DELAWARE RIVER

COMPREHENSIVE NAVIGATION STUDY

SALEM RIVER, NEW JERSEY

INTERIM FEASIBILITY REPORT

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[Section 2(b)]

DELAWARE RIVER COMPREHENSIVE NAVIGATION STUDY

ANALYSIS OF THE CORPS OF ENGINEERS INTERIM FEASIBILITY REPORT

OF THE SALEM RIVER, NEW JERSEY

U.S. FISH & WILDLIFE SERVICE

DEPARTMENT OF THE INTERIOR

Prepared by

U.S. Department of the Interior
Fish and Wildlife Service

March 1989

United States Department of the Interior

FISH AND WILDLIFE SERVICE

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March 16, 1989

Lt. Colonel G. William Quinby
District Engineer, Philadelphia District
U.S. Army Corps of Engineers
Custom House, 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Colonel Quinby:

Enclosed is the Fish and Wildlife Service's (Service) report on the anticipated fish and wildlife impacts resulting from the Army Corps of Engineers proposed modification of the Salem River Channel, Salem, New Jersey. This report has been prepared pursuant to Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is for inclusion in your final feasibility report.

Our report is based on project plans provided in the November 1988 Interim Feasibility Report Environmental Assessment and upon field investigations by Service personnel. The Service has submitted two planning aid reports to the Corps concerning the Salem River project. Our first report was submitted in September 1986, and presented a general characterization of fish and wildlife resources in the area. Our second report was submitted in August 1987, and presented the results of an interagency fish sampling survey and a reconnaissance of waterfowl/waterbird use in the project area in order to assess fish and wildlife impacts from the proposed channel modifications. Additionally we have also provided the Corps a July 17, 1987 letter commenting on the assessment of impacts from proposed overboard disposal in Salem Cove (Appendix B).

This report has the concurrence of New Jersey Division of Fish, Game and Wildlife, as indicated by the enclosed copy of the letter from Director George P. Howard (Appendix B). If there are any questions concerning the report, please contact Allen Jackson of my staff.

Sincerely,

Clifford G. Day

Clifford G. Day
Supervisor

"TAKE PRIDE IN AMERICA"

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FISH AND WILDLIFE COORDINATION ACT REPORT

[SECTION 2(b)]

DELAWARE RIVER COMPREHENSIVE NAVIGATION STUDY

ANALYSIS OF THE CORPS OF ENGINEERS INTERIM FEASIBILITY REPORT

OF THE SALEM RIVER, NEW JERSEY

Prepared for

U.S. Army Corps of Engineers
Philadelphia District
Philadelphia, Pennsylvania 19106

Prepared by

U.S. Department of the Interior
Fish and Wildlife Service
Absecon, New Jersey 08201

March 1989

Preparer: Allen C. Jackson

Project Leader: Clifford G. Day

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INTRODUCTION

1 This constitutes the Fish and Wildlife Service's (Service) report on fish and wildlife impacts which can be expected as a result of implementing the Army Corps of Engineers (Corps) selected plan to improve navigation in the Salem River, Salem County, New Jersey. The report has been prepared pursuant to Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.) and is for inclusion in the Corps Final Feasibility Report and Environmental Assessment.

The report received concurrence of the New Jersey Division of Fish, Game and Wildlife as indicated in the enclosed correspondence (Appendix B).

The report is based on project plans provided in the November 1988 draft Interim Feasibility Report - Main Report and Environmental Assessment, and upon field investigations by Service personnel. The Service submitted two planning aid reports to the Corps concerning the Salem River project. Our first report in September 1986 presented a general characterization of fish and wildlife resources in the area. Our second report in August 1987 presented the results of an interagency fish sampling survey and a reconnaissance of waterfowl/waterbird use in the project area in order to assess fish and wildlife impacts from the proposed channel modifications. Additionally, we also provided the Corps a July 17, 1987 letter commenting on the assessment of impacts from proposed overboard disposal in Salem Cove (Appendix B).

The Service requests that no part of this report be used out of context and if the report is reproduced, it should appear in its entirety. Any information excerpted from the report should be properly cited and include the page number from which the information was taken.

PROJECT DESCRIPTION

The existing Salem River Federal Navigation Project, adopted in 1925 and initially dredged to authorized dimensions in 1928, provides navigational access between the City of Salem, New Jersey and the Delaware River Federal Navigation Project (Figure 1). The authorized channel is approximately 5 miles long and has a project depth of 12 feet at mean low water. Channel width is 150 feet in Salem Cove, narrowing to 100 feet at the "cut off" at Sinnickson Landing, and provides a 450 foot wide berthing area. The authorized channel extends from Elsinboro Point at the southwestern corner of Salem Cove to the New Jersey Route 45 highway bridge in Salem. Dredging of the Little Salem River portion of the channel has been deferred because additional depth is not required in that reach.

In 1928 the present authorized dimensions and the "cut off" were established. In 1934, 1937 and again in 1945, maintenance dredging was required in the uppermost portion at the authorized project known as the Little Salem River located between the Penns Neck (Route 49) bridge and the Route 45 bridge. Due to the absence of commercial navigation in the upper portion of the river since the 1945 dredging, maintenance efforts have involved primarily the section of river downstream of the Penns Neck bridge. Maintenance dredging of this section has been performed in 1946, 1960, 1984 and 1988. Dredge material

1. The first several pages of this report provide a review of the fish and wildlife resources within the project area. This information does not require response.

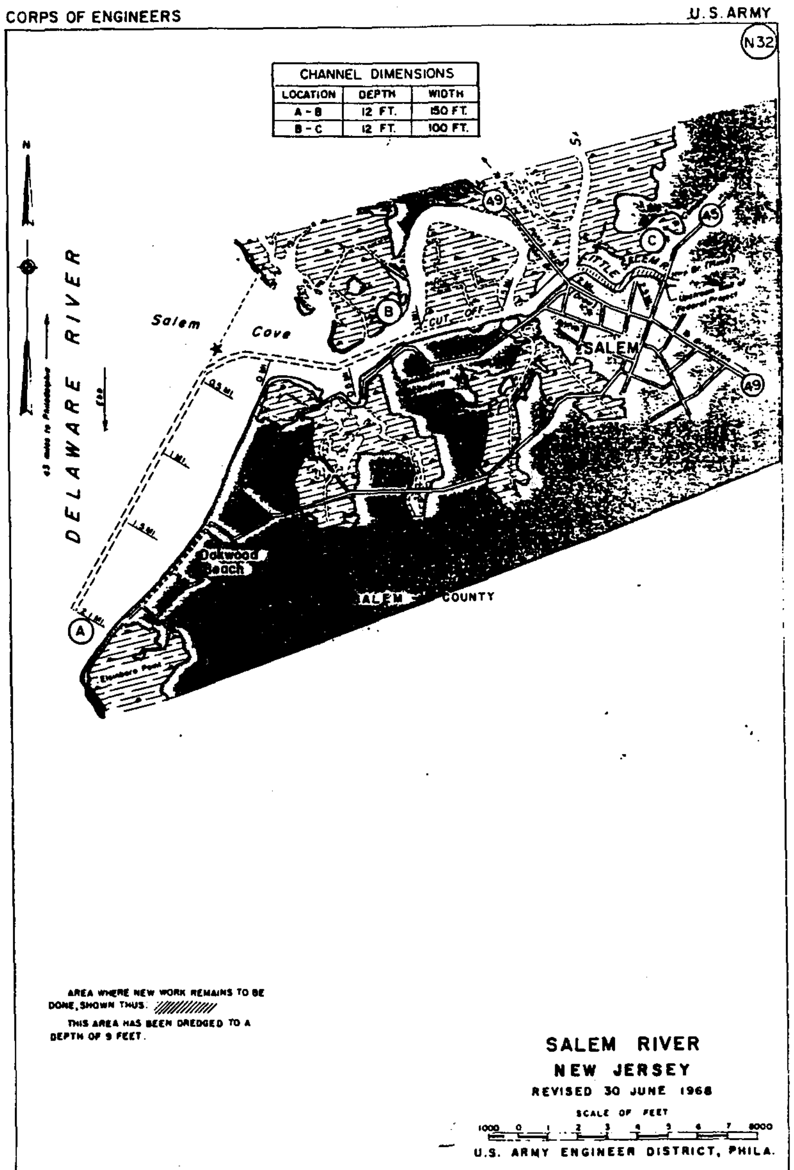

Figure 1. Project Impact Area

was removed primarily from a zone about 12,000 feet long where the channel transits Salem Cove and disposed adjacent to the channel. Upstream of the transition from Salem Cove to the Salem River proper, no maintenance dredging has been required since 1946, as depths in this portion of the project upstream to the Penns Neck bridge have naturally exceeded the authorized depth of 12 feet and do not shoal.

The Corps proposes (Figure 2) to modify the channel dimensions to the Penns Neck bridge providing an 18 foot depth at mean low water and a channel width of 180 feet. The proposed project would extend the Delaware River segment of the channel an additional 200 feet, from the 12-foot depth to the 18-foot depth contour. The plan also proposes widening the berthing area from 450 feet to 475 feet. The channel would have a 3 to 1 side slope and generate approximately 1,267,000 cubic yards of dredge spoil to be removed by hydraulic pipeline dredge. All dredged material would be placed in the active upland diked disposal area at Killcohook near Pennsville, which is associated with the main Delaware River federal navigation channel. According to the Corps, estimated impacts from proposed dredging include losses of 7 acres of vegetated wetlands and 2.5 acres of shallow water habitat.

FISH AND WILDLIFE RESOURCES

Habitat Description

The Salem River drains approximately 113 square miles of the Delaware River basin in Salem County. It begins as a moderately fast-moving stream and becomes a slow-moving tidal river before emptying into the Delaware River estuary at river mile 60. The river discharges an average of 131 cubic feet per second, has an average tidal range of 5.4 feet and is generally oligohaline (0.5-5.0 ppt). The river at the upper end of the maintained reach (Route 49 bridge) is approximately 400 feet wide. It broadens to 4,000 feet before entering Salem Cove. New Jersey water quality standards specify the following uses for the Salem River: industrial water supply after reasonable treatment; wildlife; propagation of resident fish and other aquatic life, passage of anadromous fish; primary contact recreation; and, navigation. Existing water quality in the project reach is poorly documented. A single water sample taken by the Corps in July 1983 indicated acceptable water quality. Channel sediment testing by the Corps in 1983 suggests that sediments are not contaminated by metals or toxic organics (U.S. Army Corps of Engineers, 1984; Ichthyological Associates, Inc., 1980).

Agricultural, wetland and residential/industrial are the dominant land uses bordering the Salem River. Agricultural fields are generally located inland from the river, tributaries and adjoining wetlands. Examples of this cover type can be found along Ammellbury Road and Fort Elfsborg Road south of the river and Penns Grove/Salem Road north of the river. Small grains (wheat and corn) are the most important crops.

Estuarine intertidal emergent wetland is the major wetland type in the project area. This wetland type occurs on both sides of the river, often following unnamed tributaries a mile or more inland. Saltmarsh cordgrass (*Spartina alterniflora*) is common at the mouth of the river on both shores, particularly

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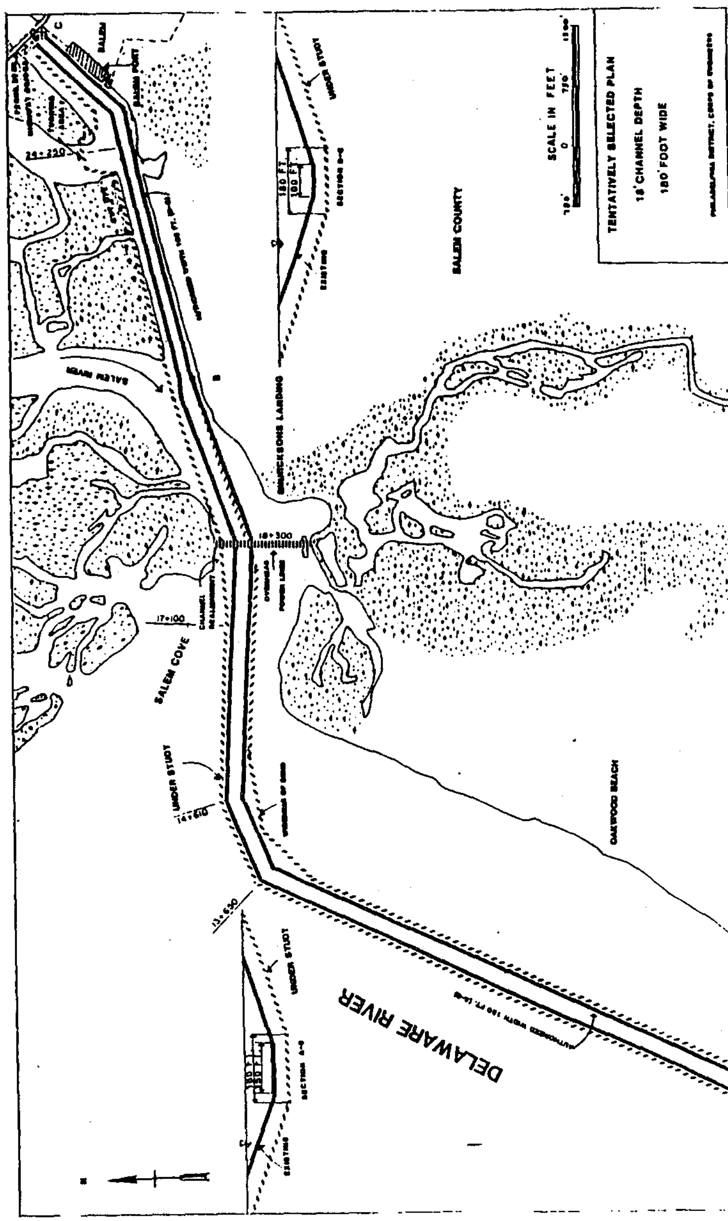

Figure 2.

within the Supawna Meadows National Wildlife Refuge. Common reed grass (Phragmites communis) is dominant in upriver and tributary wetlands; for example, on the island north of Sinnickson Landing. Emergent wetlands at the upper end of the project area are comprised of mixed freshwater species such as wild rice (Zizania aquatica), arrow arum (Peltandra virginica) and spatterdock (Nuphar advena). Examples include Fenwick Creek (Little Salem River) and Mannington Meadow (Walton, T.E. and Patrick, 1973).

The towns of Fort Elfsborg, Oakwood Beach, Sinnickson Landing and Salem border Salem Cove or the Salem River on the south side. No communities border the north side of the river, which is mainly wetland. Supawna Meadows National Wildlife Refuge (Figure 3) occupies a large tract at the mouth of the river's north side.

Shellfish

The Salem River project area is located 13 miles upriver from Delaware River oyster (Crassostrea virginia) seed beds and leased planting grounds. Seed beds are harvested for seed during May and June (when permitted) by the oyster industry for planting in leased areas. Oysters are relatively sensitive organisms. A decline in oyster harvest during the late 1950's to the late 1960's was attributed to a combination of over-harvesting, disease, predation, fouling organisms and poor water quality (U.S. Fish and Wildlife Service, 1981).

Commercial and recreational shellfisheries for blue crab (Callinectes sapidus) exist in Salem Cove. Adult crabs emerge from deep water hibernation in bay sediments during the spring months. Young of the year crabs, mostly spawned in areas further downbay, migrate to the vicinity of Salem Cove in early fall. The blue crab is considered a major commercially harvested shellfish in the Salem Cove and the Delaware Bay (U.S. Army, Corps of Engineers, 1984). The lower portion of the Salem River is also used for recreational crabbing (U.S. Fish and Wildlife Service, 1981).

Finfish

The Fish and Wildlife Service (1987) and the New Jersey Department of Environmental Protection conducted sampling activities in May and June of 1987 in Salem River and Cove. A total of 1,130 fish were collected and identified, representing 20 different species. Ninety percent were represented by bay anchovy (Anchoa mitchilli) (69 percent), striped killifish (Fundulus majalis) (8 percent), Atlantic silverside (Menidia menidia) (7.7 percent) and white perch (Morone americana) (6 percent). The remaining species include carp (Cyprinus carpio), bluefish (Pomatomus saltatrix), pumpkinseed (Lepomis gibbosus), mummichog (Fundulus heteroclitus), white catfish (Ictalurus catus), Atlantic menhaden (Brevoortia tyrannus), gizzard shad (Dorosoma cepedianum), alewife (Alosa pseudoharengus), American shad (Alosa sapidissima), blueback herring (A. aestivalis), channel catfish (I. punctatus), white crappie (Pomoxis annularis), American eel (Anguilla rustrata), sundial (Scophthalmus aquosis), golden shiner (Notemigonus crysoleucas) and brown bullhead (I. nebulosus). In addition were grass shrimp (Palaemonetes vulgaris) and various species of crabs.

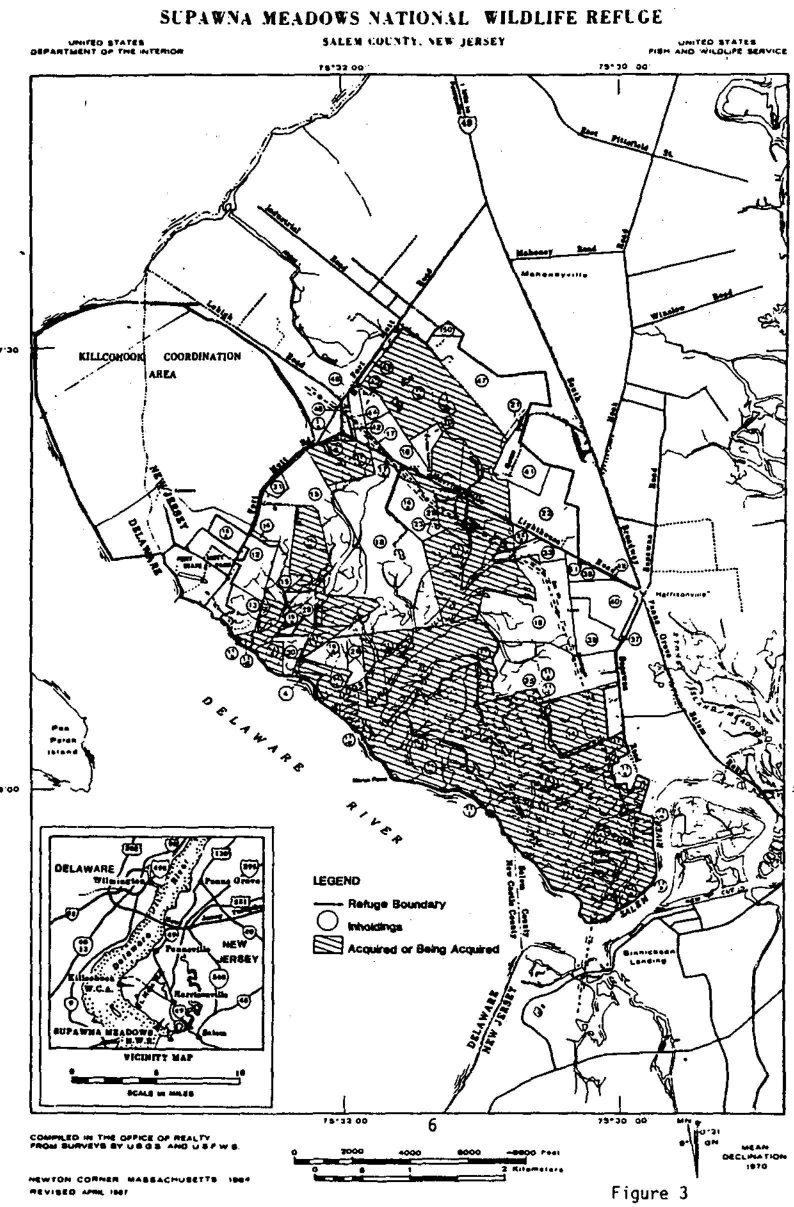

Figure 3

Of particular note is the sample presence of American shad, a State listed threatened species. Lupine (1987) determined that these shad were juveniles, which overwintered in the estuary. Most of the other fish species collected were also juveniles that utilize the lower Salem River as a nursery area.

The New Jersey Division of Fish, Game and Wildlife monitors American shad to determine population size. Recent water quality improvements are believed to have had a beneficial effect on the expanding shad population in the Delaware River.

In addition, various studies have addressed fisheries in the vicinity of the Salem River study area. Walton and Patrick (1973) examined aquatic communities of the Delaware River estuarine marshes. A relative measure of abundance was assigned by field personnel ranging from abundant to rare. White perch were frequent inhabitants of the Salem River. American eel, alewife, Atlantic menhaden and brown bullhead were rare.

Zich (1977) performed an inventory of anadromous fish for the New Jersey Division of Fish, Game and Wildlife. This study collected existing information and performed field investigations on anadromous clupeid spawning runs. Alewife spawning runs were confirmed in the Salem River, but shad spawning runs were not detected. Anadromous fish migrate from March to May and September to November (BCM Eastern, Inc., 1984).

More information is available about finfish in Salem Cove than in tidal portions of the Salem River. Ichthyological Associates Inc., (1980) collected 9 species of finfish comprising 662 specimens in two, 10-minute trawl samples (10-foot trawl) in the Delaware River approximately 50 feet off Oakwood Beach in early summer 1977. Bay anchovy (53 percent) and spot (Leiostomus xanthurus), (45 percent) were the dominant species in the sample. Tidewater silverside (M. menidia), northern pipefish (Syngnathus fuscus), white perch, striped bass (Morone saxatilis), summer flounder (Paralichthys dentatus) and hogchoker (Scophthalmus aquosis) were also taken. Another sample yielded seven species and 187 specimens. Atlantic menhaden comprised 72 percent of the catch. Other species included spot bay anchovy, Atlantic silverside, white perch, striped bass and bluefish (U.S. Fish and Wildlife Service, 1981).

Himchak (1981) collected 8 species of fish comprising 72 specimens in a single 10-minute trawl sample at the mouth of Salem River on November 17, 1980. White perch and spot comprised 90 percent of the catch. Carp, gizzard shad, brown bullhead, channel catfish and hogchoker made up the remainder of the sample.

Ichthyological Associates Inc.,(1980) sampled icthyoplankton in Salem Cove on May 4, 1977. Four, five-minute tows yielded 61 larvae representing four taxa. Striped bass comprised 66 percent of the total catch. Other larvae collected were white perch and creek chubsucker (Semotilus atromaculatus) (U.S. Fish and Wildlife Service, 1981).

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Wildlife

The Salem River and adjoining wetlands provide valuable habitat for thousands of migratory waterfowl annually. A river census is conducted each year in early January to monitor populations. The 1985 aerial census, which begins at Fort Elfsborg Road and ends at Salem Canal, disclosed 8,225 Canada geese (Branta canadensis), 600 black duck (Anas rubripes), 400 mallard (A. platyrhynchos), 100 American widgeon (A. americana), 100 scaup (Aythya sp), 500 bufflehead (Bucephala albeola) and 50 tundra swan (Cygnus columbianus) (U.S. Fish and Wildlife Service, 1985).

Supawna Meadows National Wildlife Refuge, under the administration of the Service's Tinicum National Environmental Center, provides excellent interspersion of aquatic and wetland habitat north of Sinnickson Landing. It is particularly valuable as a stopover location during waterfowl migration for resting and feeding when species occurrence and population are at optimum levels.

Service reconnaissance of the project area indicates that waterfowl and other waterbirds do not nest in wetlands bordering the south side of the oxbow island adjacent to the "cut off" (Figure 1). The river bank is steep and bordered by dense stands of common reed. Nesting activity in this immediate area was not observed (U.S. Fish and Wildlife Service, 1987).

The remaining wetlands on the oxbow island, as well as the tidal tributaries which flow through the island, provide feeding and resting habitat for various waterfowl and waterbirds. The wetlands are also being utilized by muskrats (Ondatra zibethicus). McCauley (1987) reports that the oxbow island yielded 600-700 muskrats for two part-time trappers during the trapping season between November 15 to March 15, McCauley also believes the island can sustain a 1,000-1,200 yearly harvest of this species.

Widjeskog (Appendix B) reports the area is heavily utilized by migrating and wintering waterfowl from September through March, and by muskrat and river otter (Lutra canadensis). Other wildlife using the project area include red fox (Vulpes vulpes), raccoon (Procyon lotor), striped skunk (Mephitis mephitis), eastern cottontail (Sylvilagus floridanus), whitetail deer (Odocoileus virginianus), ring-necked pheasant (Phasianus colchicus) and American woodcock (Scolopax minor). All of these fauna except woodcock are more typically associated with upland habitats, primarily forest and fields.

Under the provisions of the Service's Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981), the wetlands and nearshore shallows in the project area have medium to high habitat value for shellfish, finfish, waterfowl and waterbird species. The cover types that would be impacted by the project are estuarine emergent, estuarine intertidal and estuarine subtidal. The evaluation species for the estuarine emergent cover type is the black duck, a species of special emphasis in this region. The snowy egret (Egretta thula) was evaluated as a frequent inhabitant of the estuarine intertidal area, while the American shad (a State threatened species) was evaluated for the estuarine subtidal cover type. The habitat in the project impact area is of medium to high value for these evaluation species and is

relatively abundant on a national basis. The Service's mitigation goal is no net loss of in-kind habitat value, while minimizing the loss of in-kind habitat value.

Federal Endangered and Threatened Species

Except for occasional transient species (bald eagle, peregrine falcon), no federally listed or proposed threatened or endangered species are known to occur within the project area. The project area is within the historic range of the federally designated endangered bald eagle (Haliaeetus leucocephalus) and peregrine falcon (Falco peregrinus anatum). The only confirmed pair of nesting bald eagles in New Jersey is in Cumberland County, southwest of the project area. Nesting activity has also been observed in Mannington Meadows and in Alloways Creek (Clark, 1987). Although these nesting attempts have not been successful, they provide evidence of potential eagle nesting habitat. Additionally, a pair of eagles recently overwintered during 1986 to 1987 in Mannington Meadows (Clark, 1987).

Peregrine falcons nest on the Delaware Memorial Bridge, located about 8 miles north of the project site. Reynolds (1987) reports nesting activity on this bridge during the last 3 years, but nesting success is unknown.

The endangered shortnose sturgeon (Acipenser brevirostrum) has been collected in the Delaware River in recent years near Artificial Island, about 6 miles south of the project area (Masnik and Wilson, 1980). It has also been reported in the vicinity of Pea Patch Island. No collections have been reported from the project site; however, it may occur in the Delaware River and possibly in the lower Salem River. Table 1 (Appendix A) is a list of Federally Endangered and Threatened Species in New Jersey.

State Endangered and Threatened Species

The project area is in the breeding range of the endangered sedge wren (Cistothorus platensis); in the unconfirmed wintering range of the endangered Cooper's hawk (Accipiter cooperii); in the range of traditional nesting sites for the endangered Henslow's sparrow (Ammodramus henslowii); may be partially within the breeding ranges of the threatened savannah (Passerculus sandwichensis) and grasshopper sparrows (Ammodramus savannarum); may be partially within the range of the endangered eastern tiger salamander (Ambystoma tigrinum); and, is within the range of the endangered bog turtle (Clemmys muhlenbergii). The bald eagle (endangered), peregrine falcon (endangered) and the threatened osprey (Pandion haliaetus) inhabit areas adjacent to the project site. Bald eagle and peregrine falcon are discussed above. Clark (1987) reports 9 successful osprey nests in 1987 on Artificial Island.

American shad (threatened) was discussed previously in the finfish section. The shortnose sturgeon (endangered) is discussed above. Table 2 (Appendix A) presents a list of Endangered and Threatened Wildlife in New Jersey (federal and State status).

ASSESSMENT OF IMPACTS

The selected plan involves modifying the existing Salem River by deepening the navigation channel from a depth of 12 to 18 feet and widening from a width of 150 and 100 feet to 180 feet. The existing 5 mile channel will be extended by 200 feet from the 12 foot to the 18 foot contour in the Delaware River. The selected plan also proposes widening the berthing area/turning basin at Salem Port from 450 to 475 feet. Utilizing a 3 to 1 side slope generates approximately 1,267,000 cubic yards of dredge spoil. All dredged material will be removed by hydraulic dredge and placed in the active upland diked disposal area at Killcohook near Pennsville.

Environmental impacts which would result from the proposed project fall into two categories: 1) water quality impacts; and 2) direct loss of habitat (shallow water and wetlands).

2 Water quality impacts are associated with water column degradation from the dredging operation. Any activity which adversely affects water quality during spring and fall has the potential for interfering with or halting fish passage. Water quality problems could also impact fish nursery areas. For example, migration spawning and early growth of anadramous fish may be disrupted by turbidity depending on the type of dredge equipment used and time of dredging. Dredge induced turbidity may also interfere with fish movements, smother fish eggs and clog gills. These adverse impacts can be minimized by using hydraulic dredging or by timing mechanical dredging to avoid the months of March, April, May, September, October and November. Since the Corps proposes to hydraulic dredge, we do not anticipate the impacts to fishery resources to be significant.

3 Water quality impacts are also not expected to have significant impact upon the existing blue crab population provided hydraulic dredging is utilized. Dredging may interfere with crabbing activities depending on their proximity to the channel, as well as the season when dredging occurs. However, crabs inhabit soft bottom areas. They would not be expected to be found along the channel slope or in the immediate area of the channel (Dobarro, 1989). Being mobile, except during winter, crabs can relocate if disturbed by dredging activities. Therefore, hydraulic dredging will minimize water quality impacts and should not cause a significant impact upon crab populations.

4 Dredging will eliminate existing nearshore shallows and emergent wetlands in the vicinity of the "cut off" and turning basin. This 3,300 foot reach constitutes the narrowest part of the existing navigation channel and widening will eliminate approximately 7 acres of estuarine emergent wetlands located on the north side of the river. In addition to this wetland impact, approximately 2.5 acres of estuarine intertidal and estuarine subtidal habitat will also be affected by channel modification. Channel widening and deepening would adversely impact waterfowl and other waterbirds and wildlife dependent on nearshore shallows and wetlands for feeding and cover.

5 Wetland losses can be mitigated by creating an equal amount of wetlands from an unproductive upland. To date, the Service, the New Jersey Department of

2. Hydraulic dredging is proposed to construct and maintain the selected plan of improvement for the Salem River navigation channel. An existing dredging restriction does preclude bucket dredging and/or overboard disposal of dredged material within the Salem River during the months of March, April, May, September, October and November.

3. No response required.

4. This information has been documented in section V.A.3. of the EA.

5. Additional coordination will be required to finalize formulation of the wetland mitigation plan. All concerned agencies will be included in this coordination.

Environmental Protection and the Corps have discussed the development of a plan to fully mitigate project impacts. A potential mitigation site has been identified on the Supawna Meadows National Wildlife Refuge (Figure 4). Since additional agencies will be involved in selecting a suitable mitigation plan, we recommend the Corps initiate full interagency coordination to formulate acceptable mitigation.

6 The Service is not convinced that selection of the 18-foot dredge depth is justified. In our 1987 planning aid report, we recommended selection of a 16-foot dredge depth to minimize environmental impacts to wetlands. A 16-foot depth would result in a 170 foot wide channel, 10 feet less than the selected 180 foot width. Considering the cost associated with wetlands creation as well as less impact to wetlands, a 16-foot depth seems to be a practicable alternative that should also satisfy project objectives.

7 Dredged material disposal should not significantly affect fish and wildlife resources. The Killcohook Dredged Material Disposal Area near Pennsville, New Jersey is an active federally operated upland disposal site, is diked and has sufficient capacity to accommodate project needs. The Service encourages placement and use of spoil in confined upland sites.

RECOMMENDATIONS

8 In summary, the Service recommends the Corps implement the following actions in order to protect fish and wildlife resources:

1.) utilize hydraulic dredging to reduce water quality impacts;

2.) dispose of dredge spoil at the Killcohook Dredged Material Disposal Area;

3.) do not dredge upriver of New Jersey Route 49 bridge in Salem;

4.) formulate and coordinate a detailed plan to mitigate wetland and intertidal habitat losses; and,

5.) select the 16 x 170 feet project dimension, or provide additional justification for selecting the 18 x 180 feet project dimension.

6. The highest net benefit is gained with an 18 foot scenario. The highest net benefit is the criteria to determine the National Economic Development Plan, as opposed to the highest benefit/cost ratio. The cost of mitigation for wetlands is factored into the benefit/cost information.

7. The existing Killcohook dredged material disposal site has been selected for disposal of all material dredged for construction and maintenance of the proposed project.

8. Responses to recommendations 1, 2, 4 and 5 are provided above. In response to recommendation 3, no dredging is proposed upriver of the Route 49 bridge.

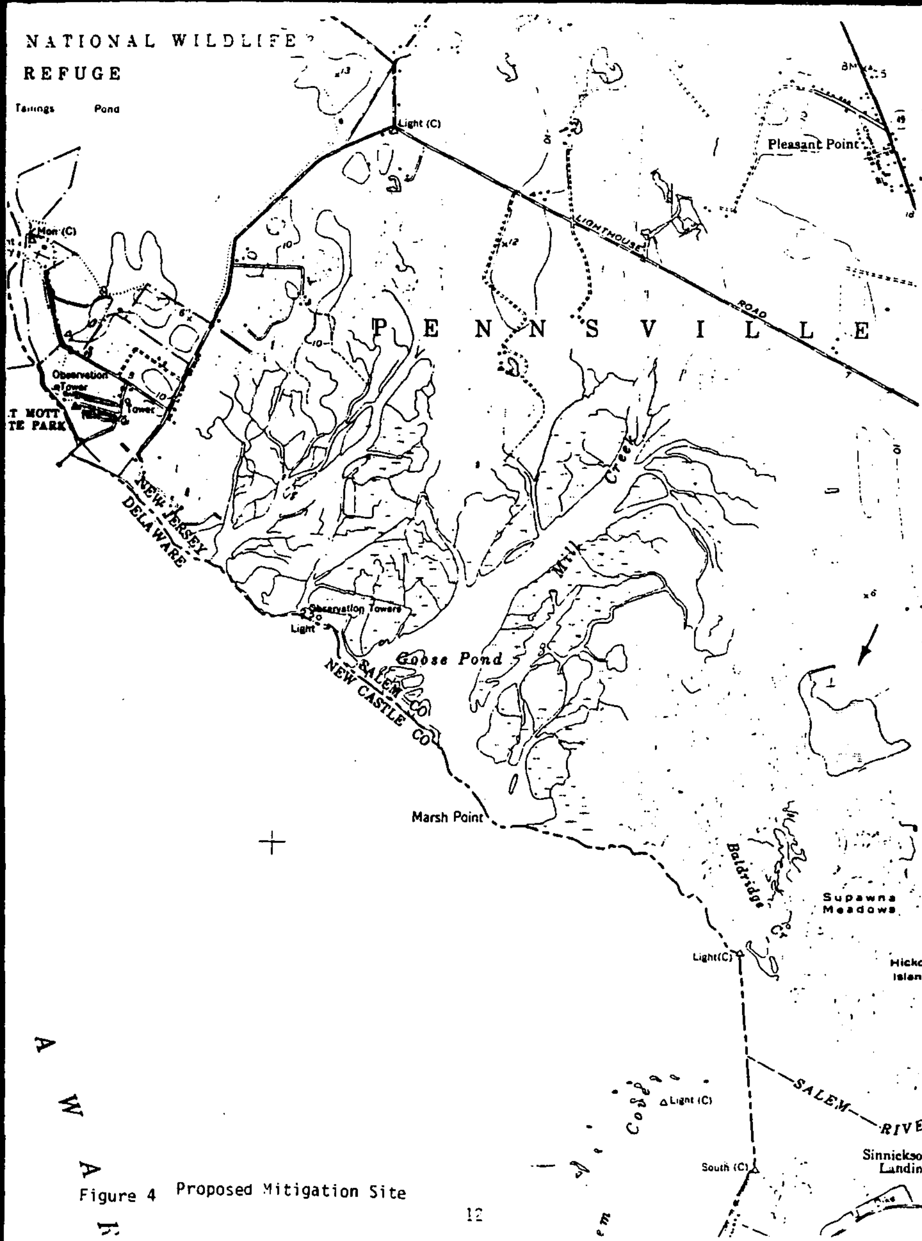

Figure 4 Proposed Mitigation Site

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APPENDIX A

(TABLES)

1. Federally Endangered and Threatened Species in New Jersey.

2. Endangered and Threatened Wildlife in New Jersey (Federal and State Status).

FEDERALLY ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

An endangered species is any species which is in danger of extinction throughout all or a significant portion of its range.

A threatened species is any species which is likely to become an endangered species within the foreseeable future throughout all or a significant portion of its range.

COMMON NAME	SCIENTIFIC NAME	STATUS	DISTRIBUTION
Fishes:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Hudson, Delaware and Atlantic coastal rivers
Reptiles:			
Turtle, Atl. Ridley*	Lepidochelys kempii	E	Oceanic, summer resident coastal waters
Turtle, green*	Chelonia mydas	T	Oceanic, summer visitor coastal waters
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic, summer visitor coastal waters
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic, summer visitor coastal waters
Turtle, loggerhead*	Caretta caretta	T	Oceanic, summer resident coastal waters, rarely nests: Atlantic and Cape May Counties
Birds:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, Am. peregrine	Falco peregrinus anatum	E	Entire state, re-establishment to former breeding range in progress
Falcon, Artic peregrine	Falco peregrinus tundrius	T	Entire state migratory
Plover, piping	Charadrius melodus	T	Entire state
Tern, roseate	Sterna dougallii dougallii	E	Entire state

Mammals:			
Cougar, eastern	Felis concolor couguar	E	Entire state, probably extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Balaena glacialis	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
Plants:			
Pogonia, small whorled	Isotria medeoloides	E	Sussex County
Swamp pink	Helonias bullata	T	Atlantic, Burlington, Camden, Cape May, Cumberland, Gloucester, Middlesex, Monmouth, Morris, Ocean, and Salem Counties

E: endangered species
T: threatened species

* Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

Endangered and Threatened Wildlife in New Jersey

Endangered species are those whose prospects for survival in the state are in immediate danger because of a loss or change of habitat, over-exploitation, predation, competition or disease. Immediate assistance is needed to prevent extinction.

Threatened species are those who may become endangered if conditions surrounding the species begin or continue to deteriorate.

FISH

Endangered

Shortnose Sturgeon*

Threatened

Atlantic Sturgeon
American Shad
Brook Trout
Atlantic Tomcod

AMPHIBIANS

Endangered

Tremblay's Salamander
Blue-spotted Salamander
Eastern Tiger Salamander
Pine Barrens Treefrog
Southern Gray Treefrog

Threatened

Long-tailed Salamander
Eastern Mud Salamander

REPTILES

Endangered

Corn Snake
Bog Turtle
Timber Rattlesnake
Atlantic Hawksbill Turtle*
Atlantic Loggerhead Turtle*
Atlantic Ridley Turtle*
Atlantic Leatherback Turtle*

Threatened

Wood Turtle
Northern Pine Snake
Atlantic Green Turtle

Continued

Endangered and Nongame Species Program

List Established: December 19, 1974
List Revised: March 29, 1979 ★ January 17, 1984 ★ May 6, 1985
July 20, 1987

New Jersey Department of Environmental Protection • Division of Fish, Game & Wildlife

BIRDS

Endangered

Pied-billed Grebe+
Cooper's Hawk
Northern Harrier+
Bald Eagle*
Peregrine Falcon*
Piping Plover
Upland Sandpiper
Least Tern
Roseate Tern
Black Skimmer
Short-eared Owl+
Cliff Swallow+
Sedge Wren
Henslow's Sparrow
Vesper Sparrow+
Loggerhead Shrike

Threatened

Osprey
Red-shouldered Hawk
Northern Goshawk
Great Blue Heron
Yellow-crowned Night Heron
Barred Owl
Red-headed Woodpecker
Bobolink
Savannah Sparrow
Ipswich Sparrow
Grasshopper Sparrow
American Bittern+
Black Rail

MAMMALS

Endangered

Sperm Whale*
Blue Whale*
Finback Whale*
Sei Whale*
Humpback Whale*
Right Whale*

*(*Indicates Federal and State endangered status.)*
(+only Breeding population endangered)

PERSPECTIVE

Species are listed as endangered when record of past and present population indicate that the species is on the decline. Habitat—that place that animals need to live—is ever changing and when habitats change, some species survive and others decline. In New Jersey habitat change is partially responsible for the decline of 54 endangered and threatened species. The Endangered and Nongame Species Program is responsible for protecting these species found in the state.

WE NEED YOUR HELP

Reports of sightings of endangered and threatened species are welcome! When you observe any species listed, jot down the date, time, exact location and any behavioral observations and send to CN 400, Trenton, NJ 08625. Your contributions to the Endangered and Nongame Wildlife Conservation Fund on your NJ Income Tax form continue to make endangered species protection possible.

HABITAT & REPRODUCTION = SURVIVAL

APPENDIX B

(CORRESPONDENCE)

1. Fish and Wildlife Service letter to New Jersey Division of Fish, Game and Wildlife (January 25, 1989).
2. New Jersey Division of Fish, Game and Wildlife letter of concurrence (February 22, 1989).
3. Fish and Wildlife Service letter to the Corps of Engineers (July 17, 1987).
4. Fish and Wildlife Service letter to New Jersey Division of Fish, Game and Wildlife (March 24, 1988).
5. New Jersey Division of Fish, Game and Wildlife letter of response (June 30, 1988).
6. Fish and Wildlife Service letter to Endangered and Nongame Species Program (March 24, 1988).
7. Endangered and Nongame Species Program letter of response (April 26, 1988).

United States Department of the Interior

FISH AND WILDLIFE SERVICE

P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201
(609) 646-9310

January 25, 1989

George P. Howard, Director
New Jersey Division of Fish,
Game and Wildlife
CN 400
Trenton, New Jersey 08625

Dear Mr. Howard:

Enclosed for your review and concurrence is the Fish and Wildlife Service's (Service) Draft Fish and Wildlife Coordination Act Report [Section 2(b)] entitled, "Delaware River Comprehensive Navigation Study: Analysis of the Corps of Engineers' Interim Feasibility Report of the Salem River, New Jersey."

The Corps selected plan involves deepening and widening the authorized Salem River Navigation Channel to a depth of 18 feet and widening to 180 feet, including widening a berthing area to 475 feet.

The Service's report contains our assessment of the selected plan and recommendations for mitigation. We have coordinated the preparation of this report with the Bureau of Freshwater Fisheries, Bureau of Marine Fisheries, Office of Environmental Review, Bivalve Shellfish Office and the Endangered and Nongame Species Program. A copy of this report has been forwarded to these Bureaus in order to expedite the Division's review.

Please provide a letter of comment including an indication of concurrence or lack thereof, within 30 days from the date of this letter. If there are any questions concerning the report, please contact Allen Jackson at this office.

Your attention to this request is appreciated.

Sincerely,

Clifford G. Day

Clifford G. Day
Supervisor

"TAKE PRIDE IN AMERICA"

Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
SH. GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

February 22, 1989

U.S. Fish and Wildlife Service
P.O. Box 534
705 Whitehorse Pike
Absecon, New Jersey 08201

Dear Mr. Jackson:

Our Division has reviewed the Section 2(b) report on the Interim Feasibility report of the Salem River, New Jersey. We concur with your recommendations and feel if these are followed, impacts to wildlife in the area will be minimized.

Sincerely,

George P. Howard
Director

LEW:sk

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201
(609-646-9310)

July 17, 1987

Lt. Colonel G. William Quinby
District Engineer, Philadelphia District
U.S. Army Corps of Engineers
Custom House, 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Colonel Quinby:

This is in regard to the Salem River portion of the Delaware River Comprehensive Navigation Study. On June 25, 1987, the Fish and Wildlife Service (Service) attended a meeting in your office with various State and Federal agency representatives to discuss environmental concerns about a Corps proposal to utilize a 500-acre shallow bay bottom site in Salem Cove for dredge material disposal. The dredge material would be generated via widening and deepening of the Salem River navigation channel, a proposal now under review by our respective agencies.

The proposed Salem Cove disposal area is identified as Site 24-16 on a map submitted by Ms. Barbara Stratton to the Service on May 22, 1987. At the aforementioned meeting, the Service voiced strong objection to the Corps disposing of dredged material in Salem Cove. In our September 1986 planning aid report ("A Survey of Fish and Wildlife Resources in the Salem River Navigation Project Area, Salem, New Jersey"), the Service evaluated 16 potential disposal sites identified by the Corps for the proposed project. Site 24-16 was not identified as a potential site during that review. We have since determined that there is little biological data available for this area. Therefore, any serious consideration of this site would necessitate development of biological information in order to properly assess disposal impacts.

Despite the current lack of data, we view the potential loss of 500 acres of intertidal and subtidal area as a major concern. Shallow water habitat is generally documented in scientific literature from Delaware Bay as being important to fish recruitment. Placement of dredge spoil at this site is likely to eliminate or degrade these waters and their dependent fish and wildlife. Furthermore, it is unlikely that the Corps could fully compensate the lost resource values via habitat creation or improvement in the nearby area. The magnitude of damage in this case may be so great as to make habitat replacement elsewhere impossible. Moreover, Site 24-16 lies adjacent to the Supawna Meadows National Wildlife Refuge, and the potential secondary impacts to the refuge could be extremely significant.

Therefore, the Service strongly discourages the continued consideration of Site 24-16 in Salem Cove as a disposal site. Practicable alternatives exist, as identified in our planning aid report, that would have substantially less environmental impacts. We recommend you pursue those alternatives.

Please contact Mr. Allen Jackson of this office if you have any questions.

Sincerely,

Michael T. Chezik
Acting Field Supervisor

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201

March 24, 1988

Mr. Lee Widjeskog
N.J. Division of Fish, Game and Wildlife
Office of Environmental Review
CN 400
Trenton, New Jersey 08625

Dear Mr. Widjeskog:

The Philadelphia District, Corps of Engineers (Corps) is conducting a feasibility study to investigate redeveloping the Port of Salem, New Jersey. The proposed project involves the deepening and widening of the existing channel to facilitate accessibility of deep-draft cargo vessels.

The authorized and maintained dimensions of the Salem River project are a 12 foot depth and width of 150 feet from Elsinboro Point to Sinnicksons Landing and 100 feet width upriver to the Route 49 bridge (enclosure 1). The proposed plan (enclosure 2) provides for increasing the depth to 18 feet and widening to 180 feet. A 450 foot turn area adjacent to the berthing area will be increased to 475 feet which will result in the loss of 7 acres of wetland. Dredge spoil will be deposited in the active federal upland diked disposal area at Killcohook, near Pennsville.

The Fish and Wildlife Service (Service) has submitted two planning aid reports to the Corps concerning the Salem River project. Our first report was submitted in September 1986, and presented a general characterization of fish and wildlife resources in the area. Our second report was submitted in August 1987, and presented the results of an interagency fish sampling survey and a reconnaissance of waterfowl/waterbird use in the project area in order to assess fish and wildlife impacts from proposed channel modifications. Copies of these reports were also submitted to the New Jersey Division of Fish, Game and Wildlife.

Since completion of the aforementioned reports, the Corps has requested that the Service evaluate the selected plan to deepen and widen the existing channel. Since this plan involves activities in the lower Salem River and Delaware River, we are coordinating our review closely with the Bureau of Freshwater Fisheries and Bureau of Marine Fisheries. Nevertheless, we would appreciate any comments that you may have in regard to impacts to wildlife resources.

Your written reply would be appreciated since it will be incorporated directly into our Fish and Wildlife Coordination Act Report.

Thank you for your attention to this request.

Sincerely,

Allen C. Jackson

Allen C. Jackson
Fish and Wildlife Biologist

Enclosures

Let's protect our earth

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
FISH, GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

June 30, 1988

U.S. Fish & Wildlife Service
P.O. Box 534
705 Whitehorse Pike
Absecon, NJ 08201

Dear Mr. Jackson:

We have reviewed the proposal to dredge the Salem River Cove area.

It is expected that the Corps will follow its guide lines regarding the timing of the dredging to avoid spawning fish.

The loss of 7 acres of wetlands must be addressed.

What proposals have been made regarding mitigation? Where will it be done? If so, it should be done prior to the dredging of the existing marsh to avoid any reduction in the productivity of the area. The area is heavily utilized by migrating and wintering waterfowl from September through March, and by muskrats and river otter year-round. Destruction of 7 acres of marsh will decrease the carring capacity of the area for these species unless mitigation measures are taken.

Sincerely,

Lee Widjeskog

Lee Widjeskog
Principal Wildlife Biologist
N.J. Fish, Game and Wildlife

sk

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201
(609-646-9310)

March 24, 1988

Ms. Joanne Frier-Murza
Endangered and Non-Game Species Program
New Jersey Division of Fish, Game and Wildlife
CN-400
Trenton, New Jersey 08625

Dear Ms. Frier-Murza:

The Philadelphia District, Corps of Engineers (Corps) is conducting a feasibility study to investigate redeveloping the Port of Salem, New Jersey. The proposed project involves the deepening and widening of the existing channel to facilitate accessibility of deep-draft cargo vessels.

The authorized and maintained dimensions of the Salem River project are a 12 foot depth and width of 150 feet from Elsinboro Point to Sinnicksons Landing and 100 feet width upriver to the Route 49 bridge (enclosure 1). The proposed plan (enclosure 2) provides for increasing the depth to 18 feet and widening to 180 feet. A 450 foot turn area adjacent to the berthing area will be increased to 475 feet which will result in the loss of 7 acres of wetland. Dredge spoil will be deposited in the active federal upland diked disposal area at Killcohook, near Pennsville.

The Fish and Wildlife Service (Service) has submitted two planning aid reports to the Corps concerning the Salem River project. Our first report was submitted in September 1986, and presented a general characterization of fish and wildlife resources in the area. Our second report was submitted in August 1987, and presented the results of an interagency fish sampling survey and a reconnaissance of waterfowl/waterbird use in the project area in order to assess fish and wildlife impacts from proposed channel modifications. Copies of these reports were also submitted to the New Jersey Division of Fish, Game and Wildlife.

Since completion of the aforementioned reports, the Corps has requested that the Service evaluate the selected plan to deepen and widen the existing channel. Since this plan involves activities in the lower Salem River and Delaware River, we are coordinating our review closely with the Bureau of Freshwater Fisheries and Bureau of Marine Fisheries. Nevertheless, we would appreciate any comments that you may have in regard to State endangered and threatened or otherwise jeopardized species.

Your written reply would be appreciated since it will be incorporated directly into our Fish and Wildlife Coordination Act Report.

Thank you for your attention to this request.

Sincerely,

Allen C. Jackson

Allen C. Jackson
Fish and Wildlife Biologist

Enclosures

State of New Jersey

DEPARTMENT OF ENVIRONMENTAL PROTECTION

DIVISION OF
SH. GAME AND WILDLIFE
GEORGE P. HOWARD
DIRECTOR

PLEASE REPLY TO:
CN 400
TRENTON, NEW JERSEY 08625

April 26, 1988

Mr. Allen C. Jackson
US Fish and Wildlife Service
P.O. Box 534
705 White Horse Pike
Absecon, NJ 08201

Dear Mr. Jackson:

The Endangered and Nongame Species Program has reviewed the documentation you provided addressing the redeveloping of the Port of Salem. We do not foresee any significant impacts to endangered or threatened species to result from the channel work up to the Route 49 bridge.

However, we do have some concern as to the status of work to be done along the Little Salem River up to the Route 45 crossing. There is a potential for conflicts in this area if the proposed channel widening plan extends up to the Route 45 bridge. If you have any further questions, please contact my office.

Sincerely,

Geo P Howard

George P. Howard
Director

LST:pjf

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Final page of Fish and Wildlife Section 2(b) Report

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Management Division
Habitat Conservation Branch
Sandy Hook Marine Lab
Highlands, New Jersey 07732

January 4, 1989

Mr. Robert L. Callegari, Chief
Planning Division
U. S. Army Corps of Engineers
Custom House- 2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

We have reviewed the Draft Interim Feasibility Report and Environmental Assessment (EA) for the proposed widening of the Salem River in New Jersey. The project is also described in a public notice dated November 29, 1989. In general, the EA adequately describes the important fishery resources and habitats
1 in the project area. To reduce the loss of ecologically valuable wetlands, you should reduce the proposed depth of dredging from -18 feet mean low water (MLW) to -16 feet. Although the wetlands
2 mitigation scheme has yet to be fully described, it does not appear to be adequate.

