1-1/4 inch cod-end mesh, and a 1/2 inch cod-end meshliner was used at several of the primary sampling locations along with the fixed sampling gear. The trawl was pulled by a 19-foot jon boat with a 40 hp outboard motor. The trawl was pulled both with and against the tide for approximately five minutes.

The 20-foot flat seine and 50 feet long bag seine were both 4 feet high and have a 1/4 inch mesh. These nets were manually pulled through the water at low tide to perform exploratory seine hauls at the Elsinboro Area.

All fish collected were identified, counted, weighed (by species), and measured (fork length, or total length for fishes without a fork). For smaller species collected in large numbers (i.e., mummichogs), length ranges were measured instead of measuring each individual fish.

4.4.2 Results

A total of 1,322 fishes from twenty-one species were collected (Table 10). The Atlantic silverside (*Menidia menidia*) was the most abundant species captured, comprising 42 percent of the total catch. The mummichug (*Fundulus heteroclitus*) was the second most abundant species, making up 25 percent of the catch. The white perch (*Morone saxatilis*) was the third most abundant with 9 percent and the Atlantic menhaden (*Brevoortia tyrannus*) comprised 8 percent of the catch. The remaining sixteen species (which included bay anchovy, striped bass, weakfish, and Atlantic croaker) accounted for 15 percent of the total catch.

Eight species of fish were collected at the Alloways Creek Area, where the Atlantic silverside dominated the catch. Several white perch, weakfish and Atlantic menhaden were also captured at the two sampling locations at this Area. Gizzard shad, striped bass, Atlantic croaker, and black drum were each represented by one individual.

The Elsinboro Area, which contained four sampling locations, was the most productive. A total of 949 fish from 18 species were captured at the Elsinboro Area. The Atlantic silverside dominated the catch. The mummichog was the second most abundant fish at this site, followed by the white perch, Atlantic menhaden, bay anchovy, and weakfish. The American eel, alewife,

Atlantic croaker, black drum, and harvestfish were each represented by only one individual at this site.

Seven species of fish were collected at the Mason's Point Area. The fish fauna at this site was indicative of a more freshwater habitat, and was dominated by brown bullhead and common carp. This site also marked the only location where the pumpkinseed and black crappie, typically considered to be freshwater fish, were collected.

The one sampling location at the Harmersville Area produced only 52 fish from four species, with the mummichog being the most abundant. This location was the only area where the naked goby was collected.

The Mill Creek Area, with three sampling locations, produced 172 fish from 12 species. The white perch was the most abundant species collected here, closely followed by the Atlantic menhaden and the mummichog. This Area produced the highest number of gizzard shad (17), and the second highest catch of weakfish (9) out of the five Areas.

Additionally, one species of invertebrate and four species of reptiles occurred as incidental captures during the fish survey. The most abundant invertebrate collected during the fish survey was the blue crab (*Callinectes sapidus*), which was collected at six of the aquatic sampling locations. Of the four reptiles captured, the northern diamondback terrapin (*Malaclemys terrapin*), with three captures, was the most common. One specimen each of the snapping turtle (*Chelydra serpentina*), red belly turtle *(Chrysemys rubriventris*) and eastern painted turtle (*Chrysemys picta*) were also captured during the fish collection effort.

The species of fishes, invertebrates, and reptiles collected are common inhabitants of the Delaware Bay and its tributaries. Although the Site has several large, open connections to the bay, the diversity of fishes collected appears moderate. This is likely due to the time of year that the sampling was conducted and the fact that the nets were not always fishing effectively due to the swift tidal currents and floating debris present at some sampling locations.

5.0
ESTUARINE AND TIDAL WETLANDS FOOD WEBS

The previous sections describe the habitats present at the Alloway Creek Site and their documented utilization by terrestrial and aquatic species. The relationships of these species in the food chains of the estuary is generally diagramed in Figures 7 and 8. These food web diagrams depict the various trophic levels for two estuarine systems during the autumn season when the field investigations were conducted.

The tidal wetlands food web (Figure 7) illustrates the several trophic levels and representative species that are directly associated with the Alloway Creek Site. As described in Section 3.0, much of the tidal wetlands are vegetated by *Phragmites*. Since *Phragmites* does not decompose as rapidly as smooth cordgrass or salt hay grass (i.e., does not contribute as much to the formation of detritus), the current contribution of these wetlands to the tidal wetlands food web is diminished. The consumers of the tidal wetlands food web are primarily represented by the mammals (e.g., raccoon) and birds (e.g., northern harrier and snowy egret) that prey on the resident species in these remnant wetlands (e.g., meadow vole and mummichog).

The estuarine food web (Figure 8) for the Alloway Creek Site illustrates the several trophic levels that are dependent on the outward flow of detritus originating in tidal wetlands. The pathways presented in this figure assume that the area is vegetated with emergent wetlands. Thus, the actual functioning of this food web is currently diminished from its full potential. An important element of this food web are the primary consumers (e.g., copepods and benthic invertebrates) which are common to both the tidal channels and Delaware Bay. Important higher trophic level consumers in this web include additional birds (e.g., double-crested cormorant) and fish (e.g., striped bass and white perch).

TABLE 1
POTENTIALLY OCCURRING THREATENED AND ENDANGERED SPECIES
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

Common Name	Scientific Name	State Status (a)	Federal Status
Grasshopper sparrow	*Ammodramus savannarum*	T/T	NL
Great blue heron (b)	*Ardea herodias*	T/S	NL
Red shouldered hawk (b)	*Buteo lineatus*	E/T	NL
Northern harrier (b)	*Circus cyaneus*	E/U	NL
Marsh wren	*Cistothorus platensis*	E	NL
Peregrine falcon	*Falco peregrinus anatum*	E	LE/SA
Bald eagle (b)	*Haliaeetus leucocephalus*	E	LT
Osprey (b)	*Pandion haliaetus*	T/T	NL
Savannah sparrow (b)	*Passerculus sandwichensis*	T/T	NL
Pied-billed grebe	*Podilymbus podiceps*	E/S	NL
Vesper sparrow	*Pooectes gramineus*	E	NL

NOTES:

(a) Status separated by a slash (/) indicates a dual status. The first letter refers to the state breeding population, and the second refers to the migratory or winter population.

(b) Species observed at one or more of the restoration sites.

State Status

T = Threatened - A species that may become endangered if conditions surrounding the species begin to or continue to deteriorate.

E = Endangered - A species whose prospects for survival within the state are in immediate danger due to one or many factors.

S = Stable - A species whose population is not undergoing any long-term increase/decrease within its natural cycle.

U = Undetermined - A species about which there is not enough information available to determine the status.

Federal Status

LE = Listed Endangered

LT = Listed Threatened

LE/SA = Listed Endangered/Similarity of Appearance

NL = Not Listed

Source:

Salem County-Rare Species & Natural Communities Presently Recorded in the NJ Natural Heritage Database; dated 30 June 1995, Supplied by the NJDEP, September 20, 1995, and autumn 1995 field observations.

TABLE 2
VEGETATION PLOTS
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

Data Point (a)	Dominant Species	Common Name	Strata (b)	Mapped Vegetation Type (c)	Description of Area
AC-VP1	*Liquidambar styraciflua*	Sweetgum	1	FO	Scrub shrub area w/ some saplings
	Prunus serotina	Black cherry	1		
	Liquidambar styraciflua	Sweetgum	2		
	Myrica pensylvanica	Northern bayberry	2		
	Lonicera japonica	Japanese honeysuckle	3		
	Panicum virgatum	Switchgrass	3		
AC-VP2	*Baccharis halimifolia*	Sea myrtle	2	PH	Edge of agricultural field / dominated by
	Rhus copallina	Winged-sumac	2		Common reed
	Lonicera japonica	Japanese honeysuckle	3		
	Phragmites australis	Common reed	3		
AC-VP3	*Spartina alterniflora*	Smooth cordgrass	3	AL	Stray Common reed & Big cordgrass along creek
AC-VP4	*Phragmites australis*	Common reed	3	PH	
AC-VP5	*Phragmites australis*	Common reed	3	PH	
AC-VP6	*Phragmites australis*	Common reed	3	CY/PH	Dominated equally by Smooth cordgrass
	Spartina alterniflora	Smooth cordgrass	3		and Big cordgrass w/ some scattered
	Spartina cynosuroides	Big cordgrass	3		Common reed.
AC-VP7	*Scirpus robustus*	Salt marsh Bulrush	3	AL	Dominated by Smooth cordgrass
	Spartina alterniflora	Smooth cordgrass	3		
AC-VP8	*Phragmites australis*	Common reed	3	PH	
AC-VP9	*Spartina alterniflora*	Smooth cordgrass	3	AL	Field w/ edge of Common reed facing Alloway Creek
H-VP10	*Spartina alterniflora*	Smooth cordgrass	3	AL	
H-VP11	*Phragmites australis*	Common reed	3	PH	
H-VP12	*Celtis occidentalis*	American hackberry	1	PH/SS	Common reed / Scrub shrub with a small
	Phragmites australis	Common reed	3		area of Pokeweed
H-VP13	*Prunus serotina*	Black cherry	1	PH/SS	Mostly dominated by Common reed, with a
	Thuja occidentalis	N. white cedar	2		few small trees and shrubs
	Phragmites australis	Common reed	3		
MP-VP14	*Baccharis halimifolia*	Sea myrtle	2	PH/SS	Next to ditch in scrub shrub area.
	Phragmites australis	Common reed	3		Dominated by Sea myrtle & Common reed.
	Rubus cuneifolius	Sand blackberry	3		
MP-VP15	*Nyssa sylvatica*	Black gum	1	FO	Between 2 ponds, approx. 100 ft. in from
	Acer rubrum	Red maple	2		edge of forested area.
	Eulalia viminea	Microstegium	3		
	Lonicera japonica	Japanese honeysuckle	3		
	Onoclea sensibilis	Sensitive fern	3		
MP-VP16	*Baccharis halimifolia*	Sea myrtle	2	PH/SS	Across from cow field. Dominated by
	Phragmites australis	Common reed	3		Common reed w/ some scrub shrub
MP-VP17	*Liquidambar styraciflua*	Sweetgum	1	SS	Scrub shrub area off of dirt road. Scattered
	Baccharis halimifolia	Sea myrtle	2		debris-matted down on ground layer.
	Lonicera japonica	Japanese honeysuckle	3		Dominated by Sea myrtle and Japanese
	Phragmites australis	Common reed	3		Honeysuckle.
	Smilax rotundifolia	Common green brier	3		
	Solidago tenuifolia	Slender-leaved goldenrod	3		
MP-VP18	*Baccharis halimifolia*	Sea myrtle	2	PH/SS	Dominated by Common reed and Switch
	Myrica pensylvanica	Northern bayberry	2		grass. Scrub shrub area off of dirt road.
	Juncus effusus	Soft rush	3		
	Panicum virgatum	Switchgrass	3		
	Phragmites australis	Common reed	3		
	Solidago tenuifolia	Slender-leaved goldenrod	3		
MP-VP19	*Juglans nigra*	Black walnut	1	FO	At the beginning of forested area, approx.
	Prunus serotina	Black cherry	1		75 ft.in from dirt road. Dominated by
	Diospyros virginiana	Persimmon	2		Black walnut. Old well next to plot.
	Eulalia viminea	Microstegium	3		
	Eupatorium rugosum	White snakeroot	3		
	Vitis labrusca	Fox Grape	3		