The proposed 18-foot deep channel would eliminate 7 acres of intertidal emergent wetlands. Because it would be more narrow, a 16-foot deep channel would destroy only 5.5 acres of wetlands. The choice of an 18-foot deep channel is only weakly supported,
3 at best, by the economic rationale presented on pages 101 to 104. Under two of the three scenarios presented (Tables 17 and 19), the 16-foot depth had the highest net economic benefit. Under the third scenario (Table 18), the net economic benefit for the 18-foot depth is more than the 16-foot depth by only $1000 ($474,00 vs. $473,000). Considering the greater loss of wetlands, and the higher dredging and disposal costs at public expense, this hardly seems worthwhile.

4 The Economic Optimization Analysis for the proposed Killcohook Disposal Area showed that while net economic benefits were highest for the 18-foot depth, the benefit/cost ratio was highest for the 16-foot depth. Finally, on page 82, the report states
5 that if dredging is limited to 16 feet, the dredged material could be used for protection of the eroding shoreline at Oakwood Beach. The economic and environmental benefits of using the sand for shore protection, rather than simply dumping it at the disposal area, should be considered in the selection of a dredging plan.

We offer the following comments on the Environmental Assessment:

1. Refer to the responses for comments 3, 4 and 5, provided below.

2. Additional information pertaining to the wetland mitigation plan is provided in the final EA.

3. The selection of an 18 foot channel as the recommended plan is supported by preliminary work conducted and by the cost/benefit data displayed on Table 20. The 18 foot option has the highest annual net benefits which are also $184,000 greater than the 16 foot depth. Tables 21, 22, and 23 of the report are sensitivity analyses reflecting changes in parameters. These risk and uncertainity analyses are worst case scenarios designed to test assumptions. The no fleet shift scenario in Table 21 optimizes at 16 feet. The no tonnage growth scenario in Table 22 optimizes at 18 feet. The cost of mitigation for wetlands is incorporated into Table 20.

4. The National Economic Development plan is based on maximizing net benefits as opposed to maximizing the benefit/cost ratio. The criteria for this approach is further explained under Plan Formulation.

5. The economic and environmental impacts have been evaluated for a scenario whereby materials from stations 8+000 to 13+000 would be placed at Oakwood Beach. Placement of such material would not necessarily contribute to protection of the shoreline due to the high percentage of fine material which would not be retained. Additionally, the sedimentation would have adverse environmental impacts. These points are further discussed in the report under Cycle 2.

A. Aquatic Resources

2.1 Fisheries

6 Paragraph 1 - What are "rare abundances"?

2.2 Benthic Habitat

7 This section should be titled "Benthic Habitat and Resources".

8 Paragraph 1 - Where were the sampling stations located? Where in the document is Table D-9 located?

9 Paragraph 5 - Figure 5 is hard to read. The station numbers should be larger. The data need to be interpreted more carefully. Saying that population size and diversity are "low" without reference to other areas or systems is meaningless. What are the species that are tolerant of organically enriched conditions, and what are the literature citations to support these contentions?

10 Paragraph 8 - "Substantial... seed beds of the American oyster... are located 13 miles downstream." Downstream of where?

2.3 Endangered and Threatened Species

11 Has a Section 7 Consultation been considered or completed for endangered and threatened aquatic species that may occur in the project area?

12 B. Upland and Wetland Habitats

2. Intertidal and Wetland Habitats

Figure 7 - Why is all of Delaware Bay shown as wetlands?

3. Aquatic Ecology

13 This section should list which fishery resources are likely to be affected by the loss of wetlands and nearshore shallows. Please involve NMFS more closely in the development of the wetlands mitigation plan. We do not see how planting *Spartina alterniflora* in an impoundment that is managed for waterfowl can fully compensate for the loss of tidally flushed wetlands. In an impoundment, access by fish and invertebrates that are dependent on wetlands would be limited. The natural export of detritus from the wetlands to the estuarine food web would be reduced or eliminated. Other functions of the wetlands, such as pollutant retention, flood protection and shoreline anchoring, would also be lost. We would prefer to see fully functioning tidal wetlands built somewhere in the river basin itself.

If you would like to discuss these recommendations, please contact Jeff Lockwood at (201) 872-0200, ext. 223.

Sincerely yours,

Stanley W. Gorski

Stanley W. Gorski
Assistant Branch Chief

6. Species found in rare abundance were encountered in small numbers. The term has been modified in the final EA to clarify the sentence.

7. Concur. This change has been made in the final EA.

8. Sampling stations referred to in paragraph 1 are designated PAS 1 through 4 on Figure 5. The reference to Table D-9 in paragraph 1 is in error. The correct Table is D-8. These tables are located in Appendix D of the main report. The above information has been incorporated into the final EA.

9. A clearer copy of Figure 5 has been incorporated into the final EA. The sampling referred to in paragraph 5 consisted of six grab samples taken at 3 locations within the existing Salem Cove dredged material disposal site. A total of 148 individuals representing seven species were identified in these samples. Approximately 2/3 of the individuals were from one species. This limited data was interpreted as low population size and diversity. The species that were collected are listed in Table D-9.

10. American oyster seed beds are located in the Delaware River, 13 miles downstream of Salem Cove. This clarification is made in the final EA.

11. The U.S. Fish and Wildlife Service has indicated that except for occasional transient species, no Federally threatened or endangered species under their jurisdiction are known to occur within the project area. The only possible species under the jurisdiction of the NMFS is the shortnose sturgeon. This species does occur in the Delaware River, but has not been documented in the Salem River. As stated in section V.A.4. of the EA, because there are no known Federally threatened or endangered species within the project area, Section 7 consultation is not required.

12. The Department of the Interior National Wetland Inventory map for the project area lists the Delaware River as estuarine, intertidal flat and estuarine, subtidal open water. Figure 7 has been modified to indicate wetland/aquatic habitat within the project area.

13. Fishery resources likely to be impacted by the loss of wetlands and shallows at the "new cut" are identified in section V.A.3. of the final EA. Additional coordination will be necessary to fully develop the wetlands mitigation plan. The NMFS will be included in this coordination.

cf: EPA, Region II
FWS, Absecon
NJDEP, F,G&W
NJDEP, Coastal Res.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Habitat and Protected
Resources Division
Sandy Hook Laboratory
Highlands, New Jersey 07732

December 28, 1990

Mr. Robert L. Callegari, Chief
Planning Division
U. S. Army Corps of Engineers
Custom House - 2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

1 We have reviewed the Interim Feasibility Report and Final Environmental Assessment (EA) for the proposed widening of the Salem River in New Jersey. In general, the concerns we expressed about the project in our letter dated January 4, 1989 have been
2 addressed. However, we remain concerned that the proposed wetlands mitigation scheme will not compensate for the value of lost tidal wetlands, intertidal habitat, and subtidal shallows to fishery resources.

3 The proposed dredging project would eliminate 7 acres of estuarine emergent wetlands. Unfortunately, the species composition of this wetland community is not adequately described in the EA. Previous conversations with U.S. Fish and Wildlife Service staff indicate that both saltmarsh cordgrass (Spartina alterniflora) and common reed (Phragmites communis) are present. Also, approximately 2.5 acres of estuarine intertidal and estuarine subtidal habitat would also be lost. The amount of each habitat type is not given in the EA.

4 To compensate for these habitat losses, the Philadelphia District proposes to create 7 acres of brackish water wetlands within an existing impoundment in the Supawna Meadows National Wildlife Refuge. However, as we stated in our original letter, we do not see how the proposed mitigation plan will compensate for the loss of intertidal habitat, subtidal shallows, and tidal wetlands that are important to the fishery resources of the Salem River and Delaware Bay. The EA states, "The loss of nearshore shallows and wetlands will adversely affect fish populations dependent on these areas for early growth and feeding".

5 Because water levels within this impoundment are controlled to benefit waterfowl, access by fish and invertebrates that are dependent on wetlands would be limited. Also, the natural export of detritus from the wetlands to the estuarine food web would be reduced or eliminated. Other functions of the wetlands, such as nutrient retention and shoreline anchoring, would also be

1. No response necessary.

2. Refer to responses provided below.

3. Approximately seven acres of estuarine emergent wetlands would be lost by widening the existing Salem River navigation channel through the cutoff area. In addition, estuarine intertidal and estuarine subtidal habitat would also be impacted through channel modification. These habitat types are defined as areas located between +3 feet and -10 feet at mean low water. Based on available survey data, the slope of the new channel side is projected to approximate the slope of the existing channel side. This would result in the creation of an equivalent amount of bottom surface as currently exists. Because sediment type and depth would be similar before and after channel modification, the recreated shallow water habitat is expected to be similar to the existing shallows. This information has been included in the EA.

4. In their March 1989 Fish and Wildlife Coordination Act Section 2(b) report, the U.S. Fish and Wildlife Service (Service) indicated that the river bank is steep in this area, and bordered by dense stands of common reed. Based on their evaluations, the Service classified the seven acres of wetlands as Category III habitat in accordance with the Fish and Wildlife Service Mitigation Policy (Federal Register Vol. 46, No. 15, January 23, 1981). Category III habitat is defined as habitat of high to medium value for fish or wildlife species that is relatively abundant on a National or State basis. According to the Service's mitigation policy, Category III habitat losses must be replaced either in-kind or out-of-kind with no net loss of habitat value and as near to the impacted site as possible.

5. The proposed wetland mitigation plan was selected with the assistance of the U.S. Fish and Wildlife Service, the Supawna Meadows Wildlife Refuge Manager and the New Jersey Department of Environmental Protection, Division of Coastal Resources. A review of other potential sites led to a determination that the proposed site would provide the best habitat value replacement, would minimize loss of habitat value at the mitigation site, is reasonably close to the impact area, and is cost effective. While not providing total in-kind habitat replacement, the proposed mitigation plan is consistent with both U.S. Fish and Wildlife Service and Corps of Engineers objectives, and will be retained.

nutrient retention and shoreline anchoring, would also be lost or altered.

6 We recommend that you develop a new mitigation plan that would benefit both waterfowl and fishery resources. We suggest some combination of tidal wetland creation and enhancement of areas dominated by common reed of sufficient acreage to compensate for losses of tidal wetlands, intertidal habitat, and subtidal shallows.

7 Thank you for the opportunity to comment on this project. We may provide additional comments as details of the mitigation plan are presented to us for our review. You will also receive a letter from our Regional Office in Gloucester, Massachusetts concerning a consultation under Section 7 of the Endangered Species Act. If you would like to discuss these recommendations, please contact Jeff Lockwood at (908) 872-3023.

Sincerely yours,

Stanley W. Gorski

Stanley W. Gorski
Assistant Division Chief

6. Additional studies will be necessary during the Preconstruction, Engineering and Design phase of this project. These studies will include a more detailed survey of the existing topography through the cutoff area, confirmation of channel size based on updated economic data, and additional coordination to finalize the details of the mitigation plan. This information will be coordinated with the NMFS as it becomes available.

7. No response necessary.

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Region
One Blackburn Drive
Gloucester, MA 01930

JAN 16 1991

Robert L. Callegari
Chief, Planning Division
Corps of Engineers
Custom House - 2 D & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

1 This is in response to your letter of December 5, 1990 requesting informal consultation, pursuant to Section 7 of the Endangered Species Act of 1973, as amended, (ESA), regarding the Delaware River Comprehensive Navigation Study, Salem River navigation project and the Federally endangered shortnose sturgeon (Acipenser brevirostrum). We concur with your determination that this project is not likely to adversely affect the shortnose sturgeon. Therefore, further consultation under Section 7 (a) (2) of the ESA is not required at this time. Should project plans change or new information become available that changes the basis for this determination, then consultation should be reinitiated.

2 However, please be advised that federal agencies are further mandated in Section 7 (a) (1) of the ESA to "in consultation with and with the assistance of the Secretary, utilize their authorities in furtherance of the purposes of this Act by carrying out programs for the conservation of endangered and threatened species." Towards this end, we have several suggestions that would strengthen the Corps of Engineers shortnose sturgeon conservation programs in the project area.

3 The Salem River project would widen and deepen the existing authorized channel, widen the bends, expand the turning basin opposite the Port of Salem berthing area, and realign the channel at Sinnickmons Landing. The current project is four miles long and extends downstream from the New Jersey Route 49 bridge at the City of Salem, to Elsinboro Point at the southwest corner of Salem Cove in the Delaware River. It is expected that 1,267,000 cubic yards of material will be removed during initial construction. Maintenance dredging requirements are estimated at 61,700 cubic yards of material, once every three years. All dredged material disposal will occur at the Federal upland diked disposal area at Killcohook. All dredging will be conducted with hydraulic dredging techniques.

1. No response required.

2. No response required.

3. No response required.

4 The Delaware River supports a population of shortnose sturgeon whose distribution extends from Trenton to Artificial Island. This project, located at the confluence of the Salem and Delaware Rivers, is in close proximity to shortnose sturgeon estuarine foraging habitat. Because hydraulic dredging causes a minimum of disturbance to sediments, alteration of habitat from turbidity is not expected. Indeed, studies have suggested that the effects of river channel deepening may ultimately enhance shortnose sturgeon habitat. However, hydraulic dredging, by virtue of its strong suctioning action, poses a threat of physically harming individual animals, especially benthic dwellers such as the shortnose sturgeon. The majority of the adult shortnose sturgeon population is believed to overwinter in the lower estuary from September to February. Although studies showed that adult fish can avoid dredging activity, work in the Connecticut River indicates that sturgeon become sedentary when water temperatures fall below 10 degrees Centigrade.

5 To provide a stronger conservation approach to dredge management
regarding shortnose sturgeon, dredging activities should be
limited to the spring and summer (March to August) when adults
are more active and are more likely to have migrated to the upper
6 estuary. Because there is a lack of data on shortnose sturgeon
movements in the Delaware River estuary below Philadelphia, we
also encourage the Corps of Engineers to sponsor or support such
studies for the purposes of evaluating Corps activities in the
area.

If you have any questions please contact Linda Shaw of my staff at (508) 281-9251.

Sincerely,

Richard B. Roe

Richard B. Roe
Regional Director

4. No response required.

5. This time frame will be considered during preparation of plans and specifications for the project.

6. We have studied the impact of Corps' activities on the shortnose sturgeon in the past, and will continue to consider the species in future planning efforts.

ENVIRONMENTAL PROTECTION AGENCY
Regional Office II
Federal Building
26 Federal Plaza
New York, New York

DEC 12 1990

Donald A. Banastek, Director
Washington Level Review Center
ATTN: CEWRC-WLR-I
Kingman Building
Fort Belvoir, Virginia 22060-5576

Dear Mr. Banastek:

1 The Environmental Protection Agency has reviewed the interim feasibility report and environmental assessment (EA) for the Salem River Federal Navigation Project, located in western Salem County, New Jersey. Based on our review, we have the following comments.

2 The existing authorized channel is currently 150 feet wide by 12 feet deep at Salem Cove, narrowing to 100 feet wide at Sinnicksons Landing. The present channel is four miles long. The proposed project consists of deepening the authorized channel to a depth of 18 feet and a width of 180 feet, which would include widening at bends and an expanded turning basin. Approximately 1,267,000 cubic yards of material would be removed by hydraulic pipeline dredge from the project area during initial construction with annual maintenance dredging requirements estimated at 61,700 cubic yards. All dredged material would be placed in the existing, active, federally owned Killcohook site located approximately 3 miles from the mouth of the Salem River.

3 According to the EA, a number of alternative channel designs, varying the channel depth and width were considered. However, the EA does not provide any analysis of why the 18 feet depth and 180 feet width were selected as the preferred alternative. If an alternative incorporating a shallower channel depth had been selected, the amount of dredging would be decreased as would the amount of wetlands impacted by the dredging. Until a channel of shallower depth is shown to be impracticable, EPA recommends that in order to minimize the project's adverse impacts the channel depth be limited to the 16 feet mean low water alternative that is identified into EA.

4 Implementation of the proposed plan would result in the loss of seven acres of intertidal emergent wetlands. In order to compensate for the loss of these areas, seven acres of brackish emergent non-tidal wetlands along the fringe of a shallow water impoundment within the Supawna Meadow National Wildlife Refuge

A23e

1. No response required.

2. No response required.

3. Corps' planning regulations require selection of the alternative plan that maximizes net national economic development benefits, and is consistent with protecting the Nation's environment. Table 20 in the main report presents the economic optimization analysis prepared for the Salem River project. This table indicates that the highest annual net benefits, $1,892,000, would result from an 18-foot project. Annual net benefits associated with a 16-foot project would only be $1,708,000. The selected plan of improvement minimizes project impacts by limiting the channel size to the most efficient, as defined by the annual net benefits, by using hydraulic dredging equipment and upland disposal of dredged material, and by fully mitigating wetland losses by constructing an equal amount of wetlands on adjacent Fish and Wildlife Service property. As such, the proposed 18-foot project is consistent with protecting the environment, and qualifies as the National Economic Development Plan. The appropriate design width for a channel 16 feet deep at mlw is 170 feet, or 10 feet less than the 18-foot alternative. Construction of the 16-foot alternative would result in the loss of approximately 5 2/3 acres of wetlands along the cut-off. While the 18-foot alternative results in the loss of an additional 1 1/3 acres of existing wetlands, wetland creation on a 1:1 basis is acceptable for mitigating this additional impact.

4. The wetland mitigation plan was developed with the assistance of the U.S. Fish and Wildlife Service. The Service classified the existing wetlands as Category III habitat, relative to their 1981 mitigation policy. Category III habitat can be mitigated out-of-kind with no net loss of habitat value. Wetlands in the vicinity of the Salem River are extremely important to waterfowl migrating along the Atlantic Flyway. As such, the mitigation effort focused on replacing lost waterfowl habitat value. The proposed plan was determined to be the most efficient, cost effective means of achieving that goal.

would be constructed. Typically, EPA requires in-kind value for value replacement for the loss of wetlands. While the proposed mitigation plan will replace seven acres of wetlands and their waterfowl habitat, other functions provided by tidal wetlands would be lost. For example, the function of water quality enhancement by providing stormwater, sediment, and toxic retention would not be compensated for under the current plan. Additionally, detrital input would be lost. Accordingly, EPA recommends that in-kind, value for value replacement of tidal wetlands be incorporated into the mitigation plan.

5 The EA maintains that the New Jersey Coastal Plain Aquifer has not been designated a sole source aquifer. This is inaccurate, the Aquifer has been so designated. The EA should amended accordingly. Although, the EA documents that the proposed project would have minimal impact on the aquifer, it has not addressed potential cumulative and secondary impacts of the project (i.e., impacts associated with over pumping of ground water and urbanization). Additional information with respect to this issue should be presented as required under Section 1424(e) of the Safe Drinking Water Act.

Thank you for the opportunity to comment. If you have any questions concerning these comments, please have Ms. Vicki Snitzler Neeck of my staff contacted at (212) 264-6677.

Sincerely yours,

John Filippelli, Chief
Federal Activities Section
Environmental Impacts Branch

cc: R. Callegari ACN-PA

5. Concur. The Raritan-Magothy aquifer has been designated a sole source aquifer within the New Jersey Coastal Plain region. This aquifer contributes significantly to potable water supplies. Within the Salem River project area, the Raritan-Magothy is overlain by the Merchantville Formation, the Woodbury Clay, the Marshalltown Formation and the Wenonah and Mount Laurel Formation. The Wenonah-Mount Laurel outcrops within the project area. The Woodbury Clay and the underlying Merchantville Formation serve as the confining layer for the Magothy Raritan Formation. Drillers commonly report the Woodbury Clay in Salem County as a black, blue or olive-gray clay and occasionally indicate the presence of coarse-grained sand, yellow pebbles, mica and hard dark clay or hardpan. The presence of this aquiclude between the Wenonah and Mount Laurel aquifer and the Raritan Magothy aquifer is sufficient to prevent exchange of water between the aquifers.

Impacts to groundwater quality can also result from the disposal of dredged material in confined upland disposal sites. Brackish water or contaminants can leach into the underlying aquifer and degrade water quality. This is more of a concern in new disposal sites as the placement of fine grained dredged material acts as a groundwater protection blanket, effectively sealing the site as it consolidates. As successive lifts of material are placed into a site and dewatered, the ability of water to percolate through the material and into the underlying aquifer is reduced. The Killcohook dredged material disposal site has been in use for many years, and is entirely blanketed with approximately 10 to 20 feet of dredged material. As such, the continued disposal of dredged material at this site is not expected to have any adverse impacts on the quality of groundwater. As with the Salem River channel, the Woodbury Clay and Merchantville Formations are situated between the Killcohook dredged material disposal site and the Raritan Magothy Formation. The presence of these layers also provide adequate protection against saltwater infiltration to the Raritan Magothy. The above information will be incorporated into the EA.

United States Department of the Interior

NATIONAL PARK SERVICE

MID-ATLANTIC REGION
143 SOUTH THIRD STREET
PHILADELPHIA, PA. 19106

TAKE PRIDE IN AMERICA

IN REPLY REFER TO:

L7423(MAR-PD)
Salem River, NJ (NRI)

JAN 18 1989

District Engineer
Project Planning Branch
U.S. Army Corps of Engineers
Custom House
2nd and Chestnut Streets
Philadelphia, PA 19106

Dear Sir:

1 Thank you for requesting our comments on the Comprehensive Navigation Study for the Salem River, New Jersey. The U.S. Army Corps of Engineers proposes to enlarge the navigational channel in the Salem River immediately downstream from a section of the river that has been identified on the Nationwide Rivers Inventory (NRI) as a potential candidate for inclusion in the National Wild and Scenic Rivers System. The Salem River, from Salem to 2 miles upstream from Courses Landing, is recognized on the NRI due to its freeflowing, relatively undeveloped nature and its outstandingly remarkable natural and cultural resources.

2 The Council on Environmental Quality has issued guidelines that require all federal agencies tc avoid or mitigate any adverse impacts to rivers that are potential candidates for inclusion in the National Wild and Scenic River System. Adverse impacts are defined as actions which could diminish the free-flowing, undeveloped characteristics, or the outstandingly remarkable values of the river. Such activities could jeopardize the river segment's ability to meet the eligibility and classification criteria for inclusion in the national system. The CEQ guidelines prescribe that an environmental impact statement must be prepared if a proposal could have a significant adverse effect on the outstanding resources of a candidate river.

3 In general, the responsible agencies have made a conscientious effort to evaluate and mitigate the environmental impacts associated with this project. Contingent upon the U.S. Fish and Wildlife Service's approval of a mitigation plan to replace lost wetland functions, we are satisfied that the project will not significantly impact the area's outstanding resources. However, we would like to emphasize that any impacts to the Salem River

1. No response required.

2. No response required.

3. The U.S. Fish and Wildlife Service provides recommendations to the Corps, but is not responsible for approving the mitigation plan. Coordination will continue with the Fish and Wildlife Service and the National Park Service to insure that all concerns are addressed.

upstream of the proposed project site would not be consistent with the river's status as potential National Wild and Scenic River. All dredging activities should be restricted to the area
4 downstream of the Penns Neck Bridge (Rte. 49), and steps should be taken to ensure that the project design does not foster increased commercial traffic in the upstream areas. The existing
5 and proposed dryland transportation facilities should be evaluated to assess their ability to handle the increase in shipping traffic without impacting the upstream river corridor. If a significant increase in upstream traffic is expected, restriction or regulation of commercial access to the river above Penns Neck Bridge should be considered. As a final comment, we
6 would like to encourage the Corps of Engineers to evaluate the potential recreational use of this area and to consider alternatives for providing public access to the Salem River within the project site.

If you have any further questions, please contact Alan Ragins at (215) 597-6486.

Sincerely,

DM R. Lee for

J. Glenn Eugster, Chief
Division of Park and Resource Planning

Enclosure

4. The proposed plan of improvement does not include any dredging activities upstream of the Route 49 bridge.

5. The landside transportation facilities have been evaluated. As noted in the Main Report, the Little Salem River was deauthorized from the 12 foot depth under Title X of the Water Resources Development Act of 1986.

6. Recreational access to the river is not a component of this project. There are two existing marinas along the natural course of the Salem River in the vicinity of the project which provide recreational access to the river.

DELAWARE RIVER BASIN COMMISSION
P.O. BOX 7360
WEST TRENTON, NEW JERSEY 08628
(609) 883-9500

GERALD M. HANSLER
EXECUTIVE DIRECTOR

HEADQUARTERS LOCATION
25 STATE POLICE DRIVE
WEST TRENTON, N.J.

December 23, 1988

Mr. Robert L. Callegari
Chief, Planning Division
Department of the Army
Philadelphia District, Corps of Engineers
Custom House - 2 D & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

The Delaware River Basin Commission (DRBC) staff has received copies of the Delaware River Comprehensive Navigation draft Interim Feasibility Report and Environmental Assessment for Salem River, New Jersey.

At this stage, we see no apparent negative impacts in this effort to encourage efficient and logical development of the Salem River estuary:

1 - Since the Salem River is believed to be a discharge aréa for the Mount Laurel/Winonah (MLW) aquifer, and the City of Salem has abandoned the regular use of the MLW wells in favor of its two surface sources, the tentative selected plan for dredging in the Salem River should not cause salt water intrusion into the MLW aquifer.

2 - Concerning aquatic biota, the U. S. Army Corps of Engineers' findings of no significant impact appear reasonable.

3 - There appears to be a minor difference between the two reports concerning estimated impacts in the "shallows" resulting from project implementation. In the TECHNICAL APPENDICES DRAFT report, 5 acres of shallows is listed; in the ENVIRONMENTAL ASSESSMENT DRAFT report, 2.5 acres of estuarine intertidal and estuarine subtidal habitat is listed.

1. No response required.

2. No response required.

3. The correct acreage of shallows to be impacted is 2.5 acres.

Mr. Robert L. Callegari 2

4 – The 16-foot deep channel has a more favorable cost/benefit ratio than the 18-foot deep channel and would affect 2 less acres of wetlands.

As this project develops, we anticipate DRBC project review as defined in Section 2-3.5 (b)(5) of the DRBC Rules of Practice and Procedure. We are pleased to have the opportunity to review and comment on the draft reports at this time.

Sincerely,

G. M. Hansler

Gerald M. Hansler

cc: Honorable Donald P. Hodel

4. The highest net benefit is gained with an 18 foot scenario. The highest net benefit is the criteria to determine the National Economic Development Plan, as opposed to the highest benefit/cost ratio. The cost of mitigation for wetlands is factored into the benefit/cost information.

THE DELAWARE RIVER AND BAY AUTHORITY

DELAWARE MEMORIAL BRIDGE
POST OFFICE BOX 71
NEW CASTLE, DELAWARE 19720
302-571-6303
FAX: (302) 571-6367

POST OFFICE BOX 71
NEW CASTLE, DELAWARE 19720
302-571-6303
FAX: (302) 571-6367

CAPE MAY - LEWES FERRY
POST OFFICE BOX 827
CAPE MAY, NEW JERSEY 08204
609-886-9699
FAX: (609) 886-1021

December 21, 1988

Department of the Army
Philadelphia District, Corps of Engineers
Attention: Robert L. Callegari, Chief, Planning Division
Custom House - 2 D & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

Your November 29, 1988 letter and the accompanying copy of the Delaware River Comprehensive Navigation Study draft Interim Feasibility Report and Environmental Assessment for Salem River is acknowledged. The following comments relate to the contents.

1. It would be perhaps appropriate to comment to the mid-stream transfer of material loaded at the Port of Salem and occasional topping off of vessels too large to transit Salem River within the boundaries of the State of Delaware. (page 9, paragraph 11)

2. It would be perhaps appropriate to comment on the contract conditions between the Salem Port Authority and Horizon Shipping and Trading Inc. as of this date. (page 14, paragraph 14)

3. Paragraph 68 and 69, page 45, should be reviewed under the terms of the present contract between the Port of Salem and the other interested individuals.

4. Paragraph 92, page 58, relates to the Delaware River and Bay Authority. Legislation has been introduced in 1988 and is expected

1. These activities are expected to continue.

2. Horizon Shipping and Trading Inc. is no longer operating out of the Port. Salém Marine Terminal is leasing the warehouse previously occupied by Horizon.

3. The lease agreements have changed since the draft report. The Interim Feasibility Report reflects new agreements.

4. As of this time, the State of New Jersey has not yet passed the legislation which would enable the authority to engage in more extensive economic development. The referenced sentence has been deleted.

to be introduced in 1989 to expand the role of the Authority. Proposed legislation would permit the Authority to engage in economic development activities. In the last sentence of paragraph 92, much is made of the funding of a consultant/director position at the Salem Port Authority. At the present time, the Authority's role involves a feasibility report concerning the Salem Port Authority co-sponsored by the Authority funding, E.D.A. funds and the Salem Port Authority. The feasibility study should be concluded by 1989.

5. Delaware River and Bay Authority has no comments concerning the environmental assessment report.

Very truly yours,

William J. Miller, Jr.
Executive Director

WJM:es

5. No response necessary.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
OFFICE OF THE COMMISSIONER
CN 402
TRENTON, N J 08625
609-292-2885

March 17, 1989

Mr. Robert L. Callegari
Chief, Planning Division
Philadelphia District
U.S. Army Corps of Engineers
2nd and Chestnut Streets
Philadelphia, PA 19106

RE: Salem River - EA

Dear Mr. Callegari:

The Office of Program Coordination of the New Jersey Department of Environmental Protection has completed its review of the Draft Interim Feasibility Report and Environmental Assessment for the Salem River. We offer the following comments for your consideration. Additional comments regarding Coastal Zone Consistency will be forwarded to you shortly from the Department's Division of Coastal Resources.

1 The Draft Environmental Assessment addresses most of the environmental issues. However, the potential mitigation site in the Supawna Meadows National Wildlife Refuge should be studied more closely. We understand that the area mentioned is not open to tide. Some provision for tidal flooding would have to be made if this site is chosen as the mitigation site.

2 The results of the sensitivity tests performed by the Corps (see Tables 16, 17, and 18) show an optimal channel depth of 16' in two out of three cases. In Table 18, which shows an optimal depth of 18', the project net benefit is only $1,000 more at 18' than at 16'. Table 17 shows a $99,000 greater project net benefit at 16' than at 18', while Table 19 shows a $160,000 greater project net benefit for the 16' depth. The 16' deep x 170' wide channel configuration would also result in 427,100 cubic yards less initial dredging and 11,100 cubic yards less maintenance dredging per year. The Final Environmental Assessment should further address why the Corps chose the 18' deep by 180' wide configuration.

100% Recycled

1. The proposed wetland mitigation site was selected with the assistance of personnel from the U.S. Fish and Wildlife Service and the NJDEP Division of Coastal Resources. The site was selected because it is adjacent to a shallow water impoundment that is managed by the Service for waterfowl. Placement of wetlands at this location would increase the habitat value for waterfowl, and would provide acceptable mitigation for project losses. Additional coordination will be required with regard to this mitigation plan. The NJDEP will be included in this coordination.

2. The sensitivity test on Tables 21, 22 and 23 of the final report are based on assumptions regarding no net gains in tonnage and no fleet changes. The sensitivity tests in the Interim Feasibility Report reflect a significant differential between the optimization of the 16 and 18 foot scenarios. The selected plan is based on the depth with the highest net benefits as explained in the report under Plan Formulation, Economic Criteria.

3 The Salem River area has experienced a yearly increase in bald eagle use around the Mannington Meadow. This region has become an important resting and feeding area for wintering eagles. During 1987 and 1988 bald eagles attempted to nest in the Mannington Creek area. A successful nesting is expected during 1989. To minimize possible disturbance to the birds, we recommend a time restriction be set to avoid dredging or improvement work between January and March. An additional restriction from March until June 15th is recommended to protect spawning anadromous fish.

Thank you for giving the New Jersey Department of Environmental Protection the opportunity to review the Draft Environmental Assessment. We hope that our comments will help you during the preparation of the final document, and during the selection of an environmentally sound course of action.

Sincerely,

Lawrence Schmidt
Director
Office of Program Coordination

3. Because of the commercial activity already occurring on the Salem River, it is unlikely that an operating dredge would significantly disturb bald eagles in the area. If eagles are nesting in the project area during a proposed dredging period, the Corps will consult with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act. The Corps currently restricts bucket dredging and/or overboard disposal in the Salem River between March 1 and May 31, and September 1 and November 30 to protect anadromous fish. This restriction will be maintained for the proposed project.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
TRENTON

DIVISION OF COASTAL RESOURCES

September 19, 1989

PLEASE ADDRESS REPLY TO:
CN 401
TRENTON, N.J. 08625

Mr. Robert L. Callegari
Chief, Planning Division
Environmental Resources Branch
Philadelphia District, Corps of Engineers
Custom House-2 D & Chestnut Streets
Philadelphia, Pa. 19106-2991

RE: Federal Consistency (FC-89-3)
Interim Feasibility Report and Environmental
Assessment for the Salem River

Dear Mr. Callegari:

1 The Department of Environmental Protection, Division of Coastal Resources, acting pursuant to Section 307 of the Federal Coastal Zone Management Act of 1972 and Section 401 of the Federal Clean Water Act has determined that the above referenced project would be conditionally acceptable with the New Jersey Coastal Management Program, provided that the issues outlined below are addressed in the Final Environmental Assessment.

2 Also, the Division concurs with the recommendations made by Office of Program Coordination. These recommendations were stated in a letter dated March 17, 1989. The following comments are to be addressed in the Final Environmental Assessment:

3 The results of the sensitivity tests performed by the Corps (Tables 16, 17, & 18) show an optimal channel depth of 16' in 2 out of 3 cases. In Table 18, which shows an optimal depth of 18', the project net benefit is only $1,000.00 more at 18' than at 16'. Table 17 shows a $99,000.00 greater project net benefit at 16' than at 18', while Table 19 shows a $160,000.00 greater project net benefit for the 16' depth. The 16' deep x 170' wide channel configuration would also result in 427,100 cubic yards less and 11,100 cubic yards less maintenance dredging per year.

1. No response required.

2. The referenced letter precedes this letter.

3. The sensitivity test on Tables 21, 22 and 23 of the final report are based on assumptions regarding no net gains in tonnage and no fleet changes. The sensitivity tests in the Interim Feasibility Report reflect a significant differential between the optimization of the 16 and 18 foot scenarios. The selected plan is based on the depth with the highest net benefits as explained in the report under Plan Formulation, Economic Criteria.

In view of this data, the Corps is advised to select the 16' deep x 170' wide project dimension or provide additional justification for selecting the 18' deep x 180' wide project dimension.

4 The region surrounding Mannington Meadow has become an important resting and feeding area for wintering bald eagles. During the 1987 and 1988 season bald eagles attempted to nest in the Mannington Creek area. To minimize possible disturbance to the birds, the Division recommends a time restriction be set to avoid dredging or improvement work between January and March. An additional restriction from March through June 15 is recommended to protect spawning anadromous fish.

Thank you for your attention and cooperation with the New Jersey Coastal Management Program.

Sincerely,

John R. Weingart, Director
Division of Coastal Resources

c: Lawrence Schmidt, Office of Program Coordination
Robert Tudor

4. Because of the commercial activity already occurring on the Salem River, it is unlikely that an operating dredge would significantly disturb bald eagles in the area. If eagles are nesting in the project area during a proposed dredging period, the Corps will consult with the U.S. Fish and Wildlife Service as required under Section 7 of the Endangered Species Act. The Corps currently restricts bucket dredging and/or overboard disposal in the Salem River between March 1 and May 31, and September 1 and November 30 to protect anadromous fish. This restriction will be maintained for the proposed project.

STATE OF NEW JERSEY
DEPARTMENT OF COMMUNITY AFFAIRS
DIVISION OF LOCAL GOVERNMENT SERVICES
WILLIAM ASHBY COMMUNITY AFFAIRS BUILDING
101 SOUTH BROAD STREET - CN 803
TRENTON, N. J. 08625-0803

THOMAS H. KEAN
GOVERNOR

ANTHONY M. VILLANE JR., D.D.S.
COMMISSIONER

December 7, 1988

Barbara Stratton
US Dept of the Army
Philadelphia District Corps of Engineers
Project Planning Branch
2nd & Chestnut Sts - Custom House
Philadelphia PA 19106-2991

RE: STATE APPLICATION IDENTIFIER: NJ 88-9036

FEDERAL PROGRAM: Navigation Projects

PROJECT: Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environ. Assessment for Salem River

Dear Ms. Stratton :

1 This will acknowledge the receipt for review by the State Review Process of the above identified proposed Direct Federal Development Activity pursuant to Presidential Executive Order 12372 and implementing Federal rules. Accordingly, a sixty (60) day review period has been assigned to this project. Comments will be forwarded to you by our office at the close of the review period.

Should you have any questions, please do not hesitate to contact us at (609) 292-9025.

Sincerely,

Nelson S. Silver, P.P.
Administrator
Intergovernmental Review and
Assistance Unit

for the Single Point of Contact
NEW JERSEY STATE REVIEW PROCESS

cc: Robert L. Callegari, Planning Div Chief

1. No response required.

STATE OF NEW JERSEY
DEPARTMENT OF COMMUNITY AFFAIRS
DIVISION OF LOCAL GOVERNMENT SERVICES
WILLIAM ASHBY COMMUNITY AFFAIRS BUILDING
101 SOUTH BROAD STREET - CN 803
TRENTON, N. J. 08625-0803

THOMAS H. KEAN
GOVERNOR

ANTHONY M. VILLANE JR., D.D.S.
COMMISSIONER

December 7, 1988

STATE REVIEW PROCESS - REVIEW OF DIRECT FEDERAL DEVELOPMENT ACTIVITY

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1 As a potentially affected party, the enclosed information regarding a Federal Direct Development Activity is being forwarded for your review and comment pursuant to Presidential Executive Order 12372 and the rules of the New Jersey State Review Process (NJAC 5:38). Questions and requests for additional information should be directed to the applicant Federal agency identified below.

---

1. STATE APPLICATION IDENTIFIER (SAI):
NJ 88-9036

2. APPLICANT:

US Dept of the Army
Philadelphia District Corps of Engineers
Project Planning Branch
2nd & Chestnut Sts - Custom House
Philadelphia PA 19106-2991

CONTACT PERSON:

Barbara Stratton
(215) 597 - 5957 EXT.

3. PROJECT INFORMATION:

- Federal Program Name -
Navigation Projects

- Project Name -
Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environ. Assessment for Salem River

4. REVIEW COMMENT DEADLINE: 01/15/89 : Any review comments must be received by the Intergovernmental Review and Assistance Unit on or before this deadline, be submitted on the enclosed form, and be mailed directly to: State Review Process, Division of Local Government Services, CN 803, Trenton, NJ 08625-0803. PHONE: (609) 292-9025.

5. A COPY OF THIS NOTICE HAS BEEN SENT TO THESE REVIEWING AGENCIES:

County of Salem
NJ Dept of Defense
NJ Dept of Environ. Protection
NJ Dept of Transportation
Wil. Met. Area Planning Comm.
Mayor of Elsinboro
Mayor of Mannington
Mayor of Pennsville
Mayor of Salem City

Nelson S. Silver, P.P.
Administrator
Intergovernmental Review and Assistance Unit
for the Single Point of Contact
NEW JERSEY STATE REVIEW PROCESS

NEW JERSEY IS AN EQUAL OPPORTUNITY EMPLOYER   88-9036-0704-8100

1. No response required.

THOMAS H. KEAN
GOVERNOR

STATE OF NEW JERSEY
DEPARTMENT OF COMMUNITY AFFAIRS
DIVISION OF LOCAL GOVERNMENT SERVICES
WILLIAM ASHBY COMMUNITY AFFAIRS BUILDING
101 SOUTH BROAD STREET – CN 803
TRENTON, N. J. 08625-0803

ANTHONY M. VILLANE JR., D.D.S.
COMMISSIONER

January 26, 1989

Ms. Barbara Stratton
Philadelphia District Corps of Engineers
Project Planning Branch
2nd & Chestnut Sts - Custom House
Philadelphia PA 19106-2991

NOTICE OF COMPLETION OF INTERGOVERNMENTAL REVIEW REQUIREMENT

FEDERAL PROGRAM: Navigation Projects
CFDA NUMBER: 12.107
APPLICANT: US Dept of the Army
Philadelphia District Corps of Engineers
PROJECT: Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environ. Assessment for Salem River
FUNDS REQUESTED: $8,725,000

SAI NUMBER: NJ 88-9036

Pursuant to the system developed in New Jersey for the intergovernmental review of applications for Federal financial assistance and Federal Direct Development Activities, the above referenced project has been submitted to the New Jersey State Review Process for review.

Comments were received from (1) the Salem County Planning Board, (2) the Mayor of Mannington Township and (3) the Mayor of Pennsville. Copies of these comments are transmitted herewith.

1 The Mayor of Mannington in a comment received 01/13/89 recommends that the proposed activity be APPROVED WITH CONDITIONS. The Condition is the lifting of the deauthorization of the Little Salem River. The deauthorization of the Little Salem River is pursuant to Title X of the Water Resources Act of 1986. The Corps should explain the rationale for this action to the Mayor.

/C O N T I N U E D/

1. **The letter of comment prepared by the Mayor of Mannington is included in this section. Refer to that letter for responses to his concerns.**

2 The Mayor of Pennsville in a comment received 01/19/89 raises questions about the disposal of fill material and drainage. While the details provided by the Township are sketchy at best, we believe that the Corps should address the Township's concerns in a reasonable fashion.

Should you have any questions, please do not hesitate to contact us (609) 292-9025.

Sincerely,

Nelson S. Silver, P.P.
Administrator
Intergovernmental Review and
Assistance Unit

for the Single Point of Contact
NEW JERSEY STATE REVIEW PROCESS

Attachment(s)
C: Applicant w/attachments
Barry Skokowski, SPOC
Governor's Office, Bureau of Policy and Planning
Reviewing Agency(s)

2. The letter of comment prepared by the Mayor of Pennsville is included in this section. Refer to that letter for responses to his concerns.

RECEIVED DEC 9 1988

NEW JERSEY STATE REVIEW PROCESS

REVIEWING AGENCY COMMENT LETTER

1 STATE APPLICATION IDENTIFIER: NJ 88-9036 COMMENT DEADLINE: 01/15/89
NAME OF APPLICANT: US Dept of the Army
Philadelphia District Corps of Engineers

CFDA NUMBER: 12.107 FEDERAL FUNDS REQUESTED: $ 8,725,000
FEDERAL PROGRAM: Navigation Projects
PROJECT NAME: Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environ. Assessment for Salem River

Pursuant to the requirements of the State's process for the intergovernmental review of applications for Federal financial assistance and Federal Direct Development Activities, the application or activity identified above has been reviewed as required by the New Jersey State Review Process. Our specific recommendation to the State's Single Point of Contact is that this proposal be:

✓ Approved.
___ Approved with conditions. *
___ Disapproved. *

* A recommendation that this proposal be 'Approved with conditions' or 'Disapproved' MUST be supported with written documentation describing the rationale for the recommended course of action. This documentation must be attached to this form.

REVIEWING AGENCY IDENTIFICATION

[This section must be completed by the Reviewing Agency]

Should you have any questions regarding these comments, please contact:

Name: Fred W. LaBastille
Title: Director
Organizational Unit/
Department & Division: Planning Board
(County Reviewing Agencies Only: COUNTY OF Salem)
Address: Salem County Offices
96-98 Market Street
Salem, NJ 08079
Telephone Number: (609) 935-7510 ext. 412

Fred W. LaBastille / 12/9/88
(12) Signature Date

cc: STATE REVIEW PROCESS, Division of Local Government Services, CN 803, Trenton, NJ 08625-0803

RACL: 12/07/88 - 677

1. No response required.

N E W   J E R S E Y   S T A T E   R E V I E W   P R O C E S S

REVIEWING AGENCY COMMENT LETTER

1 STATE APPLICATION IDENTIFIER: NJ 88-9036 COMMENT DEADLINE: 01/15/89
NAME OF APPLICANT: US Dept of the Army
Philadelphia District Corps of Engineers

CFDA NUMBER: 12.107 FEDERAL FUNDS REQUESTED: $ 8,725,000
FEDERAL PROGRAM: Navigation Projects
PROJECT NAME: Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environ. Assessment for Salem River

Pursuant to the requirements of the State's process for the intergovernmental review of applications for Federal financial assistance and Federal Direct Development Activities, the application or activity identified above has been reviewed as required by the New Jersey State Review Process. Our specific recommendation to the State's Single Point of Contact is that this proposal be:

____ Approved.
__X__ Approved with conditions. *
____ Disapproved. *

* A recommendation that this proposal be 'Approved with conditions' or 'Disapproved' MUST be supported with written documentation describing the rationale for the recommended course of action. This documentation must be attached to this form.

R E V I E W I N G   A G E N C Y   I D E N T I F I C A T I O N

[This section must be completed by the Reviewing Agency]

Should you have any questions regarding these comments, please contact:

Name: William C. Hancock, Jr.
Title: Mayor
Organizational Unit/ Department & Division: Township of Mannington
(County Reviewing Agencies Only: COUNTY OF
Address: R.D.#1, Box 129
Salem, NJ 08079

RECEIVED
JAN 12 1989
NJ State Review Process

Telephone Number: (609) 935-2359

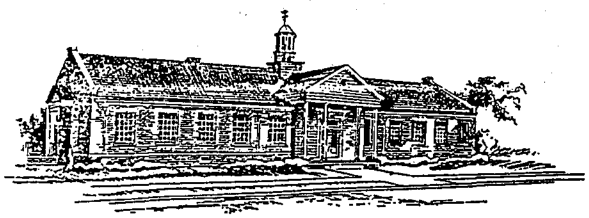
(12) Signature / 1/12/89 Date

cc: STATE REVIEW PROCESS, Division of Local Government Services, CN 803, Trenton, NJ 08625-0803

RACL: 12/07/88 - 677

1. No response required.

THE TOWNSHIP OF PENNSVILLE
SALEM COUNTY, NEW JERSEY



MUNICIPAL BUILDING, 90 NORTH BROADWAY
PENNSVILLE, NEW JERSEY 08070

JAMES K. GALLAGHER
MAYOR

TELEPHONE
OFFICE 678-3089
HOME 678-7484

December 12, 1988

Intergovt. Review & Assist. Unit
State Review Process
Div. of Local Govt. Services
CN 803
Trenton, New Jersey 08625-0803

Re: State Review Process
Applic. Iden. 88-9036

Dear Mr. Silver:

The Township received letter dated December 7, 1988 regarding the above and providing for notice of comments to your Unit.

1 The Township feels that the Salem River at the east side of this Township should be included in the proposed dredging. Since the Port of Salem is a beneficiary of this project and the material to be removed is going to placed in this Township (Killcohook), some interest of this Township should also be considered.

2 The Salem River is a collector of drainage from areas of the Township. The disposal area along Hook Road in the Township has been an impairment to good drainage and requests have been previously placed for assistance in this regard. However, these conditions have not received attention.

3 Now, the Township is again to be the instrument of providing relief to some other jurisdiction. We feel that our concerns for this improvement are likewise important to the interest of the residents of Pennsville.

We beseech your re-consideration and inclusion.

Yours very truly,

James K. Gallagher
Mayor

JKG/dhg

1. There are no benefits associated with dredging the Salem River at the east side of Pennsville Township. Therefore, the project stops at the port of Salem.

2. This Feasibility Report and this drainage question are not related. The disposal area in question is the Penns Neck Federal disposal area for the Delaware River, Philadelphia to the Sea project.

3. The township of Pennsville is the location of the existing Federal disposal site and the local sponsor is satisfying its requirement for providing a diked suitable disposal area by reimbursing the Federal government.

COMMITTEE PERSONS
WILLIAM C. HANCOCK, JR.
Mayor
GEORGE B. WRIGHT
DONALD ASAY

MARY D. PARKELL, Clerk

MANNINGTON TOWNSHIP

R.D. #1, BOX 129
SALEM, NEW JERSEY 08079

January 12, 1989

Ms. Barbara Stratton
Intergovernmental Review and
Assistance Unit
New Jersey State Review Process
Division of Local Government Services
CN 803
Trenton, New Jersey 08625-0803

Dear Ms. Stratton:

1 We have no objection to the Delaware River Comprehensive Navigation Study Draft Interim Feasibility Report & Environmental Assessment for Salem River project with the following exception:

2 In the Interim Feasibility Report, Salem River, New Jersey, on page 7, it states, "The Little Salem River is slated for deauthorization in December 1989 under the provisions of Title X of the Water Resources Act of 1986." We believe it is not in the best interests of Mannington Township or its neighboring City of Salem to deauthorize this waterway.

3 We request that you send us a copy of Title X so that we can better understand this process.

Thank you.

Sincerely,

MANNINGTON TOWNSHIP COMMITTEE

BY: William C. Hancock Jr.
William C. Hancock, Jr.
Mayor

WCH:mp

1. No response necessary.

2. Title X of the WRDA of 1986 involves deauthorization of unconstructed new projects which have not had funds appropriated for 10 years. Thus, the authorization reverts to the nine foot depth constructed in 1925.

3. Title X was provided to Mannington Township subsequent to the receipt of this letter.

State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
DIVISION OF PARKS AND FORESTRY
OFFICE OF NEW JERSEY HERITAGE
CN 404
TRENTON, N.J. 08625-0404
(609)292-2023

ONJH-C91-56

March 12, 1991

Lieutenant Colonel Kenneth H. Clow
District Engineer
Department of the Army
U. S. Army Engineer District, Philadelphia CENAP-OP-R
Custom House- 2 and & Chestnut Streets
Philadelphia, PA 19106-2991

Dear Colonel Clow:

1 As Deputy State Historic Preservation Officer for New Jersey, in accordance with 36 C.F.R. Part 800: Protection of Historic Properties, as published in the __Federal Register__, 2 September 1986 (Volume 51, Number 169, pages 31115-31125), I am commenting officially upon the project designated below:

__NATIONAL HISTORIC PRESERVATION ACT OF 1966, as amended__

__SECTION 106__: __SHPO Consultation and Comments__ (__36 CFR Part 800__)

PROJECT TITLE: Salem County, New Jersey [+ New Castle County, Delaware]
Salem River [+ Delaware River, Salem Cove]
Channel Widening and Deepening, Delaware River, Elsinboro Point to New Jersey Route 49 Bridge
Water Resources Act of 1986, P.L. 99-662, Section 859
Delaware River Comprehensive Navigation Study

FEDERAL AGENCY: Philadelphia District, Corps of Engineers
Department of the Army

I. 800.4 __Identifying Historic Properties__

I have reviewed these materials:

Heite, Edward F. and Louise B. Heite
1986 Cultural resources investigation at New Cut, Salem River, in connection with proposed dredging of Salem River, City of Salem, Elsinboro Township, and Pennsville Township, Salem County, New Jersey. Camden, Delaware.

1. No response required.

August 1986.

Cox, J. Lee, Jr.
1988 Submerged cultural resources investigations, Salem Cove and Salem River, Salem County, New Jersey and New Castle County, Delaware. Maritime Historical Institute, Inc. [No place. May 1988.

Corps of Engineers, Department of the Army, Philadelphia District
1990 Salem River, New Jersey. Interim Feasibility Report and Environmental Assessment. Delaware River Comprehensive Navigation Study. Also Technical Appendices. July 1990.

These cultural resources concern the proposed undertaking:

1) Swedish Fort Elfsborg, probably situated west of Elsinboro Point, between the shore and the existing Salem River Entrance Channel.

   No search for the site of the fort in the offshore shallows has been undertaken by the agency's consultants, hence this Office does not have enough information to render an opinion on its eligibility for the National Register of Historic Places. An estimate of its position is derived from historical records and considerations of geography and 17th century ordnance.

2) Delaware - New Jersey Boundary, monuments and sites #3 and #4, Salem Cove, at mouth of Salem River.

   The boundary markers were not explored during the reconnaissance phase of the study. Their present integrity is not known. However, their sites meet Criteria A and C of the National Register in that they mark the Colonial-period's royal land-granting activities and boundary demarcation.

3) Underwater Archaeological Targets SC01 and SR01.

4) Historical and prehistoric materials in the banks of the Salem River.

II. 800.5 <u>Assessing Effects</u>

2 I am of the opinion that the proposed widening and

2. Concur.

deepening of the Navigation Channel will not have an effect on Fort Elfsborg, because its location appears to have been shoreward of the Channel.

3 I am of the opinion that the project will not have an effect upon the state boundary markers, the monuments or their sites, provided that contract documents take note of them in order that they may be avoided in any construction-related activity; and provided furthermore, that they will be monitored during the maintenance phase of the navigation project for damage from wakes.

4 I concur with the consultant's recommendations that underwater targets SC01 and SR01 be further investigated. The report of Phase II work should be submitted to me for review and the issuing of supplemental Consultation Comments on the eligibility of the targets and the project's impacts on them.

5 I agree with the Environmental Assessment that if the Salem River's banks are altered by construction and cultural materials appear, additional investigation would be necessary.

6 Disposal of dredged spoils at the Kilcohook Disposal Area does not involve cultural resources.

<u>Additional Comments:</u>

7 Conventional provisions for discovery during construction should be made a part of contract documents.

If you have any questions, you may contact me at (609) 292-2023.

Sincerely,

Nancy L Zerbe

Nancy L. Zerbe
Deputy State Historic
Preservation Officer

NLZ/vs

c: Advisory Council on Historic Preservation
Mr. Robert L. Callegari, Planning Division
Mr. Lawrence C. Schmidt, Planning Group, DEP
Director John Weingart, New Jersey Division of Coastal Resources, DEP

disk#2A:\khclow

3. Concur. This will be made a provision of the Environmental Protection section of the contract specifications for construction.

4. Concur. Phase II work for underwater targets is scheduled for the Preconstruction, Engineering and Design phase of the planning study. The results of this work will be submitted to the Delaware and New Jersey SHPOs for their review and comment.

5. No response required.

6. Concur.

7. Concur. This is a standard provision of contract specifications for construction projects.

STATE OF DELAWARE
DEPARTMENT OF NATURAL RESOURCES
& ENVIRONMENTAL CONTROL
DIVISION OF WATER RESOURCES
89 KINGS HIGHWAY, P.O. BOX 1401
DOVER, DELAWARE 19903

SURFACEWATER MANAGEMENT SECTION	(302) 739-5726
WATERSHED ASSESSMENT BRANCH	(302) 739-4590
POLLUTION CONTROL BRANCH	(302) 739-5731
FACILITY SUPPORT BRANCH	(302) 739-5081
WETLANDS & AQUATIC PROTECTION BRANCH	(302) 739-4691

April 12, 1991

Mr. Roy E. Denmark, Jr. Chief
Environmental Resources Branch
Philadelphia District, Corps of Engineers
Custom House, 2nd and Chestnut Streets
Philadelphia, PA 19106

RE: Subaqueous Lands Permit
Salem River Dredging - Deepening and Widening - 801,600 Cubic Yards

Dear Mr. Denmark:

1 The application for the above-referenced permit was placed on public notice on February 6, 1991 for a twenty-day review period. This office has received no objections to the proposed project as a result of our public notice.

2 However, because we've seen problems in recently submitted monitoring data the Division of Water Resources is reassessing the impacts of dredging projects as they relate to our amended "Surface Water Quality Standards".

3 Based on our review we have determined that the project is consistent with the Coastal Zone Management Program and that we will subsequently issue a permit and associated Water Quality Certificate subject to the joint development of a suitable monitoring program.

If you have any further questions regarding this matter, please feel free to call this office.

Sincerely,

Robert J. Zimmerman
Administrator
Surface Water Management Section

cc: William F. Moyer
Tracy E. Skrabal
John Maxted

/djr
wfm91018

Delaware's good nature depends on you!

1. No response necessary.

2. The Philadelphia District is working with the Division of Water Resources to facilitate this review. A technical committee has been formed to develop acceptable monitoring procedures.

3. No response necessary.

STATE OF DELAWARE
DEPARTMENT OF STATE
DIVISION OF HISTORICAL AND CULTURAL AFFAIRS
15 THE GREEN
DOVER, DELAWARE 19901

BUREAU OF ARCHAEOLOGY AND HISTORIC PRESERVATION

TELEPHONE: (302) 736 - 5685

January 12, 1989

Mr. Robert L. Callegari
Chief, Planning Division
Philadelphia District
Corps of Engineers
Custom House, 2nd & Chestnut Sts.
Philadelphia, PA 19106-2991

Dear Mr. Callegari:

1 I have received and reviewed the Delaware River Comprehensive Navigation Study draft Interim Feasibility Report and Environmental Assessment for Salem River, New Jersey and the various enclosures which included cultural resources evaluations of terrestrial and underwater environs within the area of the proposed undertaking. Based on my review of this information, keeping in mind the limits of the Bureau's political jurisdiction and responsibility, it is our opinion that the proposed dredging will not affect any significant submerged resources provided dredging is confined to the existing Salem River Entrance Channel. Likewise, the utilization of the Killcohook disposal area will not affect any significant submerged resources.

2 The identified magnetometer target SC-01, which has the potential to be a significant resource, will not be affected providing overboard disposal is not revived as a viable disposal alternative and that no additional dredging is to occur outside the Entrance Channel.

3 As for the magnetometer target identified as SR-02, near buoy N-10, we concur with your conclusion that a Phase II level survey will be required. This resource, however, is within that State of New Jersey and all further consultation should be directed to the New Jersey Preservation Office.

If you require any additional information or assistance, please do not hesitate to contact me.

Sincerely,

Faye L. Stocum

Faye L. Stocum, Archaeologist/
Environmental Review Coordinator

cc: Jan Ferguson

1. No response required.

2. The selected dredged material disposal site for the proposed project is the existing Killcohook site. No additional dredging is proposed outside of that discussed in the draft report.

3. Additional investigation of the SR-02 target will be conducted prior to the start of initial construction.

BOARD OF CHOSEN FREEHOLDERS
COURT HOUSE
SALEM, NEW JERSEY 08079

DAVID A. MULFORD
Clerk of the Board

January 20, 1989

(609) 935-7510
EXT. 202

U.S. Army Corps of Engineers
Philadelphia District
Customs House
2nd & Chestnut Streets
Philadelphia, Pennsylvania 19106

Attention: Planning Division
CENAP - PL - PP

Gentlemen:

As Clerk of the Board of Chosen Freeholders of the County of Salem I have been instructed to correspond with you regarding the dredging of the Salem River channel.

1 *The Salem County Board of Chosen Freeholders fully concurs with the residents of the Township of Elsinboro regarding the placing of the dredged sand against their respective bulk-heads (seawall).*

The Salem County Freeholder Board requests every consideration be given to their request.

Thank you,

Sincerely,

David A. Mulford

David A. Mulford
Clerk of the Board

DAM/es

1. Placement of materials from stations 8+000 to 13+000 was examined further by the Corps. As discussed in the Interim Feasibility Report it was determined the fine nature of the material would limit usefulness as beachfill.

![COUNTY OF SALEM NEW JERSEY]

BOARD OF CHOSEN FREEHOLDERS
COURT HOUSE
SALEM, NEW JERSEY 08079

JOSEPH J. DYER
Freeholder Director

March 17, 1989

(609) 935-7610
Ext. 202

U.S. Army Corps of Engineers
Philadelphia District Customs House
2nd & Chestnut Street
Philadelphia, Penna. 19106

Attention: Planning Division
CENAP - PL - PP

Gentlemen:

The Salem County Board of Chosen Freeholders sent you correspondence on January 20, 1989 concerning the use of the dredged spoils during the forthcoming dredging of the Salem River Channel.

1 While we support the local township's request to have the sand placed along its bulkhead, we would not want you to misunderstand our position on the dredging.

The Board of Freeholders believes very strongly that the Salem River Channel should be dredged to a deeper draft to permit increased activity at the Salem Port.

We believe it to be of the utmost importance that this dredging be completed as soon as possible to enhance the viability of the Port and its Foreign Trade Zone.

The use of the spoils is, of course, a technical decision on the part of the Corps and that decision in no way changes our solid support for the increased depth of the dredging.

If there is a need for a formal resolution to state our position, we would be happy to provide the Corps with that document.

Respectfully,

Joseph J. Dyer DM

Joseph J. Dyer
Freeholder Director

JJD/es
cc: John Burke - Salem Port Authority
Chuck Ward, Mayor, City of Salem
James Waddington, President, Salem City Council
Pat Knoblock, Economic Development Director
Gordon Dahl, Executive Director, S.J.E.D.D.

1. No response required.

PSE&G Public Service Electric and Gas Company

80 Park Plaza, Newark, NJ 07101 / 201 430-7000 MAILING ADDRESS / P.O. Box 570, Newark, NJ 07101

December 14, 1988

Mr. Robert L. Callegari
Chief, Planning Division
Project Planning Branch
Department of the Army
Philadelphia District, Corps of Engineers
Customer House - 2D and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Mr. Callegari:

DELAWARE RIVER COMPREHENSIVE
NAVIGATION STUDY
SALEM RIVER, NEW JERSEY
DRAFT INTERIM FEASIBILITY REPORT

We acknowledge receipt of your letter dated November 29, 1988, requesting our review and comments regarding the above subject report dated November 1988. We do not have any objection to the widening and deepening of the Salem River channel. However, we do have concern with sections of the study regarding the vertical clearance under our Salem-Keeney 500-kV transmission line.

Paragraph 103, Page 61 of the Main Report and Environmental Assessment indicated that the river pilots prohibit vessels with air drafts over 80 feet from transiting the river and consider 5 feet the minimum safety standard for clearance. Please be advised that 5 feet is insufficient electrical clearance from our Salem-Keeney transmission line which operates at nominal voltage (phase to phase) of 500-kV. The minimum vertical clearance from our 500-kV conductors to the vessel should be 18 feet.

In addition, a statement on page B-13 of the Technical Appendices indicates that the pilots have measured the clearance under the PSE&G transmission line and found it to be approximately 85 feet. Please bear in mind that the clearances at particular times will differ as the conductor sags change due to temperature variations. The sag of the conductors in the Salem River crossing span can vary approximately thirty (30) feet at mid-span.

The Energy People

95-2001 (400M) 8 85

DEPARTMENT OF THE ARMY
Philadelphia District, Corps of Engineers
Custom House-2d & Chestnut Streets
Philadelphia, Pennsylvania 19106

JAN 20 1989

Planning Division

John E. Flynn, P.E.
Principal Engineer - T13A
Electric T & D
PSE&G
P.O. Box 570
Newark, New Jersey 07101

Dear Mr. Flynn:

This is in response to your letter of December 14, 1989 regarding the Delaware River Comprehensive Navigation Study, Salem River, New Jersey, Draft Interim Feasibility Report.

Your clarification on the minimum vertical clearance at the Salem-Keeney Transmission line is most helpful. The limits of the proposed channel widening are marked on the print as you requested. We have forwarded the print to the Salem River pilots with the clearance information to ensure adequate safety standards for the proposal.

We anticipate further coordination with PSE&G as this project moves into the preconstruction engineering and design stage. If you have any further comments or questions, please feel free to contact us.

Sincerely,

/S/

Encl

Robert L. Callegari
Chief, Planning Division

It is also stated on page B-14 that the Salem Port Authority contacted PSE&G to determine the feasibility of raising our wires to 100 feet above MHW in the channel and that our ultimate sag is defined as when the cable is encrusted with ice. This information is incorrect. The Salem Port Authority by letter dated September 17, 1986 (copy attached), requested that the wires be raised to 150 feet and this clearance above MHW would be at a maximum (ultimate) sag designed for an operating temperature of 212°F.

Enclosed are two prints of our Salem-Keeney 500-kV transmission line plan and profile Drawing No. 11413-R-II, Sheet 7, showing the line crossing of the Salem River. We would appreciate the Corps of Engineers marking the limits of the proposed channel widening within our 200 foot right of way on one print and returning it for our files.

The required vertical clearances stipulated above should be included in your study in the interest of navigational safety. If there are any questions regarding this matter, please contact me at (201) 430-7761.

Very truly yours,

John E. Flynn, P.E.
Principal Engineer - T13A
Electric T&D

Enclosures

PORT SALEM

62 Front Street • Salem, New Jersey 08079
(609) 935-6380

[redacted]

[redacted]

Director of Operations
Charles R. Sullivan

Director of
Economic Development
Terry A. Rakiewicz

September 17, 1986

Mr. R.D. Stys, Vice President
Transmission and Distribution
PSE&G
80 Park Place
Newark, NJ 07101

Dear Mr. Stys,

I am writing on behalf of the City of Salem Port Authority
1 Board of Commissioners to bring to your attention a problem which is limiting the economic growth of the Port of Salem. The wires owned by your company at the mouth of the Salem River are too low to offer safe passage for many vessels which could call at a shallow draft port like Salem. Based on information we have received from shipping companies utilizing the Port, it has been determined that this problem could be resolved if the wires were raised to 150 feet.

The local taxpayers and several private companies have made a significant investment in the Port of Salem. To protect this investment and provide for the viable operation of the Port, we respectfully request your assistance to correct this problem. We would be happy to meet with you at your earliest convenience to discuss this matter.

Thank you for your consideration.

Sincerely,

Terry A. Rakiewicz
Secretary/Treasurer

TAR/bh

City of Salem Port Authority

[redacted]

1. Enclosed with PSE&G letter. No response required.

mannington RESILIENT FLOORS

M. Bruce Jones
Vice President - Manufacturing

December 22, 1988

Department of The Army
Philadelphia District, Corps of Engineers
Custom House - 2 D & Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Attention: Mr. Robert L. Callegari
Chief, Planning Division

Dear Mr. Callegari:

Reference: Delaware River Comprehensive Navigation Study - Draft Interim Feasibility Report and Environmental Assessment for Salem River, New Jersey; dated November 1988

1 The referenced document has been reviewed and Mannington has no comment relative to the establishment of the waterway. Mannington does urge the Corps of Engineers to scrutinize the disposal of dredged material within the surrounding areas. Disposal area 25-G is particularly noted (Figure 13) in that it approaches the boundaries 2 of the Memorial Hospital of Salem County and several residential and business establishments. As I'm sure the Corps of Engineers is aware, extensive environmental impact studies and public hearings will be required particular to the selection of disposal sites.

Sincerely,

MANNINGTON RESILIENT FLOORS

M Bruce Jones

M. Bruce Jones
Vice President - Manufacturing

MBJ:s

BOX 30 SALEM, NEW JERSEY 08079 TEL. 609-935-3000

1. The existing Killcohook dredged material disposal site has been selected for this project. Site 25-G will not be required.

2. The appropriate level of environmental coordination has been conducted with regard to use of the Killcohook site.

December 23, 1988

Department of the Army
Philadelphia District Corps of Engineers
Custom House - 2nd and Chestnut Streets
Philadelphia, PA 19106

Attention Robert L. Callegari, Chief
Planning Division

Re: Proposed Widening and Deepening of
Salem River in Salem County, NJ

Dear Mr. Callegari:

1 As the owner of land known as Tilbury Island located on the North side of the Salem River Cut-off, I am writing to find out how the proposed improvements will affect my said property and what consideration has been given to the problems of added "wash", not only at the turning basin but along the entire Cut-off, created by additional and larger ship traffic.

2 If you will refer to the map attached hereto, I can better explain my concerns. My first concern is how much of my land, if any, will be taken to widen the Salem River Cut-off on the North side?

3 Having lost considerable land on the Southwest corner of my property as a result of the "wash" created largely by increased ship traffic in recent years, my second concern is the possible greater "wash" loss along the entire Cut-off and particularly my Southeast corner by the proposed deepened and larger turning basin.

4 I believe my second concern should be resolved by stoning the Salem River Cut-off similar to that done on the Delaware-Chesapeake Canal and in a northerly direction along the Southeast corner of my property, at least the distance the turning basis extends northward, and the Southwest corner northward enough to protect that corner--all as marked in red on the attached map.

5 As an effected land owner, I would appreciate a response to my questions and concerns prior to the scheduled workshop meeting on January 12, 1989, at the old Court House, Salem, New Jersey, as I would not like to express my personal concerns in the public meeting. Notwithstanding, this letter may be considered a part of the record effecting the proposed project.

Yours very truly,

Wayne B. Mulford

WAYNE B. MULFORD
R. D. #3, Box 79
Country Club Road
Salem, NJ 08079
Ph. (609) 935-3827

1. Refer to responses 2 and 3.

2. It has been estimated that approximately 7 acres of wetlands will be affected.

3. Based on the findings of the feasibility report, the improved conditions resulting from the project would not increase traffic, but only allow vessels to load more fully. As such the project should not further aggravate the existing problems. It has been determined that the cargo ships utilizing the Port are not the source of the problem because the movements of cargo ships are coincident with the tide changes and their speed relative to the water is minimal, therefore, a minimal wake is generated. The problems appear to be related to the assisting tugs which have no concern for tidal conditions and therefore don't "time" their movements. As a result, relative water speeds can be excessive and result in large wakes. This problem has been addressed with the Port officials.

4. Refer to response no. 3.

5. The Philadelphia District coordinated with Mr. Mulford on these concerns after the 12 January 1989 public meeting, and explained the procedure for reimbursement at fair market value for landowners of affected properties.

To: Project Planning Branch
Robert L. Callegari
Chief, Planning Officer

From: Howard S. George, Jr.
6 Friendship Drive
Salem, New Jersey

1 As one of the residents living along the Salem River Cut-off, I would like to address the dredging proposed for the cut and the erosion of our properties.

2 The plan to widen and deepen the channel will leave the angle of repose left by the dredging unable to support the material found in the cut which is sand and gravel, and therefore will cause even more erosion of the banks and also our properties.

3 My question is, "What is the Corps of Engineers planning to do to protect their banks along the cut so that this will not cause erosion of our properties?"

If the Corps of Engineers do nothing to protect their banks and causes the erosion of private property, is this not an act of negligence on your part?

1. The material in the cut is an extremely stiff clay with some intermixed sand and gravel. The channel slopes will be cut back at 3H:1V. This is very stable.

2. Based on the response to item 1 above no additional protection is required.

3. Based on the responses to items 1 & 2 above, we do not consider the lack of bank or slope protection to be an act of negligence.

NORMAN L. PATRICK, Jr.
R. D. # 3, Box 44
SALEM, N. J. 08079

February 13, 1989

THE COMMANDER and
Robert L. Callegari, Chief Planning Div.
U. S. Army Corps of Engineers
2nd and Chestnut Street
Philadelphia, Pa. 19106

Dear Robert,

I am an Elsinboro resident and have lived in my home in Salem Cove since 1972. I am not in 100% agreement with most of the Elsinboro residents that the dredging for the Channel of the Salem river is the complete cause of our loss of beach.

1 Fact #1 is that I personnally have more sand on my beach here in Salem Cove than when I moved here in 1972.

2 Fact #2 is that there is more sand now in the section of Oakwood Beach where I owned a cottage prior to 1972 then was there 50-60 years ago when I was a child. Both of these items are fact and not theory.

3 I wonder if any study has been done to see what advantage for the future might be accomplished if a jetty was built on the natural sand bar at the mouth of the Salem River and one on the natural sand bar on Elsinboro Point.

I would certainly appreciate any comments that you could make in this matter. Thank you.

Yours Truly,

Norman Patrick Jr.

Norman L. Patrick, Jr.

1. No response required.

2. No response required.

3. No studies that we are aware of have been done.

OTHER CORRESPONDENCE

PORT SALEM

(609) 935-6380
P.O. Box 1001
Salem, New Jersey 08079
FAX (609) 935-9113

Charles R. Sullivan
Director of Operations

May 2, 1991

Lt. Col. Kenneth H. Clow
District Engineer
U.S. Army Corps of Engineers
Custom House, 2nd & Chestnut St.
Philadelphia, PA 19106

Dear Lt. Col. Clow:

This concerns the Corps of Engineers feasibility study of deepening the Salem River beyond its authorized 12 foot depth. As noted in our previous correspondence of January 26, 1990 and July 9, 1984, the City of Salem Port Authority is the agency empowered by law to provide the items of non-Federal cooperation for the improvement project.

We appreciated the opportunity to express our support for the improvement before the Board of Engineers for Rivers and Harbors on March 12, 1991. As stated at that time, the Port Authority is very pleased with the recent letter from Governor Florio which offered state assistance of $2,700,000 for financing the non-Federal share of the project. The Port of Salem is willing and capable to provide the following items of cooperation:

- Provisions and maintenance at local expense of adequate public terminal and transfer facilities open to all on equal terms and such depths from the Federal channel line to and between the wharves at the terminal (berthing areas) as may be required for the accomodation of vessels at the terminal, consistent with the Federal project.;

- Provision without cost of the United States of all lands, easements, rights-of-way, and relocation necessary for the construction, and subsequent operation and maintenance of the project including suitable areas, determined by the Chief of Engineers to be required in the general public interest for initial and subsequent disposal of dredged material and necessary retaining dikes, bulkheads, and embankments therefore, or the costs of such retaining works.

- Holding and saving the United State free from damages due to the construction works, except for damages due to the fault or negligence of the United States or its contractors.

- Provision during the period of construction 10 percent of the cost of construction associated with general navigation features and an additional 10 percent of the cost of the general navigation features of the project in cash over a period not to exceed 30 years, at an interest rate determined pursuant to Section 106 of Public Law 99-662. The value of lands, easements, rights-of-way, relocations, and dredged material disposal areas provided shall be credited toward the additional 10 percent payment.

- Accomplishment without cost to the United States of alterations and relocations as required in sewer, water supply, drainage, and other utility facilities.

- Compliance with applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1978 (P.L. 91-646) and implementing regulations.

- Compliance with Section 601 of the Civil Rights Act of 1964 (P.L. 83-352).

- Establishment of regulations prohibiting discharge of unteated sewage, garbage, industrial waste, and other pollutants into the water of the port by users thereof, which regulations shall be in accordance with applicable laws or regulations of Federal, State, and local authorities responsible for pollution prevention control.

- Assume financial responsibility for cleanup of hazardous material located on project lands and covered under the Comprehensive Environmental Response, Compensation, and Liability Act. (CERCLA).

The Port of Salem looks forward to continued growth at our facilities. As such we are prepared to work with the Corps towards a Local Cooperation Agreement and construction of the project.

Sincerely,

John Burke

John Burke, Chairman

STATE OF NEW JERSEY
OFFICE OF THE GOVERNOR
CN-001
TRENTON
08625

JIM FLORIO
GOVERNOR

March 11, 1991

Lieutenant Colonel Kenneth H. Clow
U.S. Army Corps of Engineers
Philadelphia District
U.S. Customs House
2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Lt. Colonel Clow:

I am writing to you regarding the U.S. Army Corps Salem River Channel project in Salem City, New Jersey.

I understand that proposed preconstruction and engineering and design costs for this project are $10,000,000 for the federal share and $2,700,000 for non-federal.

At this time, I wish to assure the U.S. Army Corps of Engineers that the State of New Jersey supports this project, the Feasibility Study findings, and expresses an intent to fund the non-federal share of the above improvements at time of construction.

Very truly yours,

Jim Florio
GOVERNOR

U.S. Department of Transportation
United States Coast Guard

Commander
Fifth Coast Guard District

Federal Building
431 Crawford Street
Portsmouth, VA 23704-5004
Phone: (804) 398-6230
Staff Symbol: (oan)

16500
22 JAN 1991

From: Commander, Fifth Coast Guard District
To: Commander, U. S. Army Engineer District, Philadelphia

Subj: ATON IMPROVEMENTS TO SALEM RIVER NAVIGATION PROJECT

1. This is to confirm a phone conversation with Ms. Barbara Stratton regarding the Salem River Navigation Project. Ms. Stratton inquired as to the costs of, and necessity for, additional aids to navigation in Salem River to support a Corps of Engineers planned improvement to the federal project (180 ft wide channel).

2. The Coast Guard completed upgrades to the federal aids to navigation in Salem River Entrance in 1989 and 1990. The aids to navigation were constructed in positions outside of the planned project expansion. Therefore, there will be no additional costs associated with the expansion of the current project, if the channel alignment remains the identical to the current project and the project width does not exceed 180 ft.

3. If you desire further information, please call me at FTS 393-6230 or comm (804) 398-6230.

John R. Walters
JOHN R. WALTERS
By direction

Copy: WAMS
CG GP Philadelphia
CG ANT Philadelphia
CGC RED OAK

Salem Maritime Inc.

Phone: (609) 935-4881
100 West Broadway
P. O. Box 74
Salem, New Jersey 08079
FAX: (609) 935-6696

VIA FAX 1-215-597-9448

JANUARY 18th 1991

U.S. ARMY CORPS OF ENGINEERS
PHILADELPHIA DISTRICT
CUSTOM HOUSE
2nd & CHESTNUT STREETS
PHILADELPHIA PA 19106

ATTN: MR. ROBERT CALLEJARI
CHIEF PLANNING DIVISION
USCUE CENAP/PL

Dear Mr. Callejari,

We refer to our various discussions pertaining to the AIR DRAFT in the SALEM RIVER.

We are referring to page 78 of the SALEM RIVER NEW JERSEY INTERIM FEASIBILITY REPORT AND ENVIRONMENTAL ASSESSMENT dated July 1990. We are of the opinion that the airdraft does not have to be changed at all to accommodate vessels which can handle up to 10,000 tons of cargo.

This is the maximum vessel size anticipated for the project depths being considered and therefore this entire vessel class would not be constrained by the overhead clearance. For larger vessels this could be a problem, however with variations between vessels and such features as whip antennas and collapsable masts, there is a significant variation for a given vessel class.

If you need any further information please do not hesitate to contact me.

Sincerely yours,

SALEM MARITIME INC.

Georges Meier, President

GM/aa

SALEM RIVER PILOTS

Laurence B. Knapp, Jr.
P.O. Box 4367
Wilmington, DE 19807
(215) 388-2604

Richard L. Beebe
P.O. Box 758
Lewes, DE 19958
(302) 645-9498

Thomas P. Robinson
P.O. Box 259
Rehoboth, DE 19971
(302) 227-7216

Port of Salem Vessel Recommendations: Date: 06/02/90

Under the current conditions at the Port of Salem we recommend, under normal tidal conditions, that vessels not exceed the following:

Length Overall: 350'

Maximum Breadth: 65'

Maximum F.W. Draft: 15'06" At Mean High Water!

Maximum Air Draft: 85' (15' Clearance at Power Cable)

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CUSTOM HOUSE—2 D & CHESTNUT STREETS
PHILADELPHIA, PENNSYLVANIA 19106-2991

MAR 26 1990

REPLY TO
ATTENTION OF
Planning Division

John D. Burke, Chairman
City of Salem Municipal
Port Authority
465 E. Broadway
Salem, New Jersey 08079

Dear Mr. Burke:

Enclosed for your reference is additional material to be incorporated into the Local Cooperation Agreement which will be a part of the Final Feasibility Report Study for the Salem River. You were provided with a model Local Cooperation Agreement during the completion of the draft report released in November 1988. The language in the memorandums (Project Management Guidance Letter Number 2, LCA Provisions on Hazardous and Toxic Wastes dated March 2, 1990 and Project Management Guidance Letter Number 5, Disclosure of Lobbying Activities dated February 13, 1990) will be part of the LCA package for the Salem River project.

We are unaware of any problems related to hazardous and toxic wastes in the vicinity of the Salem project. Chemical testing of channel material has not revealed any significant levels of pollutants in the material to be dredged. We also would anticipate no problems related to dredged material disposal areas. Please inform us if you know of any previous industrial activities or disposal which might relate to this project.

Please contact Ms. Barbara Stratton at Area Code 215-597-5957 with any questions you have on this modification to the LCA process.

Sincerely,

John A Burner
for Robert L. Callegari
Chief, Planning Division

Enclosures

PORT SALEM

465 E. Broadway
[redacted] • Salem, New Jersey 08079
(609) 935-6380

[redacted]

Director of Operations
Charles R. Sullivan

January 26, 1990

Lt. Colonel Kenneth H. Clow
District Engineer
U.S. Army Corps of Engineers
Custom House, 2nd & Chestnut Streets
Philadelphia, PA 19106

Attention: CENAP-PL

Dear Lt. Colonel Clow:

This concerns the Corps of Engineers ongoing feasibility study of deepening the Salem River beyond its authorized 12 foot depth. The City of Salem Port Authority is the agency empowered by law to provide the non-Federal cooperation required to improve the project.

The study was initiated in response to our first letter of intent dated July 9, 1984 and we updated our intent to cooperate in this project on December 8, 1989.

At the current time, the non-Federal share of this project will be financed by the following methods.

a) Funding from the State of New Jersey Capital Improvement Bill which reflects the projected public agency participation through Fiscal Year 1997 for U.S. Army Corps of Engineers navigation projects authorized by Congress.

b) Funding from harbor use fees based on the tonnage benefitting from the improved depth. The Salem Marine Terminal Corporation anticipates shipping 60,000 tons of export for the year 1990 and also expects to increase that figure by the project base year of 1995. Mid-Atlantic Shipping and Stevedoring Inc. estimates handling 75,000 tons of cargo in 1990 and is currently designing an additional berth which will increase capacity. Port facility improvement planned by the base year are required as part of the lease arrangements with Salem Marine Terminal.

City of Salem Port Authority

Therefore, the future Salem Port Authority expenses will include annual operating expenses and financing of the local share of the Federal project.

Based on the current funding schedule the pre-construction engineering and design work will be completed for the project in 1993. Assuming construction in Fiscal Year 1994, it is our understanding that the Port of Salem will be responsible for providing $2,144,000, which represents the initial non-Federal share of the general navigation features of the project.

I anticipate that this assurance of our support for the project is satisfactory.

Sincerely,

John D. Burke, Chairman
City of Salem Municipal
Port Authority

JDB/bh

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE
P.O. Box 534
705 White Horse Pike
Absecon, New Jersey 08201
(609-646-9310)

August 5, 1987

Lt. Colonel G. William Quinby
District Engineer, Philadelphia District
U.S. Army Corps of Engineers
Custom House, 2nd and Chestnut Streets
Philadelphia, Pennsylvania 19106-2991

Dear Colonel Quinby:

This constitutes our planning aid report entitled, "A Survey of Fish and Wildlife Resources in the Lower Salem River Navigation Project Area, Salem, New Jersey (Delaware River Comprehensive Navigation Study)." This report is of a reconnaissance nature for planning assistance only and does not constitute the report of the Secretary of the Interior on the project within the meaning of Section 2(b) of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661 et seq.), nor does it represent the review comments of the Department on any forthcoming environmental statement.

Except for occasional transient species (bald eagle, peregrine falcon), no federally listed or proposed endangered or threatened species under our jurisdiction are know to exist in the project impact area. Therefore, no Biological Assessment or Section 7 consultation under the Endangered Species Act is required with the Fish and Wildlife Service. However, this determination may be reconsidered if additional information on listed or proposed species becomes available or if project plans are changed substantially. A compilation of federally listed species in New Jersey is enclosed as Appendix A.

We look forward to working with your staff on this project in the future and would like to receive the Corps' comments on the report. If you have any questions concerning any aspect of the report, please contact Mr. Allen Jackson of my staff.

Sincerely,

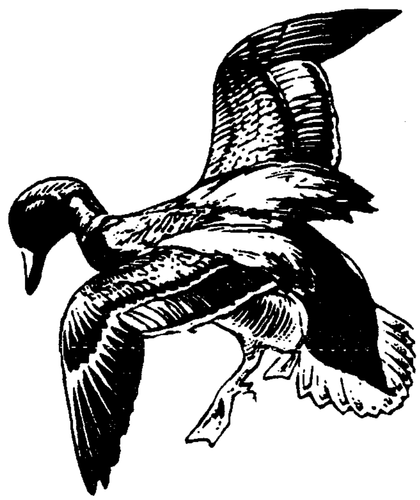
Clifford G. Day

Clifford G. Day
Field Supervisor

Enclosure

PLANNING AID REPORT

A Survey of Fish and Wildlife Resources in the
Lower Salem River Navigation Project Area, Salem, New Jersey
(Delaware River Comprehensive Navigation Study)



Prepared for:

U.S. Army Corps of Engineers
Philadelphia District
Philadelphia, Pennsylvania 19106-2991

Prepared by:

U.S. Department of the Interior
Fish and Wildlife Service
Absecon, New Jersey 08201

Preparer: Allen C. Jackson
Project Leader: Clifford G. Day

Table of Contents

Appendices

List of Figures

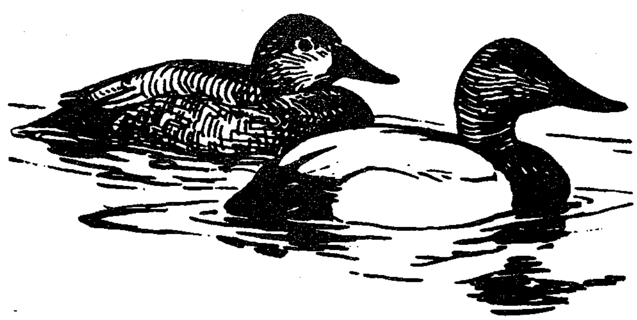
List of Tables

I. Introduction and Scope

In the Fish and Wildlife Service's (Service) September, 1986 planning aid report entitled, "A Survey of Fish and Wildlife Resources in the Salem River Navigation Project Area (Delaware River Comprehensive Navigation Study) Salem, New Jersey," the Service recommended fish sampling and a reconnaissance of waterfowl/waterbird use in the project area in order to assess fish and wildlife impacts from proposed channel modifications.

This planning aid report provides the results of an interagency fish sampling survey and a reconnaissance of waterfowl/waterbird use in the project area, conducted in the spring of 1987. The report also includes an evaluation of proposed project impacts on fish and wildlife, suggested mitigation and other appropriate recommendations.

This planning aid report presents information that is based upon the following: 1) fish sampling and waterfowl/waterbird investigations conducted on May 7, May 28 and June 23, 1987, by the Service and the New Jersey Division of Fish, Game and Wildlife; 2) review of Corps' project documents; 3) prior Service reports; and, 4) coordination with the New Jersey Division of Fish, Game and Wildlife. Objectives of this planning aid report are to: 1) present the results of conducting fish sampling and waterfowl/waterbird reconnaissance; 2) identify potential project impacts to the investigated species; and, 3) recommend means and measures to avoid, minimize or compensate for fish and wildlife damages which would result from project implementation.

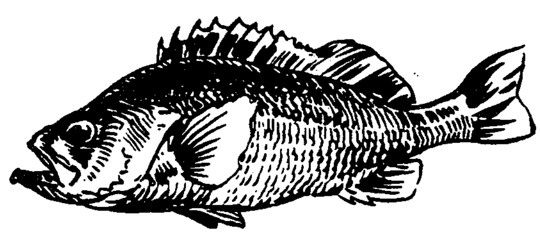


II. Description of Project Plans

The existing Salem River Federal Navigation Project was adopted in 1925 and initially dredged the river to authorized dimensions in 1928. This project provides navigational access between the City of Salem, New Jersey and the Delaware River Federal Navigation Project in the Delaware River (see Figure 1). The authorized channel is approximately 5 miles long and has a project depth of 12 feet at mean low water. Channel width is 150 feet in Salem Cove, narrowing to 100 feet at the "cut off" at Sinnicksons Landing. The authorized channel extends from Elsinboro Point at the southwestern corner of Salem Cove to the New Jersey Route 45 highway bridge in Salem. Dredging of the Little Salem River portion of the channel has been deferred because additional depth is not required in that reach.

The project area was dredged in 1984 for maintenance purposes with disposal adjacent to the channel in Salem Cove. Approximately 400,000 cubic yards of bottom materials were removed from the entrance channel in Salem Cove. Upriver sections of the channel were not dredged. The next prior incidence of maintenance dredging was in 1961.

The Corps proposes to modify the channel dimensions to provide an 18-foot depth at mean low water and a channel width of 180 feet. The channel would have a 3 or 4 to 1 side slope and generate in excess of 1 million cubic yards of dredge spoil. According to the Corps, estimated impacts from proposed dredging include losses of 7 acres of vegetated wetlands and 5 acres of shallow water habitat. Alternative depths and widths are also being investigated.



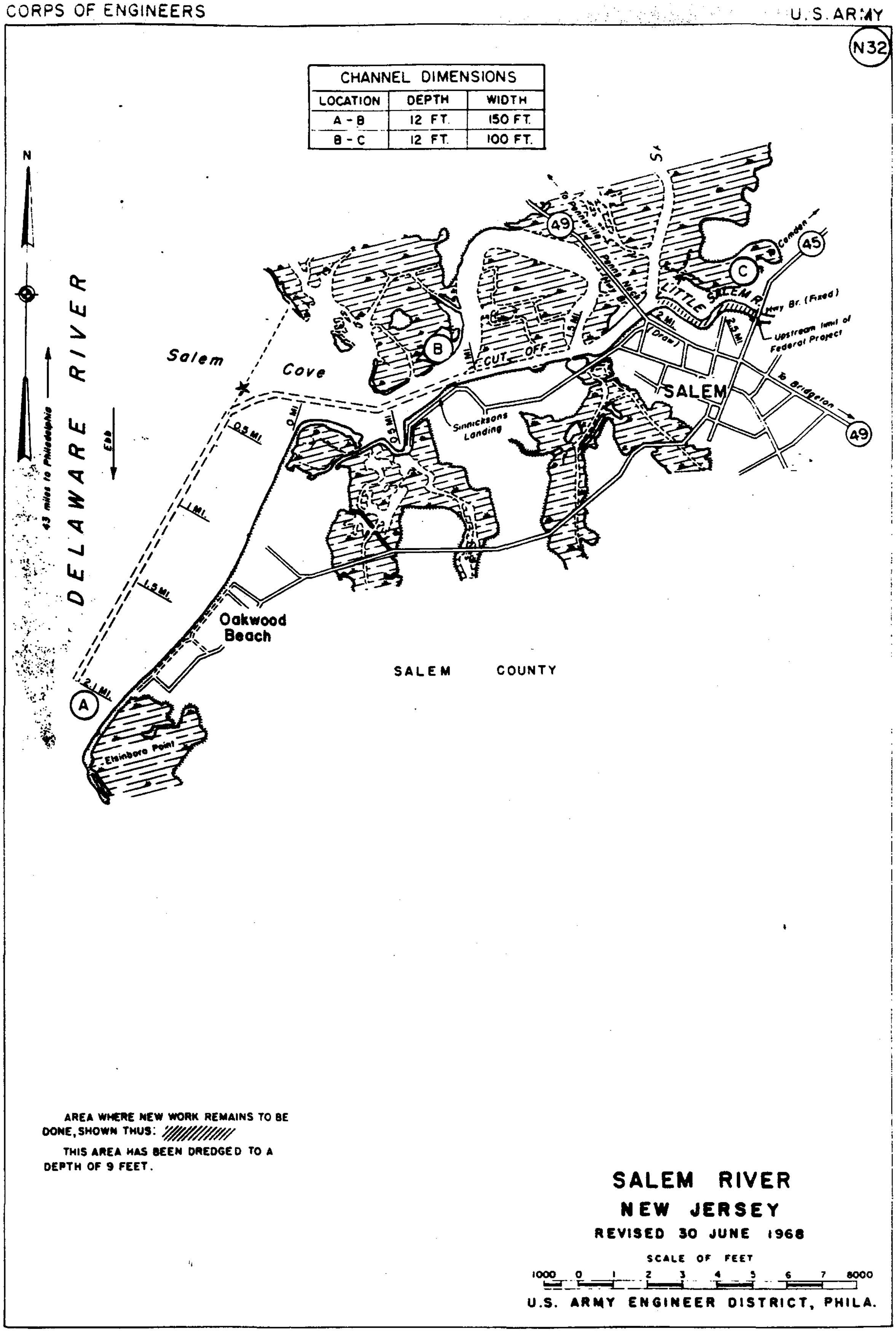


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Figure 1. Project Impact Area

III. Fish Sampling Investigation

A. Methods

Fish sampling occurred on the lower Salem River on May 5, May 28 and June 23, 1987. The Service, in coordination with the New Jersey Division of Fish, Game and Wildlife, collected fish by gill netting and hand seining to obtain biological data representative of conditions in or adjacent to the proposed channel deepening and widening project.

Each sampling day involved setting a single gill net followed by hand seining in 2 to 4 areas before returning to retrieve the net. The gill net was a 200-feet by 6-feet, 2 inch to 5 inch variable mesh experimental net which was set on the bottom in approximately 10 feet of water. The set, Site A (Figure 2), was positioned under the powerline crossing (from Hickory Island to Sinnicksons Landing), approximately 50 feet parallel and offshore on the north side of the Salem River. This site is exposed to the Delaware River, as well as to the strong currents associated with daily tidal exchanges. There is a steep drop-off from the bank, apparently due to exposure and currents. This area would be immediately adjacent to, but not part of, the dredging project.

After the gill net was set, the investigators hand-seined shallow water areas with a 200-feet by 8-feet net with 1/4 inch mesh. The top of the net is supported by floats while the bottom is weighted. One end of the net was held on shore while the net was deployed by boat, returning to shore after a 200-feet sweep was deployed. The net was then retracted by hand. The hand seine was used since it is designed to catch all sizes of fish within shallow water areas.

On May 5, 4 sites were hand seined (Figure 2). Sites 1 and 2 are located on the south side of the Salem River, directly west of the powerline crossing. Site 1 is an area just off a small sandy beach, while Site 2 is immediately adjacent, but southwest to Site 1. Site 2 includes wetland vegetation (Spartina alterniflora) and is situated on the cove side of a tidal tributary. Site 2 was not sampled June 23 due to vegetative growth and high tides. Sites 1 and 2 could be considered to be one sampling site. The area comprising these sites is sheltered from the Delaware River. This has resulted in less erosion problems, a gently sloping shoreline and densely vegetated wetlands. Sites 1 and 2 lie outside the proposed navigation project.

Sites 3 and 4 are located in the "new cut," an artificial channel that is proposed to be deepened and widened. The "new cut" by-passes a natural oxbow in the river, thereby allowing for a direct ebb and flow of the tides. Mannington Meadows which drains Salem River and Mannington Creek and Fenwick Creek converge on this area creating strong current velocities on both the incoming and outgoing tides. Steep slopes occur on both sides of the channel.

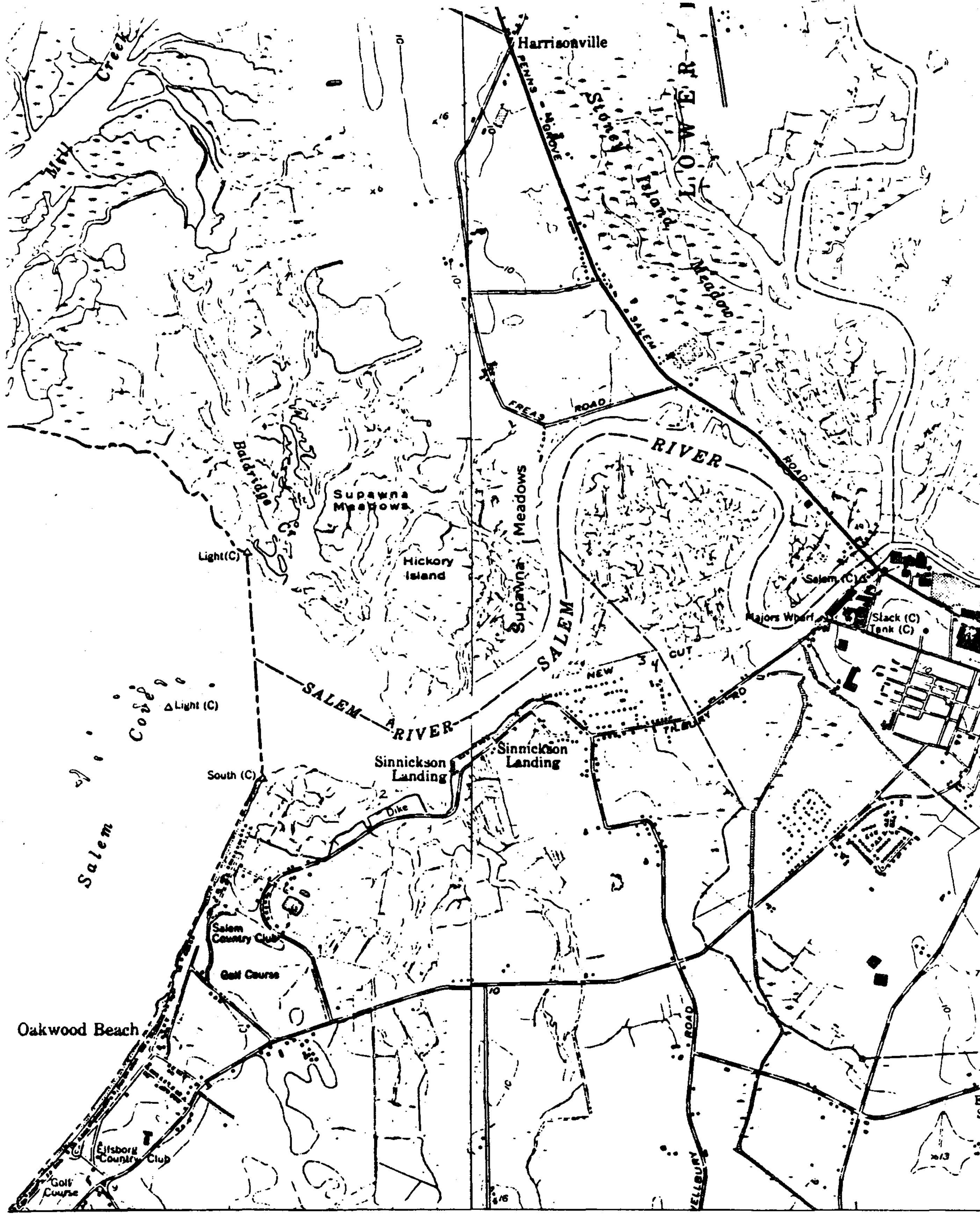

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Figure 2. Fish Sampling Sites

Sampling in this area was very difficult due to current action and thus, restricted sample site selection. Site 3 (Figure 2) is on the north side of the "new cut" along a short gravel area supported by spotty vegetation (Scirpus americanus and Spartina alterniflora). Site 4 (Figure 2) is opposite Site 3 on the south side of the "new cut." This area is influenced by development, was heavily riprapped for erosion control and contained little vegetation. Site 4 was not sampled May 28 or June 23 because of hazardous currents.

B. Results

During the 3 days of sampling (Table 1) that were conducted May 7, May 28 and June 23, 1987, a total of 1,130 fish were collected and identified, representing 20 different species (Table 2). Ninety percent were represented bay anchovy (69%), striped killifish (8%), Atlantic silverside (7.7%) and white perch (6%). The remaining species include carp, bluefish, pumpkinseed, mummichog, white catfish, Atlantic menhaden, gizzard shad, alewife, American shad, blueback herring, channel catfish, white crappie, American eel, sundial, golden shiner and brown bullhead. In addition, but not listed in Table 1, were grass shrimp and various species of crabs.

Of particular note is the sample presence of American shad, a State endangered species. Lupine (1987) determined these shad are juveniles that overwintered in the estuary. Most of the other fish species collected were also juveniles that were utilizing the lower Salem River as a nursery area.

The New Jersey Division of Fish, Game and Wildlife monitors American shad to determine population size. Recent water quality improvements are believed to have had a beneficial effect on the expanding shad population in the Delaware River. Zich (1977) confirmed spawning runs of alewife in the Salem River. Since the Salem River historically spawned shad, continued improvements in water quality may restore shad as a spawning species.

Almost all the sampling data were obtained by hand seining. The gill net sets provided little information due to debris clogging the nets, current velocities preventing proper sets and possible human disturbance. Therefore, any information obtained from the gill net sampling should be considered nonconclusive.

Table 1

FISH SAMPLING DATA

GILL NET

SITE A

	5/7/87	5/28/87	6/23/87	TOTAL
WHITE PERCH	1	1		2
CHANNEL CATFISH		1	1	2
BROWN BULLHEAD		1		1
				5

HAND SEINE

SITE 1

	5/7/87	5/28/87	6/23/87	TOTAL
BAY ANCHOVY	84	>150	45	>279
STRIPED KILLIFISH	30	> 15		> 45
ATLANTIC SILVERSIDE		> 20	43	63
WHITE PERCH	18			18
ALEWIFE	1			1
ATLANTIC MENHADEN		6		6
WHITE CATFISH	3	1		4
GOLDEN SHINER	1			1
CARP	1	3	3	7
BLUEFISH			11	11
SUNDIAL			1	1
AMERICAN EEL			1	1
PUMPKINSEED				1
				438

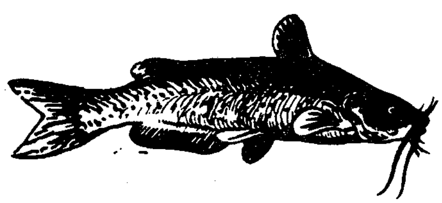

Table 1 (cont.)

HAND SEINE

SITE 2

	5/7/87	5/28/87	6/23/87	TOTAL
BAY ANCHOVY	117	230	UNABLE	347
STRIPED KILLIFISH	2	38	TO	40
MUMMICHOG		8	SEINE	8
WHITE PERCH	18	12		30
ALEWIFE	2			2
GIZZARD SHAD	5			5
BLUEBACK HERRING	2	1		3
CARP	4	6		10
WHITE CATFISH	1	3		4
SUNDIAL		1		1
WHITE CRAPPIE		2		12
PUMPKINSEED		12		464

HAND SEINE

SITE 3

	5/7/87	5/28/87	6/23/87	TOTAL
BAY ANCHOVY	5	75	65	145
ATLANTIC SILVERSIDE		25	1	26
WHITE PERCH		9	4	13
ALEWIFE	1	1		2
AMERICAN SHAD		4		4
BLUEFISH			6	6
CHANNEL CATFISH			1	1
AMERICAN EEL		1		1
CARP			2	2
				200

HAND SEINE

SITE 4

	5/7/87	5/28/87	6/23/87	TOTAL
STRIPED KILL[illegible]	7	DID NOT	DID NOT	7
WHITE PERCH	4	SAMPLE	SAMPLE	4
BAY ANCHOVY	2			2
GIZZARD SHAD	1			1
				14

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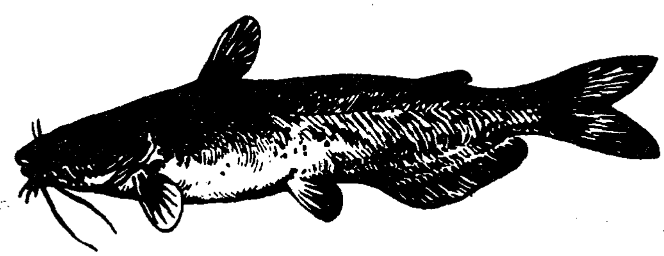
Table 2

SUMMARY OF FISH SAMPLING

	TOTAL	
BAY ANCHOVY - Anchoa mitchilli	>782	(69%)
STRIPED KILLIFISH - Fundulus majalis	> 92	(8%)
ATLANTIC SILVERSIDE - Menidia menidia	> 89	(7.8%)
WHITE PERCH - Morone americana	67	(6%)
CARP - Cyprinus carpio	19	
BLUEFISH - Pomatomus saltatrix	17	
PUMPKINSEED - Lepomis gibbosus	13	
MUMMICHOG - Fundulus heteroclitus	8	
WHITE CATFISH - Ictalurus catus	8	
ATLANTIC MENHADEN - Brevoortia tyrannus	6	
GIZZARD SHAD - Dorosoma cepedianum	6	
ALEWIFE - Alosa pseudoharengus	5	
AMERICAN SHAD - Alosa sapidissima	4	
BLUEBACK HERRING - Alosa aestivalis	3	
CHANNEL CATFISH - Ictalurus punctatus	3	
WHITE CRAPPIE - Pomoxis annularis	2	
AMERICAN EEL - Anguilla rostrata	2	
SUNDIAL - Scophthalmus aquosis	2	
GOLDEN SHINER - Notemigonus crysoleucas	1	
BROWN BULLHEAD - Ictalurus nebulosus	1	
TOTAL	>1,130	



IV. Waterfowl/Waterbird Investigation

A. Methods

Concurrent with fish sampling, Service biologists made visual observations (on foot or by boat) of waterfowl and waterbird use in the project area. Additionally, an investigation of the oxbow island was conducted to determine nesting activity and bird usage at sites adjacent to the project area. Available information on Federal/State listed threatened and endangered species, as well as winter waterfowl census data, were also reviewed.