34

TABLE 2
VEGETATION PLOTS
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

Data Point (a)	Dominant Species	Common Name	Strata (b)	Mapped Vegetation Type (c)	Description of Area
MP-VP20	*Acer saccharinum*	Silver maple	1	FO	Forested area next to a mowed field.
	Acer saccharinum	Silver maple	2		Dominated by Silver maple trees and
	Eulalia viminea	Microstegium	3		saplings. Most of ground layer is cleared
	Lonicera japonica	Japanese honeysuckle	3		and stacked in a pile.
MP-VP21	*Baccharis halimifolia*	Sea myrtle	2	PH/SS	Next to gravel road . Dominated by scrub
	Phragmites australis	Common reed	3		shrub species. Mainly, Common reed and
	Rubus cuneifolius	Sand blackberry	3		Sea myrtle.
	Solidago gigantea	Late goldenrod	3		
MP-VP22	*Baccharis halimifolia*	Sea myrtle	2	PH/SS	Dominated by Common reed, next to a
	Phragmites australis	Common reed	3		pond.
MP-VP23	*Juncus effusus*	Soft rush	3	SS	Scrub shrub area in cow field. Dominated
	Lycopus virginicus	Water horehound	3		by Soft rush and Slender-leaved goldenrod.
	Solidago tenuifolia	Slender-leaved goldenrod	3		
MP-VP24	*Baccharis halimifolia*	Sea myrtle	2	FF/SS	Fallow field / scrub shrub area off of dirt
	Juncus effusus	Soft rush	3		road, toward the dike at Mason's Point.
	Phragmites australis	Common reed	3		Patches of scrub shrub with mowed access
	Rubus cuneifolius	Sand blackberry	3		roads. Dominated by Soft rush and Sea
	Solidago gigantea	Late goldenrod	3		Myrtle.
	Solidago tenuifolia	Slender-leaved goldenrod	3		
	Thelypteris thelypteroides	Marsh fern	3		
MP-VP25	*Baccharis halimifolia*	Sea myrtle	2	FF/SS	Fallow field / scrub shrub area off of dirt
	Juncus effusus	Soft rush	3		road, toward the dike at Mason's Point.
	Panicum virgatum	Switchgrass	3		Patches of scrub shrub with mowed access
	Solidago gigantea	Late goldenrod	3		roads. Dominated by Soft rush and Switch
	Solidago tenuifolia	Slender-leaved goldenrod	3		grass. On edge before Common reed &
	Thelypteris thelypteroides	Marsh fern	3		forested areas.
MP-VP26	*Spartina alterniflora*	Smooth cordgrass	3	AL	
E-VP27	*Spartina alterniflora*	Smooth cordgrass	3	AL	Openings, hummocks, muskrat lodge
E-VP28	*Spartina alterniflora*	Smooth cordgrass	3	AL	Across from outlet structure on Mason's Point site w/ some Big cordgrass
E-VP29	*Spartina alterniflora*	Smooth cordgrass	3	AL	w/ some Big cordgrass
E-VP30	*Spartina alterniflora*	Smooth cordgrass	3	AL	w/ some Common reed & Big cordgrass
E-VP31	*Eulalia viminea*	Microstegium	3	PV	Mowed field
	Panicum virgatum	Switchgrass	3		
E-VP32	*Diospyros virginiana*	Persimmon	1	FO	Forested Area
	Prunus serotina	Black cherry	1		
	Eulalia viminea	Microstegium	3		
	Phragmites australis	Common reed	3		
	Setaria geniculata	Foxtail grass	3		
E-VP33	*Phragmites australis*	Common reed	3	PH	
E-VP34	*Acer rubrum*	Red maple	1	EDGE OF	Edge of forested area and Common reed
	Diospyros virginiana	Persimmon	1	FO & PV	
	Diospyros virginiana	Persimmon	2		
	Eulalia viminea	Microstegium	3		
	Panicum virgatum	Switchgrass	3		
	Phragmites australis	Common reed	3		
E-VP35	*Acer rubrum*	Red maple	1	PH/FO	Edge of forested area and Common reed
	Prunus serotina	Black cherry	1		
	Robinia pseudoacacia	Black Locust	1		
	Phragmites australis	Common reed	3		
E-VP36	*Phragmites australis*	Common reed	3	PH	Along Alloway Creek
E-VP37	*Phragmites australis*	Common reed	3	PH	Bushwacked area w/ some Switch grass
E-VP38	*Scirpus robustus*	Salt marsh Bulrush	3	AL	Dominated by Smooth cordgrass
	Spartina alterniflora	Smooth cordgrass	3		
	Spartina cynosuroides	Big cordgrass	3		
E-VP39	*Phragmites australis*	Common reed	3	PH	
E-VP40	*Phragmites australis*	Common reed	3	PH	
MC-VP41	*Juniperus virginiana*	Eastern red cedar	1	FO	Forested area bordering a strip of
	Baccharis halimifolia	Sea myrtle	2		agricultural field.
	Juniperus virginiana	Eastern red cedar	2		
	Myrica pensylvanica	Northern bayberry	2		
	Phytolacca americana	Common pokeweed	2		
	Lonicera japonica	Japanese honeysuckle	3		
	Phragmites australis	Common reed	3		
	Smilax rotundifolia	Common green brier	3		

35

TABLE 2
VEGETATION PLOTS
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

Data Point (a)	Dominant Species	Common Name	Strata (b)	Mapped Vegetation Type (c)	Description of Area
MC-VP42	*Panicum virgatum*	Switchgrass	3	AL	Dominated by Smooth cordgrass w/ tidal influence. edge is bordered with N. Bayberry Cattails & Sea myrtle
	Spartina alterniflora	Smooth cordgrass	3		
	Spartina cynosuroides	Big cordgrass	3		
MC-VP43	*Prunus serotina*	Black cherry	1	FO	Forested area that borders a small dike which is dominated by Common reed.
	Elaeagnus commutata	American silverberry	2		
	Baccharis halimifolia	Sea myrtle	2		
	Myrica pensylvanica	Northern bayberry	2		
	Lonicera japonica	Japanese honeysuckle	3		
	Rubus cuneifolius	Sand blackberry	3		
	Vitis labrusca	Fox Grape	3		
MC-VP44	*Phragmites australis*	Common reed	3	PH	
MC-VP45	*Phragmites australis*	Common reed	3	PH	
MC-VP46	*Phragmites australis*	Common reed	3	PH	
MC-VP47	*Phragmites australis*	Common reed	3	PH	
MC-VP48	*Nyssa sylvatica*	Black gum	1	FO	Forested area
	Sassafras albidum	Sassafras	1		
	Diospyros virginiana	Persimmon	2		
	Viburnum dentatum	Northern arrow-wood	2		
	Eulalia viminea	Microstegium	3		
MC-VP49	*Nyssa sylvatica*	Black gum	1	FO	Forested area
	Sassafras albidum	Sassafras	1		
	Myrica pensylvanica	Northern bayberry	2		
	Viburnum dentatum	Northern arrow-wood	2		
	Lonicera japonica	Japanese honeysuckle	3		
	Smilax rotundifolia	Common green brier	3		
MC-VP50	*Phragmites australis*	Common reed	3	PH	

NOTES:
(a) AC-VP1 = Alloways Creek; H-VP11 = Harmersville; MP-VP14 = Mason's Point; E-VP27 = Elsinboro; MC-VP41 = Mill Creek
(b) Strata 1 = tree; 2 = shrub/sapling; 3 = herbaceous/vine
Vegetation data was collected on October 16-20, 1995

LEGEND:
(c) FO = Forested; PH = *Phragmites australis*; SP = *Spartina alterniflora;* CY/AL = *Spartina cynosuroides / Spartina alterniflora*; SS = scrub shrub; PH/SS = *Phragmites australis* / scrub shrub; FF/SS = fallow field / scrub shrub; PH/FO = *Phragmites australis* / Fo PV = *Panicum virgatum*

36

TABLE 3
VEGETATION COVER TYPE AREAS
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

	Alloways Creek		Harmersville		Elsinboro		Mill Creek		Mason's Point		All Areas	
Cover Type (a)	Acres	Percent of total (b)	Acres	Percent of total (b)	Acres	Percent of total (b)	Acres	Percent of total (b)	Acres	Percent of total (b)	Acres	Percent of total (b)
PH	82.7	34.8%	25.6	52.4%	899.6	68.7%	920.4	81.3%	307.5	35.3%	2235.9	62.1%
AL	66.0	27.7%	21.1	43.1%	326.4	24.9%	46.9	4.1%	17.5	2.0%	477.9	13.3%
AG	74.2	31.2%			11.9	0.9%	128.8	11.4%	165.3	19.0%	380.1	10.6%
PH/SS	5.9	2.5%	2.2	4.5%			0.7	0.1%	186.4	21.4%	195.2	5.4%
FO	4.3	1.8%			6.3	0.5%	25.4	2.2%	106.1	12.2%	142.1	3.9%
MF					41.0	3.1%			2.1	0.2%	43.1	1.2%
FF/SS									37.7	4.3%	37.7	1.0%
FF							4.3	0.4%	21.7	2.5%	26.0	0.7%
SS	0.9	0.4%					1.3	0.1%	18.1	2.1%	20.2	0.6%
PV					17.0	1.3%					17.0	0.5%
PH/FO					7.6	0.6%					7.6	0.2%
DEV							2.9	0.3%	3.8	0.4%	6.7	0.2%
CY/AL	4.1	1.7%									4.1	0.1%
SC									3.8	0.4%	3.8	0.1%
TL/PH							2.1	0.2%			2.1	0.1%
OW	35.8	13.1%	15.2	23.7%	274.3	17.3%	242.1	17.6%	149.9	14.7%	717.4	16.6%
Total Vegetated Area (b)	238.0	86.9%	48.9	76.3%	1309.9	82.7%	1132.8	82.4%	870.1	85.3%	3599.6	83.4%
Total Area	273.8		64.1		1584.2		1374.9		1020.0		4317.0	

Notes:

(a) FO = Forested; PH = *Phragmites australis*; SP = *Spartina alterniflora*; CY/AL = *Spartina cynosuroides / Spartina alterniflora*; SS = scrub shrub; PH/SS = *Phragmites australis* / scrub shrub; FF/SS = fallow field / scrub shrub; PH/FO = *Phragmites australis* / Forested; PV = *Panicum virgatum;* SC = *Scirpus sp.*

(b) relative percent of each cover type is based on total vegetated area (i.e., total area minus open water area); percent of OW based on total area

TABLE 4
NUMBER OF BIRDS OBSERVED ALONG TRANSECTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

MC-BT1					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
Mourning dove	*Zenaida macroura*	9	7	1	17
Song sparrow	*Melospiza melodia*	5	4	1	10
Ruby-crowned kinglet	*Regulus calendula*	6	2	1	9
Yellow-rumped warbler	*Dendroica coronata*	2	4		6
Red-winged blackbird	*Agelaius phoeniceus*	2	1	2	5
White-throated sparrow	*Zonotrichia albicollis*	3		2	5
Blue jay	*Cyanocitta cristata*	3			3
Common flicker	*Colaptes auratus*	2	1		3
Black-capped chickadee	*Parus atricapillus*			3	3
Golden-crowned kinglet	*Regulus satrapa*	2			2
Downy woodpecker	*Picoides pubescens*	1		1	2
Rufous-sided towhee	*Pipilo erythrophthalmus*	2			2
Red-tailed hawk	*Buteo jamaicensis*		1	1	2
Gray catbird	*Dumetella carolinensis*	1	1	1	3
American kestrel	*Falco sparverius*	1			1
Eastern phoebe	*Sayornis phoebe*	1			1
White-crowned sparrow	*Zonotrichia leucophrys*	1			1
Common yellow throat	*Geothlypis trichas*		1		1
Northern cardinal	*Cardinalis cardinalis*		1		1
Red-bellied woodpecker	*Melanerpes carolinus*			1	1

Note:
MC-BT1- Mill Creek Bird Transect 2

38

TABLE 4
NUMBER OF BIRDS OBSERVED ALONG TRANSECTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

MC-BT2					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
Yellow-rumped warbler	*Dendroica coronata*		17	24	41
House finch	*Carpodacus mexicanus*	2	12	3	17
Ruby-crowned kinglet	*Regulus calendula*	6	5	5	16
American robin	*Turdus migratorius*	5	1	6	12
Black-capped chickadee	*Parus atricapillus*	3	2		5
Common flicker	*Colaptes auratus*	2		2	4
Red-winged blackbird	*Agelaius phoeniceus*		4		4
Palm warbler	*Dendroica palmarum*		3		3
Swamp sparrow	*Melospiza georgiana*		1	2	3
American kestrel	*Falco sparverius*	1		1	2
Northern harrier	*Circus cyaneus*	1		1	2
Gray catbird	*Dumetella carolinensis*	1	1		2
Song sparrow	*Melospiza melodia*		1	1	2
Long-billed marsh wren	*Cistothorus palustris*		1	1	2
Common yellow throat	*Geothlypis trichas*		1	1	2
White-throated sparrow	*Zonotrichia albicollis*			2	2
Turkey vulture	*Cathartes aura*	1			1
Rufous-sided towhee	*Pipilo erythrophthalmus*	1			1
Field sparrow	*Spizella pusilla*		1		1
Savannah sparrow	*Passerculus sandwichensis*			1	1
American black duck	*Anas rubripes*			1	1
Ring-necked pheasant	*Phasianus colchicus*			1	1
White-breasted nuthatch	*Sitta carolinensis*			1	1
Red shouldered hawk	*Buteo lineatus*			1	1
Tufted titmouse	*Parus bicolor*			1	1

Note:
MC-BT2- Mill Creek Bird Transect 4

39

TABLE 4
NUMBER OF BIRDS OBSERVED ALONG TRANSECTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

MP-BT3					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
American robin	*Turdus migratorius*	4	50	50	104
Yellow-rumped warbler	*Dendroica coronata*	15	8	8	31
Blue jay	*Cyanocitta cristata*	7	12	10	29
Ruby-crowned kinglet	*Regulus calendula*	5	8	5	18
Common bobwhite	*Colinus virginianus*		15		15
Swamp sparrow	*Melospiza georgiana*		3	6	9
Red-winged blackbird	*Agelaius phoeniceus*			7	7
Black-capped chickadee	*Parus atricapillus*	6			6
Gray catbird	*Dumetella carolinensis*	3		3	6
Golden-crowned kinglet	*Regulus satrapa*	4			4
Tufted titmouse	*Parus bicolor*	2	2		4
White-throated sparrow	*Zonotrichia albicollis*	2		2	4
Rufous-sided towhee	*Pipilo erythrophthalmus*		1	3	4
Song sparrow	*Melospiza melodia*		4		4
Mourning dove	*Zenaida macroura*	1		2	3
Carolina wren	*Thryothorus lubovicianus*	1		2	3
Turkey vulture	*Cathartes aura*	2	1		3
Downy woodpecker	*Picoides pubescens*	2		1	3
Red-tailed hawk	*Buteo jamaicensis*		1	1	2
Common flicker	*Colaptes auratus*		1		1
Northern cardinal	*Cardinalis cardinalis*		1		1
Common crow	*Corvus brachyrhynchos*			1	1
Gray-cheeked thrush	*Catharus ustulatus*			1	1

Note:
MP-BT3- Mason's Point Bird Transect 4

40

TABLE 4
NUMBER OF BIRDS OBSERVED ALONG TRANSECTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

MP-BT4					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
Greater yellowlegs	*Tringa melanoleuca*	1	150		151
Yellow-rumped warbler	*Dendroica coronata*	11	35	12	58
Tree swallow	*Iridoprocne bicolor*		50		50
Red-winged blackbird	*Agelaius phoeniceus*	3	8	5	16
Swamp sparrow	*Melospiza georgiana*		15		15
Ruby-crowned kinglet	*Regulus calendula*	2	8		10
Song sparrow	*Melospiza melodia*		6		6
Black-capped chickadee	*Parus atricapillus*		1	4	5
White-throated sparrow	*Zonotrichia albicollis*		5		5
Northern harrier	*Circus cyaneus*	1		2	3
Northern cardinal	*Cardinalis cardinalis*		3		3
Blue jay	*Cyanocitta cristata*		3		3
Common crow	*Corvus brachyrhynchos*	2			2
Common yellow throat	*Geothlypis trichas*	1	1		2
Palm warbler	*Dendroica palmarum*	2			2
Gray catbird	*Dumetella carolinensis*		2		2
Dark-eyed junco	*Junco hyemalis*		2		2
Tufted titmouse	*Parus bicolor*			2	2
Carolina wren	*Thryothorus lubovicianus*	1			1
Great blue heron	*Ardea herodias*	1			1
Savannah sparrow	*Passerculus sandwichensis*	1			1
Common flicker	*Colaptes auratus*		1		1
American robin	*Turdus migratorius*		1		1
Purple finch	*Carpodacus purpureus*		1		1
Downy woodpecker	*Picoides pubescens*		1		1

Note:
MP-BT4- Mason's Point Bird Transect 3

41

TABLE 4
NUMBER OF BIRDS OBSERVED ALONG TRANSECTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

AC-BT5					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
Red-winged blackbird	*Agelaius phoeniceus*	25	50	3	78
Song sparrow	*Melospiza melodia*		14	2	16
Swamp sparrow	*Melospiza georgiana*		13		13
Yellow-rumped warbler	*Dendroica coronata*		10		10
Ruby-crowned kinglet	*Regulus calendula*	1	5		6
Mourning dove	*Zenaida macroura*	5			5
House finch	*Carpodacus mexicanus*		1		1
Northern cardinal	*Cardinalis cardinalis*		1		1