B. Results

The project area is within the historic range of the federally-designated endangered bald eagle and peregrine falcon. The only confirmed pair of nesting bald eagles in New Jersey is in Cumberland County. Nesting activity has also been observed in Mannington Meadows and in Alloways Creek (Clark, 1987). Although these nesting attempts have not been successful they provide evidence to the excellent habitat for the eagle that the area provides. Additionally, a pair of eagles recently overwintered during 1986 to 1987 in Mannington Meadows (Clark, 1987).

Peregrine falcons nest on the Delaware Memorial Bridge. Reynolds (1987) reports nesting activity on this bridge during the last 3 years, but nesting success is unknown. Further upriver, the Commodore Barry Bridge has provided successful nests in 1986 and 1987 (Clark, 1987).

Clark also reports 9 successful nests in 1987 on Artificial Island for the State threatened osprey.

The Salem River and adjoining wetlands provide valuable habitat for thousands of migratory waterfowl annually. The river is censused each year in early January to monitor populations. The 1985 aerial census, which begins at Fort Elfsborg Road and ends at Salem Canal, disclosed 8,225 Canada geese, 600 black duck, 400 mallard, 100 American widgeon, 100 scaup, 500 bufflehead and 50 tundra swan (U.S. Fish and Wildlife Service, 1985).

Supawna Meadows National Wildlife Refuge (Figure 3), provides excellent interspersion of aquatic and wetland habitat north of Sinnicksons Landing. This refuge is particularly valuable as a stopover location during waterfowl migration for resting and feeding when species occurrence and population are at optimum levels.

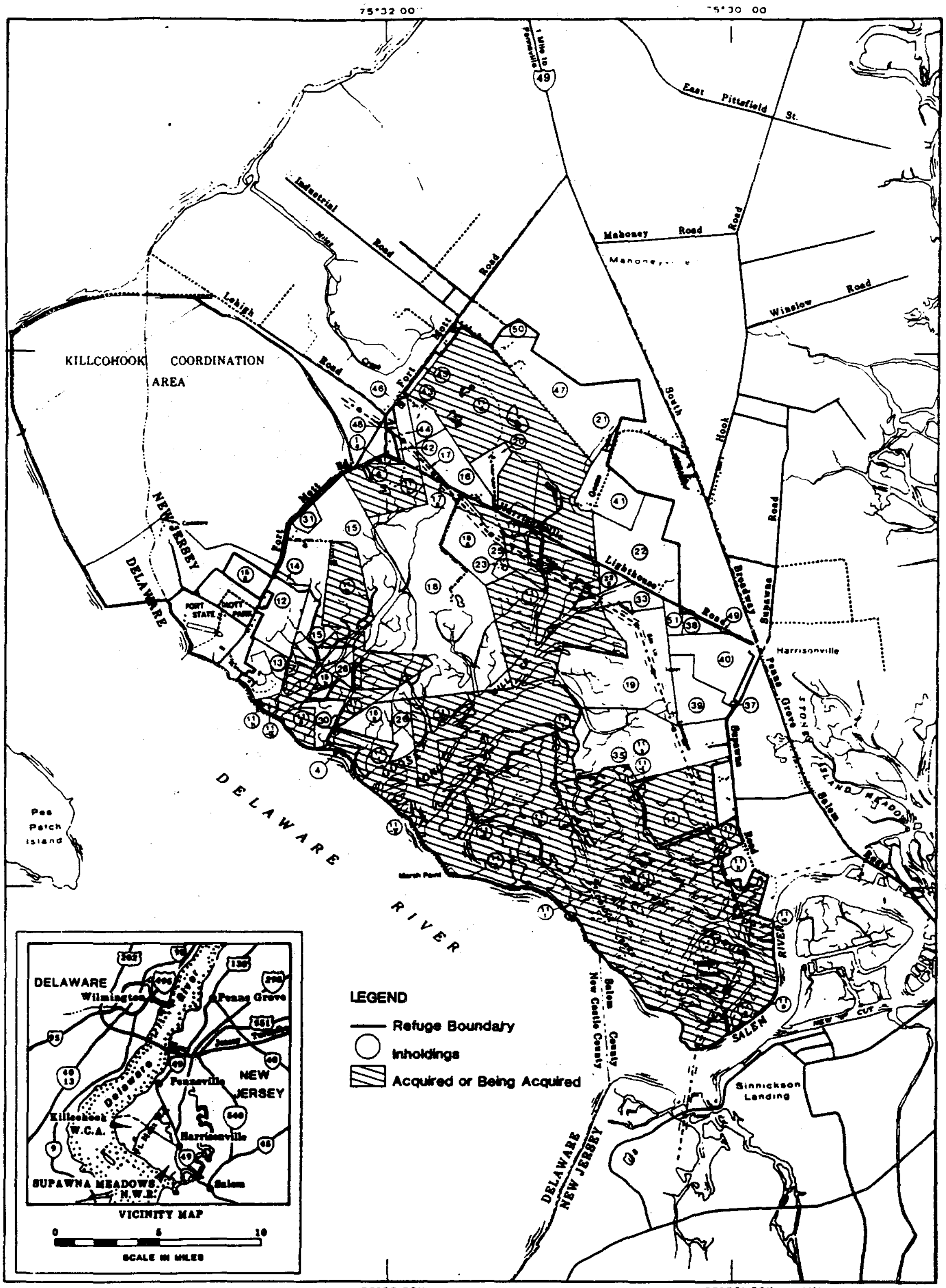
Service reconnaissance of the project area provided information to conclude that waterfowl and waterbirds do not nest in wetlands bordering the "new cut." The banks are steep and dense stands of common reed grow adjacent to the north bank. Nesting activity in this immediate area was not observed.

SUPAWNA MEADOWS NATIONAL WILDLIFE REFUGE

UNITED STATES DEPARTMENT OF THE INTERIOR

SALEM COUNTY, NEW JERSEY

UNITED STATES FISH AND WILDLIFE SERVICE



75°32'00"

75°30'00"

COMPILED IN THE OFFICE OF REALTY FROM SURVEYS BY U.S.G.S. AND U.S.F.W.S.

0 2000 4000 6000 8000 Feet

0 .5 1 2 Kilometers

MN 0°21' GN 9° MEAN DECLINATION 1970

NEWTON CORNER, MASSACHUSETTS 1984
REVISED APRIL 1987

Figure 3. Supawna Meadows

The wetlands on the oxbow island, as well as the tidal tributaries which flow through the island, provide feeding and resting habitat for various waterfowl and waterbirds. The wetland banks are also being utilized as dens by muskrats. McCauley (1987) reports that the oxbow island yielded 600-700 muskrats for 2 part-time trappers during the trapping season between November 15 to March 15. McCauley also believes the island can sustain a 1,000-1,200 yearly harvest of this species.

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V. Conclusions and Recommendations

The preliminary impact assessment in the Service's September, 1986 planning aid report predicts that environmental impacts would result from the project as proposed. Fish and wildlife resource impacts fall into the following two categories: 1) water quality impacts; and 2) direct loss of habitat (e.g., shallow water and wetlands).

Water quality impacts are associated with water column degradation from the dredging operation. Any activity which adversely affects water quality during spring and fall has the potential for interfering with or halting fish passage. Water quality problems could also impact fish nursery areas. For example, migration spawning and early growth of anadromous fish may be disrupted by turbidity depending on the type of dredge equipment used or time of dredging. Dredge induced turbidity may also interfere with fish movements, smother fish eggs and clog gills. These adverse impacts can be minimized by using hydraulic dredging or by timing dredging to avoid the months of March, April, May, September, October and November.

Loss of shallow water habitat and vegetated wetlands is proportional to the depth and width of channel dimensions. The present channel, in the "new cut," is 12-feet deep and 100-feet in width. The Corps provided the following channel dimensions and estimated impacts to wetlands and shallows resulting from project implementation:

Channel dimensions (feet)		Environmental loss (acres)	
depth	width	wetlands	shallows
14	160	4.5	4.0
16	170	5.5	4.5
18	180	7.0	5.0
20	250	9.0	5.5
22	280	13.0	6.5
24	280	17.0	7.0

Under the provisions of the Service's Mitigation Policy (Federal Register, Vol. 46, No. 15, January 23, 1981), the wetlands and nearshore shallows in the project area are designated as Resource Category II. The cover types that would be impacted by the project are estuarine emergent, estuarine intertidal and estuarine subtidal. The evaluation species for the estuarine emergent cover type is the black duck, a species of special emphasis in this region. The snowy egret was evaluated as a frequent inhabitant of the estuarine intertidal area, while the American shad (a State endangered species) was evaluated for the estuarine subtidal cover type. The habitat in the project impact area is of high value to these evaluation species and is scarce or becoming scarce in the ecoregion. The mitigation goal for Resource Category II habitat is no net loss of in-kind habitat values. Therefore, the Service recommends in-kind replacement on at least a 1 to 1 ratio.

Selection of a final plan to avoid or minimize biological impacts is required by the U.S. Environmental Protection Agency's Section 404(b)(1) Guidelines (Federal Register, Vol. 45, No. 249, December 24, 1980). Additionally, selection of a plan with less environmental impacts will minimize the need for habitat compensation. In this regard, the Service recommends selection of a 16-feet dredge depth.

Replacement of shallow water habitat in the "new cut" area may possibly be compensated for on-site by designing a gentle slope on the oxbow island at a 5 to 1 ratio. However, this may exacerbate wetland taking, and shallows creation may not be practical given the strong current velocities eroding the area. Structural alternatives such as riprap or angled groins may be necessary to stabilize the area or portions of it. Therefore, the Service recommends that the Corps investigate the feasibility of creating a more gentle slope into project design and its effects on wetland taking.

Wetland losses should be mitigated by creating an equal amount of wetlands from an unproductive upland habitat. There appear to be sufficient sites (dominated by common reed) on Supawna Meadows National Wildlife Refuge which are suitable for wetland creation. The Service is available to provide technical assistance in determining the feasibility of wetland creation on the refuge. If mitigation on the refuge does not materialize, the Corps should investigate other appropriate sites to implement compensatory mitigation along the Salem River. For example, the upland section of the oxbow island may provide adequate area to provide for compensation requirements.

VI. References Cited

Clark, K. 1987. Personal communication, New Jersey Division of Fish, Game and Wildlife, Tuckahoe Wildlife Management Area, Tuckahoe, New Jersey.

Lupine, A. 1987. Personal communication, New Jersey Division of Fish, Game and Wildlife; Freshwater Fisheries Lab, Lebanon, New Jersey.

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Zich, H.E. 1977. The collection of existing information and field investigation of anadromous clupeid spawning in New Jersey. Misc. Rept. No. 41, New Jersey Dept. of Environmental Protection, Division of Fish, Game and Shellfisheries. Unpaged.

Appendices

Appendix A

Endangered Species List

FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	*Acipenser brevirostrum*	E	Hudson and Delaware Rivers plus other Atlantic coastal rivers
REPTILES:			
Turtle, green*	*Chelonia mydas*	T	Oceanic summer visitor coastal waters
Turtle, hawksbill*	*Eretmochelys imbricata*	E	Oceanic summer visitor coastal waters
Turtle, leatherback*	*Dermochelys coriacea*	E	Oceanic summer visitor coastal waters
Turtle, loggerhead*	*Caretta caretta*	T	Oceanic summer resident coastal waters rarely nests: Cape May and Atlantic Counties
Turtle, Atlantic ridley*	*Lepidochelys kempii*	E	Oceanic summer resident coastal waters
BIRDS:			
Eagle, bald	*Haliaeetus leucocephalus*	E	Entire state
Falcon, American peregrine	*Falco peregrinus anatum*	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic	*Falco peregrinus tundrius*	E	Entire state migratory - no nesting
Piping Plover	*Charadrius melodus*	T	Entire State
MAMMALS:			
Cougar, eastern	*Felis concolor cougar*	E	Entire state - probably extinct
Whale, blue*	*Balaenoptera musculus*	E	Oceanic
Whale, finback*	*Balaenoptera physalus*	E	Oceanic
Whale, humpback*	*Megaptera novaeangliae*	E	Oceanic
Whale, right*	*Eubalaena* spp. (all species)	E	Oceanic
Whale, sei*	*Balaenoptera borealis*	E	Oceanic
Whale, sperm*	*Physeter catodon*	E	Oceanic
MOLLUSKS:			
None			
PLANTS:			
Small whorled pogonia	*Isotria medeoloides*	E	Bergen (Franklin Lakes, Closter), Mercer (Trenton), & Sussex (Montague, Sparta, Hainesville) Counties

*Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

UNITED STATES
DEPARTMENT OF THE INTERIOR
FISH AND WILDLIFE SERVICE

Suite 322
311 South Allen Street
State College, Pennsylvania 16801

September 29, 1986

Lt. Colonel Ralph V. Locurcio
District Engineer, Philadelphia District
U.S. Army Corps of Engineers
Custom House, 2nd & Chestnut Streets
Philadelphia, Pennsylvania 16801

Dear Colonel Locurcio:

This constitutes our planning aid report entitled "A Survey of Fish and Wildlife Resources in the Salem River Navigation Project Area, Salem, New Jersey". This report is of a reconnaissance nature and does not constitute the report of the Secretary of the Interior on the project within the meaning of Section 2(b) of the Fish and Wildlife Coordination Act, nor does it represent the review comments of the Department on any forthcoming environmental statement.

Except for occasional transient species, no federally listed or proposed endangered or threatened species under our jurisdiction are known to exist in the project impact area. Therefore, no Biological Assessment or Section 7 consultation under the Endangered Species Act is required with the Fish and Wildlife Service. However, this determination may be reconsidered if additional information on listed or proposed species becomes available or if project plans are changed substantially. A compilation of federally listed species in New Jersey is enclosed in Appendix B.

We look forward to working with your staff on this project in the future.

Sincerely,

Charles Kulp

Charles J. Kulp
Field Supervisor

Enclosures

A Survey of Fish and Wildlife Resources in The Salem River Navigation Project Area (Delaware River Comprehensive Navigation Study)

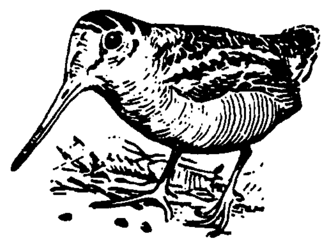
Salem, New Jersey

U.S. Department of the Interior
Fish and Wildlife Service

September 1986

Planning Aid Report

A Survey of Fish and Wildlife Resources
in the Salem River Navigation Project Area,
Salem, New Jersey



Prepared for

U.S. Army Corps of Engineers,
Philadelphia District

Preparer: Michael T. Chezik
Project Leader: Charles J. Kulp

3

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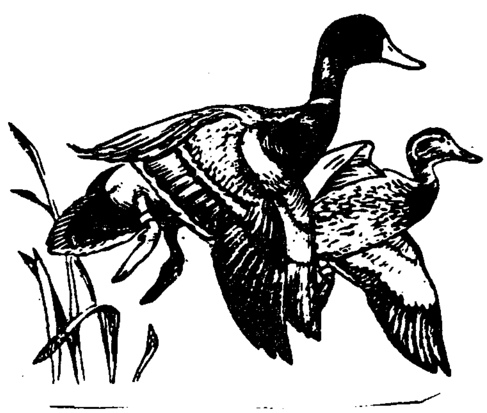
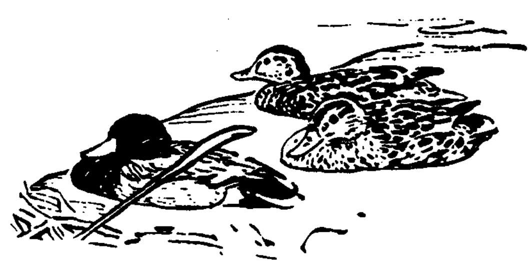


I. Introduction and Scope

This planning aid report (PAR) provides fish and wildlife information, a preliminary impact assessment and recommendations to reduce adverse impacts to fish and wildlife resources associated with the proposed construction and operation of a modified navigation project in the Salem River, New Jersey. The Corps'study was authorized by a series of resolutions by the Committee on Public Works, United States Senate in 1954 and 1974, and by the House of Representatives, Committee on Public Works in 1964. The purpose of the study is to investigate the need to expand navigation channels and anchorages for commercial shipping interests.

Our PAR is based on a review of Corps project documents, prior Fish and Wildlife Service (Service) reports, coordination with the New Jersey Division of Fish, Game and Wildlife and a site visit conducted on April 26, 1985. It is not intended to be a comprehensive treatment of fish and wildlife, project affects or mitigation. The objective of the PAR is to review available data, identify project impacts and recommend means and measures to avoid, minimize or compensate for fish and wildlife damages which would result from the proposed project modifications.

Much of the information in this report is taken from a prior PAR entitled "Delaware River Dredging Disposal Study, Small Navigation Projects," dated October 1981 (U.S. Fish and Wildlife Service, 1981). Coordination with the New Jersey Division of Fish, Game and Wildlife suggests that no additional fishery data for the Salem River is available for this report.

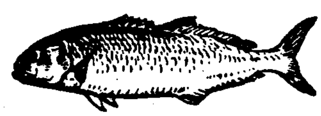


II. Description of Project Plans

The existing Salem River Federal Navigation Project, adopted in 1925 and initially dredged to authorized dimensions in 1928, provides navigational access between the City of Salem, New Jersey and the Delaware River Federal Navigation Project (see Figure 1). The authorized channel is approximately 5 miles long and has a project depth of 12 feet at mean low water. Channel width is 150 feet in Salem Cove, narrowing to 100 feet at the cutoff at Sinnickson Landing. The authorized channel extends from Elsinboro Point at the southwestern corner of Salem Cove to the New Jersey Route 45 highway bridge in Salem. Dredging of the Little Salem River portion of the channel has been deferred because additional depth is not required in that reach.

The project area was dredged in 1984 for maintenance purposes with disposal adjacent to the channel in Salem Cove. Approximately 400,000 cubic yards of bottom materials were removed from the entrance channel in Salem Cove. Upriver sections of the channel were not dredged. The next prior incidence of maintenance dredging was in 1961.

Corps planners have not completed channel dimensions for the proposed modification. However, a 200-foot wide channel the full length of the existing project is being considered. This channel would have 3 or 4 to 1 side slopes and be 24 feet deep at mean low water. Amounts to be dredged are unknown, but could exceed 1 million cubic yards. Spoil may be deposited at one or more of the potential disposal areas discussed later in the report.



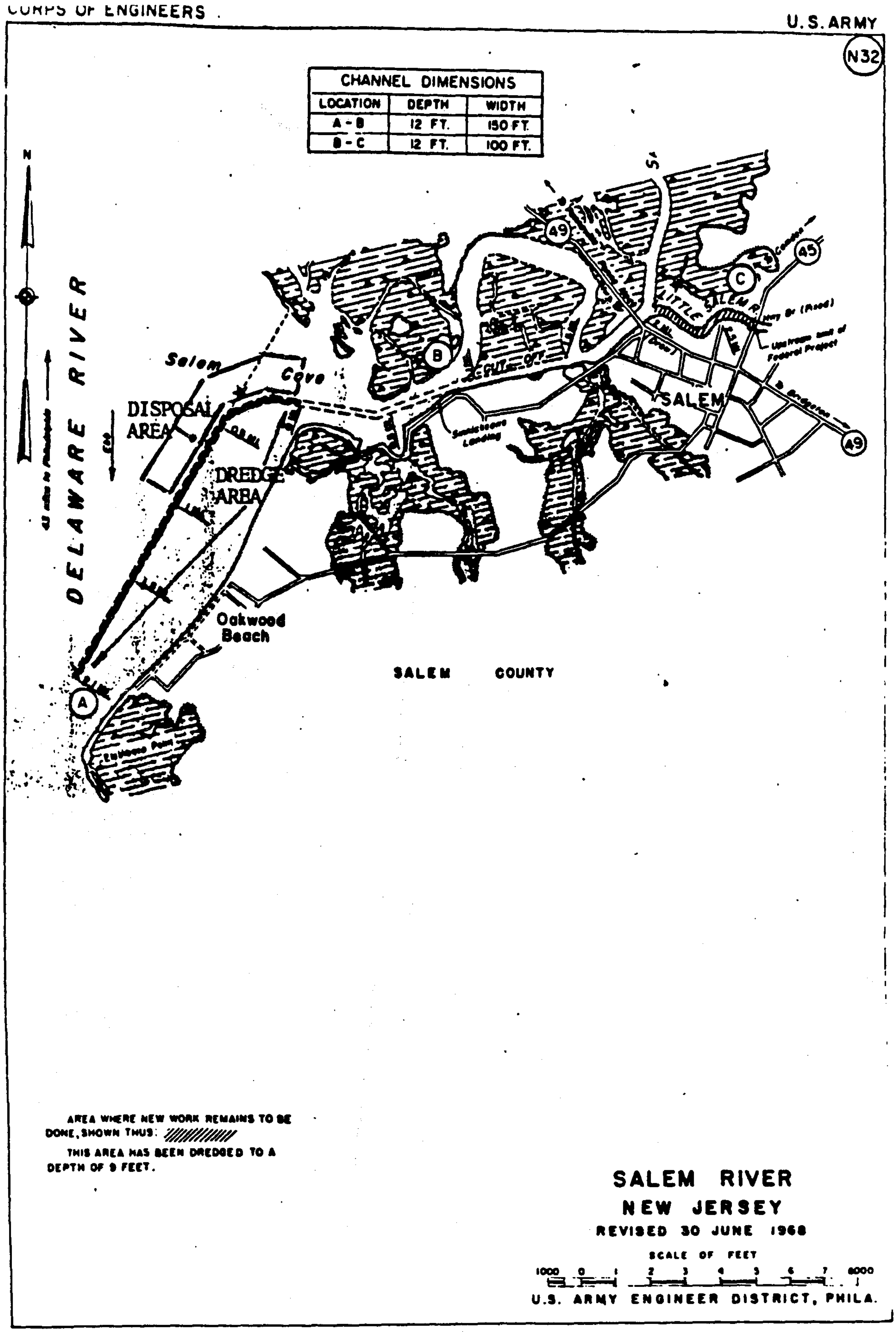

CORPS OF ENGINEERS
U.S. ARMY
N32
CHANNEL DIMENSIONS
LOCATION DEPTH WIDTH
A - B 12 FT. 150 FT.
B - C 12 FT. 100 FT.
N
DELAWARE RIVER
Salem Cove
DISPOSAL AREA
DREDGE AREA
CUT-OFF
Oakwood Beach
SALEM
LITTLE SALEM R.
SALEM COUNTY
49
45
A
B
C
AREA WHERE NEW WORK REMAINS TO BE DONE, SHOWN THUS:
THIS AREA HAS BEEN DREDGED TO A DEPTH OF 9 FEET.
SALEM RIVER
NEW JERSEY
REVISED 30 JUNE 1968
SCALE OF FEET
1000 0 1 2 3 4 5 6 7 8000
U.S. ARMY ENGINEER DISTRICT, PHILA.

Figure 1

III. Fish and Wildlife Resources

A. Aquatic and Terrestrial Habitats

The Salem River drains about 100 square miles of the Delaware River Basin in Salem County. It begins as a moderately fast-moving stream and becomes a slow-moving tidal river before emptying into the Delaware River estuary at rivermile 58. The river discharges an average of 131 cubic feet per second, has an average tidal range of 5.4 feet and is generally oligohaline (0.5-5.0 ppt). The river at the upper end of the maintained reach (Rt 49 bridge) is approximately 400 feet wide. It broadens to 4,000 feet before entering Salem Cove. New Jersey water quality standards specify the following uses for the Salem River: industrial water supply after reasonable treatment; wildlife; propagation of resident fish and other aquatic life, passage of anadromous fish; primary contact recreation; and navigation. Existing water quality in the project reach is poorly documented. A single water sample taken by the Corps in July 1983 indicated acceptable water quality. Channel sediment testing by the Corps in 1983 suggests that sediments are not contaminated by metals or toxic organics (Army Corps of Engineers, 1984; Ichthyological Associates, Inc., 1980).

Agricultural, wetland and residential/industrial are the dominant land uses bordering the Salem River. Agricultural fields are generally located inland from the river, tributaries and adjoining wetlands. Examples of this cover type can be found along Ammellbury Road and Fort Elfsborg Road south of the river and Penns Grove/Salem Road north of the river. Small grains (wheat and corn) are the most important crops.

Estuarine Intertidal Emergent Wetland is the major wetland type in the project area. This wetland type occurs on both sides of the river, often following unnamed tributaries a mile or more inland. Saltmarsh cordgrass is common at the mouth of the river on both shores, particularly within the Supawna Meadows National Wildlife Refuge. Common reed grass is dominant in upriver and tributary wetlands; for example, on the island north of Sinnickson Landing. Emergent wetlands at the upper end of the project area are comprised of mixed freshwater species such as wild rice, arrow arum and spatterdock. Examples include Fenwick Creek (Little Salem River) and Mannington Meadow (Walton, T.E. and Patrick, 1973).

Numerous non-tidal wetlands, classified as Palustrine Emergent, Scrub-Shrub or Forested, also occur within the project area. Cattail, black rush and common reed grass are the most prevalent species in Emergent Wetlands and are often found in low areas adjoining agricultural fields. Scrub-Shrub Wetlands may also occur in low areas, particularly where drainage ditches have not been maintained. Southern arrow-wood is typical of the Scrub-Shrub Wetland class and may be found adjacent to the Salem County landfill along Tillbury Road. Forested wetlands are less common than Emergent or Scrub-Shrub, but a few may be seen near Sinnickson Landing. Red maple is the dominant wetland species in Forested Wetlands.

The towns of Fort Elfsborg, Oakwood Beach, Sinnickson Landing and Salem border Salem Cove or the Salem River on the south side. No communities border the north side of the river, which is mainly wetland. Supawna Meadows National Wildlife Refuge occupies a large tract at the mouth of the river's north side.

B. Shellfish

The Salem River project area is located 13 miles upriver from Delaware River oyster seed beds and leased planting grounds. However, a commercial fishery of blue crabs and recreational crabbing occurs in Salem Cove. Recreational crabbing also occurs in the lower river (U.S. Fish and Wildlife Service, 1981).

C. Finfish

The Service noted in its 1981 PAR that fishery data is lacking for the project area. This condition has apparently not changed. The New Jersey Division of Fish, Game and Wildlife has sampled non-tidal reaches of the Salem River, but not the lower river and has no plans to do so (McClain 1985). The upriver sampling confirmed the spawning of alewife and use by American eel, both diadromous species.

More information is available about finfish in Salem Cove than in tidal portions of the Salem River. Ichthyological Associates Inc., collected 9 species of finfish comprising 662 specimens in two, ten-minute trawl samples (10-foot trawl) in the Delaware River approximately 50 feet off Oakwood Beach in early summer 1977. Bay anchovy (53 percent) and spot (45 percent) were the dominant species in the sample. Tidewater silverside, northern pipefish, white perch, striped bass, summer flounder and hogchoker were also taken. Another sample yielded seven species and 187 specimens.

Atlantic menhaden comprised 72 percent of the catch. Other species included spot, bay anchovy, Atlantic silverside, white perch, striped bass and bluefish (U.S. Fish and Wildlife Service, 1981).

Himchak (1981) collected 8 species of fish comprising 72 specimens in a single ten-minute trawl sample at the mouth of Salem River on November 17, 1980. White perch and spot comprised 90 percent of the catch. Carp, gizzard shad, brown bullhead, channel catfish and hogchoker made up the remainder of the sample.

Ichthyological Associates Inc., sampled ichthyoplankton in Salem Cove on May 4, 1977. Four, five-minute tows yielded 61 larvae representing four taxa. Striped bass comprised 66 percent of the total catch. Other larvae collected were white perch and creek chubsucker (U.S. Fish and Wildlife Service, 1981).

D. Wildlife

The Salem River and adjoining wetlands provide valuable habitat for thousands of migratory waterfowl annually. The river is censused each year in early January to monitor populations. The 1985 aerial census, which begins at Fort

Elfsborg Road and ends at Salem Canal, disclosed 8,225 Canada geese, 600 black duck, 400 mallard, 100 American widgeon, 100 scaup, 500 bufflehead and 50 tundra swan (U.S. Fish and Wildlife Service, 1985).

Supawna Meadows National Wildlife Refuge, under the administration of the Tinicum National Environmental Center, provides excellent interspersion of aquatic and wetland habitat north of Sinnickson Landing. It is particularly valuable as a stopover location during waterfowl migration for resting and feeding when species occurrence and population are at optimum levels.

Other wildlife besides waterfowl using the project area include muskrat, red fox, raccoon, striped skunk, eastern cottontail, whitetail deer, ringnecked pheasant, and American woodcock. With exception for the first and last species listed, all of these fauna are more typically associated with upland habitats, primarily forest and field.

E. Threatened/Endangered Species

The project area is within the historic range of the bald eagle and peregrine falcon. The bald eagle is a rare visitor to the Delaware Valley and is most often seen during fall migration. The peregrine falcon is rare and irregularly observed. Neither species is known to breed in or near the project area.

The shortnose sturgeon has been collected in the Delaware River in recent years near Artificial Island (Masnik and Wilson, 1980). It has also been reported in the vicinity of Pea Patch Island. No collections have been reported from the project site; however, it may occur in the Delaware River and possibly in the lower Salem River.

F. Mitigation Policy

The Service classifies wetlands and nearshore shallows in the project area as Resource Category II in its Mitigation Policy. Upland habitats, except for developed areas, are classified as Resource Category III. Resource Category II means these habitats have high value and must be replaced with no net loss of habitat value. Category III means these habitats have high to medium value and must be replaced with no net loss of habitat value while minimizing loss of in-kind habitat value.

IV. Preliminary Impact Assessment

A. Dredging

Dredging impacts may be generally categorized into water column impacts and bottom impacts. Potential water column impacts include:

1. increased turbidity,

2. increased oxygen demand,

3. reduced light penetration,

4. reduced photosynthetic oxygen production,

5. release of toxic organic compounds and heavy metals,

6. increased temperature and,

7. increased salinity.

These impacts vary with the magnitude and duration of the disturbance, physical and chemical content of the sediment, water quality and hydrologic characteristics of the waterbody. Impacts may also vary with the type, condition and operation of the dredging equipment. Hopper dredge overflow and clamshell dredging usually generate the highest turbidity and are of greatest concern (Darnell, 1976; Allen and Hardy, 1980).

The above-noted impacts to the water column constitute degradation of water quality and may be short or long term. Any activity which adversely affects water quality during spring and fall has the potential for interfering with or halting fish passage. It may also jeopardize waterfowl if toxic chemicals are resuspended.

Potential bottom impacts at and surrounding the dredge site include:

1. destruction of benthic organisms,

2. altered benthic diversity following recolonization,

3. changed circulation patterns,

4. modified sediment input and deposition,

5. changed nearshore wave refraction and diffraction patterns,

6. creation of oxygen depleted sinks, and

7. creation of contaminant traps (Allen and Hardy, 1980).

Bottom impacts vary with invertebrate tolerance, project characteristics, hydrology, sediment contamination and water quality.

Specific impacts resulting from channel deepening and widening are difficult to predict due to the vagueness of project plans and the absence of certain biological information. However, we anticipate the following impacts based on available project and biological data.

1. Dredging will eliminate existing nearshore shallows and emergent wetlands, primarily in the area of the "Cut off", located north of Sinnickson Landing. This 3,300-foot reach is in the narrowest part of the navigation channel and broadening it will encroach into nearshore shallows and wetlands, primarily on the north side. The magnitude of this loss can't be stated, since the Corps has not yet settled on a specific channel modification plan. However, information available to us indicates that

wetland losses could range from 2.2 to 8.5 acres. We believe it is reasonable to anticipate additional wetland losses due to sloughing of channel banks. The Corps has not provided an estimate of the loss of nearshore shallows which could exceed wetland losses.

2. The loss of nearshore shallows and wetlands will adversely affect fish populations dependent on these areas for spawning, early growth and feeding. Absence of fishery data in the upper half of the project area does not allow us to be specific about species affected. There may also be temporary effects to fish as a result of the dredging. For example, migration, spawning and early growth of anadromous fish may be disrupted by turbidity depending on the type of equipment used or timing of dredging. Dredge-induced turbidity may also interfere with fish movements, smother fish eggs and clog gills. These impacts can be minimized by using hydraulic dredges or by timing dredging to avoid spawning periods.
3. Channel widening and deepening will adversely affect waterfowl and other waterbirds dependent on nearshore shallows and wetlands for nesting, brood development, cover and feeding. We do not have data on waterfowl nesting along the channel, so it is impossible to predict how extensive impacts may be. In general, the channel seems to be most valuable as a wintering area rather than for waterfowl production. Therefore, the major impact to waterfowl may be the loss of feeding opportunities and cover. As with fisheries, there could be some temporary impacts to waterfowl and other waterbirds during dredging. Disturbances to nearby nesting waterfowl and other waterbirds are possible due to close proximity of the dredging equipment.

4. Regardless of the channel dimensions selected, we do not anticipate significant changes in the existing salinity regime within the project area or Mannington Meadows. The only exception might be the persistence of a wedge of higher salinity water along the bottom of the deepened channel, downstream of RT 49, at low river flows. However, proposed project modifications are not expected to have measurable impacts on salinity within the Supawna Meadows National Wildlife Refuge.

5. As indicated previously, commercial potting of blue crabs occurs in Salem Cove, as does recreational crabbing. Dredging may interfere with these activities depending on their proximity to the channel, as well as the season when dredging occurs.

In order to complete our responsibilities under the Fish and Wildlife Coordination Act, the Service will need detailed information about proposed project modifications. Channel location, depth, width and side slopes must be specified, as well as the method and season of dredging.

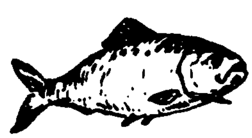
We will also need precise locations and amounts/types of wetlands directly or indirectly affected by project improvements. Losses of shallow areas need to be located and quantified by acreage and depth. In addition to this information, the Service believes investigations of fish and waterfowl/waterbird inhabitants are needed to better characterize existing resource conditions. We recommend spring sampling be undertaken for adult, juvenile and young fish in nearshore and channel areas of the project reach. We also recommend a reconnaissance of waterfowl/waterbird use in the project area. These investigations would provide information necessary to conduct a meaningful assessment of fish and wildlife resources and project impacts to those resources.

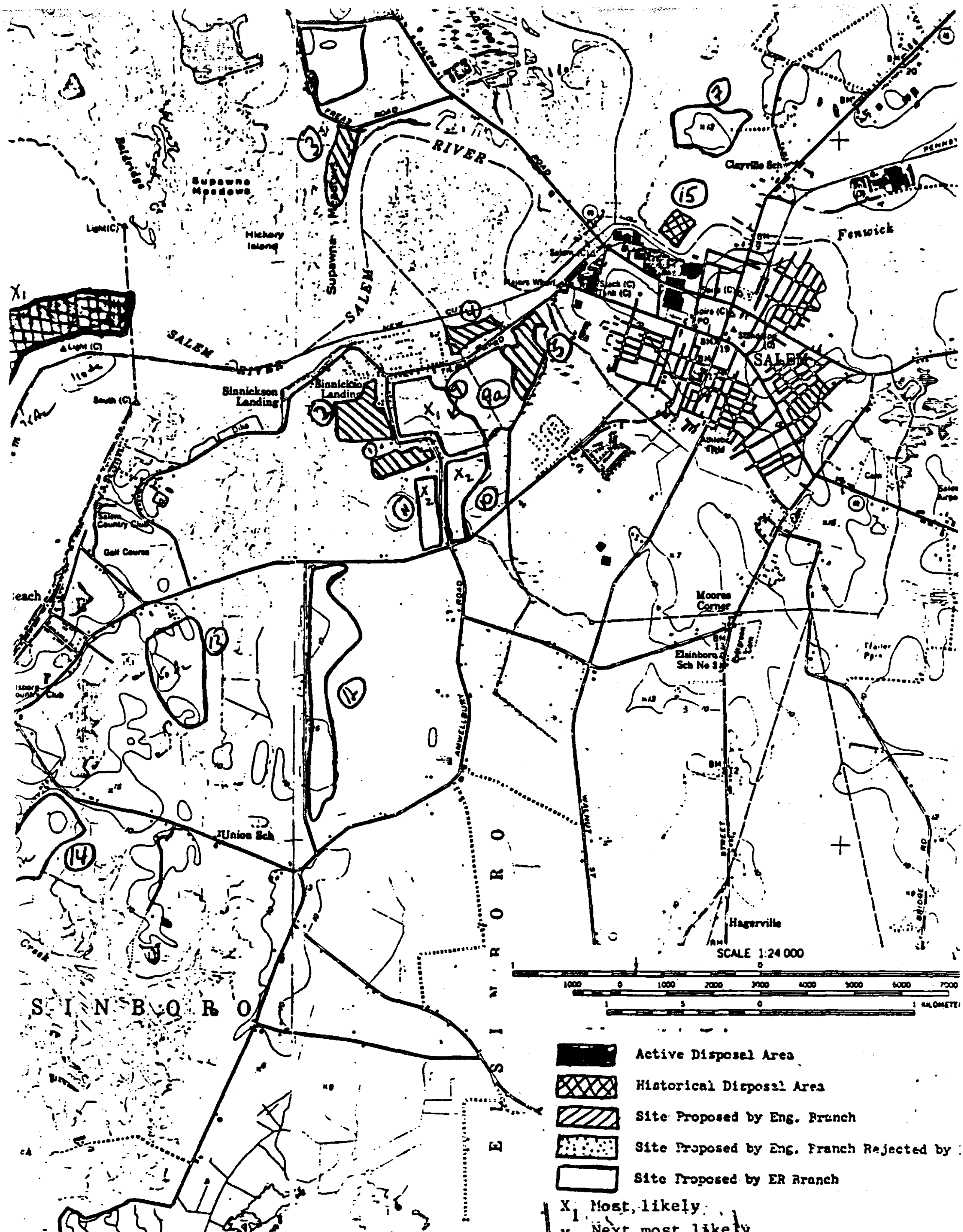
B. Disposal of dredged material.

Impacts of dredged material disposal on fish and wildlife habitat are usually easier to predict than dredging impacts because disposal results in burying habitats under tons of sediment. Generally, the effect is devastating, long-term and irreversible. However, in aquatic situations, recolonization by benthos and fish can occur depending upon how much sediment is placed and the physical characteristics of the sediment and contaminants. The Service discourages placement of dredged material in aquatic systems, particularly wetlands, and encourages placement and use of spoil in confined upland sites.

The Service assessed 16 potential disposal sites selected by the Corps for the proposed project. All of the sites occur to varying degrees in proximity to the river or Salem Cove. Figure 2 shows the locations of the 16 sites. The Service visited the 16 sites on April 26, 1985 and completed a preliminary fish and wildlife assessment (Appendix A) for each one. Funding and time constraints did not allow for a thorough assessment of fish and wildlife at each of the candidate sites. Additional review, therefore, will be needed to confirm our findings.

The completed assessment forms contain information about the occurrence (abundant, common, occasional or trace) and quality (high, medium or low) of a variety of aquatic and terrestrial habitats, and shellfish, finfish and wildlife resources which occur at each candidate site (Item E through I). A circled letter code indicates that the habitat or resource is present at the indicated level of occurrence and quality. If not circled, the habitat or resource was not found. Each circle is a reflection of information obtained during the site visit, review of aerial photographs and National Wetland Inventory maps, other available fish and wildlife data and professional judgment.





Active Disposal Area
Historical Disposal Area
Site Proposed by Eng. Branch
Site Proposed by Eng. Franch Rejected by
Site Proposed by ER Branch
X_1 Most likely
X_2 ~~Next~~ most likely
SCALE 1:24 000
SALEM RIVER
Supawna Meadows
Hickory Island
Sinnickson Landing
Salem Country Club
Golf Course
Clayville Sch
Fenwick
SALEM
Moores Corner
Elsinboro Sch No 3
Hagerville
Union Sch
ELSINBORO

Figure 2

The following table is a compilation showing the results of the assessment:

Table 1.

Site	Prelim. Determination of Suitability	Type of Mitigation	Magnitude of Mitigation
1	SM	OK	Mn
2	SM	OK	Mn
3	SM	OK	Mn
4	SM	OK	Mn
5	S	--	--
6	SM	IK	Mn
7	SM	Ik,OK	Mn
8	SM	IK,OK	Md
9	SM	IK,OK	Mn
9a	SM	IK,OK	Md
10	SM	IK,OK	Mn
11	SM	OK	Mn
12	SM	OK	Mn
13	SM	OK	Mn
14	SM	OK	Mn
15	US	--	--

Letter codes: US = Unsuitable; IK = In-kind replacement; OK = In-kind or Out-of-kind replacement; Md = Moderate; Mn = Minor.

Of the 16 sites examined, only site 15 was judged unsuitable because of extensive wetland destruction. The remaining sites were all judged suitable with mitigation, except for site 5 which could be used without mitigation. Although suitable with mitigation, sites 8 and 9a contain moderate amounts of wetland which would be difficult to mitigate. Therefore, we recommend that sites 8 and 9a, as well as site 15, not be used for spoil disposal.

Most of the sites judged suitable for disposal require minor mitigation. Minor mitigation may be of two types: in-kind replacement of existing habitat values (Resource Category II) or in-kind/out-of-kind replacement (Resource Category III). Where in-kind replacement is specified, minor amounts of wetland exist which must be replaced in-kind. Where in-kind/out-of-kind replacement is indicated, upland habitat values must be replaced in-kind or out-of-kind.

The majority of the candidate sites are comprised of agricultural land. These habitats provide food and cover during the growing season for a variety of wildlife such as pheasant, cottontail rabbits and deer. However, they have little wildlife value after autumn, when harvesting and plowing reduces values. As mitigation for the loss of project-related habitat values, we recommend the Corps implement wildlife habitat improvements on disposal sites after capacity is reached. Guidance can be found in the Dredge Material Research Program, Technical Report D-78-37, entitled "Handbook for Terrestrial Wildlife Habitat Development on Dredged Material." Such improvements would satisfy the requirement for in-kind/out-of-kind replacement of upland habitat values lost through spoil disposal.

Minor wetland mitigation can take two forms: wetland creation or enhancement of existing wetlands. We prefer wetland creation, since enhancement generally requires periodic maintenance. We suggest the Corps seek to enlarge existing wetlands, preferably in non-forested locations. This will minimize impacts to terrestrial wildlife due to the conversion of upland to wetland. Thus, the requirement for in-kind replacement will be satisfied.

Site 6 was apparently used as an overboard disposal site for 400,000 cubic yards of dredged material in 1984. We understand that the Corps attempted to place this material to create a mounding effect, thereby creating small islands and confining the disturbance to the smallest area possible. We would like to know whether this effort was successful and what environmental benefits were obtained. We are particularly interested in determining if the activity enhanced fish and wildlife values at the site. If habitat values were enhanced, care should be taken in using the site again to avoid adversely impacting these resources.

The Supawna Meadows National Wildlife Refuge lies adjacent to site 3. If this site is used, extreme care should be taken to avoid adverse impacts to refuge lands.

The Service has received reports in recent years of dead waterfowl being found at some of the existing disposal sites along the Delaware River (i.e., Pedricktown). We suspect that botulism may be the cause, although evidence is not available to substantiate it. Botulism generally develops in low areas suddenly flooded after being dry for long periods of time. Prevention of botulism entails the draining of disposal areas as quickly as possible to avoid development of stagnant ponds which may attract waterfowl.

V. Recommendations

The Service recommends that the Corps implement the following actions to characterize, avoid, minimize and compensate for adverse impacts to fish and wildlife resources.

1. Initiate spring sampling for adult, juvenile and young fish in nearshore and channel areas throughout the project reach. The purpose of the investigation is to obtain information about fish in the project area to enable a meaningful assessment of project improvements in the future.

2. Initiate a reconnaissance of waterfowl/waterbird use in the project area, with emphasis on spring and fall observations. The purpose of the investigation is to characterize wildlife resources in the project area to enable a meaningful assessment of project improvements in the future.

3. Avoid dredging in wetlands and nearshore shallows. If this cannot be avoided or minimized, replace these habitats elsewhere in the project area or vicinity so that there is no net loss of in-kind habitat value.

4. Avoid placing dredged material on wetlands. If this cannot be completely avoided or minimized, replace impacted wetlands in such a manner that no net loss of in-kind habitat value would result.

5. Compensate for upland habitat values lost through spoil disposal via terrestrial wildlife habitat improvements after site capacity is exhausted.

6. Report on the effects of 1984 overboard disposal at site 6 on fish and wildlife. If fish and wildlife values were enhanced, implement measures to protect and increase those values if site 6 is again proposed for disposal of dredged material.

7. Use extreme care to avoid impacting the Supawna Meadows National Wildlife Refuge, if site 3 is selected for disposal of dredged material.

These recommendations are preliminary. We believe it would be prudent to have a meeting with various state and federal agencies to discuss project impacts and recommendations prior to initiation of future project planning stages.

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VII. Appendix A

Fish and Wildlife Assessment
of
Candidate Disposal Sites

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Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #1

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-11CL

E. Aquatic Habitats	Occurrence (circle one)				Quality (circle one)		
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

J. Preliminary Determination of Suitability	(circle one or more)		
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Entire site is Agricultural land

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = [illegible]

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: # 2

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

	(circle one or more)		
J. Preliminary Determination of Suitability			
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: All Cropland (small [illegible])

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor.

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Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #3

C. Date of Site Visit: 4-21-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-?-111L

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
1.	Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2.	Tidal stream	A	C	O	T	H	M	L
3.	Non-tidal stream	A	C	O	T	H	M	L
4.	Pond/Lake	A	C	O	T	H	M	L
5.	Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6.	Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
1.	Forest	A	C	O	T	H	M	L
2.	Shrubland	A	C	O	T	H	M	L
3.	Old Field	A	C	O	T	H	M	L
4.	Cropland	A	C	O	T	H	M	L
5.	Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
1.	Freshwater	A	C	O	T	H	M	L
2.	Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
1.	Waterfowl	A	C	O	T	H	M	L
2.	Furbearers	A	C	O	T	H	M	L
3.	Small Game	A	C	O	T	H	M	L
4.	Big Game	A	C	O	T	H	M	L
5.	Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
1.	Entire site	S	SM	US
2.	ER Branch modified site	S	SM	US
K.	Type of Mitigation			
1.	Entire site	IK	OK	NN
2.	ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
1.	Entire site	Mj	Md	Mn
2.	ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Mostly agricultural field (corn stubble) Bordered on west by Supawna Meadows NWR

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor.

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #4

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: ______

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor.

Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #5

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-102

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Active landfill

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Delaware City

B. Disposal Site Designation: #6

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments:

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #7

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-111R

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

J. Preliminary Determination of Suitability (circle one or more)

1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US

K. Type of Mitigation

1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN

L. Magnitude of Mitigation

1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Mostly agricultural field (wheat) surrounded by emergent wetland

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: # 8

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-172-111L

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

	(circle one or more)		
J. Preliminary Determination of Suitability			
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Mostly agricultural field (corn stubble). Approx. 5 ac PEM (black rush) in NE corner. Some [illegible]

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor.

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: # 9

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream Ditch	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: ______

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #9A

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream (Ditch)	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

	(circle one or more)		
J. Preliminary Determination of Suitability			
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Land clearing for warehouse underway in N.E. Corner of site. Also ditch cleaning. Port development. 404 [illegible]?

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #10

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

	(circle one or more)		
J. Preliminary Determination of Suitability			
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Commonly used in NE corner of site

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor.

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: # 11

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-1106

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Entire site is agricultural field

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #12

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: USGS 34033-178-1101

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: All agricultural

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = M[illegible]

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Delaware City

B. Disposal Site Designation: #13

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

	Occurrence (circle one)				Quality (circle one)		
E. Aquatic Habitats							
1. Tidal River							
a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2. Tidal stream	A	C	O	T	H	M	L
3. Non-tidal stream	A	C	O	T	H	M	L
4. Pond/Lake	A	C	O	T	H	M	L
5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F. Terrestrial Habitats							
1. Forest	A	C	O	T	H	M	L
2. Shrubland	A	C	O	T	H	M	L
3. Old Field	A	C	O	T	H	M	L
4. Cropland	A	C	O	T	H	M	L
5. Developed	A	C	O	T	H	M	L
G. Shellfish	A	C	O	T	H	M	L
H. Finfish							
1. Freshwater	A	C	O	T	H	M	L
2. Diadromous	A	C	O	T	H	M	L
I. Wildlife							
1. Waterfowl	A	C	O	T	H	M	L
2. Furbearers	A	C	O	T	H	M	L
3. Small Game	A	C	O	T	H	M	L
4. Big Game	A	C	O	T	H	M	L
5. Non-game	A	C	O	T	H	M	L

	(circle one or more)		
J. Preliminary Determination of Suitability			
1. Entire site	S	SM	US
2. ER Branch modified site	S	SM	US
K. Type of Mitigation			
1. Entire site	IK	OK	NN
2. ER Branch modified site	IK	OK	NN
L. Magnitude of Mitigation			
1. Entire site	Mj	Md	Mn
2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments:

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Delaware City

B. Disposal Site Designation: #14

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 34033-178-110L

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
1.	Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
2.	Tidal stream	A	C	O	T	H	M	L
3.	Non-tidal stream Ditch	A	C	O	T	H	M	L
4.	Pond/Lake	A	C	O	T	H	M	L
5.	Non-tidal vegetated wetlands	A	C	O	T	H	M	L
6.	Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
1.	Forest	A	C	O	T	H	M	L
2.	Shrubland	A	C	O	T	H	M	L
3.	Old Field	A	C	O	T	H	M	L
4.	Cropland	A	C	O	T	H	M	L
5.	Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
1.	Freshwater	A	C	O	T	H	M	L
2.	Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
1.	Waterfowl	A	C	O	T	H	M	L
2.	Furbearers	A	C	O	T	H	M	L
3.	Small Game	A	C	O	T	H	M	L
4.	Big Game	A	C	O	T	H	M	L
5.	Non-game	A	C	O	T	H	M	L

		(circle one or more)		
J.	Preliminary Determination of Suitability			
1.	Entire site	S	SM	US
2.	ER Branch modified site	S	SM	US
K.	Type of Mitigation			
1.	Entire site	IK	OK	NN
2.	ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
1.	Entire site	Mj	Md	Mn
2.	ER Branch modified site	Mj	Md	Mn

M. Additional Comments:

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor:

Review of Candidate Disposal Sites
Fish and Wildlife Assessment

A. USGS 7 1/2' Quadrangle: Salem

B. Disposal Site Designation: #15

C. Date of Site Visit: 4-26-85

D. Source, Year and Code of Aerial Photograph: ASCS 4033-178-111R

		Occurrence (circle one)				Quality (circle one)		
E.	Aquatic Habitats							
	1. Tidal River							
	a. deepwater (> 6' MLW)	A	C	O	T	H	M	L
	b. shallows (< 6' MLW)	A	C	O	T	H	M	L
	2. Tidal stream	A	C	O	T	H	M	L
	3. Non-tidal stream	A	C	O	T	H	M	L
	4. Pond/Lake	A	C	O	T	H	M	L
	5. Non-tidal vegetated wetlands	A	C	O	T	H	M	L
	6. Tidal vegetated wetlands	A	C	O	T	H	M	L
F.	Terrestrial Habitats							
	1. Forest	A	C	O	T	H	M	L
	2. Shrubland	A	C	O	T	H	M	L
	3. Old Field	A	C	O	T	H	M	L
	4. Cropland	A	C	O	T	H	M	L
	5. Developed	A	C	O	T	H	M	L
G.	Shellfish	A	C	O	T	H	M	L
H.	Finfish							
	1. Freshwater	A	C	O	T	H	M	L
	2. Diadromous	A	C	O	T	H	M	L
I.	Wildlife							
	1. Waterfowl	A	C	O	T	H	M	L
	2. Furbearers	A	C	O	T	H	M	L
	3. Small Game	A	C	O	T	H	M	L
	4. Big Game	A	C	O	T	H	M	L
	5. Non-game	A	C	O	T	H	M	L

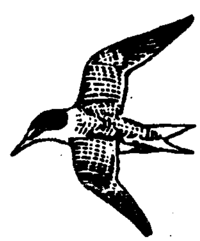
		(circle one or more)		
J.	Preliminary Determination of Suitability			
	1. Entire site	S	SM	US
	2. ER Branch modified site	S	SM	US
K.	Type of Mitigation			
	1. Entire site	IK	OK	NN
	2. ER Branch modified site	IK	OK	NN
L.	Magnitude of Mitigation			
	1. Entire site	Mj	Md	Mn
	2. ER Branch modified site	Mj	Md	Mn

M. Additional Comments: Entire site is tidal wetland dominated by common reed

Letter codes: A = Abundant; C = Common; O = Occasional; T = Trace; H = High; M = Moderate; L = Low; S = Suitable; SM = Suitable with mitigation; US = Unsuitable; IK = Inkind replacement; OK = Inkind or Out-of-kind replacement; NN = None necessary; Mj = Major; Md = Moderate; Mn = Minor

Appendix B

Endangered Species List



FEDERALLY LISTED ENDANGERED AND THREATENED SPECIES IN NEW JERSEY

Common Name	Scientific Name	Status	Distribution
FISHES:			
Sturgeon, shortnose*	Acipenser brevirostrum	E	Hudson and Delaware Rivers plus other Atlantic coastal rivers
REPTILES:			
Turtle, green*	Chelonia mydas	T	Oceanic summer visitor coastal waters
Turtle, hawksbill*	Eretmochelys imbricata	E	Oceanic summer visitor coastal waters
Turtle, leatherback*	Dermochelys coriacea	E	Oceanic summer visitor coastal waters
Turtle, loggerhead*	Caretta caretta	T	Oceanic summer resident coastal waters rarely nests: Cape May and Atlantic Counties
Turtle, Atlantic ridley*	Lepidochelys kempii	E	Oceanic summer resident coastal waters
BIRDS:			
Eagle, bald	Haliaeetus leucocephalus	E	Entire state
Falcon, American peregrine	Falco peregrinus anatum	E	Entire state - re-establishment to former breeding range in progress
Falcon, Arctic	Falco peregrinus tundrius	E	Entire state migratory - no nesting
Piping Plover	Charadrius melodus	T	Entire State
MAMMALS:			
Cougar, eastern	Felis concolor cougar	E	Entire state - probably extinct
Whale, blue*	Balaenoptera musculus	E	Oceanic
Whale, finback*	Balaenoptera physalus	E	Oceanic
Whale, humpback*	Megaptera novaeangliae	E	Oceanic
Whale, right*	Eubalaena spp. (all species)	E	Oceanic
Whale, sei*	Balaenoptera borealis	E	Oceanic
Whale, sperm*	Physeter catodon	E	Oceanic
MOLLUSKS:			
None			
PLANTS:			
Small whorled pogonia	Isotria medeoloides	E	Bergen (Franklin Lakes, Closter), Mercer (Trenton), & Sussex (Montague, Sparta, Hainesville) Counties

*Except for sea turtle nesting habitat, principal responsibility for these species is vested with the National Marine Fisheries Service.