Note:
AC-BT5- Alloways Creek Bird Transect 5

TABLE 5
NUMBER OF BIRDS OBSERVED AT OBSERVATION POINTS
OCTOBER 18 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

MP-BP1					
Common Name	Scientific Name	10/18/95	10/19/95	10/20/95	Total
Tree swallow	*Iridoprocne bicolor*		50	50	100
Mallard	*Anas platyrhynchos*		23		23
Canada goose	*Branta canadensis*	15			15
Greater yellowlegs	*Tringa melanoleuca*	1	10		11
Northern harrier	*Circus cyaneus*		1	4	5
Red-winged blackbird	*Agelaius phoeniceus*	4			4
Ring-billed gull	*Larus delawarensis*			4	4
Clapper rail	*Rallus longirostris*		3		3
Common crow	*Corvus brachyrhynchos*			3	3
Double crested cormorant	*Phalacrocorax auritus*	2			2
Turkey vulture	*Cathartes aura*			2	2
American kestrel	*Falco sparverius*	1			1
Song sparrow	*Melospiza melodia*	1			1
Ruby-crowned kinglet	*Regulus calendula*	1			1
Black-crowned night heron	*Nycticorax nycticorax*		1		1
Great blue heron	*Ardea herodias*			1	1

Note:
MP-BP1- Mason's Point Bird Observation Point 3

TABLE 6
SMALL MAMMALS CAPTURED
OCTOBER 17 TO 20, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

		SITE:	AC-SMT 1						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	18	32.5	23	22	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
House mouse	*Mus musculus*		1	1	3	1	120 - 150	12 - 25	6
White-footed mouse	*Peromyscus leucopus*		3	3	2	2	110 - 170	15 - 32	10

		SITE:	MP-SMT 2						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	18	24	24	23.5	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
White-footed mouse	*Peromyscus leucopus*			3	4		110 - 165	10 - 22	7

		SITE:	MP-SMT 3						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	17.5	24.5	24.5	23.5	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
White-footed mouse	*Peromyscus leucopus*			3	2	4	125 - 170	15 - 24	9

		SITE:	MP-SMT 4						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	16.5	25	24	22	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
White-footed mouse	*Peromyscus leucopus*		1	4	5	8	125 - 165	11 - 25	18
Masked shrew	*Sorex cinereus*				1		90	4	1

		SITE:	MC-SMT 5						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	17.5	25	26	28	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
White-footed mouse	*Peromyscus leucopus*		3	7	8	6	115 - 170	11 - 26	24

		SITE:	MC-SMT 6						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	18.5	24.5	24	23.5	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
Meadow vole	*Microtus pennsylvanicus*				1		120	17	1
House mouse	*Mus musculus*				1		110	22	1
White-footed mouse	*Peromyscus leucopus*		5	4	9	8	113 - 170	9 - 28	26

		SITE:	MC-SMT 7						
		DATE:	10/17	10/18	10/19	10/20	size	weight	
		DURATION (HR.):	18.5	24.5	26	19	range (a) (mm)	range (g)	Total Catch
Common Name	Scientific Name								
House mouse	*Mus musculus*					1	NA (b)	NA (b)	1
White-footed mouse	*Peromyscus leucopus*		1	1	7	11	105 - 167	11 - 23	20

NOTES:
Mammal Transects (MT) consisted of fifteen co-located Sherman and Snap traps, and five Pitfall traps.
Initial set of all traps occurred on 10/16/95
(b) Size range indicates total length of animal (body and tail)
AC - Alloways Creek; MC - Mill Creek; MP - Mason's Point
(b) animal escaped before it could be measured.

44

TABLE 7
RANGE OF WATER QUALITY PARAMETERS
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:	ALLOWAYS CREEK		ELSINBORO			
LOCATION:	AC-AS1	AC-AS2	E-AS4	E-AS5	E-AS6	E-AS9
Approx. width (ft.)	35 - 45	30 - 50	100 - 150	30 - 40	250 - 350	40 - 50
Depth of water (ft.)	1 - 6	1 - 6	0 - 5	2 - 7	0 - 5	0 - 5
Temperature (C)	18.4 - 19.3	18.7 - 19.2	18.9 - 20.3	19.3 - 19.4	19.5 - 20.0	18.7 - 20.1
Salinity (o/oo)	8.8 - 11.8	8.9 - 11.3	9.4 - 12.0	9.4 - 9.9	9.0 - 9.3	8.9 - 9.3
Conductivity (uS/cm)	15.1 - 19.7	15.3 - 19.0	16 - 20	16.1 - 16.9	15.3 - 16.0	15.4 - 16.1
Dissolved Oxygen (mg/L)	5.0 - 6.5	5.84 - 6.65	6.0 - 7.3	6.57 - 10.0	6.7 - 10.8	6.1 - 7.67
pH	7.1 - 7.3	7.2 - 7.51	7.36 - 7.57	7.46 - 7.75	7.6 - 7.8	7.35 - 7.78
Secchi depth (inches)	8 - 14	9 - 15	12 - 18	14 - 18	6 - 12	14

SITE:	MASON'S POINT		HARMERSVILLE	MILL CREEK		
LOCATION:	MP-AS7	MP-AS8	H-AS3	MC-AS10	MC-AS11	MC-AS12
Approx. width (ft.)	>100	>100	20 - 30	40 - 50	30 -40	30 - 40
Depth of water (ft.)	1 - 2	1 - 3	2 - 7	0 - 5	0 - 5	0 - 5
Temperature (C)	18.0 - 22.5	18.2 - 21.4	19 - 19.7	18.5 - 23	17.4 - 20.4	20.2 - 21.5
Salinity (o/oo)	7.8 - 8.0	8.1 - 8.2	9.2 - 12.2	7.5 - 8.1	8.1 - 8.2	7.8 - 8.2
Conductivity (uS/cm)	13.6 - 14	14.0 - 14.2	15.7 - 20.4	12.7 - 14.1	14 - 14.1	13.6 - 14.2
Dissolved Oxygen (mg/L)	12.8 - 14.5	11.98 - 13.85	5.8 - 7.27	5.62 - 7.68	5.31 - 6.6	6.16 - 8.62
pH	8.38 - 9.05	8.44 - 9.03	7.25 - 7.63	7.22 - 7.63	7.32 - 7.47	7.52 - 7.83
Secchi depth (inches)	9 - 12	10 - 12	10 - 18	8 - 17	6 - 12	12 - 13

TABLE 8
MACROZOOPLANKTON COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:	ALLOWAYS CREEK						ELSINBORO											
LOCATION:	AC-AS1			AC-AS2			E-AS4			E-AS5			E-AS6			E-AS9		
DATE:	9/25/95			9/25/95			9/25/95			9/29/95			9/29/95			10/2/95		
REPLICATE:	1	2		1	2		1	2		1	2		1	2		1	2	
TAXON	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter
Coelenterata																		
Hydrozoan medusae	1	3	0.10	3	9	0.30		15	0.38	3	1	0.10					1	0.03
Rotifera																		
Asplanchna sp.																5		0.13
Brachionus sp.													68	41	2.71	380	337	18
Unid. Rotifera	1		0.03	1		0.03	5	5	0.25	1	1	0.05						
Nematoda																		
Unid. Nematoda	1	7	0.20	13	14	0.66	35	40	1.88	9	6	0.38	3	10	0.31			
Annelida																		
Polychaeta larvae	4	16	0.50	8	14	0.54	10	20	0.75	4	1	0.13	4	2	0.14		3	0.08
Arthropoda																		
Crustacea																		
Copepoda																		
Calanoida	8	25	0.83	6	32	0.94	60	50	2.75	1		0.03					3	0.08
Cyclopoida													8		0.19	25	3	0.71
Harpacticoida	3	3	0.15	7	5	0.29				4	1	0.13	4	2	0.14	10	10	0.50
Calonoid copepodids	3	8	0.28	10	5	0.36	10	20	0.75		1	0.03				5		0.13
Cyclopoid copepodids	1	2	0.08							3	1	0.10	6	5	0.28		10	0.25
Copepod nauplii	60	45	2.63	35	50	2.11	380	315	17.38	47	28	1.88	28	28	1.39	80	83	4
Cirripedia (Barnacles)																		
Barnacle nauplii	23	58	2.03	89	113	5.04	145	65	5.25	34	21	1.38	23	17	0.99	40	43	2
Barnacle cypris	1		0.03	1	2	0.08		5	0.13									
Decopoda																		
Caridean shrimp		1	0.03															
Arachnoidea																		
Hydracarina		2	0.05															
TOTAL	106	170	7	173	241	10	645	535	30	106	61	4	141	105	6	545	494	26

TABLE 8
MACROZOOPLANKTON COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:	HARMERSVILLE			MILL CREEK									MASON'S POINT					
LOCATION:	H-AS3			MC-AS10			MC-AS11			MC-AS12			MP-AS7			MP-AS8		
DATE:	9/25/95			10/2/95			10/2/95			10/2/95			9/30/95			9/30/95		
REPLICATE:	1	2		1	2		1	2		1	2		1	2		1	2	
TAXON	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter	No. of Indiv.	No. of Indiv.	Mean No. per Liter
Coelenterata																		
Hydrozoan medusae	1	1	0.05															
Rotifera																		
Asplanchna sp.								10	0.25	2	1	0.08						
Brachionus sp.	1	3	0.11	140	40	5		5	0.13				8920	8360	432	9920	12880	570
Unid. Rotifera	2		0.05							1	2	0.08						
Nematoda																		
Unid. Nematoda	3	13	0.41	100	20	3		10	0.25	3	8	0.28	40		1			
Annelida																		
Polychaeta larvae	4	20	0.60															
Arthropoda																		
Crustacea																		
Copepoda																		
Calanoida	18	27	1.12					5	0.13		1	0.03		40	1			
Cyclopoida	2	3	0.13	20		1							1280	2400	92	160	480	16
Harpacticoida	7	3	0.26				20	10	0.75		1	0.03		40	1			
Calonoid copepodids	3		0.08							1		0.03						
Cyclopoid copepodids	4		0.10		100	3				2		0.05	400	760	29	160	240	10
Copepod nauplii	133	383	12.91	4980	5580	264	4740	525	131.63	56	66	3.05	320	520	21	320	400	18
Cirripedia (Barnacles)																		
Barnacle nauplii	8	7	0.37	100	80	5												
Barnacle cypris																		
Decopoda																		
Caridean shrimp																		
Arachnoidea																		
Hydracarina																		
TOTAL	186	461	16	5340	5820	279	4760	565	133	65	79	4	10960	12120	577	10560	14000	614

5A

TABLE 9
MACROINVERTEBRATES COLLECTED
SEPTEMBER 25 TO OCTOBER 02, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:	ALLOWAYS CREEK						ELSINBORO											
LOCATION:	AC-AS1			AC-AS2			E-AS4			E-AS5			E-AS6			E-AS9		
DATE:	9/25/95			9/25/95			9/25/95			9/29/95			9/29/95			10/2/95		
REPLICATE:	1	2		1	2		1	2		1	2*		1	2		1	2	
TAXON	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter
Cnidaria																		
Hydrozoa (polyp)													0	4	88			
Platyhelminthes																		
Turbellaria																		
Nemertea (Rhynchocoela)																		
Cerebratulus sp.	4	0	88				0	4	88	8		352	4	0	88	0	4	88
Annelida																		
Oligochaeta	72	44	2552	288	76	8008	20	60	1760				636	180	17952	4	100	2288
Polychaeta																		
Ampharetidae																		
Hypaniola grayi	24	12	792	4	0	88	36	24	1320									
Ampharetidae (juv.)				0	8	176												
Nereidae																		
Laeonereis culveri	16	8	528	48	40	1936	0	56	1232	28		1232				4	36	880
Nereis succinea							44	0	968							4	0	88
Spionidae																		
Polydora sp.	0	16	352				152	32	4048							0	8	176
Scolecolepides viridis	0	4	88							8		352						
Arthropoda																		
Crustacea																		
Isopoda																		
Cyathura polita	16	28	968	0	4	88	36	20	1232	28		1232				8	0	176
Edotea triloba	12	8	440	0	4	88	16	4	440	24		1056	0	4	88			
Amphipoda																		
Aoridae																		
Leptocheirus plumulosus	24	0	528	4	4	176	0	4	88	4		176	44	16	1320			
Corophiidae																		
Corophium sp.				0	4	88	4	0	88							0	8	176
Gammaridea																		
Gammarus palustris							8	4	264									
Gammarus sp. (juv.)	0	12	264	0	4	88				4		176	8	0	176	0	8	176
Melitidae																		
Melita nitida																0	4	88
Copepoda																		
Harpacticoida													4	4	176			
Decapoda																		
Arenaeus cribrarius																0	4	88
Rhithropanopeus harrisii										4		176				0	8	176
Insecta																		
Chironomidae							8	8	352	4		176				4	12	352
Mollusca																		
Gastropoda (juv.)																		
Bivalvia																		
Mulinia lateralis							0	4	88									
Musculium sp.							4	0	88									
Mytilus edulis (juv.)							4	0	88									
TOTAL	168	132	6600	344	144	10736	332	220	12144	112	*	4928	696	208	19888	24	192	4752

Notes: * = sample not counted as it was not deemed to be a representative sample.

TABLE 9
MACROINVERTEBRATES COLLECTED
SEPTEMBER 25 TO OCTOBER 02, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:	HARMERSVILLE			MILL CREEK									MASON'S POINT					
LOCATION:	H-AS3			MC-AS10			MC-AS11			MC-AS12			MP-AS7			MP-AS8		
DATE:	9/25/95			10/2/95			10/2/95			10/2/95			9/30/95			9/30/95		
REPLICATE:	1	2		1	2		1	2		1	2		1	2		1	2	
TAXON	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter	No. of Indiv.	No. of Indiv.	Mean No. per Sq. Meter
Cnidaria																		
Hydrozoa (polyp)																		
Platyhelminthes																		
Turbellaria																12	12	528
Nemertea (Rhynchocoela)																		
Cerebratulus sp.										0	8	176						
Annelida																		
Oligochaeta				1496	1644	69080	830	484	28908	402	564	21252	0	32	704	32	24	1232
Polychaeta																		
Ampharetidae																		
Hypaniola grayi																8	8	352
Ampharetidae (juv.)																		
Nereidae																		
Laeonereis culveri	1	0	22	16	16	704	10	20	660	26	24	1100	0	4	88	72	68	3080
Nereis succinea	0	4	88													4	0	88
Spionidae																		
Polydora sp.	7	16	506															
Scolecolepides viridis																		
Arthropoda																		
Crustacea																		
Isopoda																		
Cyathura polita	8	6	308	4	0	88												
Edotea triloba	1	2	66	4	4	176	2	0	44									
Amphipoda																		
Aoridae																		
Leptocheirus plumulosus	1	0	22	12	4	352	10	0	220									
Corophiidae																		
Corophium sp.	1	9	220													0	4	88
Gammaridea																		
Gammarus palustris										0	4	88						
Gammarus sp. (juv.)																		
Melitidae																		
Melita nitida																		
Copepoda																		
Harpacticoida				0	12	264												
Decapoda																		
Arenaeus cribrarius																		
Rhithropanopeus harrisii	0	3	66															
Insecta																		
Chironomidae				0	4	88							0	8	176	16	0	352
Mollusca																		
Gastropoda (juv.)				4	0	88												
Bivalvia																		
Mulinia lateralis																		
Musculium sp.																		
Mytilus edulis (juv.)																		
TOTAL	19	40	1298	1536	1684	70840	852	504	29832	428	600	22616	0	44	968	144	116	5720

Notes: * = sample not counted as it was

TABLE 10
TOTAL NUMBER OF FISHES AND INCIDENTAL SPECIES COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:		ALLOWAY CREEK							
LOCATION:		AC-AS 1				AC-AS 2			
DATE:		9/26/95	9/27/95	9/28/95	*9/29/95	9/26/95	9/27/95	9/28/95	*9/29/95
COMMON NAME	SCIENTIFIC NAME								
FISHES									
American eel	*Anguilla rostrata*								
Alewife	*Alosa pseudoharengus*								
Atlantic menhaden	*Brevoortia tyrannus*		1					1	
Gizzard shad	*Dorosoma cepedianum*						1		
Bay anchovy	*Anchoa mitchilli*								
Common carp	*Cyprinus carpio*								
White catfish	*Ameiurus catus*								
Yellow bullhead	*Ameiurus natalis*								
Brown bullhead	*Ameiurus nebulosus*								
Channel catfish	*Ictalurus punctatus*								
Mummichog	*Fundulus heteroclitus*								
Atlantic silverside	*Menidia menidia*		48						
White perch	*Morone americanus*	2	1	5					
Striped bass	*Morone saxatilis*								1
Pumpkinseed	*Lepomis gibbosus*								
Black crappie	*Pomoxis nigromaculatus*								
Weakfish	*Cynoscion regalis*	1		1		1			2
Atlantic croaker	*Micropogon undulatus*								1
Black drum	*Pogonias cromis*				1				
Harvestfish	*Peprilus alepidotus*								
Naked goby	*Gobiosoma bosci*								
INCIDENTALS									
Blue crab	*Callinectes sapidus*			1	1	1	1		1

* Otter Trawl

TABLE 10
TOTAL NUMBER OF FISHES AND INCIDENTAL SPECIES COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:		ELSINBORO												
LOCATION:		E-AS 4				E-AS 5			E-AS 6			E-AS 9		
DATE:		9/26/95	9/27/95	9/28/95	*9/30/95	9/29/95	9/30/95	10/1/95	9/29/95	9/30/95	10/1/95	10/2/95	10/3/95	10/4/95
COMMON NAME	SCIENTIFIC NAME													
FISHES														
American eel	*Anguilla rostrata*							1						
Alewife	*Alosa pseudoharengus*				1									
Atlantic menhaden	*Brevoortia tyrannus*				1					27	32			
Gizzard shad	*Dorosoma cepedianum*										2			
Bay anchovy	*Anchoa mitchilli*				30									
Common carp	*Cyprinus carpio*								1	2				
White catfish	*Ameiurus catus*									1	1			2
Yellow bullhead	*Ameiurus natalis*		1							1				
Brown bullhead	*Ameiurus nebulosus*										2			
Channel catfish	*Ictalurus punctatus*							1			1			
Mummichog	*Fundulus heteroclitus*	1		5	10	91	91	47						
Atlantic silverside	*Menidia menidia*	2		1	500	3								
White perch	*Morone americanus*	2	1		13	2	5	16	1		2		24	2
Striped bass	*Morone saxatilis*				9								1	
Pumpkinseed	*Lepomis gibbosus*													
Black crappie	*Pomoxis nigromaculatus*													
Weakfish	*Cynoscion regalis*							2					6	2
Atlantic croaker	*Micropogon undulatus*				1									
Black drum	*Pogonias cromis*				1									
Harvestfish	*Peprilus alepidotus*							1						
Naked goby	*Gobiosoma bosci*													
INCIDENTALS														
Blue crab	*Callinectes sapidus*		3	1						6				
Diamondback Terrapin	*Malaclemys terrapin*			1		2								