U.S. Department of Transportation
United States Coast Guard

Captain of the Port, Philadelphia

U.S. Coast Guard Base
Gloucester City, NJ
08030-9999

16000

MAR 10 1986

Mr. Wilbert J. Cummings
Salem Port Authority
62 Front Street
Salem, NJ 080797

Dear Sir:

The Application submitted for a Certificate of Adequacy (COA) for oily waste reception facilities by Salem Port Authority located at Salem, NJ has been reviewed. Based upon the information contained in the Application, supporting worksheets and calculations, the reception facility identified appears to meet the requirements for reception facilities for oily wastes as stipulated in 33 Code of Federal Regulations 158 (33 CFR 158).

An interim COA letter is hereby issued. All requirements for adequacy appear to have been met, except for the physical inspection of the reception facility intended for use, and the review of the Application by the U.S. Environmental Protection Agency (EPA). Your terminal/port may continue normal operations. Upon satisfactory completion of the reception facility inspection and satisfactory review of the Application by the EPA a final COA will be issued. Changes to the COA Application must be reported to this office as required by 33 CFR 158.140. A copy of this letter must be available for inspection by interested parties. For additional information please contact LT(jg) Robert Mitchell of my staff at (609) 456-1370.

Sincerely,

E. K. Roe

E. K. ROE
Captain, U.S. Coast Guard
Captain of the Port,
Philadelphia

PORT SALEM

62 Front Street • Salem, New Jersey 08079
(609) 935-6380

Executive Director
James F. Storm

July 9, 1984

Lt. Col. Ralph Locurcio
District Engineer
U.S. Army Corps of Engineers
2nd & Chestnut Street
Philadelphia, Penna. 19106

Re: Planning Branch - Salem River Feasibility Study

Dear Col. Locurcio:

Congressman William J. Hughes has passed to us a copy of Col. Baldwin's March 26, 1984 regarding a possibility study to deepen the Salem River channel. The letter indicated that the project required an appropriate non-federal sponsor. The City of Salem Port Authority is willing to be that sponsor.

As per your letter, the sponsor is required to provide certain items of local cooperation. The provisions of lands and easements, rights of way, relocations, disposal areas, berths and facilities fall with the powers of The Port Authority. We request that action be taken to include The Salem River in the Delaware River comprehensive navigation study.

Development at the Port of Salem is proceeding at a rapid rate. The beneficiaries of the increased channel depth are numerous. The management of The Port of Salem will assist the Corps in any way necessary to accomplish this study and provide for the deepening of the existing Salem River channel.

Very truly yours,

James F. Storm
Executive Director

JFS/ls
cc: Congressman William Hughes

Incl. 1

APPENDIX A

PUBLIC COORDINATION

CENAP-PL-PP March 16, 1989

To: Files
From: B.E. Stratton

Subject: Salem River March 13, 1989 workshop with Mayor H. Lee Lark and the interested residents of Oakwood Beach.

1. Background. This meeting was a result of the January 12, 1989 workshop at the Old Courthouse. Residents of the Oakwood Beach area and the mayor expressed great concern with the erosion problem along the shoreline and were adamant about their desire to have the Beach used as a disposal for the sand from the channel. The Corps made a commitment to issue a factsheet and meet again to discuss the matter.

2. Attendees.

a. Corps representatives

John Tunnell, Chief, Project Development Branch
C. Lee Ware, Chief, Project Planning Section
Roy Denmark, Chief, Environmental Resources Branch
Scott Fritzinger, Chief, Geotechnical Section, Design Branch
Barbara E. Stratton, Water Resources Planner, Project Planning Section

b. John Mruz of Congressman Hughes' office

c. Port Salem Representatives

John Burke, Chairman
Earl Gage, Member
Robert Johnson, Member

d. Elsinboro Representatives

Mayor H. Lee Lark

About 50-60 residents

3. Summary/structure of the meeting. Mayor Lark chaired the meeting. Lee Ware and the Corps representatives discussed the questions regarding erosion as listed and outlined in the Factsheet prepared for the residents. Each segment had a question and answer session. Since some topics were raised in the context of other issues-the order became somewhat condensed through the evening.

4. The first question - do the channels cause erosion - was explained as noted and generated a high degree of skepticism from the audience. Mr. Lippincott and others attested to the fact that at Mean Low Water (MLW) the depth adjacent to the channel is six feet. According to Mr. Lippincott, the seawall was put in to keep sand off of backyards and it was following the creation of the new cut that the beaches began to erode. The general consensus was that the deeper the channel the faster the flow with increased erosion.
John Tunnell brought up the 1986 authorized Delaware Bay erosion control study which is currently unfunded as a way for the residents to achieve a more complete analysis of the erosion situation and a long term solution. The states of New Jersey and Delaware would act as local sponsor for the erosion study.
The point was raised that if this study to use Oakwood Beach for disposal is to go forward the beach may have to have public access, a problem in the past.
One individual stated that his section of beach (near a sluice gate) has only eroded one foot since 1950 and the area in the vicinity of Oakwood Inn does not need sand.
A resident of Elsinboro Point, Spencer Richardson, indicated that he placed approximately 150 cubic yards of sand behind a reconstructed seawall about five years ago. According to Mr. Richardson, this loss is primarily caused by ship wakes from the Delaware River. Several times the Corps explained the differences in the navigation project and the historical erosion problem.
The quantity of material removed since 1907 was reviewed for the residents. Questions #2 (frequency of dredging) and #4 (quantity) were covered in this discussion.
Residents feel that the bigger channel creates a shift in profile to fill in the channel whereby no net change occurs in depths off of Oakwood Beach and shore material ends up in the channel. The channel, not waves, are the cause of the problem according to these residents.
4. Quality and location of the materials - (#4 and #9). Scott Fritzinger discussed the boring chart which shows that most of the material is fine grain and would not stay if placed on the Beach. The composite samples were displayed and discussed.
The Corps indicated that the material could not be recommended as beachfill due to the composition.
Many residents seemed to think that getting material that probably would not stay long on the beach and no guarantees was a reasonable gamble.

5. Environmental aspects (#5 and #10). Roy Denmark indicated that due to the fine nature of the material considerable turbidity would result. One resident stated that the overboard disposal in the Cove caused much turbidity. Denmark pointed out that overboard disposal normally is resisted by environmental agencies. Residents were told that the environmental agencies would not necessarily grant the permits due to the impacts but the Corps would begin coordination with these agencies depending

on the level of local interest in beach disposal. Residents indicated that they would be willing to accept a 50% loss of the estimated 300,000 cubic yards even for a short time.
The question of public access was again raised. The Corps pointed out that easements and rights of way might have to be obtained and public access would be a prerequisite. Spencer Richardson from Elsinboro Point indicated he did not want public access. Another resident stated that the area between MLW and MHW is owned by New Jersey (Delaware owns below MLW).
Mr. Lippincott discussed the training dikes at Pea Patch Island and their impacts and study and lack of study. He indicated that a Corps representative had told him years ago that the model studies were not thorough enough.
The sediment testing results were discussed as not being a concern and the problems of unaesthetic odors for about a month at the time of disposal were mentioned.

6. How material would be placed (#6). The Corps described the general plan for a berm and area of placement.

7. The costs (#7) and financing (#8). These discussions involved John Burke and clarifications on the 80/20 cost share and project sponsor responsibilities to provide Lands, Easements and Rights--of-Way (LERRD). John Tunnell suggested that the Elsinboro residents coordinate with the Port as sponsor to request inclusion of Elsinboro beaches as a disposal area.

8. Pennsville bulkhead (#11). The Corps noted the state constructed the bulkheads and the stone revetment was later constructed at Federal expense due to the cause of the erosion, the Federal training dike at Pennsville.

9. Impacts on Mannington Meadows (#12). A resident noted the NJ DOT proposal for a new bridge at Route 49 (The Corps will review for any changes in impacts to Mannington Meadow).

10. Erosion at Tilbury Island. The discussion used an aerial photograph with the bottom of the channel and sideslopes depicted to show the relatively small change in increase to the surface of the water.

11. Ship generated waves (#15). This topic was generally addressed several times and will be more specifically addressed by John Burke with Elsinboro representatives. He is to follow up with the U.S. Coast Guard on this matter.

FACTSHEET MARCH 1989

Delaware River Comprehensive Navigation Study
Salem River

The Philadelphia District sponsored a public workshop on January 12, 1989 to discuss the proposed navigation improvement to the Salem River as described in the Draft Feasibility Study, November 1988. This factsheet is intended to respond to the concerns raised that evening.

Many of those at the January 12th meeting were homeowners of properties along the Delaware River's edge at Elsinboro near Salem Cove. They voiced concern over the loss of Oakwood Beach shoreline and some felt strongly that the Delaware River channel and Salem River entrance channel contribute to or cause the erosion.

The recommended plan of improvement for the Salem River includes deepening the channel from the existing 12 foot Mean Low Water (MLW) depth to 18 feet MLW and widening to 180 feet with provisions for a 495 foot wide turning basin. Many disposal options were analyzed, including disposal at Oakwood Beach for some of the materials from the Cove area under a shallower 16 foot MLW channel depth. The recommended disposal option was placement of all material in the Killcohook disposal area.

The basis for deepening the navigation channel is the projected growth of the Port operations through development of the two current shipping companies, improved facilities at the Port, and a more efficient operation.

QUESTIONS AND ANSWERS

1. Do the navigation channels for the Delaware and Salem River channels cause erosion at Elsinboro and Oakwood Beach?

We reviewed the findings presented in the report and conducted additional analysis of changes to the shoreline over the years. As part of this endeavor, two field visits were conducted to Oakwood Beach and to the mounds in the Cove. In-house surveys were analyzed and we contacted other Federal and state offices for further information. The preliminary results support the conclusions as stated in the November 1988 Draft Feasibility Report that the proposed deepening would have no detectable effects on the shoreline.

Our review of readily available historic surveys and maps revealed no trend towards increasing depths in the area between Oakwood

Beach and the channel for the period between 1922 and 1983. There was a noticable change (build up) in the Cove area west of the mounds during this period. We are obtaining a series of historic topographic maps and hydrographic surveys to permit a more thorough evaluation of the river and shoreline changes from the mid-180C's to the present. Our analysis of this information will be presented in the final report in a summary form.

As a part of the reevaluation, we reviewed a series of New Jersey Department of Environmental Protection aerial photos from 1940 to 1986. Based on a preliminary analysis of these photos, it does not appear that significant shoreline erosion occurred during that period. Two factors qualify this preliminary conclusion - the stage of tide at the time the photography is obtained influences the apparent location of the shoreline in the photograph, and complicates the evaluation of erosion; and two, the scale of this series is relatively small, which makes small changes in shoreline location difficult to detect. Based on previous work and the recent investigation, we could establish no relationship between erosion and the navigation channels.

Archaeological research based on predictive modeling indicates that the probable location of Fort Elfsborg is between the present Mean High Water line and the Main Channel of the Delaware River. The fort was most probably at ground level (as were other forts on the Delaware) when it was constructed by the Swedes in 1643. The work performed by the archaeologists involved examination of maps and road surveys at the current Elsinboro Point. The shore shown on the 1809 road survey and the 1729 shoreline indicate that shore erosion at this area has been fairly regular over the past three centuries, possibly totalling 500 to 1000 feet.

We intend to pursue further analysis of historic shoreline behavior when the requested surveys arrive from Rockville, Maryland. We anticipate that examination of the shorelines and offshore depths will lead to more definitive information on the erosion.

2. How frequently has the Salem River been dredged?

The Salem River has been dredged eight times starting with the 1907 authorization and subsequent construction to 9 feet, the 1928 construction to 12 feet, and maintenance dredgings in 1934, 1937, 1945, 1961, 1984 and 1988.

3. What is the quantity of material removed?

The total dredged quantity over the years amounts to an estimated 865,000 cubic yards, including the 1988 maintenance dredging. Eighteen thousand cubic yards were dredged from the Little Salem River up through 1945. The 1988 dredging involved 350,000 cubic yards although to maintain the 12 foot depth is 125,000 cubic yards every four years.

4. Is the quality of the material suitable for placement on Oakwood Beach?

Subsurface testing in the Salem River channel was conducted prior to the maintenance dredging in 1984 and again in 1985 for this study. The results indicated limited potential for beachfill. The data indicated that Salem River channel sediments between stations 8+000 and 13+000 could be placed on Oakwood Beach. These stations are located at the upstream end of the entrance channel and near Sinnicksons Landing as depicted on the attached figure. The tests which were conducted were preliminary and involved only three stations at intervals of 1000 feet but they demonstrated that the quality of the material is not consistent within the stations. The composition of the material varies and is intermixed at different depths. The borings were taken in 1985 prior to the most recent maintenance dredging and included fine sediments and very fine silt, clay and sand. The materials in the remaining sections of the channel are nearly all fine and not suitable for disposal on the beach. Fine materials are not likely to remain and cause additional turbidity and construction problems during the disposal operations. Tidal actions prolong the turbidity and results in environmental and aesthetic impacts.

More detailed foundation and materials investigations will be performed as a part of the the next stage of study. More extensive subsurface samples will be taken to more precisely determine the nature of the material as a part of preconstruction engineering and design work.

5. Would placement of material on the beach cause any adverse environmental impacts?

Due to the high percentage of fine material at stations 8+000-13+000 if the channel were constructed to 18 feet, approximately half of the material (150,000 cubic yards) would be susceptible to rapid dispersal during and after disposal operations due to tidal current and wave action. It is very difficult to determine the amount of materials which might stay on the beach for any period of time even if confined by a berm. The state and Federal environmental agencies will be contacted for comment and necessary approvals if the decision is reached to pursue disposal on Oakwood Beach.

6. If conditions allow, where and how would material be placed on the beach?

Based on our analysis, material would be placed along the 7500 feet of beach from south of the country club to Elsinboro Point as depicted on the attached figure. According to our tentative plan, the dredging and disposal to Killcohook would be performed by a 27 inch pipeline hydraulic dredge. Materials would be pumped onto Oakwood Beach by a second hydraulic dredge using a 12 inch diameter pipeline. It would be necessary to construct a berm to retain material and a dozer would be used to spread material. It is uncertain whether the material could be used to effectively build the berm or if other materials would be required.

If it is possible to dispose of materials along this beach, the estimated 150,000 cubic yards which might be retained would occupy a theoretical space 7500 feet long and 180 feet wide by 3 feet thick or 7500 feet long and 70 feet wide by 8 feet thick.

7. Is there a cost difference if Oakwood Beach is used for disposal?

The current cost estimate for disposal at Oakwood, is equal to the cost of disposing all material at Killcohook. In the event that the final decision is reached to use Oakwood Beach, these figures will be refined in the next stage of study prior to construction.

8. Who would finance any cost differences for disposal at Oakwood?

The project sponsor, in this case the Port of Salem finances any extra costs under the provisions of Section 933 of the Water Resources Act of 1986 (Cost Sharing for Disposal of Material on Beaches). Prior to any such payment or commitment all affected property owners would be required to grant permission for the disposal. The project sponsor could additionally recapture these expenditures from Elsinboro Township through a cost sharing agreement.

9. The November draft Feasibility Report indicated that disposal to Oakwood Beach is possible only to a channel depth of 16 feet (16 feet with two feet of allowable overdepth. Is this still true?

Based on the limited number of borings obtained for the Draft Feasibility Report, an initial assessment as to the character and quality of the material between stations 8+000 and 13+000 to a depth of 18 feet (a 16 foot channel depth with additional two feet of overdepth dredging) indicated that the material could have some use as beachfill. Further comparison of the character and quality of the in-place material to an 18 foot depth versus that to a 20 foot depth (a 18 foot channel depth with additional two feet of overdepth dredging) does not present any marked difference.
Because of the great variation in material types from the limited

data available, further sub-surface investigations will be required during later studies to accurately define the true extent of suitable beachfill material.

10. Are contaminants present in the sediments.?

Sediment samples have been collected at several locations within the proposed dredging area. These samples have been analyzed for,purgeable hydrocarbons, purgeable aromatics, PCB's, pesticides and heavy metals using the standard elutriate test. This test has been shown to be a reliable indicator of chemical contaminant release from sediments during dredging and disposal operations. The analyses indicated that the sediments are of good quality with less-than-detectable concentrations of most metals and toxic organic compounds. Low concentrations of arsenic, barium, cadmium, lead, zinc and phenols were detected at some locations. However, concentrations of these parameters were within acceptable standards and do not pose a problem.

The material will have an unpleasant odor if placed on the beach due to the presence of decaying organic matter.

11. Who was responsible for building the steel sheet pile bulkhead at Pennsville in response to the shoreline erosion problem?

The bulkheads along the Pennsville shoreline were constructed by the State of New Jersey during the period 1956 through 1965 in an attempt to halt the erosion caused by the 1943 construction of the Pennsville dike. A Corps investigation concluded th
at the training dike at Pennsville caused the damages from Beach Avenue to a point 1,300 upstream and determined mitigation was warranted. The report entitled "Mitigation of Erosion Damages, Delaware River, Pennsville, New Jersey" (1980) discusses the plan to place bedding material and armor stone to reinforce the bulkheads with toe protection. This project was constructed in 1982 at the Federal government's expense.

12. Would Mannington Meadow be impacted by the proposed project?

The volume of water flowing through the cutoff to the Meadow is controlled by the mean range of tide (5.6 feet) in the Salem River and the river dimensions up to Mannington Meadows at the Route 49 bridge. Since the tide range is unaffected and the commercial navigation project stops short of the Route 49 bridge, the flow in Mannington Meadow should not be affected by the improved channel.

13. Would erosion increase at the Tilbury Road properties if the channel is widened?

Widening the channel should not impact erosion in the area of the cut-off and Tilbury Island. It is necessary to remove a small portion of the island to construct the turning basin and widen the channel. The channel will be widened from 100' to 180' with sideslopes of three feet horizontally to one foot vertically. This will redistribute the volume of water carried in the channel up to the Route 49 bridge, but the likely outcome is for the velocities to decrease. The expanded river channel and broader sideslopes would carry the water over a larger cross-section, thus reducing any erosion impacts. The fetch, or area where waves are generated by wind, will not change sufficiently to cause any impacts on the shoreline.

14. What are the distances relative to the channels?

The Salem River entrance channel is approximately parallel to Oakwood Beach between 1,700 feet and 2,000 feet from the shoreline.

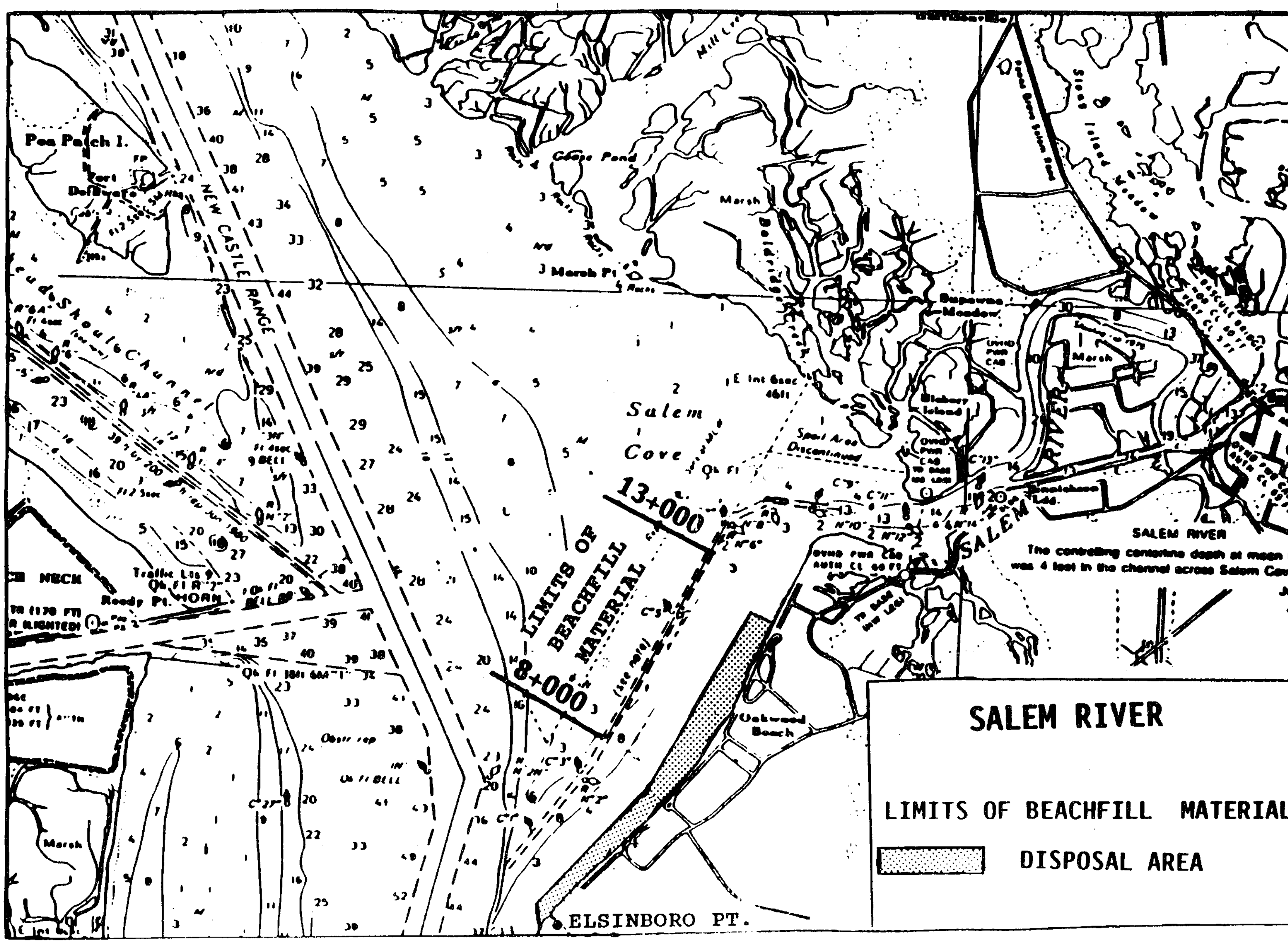
The Delaware River channel is located 2,000 feet (0.4 miles) from Elinsboro Point, 2,900 feet (0.55 miles) from Oakwood Beach and 10,000 feet (1.89 miles) from Sinnicksons Landing.

15. Do waves generated by vessels calling at Salem?

The commercial traffic is expected to increase along the Salem River with or without an improved channel. Navigation practices are not expected to change in terms of daylight transits and use of tidal cycles and tugs. Due to several factors, we do not expect any erosion problems due directly to the commercial traffic.

Vessel generated wave height depends on vessel speed relative to water, draft and hull shape, water depth and the blockage ratio (the ship cross section compared to the channel cross section). The effects on the shore depend upon the distance to shore and the water depth versus wave height. The commercial traffic transits the river slowly due to the strong currents as well as the constraints of a narrow channel.

This review of information concluded that vessel generated wave problems are more likely with the departing tugs, as reported by residents, because the solo tugs travel at higher speed and against the tide. The channel improvement would not directly influence the vessel traffic since growth at the Port will occur regardless of a new project. A more practical approach to solving any problems from the wakes of departing or unaccompanied tugs might be for the Port to consider establishing a speed restriction on all boat traffic.


SALEM RIVER
LIMITS OF BEACHFILL MATERIAL
DISPOSAL AREA
LIMITS OF BEACHFILL MATERIAL
13+000
8+000
Salem Cove
NEW CASTLE RANGE
Pea Patch I.
Fort Delaware
Goose Pond
Marsh Pt
Mill Cr
Marsh
Oakwood Beach
ELSINBORO PT.
SALEM RIVER
SALEM RIVER
The controlling centerline depth at mean low water was 4 feet in the channel across Salem Cove

DISPOSITION FORM

For use of this form, see AR 340-15; the propenent agency is TAGO

REFERENCE OR OFFICE SYMBOL	SUBJECT
CENAP-PL-PP	Salem River Public Workshop, held 1/12/89, Old Courthouse, Salem, New Jersey

TO Files FROM B.E. Stratton DATE 20 Jan 89 CMT 1
STRATTON/gaw/5957

1. Summary: The majority of those at the meeting were homeowners of properties along the river's edge at Elsinboro. They voiced concern over the loss of the Oakwood Beach shoreline and strongly felt that the two river channels (Delaware and Salem) contribute to the erosion. Additional issues included the potential for erosion along the cutoff, the viability of the present port and potential for achieving the growth projected, and port financing capabilities. In response to the strong objections of Elsinboro officials and residents, and statements by Representative Hughes and local port officials that support for the project was contingent on satisfactorily addressing their concerns, a commitment was made to reconsider disposal options for Oakwood Beach. A follow up fact sheet is to report on our findings and another meeting is planned on this matter.

2. Attendees.

a. Corps Representatives
- John Tunnell, Chief, Project Plng. Branch
- C. Lee Ware, Actg. Chief, Proj. Studies Section
- Roy Denmark, Chief, Environmental Branch
- Jerry Pasquale, Biologist, Environmental Br.
- Robert Selsor, Chief Economist, Economics and Evaluations
- Barbara Stratton, Water Resources Planner Project Studies Section

b. Mark Brown of Congressman Hughes office attended.

c. Port Salem Representatives:
John Burke, Chairman
Robert Johnson, Member
Earl Gage, Member
Jim Waddington, City Council Liaison

d. An attendance list is attached. The audience numbered about 100 and included primarily the local officials and residents of neighboring communities. Several shippers also were present.

3. Slide Presentation. Barbara Stratton presented a talk on the history of Corps involvement in navigation at Salem, the study considerations and alternatives, and details on the recommended plan. The attached text indicates the presentation. This was followed by a question and answer period.

4. The questions and answers focused almost exclusively on the erosion questions. A summary of comments and responses follows.

a. The first comment was on the validity of the economic projections over the 50 year project life. The individual recommended staged construction of the 18 foot project, initial dredging to 16 feet using the spoils as beach fill and further deepening in the first maintenance cycle dredging to 18 feet.

b. Elsinboro residents said they were previously informed by the Corps (Colonel Ton) that the sand from the Oakwood Beach all was not getting in the channel, yet sand has been dredged in the last two maintenance cycles as evidenced by the stable islands in the cove. The question was raised (and not answered) as to why the maintenance material was not deposited at Oakwood Beach.

c. One resident (Spencer Richardson) wants a sheet steel bulkhead built in front of the houses. He blamed waves generated by ship traffic for the problems. Mr. Tunnell indicated this was an erosion control measure which we could consider under a study authority for which we have not yet been funded.

d. Mr. Lippincott (the originator of the overboard options and a frequent correspondent) presented his material (attached) and blamed the training dike at Pea Patch Island and constriction of the channel by Killcohook disposal area for the erosion problems at Elsinboro.

e. The point was also raised that the sand in existing Federal sites is sold for $.10 per cubic yard, yet residents of Elsinboro cannot have it for erosion protection. (no response)

f. Concern was also raised over the impact of ship wakes and erosion in the area of the cutoff. Lee Ware indicated no erosion is anticipated in the cutoff area since vessels travel at dead slow and the cross section is larger with the project. Bank clearance lanes should minimize suction effects between the vessels and banks and the sideslopes are milder and more stable for the enlarged channel.

g. The mayor of Mannington (William Hancock) is concerned that the Little Salem River (Fenwick Creek) is scheduled for de-authorization in 1989. He foresees eventually recreational development of the river with marinas and other amenities. He also indicated that the breakdown of the dikes at Mannington Meadows and the increased flow from that area have increased erosion at Oakwood Beach. Also, he stated that silt from the meadows will rapidly shoal the channel.(A letter is forthcoming.)

h. A question was raised as to who constructed the steel sheet pile bulkhead at Pennsville. Corps representatives will check on that in the office.

i. The mayor of Elsinboro (Lee Lark) requested placement of sand on the beach. Additionally, he suggested to the audience that they write to Congressman Hughes. John Tunnell suggested that concerned people should write directly to the Corps (several have done so). Further explanations of the possible causes (historical, northwest winds) were presented. John Tunnell said that the results of a physical model indicate that river currents stay confined to the channel and support our conclusions. He indicated that there will always be a disagreement on the cause of the erosion given all of the influences and unknowns. In order to provide some temporary assistance, as a part of the construction project, Tunnell stated that it might be possible to call Elsinboro a disposal area and obtain real estate agreements from residents and put sand adjacent to bulkheads. It was noted again that a study of the erosion in the Bay awaits authorization and could provide long-term answers for Elsinboro residents.

j. John Larkin, the Emergency Management Coordinator for Elsinboro, brought up concerns over the odors caused by beach disposal and the possible chemical content of material.

k. A question was raised as to who would be responsible if the channel did result in an erosion problem or lead to some other incident. It was stated that the Corps would be responsible for correcting problems due to a design deficiency and it was noted that a revetment was provided by the Corps along the Pennsville Shoreline at Federal expense to correct a problem caused by features of the navigation project.

l. Several people questioned how the port would finance the project, what justification there was for improvements based on the level of traffic, and the views of Salem officials on the potential effects at Elsinboro. The representatives from the Port Authority, (Earl Gage, John Burke, and Jim Waddington) indicated support of placing sand at Oakwood Beach if at all possible and indicated that the project economics were based on development of four berths. They see potential to benefit the entire county if the port grows and utilizes the FTZ status.

5. Those in attendance were told that the Corps would reevaluate the possibilities of disposal at Oakwood Beach and Elsinboro and a factsheet with findings would be issued.

B. Stratton

B. Stratton
Project Manager

Attachments:
(1) Public Notice
(2) Factsheet
(3) Text
(4) Attendees
(5) Submitted Materials
    (a) Lippincott, George letters
    (b) Petition

#37

DELAWARE RIVER
COMPREHENSIVE NAVIGATION STUDY SALEM RIVER
SALEM COUNTY, NEW JERSEY

January 12, 1989
7:00P

OLD COURTHOUSE
Salem, New Jersey

Ref; Water Resources Act
Section 859 of 1986
Public Law 99-662

To To THE COMMANDER: &
ROBERT L. CALLEGARI, Chief, Planning Division
U.S.Army Corps of Engineers
Philadelphia District

From JOSEPH G. LIPPINCOTT, Sr. DAV
ELSINBORO - SALEM, New Jersey 08079

This is to say, thank you the Corps for having this Workshop Meeting and the Water Front People of ELSINBORO & Township Gov. Representatives , and other's State people, + U.S. Gov. Officials. Glad to have you here -
The Sovereignty of MAN layth hidden in KNOWLEDGE, wherein KINGS, with all their GOLD can not buy. Bacon

1. Here is a phone survey of FORT ELFSBORG section of ELSINBORO from William L. Richmond (Lot 4.09) on south west whom want the Salem River dredging's on their eroded (what's left of them) BEACHES.

2. If you drop the spoils on west side of Salem River Channel site (24-6) its like "PERPETUAL MOTION" enough said -

3. Piping to Killcohook five miles +50 foot up and over the dikes - up's the cost ++$$

4. The CORPS did not mention the for sale price per Cu.Yd. you sell the dredging's for - ? ?

5. The CORPS speak of maintenance costs @ Killcohook,201,Artificial Island - maintenance on ELSINBORO - o.oo $ here you help the little fellow the TAX PAYER !

6. Drop spoils from William L. Richmond (Lot 4.09) on south west thru Sidney Riley (Lot 25.24), thru Robert H. Cocking (25.10) thru James Buechler (23.24) thru Benj. Ferguson (23.17) thru to Spencer Richardson Lot (23.1) that is Block 23 ,Lot No.1 total 3,100 feet ±

7. Put back the SAND & STONE from where it came from ELSINBORO'S BEACHES'S Site (24-17)

8. We want PORT SALEM & the jobs + economics the PORT will help SALEM COUNTY.

Joseph G. Lippincott, Sr.
JOSEPH G. LIPPINCOTT, Sr. DAV

325 Fenwick Ave.
Salem, New Jersey 08079 2105

214 River Lane

US Army Corps
of Engineers
Philadelphia District

Public Notice

In reply refer to:
Planning Division

29 NOV 1988

DELAWARE RIVER
COMPREHENSIVE NAVIGATION STUDY SALEM RIVER
SALEM COUNTY, NEW JERSEY

Notice is hereby given that the Philadelphia District, U.S. Army Corps of Engineers, proposes to deepen and widen the existing navigation channel at the Salem River, New Jersey. This project is discussed in the Delaware River Comprehensive Navigation Study draft Interim Feasibility Report and Environmental Assessment for Salem River, New Jersey. The purpose of the study is to consider navigational improvements to meet the needs of existing and projected commerce on the waterway.

The existing channel is 12 feet deep Mean Low Water and 150 feet wide from the Delaware River through Salem Cove, narrowing to 100 feet at Sinnicksons Landing. The total project length is five miles. Proposed improvements include enlarging the channel to a depth of 18 MLW and a width of 180 feet, and providing a turning basin at the Port of Salem (See attached Figure). The proposed project would extend the Delaware segment of the channel an additional 200 feet, from the 12 foot depth to the 18 foot contour. Approximately 1,267,000 yards of material would be removed by hydraulic pipeline dredge. All dredged material would be placed in the active upland disposal area at Killcohook.

Channel depths of 14 feet to 24 feet and corresponding widths ranging from 160 feet to 280 feet were examined during the study. Based on the finding of the study and in view of the conditional authorization of a 20 foot project for the Salem River by Section 859 of the Water Resources Act of 1986, construction of an 18 foot project is recommended at this time. Construction to 20 feet is to be deferred until such time as navigation needs change and further deepening is warranted.

The purpose of the Environmental Assessment is to provide a discussion of all pertinent environmental issues regarding the proposed project. The Environmental Assessment concludes that the proposed action would not have a significant adverse impact on the environment. Therefore, a draft Finding of No Significant Impact has also been prepared. Section 401 Water Quality Certification and concurrence of Federal consistency with the New Jersey Coastal Zone Management Program has been requested from the New Jersey Department of Environmental Protection.

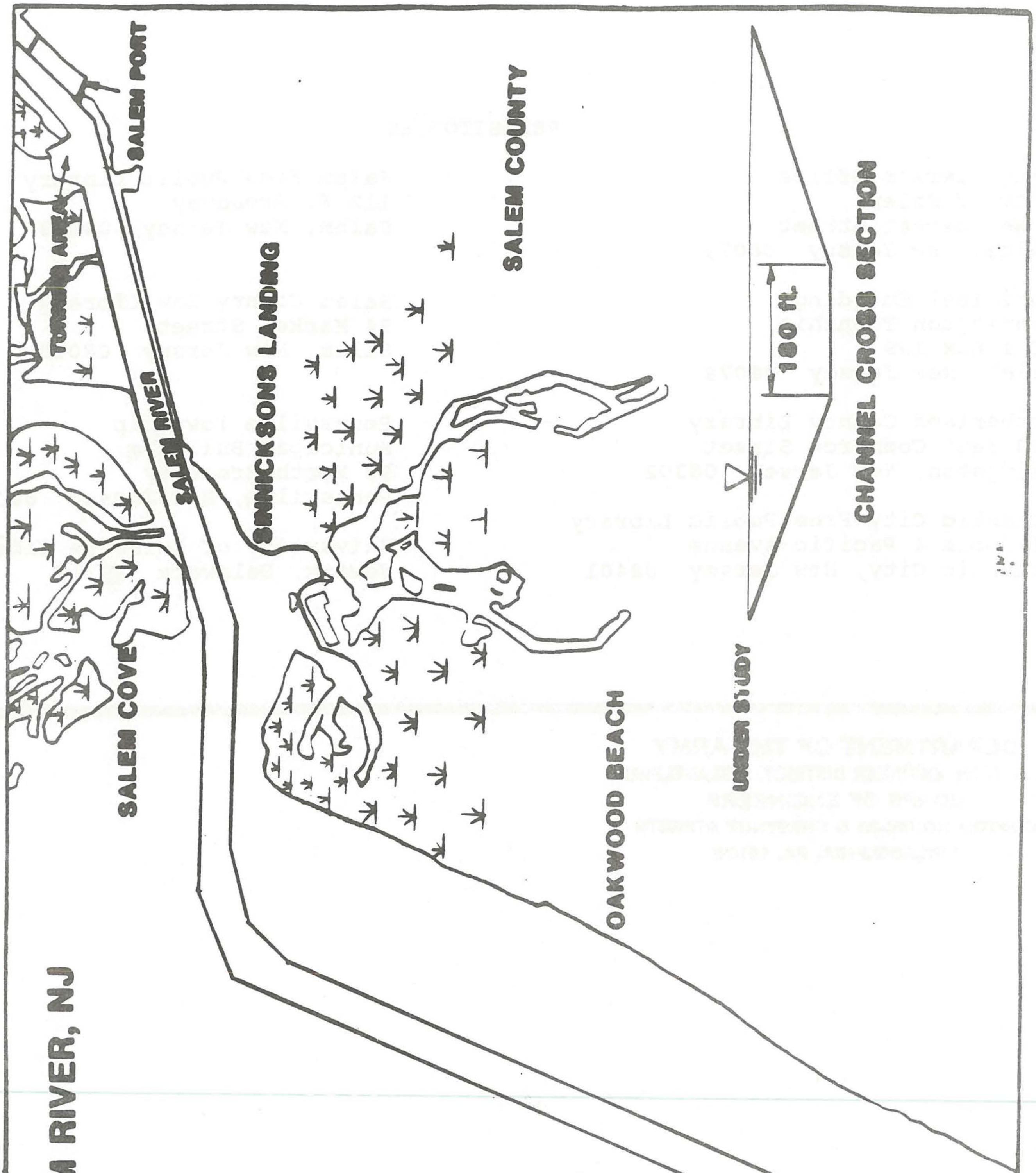
The Environmental Assessment for this project is being coordinated with the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, the New Jersey Department of Environmental Protection, local officials and all other known interested parties. The public and all agencies are invited to comment on this proposal. Copies of the documents are available upon request and are also available for public review at the Philadelphia District Office and at the repositories listed on the attached sheet.

An informal workshop meeting is being scheduled for January 12, at 7:00 PM at the Old Courthouse, Broadway and Market Streets, Salem, New Jersey. The purpose of this workshop will be to discuss the project proposals and answer questions. Comments on the draft Interim Feasibility Report and Environmental Assessment should be provided within 30 days after the date of this notice. All comments on the proposed work should be directed to the District Engineer, Philadelphia District, U.S. Army Corps of Engineers, 2nd and Chestnut Streets, Philadelphia, Pennsylvania 19106, ATTN: Project Planning Branch. For further information please contact Barbara Stratton at 215-597-5957.

FOR THE COMMANDER:

for [illegible]

ROBERT L. CALLEGARI
Chief, Planning Division


SALEM RIVER, NJ
SALEM PORT
TURNING AREA
SALEM RIVER
SINNICKSONS LANDING
SALEM COUNTY
CHANNEL CROSS SECTION
180 ft.
UNDER STUDY
OAKWOOD BEACH
SALEM COVE
DELAWARE RIVER

REPOSITORIES

City Clerk's Office
City of Salem
1 New Market Street
Salem, New Jersey 08079

Municipal Building
Mannington Township
RD 1 Box 129
Salem, New Jersey 08079

Cumberland County Library
800 East Commerce Street
Bridgeton, New Jersey 08302

Atlantic City Free Public Library
Illinois & Pacific Avenue
Atlantic City, New Jersey 08401

Salem Free Public Library
112 W. Broadway
Salem, New Jersey 08079

Salem County Law Library
94 Market Street
Salem, New Jersey 08079

Pennsville Township
Municipal Building
90 North Broadway
Pennsville, New Jersey 08070

University of Delaware Library
Newark, Delaware 19717

DEPARTMENT OF THE ARMY
U. S. ARMY ENGINEER DISTRICT, PHILADELPHIA
CORPS OF ENGINEERS
CUSTOM HOUSE-2D & CHESTNUT STREETS
PHILADELPHIA, PA. 19106

DELAWARE RIVER
COMPREHENSIVE NAVIGATION STUDY

SALEM RIVER, NEW JERSEY
FINAL INTERIM FEASIBILITY REPORT

ECONOMIC APPENDIX

MAY 1991

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ECONOMIC APPENDIX

INTRODUCTION

This economic appendix presents an analysis of the benefits that would result from deepening the Salem River, NJ federal navigation project. The Philadelphia District is analyzing deepening the Salem River navigation channel from its current authorized and maintained project depth of 12 feet to the following depths: 14 feet, 16 feet, 18 feet, 20 feet, 22 feet, and 24 feet. This range of depths was selected to establish, in conjunction with costs, the plan of improvement that maximizes net benefits. The economic analysis estimates the benefits that are anticipated to result from deepening the channel from 12 feet to the with-project condition alternative depths. Benefits will result from the decrease in the cost per ton of shipping commodities into or out of the port of Salem. These cost savings will occur in two ways: 1) a deeper channel depth will allow current vessels to carry more cargo, thus apportioning their operating costs over more tons, and 2) larger vessels with lower costs per ton will be able to call on the port.

In accord with ER 1105-2-100, Chapter 6, Section 7, the application of the nine-step procedure for the estimation of deep-draft navigation benefits has been followed in this economic appendix.

The port of Salem has been in operation only since 1982 and, thus, does not provide a lengthy historical record to analyze. A total of 183,400 short tons of cargo have been handled by the port from 1982 to 1989. There have been a total of 218 vessel movements into or out of the port over that same period.

The major commodities that moved through the port during its first eight years included general cargo/containers, grain, fertilizer, chemicals, peat moss, perishables, frozen food, scrap iron and steel, lumber, wastepaper, wire coils, and fish meal. During the first three years, barges were the primary vessel type; particularly of significance were grain barge movements. Over the next five years, only one barge shipment occurred, and the remainder of vessel trips have been by general cargo/container vessels and bulk vessels. Grain movements stopped in 1984 because of operational problems with the grain elevator. Funding is anticipated in the near future which will be used to repair the grain elevator.

The benefits calculated in this analysis were based on a projection and annualization of commodity flows over the 50-year project life, which extends from 1994 through 2044. A number of different data sources were referenced (Port of Salem, Philadelphia Maritime Exchange, Mid-Atlantic, the terminal operator, Voigt Maritime, the shipping agent for the line using Mid-Atlantic's terminal, Waterborne Commerce Statistics Center, and PIERS, a computerized data base of import/export data). Data from the year 1989 has been selected to represent the baseline, existing condition from which tonnage has been projected and benefits estimated. Growth in general cargo/container traffic has been projected for the first 20 years of the project life (1994-2014) and then held constant for the remainder of the project life. Bulk movements are anticipated to grow at 2% per year from 1989, onwards, based on anticipated growth in income for the study area as reported by OBERS projection service. (Projections of future commerce are discussed in detail later in this appendix.) Commodity flows will not vary by channel depth. A discount rate of 8 3/4% and an April 1990 price level were applied for the calculations.

ECONOMIC STUDY AREA

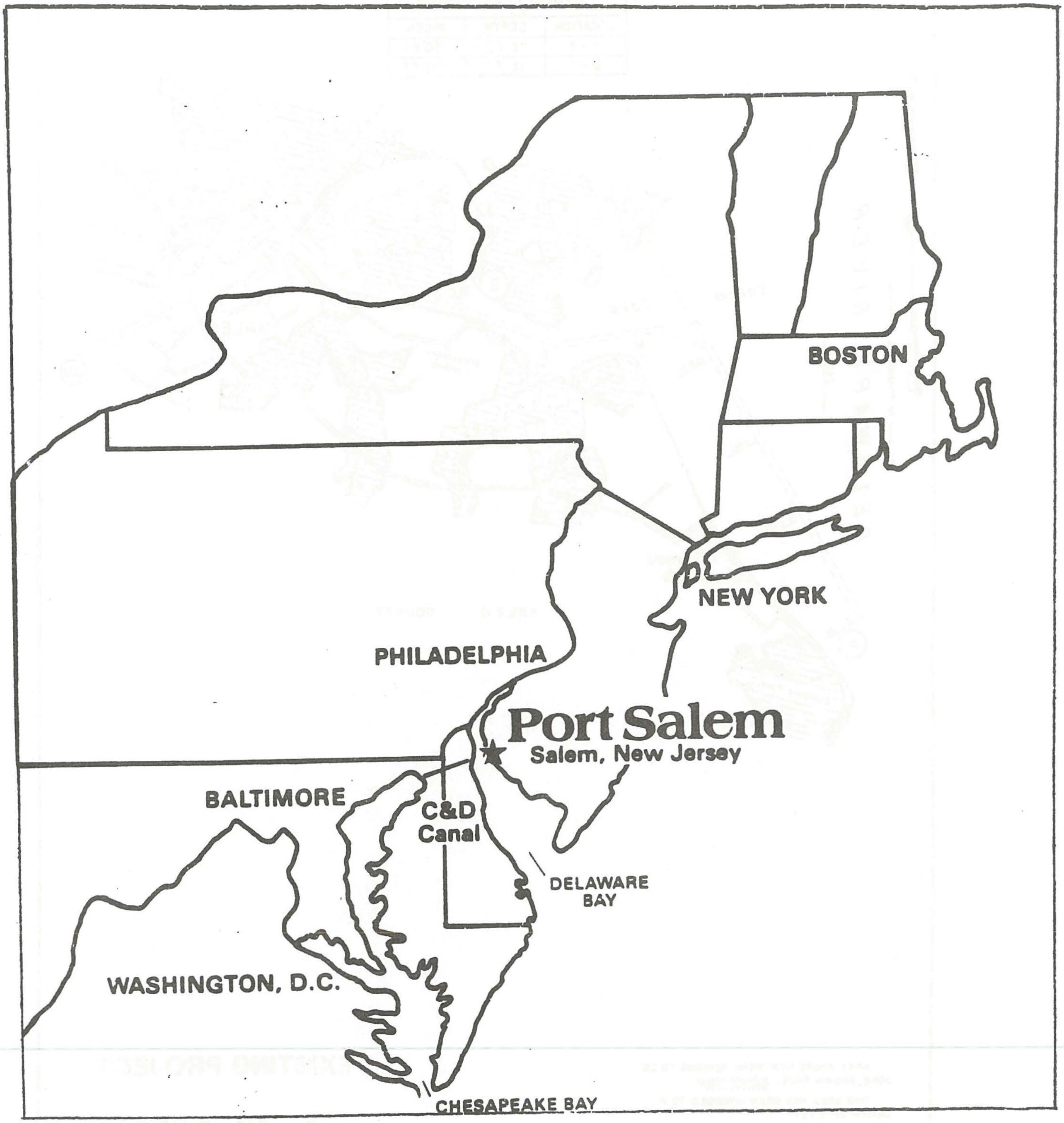
This section presents a summary of the commodities (with trade routes) which historically have used the Salem River:

a. General Cargo/Containers
   (1) Salem to Bermuda
   (2) Salem to Jamaica
   (3) Salem to Trinidad
   (4) Salem to Barbados
b. Grain (originating from southern New Jersey agricultural region)
   (1) Salem to Jamaica
   (2) Salem to Nova Scotia
c. Fertilizer (destined for use in southern New Jersey agricultural region)
   (1) South Carolina to Salem
   (2) Nova Scotia to Salem
d. Perishables (originating from southern New Jersey agricultural region; processed in local irradiation facility; shipped to foreign destinations)
   (1) Salem to Trinidad
   (2) Salem to East Germany
   (3) Salem to United Kingdom
e. Scrap Iron/Steel (used locally in the manufacture of finished steel products)
   (1) Nova Scotia to Salem
f. Lumber (used in local construction industry)
   (1) Brazil to Salem
g. Fish Meal (used locally)
   (1) Maryland to Salem
h. Other Miscellaneous Bulk Commodities
   (1) Salem from Trinidad
   (2) Salem from Brazil
   (3) Salem from Mexico

General cargo/containers to Bermuda is currently the most significant commodity [illegible]. The local port facility, in concert with its shipping agent, has carved out a successful niche market for moving [illegible] tonnage through the port. Cargo is transported to Salem mostly by truck and/or in small lots for shipment on a weekly basis. Shipments originate predominantly from the local market area: New Jersey, Delaware and Pennsylvania although shipments from further origin points such as the U.S. Midwest and Canada are not unusual. Types of export cargo include transportation equipment, chemicals, electrical equipment, machinery, construction materials, foodstuffs, consumer durable goods, and hotel products. Salem has achieved a niche to handle these small lots principally because it has been able to successfully make great use of its capability to efficiently and quickly handle tonnage, no matter how relatively small the individual lots might be. Bulk tonnage is also an important commodity type moving through the port: specific examples in 1989-1990 are exports of waste paper to Guatemala and Ecuador, steel coil exports to Jamaica, and the import of cocoa butter from Mexico.