* 10' & 50' Seine

TABLE 10
TOTAL NUMBER OF FISHES AND INCIDENTAL SPECIES COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

SITE:		MASON'S POINT						HARMERSVILLE		
LOCATION:		MP-AS 7			MP-AS 8			H-AS 3		
DATE:		9/29/95	9/30/95	10/1/95	9/29/95	9/30/95	10/1/95	9/26/95	9/27/95	9/28/95
COMMON NAME	SCIENTIFIC NAME									
FISHES										
American eel	*Anguilla rostrata*									
Alewife	*Alosa pseudoharengus*									
Atlantic menhaden	*Brevoortia tyrannus*	3		4						
Gizzard shad	*Dorosoma cepedianum*									
Bay anchovy	*Anchoa mitchilli*									
Common carp	*Cyprinus carpio*	5	3	11		1				
White catfish	*Ameiurus catus*		2							
Yellow bullhead	*Ameiurus natalis*									
Brown bullhead	*Ameiurus nebulosus*	20	14	7			6			
Channel catfish	*Ictalurus punctatus*									
Mummichog	*Fundulus heteroclitus*								18	25
Atlantic silverside	*Menidia menidia*							2	2	
White perch	*Morone americanus*				1			1		
Striped bass	*Morone saxatilis*									
Pumpkinseed	*Lepomis gibbosus*			2		1				
Black crappie	*Pomoxis nigromaculatus*	1	1							
Weakfish	*Cynoscion regalis*									
Atlantic croaker	*Micropogon undulatus*									
Black drum	*Pogonias cromis*									
Harvestfish	*Peprilus alepidotus*									
Naked goby	*Gobiosoma bosci*							3	1	
INCIDENTALS										
Blue crab	*Callinectes sapidus*	57	34	22	83	34	33			
Red belly	*Chrysemys rubriventris*	1								
Eastern Painted	*Chrysemys picta*	1								

25

TABLE 10
TOTAL NUMBER OF FISHES AND INCIDENTAL SPECIES COLLECTED
SEPTEMBER 25 TO OCTOBER 4, 1995
ALLOWAY CREEK SITE
SALEM COUNTY, NEW JERSEY

		SITE:	MILL CREEK								
		LOCATION	MC-AS10			MC-AS 11			MC-AS 12		
		DATE:	10/2/95	10/3/95	10/4/95	10/2/95	10/3/95	10/4/95	10/2/95	10/3/95	10/4/95
COMMON NAME	SCIENTIFIC NAME										
FISHES											
American eel	*Anguilla rostrata*										
Alewife	*Alosa pseudoharengus*						2				
Atlantic menhaden	*Brevoortia tyrannus*		4	2	8	25	1				
Gizzard shad	*Dorosoma cepedianum*		3		4	3	1	3	3		
Bay anchovy	*Anchoa mitchilli*									11	
Common carp	*Cyprinus carpio*			1		1					
White catfish	*Ameiurus catus*								2		
Yellow bullhead	*Ameiurus natalis*										
Brown bullhead	*Ameiurus nebulosus*						1			1	
Channel catfish	*Ictalurus punctatus*										
Mummichog	*Fundulus heteroclitus*		20	5	3		2	2	3		2
Atlantic silverside	*Menidia menidia*								2		
White perch	*Morone americanus*		19	2		3	1	4	17		
Striped bass	*Morone saxatilis*										
Pumpkinseed	*Lepomis gibbosus*										
Black crappie	*Pomoxis nigromaculatus*										
Weakfish	*Cynoscion regalis*		2	4	2		1				
Atlantic croaker	*Micropogon undulatus*									2	
Black drum	*Pogonias cromis*										
Harvestfish	*Peprilus alepidotus*										
Naked goby	*Gobiosoma bosci*										
INCIDENTALS											
Snapping Turtle	*Chelydra serpentina*					1					

DELAWARE RIVER

MILL CREEK

MASON'S POINT

ELSINBORO

HARMERSVILLE

ALLOWAYS CREEK

FORT ELFSBORO ROAD

MASON POINT ROAD

ROSS BOARD ROAD

ALLOWAYS CREEK NECK ROAD

ABBOTTS MILL ROAD

POPLAR ST.

STRAIGHT DITCH

MILL CREEK

ALLOWAY CREEK

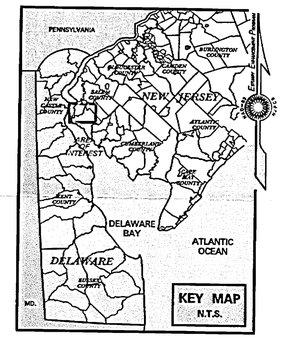
MC-AS12 MC-VP46 MC-BT1A MC-AS11 MC-VP47 MC-SMT7 MC-BT1B MC-SMT6 MC-VP45 MC-VP49 MC-AS10 MC-VP50 MC-BT2B MC-VP41 MP-VP23 MP-BT3A MP-VP21 MP-SMT3 MP-VP17 MP-BT3B MC-VP43 MC-VP42 MP-VP18 MP-VP19 MC-VP44 MC-VP40 MC-BT2A MC-SMT5 MC-VP21 MP-SMT4 MP-SMT2 MP-VP16 E-VP30 E-AS9 MP-AS7 E-VP29 MP-VP24 MP-VP25 MP-VP15 MP-VP22 MP-BT4B MP-BP1 MP-AS8 MP-VP14 E-AS6 E-VP28 MP-BT4A E-VP40 E-VP37 E-VP38 E-VP39 E-VP27 E-AS4 E-VP35 E-VP34 E-VP31 E-VP32 E-VP33 E-AS5 E-VP36 AC-VP1 AC-VP2 AC-BT4B AC-AS2 AC-BT5A AC-VP8 AC-VP9 AC-VP7 AC-AS1 H-VP20 H-VP21 H-AS3 H-VP22 H-VP23 AC-VP6 AC-VP5 AC-BT5B

0 1000 2000 3000

1000 750 500 250 250 500 750 1000

SCALE IN FEET

Woodward-Clyde



LEGEND

- PRELIMINARY SITE BOUNDARIES
- EXISTING SURFACE WATER FEATURE
- EXISTING ROAD
- MUNICIPAL BOUNDARY
- MP-VP18 VEGETATION PLOT
- MC-AS10 AQUATIC STATION
- BP-1 BIRD STATION
- MP-SMT2 SMALL MAMMAL TRANSECT
- BT1A — BT1B BIRD TRANSECT

PSE&G Public Service Electric & Gas Company

ESTUARY ENHANCEMENT PROGRAM

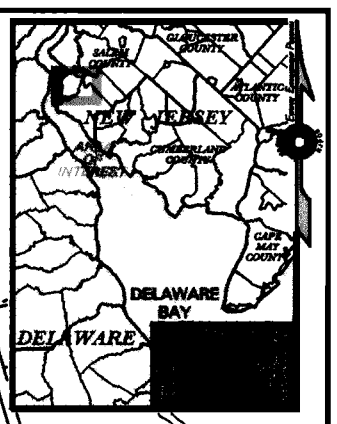
FIGURE 1

MAP SHOWING BIOLOGICAL SAMPLING LOCATIONS LOWER ALLOWAYS CREEK AND ELSINBORO TOWNSHIPS SALEM COUNTY, NEW JERSEY

CADD	RKB	DATE	8 JAN 96	SCALE	1"=1000'
FILE	B9KC01	CHECKED	RTC	EXAMINED	RLH

LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY

ELSINBORO TOWNSHIP
SALEM COUNTY



SALEM-HANCOCKS BRIDGE ROAD

ALLOWAY CREEK

POPLAR ST

LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY
- VEGETATIVE COVER BOUNDARY

PH	*Phragmites australis*
AL	*Spartina alterniflora*
CY	*Spartina cynosuroide*
FO	FORESTED
SS	SCRUB-SHRUB
AG	AGRICULTURAL LAND
OW	OPEN WATER

450 0 450 900 1350

SCALE IN FEET

Woodward-Clyde

PSEG Public Service Electric & Gas Company

ESTUARY ENHANCEMENT PROGRAM

FIGURE 2
ALLOWAYS CREEK VEGETATIVE COVER
LOWER ALLOWAYS CREEK AND ELSINBORO TOWNSHIPS SALEM COUNTY, NEW JERSEY

CADD RKB	DATE 5 DEC 95	SCALE 1"=450'	
FILE MP4	CHECKED CPB	EXAMINED RLH	

ALLOWAY CREEK

ELSINBORO TOWNSHIP
SALEM COUNTY

LOWER ALLOWAYS CREEK TOWNSHIP
SALEM COUNTY

DELAWARE BAY

DELAWARE

NEW JERSEY

LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY
- VEGETATIVE COVER BOUNDARY

PH	*Phragmites australis*
AL	*Spartina alterniflora*
CY	*Spartina cynosuroide*
PV	*Panicum virgatum*
TL	*Typha latifolia*
FO	FORESTED
SS	SCRUB-SHRUB
AG	AGRICULTURAL LAND
FF	FALLOW FIELD
MF	MUD FLAT
DEV	DEVELOPED LAND
OW	OPEN WATER

250 0 250 500 750

SCALE IN FEET

Woodward-Clyde

OPSEG Public Service Electric & Gas Company

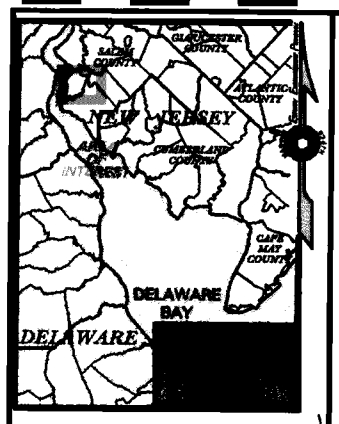
ESTUARY ENHANCEMENT PROGRAM

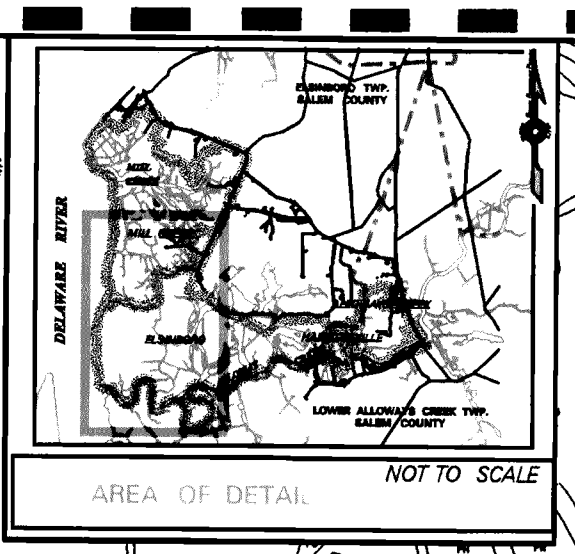
FIGURE 3

HARMERSVILLE VEGETATIVE COVER

LOWER ALLOWAYS CREEK TOWNSHIP SALEM COUNTY, NEW JERSEY

CADD RKB DATE 5 DEC 95 SCALE 1"=250'
FILE MP42 CHECKED CPB EXAMINED RLH





DELAWARE RIVER

MONEY ISLAND ROAD

BLACK DITCH

MONEY ISLAND

ALLOWAY CREEK

LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY

- FO FORESTED
- SS SCRUB-SHRUB
- AG AGRICULTURAL LAND
- OW OPEN WATER

- PH *Phragmites australis*
- AL *Spartina alterniflora*
- PV *Panicum virgatum*
- TL *Typhia latifolia*