EXISTING CONDITION

The port of Salem is located in Salem County, NJ. As shown in Figure B-1 (regional map), the port is located approximately 50 miles south/southeast of the city of Philadelphia, PA. The port is located at almost exactly the same latitude as the Chesapeake and Delaware (C&D) Canal. As shown in Figure B-2, the port of Salem is located approximately two statute miles inland from the eastern shore of the Delaware River, and approximately 5 statute miles from



SALEM RIVER, NEW JERSEY
INTERIM FEASIBILITY REPORT

GEOGRAPHIC STUDY AREA

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

FIGURE B-1

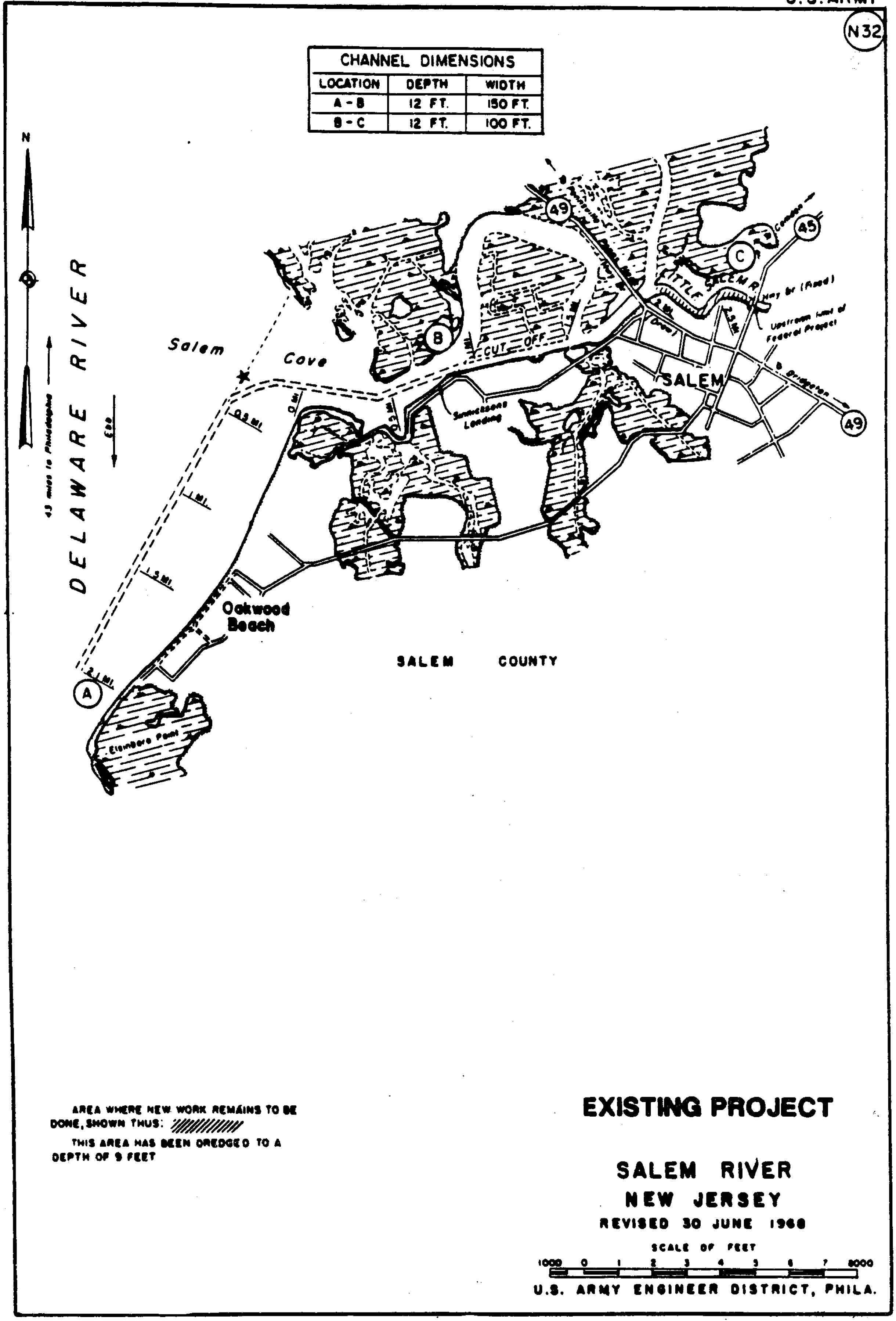

N32
CHANNEL DIMENSIONS
LOCATION DEPTH WIDTH
A - B 12 FT. 150 FT.
B - C 12 FT. 100 FT.
N
DELAWARE RIVER
Salem Cove
Oakwood Beach
SALEM COUNTY
SALEM
CUT OFF
LITTLE SALEM R.
A
B
C
49
45
AREA WHERE NEW WORK REMAINS TO BE DONE, SHOWN THUS:
THIS AREA HAS BEEN DREDGED TO A DEPTH OF 9 FEET
EXISTING PROJECT
SALEM RIVER
NEW JERSEY
REVISED 30 JUNE 1968
SCALE OF FEET
U.S. ARMY ENGINEER DISTRICT, PHILA.

FIGURE B-2

where the navigation channel leading to the port branches off from the main Delaware River channel.

The authorized Salem River federal navigation project includes an entrance channel and a cutoff (as shown in Figure B-2). The project covers a distance of approximately 5 miles (entrance to the port of Salem). The authorized and currently maintained channel depth is 12 feet mean low water. The authorized and maintained width of the entrance channel is 150 feet (approximately 3 miles), with the remainder of the channel (approximately 2 miles) having an authorized and maintained width of 100 feet.

EXISTING FACILITIES

Figure B-3 shows the layout and boundaries of the port of Salem. The current berthing facility owned by the Salem Port Authority consists of a wharf 120 feet long and 100 feet wide. A work barge measuring 240 feet long and 48 feet wide is moored alongside the wharf. Another berth is situated at the Mid-Atlantic Shipping property directly downriver from the Salem Port Authority facilities. Below is a description of study area facilities.

A bulk crane located on the crane barge has a 100 ton lift capacity. The bulk crane is capable of making six lifts per hour, and is equipped with a three cubic yard bucket that can be lifted 10-12 times per hour.

Container cranes are leased on an as-needed basis. Three capacities of cranes have been used, 22 ton, 65 ton, and 100 ton. The cranes are self-propelled and mounted on rubber tires.

Storage facilities for cargo include a 60,000 square foot

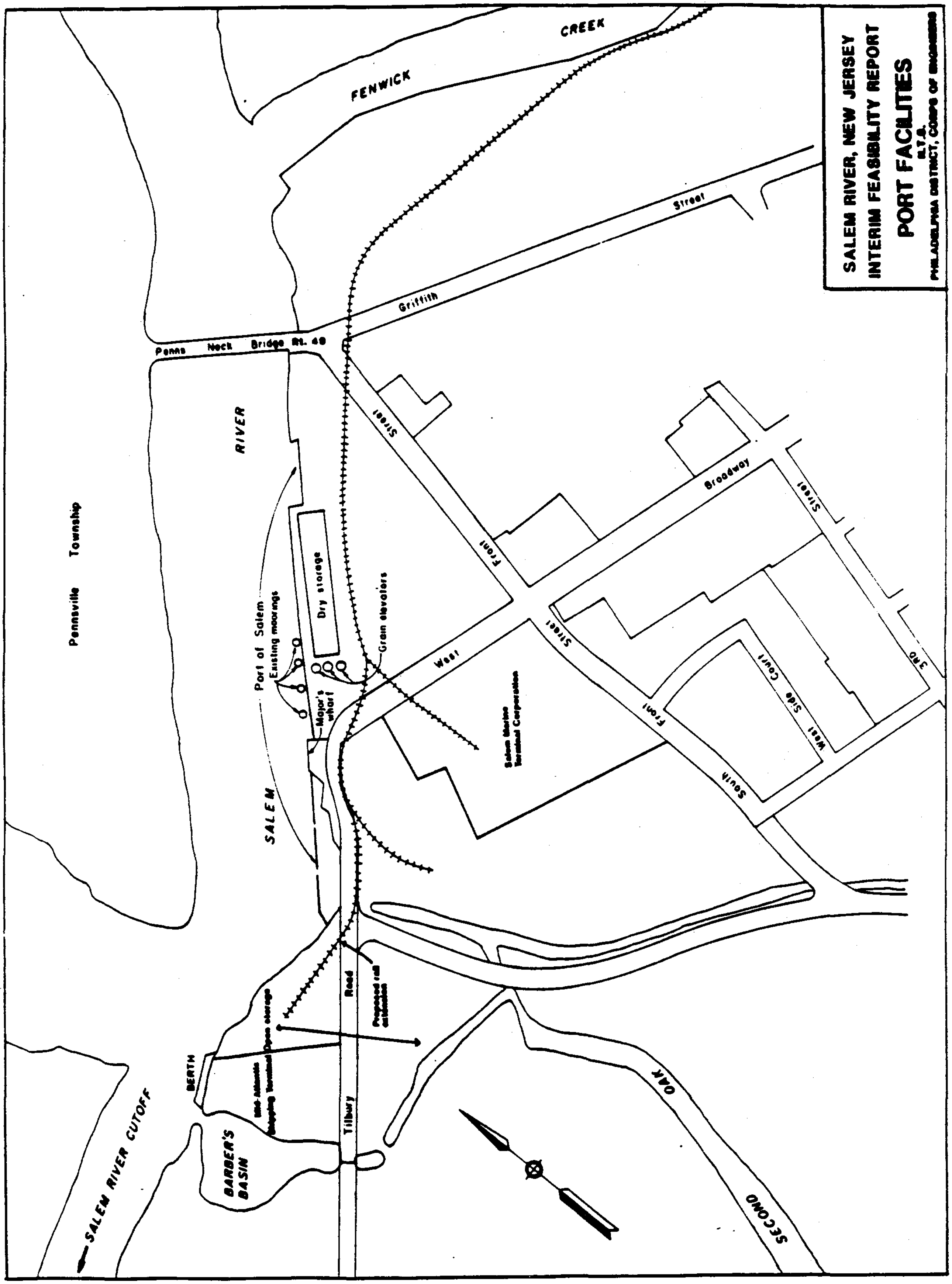

SALEM RIVER, NEW JERSEY
INTERIM FEASIBILITY REPORT
PORT FACILITIES
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
FENWICK
CREEK
Griffith
Street
Penns Neck Bridge Rt. 49
RIVER
SALEM
Pennsville Township
Port of Salem
Existing moorings
Dry storage
Grain elevators
Major's wharf
Front
Street
Broadway
West
Street
Salem Marine Terminal Corporation
West Side Court
South
3RD
Street
OAK
SECOND
Tilbury
Road
Proposed rail extension
Open storage
BERTH
BARBER'S BASIN
SALEM RIVER CUTOFF

FIGURE B-3

transit shed, a 28,000 square foot bulk warehouse, three dry grain tanks with a 1,700 ton capacity, and one wet grain tank that holds about 220 tons. Additional storage facilities include 190,000 square feet of open space for storing containers.

The design capacity of the Port's grain elevator is five million bushels, or 125,000 tons, per year. Its storage capacity is 85,000 bushels (2575 short tons). Approximately 8,000 bushels per hour of grain can be loaded into a ship at port. The Port's grain dryer has a capacity of 65 tons per hour, and sits alongside the grain storage tank.

The port has direct rail access via a rail spur of the West Jersey Short Line whose usable rail line ends just past the cold storage facility. Remnants of the rail spur extend to near the end of the Fire Parcel property (see Figure B-3) but would have to be reconstructed before being usable. This line is owned by Salem County and consists of 18 miles of rail line. The line is operated for the county by the West Jersey Short Line Railroad and connects to Conrail. The siding in the Port of Salem's boundaries has the capacity for ten cars, with additional capacity for 100 railcars present in the Short Line's yards which are located about ten minutes travel time from the port. The Short Line indicates that there is sufficient room available within the port for providing additional rail sidings.

An additional need to supplement the port's ability to handle bulk commodity shipments by rail is the development of a permanent, in-place means for transferring commodities between the rail cars and either the grain elevator or an awaiting ship. Vacuum hoses or portable conveyors have been used for these movements.

A representative of the West Jersey Short Line said the company was prepared to install an additional siding at the port alongside the grain elevator with room for ten cars, if demand warrants. An unloading pit would be capable of sending 100 tons/hour of grain from the rail cars directly to the grain elevators.

The rail line has been used for shipments going through the port such as soybeans, scrap iron and steel, and fishmeal. For example, the shipment of fishmeal was vacuumed from the ship directly into waiting rail cars, a distance of approximately 50 yards. Three or four cars were loaded at a time and then pulled to the Short Line's rail siding and another three or four empty cars were brought to the port's siding. Each car carried about 100 tons of fishmeal, and 20 cars were needed for the shipment.

EXISTING VESSEL OPERATING PRACTICES

PILOT RESTRICTIONS

Salem is a relatively new port. In 1985, as the port was just commencing operations, the pilots did not have experience in navigating the channel. The deepest draft of a vessel during initial operations was approximately 16 feet. Over time, with further experience, the pilots limited the maximum draft of vessels under existing conditions to approximately 15.5 feet. The 12 foot (MLW) without project condition provides approximately 17.5 feet of depth at high tide. An allowance for two feet of underkeel clearance is based on the experience and professional expertise of the pilots. The actual operating practice of vessels based on data from the pilots logs has been incorporated into the economic analysis.

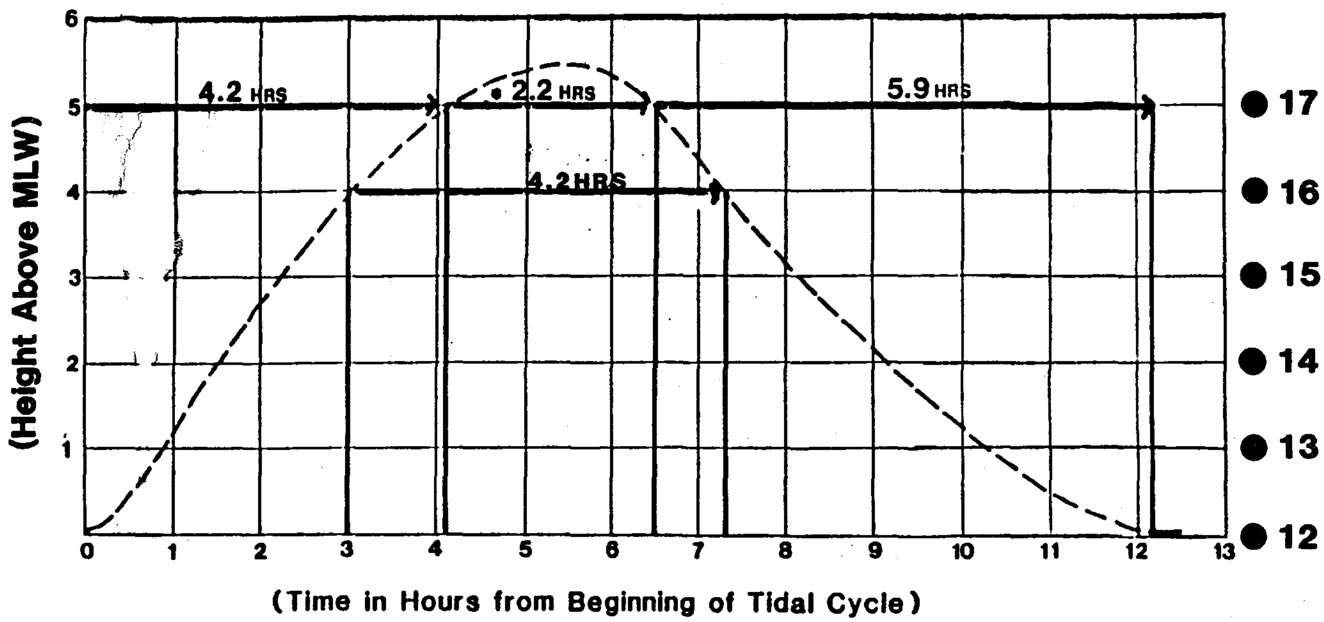
TIDAL USE

Vessels currently using the port of Salem operate using the tide, if necessary, based on the consideration of vessel draft versus channel depth. That is, based on discussions with the pilots, some ships transit the Salem River navigation channel only during periods of high tide. Figure B-4 presents a tidal chart for the port of Salem. The tidal fluctuation at Salem is 5.5 feet, meaning that ships using the channel at high tide have approximately 17.5 feet of depth with which to work. The time of the tidal cycle is approximately 12.4 hours.

Figure B-4 indicates the tidal "window" that is currently available for ships using the Salem channel whose required draft (vessel sailing draft plus 2 feet of underkeel clearance) exceeds the MLW channel depth. For example, a ship requiring a 17 foot channel depth has approximately 2.2 hours during which the channel is at least that deep. If the vessel misses its "window" it has to wait 10.1 hours for its next opportunity. Similarly, a vessel requiring a 16-foot channel depth has a "window" of 4.2 hours during which it could use the channel.

TUG USE

The current practice is to use one 525 horsepower tug, with a length of 46 feet, draft of six feet, and a beam of ten feet. This



● Indicates Channel Depth (MLW)

SALEM RIVER, NEW JERSEY
INTERIM FEASIBILITY REPORT

Tidal Rise and Depth of the Salem River Navigation Channel

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS

FIGURE B-4

practice is expected to continue in the future at all potential channel depths. On an inbound trip, the tug precedes a ship up the Salem navigation channel and then ties onto it at the point where the channel width narrows from 150 feet to 100 feet. Until that point, the vessel has been proceeding under its own power. The tug is then positioned on the starboard side of the ship's bow. When the pair reach the turning basin, the tug positions itself perpendicular to the keel and turns the ship to the left (i.e., counter clockwise, with the bow turning to the left and the stern to the right). The ship is rotated 180 degrees until it is facing downstream. Turning ships to the left is required because of the unique dimensional and tidal characteristics of the port of Salem, even though most ships are "right propellered", and turn more easily to the right. The ship is then pushed into position with its port side next to the wharf. Tug costs are incorporated into the transportation cost model.

The pilots prefer to bring ships up the channel on the flood tide as the increasing depth provides more maneuverability for the ships.

EXISTING VESSEL USE

The number of vessel trips (including backhaul movements) historically through the port of Salem is shown in Table B-1. Barge movements predominated in 1982-1984. A significant change occurred during 1985-1986, in which there were 49 vessel trips, only two of which were by barge. In 1987 through 1989, there were 146 vessel trips through Salem, all of which were by ship. A

TABLE B-1
HISTORIC PORT OF SALEM VESSEL TRIPS (INBOUND AND OUTBOUND)
1982-1989

VESSEL TYPE AND COMMODITY	1982	1983	1984	1985	1986	1987	1988	1989 1]	TOTAL
SHIPS									
CONTAINER (BERMUDA TRADE)	0	0	0	0	0	0	0	68	68
GENERAL CARGO/CONTAINER	0	0	0	24	21	26	18	0	89
BULK COMMODITIES	0	0	1	2	0	0	0	34	37
SUBTOTAL	0	0	1	26	21	26	18	102	194
BARGES									
GRAIN	3	0	11	0	0	0	0	0	14
FERTILIZER	0	4	2	0	1	0	0	0	7
CHEMICALS	2	0	0	0	0	0	0	0	2
SCRAP IRON & STEEL	0	0	0	1	0	0	0	0	1
SUBTOTAL	5	4	13	1	1	0	0	0	24
TOTAL	5	4	14	27	22	26	18	102	218

SOURCES: PORT OF SALEM, PORTS OF PHILADELPHIA MARITIME EXCHANGE, MID-ATLANTIC, WCSC, PIERS

1] MOST MOVEMENTS INVOLVE EMPTY OR INSIGNIFICANT TONNAGE ON INBOUND LEG; ONLY TWO VESSELS IN 1989 INVOLVED SIGNIFICANT BACKHAUL

2] PRIOR TO 1989, CONTAINERS WERE NOT A MAJOR FACTOR IN SALEM TRAFFIC AND ARE INSEPARABLE FROM GENERAL CARGO TRIPS. TRAFFIC IN 1989 MARKED THE BEGINNING OF THE CONTAINER TRADE TO BERMUDA. ALTHOUGH THEY ARE REPORTED SEPARATELY FOR 1989, IT SHOULD BE NOTED THAT "CONTAINER" TRIPS MAY ALSO CARRY GENERAL CARGO TONNAGE AND VICE VERSA.

vessel trip is defined as either an inbound or outbound usage of the Salem River channel. Barge movements have stopped because of operational problems with the grain elevator. Grain movements are expected to recommence once the grain elevator becomes operational again.

COMMODITY MOVEMENTS-HISTORICAL TONNAGE

The Salem City Council voted in 1982 to create a Municipal Port Authority to oversee the redevelopment of the port area and the construction of port facilities.

The first modern day shipment through the port of Salem occurred in May 1982, when 1,500 short tons of soybeans travelled by barge down the Salem River channel en route to Norfolk, VA, by way of the Chesapeake and Delaware Canal. Four additional barge shipments occurred that year, two for soybeans and two for chemicals. A summary of historical general cargo/container and bulk commodity movement categories from 1982-1989 is given in Table B-2. Preliminary data estimated that general cargo/container tonnage in 1990 was equal to 22,900 tons.

Grain shipments comprised the majority of tonnage between 1982 and 1984. In 1985, the leading commodity, in terms of tonnage, was scrap iron and steel imported from Nova Scotia. The second largest commodity movement was wastepaper. General cargo amounted to 4,400 short tons and comprised the third largest commodity volume.
Also, in 1986, general cargo/containers and lumber comprised the two largest commodity groups. Frozen food was the third largest

TABLE B-2
HISTORIC PORT OF SALEM TONNAGE
1982-1989

COMMODITY	1982	1983	1984	1985	1986	1987	1988	1989	
GENERAL CARGO/CONTAINERS	0	0	0	4,400	5,200	32,600	22,600	14,400	1]
BULK	7,700	6,000	22,300	25,100	11,100	0	0	24,800	
TOTAL 2]	7,700	6,000	22,300	29,500	16,300	32,600	22,600	39,200	

SOURCES: PORT OF SALEM, PORTS OF PHILADELPHIA MARITIME EXCHANGE, MID-ATLANTIC, PIERS, WCSC

1] ALL GENERAL CARGO/CONTAINER TONNAGE MOVED PRIOR TO 1989 WAS ON TRADE ROUTES OTHER THAN BERMUDA; ALL GENERAL CARGO/CONTAINER TONNAGE FOR 1989 IS FOR BERMUDA TRADE ROUTE COMMENCED IN APRIL 1989; BASED ON SAME RATE OF TONNAGE FOR THIS TRADE ROUTE, PRORATION FOR FULL YEAR= 21,600, TONNAGE FOR 1990 FOR GENERAL CARGO/CONTAINERS TO BERMUDA=22,900

2] STRICTLY BARGE MOVEMENTS 1982-1984, ONLY ONE BARGE MOVEMENT IN BOTH 1985 AND 1986 (REMAINDER OF MOVEMENTS IN VESSELS); STRICTLY VESSEL MOVEMENTS 1987-1989

3] TOTAL TONNAGE FOR 1987-1988 REPORTED BY PORT OF SALEM IS CORRECT, HOWEVER BULK TONNAGE MOVED IS NOT CLEARLY SEPARABLE FROM THE GENERAL CARGO/CONTAINER CATEGORY IN THE DATA SOURCES.

commodity. Scrap iron and steel imports were fourth in significance. The years 1987 and 1988 were reported as entirely general cargo/container movements. The year 1989 showed approximately 50% of total movements as general cargo/container movements to Bermuda, with the other half consisting of bulk movements of stone, paper, and cement. Bermuda traffic is port to port, and 3% of bulk movements involve topping-off at Salem. Table B-3 presents vessel movements by trade route for 1989.

FUTURE PORT IMPROVEMENTS

Port officials and the individual companies shipping out of Salem were contacted to identify planned expansions in port facilities and equipment. The facilities anticipated to be in place at the port by the base year, 1994, are shown in Table B-4. One berth is currently operational and managed by the Salem Port Authority under lease to Salem Marine Terminal Corp. A second berth, constructed by Mid-Atlantic Shipping, became operational in April 1989. Salem Marine Terminal is currently arranging for financing to build an additional berth on leased port property. Also, the company is actively developing plans for construction of another berth on additional port property. Thus, the project will have a total of four berths available for usage by vessels by the project base year. Further, the County of Salem Economic Development Authority and Salem Port Authority are working together to expand the foreign trade zone (FTZ) designation. The impact of the FTZ, considered speculative at this time, has not been included in the projection of commodities.

TABLE B-3

VESSEL MOVEMENTS BY TRADE ROUTE
(INBOUND AND OUTBOUND)

TRADE ROUTE	1989 1]
BERMUDA	80 2]
JAMAICA	0
GUATEMALA	6
NEW YORK	4
FLORIDA	3
HONDURAS	2
MEXICO	1
COLOMBIA	1
NOVA SCOTIA	1
SAVANNAH	0
BALTIMORE	1
EQUADOR	1
CANARY ISLANDS	1
VENEZUELA	1
TOTAL	102

SOURCE: PORTS OF PHILADELPHIA MARITIME EXCHANGE, WCSC, PIERS

1] MOST MOVEMENTS INVOLVE EMPTY OR INSIGNIFICANT TONNAGE ON BACKHAUL; ONLY TWO VESSELS IN 1989 INVOLVED SIGNIFICANT BACKHAUL

2] 68 OF THESE MOVEMENTS WERE FOR CONTAINERS TO AND FROM BERMUDA

TABLE B-4
LOADING/UNLOADING AND STORAGE FACILITIES, 1994
(ALL CHANNEL DEPTHS)

<u>Berths</u>
-Three berths at the Salem Municipal Port Authority location
-One berth at the Mid-Atlantic Shipping location

<u>General Cargo/Container and Bulk</u>
-88,000 sq. ft. of warehouse covered space
-190,000 sq. ft. of uncovered space available for staging containers
-Access to unlimited crane capacity on a lease basis. Current capacity of 180 tons per hour, and an available 3 cubic yard bucket which can be lifted 10-12 times per hour

<u>Grain</u>
-Three dry storage tanks holding a total of 1,700 tons
-One tank holding 220 tons of wet or dry grain
-Grain dryer with a capacity of 25 tons per hour
-Stack and reclaim capacity of 200 tons per hour

<u>Rail</u>
-Rail facility capable of handling 10,000 tons per month

COMMODITY PROJECTIONS

Estimates of future commodity movements through the Port of Salem were based on the historical data base of vessel movements and tonnage, interviews with the local users and port authority, and economic growth projections from a consulting firm service.

General Cargo/Container Exports to Bermuda. No single data source will capture traffic for a port in its entirety; errors in reporting and collection distort any data base. Also, different sources are interested in different measurements, for instance, one may focus on TEU's (twenty-foot equivalent units, the standard measure for container box size) while another is concerned with tonnage. Therefore, figures for Salem were collected from several sources.

Data collected for Salem indicated that its share of the North Atlantic-Bermuda trade was approximately 20% or 19,400 short tons in 1989. This figure was used as the basis for computing savings in the transportation cost model. A closer check of shipping records, however, indicated that Salem's traffic was somewhat higher for 1989 than the market share estimate revealed, or 21,600 short tons. Projected traffic, as explained in more detail below, was based on the slightly higher tonnage and TEU figures for 1989 and 1990 obtained when additional data sources were consulted.

Projected growth of container traffic was obtained from two sources. The DRI/TBS World Sea Trade Service has been used as the major source for the projections of export tonnage from the U.S. North Atlantic Coast to Bermuda through the year 2000. Table B-5

TABLE B-5

U.S. NORTH ATLANTIC EXPORTS OF GENERAL CARGO/CONTAINERS TO BERMUDA
SALEM RIVER PROJECTIONS
GROWTH FOR FIRST 20 YEARS OF PROJECT LIFE (TO YEAR 2014)

	TOTAL MARKET: U.S. NORTH ATLANTIC			SALEM:		
YEAR	DRI/TBS CONTAINER S.T.	DRI/TBS CONTAINER TEUS	DRI/TBS TONS PER TEU	CONTAINER TONS	CONTAINER TEUS	TONS PER TEU
1989	96,973 *	9,733 *	9.96	19,400 *1]	2,058 2]	9.43
1990	105,902 *	10,850 *	9.76	21,200 *1]	2,489 2]	8.52
1991	113,507 *	11,727 *	9.68	30,432	3,804 3]	8.00
1992	123,856 *	12,763 *	9.70	32,200	4,025 3]	8.00
1993	137,429 *	14,117 *	9.74	34,688	4,336 3]	8.00
1994	149,710 *	15,370 *	9.74	38,080	4,760 3]	8.00
1995	160,859 *	16,575 *	9.70	41,904	5,238 3]	8.00
1996	173,515 *	17,943 *	9.67	53,040	6,630	8.00
1997	186,608 *	19,361 *	9.64	57,418	7,177	8.00
1998	199,758 *	20,810 *	9.60	61,955	7,744	8.00
1999	213,047 *	22,315 *	9.55	66,592	8,324	8.00
2000	225,654 *	23,822 *	9.47	71,408	8,926	8.00
2001	243,706	25,847	9.43	76,230	9,529	8.00
2002	263,203	28,044	9.39	82,710	10,339	8.00
2003	284,259	30,428	9.34	89,740	11,218	8.00
2004	307,000	33,014	9.30	97,368	12,171	8.00
2005	331,560	35,820	9.26	105,645	13,206	8.00
2006	358,085	38,865	9.21	114,624	14,328	8.00
2007	386,731	42,168	9.17	124,367	15,546	8.00
2008	417,670	45,753	9.13	134,939	16,867	8.00
2009	451,083	49,642	9.09	146,408	18,301	8.00
2010	487,170	53,861	9.04	158,853	19,857	8.00
2011	526,144	58,439	9.00	172,356	21,544	8.00
2012	568,235	63,407	8.96	187,006	23,376	8.00
2013	613,694	68,796	8.92	202,901	25,363	8.00
2014	662,790	74,644	8.88	220,148	27,519	8.00
			AVG ANN TONS	113,000		

*: DATA PROVIDED BY DRI/TBS, OTHER YEARS CALCULATED FROM PROVIDED YEARS
1] FOR 1989-1990, BASED ON 20% MARKET SHARE FOR SALEM;
ACTUAL TONNAGE SLIGHTLY HIGHER (1989=21,600; 1990=22,900)
2] SOURCE: VOIGT MARITIME, HISTORIC TEU DATA
3] SOURCE: VOIGT MARITIME, PROJECTED TEU DATA

presents DRI/TBS projections for the total market in the left-hand columns. This analysis extrapolates DRI's figures from the year 2000 to the year 2014 to anticipate continued growth for the first 20 years of the project life. Tonnage has then been held constant in the benefit analysis for the remaining 30 years of the project life.

Specific projections for Salem, shown in the right-hand columns, relied on a combination of DRI data and projections made by the shipping agent (Voight Maritime) for the carrier (Bermuda International Shipping Ltd. or BISL) using Mid-Atlantic terminal. Prior to 1990, as noted above, Salem had an approximate 20% share of the total U.S. North Atlantic market. However, Salem's market share has increased to 21.2% for the full year of 1990, with the market share in the second half of 1990 rising to 24.4%. Also, in late 1990, Lloyd Bermuda, one of the two North Atlantic competitors to the Mid-Atlantic/BISL/Voigt operation, ceased operations. The Mid-Atlantic market share has continued to increase, reaching 28.7% by January-February 1991.

By 1995, Mid-Atlantic is projected by the shipping agent, Voigt, to split the 25% market share vacated by Lloyd Bermuda with its one competitor, Bermuda Container Lines (which operates out of the port of New York) and reach a 40% market share. This projection developed by Voigt is based on the reasonable expectation of Mid-Atlantic being able to capture half of the open market share as well as in-depth knowledge of the promising market conditions for the Bermuda market. The figures on Table 8 reflect Voight's TEU projections, converted to short tons using an average of 8 tons per TEU (historic average from 1989-90 data). By 1995, the figures reflect a 40% market share of DRI's projection for the total market. From 1996 on, the growth rate incorporated in DRI's projections has been used to forecast Salem's TEU's which were then converted to tonnage using the aforementioned 8 tons per TEU. Average annual tonnage for this commodity and trade route is equal to 113,000 tons.

<u>Bulk Movements.</u> Bulk tonnage through the port of Salem in 1989 was equal to 24,800 tons. The major commodity moved was wastepaper to the Caribbean and Central America. Also important were cocoa butter from Central America, and cement blocks to the Caribbean. Growth in tonnage, applying OBERS, will be at 2% per annum. The OBERS projections for the region from the U.S. Dept. of Commerce, Bureau of Economic Analysis, 1985 OBERS Projections, Volume 2, "Metropolitan Statistical Area Projections to 2035", were applied. THe most narrowly defined level of economic activity and population, the Wilmington, DE-NJ-MD PMSA, which includes Salem County, NJ, was used. Application of a linkage of bulk commodities with OBERS growth in personal income was utilized. This decision was made because total personal income was considered a reasonable indicator of bulk commodity growth at Salem. The bulk commodities moving through Salem are indirect goods that will ultimately be converted into consumer goods. Economic theory holds that consumption is a function of income. Thus, using personal income should give a reasonable indicator of growth for bulk commodities moving through Salem. Average annual bulk tonnage is equal to

31,000 tons.

Commodity projections are anticipated to be the same for the without and with project condition channel depths. The port plans for additional berths to be available by the project base year will significantly increase the port's annual throughput capacity and assure that the growth in tonnage can be handled by the port users.

In order to independently assess the level of potential future commodity movements, two ports located on the east coast of the U.S. with 24-foot channel depths were contacted (Port Royal, SC, and Richmond, VA). Discussions with representatives from both ports indicated that they are more heavily oriented towards bulk cargo than Salem is anticipated to be. However, the annual tonnage of these ports did provide excellent assurance on the potential for future tonnage that is projected to pass through the port of Salem. For example, Port Royal, in operation for only a couple of years, has already handled in excess of 170,000 tons. Also, average annual tonnage through the port of Richmond was 2.1 million tons. By comparison, the average annual tonnage through the port of Salem is projected to be 144,000 tons.

The analysis of commodity projections for Salem was based only on existing commodities (with relevant trade routes) that have moved through the port historically. As stated, the commodity projections will be the same for all depths. No new commodities or diversions are included in the analysis, although a list of potential additional commodities were identified in the economic investigation and are discussed in the Risk and Uncertainty

Analysis section of this economic appendix. There will not be a throughput capacity constraint over the project life. This was determined by comparing projected tonnage to the capability of the port to handle this amount of tonnage over the project life.

WITH PROJECT CONDITION

The project improvements studied consist of MLW channel depths of 14 feet, 16 feet, 18 feet, 20 feet, 22 feet, and 24 feet. This range was selected to bracket the optimum channel depth. The with-project condition designed channel width will be sufficient to fully accomodate one-way ship traffic for the projected design vessels. The turning basin will also be enlarged as required to handle the dimensions of the design vessels. Berth depths will be sufficiently deeper than the channel depth to assure no constraint on vessel loading and unloading because of the tidal range. Commodity projections will be the same as for the 12 foot (MLW) without project condition channel depth.

The benefits from the proposed with project condition alternatives are defined as the transportation cost savings that would result primarily because of the following factors with a deeper channel:

-Ships will be loaded more fully, thus spreading costs over a larger load

-Cost savings will be achieved since larger ships offer economies of scale in shipping costs

-For the larger vessels, the amount of shutout tonnage (i.e., amount of a ship's load capacity that cannot be carried) is reduced as the channel is deepened

FLEET DISTRIBUTION

A fleet distribution is influenced by many factors. The criteria for selecting ship sizes include the volume of trade, distance of transport, controlling depths at both the loading and discharge ports, and cargo handling and storage facilities. Generally, the most efficient vessel size for any trade route tends to be one of the largest, if not the largest, ship that can be accomodated on that route. So, as the Salem River is deepened, a gradual shift to a larger weighted fleet size is projected in order to take advantage of cost efficiencies provided by the deeper navigational channel. For general cargo/container vessels, the fleet distributions were based on operating costs as a criteria and assumed a normal distribution using the optimal vessel as the mean. Any vessel which had an operating cost greater than one standard deviation was dropped from the distribution for the considered channel depth. The maximum general cargo/container vessel class that will use the Salem River channel is projected to be 5000 DWT. For bulk commodities, fleet distributions again used operating costs as a criteria but were adjusted based on a combination of interviews and professional judgement regarding shifts in costs per ton among vessel classes with channel improvements.

A referral to world and regional fleet statistics developed by the IWR MARDATA Ship Library verified that there are sufficient vessels of pertinent size to handle the tonnage projected to be moved through Salem over the project life.

As the channel becomes deeper a larger proportion of commodities would move by larger vessel classes. This assumption for the channel deepening is based on traditional navigational vessel operating decisions. As stated in Step 5 of ER 1105-2-100, Chapter 6, Section 7, "Transportation costs with a plan should reflect any efficiencies that can be reasonably expected such as use of larger vessels, increased load reductions in transit time and delays, etc."

The primary sources for vessel information included the two companies operating facilities on the Salem River, the Corps' Institute for Water Resources, Port of Salem officials, the pilots association, and the local tug and launch company. Additional sources of information included shipping companies and ship brokers using the port of Salem. These sources were asked to identify the most likely and maximum vessel dimensions for both ships and barges for each of the channel depths.

Table B-6 presents the fleet distributions for general cargo/container vessels for each level of current actual operating practice defined by data from the pilots logs(i.e., fully loaded, 1.5 feet lightloaded, and 2.5 feet lightloaded), and for each channel depth. The largest vessel size anticipated is 5000 DWT. Table B6-A presents the fleet distribution for bulk vessels. The largest vessel size anticipated is 10,000 DWT. The fleet distributions will not shift over the project life.

TABLE B-6

FLEET DISTRIBUTION BY CHANNEL DEPTH FOR GENERAL CARGO/CONTAINER VESSELS
ACTUAL OPERATING PRACTICE: DESIGN DRAFT AND CARRYING CAPACITY ADJUSTMENT
FLEET DISTRIBUTIONS BY CHANNEL DEPTH ESTIMATED BASED ON NORMAL DISTRIBUTION
FOR VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN

VESSEL CLASS	A]	B]	C]
12 FT CHANNEL			
1000 DWT			
1500 DWT	10.0%	2.9%	0.5%
2000 DWT		11.4%	20.4%
3000 DWT	60.0%	45.7%	40.8%
4000 DWT	30.0%	40.0%	38.3%
5000 DWT			
14 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	8.1%	1.4%	14.4%
3000 DWT	46.3%	37.5%	28.8%
4000 DWT	45.6%	38.9%	29.5%
5000 DWT		22.2%	27.3%
16 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.1%	1.1%	16.9%
3000 DWT	32.6%	30.4%	26.5%
4000 DWT	35.8%	33.7%	27.7%
5000 DWT	30.5%	34.8%	28.9%
18 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.2%	0.4%	4.3%
3000 DWT	27.9%	31.3%	30.0%
4000 DWT	34.9%	33.6%	31.4%
5000 DWT	36.0%	34.7%	34.3%

FOOTNOTES:

A] VESSELS OPERATING >15 FT SAILING DRAFT CURRENTLY (UNCONSTRAINED)

B] VESSELS OPERATING WITH 14 FT SAILING DRAFT CURRENTLY (1.5 FT CONSTRAINT)

C] VESSELS OPERATING WITH 13 FT SAILING DRAFT CURRENTLY (2.5 FT CONSTRAINT)

TABLE B-6 (CONT.)

VESSEL CLASS	A]	B]	C]
20 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.2%	0.4%	4.3%
3000 DWT	27.9%	31.3%	30.0%
4000 DWT	34.9%	33.6%	31.4%
5000 DWT	36.0%	34.7%	34.3%
22 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.2%	0.4%	4.3%
3000 DWT	27.9%	31.3%	30.0%
4000 DWT	34.9%	33.6%	31.4%
5000 DWT	36.0%	34.7%	34.3%
24 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.2%	0.4%	4.3%
3000 DWT	27.9%	31.3%	30.0%
4000 DWT	34.9%	33.6%	31.4%
5000 DWT	36.0%	34.7%	34.3%

FOOTNOTES:

A] VESSELS OPERATING >15 FT SAILING DRAFT CURRENTLY (UNCONSTRAINED)

B] VESSELS OPERATING WITH 14 FT SAILING DRAFT CURRENTLY (1.5 FT CONSTRAINT)

C] VESSELS OPERATING WITH 13 FT SAILING DRAFT CURRENTLY (2.5 FT CONSTRAINT)

TABLE B-6

FLEET DISTRIBUTION [illegible] CHANNEL [illegible]

BULK COMMODITIES

GRAINS [illegible] FERTILIZER [illegible] LUMBER [illegible] IRON/STEEL [illegible] DISTRIBUTION

VESSEL CLASS

12 FT CHANNEL	
2000 DWT	5%
4000 DWT	44%
5000 DWT	
6000 DWT	44%
10000 DWT	
BARGES	7%
14 FT CHANNEL	
2000 DWT	2%
4000 DWT	39%
6000 DWT	52%
10000 DWT	
BARGES	7%
16 FT CHANNEL	
2000 DWT	1%
4000 DWT	32%
6000 DWT	60%
10000 DWT	
BARGES	7%
18 FT CHANNEL	
2000 DWT	
4000 DWT	29%
6000 DWT	64%
10000 DWT	
BARGES	7%
20 FT CHANNEL	
2000 DWT	
4000 DWT	17%
6000 DWT	73%
10000 DWT	3%
BARGES	7%
22 FT CHANNEL	
2000 DWT	
4000 DWT	16%
6000 DWT	66%
10000 DWT	11%
BARGES	7%
24 FT CHANNEL	
2000 DWT	
4000 DWT	15%
6000 DWT	66%
10000 DWT	12%
BARGES	7%

TABLE B-6A

FLEET DISTRIBUTION [illegible] GENERAL CARGO/CONTAINER VESSELS

ACTUAL OPERATING PRACTICE: DESIGN [illegible] CARRYING CAPACITY ADJUSTMENT

VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN

VESSEL CLASS	A]	B]	C]
12 FT CHANNEL			
1000 DWT			
1500 DWT	10.0%	2.9%	0.5%
2000 DWT		11.4%	20.4%
3000 DWT	60.0%	45.7%	40.8%
4000 DWT	30.0%	40.0%	38.3%
5000 DWT			
14 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	8.1%	1.4%	14.4%
3000 DWT	46.3%	37.5%	28.8%
4000 DWT	45.6%	38.9%	29.5%
5000 DWT		22.2%	27.3%
16 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.1%	1.1%	16.9%
3000 DWT	32.6%	30.4%	26.5%
4000 DWT	35.8%	33.7%	27.7%
5000 DWT	30.5%	34.8%	28.9%
18 FT CHANNEL			
1000 DWT			
1500 DWT			
2000 DWT	1.2%	0.4%	4.3%
3000 DWT	27.9%	31.3%	30.0%
4000 DWT	34.9%	33.6%	31.4%
5000 DWT	36.0%	34.7%	34.3%

FOOTNOTES:

A] VESSELS OPERATING >15 FT SAILING DRAFT CURRENTLY (UNCONSTRAINED)

B] VESSELS OPERATING WITH 14 FT SAILING DRAFT CURRENTLY (1.5 FT CONSTRAINT)

C] VESSELS OPERATING WITH 13 FT SAILING DRAFT CURRENTLY (2.5 FT CONSTRAINT)

General Cargo/Container Benefits: Exports to Bermuda. A transportation cost model was developed to analyze the actual operating practices of outbound general cargo/container vessels to Bermuda (determined from the sailing drafts listed by the Salem River pilot logs). Vessel movements on this trade route are port to port. The current vessel used on this trade route is the "Bermuda Islander", with a design draft of 16.33 feet, design deadweight tonnage of 2650 short tons, length of 262 feet, and beam of 43 feet. 11.8% of vessel movements have operated making full channel use, 44.1% have operated 1.5 feet lightloaded, and 41.2% have operated 2.5 feet lightloaded. 2.9% of the fleet have operated greater than 2.5 feet lightloaded and are not included in the benefit analysis. The transportation cost model adjusted the design draft of lightloaded vessels to analyze the constraint of actual vessel operating practice versus channel depth on the cost of tonnage being moved. Thus, for example, 1.5 feet of lightloading is equivalent to a 1.5 foot reduction of vessel design draft, or a 1.5 foot operational constraint in the transportation cost model.

Table B-7 presents the transportation cost model for the unconstrained vessels in the fleet. General cargo/container vessels in the fleet can load to a weight maximum of 76% of the design deadweight tonnage carrying capacity (including TEU box weight). This percentage nets out carrying capacity tonnage that must be allocated for ballast, fuel, freshwater tanks, stores, and

TABLE B-7

TRANSPORTATION COST MODEL
SALEM RIVER
VESSEL CLASSES ADJUSTED BASED ON 76% CARRYING CAPACITY FOR BERMUDA ISLANDER

	General Cargo and Container Vessels:					
VESSEL/CHANNEL CHARACTERISTICS						
Design Deadweight Tonnage (tonnes)	1000	1500	2000	3000	4000	5000
Vessel Carried Tonnage Capacity (S.T.)	838	1257	1675	2513	3351	4189
Design Draft	12.8	14.6	17.7	18	19	22
Immersion Factor (M.T.)	18.0	19.0	20.0	21.0	36.0	39.0
Tidal Allowance	5.5	5.5	5.5	5.5	5.5	5.5
Required Keel Clearance	2	2	2	2	2	2
Required Channel Depth	14.8	16.6	19.7	20	21	24
Shut Out Tonnage to Port (By Depth)						
12	0	0	582	694	1668	3352
14	0	0	53	139	715	2321
16	0	0	0	0	0	1289
18	0	0	0	0	0	258
20	0	0	0	0	0	0
22	0	0	0	0	0	0
24	0	0	0	0	0	0
	0	0	0	0	0	0
Cargo Tonnage (S.T.)-Net Box Wgt						
12	609	914	796	1323	1224	608
14	609	914	1180	1727	1917	1359
16	609	914	1219	1828	2437	2109
18	609	914	1219	1828	2437	2859
20	609	914	1219	1828	2437	3046
22	609	914	1219	1828	2437	3046
24	609	914	1219	1828	2437	3046
OCEAN VOYAGE PARAMETERS						
Cruising Speed (Statute MPH)	16	16	16	17	17	18
Cruising Speed (Nautical MPH)	13.9	13.9	13.9	14.8	14.8	15.7
Hourly Operating Cost at Sea	$338	$344	$356	$374	$397	$421
CARGO TRANSFER COSTS						
In-Port						
In-Port Waiting Hours	9	9	9	9	9	9
In-Port Transfer Hours (180 TPH)	3	5	7	10	14	16
Hourly In-Port Operating Cost	$262	$264	$272	$282	$296	$309
In-Port Cargo Transfer Cost	$887	$1,340	$1,839	$2,864	$4,001	$4,900
In-Port Waiting Time Cost	$2,358	$2,376	$2,445	$2,538	$2,663	$2,777
Dockage						
Vessel Length	187	254	257	268	332	353
24 Hour Dockage Fee	$374	$508	$514	$536	$664	$706
Days in Port	1	1	1	1	1	1
Dockage Costs	$374	$508	$514	$536	$664	$706
Wharfage Fee per Net Ton	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25
Wharfage Costs						
12	$762	$1,142	$994	$1,654	$1,530	$761
14	$762	$1,142	$1,475	$2,159	$2,397	$1,698
16	$762	$1,142	$1,523	$2,285	$3,046	$2,636
18	$762	$1,142	$1,523	$2,285	$3,046	$3,574

TABLE B-7 (CONT.)

20	$762	$1,142	$1,523	$2,285	$3,046	$3,808
22	$762	$1,142	$1,523	$2,285	$3,046	$3,808
24	$762	$1,142	$1,523	$2,285	$3,046	$3,808
Total In-Port Costs						
12	$4,380	$5,367	$5,792	$7,592	$8,855	$9,143
14	$4,380	$5,367	$6,273	$8,096	$9,721	$10,080
16	$4,380	$5,367	$6,321	$8,222	$10,371	$11,018
18	$4,380	$5,367	$6,321	$8,222	$10,371	$11,956
20	$4,380	$5,367	$6,321	$8,222	$10,371	$12,190
22	$4,380	$5,367	$6,321	$8,222	$10,371	$12,190
24	$4,380	$5,367	$6,321	$8,222	$10,371	$12,190
In-Port Travel Costs						
Tidal Delays						
Avg. Hrs. of Maximum Tidal Delay	6	6	6	6	6	6
Avg. Feet of Tidal Delay Per Depth						
12	2.8	4.6	5.5	5.5	5.5	5.5
14	0.8	2.6	5.5	5.5	5.5	5.5
16	0.0	0.6	3.7	4.0	5.0	5.5
18	0.0	0.0	1.7	2.0	3.0	5.5
20	0.0	0.0	0.0	0.0	1.0	4.0
22	0.0	0.0	0.0	0.0	0.0	2.0
24	0.0	0.0	0.0	0.0	0.0	0.0
Avg. Hrs. of Tidal Delay Per Depth						
12	3.13	4.25	6.00	6.00	6.00	6.00
14	1.50	2.75	6.00	6.00	6.00	6.00
16	0.00	0.75	3.50	3.90	4.90	6.00
18	0.00	0.00	1.75	2.25	3.13	6.00
20	0.00	0.00	0.00	0.00	1.50	3.90
22	0.00	0.00	0.00	0.00	0.00	2.25
24	0.00	0.00	0.00	0.00	0.00	0.00
Delay for Tide:						
Operating Cost at Sea	$338	$344	$356	$374	$397	$421
Operating Cost at Port	$262	$254	$272	$282	$296	$309
Tidal Delay Costs						
12	$819	$1,080	$1,632	$1,692	$1,776	$1,854
14	$393	$699	$1,632	$1,692	$1,776	$1,854
16	$0	$191	$952	$1,100	$1,450	$1,854
18	$0	$0	$476	$635	$925	$1,854
20	$0	$0	$0	$0	$444	$1,205
22	$0	$0	$0	$0	$0	$695
24	$0	$0	$0	$0	$0	$0
Pilotage						
Vessel Length	187	254	257	268	332	353
Vessel Beam	36	39.7	43	44	59	60
Vessel Draft	12.8	14.6	17.7	18	19	22
Pilotage Units	67.32	100.838	110.51	117.92	195.88	211.8
C&D Use Flag						
Delaware River Pilot Fee	$1,320	$1,331	$1,459	$1,557	$2,586	$2,796
C&D Canal Fee (if applicable)	$500	$500	$500	$500	$500	$500
Tug Costs						
Number of Tugs Used	1	1	1	1	1	1
Tug Rate	$650	$650	$650	$650	$650	$650

TABLE B-7 (CONT.)

	Tug Costs	$650	$650	$650	$650	$650	$650
In-Port & Cargo Transfer Costs							
	12	$7,169	$8,427	$9,533	$11,490	$13,866	$14,442
	14	$6,743	$8,046	$10,014	$11,995	$14,733	$15,380
	16	$6,350	$7,538	$9,382	$11,529	$15,057	$16,318
	18	$6,350	$7,348	$8,906	$11,063	$14,531	$17,255
	20	$6,350	$7,348	$8,430	$10,429	$14,050	$16,841
	22	$6,350	$7,348	$8,430	$10,429	$13,606	$16,331
	24	$6,350	$7,348	$8,430	$10,429	$13,606	$15,636

TOTAL COST AND COST PER NET CARGO TON BY TRADE ROUTE:

Bermuda							
Total Cost:	12' Channel Depth	$48,641	$51,766	$55,195	$58,704	$65,653	$66,864
	14' Channel Depth	$47,790	$51,004	$56,157	$59,713	$67,386	$68,739
	16' Channel Depth	$47,004	$49,988	$54,893	$58,781	$68,034	$70,615
	18' Channel Depth	$47,004	$49,607	$53,941	$57,850	$66,983	$72,490
	20' Channel Depth	$47,004	$49,607	$52,989	$56,581	$66,021	$71,661
	22' Channel Depth	$47,004	$49,607	$52,989	$56,581	$65,133	$70,641
	24' Channel Depth	$47,004	$49,607	$52,989	$56,581	$65,133	$69,251
Cost Per Ton:	12' Channel Depth	$79.83	$56.64	$69.38	$44.36	$53.63	$109.90
	14' Channel Depth	$78.44	$55.81	$47.59	$34.58	$35.15	$50.60
	16' Channel Depth	$77.15	$54.70	$45.05	$32.16	$27.92	$33.49
	18' Channel Depth	$77.15	$54.28	$44.27	$31.65	$27.48	$25.36
	20' Channel Depth	$77.15	$54.28	$43.49	$30.96	$27.09	$23.52
	22' Channel Depth	$77.15	$54.28	$43.49	$30.96	$26.73	$23.19
	24' Channel Depth	$77.15	$54.28	$43.49	$30.96	$26.73	$22.73

Distances to Ports-Nautical Miles		
Bermuda		706

crew. Based on historical movements, the average weight per container box is estimated to be three tons, and the average cargo carried per box equal to a weight of eight tons. Taken together, the 76% cargo capacity and the cargo weight per box determine the maximum cargo tonnage on board for given drafts.

Vessel classes range from 1000 to 5000 DWT. The immersion factors were developed by applying a U.S. Maritime Administration equation provided by IWR. The tidal allowance is 5.5 feet with required underkeel clearance of 2 feet. Shut-out tonnage is determined by netting out constrained tonnage (based on the immersion factor) from the available channel depth in comparison to the maximum vessel carrying capacity of 76%. Cargo tonnage carried nets out from the calculation the weight of the TEU boxes that hold the commerce. Cruising speeds (in knots) used were checked and appear reasonable compared to data provided by IWR. Loading, dockage, wharfage, and tug costs are based on coordination with representatives of the Salem River facility. Operating costs at sea and in port appear reasonable compared to a regression model that used FY 1990 IWR Foreign Flag Container vessel operating cost data. Tidal delays are defined based on the channel depth, vessel characteristics, range of tide, and underkeel clearance. Pilotage costs, obtained from coordination with the local pilots, are calculated applying vessel design characteristics for length, beam, and draft. Round trip distances were checked with the publication, <u>Distances Between Ports</u> (Dept. of the Navy), and appear reasonable. Total transportation costs are a summation of the total costs for a round-trip movement. Backhauling is a very insignificant part of the operations for this trade route. Ships to Bermuda are not always loaded to cubic capacity. Transportation costs per ton are determined by dividing total transportation costs by the amount of tons carried for each channel depth and vessel class. Total trip costs from the model appear reasonable when compared to revenues per box obtained from the shipping line on the Bermuda trade route. For example, the "Bermuda Islander" can carry a maximum of approximately 75 boxes currently. The tariff rate assessed by the shipping line averages $1700 per box, which translates into total revenues for a fully loaded trip of $127,500. The transportation cost model estimated a combination of water transport and port costs of $57,000 for this vessel size for the current 12 foot channel.

The transportation savings model for unconstrained vessels, Table B-8, incorporated the cost per ton data from Table B-7, the fleet distributions by channel depth from Table B-6, and the commodity projections from Table B-5. Average annual cumulative transportation savings, by channel depth, are displayed in the last row of the table.

Tables B-9 and B-10 represent comparable transportation cost models to Table B-7. The impact of 1.5 and 2.5 foot constraints on actual operating practice have been incorporated into these models. The greater the constraint, the less tonnage that is carried per channel depth.

Tables B-11 and B-12 are comparable transportation savings models to Table B-8. However, the transportation costs per ton and fleet distributions are different in order to incorporate the shift

TABLE B-8

SALEM RIVER
TOTAL TRANSPORTATION SAVINGS DISCOUNT RATE= 8.750% PRICE LEVEL= APRIL 1990
TRADE ROUTE: GENERAL CARGO/CONTAINERS-BERMUDA
VESSEL CLASSES GREATER THAN 5000 DWT DELETED
REVISED TRANS. COST MODEL INCORPORATING 11/23/90 WLRC COMMENTS AND FRC COMMENTS (F:VC5A3ARR)
APPLYING REVISED HISTORIC AND REVISED COMMODITY DATA FROM F:DRIBDA1
TRANS COST MODEL ADJUSTED BASED ON 76% CARRYING CAPACITY INCLUDING WEIGHT OF BOXES
FLEET DEFINED BY NORMAL DISTRIBUTION FOR VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN

12 FEET:			12 FEET:		14 FEET:	% OF	
		PCT.	AVG	TOTAL	AVG	TOTAL FLEET	TOTAL
DESDWT	DDRAFT	OF FLEET	$/TON	TRANS COSTS	$/TON	$/TON	TRANS COSTS
1,000	12.8	0.0%	$79.83	$0	$78.44	0.00%	$0
1,500	14.6	10.0%	$56.64	$109,882	$55.81	0.00%	$0
2,000	17.7	0.0%	$69.38	$0	$47.59	8.10%	$74,783
3,000	18.0	60.0%	$44.36	$516,350	$34.58	46.30%	$310,604
4,000	19.0	30.0%	$53.63	$312,127	$35.15	45.60%	$310,951
5,000	22.0	0.0%	$109.90	$0	$50.60	0.00%	$0
TOTAL SHORT TONS (1989) 1]	19,400	100.0%				100.0%	
				$938,359			$696,338
CUMULATIVE SAVINGS							$242,020

1] SOURCE: WLRC & MID-ATLANTIC SHIPPING CORP

TABLE B-8 (Cont.)

16 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS	18 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS	20 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$77.15	0.00%	$0	$77.15	0.00%	$0	$77.15	0.00%	$0
$54.70	0.00%	$0	$54.28	0.00%	$0	$54.28	0.00%	$0
$45.05	1.10%	$9,614	$44.27	1.20%	$10,306	$43.49	1.20%	$10,124
$32.16	32.60%	$203,393	$31.65	27.90%	$171,309	$30.96	27.90%	$167,574
$27.92	35.80%	$193,910	$27.48	34.90%	$186,056	$27.09	34.90%	$183,416
$33.49	30.50%	$198,160	$25.36	36.00%	$177,114	$23.52	36.00%	$164,264
	100.0%			100.0%			100.0%	
		$605,077			$544,785			$525,378
		$333,282			$393,573			$412,981

TABLE B-8 (Cont.)

22 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$77.15	0.00%	$0
$54.28	0.00%	$0
$43.49	1.20%	$10,124
$30.96	27.90%	$167,574
$26.73	34.90%	$180,978
$23.19	36.00%	$161,959
	100.0%	
		$520,636
		$417,723

24 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$77.15	0.00%	$0
$54.28	0.00%	$0
$43.49	1.20%	$10,124
$30.96	27.90%	$167,574
$26.73	34.90%	$180,978
$22.73	36.00%	$158,746
	100.0%	
		$517,423
		$420,936

TABLE B-8 (CONT.)

PREDICTED TONNAGE:		PERIOD	AVG ANN GROWTH/YR FOR PERIOD
1989	19,400		
1994	38,080	1989-1994	14.40%
2001	76,230	1994-2001	10.40%
2011	172,356	2001-2011	8.50%
2014	220,148	2011-2014	8.50%
2031	220,148	2014-2031	0.00%
2044	220,148	2031-2044	0.00%

YEAR	CUMULATIVE TRANS COSTS 12 FT		PRESENT WORTH TRANS COSTS 12 FT	PRESENT WORTH TRANS COSTS 14 FT	PRESENT WORTH TRANS COSTS 16 FT	PRESENT WORTH TRANS COSTS 18 FT	PRESENT WORTH TRANS COSTS 20 FT	PRESENT WORTH TRANS COSTS 22 FT	PRESENT WORTH TRANS COSTS 24 FT
1994	$1,841,892	1.00000	$1,841,892	$1,366,833	$1,187,697	$1,069,352	$1,031,257	$1,021,949	$1,015,643
1995	$2,033,448	0.91954	$1,869,837	$1,387,571	$1,205,717	$1,085,576	$1,046,904	$1,037,454	$1,031,052
1996	$2,244,927	0.84555	$1,898,207	$1,408,624	$1,224,011	$1,102,047	$1,062,788	$1,053,195	$1,046,696
1997	$2,478,399	0.77752	$1,927,008	$1,429,996	$1,242,582	$1,118,768	$1,078,913	$1,069,174	$1,062,577
1998	$2,736,153	0.71496	$1,956,245	$1,451,693	$1,261,435	$1,135,742	$1,095,283	$1,085,396	$1,078,699
1999	$3,020,713	0.65744	$1,985,926	$1,473,719	$1,280,574	$1,152,974	$1,111,901	$1,101,864	$1,095,065
2000	$3,334,867	0.60454	$2,016,057	$1,496,078	$1,300,003	$1,170,467	$1,128,771	$1,118,582	$1,111,680
2001	$3,681,693	0.55590	$2,046,646	$1,518,778	$1,319,728	$1,188,226	$1,145,897	$1,135,554	$1,128,547
2002	$4,064,589	0.51117	$2,077,698	$1,541,821	$1,339,751	$1,206,255	$1,163,283	$1,152,783	$1,145,670
2003	$4,487,306	0.47004	$2,109,222	$1,565,214	$1,360,078	$1,224,556	$1,180,933	$1,170,274	$1,163,052
2004	$3,687,169	0.43222	$1,593,677	$1,182,638	$1,027,642	$925,245	$892,284	$884,230	$878,774
2005	$4,000,578	0.39745	$1,590,014	$1,179,919	$1,025,280	$923,118	$890,233	$882,198	$876,754
2006	$4,340,627	0.36547	$1,586,358	$1,177,207	$1,022,923	$920,996	$888,187	$880,170	$874,738
2007	$4,709,581	0.33606	$1,582,712	$1,174,501	$1,020,571	$918,879	$886,145	$878,146	$872,728
2008	$5,109,895	0.30902	$1,579,073	$1,171,801	$1,018,225	$916,766	$884,108	$876,128	$870,721
2009	$5,544,236	0.28416	$1,575,443	$1,169,107	$1,015,884	$914,659	$882,075	$874,113	$868,720
2010	$6,015,496	0.26130	$1,571,821	$1,166,419	$1,013,549	$912,556	$880,047	$872,104	$866,723
2011	$6,526,813	0.24027	$1,568,208	$1,163,738	$1,011,219	$910,458	$878,024	$870,099	$864,730
2012	$7,081,593	0.22094	$1,564,603	$1,161,063	$1,008,894	$908,365	$876,006	$868,099	$862,742
2013	$7,683,528	0.20316	$1,561,006	$1,158,393	$1,006,575	$906,277	$873,992	$866,103	$860,759
2014	$8,336,628	0.18682	$1,557,418	$1,155,731	$1,004,261	$904,194	$871,983	$864,112	$858,780
2015	$8,336,628	0.17179	$1,432,108	$1,062,741	$923,459	$831,443	$801,823	$794,586	$789,683
2016	$8,336,628	0.15796	$1,316,881	$977,233	$849,157	$764,545	$737,309	$730,654	$726,145
2017	$8,336,628	0.14525	$1,210,925	$898,605	$780,834	$703,030	$677,985	$671,866	$667,720
2018	$8,336,628	0.13357	$1,113,494	$826,303	$718,009	$646,464	$623,435	$617,807	$613,995
2019	$8,336,628	0.12282	$1,023,903	$759,819	$660,238	$594,450	$573,273	$568,099	$564,593
2020	$8,336,628	0.11294	$941,520	$698,684	$607,115	$546,621	$527,148	$522,390	$519,166
2021	$8,336,628	0.10385	$865,765	$642,468	$558,267	$502,640	$484,734	$480,358	$477,394

TABLE B-8 (CONT.)

2022	$8,336,628	0.09549	$796,106	$590,775	$513,349	$462,197	$445,732	$441,709	$438,983
2023	$8,336,628	0.08781	$732,052	$543,242	$472,045	$425,009	$409,869	$406,169	$403,663
2024	$8,336,628	0.08075	$673,151	$499,533	$434,064	$390,813	$376,891	$373,489	$371,184
2025	$8,336,628	0.07425	$618,989	$459,340	$399,140	$359,368	$346,566	$343,438	$341,319
2026	$8,336,628	0.06828	$569,186	$422,382	$367,025	$330,453	$318,681	$315,805	$313,856
2027	$8,336,628	0.06278	$523,389	$388,397	$337,494	$303,865	$293,040	$290,395	$288,603
2028	$8,336,628	0.05773	$481,277	$357,147	$310,339	$279,416	$269,462	$267,030	$265,383
2029	$8,336,628	0.05309	$442,554	$328,411	$285,370	$256,935	$247,782	$245,545	$244,030
2030	$8,336,628	0.04881	$406,946	$301,987	$262,409	$236,262	$227,845	$225,789	$224,395
2031	$8,336,628	0.04489	$374,203	$277,689	$241,295	$217,252	$209,513	$207,622	$206,341
2032	$8,336,628	0.04128	$344,095	$255,346	$221,881	$199,772	$192,655	$190,916	$189,738
2033	$8,336,628	0.03795	$316,409	$234,801	$204,028	$183,698	$177,154	$175,555	$174,472
2034	$8,336,628	0.03490	$290,951	$215,909	$187,612	$168,918	$162,901	$161,430	$160,434
2035	$8,336,628	0.03209	$267,541	$198,537	$172,517	$155,327	$149,794	$148,442	$147,526
2036	$8,336,628	0.02951	$246,015	$182,563	$158,636	$142,829	$137,741	$136,498	$135,656
2037	$8,336,628	0.02714	$226,221	$167,874	$145,873	$131,337	$126,659	$125,515	$124,741
2038	$8,336,628	0.02495	$208,019	$154,367	$134,136	$120,770	$116,468	$115,416	$114,704
2039	$8,336,628	0.02294	$191,282	$141,947	$123,343	$111,053	$107,097	$106,130	$105,475
2040	$8,336,628	0.02110	$175,891	$130,526	$113,419	$102,118	$98,480	$97,591	$96,989
2041	$8,336,628	0.01940	$161,739	$120,024	$104,293	$93,901	$90,556	$89,739	$89,185
2042	$8,336,628	0.01784	$148,726	$110,366	$95,902	$86,346	$83,270	$82,518	$82,009
2043	$8,336,628	0.01640	$136,759	$101,486	$88,186	$79,399	$76,570	$75,879	$75,411
2044	$8,336,628	0.01508	$125,756	$93,321	$81,090	$73,010	$70,409	$69,774	$69,343
CUMULATIVE PRES WORTH: TRANS COSTS			$61,060,118	$45,311,571	$39,373,065	$35,449,824	$34,186,963	$33,878,386	$33,669,336
CRF, 50 YRS			0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400
AVG ANN CUMULATIVE TRANS COSTS			$5,424,581	$4,025,480	$3,497,903	$3,149,362	$3,037,170	$3,009,756	$2,991,184
AVG ANN CUMULATIVE TRANS SAVINGS				$1,399,101	$1,926,678	$2,275,219	$2,387,411	$2,414,825	$2,433,397

TABLE B-9

TRANSPORTATION COST MODEL
SALEM RIVER
ACTUAL OPERATING PRACTICE: 1.5 FOOT CONSTRAINT
VESSEL CLASSES ADJUSTED BASED ON 76% CARRYING CAPACITY FOR BERMUDA ISLANDER
AND ADJUSTED FOR IMPACT OF CONSTRAINT ON CARRYING CAPACITY

	General Cargo and Container Vessels:					
VESSEL/CHANNEL CHARACTERISTICS						
Design Deadweight Tonnage (tonnes)	1000	1500	2000	3000	4000	5000
Vessel Carried Tonnage Capacity (S.T.)	481	880	1279	2097	2637	3415
Design Draft	11.3	13.1	16.2	16.5	17.5	20.5
Immersion Factor (M.T.)	18.0	19.0	20.0	21.0	36.0	39.0
Tidal Allowance	5.5	5.5	5.5	5.5	5.5	5.5
Required Keel Clearance	2	2	2	2	2	2
Required Channel Depth	13.3	15.1	18.2	18.5	19.5	22.5
Shut Out Tonnage to Port (By Depth)						
12	0	0	185	277	953	2579
14	0	0	0	0	0	1547
16	0	0	0	0	0	516
18	0	0	0	0	0	0
20	0	0	0	0	0	0
22	0	0	0	0	0	0
24	0	0	0	0	0	0
	0	0	0	0	0	0
Cargo Tonnage (S.T.)-Net Box Wgt						
12	350	640	795	1323	1224	608
14	350	640	930	1525	1918	1358
16	350	640	930	1525	1918	2109
18	350	640	930	1525	1918	2484
20	350	640	930	1525	1918	2484
22	350	640	930	1525	1918	2484
24	350	640	930	1525	1918	2484
OCEAN VOYAGE PARAMETERS						
Cruising Speed (Statute MPH)	16	16	16	17	17	18
Cruising Speed (Nautical MPH)	13.9	13.9	13.9	14.8	14.8	15.7
Hourly Operating Cost at Sea	$338	$344	$356	$374	$397	$421
CARGO TRANSFER COSTS						
In-Port						
In-Port Waiting Hours	9	9	9	9	9	9
In-Port Transfer Hours (180 TPH)	2	4	5	8	11	14
Hourly In-Port Operating Cost	$262	$264	$272	$282	$296	$309
In-Port Cargo Transfer Cost	$509	$938	$1,403	$2,389	$3,148	$4,257
In-Port Waiting Time Cost	$2,358	$2,376	$2,445	$2,538	$2,660	$2,777
Dockage						
Vessel Length	187	254	257	268	332	353
24 Hour Dockage Fee	$374	$508	$514	$536	$664	$706
Days in Port	1	1	1	1	1	1
Dockage Costs	$374	$508	$514	$536	$664	$706
Wharfage Fee per Net Ton	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25
Wharfage Costs						
12	$437	$800	$994	$1,654	$1,531	$760
14	$437	$800	$1,162	$1,906	$2,397	$1,698

TABLE B-9 (Cont.)

16	$437	$800	$1,162	$1,906	$2,397	$2,636
18	$437	$800	$1,162	$1,906	$2,397	$3,104
20	$437	$800	$1,162	$1,906	$2,397	$3,104
22	$437	$800	$1,162	$1,906	$2,397	$3,104
24	$437	$800	$1,162	$1,906	$2,397	$3,104
Total In-Port Costs						
12	$3,678	$4,622	$5,356	$7,117	$8,002	$8,499
14	$3,678	$4,622	$5,525	$7,369	$8,869	$9,437
16	$3,678	$4,622	$5,525	$7,369	$8,869	$10,375
18	$3,678	$4,622	$5,525	$7,369	$8,869	$10,844
20	$3,678	$4,622	$5,525	$7,369	$8,869	$10,844
22	$3,678	$4,622	$5,525	$7,369	$8,869	$10,844
24	$3,678	$4,622	$5,525	$7,369	$8,869	$10,844
In-Port Travel Costs						
Tidal Delays						
Avg. Hrs. of Maximum Tidal Delay	6	6	6	6	6	6
Avg. Feet of Tidal Delay Per Depth						
12	1.3	3.1	5.5	5.5	5.5	5.5
14	0.0	1.1	4.2	4.5	5.5	5.5
16	0.0	0.0	2.2	2.5	3.5	5.5
18	0.0	0.0	0.2	0.5	1.5	4.5
20	0.0	0.0	0.0	0.0	0.0	2.5
22	0.0	0.0	0.0	0.0	0.0	0.5
24	0.0	0.0	0.0	0.0	0.0	0.0
Avg. Hrs. of Tidal Delay Per Depth						
12	1.8	3.1	6.0	6.0	6.0	6.0
14	0.0	1.5	3.9	4.3	6.0	6.0
16	0.0	0.0	2.3	2.8	3.5	6.0
18	0.0	0.0	0.3	0.8	1.8	4.3
20	0.0	0.0	0.0	0.0	0.0	2.8
22	0.0	0.0	0.0	0.0	0.0	0.8
24	0.0	0.0	0.0	0.0	0.0	0.0
Delay for Tide:						
Operating Cost at Sea	$338	$344	$356	$374	$397	$421
Operating Cost at Port	$262	$254	$272	$282	$296	$309
Tidal Delay Costs						
12	$459	$794	$1,632	$1,692	$1,776	$1,854
14	$0	$381	$1,061	$1,199	$1,776	$1,854
16	$0	$0	$612	$776	$1,036	$1,854
18	$0	$0	$82	$212	$518	$1,313
20	$0	$0	$0	$0	$0	$850
22	$0	$0	$0	$0	$0	$232
24	$0	$0	$0	$0	$0	$0
Pilotage						
Vessel Length	187	254	257	268	332	353
Vessel Beam	36	39.7	43	44	59	60
Vessel Draft	12.8	14.6	17.7	18	19	22
Pilotage Units	67.32	100.838	110.51	117.92	195.88	211.8
C&D Use Flag						
Delaware River Pilot Fee	$1,320	$1,331	$1,459	$1,557	$2,586	$2,796
C&D Canal Fee (if applicable)	$500	$500	$500	$500	$500	$500

TABLE B-9 (Cont.)

Tug Costs

Number of Tugs Used	1	1	1	1	1	1
Tug Rate	$650	$650	$650	$650	$650	$650
Tug Costs	$650	$650	$650	$650	$650	$650

In-Port & Cargo Transfer Costs

12	$6,106	$7,397	$9,097	$11,015	$13,014	$13,799
14	$5,648	$6,984	$8,694	$10,774	$13,880	$14,737
16	$5,648	$6,603	$8,245	$10,351	$13,140	$15,674
18	$5,648	$6,603	$7,715	$9,787	$12,622	$15,603
20	$5,648	$6,603	$7,633	$9,575	$12,104	$15,139
22	$5,648	$6,603	$7,633	$9,575	$12,104	$14,521
24	$5,648	$6,603	$7,633	$9,575	$12,104	$14,289

TOTAL COST AND COST PER NET CARGO TON BY TRADE ROUTE:

Bermuda

Total Cost:	12' Channel Depth	$46,515	$49,705	$54,324	$57,754	$63,948	$65,577
	14' Channel Depth	$45,598	$48,880	$53,518	$57,271	$65,681	$67,453
	16' Channel Depth	$45,598	$48,118	$52,620	$56,425	$64,201	$69,328
	18' Channel Depth	$45,598	$48,118	$51,560	$55,297	$63,165	$69,184
	20' Channel Depth	$45,598	$48,118	$51,396	$54,874	$62,129	$68,257
	22' Channel Depth	$45,598	$48,118	$51,396	$54,874	$62,129	$67,021
	24' Channel Depth	$45,598	$48,118	$51,396	$54,874	$62,129	$66,558
Cost Per Ton:	12' Channel Depth	$133.08	$77.70	$68.30	$43.65	$52.22	$107.81
	14' Channel Depth	$130.46	$76.41	$57.55	$37.56	$34.25	$49.66
	16' Channel Depth	$130.46	$75.22	$56.58	$37.01	$33.48	$32.88
	18' Channel Depth	$130.46	$75.22	$55.44	$36.27	$32.94	$27.86
	20' Channel Depth	$130.46	$75.22	$55.27	$35.99	$32.40	$27.48
	22' Channel Depth	$130.46	$75.22	$55.27	$35.99	$32.40	$26.99
	24' Channel Depth	$130.46	$75.22	$55.27	$35.99	$32.40	$26.80

Distances to Ports-Nautical Miles

Bermuda	706

TABLE B-10

TRANSPORTATION COST MODEL
SALEM RIVER
ACTUAL OPERATING PRACTICE: 2.5 FOOT CONSTRAINT
VESSEL CLASSES ADJUSTED BASED ON 76% CARRYING CAPACITY FOR BERMUDA ISLANDER
AND ADJUSTED FOR IMPACT OF CONSTRAINT ON CARRYING CAPACITY

	General Cargo and Container Vessels:					
VESSEL/CHANNEL CHARACTERISTICS						
Design Deadweight Tonnage (tonnes)	1000	1500	2000	3000	4000	5000
Vessel Carried Tonnage Capacity (S.T.)	243	628	1014	1819	2161	2899
Design Draft	10.3	12.1	15.2	15.5	16.5	19.5
Immersion Factor (M.T.)	18.0	19.0	20.0	21.0	36.0	39.0
Tidal Allowance	5.5	5.5	5.5	5.5	5.5	5.5
Required Keel Clearance	2	2	2	2	2	2
Required Channel Depth	12.3	14.1	17.2	17.5	18.5	21.5
Shut Out Tonnage to Port (By Depth)						
12	0	0	0	0	477	2063
14	0	0	0	0	0	1031
16	0	0	0	0	0	0
18	0	0	0	0	0	0
20	0	0	0	0	0	0
22	0	0	0	0	0	0
24	0	0	0	0	0	0
	0	0	0	0	0	0
Cargo Tonnage (S.T.)-Net Box Wgt						
12	176	457	738	1323	1225	608
14	176	457	738	1323	1571	1358
16	176	457	738	1323	1571	2108
18	176	457	738	1323	1571	2108
20	176	457	738	1323	1571	2108
22	176	457	738	1323	1571	2108
24	176	457	738	1323	1571	2108
OCEAN VOYAGE PARAMETERS						
Cruising Speed (Statute MPH)	16	16	16	17	17	18
Cruising Speed (Nautical MPH)	13.9	13.9	13.9	14.8	14.8	15.7
Hourly Operating Cost at Sea	$338	$344	$356	$374	$397	$421
CARGO TRANSFER COSTS						
In-Port						
In-Port Waiting Hours	9	9	9	9	9	9
In-Port Transfer Hours (180 TPH)	1	3	4	7	9	12
Hourly In-Port Operating Cost	$262	$264	$272	$282	$296	$309
In-Port Cargo Transfer Cost	$257	$670	$1,113	$2,072	$2,580	$3,614
In-Port Waiting Time Cost	$2,358	$2,376	$2,445	$2,538	$2,660	$2,777
Dockage						
Vessel Length	187	254	257	268	332	353
24 Hour Dockage Fee	$374	$508	$514	$536	$664	$706
Days in Port	1	1	1	1	1	1
Dockage Costs	$374	$508	$514	$536	$664	$706
Wharfage Fee per Net Ton	$1.25	$1.25	$1.25	$1.25	$1.25	$1.25
Wharfage Costs						
12	$220	$571	$922	$1,653	$1,531	$760
14	$220	$571	$922	$1,653	$1,964	$1,698

TABLE B-10 (Cont.)

16	$220	$571	$922	$1,653	$1,964	$2,635
18	$220	$571	$922	$1,653	$1,964	$2,635
20	$220	$571	$922	$1,653	$1,964	$2,635
22	$220	$571	$922	$1,653	$1,964	$2,635
24	$220	$571	$922	$1,653	$1,964	$2,635
Total In-Port Costs						
12	$3,209	$4,125	$4,994	$6,800	$7,434	$7,856
14	$3,209	$4,125	$4,994	$6,800	$7,867	$8,794
16	$3,209	$4,125	$4,994	$6,800	$7,867	$9,732
18	$3,209	$4,125	$4,994	$6,800	$7,867	$9,732
20	$3,209	$4,125	$4,994	$6,800	$7,867	$9,732
22	$3,209	$4,125	$4,994	$6,800	$7,867	$9,732
24	$3,209	$4,125	$4,994	$6,800	$7,867	$9,732
In-Port Travel Costs						
Tidal Delays						
Avg. Hrs. of Maximum Tidal Delay	6	6	6	6	6	6
Avg. Feet of Tidal Delay Per Depth						
12	0.3	2.1	5.2	5.5	5.5	5.5
14	0.0	0.1	3.2	3.5	4.5	5.5
16	0.0	0.0	1.2	1.5	2.5	5.5
18	0.0	0.0	0.0	0.0	0.5	3.5
20	0.0	0.0	0.0	0.0	0.0	1.5
22	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0
Avg. Hrs. of Tidal Delay Per Depth						
12	0.3	2.3	4.9	6.0	6.0	6.0
14	0.0	0.1	3.1	3.5	4.3	6.0
16	0.0	0.0	1.5	1.8	2.8	6.0
18	0.0	0.0	0.0	0.0	0.8	3.5
20	0.0	0.0	0.0	0.0	0.0	1.8
22	0.0	0.0	0.0	0.0	0.0	0.0
24	0.0	0.0	0.0	0.0	0.0	0.0
Delay for Tide:						
Operating Cost at Sea	$338	$344	$356	$374	$397	$421
Operating Cost at Port	$262	$254	$272	$282	$296	$309
Tidal Delay Costs						
12	$66	$572	$1,333	$1,692	$1,776	$1,854
14	$0	$25	$850	$987	$1,258	$1,854
16	$0	$0	$408	$494	$814	$1,854
18	$0	$0	$0	$0	$222	$1,082
20	$0	$0	$0	$0	$0	$541
22	$0	$0	$0	$0	$0	$0
24	$0	$0	$0	$0	$0	$0
Pilotage						
Vessel Length	187	254	257	268	332	353
Vessel Beam	36	39.7	43	44	59	60
Vessel Draft	12.8	14.6	17.7	18	19	22
Pilotage Units	67.32	100.838	110.51	117.92	195.88	211.8
C&D Use Flag						
Delaware River Pilot Fee	$1,320	$1,331	$1,459	$1,557	$2,586	$2,796
C&D Canal Fee (if applicable)	$500	$500	$500	$500	$500	$500

TABLE B-10 (Cont.)

Tug Costs						
Number of Tugs Used	1	1	1	1	1	1
Tug Rate	$650	$650	$650	$650	$650	$650
Tug Costs	$650	$650	$650	$650	$650	$650
In-Port & Cargo Transfer Costs						
12	$5,245	$6,678	$8,435	$10,698	$12,446	$13,156
14	$5,179	$6,132	$7,953	$9,993	$12,361	$14,094
16	$5,179	$6,106	$7,511	$9,500	$11,917	$15,031
18	$5,179	$6,106	$7,103	$9,006	$11,325	$14,259
20	$5,179	$6,106	$7,103	$9,006	$11,103	$13,718
22	$5,179	$6,106	$7,103	$9,006	$11,103	$13,177
24	$5,179	$6,106	$7,103	$9,006	$11,103	$13,177

TOTAL COST AND COST PER NET CARGO TON BY TRADE ROUTE:

Bermuda

Total Cost:	12' Channel Depth	$44,792	$48,268	$53,000	$57,120	$62,812	$64,291
	14' Channel Depth	$44,661	$47,175	$52,035	$55,710	$62,642	$66,166
	16' Channel Depth	$44,661	$47,125	$51,151	$54,723	$61,754	$68,042
	18' Channel Depth	$44,661	$47,125	$50,335	$53,736	$60,570	$66,497
	20' Channel Depth	$44,661	$47,125	$50,335	$53,736	$60,126	$65,415
	22' Channel Depth	$44,661	$47,125	$50,335	$53,736	$60,126	$64,334
	24' Channel Depth	$44,661	$47,125	$50,335	$53,736	$60,126	$64,334
Cost Per Ton:	12' Channel Depth	$253.97	$105.63	$71.86	$43.18	$51.29	$105.72
	14' Channel Depth	$253.23	$103.24	$70.55	$42.12	$39.87	$48.71
	16' Channel Depth	$253.23	$103.13	$69.35	$41.37	$39.30	$32.27
	18' Channel Depth	$253.23	$103.13	$68.25	$40.62	$38.55	$31.54
	20' Channel Depth	$253.23	$103.13	$68.25	$40.62	$38.27	$31.03
	22' Channel Depth	$253.23	$103.13	$68.25	$40.62	$38.27	$30.51
	24' Channel Depth	$253.23	$103.13	$68.25	$40.62	$38.27	$30.51

Distances to Ports-Nautical Miles	
Bermuda	706

TABLE B-11

SALEM RIVER
TOTAL TRANSPORTATION SAVINGS DISCOUNT RATE= 8.750% PRICE LEVEL= APRIL 1990
TRADE ROUTE: GENERAL CARGO/CONTAINERS-BERMUDA 3/5/91
VESSEL CLASSES GREATER THAN 5000 DWT DELETED
1.5 FT CONSTRAINT
REVISED TRANS. COST MODEL INCORPORATING 11/23/90 WLRC COMMENTS AND FRC COMMENTS (F:VC2A)
APPLYING REVISED HISTORIC AND REVISED COMMODITY DATA FROM F:DRIBDA1
TRANS COST MODEL ADJUSTED BASED ON 76% CARRYING CAPACITY (WLRC EQUATION) INCLUDING WEIGHT OF BOXES
FLEET DEFINED BY NORMAL DISTRIBUTION FOR VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN

	12 FEET:		12 FEET:			14 FEET:	% OF	
			PCT.	AVG	TOTAL	AVG	TOTAL FLEET	TOTAL
DESDWT	DDRAFT		OF FLEET	$/TON	TRANS COSTS	$/TON	$/TON	TRANS COSTS
1,000	12.8		0.0%	$133.08	$0	$130.46	0.00%	$0
1,500	14.6		2.9%	$77.70	$43,714	$76.41	0.00%	$0
2,000	17.7		11.4%	$68.30	$151,052	$57.55	1.40%	$15,631
3,000	18.0		45.7%	$43.65	$386,992	$37.56	37.50%	$273,249
4,000	19.0		40.0%	$52.22	$405,227	$34.25	38.90%	$258,471
5,000	22.0		0.0%	$107.81	$0	$49.66	22.20%	$213,876
TOTAL SHORT TONS (1989) 1]		19,400	100.0%				100.0%	
					$986,986			$761,226
CUMULATIVE SAVINGS								$225,759

1] SOURCE: WLRC & MID-ATLANTIC SHIPPING CORP

TABLE B-11 (Cont.)

16 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS	18 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS	20 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$130.46	0.00%	$0	$130.46	0.00%	$0	$130.46	0.00%	$0
$75.22	0.00%	$0	$75.22	0.00%	$0	$75.22	0.00%	$0
$56.58	1.10%	$12,074	$55.44	0.40%	$4,302	$55.27	0.40%	$4,289
$37.01	30.40%	$218,270	$36.27	31.30%	$220,239	$35.99	31.30%	$218,538
$33.48	33.70%	$218,886	$32.94	33.60%	$214,716	$32.40	33.60%	$211,196
$32.88	34.80%	$221,979	$27.86	34.70%	$187,548	$27.48	34.70%	$184,990
	100.0%			100.0%			100.0%	
		$671,209			$626,805			$619,013
		$315,776			$360,181			$367,972

TABLE B-11 (Cont.)

22 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS	24 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$130.46	0.00%	$0	$130.46	0.00%	$0
$75.22	0.00%	$0	$75.22	0.00%	$0
$55.27	0.40%	$4,289	$55.27	0.40%	$4,289
$35.99	31.30%	$218,538	$35.99	31.30%	$218,538
$32.40	33.60%	$211,196	$32.40	33.60%	$211,196
$26.99	34.70%	$181,691	$26.80	34.70%	$180,412
	100.0%			100.0%	
		$615,715			$614,436
		$371,271			$372,550

TABLE B-11 (Cont.)

PREDICTED TONNAGE:		PERIOD	AVG ANN GROWTH/YR FOR PERIOD
1989	19,400		
1994	38,080	1989-1994	14.40%
2001	76,230	1994-2001	10.40%
2011	172,356	2001-2011	8.50%
2014	220,148	2011-2014	8.50%
2031	220,148	2014-2031	0.00%
2044	220,148	2031-2044	0.00%

YEAR	CUMULATIVE TRANS COSTS 12 FT	SPPW,8 3/4%	PRESENT WORTH TRANS COSTS 12 FT	PRESENT WORTH TRANS COSTS 14 FT	PRESENT WORTH TRANS COSTS 16 FT	PRESENT WORTH TRANS COSTS 18 FT	PRESENT WORTH TRANS COSTS 20 FT	PRESENT WORTH TRANS COSTS 22 FT	PRESENT WORTH TRANS COSTS 24 FT
1994	$1,937,341	1.00000	$1,937,341	$1,494,201	$1,317,508	$1,230,347	$1,215,053	$1,208,578	$1,206,068
1995	$2,138,824	0.91954	$1,966,735	$1,516,872	$1,337,498	$1,249,014	$1,233,489	$1,226,916	$1,224,367
1996	$2,361,262	0.84555	$1,996,575	$1,539,886	$1,357,791	$1,267,965	$1,252,204	$1,245,531	$1,242,943
1997	$2,606,833	0.77752	$2,026,868	$1,563,250	$1,378,392	$1,287,203	$1,271,202	$1,264,429	$1,261,802
1998	$2,877,944	0.71496	$2,057,621	$1,586,968	$1,399,305	$1,306,733	$1,290,490	$1,283,613	$1,280,946
1999	$3,177,250	0.65744	$2,088,840	$1,611,046	$1,420,536	$1,326,559	$1,310,070	$1,303,088	$1,300,381
2000	$3,507,684	0.60454	$2,120,532	$1,635,490	$1,442,089	$1,346,686	$1,329,946	$1,322,859	$1,320,111
2001	$3,872,483	0.55590	$2,152,706	$1,660,304	$1,463,969	$1,367,119	$1,350,125	$1,342,930	$1,340,141
2002	$4,275,222	0.51117	$2,185,368	$1,685,495	$1,486,181	$1,387,861	$1,370,610	$1,363,306	$1,360,474
2003	$4,719,845	0.47004	$2,218,525	$1,711,068	$1,508,730	$1,408,918	$1,391,405	$1,383,991	$1,381,116
2004	$3,878,243	0.43222	$1,676,264	$1,292,842	$1,139,960	$1,064,545	$1,051,312	$1,045,710	$1,043,538
2005	$4,207,894	0.39745	$1,672,410	$1,289,870	$1,137,339	$1,062,097	$1,048,895	$1,043,306	$1,041,139
2006	$4,565,565	0.36547	$1,668,566	$1,286,904	$1,134,725	$1,059,656	$1,046,484	$1,040,907	$1,038,745
2007	$4,953,638	0.33606	$1,664,730	$1,283,946	$1,132,116	$1,057,220	$1,044,078	$1,038,515	$1,036,357
2008	$5,374,697	0.30902	$1,660,903	$1,280,994	$1,129,513	$1,054,789	$1,041,678	$1,036,127	$1,033,975
2009	$5,831,546	0.28416	$1,657,085	$1,278,050	$1,126,917	$1,052,365	$1,039,283	$1,033,745	$1,031,598
2010	$6,327,228	0.26130	$1,653,275	$1,275,112	$1,124,326	$1,049,945	$1,036,894	$1,031,369	$1,029,226
2011	$6,865,042	0.24027	$1,649,475	$1,272,180	$1,121,742	$1,047,532	$1,034,511	$1,028,998	$1,026,860
2012	$7,448,571	0.22094	$1,645,683	$1,269,256	$1,119,163	$1,045,124	$1,032,132	$1,026,632	$1,024,500
2013	$8,081,699	0.20316	$1,641,900	$1,266,338	$1,116,590	$1,042,721	$1,029,760	$1,024,272	$1,022,145
2014	$8,768,644	0.18682	$1,638,125	$1,263,427	$1,114,023	$1,040,324	$1,027,392	$1,021,918	$1,019,795
2015	$8,768,644	0.17179	$1,506,322	$1,161,772	$1,024,389	$956,620	$944,729	$939,694	$937,742
2016	$8,768,644	0.15796	$1,385,124	$1,068,296	$941,967	$879,650	$868,716	$864,087	$862,292
2017	$8,768,644	0.14525	$1,273,677	$982,341	$866,177	$808,874	$798,819	$794,563	$792,912
2018	$8,768,644	0.13357	$1,171,197	$903,302	$796,484	$743,792	$734,546	$730,632	$729,114
2019	$8,768,644	0.12282	$1,076,963	$830,623	$732,399	$683,947	$675,445	$671,846	$670,450
2020	$8,768,644	0.11294	$990,311	$763,791	$673,471	$628,917	$621,099	$617,789	$616,506
2021	$8,768,644	0.10385	$910,631	$702,336	$619,283	$578,314	$571,125	$568,082	$566,902

TABLE B-11 (CONT.)

2022	$8,768,644	0.09549	$837,361	$645,827	$569,456	$531,783	$525,173	$522,374	$521,289
2023	$8,768,644	0.08781	$769,988	$593,864	$523,638	$488,996	$482,918	$480,344	$479,346
2024	$8,768,644	0.08075	$708,035	$546,081	$481,506	$449,651	$444,062	$441,696	$440,778
2025	$8,768,644	0.07425	$651,066	$502,144	$442,764	$413,473	$408,333	$406,157	$405,313
2026	$8,768,644	0.06828	$598,682	$461,741	$407,139	$380,205	$375,479	$373,478	$372,702
2027	$8,768,644	0.06278	$550,512	$424,590	$374,381	$349,613	$345,268	$343,428	$342,714
2028	$8,768,644	0.05773	$506,218	$390,427	$344,258	$321,484	$317,487	$315,796	$315,140
2029	$8,768,644	0.05309	$465,488	$359,014	$316,559	$295,617	$291,943	$290,387	$289,784
2030	$8,768,644	0.04881	$428,035	$330,128	$291,089	$271,832	$268,453	$267,022	$266,468
2031	$8,768,644	0.04489	$393,595	$303,566	$267,668	$249,960	$246,853	$245,538	$245,028
2032	$8,768,644	0.04128	$361,926	$279,141	$246,132	$229,849	$226,991	$225,782	$225,313
2033	$8,768,644	0.03795	$332,806	$256,681	$226,328	$211,355	$208,728	$207,616	$207,184
2034	$8,768,644	0.03490	$306,028	$236,029	$208,118	$194,349	$191,934	$190,911	$190,514
2035	$8,768,644	0.03209	$281,405	$217,038	$191,373	$178,712	$176,491	$175,550	$175,186
2036	$8,768,644	0.02951	$258,764	$199,575	$175,975	$164,333	$162,290	$161,425	$161,090
2037	$8,768,644	0.02714	$237,944	$183,517	$161,816	$151,111	$149,232	$148,437	$148,129
2038	$8,768,644	0.02495	$218,799	$168,752	$148,796	$138,952	$137,225	$136,494	$136,210
2039	$8,768,644	0.02294	$201,194	$155,174	$136,824	$127,772	$126,184	$125,512	$125,251
2040	$8,768,644	0.02110	$185,006	$142,689	$125,815	$117,492	$116,031	$115,413	$115,173
2041	$8,768,644	0.01940	$170,121	$131,208	$115,692	$108,038	$106,696	$106,127	$105,907
2042	$8,768,644	0.01784	$156,433	$120,651	$106,384	$99,346	$98,111	$97,588	$97,385
2043	$8,768,644	0.01640	$143,846	$110,943	$97,824	$91,352	$90,217	$89,736	$89,550
2044	$8,768,644	0.01508	$132,272	$102,017	$89,953	$84,002	$82,958	$82,516	$82,345
CUMULATIVE PRES WORTH: TRANS COSTS			$64,224,340	$49,533,908	$43,676,396	$40,786,945	$40,279,947	$40,065,304	$39,982,075
CRF, 50 YRS			0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400
AVG ANN CUMULATIVE TRANS COSTS			$5,705,690	$4,400,592	$3,880,211	$3,623,512	$3,578,470	$3,559,402	$3,552,008
AVG ANN CUMULATIVE TRANS SAVINGS				$1,305,098	$1,825,479	$2,082,178	$2,127,220	$2,146,289	$2,153,683

TABLE B-12

SALEM RIVER
TOTAL TRANSPORTATION SAVINGS DISCOUNT RATE= 8.750% PRICE LEVEL= APRIL 1990
TRADE ROUTE: GENERAL CARGO/CONTAINERS-BERMUDA 3/5/91
VESSEL CLASSES GREATER THAN 5000 DWT DELETED
2.5 FT CONSTRAINT
REVISED TRANS. COST MODEL INCORPORATING 11/23/90 WLRC COMMENTS AND FRC COMMENTS (F:VC3A)
APPLYING REVISED HISTORIC AND REVISED COMMODITY DATA FROM F:DRIBDA1
TRANS COST MODEL ADJUSTED BASED ON 76% CARRYING CAPACITY (WLRC EQUATION) INCLUDING WEIGHT OF BOXES
FLEET DEFINED BY NORMAL DISTRIBUTION FOR VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN

	12 FEET:		12 FEET:		14 FEET:	% OF	
		PCT.	AVG	TOTAL	AVG	TOTAL FLEET	TOTAL
DESDWT	DDRAFT	OF FLEET	$/TON	TRANS COSTS	$/TON	$/TON	TRANS COSTS
1,000	12.8	0.0%	$253.97	$0	$253.23	0.00%	$0
1,500	14.6	0.5%	$105.63	$10,246	$103.24	0.00%	$0
2,000	17.7	20.4%	$71.86	$284,393	$70.55	14.40%	$197,088
3,000	18.0	40.8%	$43.18	$341,778	$42.12	28.80%	$235,333
4,000	19.0	38.3%	$51.29	$381,095	$39.87	29.50%	$228,176
5,000	22.0	0.0%	$105.72	$0	$48.71	27.30%	$257,978
TOTAL SHORT TONS (1989) 1]	19,400	100.0%				100.0%	
				$1,017,513			$918,575
CUMULATIVE SAVINGS							$98,937

1] SOURCE: WLRC & MID-ATLANTIC SHIPPING CORP

TABLE B-12 (Cont.)

16 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$253.23	0.00%	$0
$103.13	0.00%	$0
$69.35	16.90%	$227,371
$41.37	26.50%	$212,683
$39.30	27.70%	$211,190
$32.27	28.90%	$180,925
	100.0%	
		$832,169
		$185,343

18 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$253.23	0.00%	$0
$103.13	0.00%	$0
$68.25	4.30%	$56,934
$40.62	30.00%	$236,408
$38.55	31.40%	$234,831
$31.54	34.30%	$209,873
	100.0%	
		$738,047
		$279,465

20 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$253.23	0.00%	$0
$103.13	0.00%	$0
$68.25	4.30%	$56,934
$40.62	30.00%	$236,408
$38.27	31.40%	$233,126
$31.03	34.30%	$206,480
	100.0%	
		$732,948
		$284,565

TABLE B-12 (Cont.)

22 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$253.23	0.00%	$0
$103.13	0.00%	$0
$68.25	4.30%	$56,934
$40.62	30.00%	$236,408
$38.27	31.40%	$233,126
$30.51	34.30%	$203,020
	100.0%	
		$729,488
		$288,025

24 FEET: AVG $/TON	% OF TOTAL FLEET $/TON	TOTAL TRANS COSTS
$253.23	0.00%	$0
$103.13	0.00%	$0
$68.25	4.30%	$56,934
$40.62	30.00%	$236,408
$38.27	31.40%	$233,126
$30.51	34.30%	$203,020
	100.0%	
		$729,488
		$288,025

TABLE B-12 (Cont.)

PREDICTED TONNAGE:		PERIOD	AVG ANN GROWTH/YR FOR PERIOD
1989	19,400		
1994	38,080	1989-1994	14.40%
2001	76,230	1994-2001	10.40%
2011	172,356	2001-2011	8.50%
2014	220,148	2011-2014	8.50%
2031	220,148	2014-2031	0.00%
2044	220,148	2031-2044	0.00%

YEAR	CUMULATIVE TRANS COSTS 12 FT	SPPW,8 3/4%	PRESENT WORTH TRANS COSTS 12 FT	PRESENT WORTH TRANS COSTS 14 FT	PRESENT WORTH TRANS COSTS 16 FT	PRESENT WORTH TRANS COSTS 18 FT	PRESENT WORTH TRANS COSTS 20 FT	PRESENT WORTH TRANS COSTS 22 FT	PRESENT WORTH TRANS COSTS 24 FT
1994	$1,997,262	1.00000	$1,997,262	$1,803,059	$1,633,454	$1,448,703	$1,438,694	$1,431,902	$1,431,902
1995	$2,204,977	0.91954	$2,027,565	$1,830,416	$1,658,238	$1,470,683	$1,460,522	$1,453,627	$1,453,627
1996	$2,434,295	0.84555	$2,058,328	$1,858,188	$1,683,397	$1,492,997	$1,482,682	$1,475,682	$1,475,682
1997	$2,687,461	0.77752	$2,089,558	$1,886,381	$1,708,938	$1,515,649	$1,505,178	$1,498,072	$1,498,072
1998	$2,966,957	0.71496	$2,121,262	$1,915,002	$1,734,867	$1,538,646	$1,528,015	$1,520,801	$1,520,801
1999	$3,275,521	0.65744	$2,153,446	$1,944,057	$1,761,189	$1,561,990	$1,551,198	$1,543,875	$1,543,875
2000	$3,616,175	0.60454	$2,186,119	$1,973,553	$1,787,911	$1,585,690	$1,574,734	$1,567,300	$1,567,300
2001	$3,992,257	0.55590	$2,219,288	$2,003,497	$1,815,038	$1,609,748	$1,598,626	$1,591,079	$1,591,079
2002	$4,407,452	0.51117	$2,252,960	$2,033,894	$1,842,576	$1,634,172	$1,622,881	$1,615,220	$1,615,220
2003	$4,865,827	0.47004	$2,287,143	$2,064,754	$1,870,532	$1,658,966	$1,647,504	$1,639,727	$1,639,727
2004	$3,998,195	0.43222	$1,728,110	$1,560,078	$1,413,329	$1,253,475	$1,244,815	$1,238,938	$1,238,938
2005	$4,338,041	0.39745	$1,724,137	$1,556,491	$1,410,080	$1,250,593	$1,241,953	$1,236,090	$1,236,090
2006	$4,706,775	0.36547	$1,720,173	$1,552,913	$1,406,838	$1,247,719	$1,239,098	$1,233,248	$1,233,248
2007	$5,106,851	0.33606	$1,716,219	$1,549,343	$1,403,604	$1,244,850	$1,236,249	$1,230,413	$1,230,413
2008	$5,540,933	0.30902	$1,712,274	$1,545,782	$1,400,378	$1,241,988	$1,233,407	$1,227,585	$1,227,585
2009	$6,011,912	0.28416	$1,708,337	$1,542,228	$1,397,158	$1,239,133	$1,230,572	$1,224,763	$1,224,763
2010	$6,522,925	0.26130	$1,704,410	$1,538,683	$1,393,947	$1,236,285	$1,227,743	$1,221,947	$1,221,947
2011	$7,077,374	0.24027	$1,700,492	$1,535,146	$1,390,742	$1,233,443	$1,224,921	$1,219,138	$1,219,138
2012	$7,678,950	0.22094	$1,696,583	$1,531,617	$1,387,545	$1,230,607	$1,222,105	$1,216,335	$1,216,335
2013	$8,331,661	0.20316	$1,692,683	$1,528,096	$1,384,355	$1,227,778	$1,219,295	$1,213,539	$1,213,539
2014	$9,039,852	0.18682	$1,688,791	$1,524,583	$1,381,173	$1,224,956	$1,216,492	$1,210,749	$1,210,749
2015	$9,039,852	0.17179	$1,552,912	$1,401,915	$1,270,044	$1,126,396	$1,118,614	$1,113,333	$1,113,333
2016	$9,039,852	0.15796	$1,427,965	$1,289,117	$1,167,856	$1,035,767	$1,028,610	$1,023,754	$1,023,754
2017	$9,039,852	0.14525	$1,313,071	$1,185,395	$1,073,891	$952,429	$945,848	$941,383	$941,383
2018	$9,039,852	0.13357	$1,207,422	$1,090,019	$987,486	$875,797	$869,746	$865,640	$865,640
2019	$9,039,852	0.12282	$1,110,273	$1,002,316	$908,033	$805,330	$799,766	$795,991	$795,991
2020	$9,039,852	0.11294	$1,020,941	$921,670	$834,973	$740,534	$735,417	$731,945	$731,945
2021	$9,039,852	0.10385	$938,796	$847,513	$767,791	$680,950	$676,246	$673,053	$673,053

TABLE 12 (CONT.)