900 0 900 1800 2700

SCALE IN FEET

Woodward-Clyde

OPSEG Public Service Electric & Gas Company

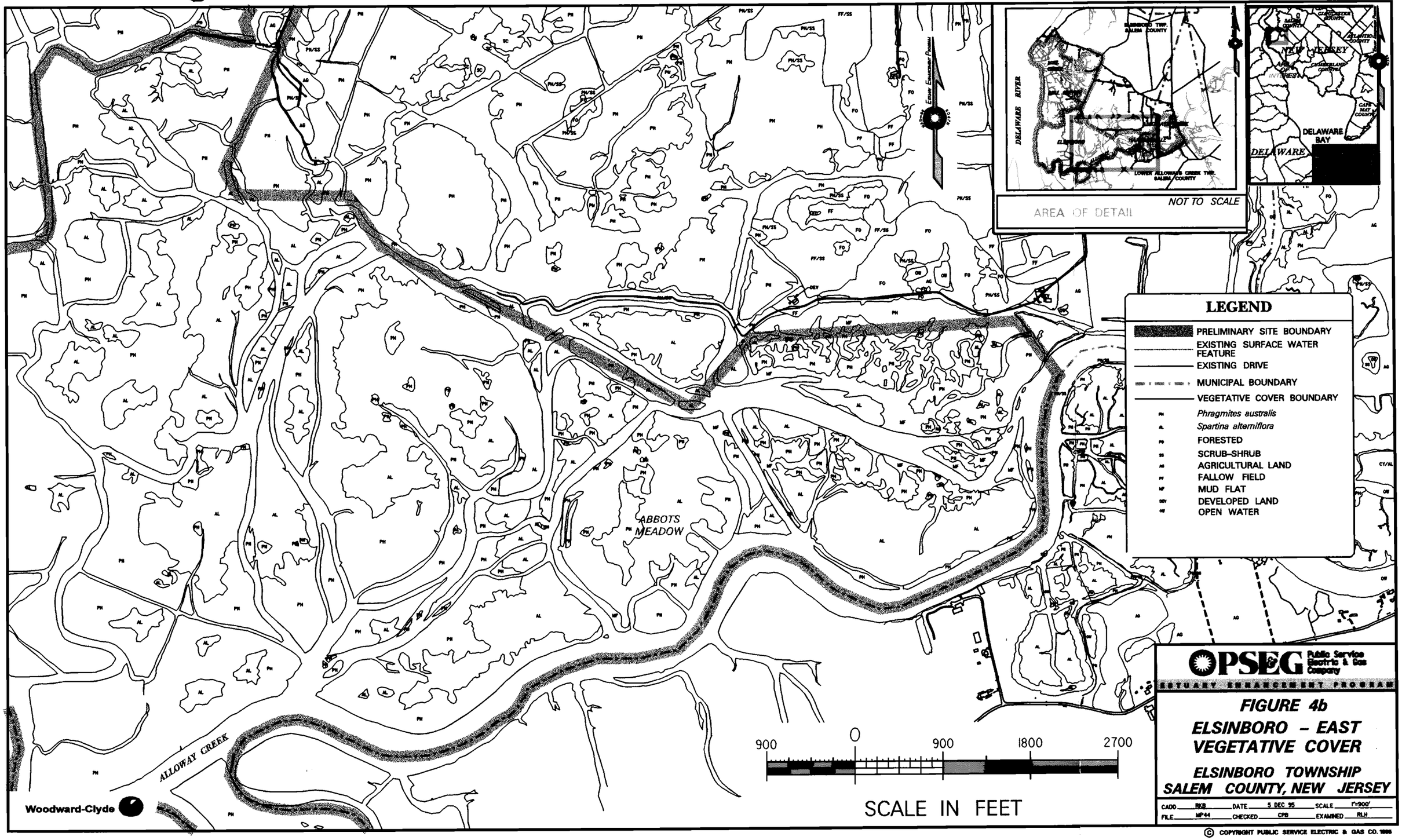
ESTUARY ENHANCEMENT PROGRAM

FIGURE 4a

ELSINBORO – WEST VEGETATIVE COVER

ELSINBORO TOWNSHIP SALEM COUNTY, NEW JERSEY

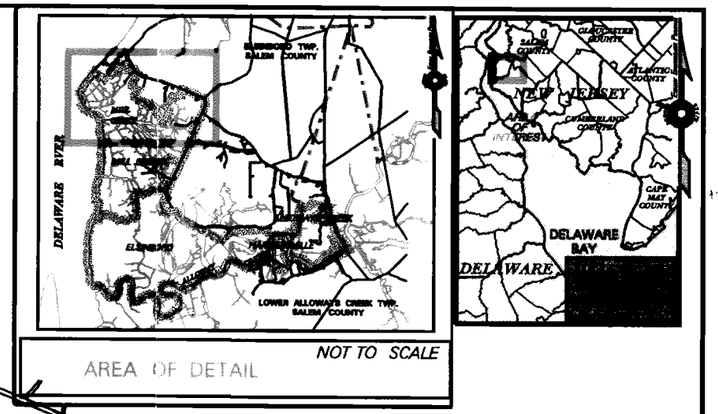
CADD RKB	DATE 5 DEC 95	SCALE 1"=900'	
FILE MP43	CHECKED CPB	EXAMINED RLH	



LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY
- PH — *Phragmites australis*
- AL — *Spartina alterniflora*
- FO — FORESTED
- AG — AGRICULTURAL LAND
- DEV — DEVELOPED LAND

ESTUARY ENHANCEMENT PROGRAM



DELAWARE RIVER

MILL CREEK

FORT ELFSBORG ROAD

MONEY ISLAND ROAD

FORT ELFSBORG ROAD

700 0 700 1400 2100

SCALE IN FEET

Woodward-Clyde

OPSEG Public Service Electric & Gas Company

ESTUARY ENHANCEMENT PROGRAM

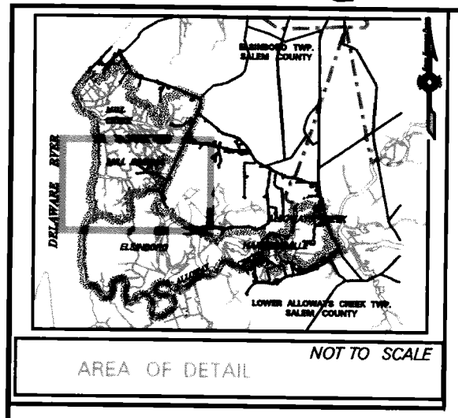
FIGURE 5a

MILL CREEK – NORTH VEGETATIVE COVER

ELSINBORO TOWNSHIP SALEM COUNTY, NEW JERSEY

CADD RKB DATE 5 DEC 95 SCALE 1"=700'

FILE MP45 CHECKED CPB EXAMINED RLH

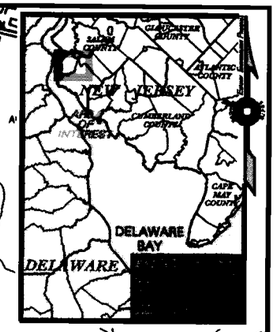


DELAWARE RIVER

STRAIGHT DITCH

BLACK DITCH

MONEY ISLAND ROAD



LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY
- PH — *Phragmites australis*
- AL — *Spartina alterniflora*
- TL — *Typha latifolia*
- FO — FORESTED
- SS — SCRUB–SHRUB
- AG — AGRICULTURAL LAND
- FF — FALLOW FIELD
- DEV — DEVELOPED LAND
- OW — OPEN WATER

700 0 700 1400 2100

SCALE IN FEET

Woodward-Clyde

PSE&G Public Service Electric & Gas Company

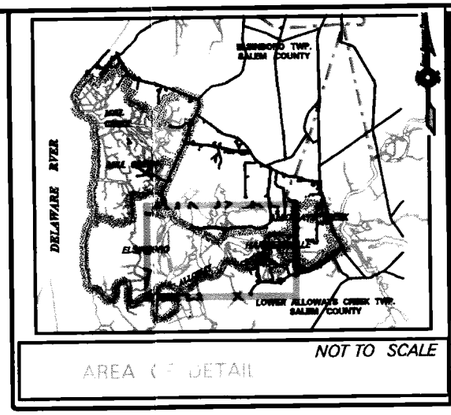
ESTUARY ENHANCEMENT PROGRAM

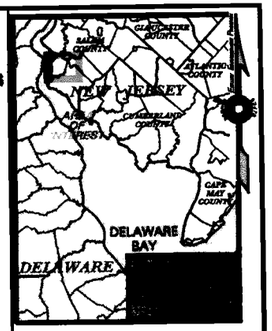
FIGURE 5b

MILL CREEK – SOUTH VEGETATIVE COVER

ELSINBORO TOWNSHIP SALEM COUNTY, NEW JERSEY

CADD	RKB	DATE	5 DEC 95	SCALE	1"=700'
FILE	MP46	CHECKED	CPB	EXAMINED	RLH





LEGEND

- PRELIMINARY SITE BOUNDARY
- EXISTING SURFACE WATER FEATURE
- EXISTING DRIVE
- MUNICIPAL BOUNDARY
- VEGATATIVE COVER BOUNDARY

AG	AGRICULTURE
AL	Spartina alterniflora
DEV	DEVELOPED
FF	FALLOW FIELD
FO	FORESTED
MF	MUD FLAT
PH	Phragmites australis
PY	Panicum virgatum
SC	Scirpsa sp.
SS	SCRUB/SHRUB
TL	Typha latifolia

900 0 900 1800 2700

SCALE IN FEET

Woodward-Clyde

OPSEG Public Service Electric & Gas Company

ESTUARY ENHANCEMENT PROGRAM

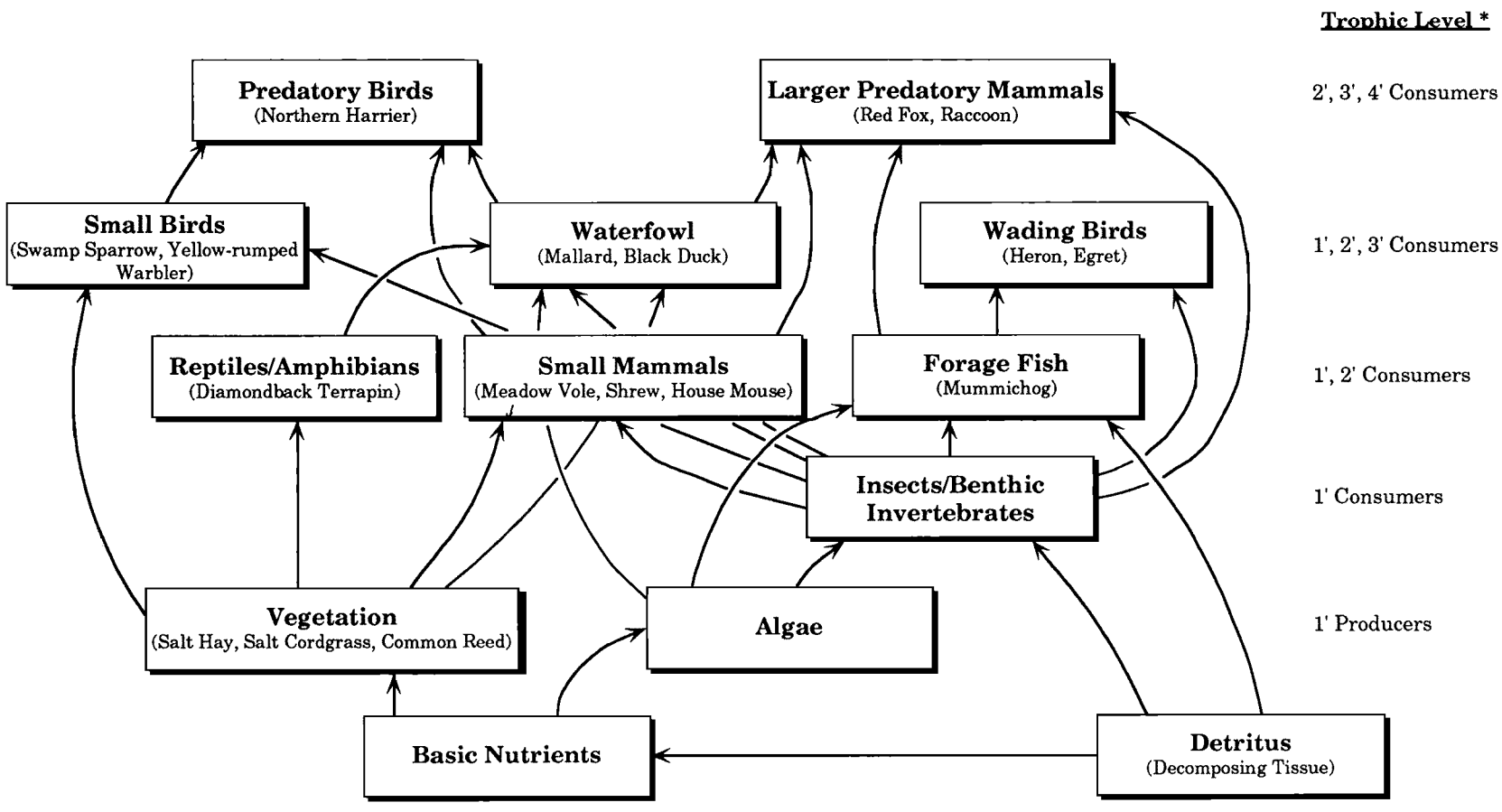
FIGURE 6

MASON'S POINT VEGETATIVE COVER

ELSINBORO TOWNSHIPS SALEM COUNTY, NEW JERSEY

CADD RKB/JL DATE 15 JAN 96 SCALE 1"=900'

FILE MP47 CHECKED RTG EXAMINED RLH



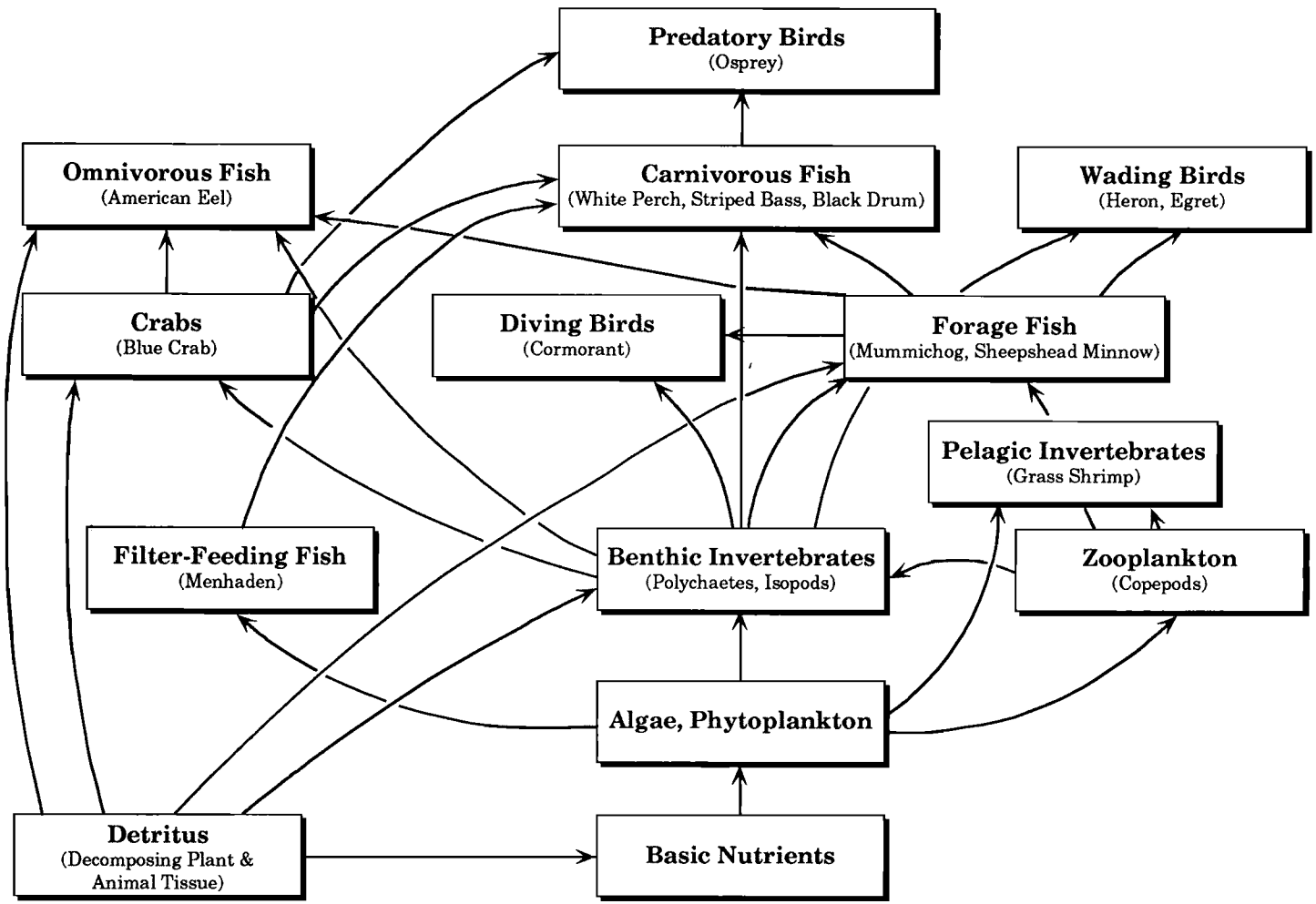
Key:

* 1', 2', 3', etc. – Primary, Secondary, Tertiary, etc.

AUTUMN TIDAL WETLAND FOOD WEB
ALLOWAY CREEK WATERSHED
WETLAND RESTORATION SITES
SALEM COUNTY, NEW JERSEY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	BAS	SCALE:	NONE	PROJ. NO.:	5E04739
CK'D. BY:	ABB	DATE:	JAN 7, 1996	FIG. NO:	7



Key:

* 1', 2', 3', etc. – Primary, Secondary, Tertiary, etc.

AUTUMN ESTUARINE FOOD WEB
ALLOWAY CREEK WATERSHED
WETLAND RESTORATION SITES
SALEM COUNTY, NEW JERSEY

WOODWARD-CLYDE CONSULTANTS
CONSULTING ENGINEERS, GEOLOGISTS AND ENVIRONMENTAL SCIENTISTS
WAYNE, NEW JERSEY

DR. BY:	BAS	SCALE:	NONE
CK'D. BY:	ABB	DATE	

64