2022	$9,039,852	0.09549	$863,261	$779,322	$706,015	$626,161	$621,835	$618,899	$618,899
2023	$9,039,852	0.08781	$793,803	$716,618	$649,209	$575,781	$571,802	$569,103	$569,103
2024	$9,039,852	0.08075	$729,934	$658,959	$596,974	$529,453	$525,795	$523,313	$523,313
2025	$9,039,852	0.07425	$671,203	$605,939	$548,942	$486,854	$483,490	$481,207	$481,207
2026	$9,039,852	0.06828	$617,198	$557,186	$504,774	$447,682	$444,588	$442,490	$442,490
2027	$9,039,852	0.06278	$567,539	$512,354	$464,160	$411,661	$408,817	$406,887	$406,887
2028	$9,039,852	0.05773	$521,875	$471,131	$426,814	$378,539	$375,924	$374,149	$374,149
2029	$9,039,852	0.05309	$479,885	$433,224	$392,472	$348,082	$345,677	$344,045	$344,045
2030	$9,039,852	0.04881	$441,273	$398,366	$360,894	$320,075	$317,864	$316,363	$316,363
2031	$9,039,852	0.04489	$405,769	$366,314	$331,857	$294,322	$292,289	$290,909	$290,909
2032	$9,039,852	0.04128	$373,121	$336,840	$305,156	$270,641	$268,771	$267,502	$267,502
2033	$9,039,852	0.03795	$343,099	$309,738	$280,603	$248,865	$247,146	$245,979	$245,979
2034	$9,039,852	0.03490	$315,494	$284,817	$258,026	$228,842	$227,261	$226,188	$226,188
2035	$9,039,852	0.03209	$290,109	$261,901	$237,265	$210,429	$208,975	$207,989	$207,989
2036	$9,039,852	0.02951	$266,767	$240,828	$218,175	$193,498	$192,161	$191,254	$191,254
2037	$9,039,852	0.02714	$245,303	$221,451	$200,620	$177,929	$176,700	$175,866	$175,866
2038	$9,039,852	0.02495	$225,566	$203,633	$184,478	$163,613	$162,483	$161,716	$161,716
2039	$9,039,852	0.02294	$207,417	$187,249	$169,635	$150,449	$149,409	$148,704	$148,704
2040	$9,039,852	0.02110	$190,728	$172,183	$155,987	$138,344	$137,388	$136,739	$136,739
2041	$9,039,852	0.01940	$175,382	$158,329	$143,436	$127,213	$126,334	$125,737	$125,737
2042	$9,039,852	0.01784	$161,271	$145,590	$131,895	$116,977	$116,169	$115,620	$115,620
2043	$9,039,852	0.01640	$148,295	$133,876	$121,283	$107,565	$106,822	$106,318	$106,318
2044	$9,039,852	0.01508	$136,363	$123,104	$111,524	$98,911	$98,227	$97,763	$97,763
CUMULATIVE PRES WORTH: TRANS COSTS			$66,210,760	$59,772,792	$54,150,260	$48,025,615	$47,693,798	$47,468,640	$47,468,640
CRF, 50 YRS			0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400	0.0888400
AVG ANN CUMULATIVE TRANS COSTS			$5,882,164	$5,310,215	$4,810,709	$4,266,596	$4,237,117	$4,217,114	$4,217,114
AVG ANN CUMULATIVE TRANS SAVINGS				$571,949	$1,071,455	$1,615,568	$1,645,047	$1,665,050	$1,665,050

in operational cost efficiencies between vessel classes due to the actual operating practice constraints.

Bulk Benefits. This benefit estimation has applied, as a base, tonnage at the 1989 level (with 2% per annum growth). The transportation cost model for bulk vessels anticipated that the fleet would load as deeply as possible based on the channel depth available. A cargo carrying capacity of aproximately 95% was applied for bulk vessels. The transportation savings model incorporates the fleet distributions from Table B6-A with the operating costs per ton for the bulk vessel classes determined in the transportation cost model. Historically, in 1989-1990, a minimal 3% of total bulk movements through Salem involved topping off. The average annual benefits are estimated as follows:

12 to 14 feet:	$148,100
12 to 16 feet:	$183,300
12 to 17 feet:	$192,200
12 to 18 feet:	$201,100
12 to 19 feet:	$207,200
12 to 20 feet:	$213,400
12 to 22 feet:	$225,000
12 to 24 feet:	$241,100

LEAST-COST PORT ANALYSIS

Dr. Russell Harrison, a professor at the Rutgers University-Camden campus, in a 1989 study, Identifying Key Target Opportunities For The Port of Salem, tabulated data to help identify the countries, commodities, and types of vessels that define key market niches for terminal operations at the Port of Salem. Dr. Harrison stated in the study that, "Any specific terminal operation in the North Atlantic port region, in general, or in South Jersey, in particular, can succeed. It can do so to the extent that it positions itself to capture certain targets of opportunity, which may be a niche defined by target countries and target products, bolstered by a willingness to provide competitive service at competitive prices". The data collected by Dr. Harrison for comparative shipping costs for the ports in the competitive market area extending from Boston, Massachusetts to Norfolk, Virginia were of particular use in conducting a least-cost analysis in this study for "niche" tonnage being moved through Salem. Table B-13 presents a port by port cost analysis for the movement of general cargo/container tonnage by the potentially competing ports (Salem, Philadelphia, Boston, New York, Baltimore, and Norfolk) for the Bermuda trade route. There are no plans for ILA unionization of labor at the port of Salem. This example considers tonnage being handled by the 5000 DWT vessel class. The results in the table verify that vessel movements for this "niche" market are accomplished more efficiently by the port of Salem than through the potentially competing larger North Atlantic ports.

RESULTS OF ECONOMIC ANALYSIS

Average annual costs have been annualized in Table B-14. Table B-15 presents average annual benefits, average annual costs, and the economic optimization for the project. Average annual

TABLE B-13

COMPARATIVE TRANSPORTATION COSTS FOR POTENTIALLY COMPETING PORTS

5000 DWT VESSEL CLASS

SOURCE: "IDENTIFYING KEY TARGET OPPORTUNITITES FOR THE PORT OF SALEM", DR. RUSSELL S. HARRISON, RUTGERS UNIVERSITY-CAMDEN, AUGUST 1989

TRADE ROUTE EXAMPLE: BERMUDA

COST CATEGORY	SALEM	PHILADELPHIA	BOSTON	NEW YORK	BALTIMORE	NORFOLK
NAVIGATIONAL SERVICES:						
TUGS	$1,000	$575	$1,472	$1,780	$670	$954
PILOTAGE	$2,800	$2,500	$1,144	$1,255	$2,900	$1,150
LINE RUNNING	$0	$575	$384	$1,725	$454	$575
SURVEYORS	$0	$287	$287	$287	$287	$460
DOCKAGE	$200	$575	$748	$575	$438	$287
OTHER	$0	$635	$138	$460	$230	$230
GOVT. REQUIREMENT COSTS:						
ENTRANCE/CLEARANCE	$551	$551	$551	$551	$551	$551
IMMIGRATION/CUSTOMS	$115	$115	$115	$115	$115	$115
MISCELLANEOUS	$115	$115	$115	$115	$115	$115
VESSEL OPERATING COSTS (ROUND TRIP)	$63,071	$63,695	$67,749	$62,551	$62,828	$55,447
LOADING & DISCHARGING:						
STEVEDORING	$22,848	$30,464	$30,464	$30,464	$30,464	$30,464
CLERKING	$100	$500	$303	$303	$606	$303
SUPPLIES	$2,645	$2,645	$2,645	$2,645	$2,645	$2,645
WHARFAGE	$5,331	$5,758	$6,093	$4,265	$4,265	$4,661
TRUCK LOADING	$36,556	$39,542	$50,265	$39,542	$39,542	$50,113
TOTAL	$135,300	$148,500	$162,500	$146,600	$146,100	$148,100

TABLE B-14

REVISION TO COSTS, 3/7/91

F:SALCA1RB

SALEM RIVER COST ANNUALIZATION 1)
DISCOUNT RATE= 8.750%
PRICE LEVEL= APRIL 1990

	12 FT	14 FT	16 FT	17 FT	18 FT	19 FT	20 FT	22 FT	24 FT
FIRST COST:									
PROJECT	$0	$4,330,000	$7,071,000	$8,914,000	$9,974,000	$14,493,000	$17,747,000	$23,431,000	$26,736,000
ASSOC. COSTS	$0	$164,000	$222,000	$239,000	$266,000	$276,000	$299,000	$398,000	$452,000
SUBTOTAL	$0	$4,494,000	$7,293,000	$9,153,000	$10,240,000	$14,769,000	$18,046,000	$23,829,000	$27,188,000
INT DURING CONSTR 2)	$0	$160,605	$260,634	$327,106	$365,952	$527,808	$644,920	$851,590	$971,632
TOTAL	$0	$4,654,605	$7,553,634	$9,480,106	$10,605,952	$15,296,808	$18,690,920	$24,680,590	$28,159,632
CRF	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884	0.08884
AVG ANN FIRST COSTS	$0	$413,515	$671,065	$842,213	$942,233	$1,358,968	$1,660,501	$2,192,624	$2,501,702
MAINTENANCE COSTS:									
DREDGING CYCLE-YEARS	4	4	3	3	3	3	3	3	3
PROJECT	$1,394,000	$1,905,000	$1,909,000	$2,060,000	$2,215,000	$2,557,000	$2,865,000	$3,438,000	$3,794,000
ASSOC COSTS	$0	$88,000	$81,000	$86,000	$92,000	$91,000	$89,000	$90,000	$103,000
TOTAL	$1,394,000	$1,993,000	$1,990,000	$2,146,000	$2,307,000	$2,648,000	$2,954,000	$3,528,000	$3,897,000
SFF	0.219477	0.219477	0.305796	0.305796	0.305796	0.305796	0.305796	0.305796	0.305796
AVG ANN MAINT COSTS	$305,951	$437,418	$608,534	$656,238	$705,471	$809,748	$903,321	$1,078,848	$1,191,687
AVG ANN COSTS (12 FT)	$306,000								
CUMULATIVE AVG ANN COSTS		$851,000	$1,280,000	$1,498,000	$1,648,000	$2,169,000	$2,564,000	$3,271,000	$3,693,000
CUMULATIVE AVG ANN COSTS (NETTING OUT 12 FT AVG ANN COSTS)		$545,000	$974,000	$1,192,000	$1,342,000	$1,863,000	$2,258,000	$2,965,000	$3,387,000

1)INCLUDES MITIGATION, REPLACEMENT, AND NAVIGATION AID COSTS
2)NINE MONTH CONSTRUCTION PERIOD;FIRST COST APPORTIONED UNIFORMLY

EXAMPLE:
INTEREST DURING CONSTRUCTION CALCULATION (18 FEET):

MONTH 1-	$1,137,778	1.06493	$1,211,656
MONTH 2-	$1,137,778	1.05752	$1,203,219
MONTH 3-	$1,137,778	1.05015	$1,194,835
MONTH 4-	$1,137,778	1.04283	$1,186,512
MONTH 5-	$1,137,778	1.03557	$1,178,247
MONTH 6-	$1,137,778	1.02835	$1,170,039
MONTH 7-	$1,137,778	1.02119	$1,161,889
MONTH 8-	$1,137,778	1.01408	$1,153,796
MONTH 9-	$1,137,778	1.00701	$1,145,759
TOTAL	$10,240,000		$10,605,952 TOTAL INV. COST
			$10,240,000 MINUS FIRST COST

			$365,952 INT. DURING CONSTR.

TABLE B-15

SALEM RIVER ECONOMIC OPTIMIZATION F:SRRRB1
GENERAL CARGO/CONTAINER & BULK BENEFIT REASSESSMENT
HIGHEST NET BENEFIT DEPTH FOR EACH SENSITIVITY NOTED BY ASTERISK
APPLYING TRANSPORTATION COST MODEL WITH IMPACT OF ACTUAL OPERATING PRACTICES
REVISION TO COSTS, 3/7/91
CONTAINER: MID-ATLANTIC SHIPPING, INC. BERMUDA TRADE USING REVISED HISTORIC TONNAGE AND MID-ATL/VOIGT PROJECTIONS
BULK: REVISED TO APPLY 1989 TONNAGE WITH 2% GROWTH
TRANS COST MODEL ADJUSTMENT BASED ON REVISED 76% CARRYING CAPACITY FOR ALL VESSEL CLASSES INCLUDING BOX WEIGHT
VESSEL CLASSES GREATER THAN 5000 DWT DELETED, REVISED IMMERSION FACTORS
FLEET DEFINED BY NORMAL DISTRIBUTION FOR VESSEL CLASSES <1 STANDARD DEVIATION FROM MEAN
REVISION TO CARRYING CAPACITY BASED ON WLRC DEFINITION
DISCOUNT RATE= 8.750%
PRICE LEVEL= APRIL 1990

CHANNEL IMPROVEMENT	CUMULATIVE AVG ANN BENEFITS	CUMULATIVE AVG ANN COSTS	BENEFIT-COST RATIO	NET BENEFITS	GENERAL CARGO/ CONTAINER BENEFITS	BULK BENEFITS
12 TO 14 FT	$1,124,000	$545,000	2.1	$579,000	$976,300	$148,100
12 TO 16 FT	$1,657,000	$974,000	1.7	$683,000	$1,473,800	$183,300
12 TO 17 FT	$1,855,000	$1,192,000	1.6	$663,000	$1,663,050	$192,200
12 TO 18 FT	$2,053,000	$1,342,000	1.5	$711,000 *	$1,852,300	$201,100
12 TO 19 FT	$2,082,000	$1,863,000	1.1	$219,000	$1,874,950	$207,200
12 TO 20 FT	$2,111,000	$2,258,000	0.9	($147,000)	$1,897,600	$213,400
12 TO 22 FT	$2,143,000	$2,965,000	0.7	($822,000)	$1,917,500	$225,000
12 TO 24 FT	$2,164,000	$3,387,000	0.6	($1,223,000)	$1,922,900	$241,100

PESSIMISTIC SCENARIO: BULK BENEFITS DELETED, SALEM STRICTLY A GENERAL CARGO/CONTAINER PORT:

CHANNEL IMPROVEMENT	CUMULATIVE AVG ANN BENEFITS	CUMULATIVE AVG ANN COSTS	BENEFIT-COST RATIO	NET BENEFITS	GENERAL CARGO/ CONTAINER BENEFITS
12 TO 14 FT	$976,000	$545,000	1.8	$431,000	$976,300
12 TO 16 FT	$1,474,000	$974,000	1.5	$500,000	$1,473,800
12 TO 17 FT	$1,663,000	$1,192,000	1.4	$471,000	$1,663,050
12 TO 18 FT	$1,852,000	$1,342,000	1.4	$510,000 *	$1,852,300
12 TO 19 FT	$1,875,000	$1,863,000	1.0	$12,000	$1,874,950
12 TO 20 FT	$1,898,000	$2,258,000	0.8	($360,000)	$1,897,600
12 TO 22 FT	$1,918,000	$2,965,000	0.6	($1,047,000)	$1,917,500
12 TO 24 FT	$1,923,000	$3,387,000	0.6	($1,464,000)	$1,922,900

TABLE B-15 (Cont.)

SENSITIVITY ANALYSIS (AVG ANN BENEFITS):

	F:S91D7RR1	F:S8RRA	F:S9RRA
12 TO 14 FT	$1,399,101	$1,305,098	$571,949
12 TO 16 FT	$1,926,678	$1,825,479	$1,071,455
12 TO 18 FT	$2,275,219	$2,082,178	$1,615,568
12 TO 20 FT	$2,387,411	$2,127,220	$1,645,047
12 TO 22 FT	$2,414,825	$2,146,289	$1,665,050
12 TO 24 FT	$2,433,397	$2,153,683	$1,665,050

PCT. OF GENERAL CARGO/CONTAINER OUTBOUND FLEET SAILING DRAFTS(SOURCE:BEEBE PILOT LOG):

F:SCTCMR9:>15 FT	11.8%
F:SCTCMR12:14 FT	44.1%
F:SCTCMR13:13 FT	41.2%
OTHER:12 FT	2.9%
TOTAL	100.0%

benefits for general cargo/containers have been determined by taking a weighted average of the transportation savings quantified in Tables B-8, B-11,and B-12, based on an apportionment of the fleet for actual operating practice constraints (i.e., 11.8%: unconstrained, 44.1%: 1.5 foot constraint, and 41.2%: 2.5 foot constraint). Bulk benefits are based on 2% growth in tonnage per annum beyond the existing 1989 level. The optimal channel depth plan (at an 8 3/4% discount rate) is 18 feet, with a benefit-cost ratio (BCR) of 1.5 and net benefits of $711,000, with both general cargo/container and bulk benefits included. With bulk benefits deleted, the project remains at 18 feet, has a BCR of 1.4 and net benefits of $510,000.

A multiport analysis is not necessary for Salem because of the procedure applied in the study. Salem must be recognized as a "niche" market which has targeted a specific strategy for bringing certain commodities through the port. The analysis has only evaluated commodities that have historically moved through the port and are expected to continue to do so in the future. The actual movement of these commodities through Salem at the present time clearly delineates the economic viability and cost competitiveness of Salem versus other competing ports. An increase in berths and facilities at Salem will continue to increase the capability of the port to handle the same commodities at an increased level of tonnage. No new commodities, diversions, or induced tonnage are claimed in the analysis, which precludes the need to undertake a multiport analysis for the movement of commerce through the port of Salem. Based on tonnage projections, the port/landside facilities will be sufficient to handle projected throughput capacity.

RISK AND UNCERTAINTY ANALYSIS

A risk and uncertainty analysis was conducted to vary the key parameter of tonnage growth to determine the impact that this would have on project justification. A breakeven analysis of growth in tonnage for the selected plan was accomplished, and potential new tonnage as a result of the project is also discussed.

A. NO GROWTH IN TONNAGE OVER PROJECT LIFE

Transportation savings have been quantified with tonnage held constant at the level for year one of the project, 1994 (general cargo/containers=38,080 tons and bulk=27,200 tons). The results are as follows:

Channel Depth Increment	G.C./Container Trans Savings	Bulk Trans Savings	Total Trans Sav	BCR
12-14 feet	$412,600	$130,600	$ 543,000	0.9
12-16 feet	$622,800	$161,600	$ 784,000	0.8
12-18 feet	$782,800	$177,300	$ 960,000	0.7
12-20 feet	$801,900	$188,200	$ 990,000	0.4
12-22 feet	$810,300	$198,400	$1,009,000	0.3
12-24 feet	$812,600	$212,600	$1,025,000	0.3

With no growth in general cargo/container and bulk tonnage over the project life, the project would not be justified.

B. NO GROWTH IN TONNAGE BEYOND THE EXISTING YEAR

Transportation savings have been quantified with no growth in tonnage beyond the level of the existing year, 1989 (general cargo/containers=19,400 tons, bulk=24,600 tons). The results are as follows:

Channel Depth Increment	G.C./Container Trans Savings	Bulk Trans Savings	Total Trans Sav	BCR
12-14 feet	$209,900	$118,300	$328,000	0.6
12-16 feet	$316,900	$146,400	$463,000	0.5
12-18 feet	$398,300	$160,600	$559,000	0.4
12-20 feet	$408,000	$170,500	$579,000	0.3
12-22 feet	$412,300	$179,700	$592,000	0.2
12-24 feet	$413,400	$192,600	$606,000	0.2

With no growth in tonnage beyond the existing year level, the project would not be justified.

C. GROWTH IN GENERAL CARGO/CONTAINER TONNAGE TO THE YEAR 2000

Transportation savings have been quantified with growth in general cargo/container tonnage to the final year projected by DRI/TBS, the year 2000, or 71,400 tons. Bulk tonnage has been allowed to grow at 2% per annum over the project life. The results are as follows:

Channel Depth Increment	G.C./Container Trans Savings	Bulk Trans Savings	Total Trans Sav	BCR
12-14 feet	$ 674,000	$148,100	$ 822,000	1.5
12-16 feet	$1,017,500	$183,300	$1,201,000	1.2

12-18 feet	$1,278,800	$201,100	$1,480,000	1.1
12-20 feet	$1,310,100	$213,400	$1,524,000	0.7
12-22 feet	$1,323,800	$225,000	$1,549,000	0.5
12-24 feet	$1,327,100	$241,100	$1,568,000	0.4

With growth in general cargo/container tonnage only to the year 2000 (covering the first six years of the project life), the project depth would optimize at 14 feet.

D. BREAKEVEN ANALYSIS

Growth in tonnage through year 17 of the project life is required to remain above the breakeven point of economic optimization for the selected 18 foot plan.

E. INDUCED TONNAGE

New commodities were identified during the study investigation that could potentially move through Salem over the project life based on discussions with Port of Salem officials, shippers, and local industries. The potential commodities and trade routes are as follows:

a. Rolled Newsprint (for needs of local newspapers)

(1) New Brunswick, Canada to Salem

b. Polyvinyl Chloride (used as a raw material by local plant to make vinyl resilient floor coverings)

(1) Canada to Salem

(2) Chile to Salem

c. New Perishables (originating from southern New Jersey agricultural region; processed in local irradiation facility; shipped to foreign destinations)

(1) Salem to Trinidad

(2) Salem to United Kingdom

(3) Salem to Brazil

d. Wood Pulp (for local paper needs)

(1) Georgia to Salem

(2) Chile to Salem

(3) Sweden to Salem

e. Cement Clinker (raw material used to make building products locally)

(1) Spain to Salem

f. Bauxite (raw material used by local plant in the manufacturing of rubber, plastics)

(1) Jamaica to Salem

g. Magnesium Oxide (raw material used by local plant to make magnesium oxide hybrid slurry for utility systems)

(1) Greece to Salem

(2) United Kingdom to Salem

(3) Mexico to Salem

h. Copper (raw material used by local plant for mineral processing)

(1) Canada to Salem

(2) Chile to Salem

i. Zircon (raw material used by local plant for mineral processing)

(1) Brazil to Salem

j. Epsom Salt (raw material used by local plant for mineral processing)

(1) Mexico to Salem

k. Furniture (Swedish furniture manufacturer has distribution warehouse situated near port)

(1) Sweden to Salem

If this tonnage were to become reality in moving through Salem, total benefits for the project could be higher than the benefits as quantified for the commodities in Table B-15. However, due to the speculative nature of these new commodities, it is not considered appropriate to include them in the benefit analysis.

ENGINEERING

APPENDIX C

Delaware River
Comprehensive Navigation Study
Salem River, New Jersey

APPENDIX C

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LIST OF TABLES

1.0 Utilities - There are no known utilities within the project limits which would be affected by the project.

2.0 Channel Alignment and Geometry - The proposed main stem channel alignment follows the authorized channel alignment to Station 17+200. The proposed channel alignment diverges to the north of the authorized channel at this point in order to provide adequate vessel clearance from existing powerlines. From Station 20+300 to 25+800 the proposed left channel limit coincides with the authorized left channel limit. This alignment is due to existing bulkheads, private property and the Port of Salem along the left bank.

Channel widths are based on EM 1110-2-1613, "Hydraulic Design of Deep Draft Navigation Projects", for one way traffic with good vessel maneuverability. Bank clearances of 60% beam width and a channel width of 180% beam width is required. Table 1 shows the channel widths developed for all project depth alternatives based on the combined beam widths of the design vessel and tug. Table 2 shows the corresponding main stem dredging quantities.

Table 1 - Main Stem Channel Width

Design Depth	Beam Width	Channel Width
14'	52	160
16'	55	170
17'	60	180
18'	60	180
19'	75	230
20'	84	250
22'	92	280
24'	92	280

Channel bends were designed based on the apex method of bend widening. Table 3 shows bend locations and widening requirements for all design depth alternatives.

Turning basin geometry was determined using EM 1110-2-1613. EM 1110-2-1613 requires a turning basin diameter of 1.5 times the design vessel length. See Tables 4 and 5 for turning basin diameters and quantities.

The total of the main stem (Table 2), bend widening (Table 3), and turning basin (Table 5) quantities comprise the Federal requirement to increase the channel from its authorized to proposed dimensions (Table 6).

TABLE 2

MAIN STEM CHANNEL
QUANTITY SUMMARY

PROJECT DIMENSIONS	REQUIRED DREDGING STA 3+000 TO STA 17+200	REQUIRED DREDGING STA 17+200 TO STA 25+800	OVERDEPTH DREDGING (2 FT) STA 3+000 TO STA 17+200	OVERDEPTH DREDGING (2 FT) STA 17+200 TO STA 25+800	TOTAL CY
AUTHORIZED	304,866	6,187	126,933	6,703	444,689
14 X 160	188,239	100,208	13,696	31,073	333,216
16 X 170	413,614	173,699	31,344	58,758	677,415
17 X 180	568,383	273,757	44,696	79,772	966,608
18 X 180	675,591	322,053	49,578	84,484	1,131,706
19 X 230	1,088,468	565,711	101,022	119,402	1,874,603
20 X 250	1,364,687	736,001	124,037	135,281	2,360,006
22 X 280	1,919,065	1,075,772	156,515	156,336	3,307,688
24 X 280	2,297,805	1,305,189	157,455	159,606	3,920,055

TABLE 3

BEND WIDENING QUANTITIES

STA 13 + 200 TO STA 14 + 130

PROJECT DIMENSIONS (FT)	DREDGING (CY) REQUIRED	DREDGING (CY) OVERDEPTH	TOTAL CUBIC YARDS
14 X 160	17940	4486	22426
16 X 170	22426	4486	26912
17 X 180	24669	4486	29155
18 X 180	26912	4486	31398
19 X 230	29155	4486	33641
20 X 250	31398	4486	35884
22 X 280	35884	4486	40370
24 X 280	40370	4486	44856

STA 14 + 130 TO STA 15 + 080

PROJECT DIMENSIONS (FT)	DREDGING (CY) REQUIRED	DREDGING (CY) OVERDEPTH	TOTAL CUBIC YARDS
14 X 160	10979	3662	14641
16 X 170	14641	3662	18303
17 X 180	16472	3662	20134
18 X 180	18303	3662	21965
19 X 230	20134	3662	23796
20 X 250	21965	3662	25627
22 X 280	25627	3662	29289
24 X 280	29289	3662	32951

STA 16 + 600 TO STA 17 + 850

PROJECT DIMENSIONS (FT)	DREDGING (CY) REQUIRED	DREDGING (CY) OVERDEPTH	TOTAL CUBIC YARDS
14 X 160	5778	5778	11556
16 X 170	11556	5778	17334
17 X 180	14445	5778	20223
18 X 180	17334	5778	23112
19 X 230	20223	5778	26001
20 X 250	23112	5778	28890
22 X 280	28890	5778	34668
24 X 280	34668	5778	40446

Table 4 - Turning Basin Requirements

Depth	Design Vessel Length	Turning Basin Diameter
14	250	375
16	315	475
17	330	495
18	330	495
19	370	555
20	440	660
22	450	675
24	450	675

Table 5 - Turning Basin Quantities

Depth	Dredging (C.Y.)	2' Overdepth (C.Y.)	Total (C.Y.)
14	8,389	3,501	11,890
16	27,904	8,162	36,066
17	32,841	8,162	41,003
18	38,044	8,162	46,206
19	53,342	8,662	62,004
20	110,877	14,335	125,212
22	204,795	19,952	224,747
24	229,020	19,952	248,972

Table 6 - Federal Project Totals

Depth	Required Dredging	Overdepth	Total (CY)
14	331,533	62,196	393,729
16	663,840	112,190	776,030
17	930,567	146,556	1,077,123
18	1,098,237	156,150	1,254,387
19	1,777,033	243,012	2,020,045
20	2,288,040	287,579	2,575,619
22	3,290,033	346,729	3,636,762
24	3,936,341	350,939	4,287,280

3.0 Non-Federal Requirements - Table 7 is a summary of Non-Federal dredging requirements. The depths for berths 1 through 4 are based upon anticipated vessel usage with continuous tidal operation.

4.0 Quantity Development - All previously presented quantities were developed using soundings from the March 1984 Salem River Survey. Main stem quantities were computer generated using the "DREQUA" program average.end area method.

TABLE 7 - NON-FEDERAL REQUIREMENTS

BERTH NO	CHANNEL EL -12.0 D	REQ'D	OD	TOTAL	CHANNEL EL -14.0 D	REQ'D	OD	TOTAL	CHANNEL EL -16.0 D	REQ'D	OD	TOTAL
1	16	0	0	0	18	1400	1400	2800	20	2800	1400	4200
2	16	0	0	0	18	1525	1379	2904	20	2947	1393	4340
3	16	0	0	0	18	2074	2074	4148	20	4148	2074	6222
4	16	0	0	0	18	2074	2074	4148	20	4148	2074	6222
TOTAL		0	0	0		7073	6927	14000		14043	6941	20984

BERTH NO	CHANNEL EL -17.0 D	REQ'D	OD	TOTAL	CHANNEL EL -18.0 D	REQ'D	OD	TOTAL	CHANNEL EL -19.0 D	REQ'D	OD	TOTAL
1	21	3500	1400	4900	22	4200	1400	5600	23	4900	1400	6300
2	21	3516	1435	4951	22	4410	1449	5859	23	4965	1460	6425
3	21	5185	2074	7259	22	6222	2074	8296	23	7259	2074	9333
4	21	5185	2074	7259	22	6222	2074	8296	23	7259	2074	9333
TOTAL		17386	6983	24369		21054	6997	28051		24383	7008	31391

BERTH NO	CHANNEL EL -20.0 D	REQ'D	OD	TOTAL	CHANNEL EL -22.0 D	REQ'D	OD	TOTAL	CHANNEL EL -24.0 D	REQ'D	OD	TOTAL
1	24	5600	1400	7000	26	7000	1400	8400	28	8400	1400	9800
2	24	5851	1477	7328	26	14870	2572	17442	28	17487	2732	20219
3	24	8296	2074	10370	26	10370	2074	12444	28	12444	2074	14518
4	24	8296	2074	10370	26	10370	2074	12444	28	12444	2074	14518
TOTAL		28043	7025	35068		42610	8120	50730		50775	8280	59055

Berthing area quantities were computed based on initial conditions consistent with Port Authority plans and proposed depths based on anticipated usage. The turning basin quantities were determined by plotting sections and calculating volumes using the average end area method.

5.0 Planned Improvements - With project planned improvements, funded by Non-Federal means, include deepening of existing berthing areas.

6.0 Shoaling Analysis - Results of the shoaling analysis performed for all project depth alternatives are shown on Table 8. Rates given are based on a 4 year maintenance cycle for the 14' project depth and a 3 year cycle for the 16' through 24' project depths.

TABLE 8 - AVERAGE ANNUAL MAINTENANCE DREDGING QUANTITIES

CHANNEL DIMENSIONS	FEDERAL FEATURES (CY/YR) STA. 0+000 TO STA. 20+400	STA. 20+400 TO STA. 26+300 (WITH TURNING BASIN)	TOTAL	NON-FED BERTHS (CY/YR)	* PROJECT TOTALS (CY/YR)
14 X 160	30600	6300	36900	1700	38600
16 X 170	40100	9300	49400	2100	51500
17 X 180	45100	9600	54700	2300	57000
18 X 180	50200	10000	60200	2500	62700
19 X 230	63700	11700	75400	2700	78100
20 X 250	77200	13500	90700	2800	93500
22 X 280	97200	16900	114100	3000	117100
24 X 280	110000	19000	129000	3500	132500

* PROJECT TOTALS FOR THE 14' CHANNEL ARE BASED ON A 4 YR CYCLE
TOTALS FOR THE 16' THROUGH 24' CHANNELS ARE BASED ON A 3 YR CYCLE

Note: Quantities are cumulative and include dredged quantities for the existing 12' project.

The shoaling anlaysis was performed utilizing a "Volume-of-Cut" method, as presented in ETL 1110-2-293, "Entrance Channel Infill Rates," dated 15 March 1984. The volume-of-cut method is based on the premise that channel improvements which deepen and/or widen the existing channel increase the shoaling rate by a factor related to the increased "volume of cut" beyond the estimated natural "equilibrium" depth for the channel. In this evaluation, the alternative channel dimensions ranged from 14 X 160 up to 24 X 280 (depth X width, units of feet), compared to the authorized 12 X 150 channel. The considered channel enlargements relative to authorized dimensions necessarily lead to projected increases in shoaling rate.

7.0 <u>Disposal Alternatives Investigated</u> - The alternatives investigated are discussed below by cycle.

Cycle One: Non-structural measures were investigated. It was determined that increased utilization of the measures currently being utilized could not achieve the planning objectives.

Cycle Two: A list of disposal area sites was evaluated for available capacity and cost. The site with available capacity and the least cost was determined to be Killcohook Disposal Area, a Federal site, for the placement of both initial and maintenance quantities.

Cycle Three: Detailed cost estimates were developed of all depths with initial and maintenance quantities going to Killcohook. The 18′ project was chosen based on this optimization.

8.0 <u>Selected Plan</u> - The selected plan includes dredging to a channel depth of 18′ plus 2′ allowable overdepth and disposal of both initial and maintenance dredging quantities at Killcohook disposal area.

9.0 <u>Cost Estimates</u> - Detailed estimates and a summary for all project depths with all disposal going to Killcohook are provided in this appendix.

TABLE 9 – KILLCOHOOK DISPOSAL AREA REQUIREMENTS

CHAN DEPTH	INITIAL DREDGING	BULKING (x 1.5)	SHRINKAGE (– 1.2)	MAINT DREDGING	BULKING (x 1.8)	SHRINKAGE (– 1.5)	FINAL ** QTY (CY)
14	407729	611594	339774	38600	69480	25733	1574958
16	797014	1195521	664178	51500	92700	34333	2312162
17	1101492	1652238	917910	57000	102600	38000	2741910
18	1282438	1923657	1068698	62700	112860	41800	3075098
19	2051436	3077154	1709530	78100	140580	52067	4208746
20	2610687	3916031	2175573	93500	168300	62333	5167587
22	3687492	5531238	3072910	117100	210780	78067	6820126
24	4346335	6519503	3621946	132500	238500	88333	7861932

** TOTAL IN PLACE QUANTITY AFTER 50 YEAR PROJECT LIFE

COST ESTIMATES

SALEM RIVER

PROJECT COSTS

Refer to Page C - 15 for the Salem River Cost Estimate Summary.

INITIAL CONSTRUCTION COST

Estimates were prepared for initial dredging of the Federal and Non-Federal associated portions of the recommended plan. Dredging of the Federal and Non-Federal associated portions of the project will be done simultaneously by the same dredging contractor. The estimates assume that the dredging of the Federal and Non-Federal associated portion of the recommended project will be done using a hydraulic dredge. Material will be pumped to the Killcohook disposal area. Cost estimates were also prepared for disposal area replacement. The disposal area work consists of site clearing, dike raisings and construction of sluices. All disposal area work will be done prior to initial dredging. Costs also include mitigation for wetlands. Initial dredging costs reflect April 1990 price levels.

MAINTENANCE COSTS

Estimates were prepared for maintenance dredging of the existing 12' project and each alternative project depth as well as the 18' recommended plan. Dredging of the Federal project, including the existing 12' channel, and Non-Federal berth areas will be done simultaneously by the same dredging contractor. In order to develop incremental project costs, the existing project maintenance costs were annualized and deducted from the cumulative annual maintenance costs. Maintenance costs are based on dredging on a four year cycle for existing and 14 foot projects and a three year cycle for depths 16 through 24. All maintenance dredging will be done using a hydraulic dredge pumping all dredged material into Killcohook disposal area. Maintenance dredging costs reflect April 1990 price levels.

DISPOSAL

All initial and maintenance dredging material will be disposed at Killcohook disposal area throughout the 50 year project life.

CONTINGENCIES

The estimated cost for each major subdivision of feature of the recommended plan includes an item for "contingencies". The item for "contingencies" is an allowance against some adverse or unanticipated condition not susceptible to exact evaluation from the data at hand but which must be expressed or represented in the cost estimate. The contingency allowances used in the development of the cost estimates for the recommended project were estimated as a lump sum amount. The contingency allowances used in the following major features of the cost estimates reflect the following uncertainties and concerns exposed during the feasibility study:

a. Mobilization, Demobilization and Preparatory Work: Contingencies in this line item reflect concerns about availability of dredges and probability of having to mobilize the dredge and attendant plant from a distance of more than 200 miles from the dredging site.

b. Pipeline Dredging: Contingencies for the line item reflect concerns about encountering boulders, timber piles and any other miscellaneous objects as previously encountered during the maintenance dredging operations of the existing project. In addition contingencies reflect concerns about the fluctuation of fuel prices, surveys, labor costs and size of digging banks.

PLANNING, ENGINEERING AND DESIGN

Planning, Engineering and Design (P,E&D) related costs for the Federal portion of the recommended plan during the initial dredging stage were estimated as a lump sum item based on similar Corps of Engineers projects. The related costs consisted of P,E&D in the amount of $450,000 and E&D during construction in the amount of $75,000 for a total P,E&D lump sum cost of $525,000. Planning, Engineering and Design (P,E&D) for the Non-Federal associated portion of the recommended plan during the initial dredging stage were estimated at 15 percent of the direct construction cost. Planning, Engineering and Design (P,E&D) during the maintenance dredging stages for both the Federal and Non-Federal associated portions of the recommended project were estimated at 15 percent of the direct construction cost.

CONSTRUCTION MANAGEMENT

Construction Management (S&A) related costs for the Federal portion of the recommended plan during the initial dredging stage were estimated as a lump sum in the amount of $400,000 Non-Federal associated portions of the work during the initial dredging stage were estimated at 10 percent. During the maintenance dredging stages, Construction Management (S&A) related costs for the Federal and Non-Federal associated portions of the recommended plan were estimated at 10 percent of the direct construction cost.

REAL ESTATE

The values of lands and damages are based on real estate gross appraisals prepared by the Appraisal Branch of the Baltimore District Real Estate Division. The lands were inspected in the field and a determination of value was estimated by comparing similar properties located within the geographical area of the project. Adjustments were made for use requirement, size, and physical features to establish the fair market value of parcels being evaluated. These included potential disposal areas, wetlands required for excavation of the channel and turning basin, and uplands required for mitigation work.

ADMINISTRATION COSTS

Administration costs for the local sponsor and the Government are based on estimated values determined to be relevant to the work required. The local sponsors administrative cost was computed from a previous navigation project and increased by means of an economy factor to the current price level. The Government's computed value is based on past experience in performing required project tasks.

CONTINGENCIES

The contingency for lands is 25% based on EM 1110-2-1301, Appendix C, EC 1110-2-263, EC 1110-2-538 and the allowance for appraisal values to have an additional contingency factor to offset the effects of counteroffers and uneconomic remnants incurred during the acquisition process for the project. A contingency of 15% is used for administrative and contract costs as determined by the above mentioned regulations

COST ESTIMATES

REPLACEMENT COST DATA

1. There are four components to the replacement costs which are factored into the comparative cost data for each alternative depth considered for the Salem project:

   a. Accelerated site acquisition costs of the 20I

   b. Differences between disposal area annual maintenance costs.

   c. Difference between the transportation costs per cubic yard.

   d. Differences between the disposal area diking costs.

Each component will be considered separately, using the 18 foot project as an example. The base year for the project is 1994, as noted previously.

2. One new site (20I) would have to be acquired earlier for the Philadelphia to the Sea project if Killcohook were to serve as the disposal site for the 18 foot Salem project. This acceleration in years is determined by dividing 3,252,300 cubic yards, the Salem initial and maintenance dredging volumes, by the annual maintenance quantities for the appropriate ranges of the 40 foot Philadelphia to the Sea project. The reimbursement costs calculated incorporate the impact on Killcohook's use from the placement of material from the berthing areas.

$$\frac{3{,}252{,}300}{2{,}081{,}000} = 1.56 \text{ years accelerated use, rounded to 2 years}$$

This projection is based on a disposal capacity at Killcohook given a 50 foot dike elevation, use of 20I for 10 years and subsequent use of Artificial Island, an existing Federal disposal site located by the Salem Nuclear Power Plant.

3. <u>Acquisition.</u> The method of establishing the cost differences for acquisition of 20I uses the Single Payment Present Worth Factor (SPPWF) for the accelerated year of acquisition in the project life (2022) minus the SPPWF for the scheduled year of acquisition (2024) multiplied by the acquisition cost of the new site. Through these calculations it is possible to convert the cost of acquisition in the different years to present dollars for comparison. The cost of 20I would be about $3,838,000, including contingencies and administration costs, and the project year shift is from the 30th to 28th year of operations. The cost of accelerated acquisition is $52,900 in present worth dollars for the Federal project and $2,600 to account for berth dredging.

4. Maintenance. The differences in annual maintenance costs of Killcohook versus 20I and Artificial Island are a result of the two accelerated years and are converted to present worth costs. The difference in maintenance of the disposal sites is multiplied by the Uniform Series Present Worth Factor (USPWF for two years) and the appropriate SPPWF at project years 28 and 39.

Annual Maintenance Cost based on Dredged-Material Disposal

Management Model (D2M2)

SITE	COST
Killcohook	$12,502
20I	$ 2,746
Artificial Island	$12,495

The difference in use of 20I versus Killcohook in the years 2022-2024 results in savings to the Federal government of $2,300 for the Federal project and the berth related usage (present worth value) with contingencies and E&D, S&A. The use of Artificial Island versus 20I in the year 2033 would cost the Federal government $900. For this maintenance factor, use of Killcohook for the Salem project and berths saves a total of $1,400 rather than incurring any extra costs. Of this amount $1,300 is attributed to the Federal project and $100 to berths.

5. Transportation. According to the D2M2 model, a hopper dredge is the least expensive mode of transportation for Delaware River material to Killcohook. Transportation costs per cubic yard for the Philadelphia to the Sea project using a hopper dredge are as follows:

RANGE/PRICE PER CUBIC YARD
DOLLARS

Disposal Area	Bulkhead Bar	New Castle	Deepwater
Killcohook	1.44	1.82	1.85
20I	1.45	2.63	1.27
Artificial Island	2.90	6.77	2.40

The differences in costs between Killcohook, 20I, and Artificial Island are established by calculating a weighted cost per cubic yard for each range and multiplying by the appropriate yardage and the SPPWF to determine the transportation cost difference in present worth value. The cost to the Federal government, would be $434,000 for the Federal project and $21,100 for the berthing material, including contingencies and E&D, S&A.

6. <u>Diking.</u> The cost differences of diking can be determined from D2M2 input and are expressed in dollars per cubic yard. These figures, when used with the SPPWF for the year of acquisition, indicates the present worth of the replacement cost of diking.

7. The differences per cubic yard are $1.90 for Killcohook versus 20I and $1.62 for use of Artificial Island versus 20I. Including contingencies and E&D, S&A, the net cost is $411,500 for accelerated diking and use of Killcohook for the Federal project. The cost due to berth dredging is $20,000. The replacement cost for use of Killcohook as discussed in the Main Report is the sum of these four components.

ITEMS		FEDERAL COSTS	NON-FEDERAL COSTS
a. Accelerated acquisition		$ 52,900	$ 2,600
b. Disposal area annual maintenance		$- 1,300	$ - 100
c. Transportation		$434,000	$ 21,100
d. Diking		$411,500	$ 20,000
	SUB-TOTAL	$897,100	$ 43,600
	TOTAL		$940,700 $941,000 (rounded)

SALEM RIVER COST ESTIMATE SUMMARY

KILLCOHOOK DISPOSAL AREA

1. Initial Costs (1)

PROJECT DEPTH	PROJECT COSTS (2)	ASSOCIATED COSTS
12	0	0
14	$4,602,000	$102,000
16	$7,741,000	$104,000
17	$9,475,000	$104,000
18	$10,631,000	$106,000
19	$15,292,000	$135,000
20	$18,831,000	$167,000
22	$24,960,000	$177,000
24	$28,547,000	$190,000

2. Maintenance Costs (1)

PROJECT DEPTH	PROJECT COSTS	ASSOCIATED COSTS	FREQUENCY (YRS)
12	$1,394,000	0,000	4
14	$1,911,000	$57,000	4
16	$1,916,000	$54,000	3
17	$2,068,000	$56,000	3
18	$2,226,000	$63,000	3
19	$2,569,000	$65,000	3
20	$2,868,000	$66,000	3
22	$3,439,000	$75,000	3
24	$3,796,000	$76,000	3

NOTE:

1. APRIL 1990 PRICE LEVEL
2. INCLUDES MITIGATION COSTS & LERRD

M-CACES COST ESTIMATE

AND

SELECTED PLAN BACKUP

SALEM RIVER

RECOMMENDED PLAN

INITIAL PROJECT COSTS

DEPTH: 18 FEET　　D/A: KILLCOHOOK　　ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990　　DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	7	AC	$18,525.00	$129,675	$32,419	$162,094
	TOTAL, FISH AND WILDLIFE FACILITIES				$129,675	$32,419	$162,094
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$246,490	$61,622	$308,112
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	1254387	C.Y.	$4.87	$6,108,865	$1,527,216	$7,636,081
	TOTAL, DREDGING COST				$6,355,355	$1,588,838	$7,944,193
	TOTAL CONSTRUCTION COSTS				$6,485,030	$1,621,257	$8,106,287
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$525,000	$0	$525,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$400,000	$0	$400,000
	SUBTOTAL				$7,410,030	$1,621,257	$9,031,287
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$739,874	$157,271	$897,145
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$38,510	$7,649	$46,159
	TOTAL, LANDS AND DAMAGES				$778,384	$164,920	$943,304
	TOTAL PROJECT COSTS				$8,188,414	$1,786,177	$9,974,591
	(ROUNDED)				$8,188,000	$1,786,000	$9,974,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 18 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$5,510	$1,378	$6,888
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	28051	C.Y.	$4.87	$136,608	$34,152	$170,760
	SUBTOTAL, DREDGING COST				$142,118	$35,530	$177,648
12.0.-.-	TOTAL CONSTRUCTION COSTS				$142,118	$35,530	$177,648
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$21,318	$5,330	$26,648
31.-.-.-	CONSTRUCTION MANAGEMENT				$14,212	$3,553	$17,765
	SUBTOTAL				$177,648	$44,413	$222,061
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$35,920	$7,637	$43,557
	TOTAL, LANDS AND DAMAGES				$35,920	$7,637	$43,557
	TOTAL PROJECT COSTS				$213,568	$52,050	$265,618
	(ROUNDED)				$214,000	$52,000	$266,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH: 18 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 CYCLE: 3 YEARS DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$241,950	$60,480	$302,430
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	180600	C.Y.	$6.51	$1,175,706	$293,926	$1,469,632
	SUBTOTAL, DREDGING COST				$1,417,656	$354,414	$1,772,070
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,417,656	$354,414	$1,772,070
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$212,648	$53,162	$265,810
31.-.-.-	CONSTRUCTION MANAGEMENT				$141,766	$35,442	$177,208
	TOTAL PROJECT COSTS				$1,772,070	$443,018	$2,215,088
	(ROUNDED)				$1,772,000	$443,000	$2,215,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 18 FEET | D/A: KILLCOHOOK | ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 | CYCLE: 3 YEARS | DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$10,050	$2,512	$12,562
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	7500	C.Y.	$6.51	$48,825	$12,206	$61,031
	SUBTOTAL, DREDGING COST				$58,875	$14,718	$73,593
12.0.-.-	TOTAL CONSTRUCTION COSTS				$58,875	$14,718	$73,593
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,831	$2,208	$11,039
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,888	$1,472	$7,360
	TOTAL PROJECT COSTS				$73,594	$18,398	$91,992
	(ROUNDED)				$74,000	$18,000	$92,000

TOTAL PED & CONSTRUCTION
MANAGEMENT -

ACTIVITY COST AND SCHEDULE

Designed By: U.S. ARMY CORPS OF ENGINNERS
Estimated By: JOSE ALVAREZ

Prepared By: STERLING H. JOHNSON

Date: 01/24/91

M - C A C E S   G O L D   E D I T I O N

Release 4.84

No errors detected ....

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SUMMARY REPORTS SUMMARY PAGE

No Detailed Estimate...

No Backup Reports...

* * * END TABLE OF CONTENTS * * *

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PROJECT NJ_S_R: TOTAL PED & CONSTRUCTION - MANAGEMENT -

SUMMARY PAGE 1

** PROJECT OWNER SUMMARY - LEVEL 2 **

		CONTRACT	CONTINGN	ESCALATN	OTHER	TOTAL COST
30	PLANNING,ENGINEERING & DESIGN					
30. A	PLANNING	98,000	0	0	0	98,000
30. B	ENGINEERING AND DESIGN PRIOR TO	5,000	0	0	0	5,000
30. D	ENVIRONMENTAL & REGULATION ACTIV	67,000	0	0	0	67,000
30. E	DESIGN RELATED ENGINEERING	122,000	0	0	0	122,000
30. F	DESIGN MEMORANDUM	28,000	0	0	0	28,000
30. H	PLANS AND SPECIFICATIONS	70,000	0	0	0	70,000
30. J	ENGINEERING DURING CONSTRUCTION	75,000	0	0	0	75,000
30. M	COST ENGINEERING	10,000	0	0	0	10,000
30. P	PROJECT MANAGEMENT	50,000	0	0	0	50,000
	PLANNING,ENGINEERING & DESIGN	525,000	0	0	0	525,000
31	CONSTRUCTION MANAGEMENT					
	CONSTRUCTION MANAGEMENT	400,000	0	0	0	400,000
	TOTAL PED & CONSTRUCTION	925,000	0	0	0	925,000

** PROJECT OWNER SUMMARY - LEVEL 3 **

		CONTRACT	CONTINGN	ESCALATN	OTHER	TOTAL COST
30	PLANNING,ENGINEERING & DESIGN					
30. A	PLANNING					
30. A. 1	WITHOUT PROJECT CONDITIONS	7,000	0	0	0	7,000
30. A. 2	STUDY MANAGEMENT	70,000	0	0	0	70,000
30. A. 3	ECONOMIC ANALYSIS	21,000	0	0	0	21,000
	PLANNING	98,000	0	0	0	98,000
30. B	ENGINEERING AND DESIGN PRIOR TO					
30. B. 1	REAL ESTATE	5,000	0	0	0	5,000
	ENGINEERING AND DESIGN PRIOR TO	5,000	0	0	0	5,000
30. D	ENVIRONMENTAL & REGULATION ACTIV					
30. D. 1	ENVIRONMENTAL ANALYSIS	8,000	0	0	0	8,000
30. D. 2	CULTURAL RESOURCES	25,000	0	0	0	25,000
30. D. 3	CHEMICAL TESTING	7,000	0	0	0	7,000
30. D. 4	FISH AND WILDLIFE	15,000	0	0	0	15,000
30. D. 5	ENVIRONMENTAL ASSESSMENT	8,000	0	0	0	8,000
30. D. 6	COORDINATION FOR ENV. ASSESSMENT	2,000	0	0	0	2,000
30. D. 7	WATER QUALITY CERTIFICATION	2,000	0	0	0	2,000
	ENVIRONMENTAL & REGULATION ACTIV	67,000	0	0	0	67,000
30. E	DESIGN RELATED ENGINEERING					
30. E. 1	SHIP SIMULATION	50,000	0	0	0	50,000
30. E. 2	SURVEYS	20,000	0	0	0	20,000
30. E. 3	VERIFY DISPOSAL AREAS	6,000	0	0	0	6,000
30. E. 4	SHOALING STUDY	10,000	0	0	0	10,000
30. E. 5	GROUNDWATER ANALYSIS	5,000	0	0	0	5,000
30. E. 6	DESIGN ANALYSIS	25,000	0	0	0	25,000
30. E. 7	PREPARE FOR E2 MEETING	6,000	0	0	0	6,000
	DESIGN RELATED ENGINEERING	122,000	0	0	0	122,000
30. F	DESIGN MEMORANDUM					
30. F. 1	DRAFT DM	20,000	0	0	0	20,000

** PROJECT OWNER SUMMARY - LEVEL 3 **

	CONTRACT	CONTINGN	ESCALATN	OTHER	TOTAL COST
30. F. 2 FINAL DM	8,000	0	0	0	8,000
DESIGN MEMORANDUM	28,000	0	0	0	28,000
30. H PLANS AND SPECIFICATIONS					
PLANS AND SPECIFICATIONS	70,000	0	0	0	70,000
30. J ENGINEERING DURING CONSTRUCTION					
30. J. 3 ALL OTHER ENGR. DURING CONSTRUC.	75,000	0	0	0	75,000
ENGINEERING DURING CONSTRUCTION	75,000	0	0	0	75,000
30. M COST ENGINEERING					
COST ENGINEERING	10,000	0	0	0	10,000
30. P PROJECT MANAGEMENT					
30. P. 1 VERIFY PLAN	2,000	0	0	0	2,000
30. P. 2 COORDINATION	38,000	0	0	0	38,000
30. P. 3 VALUE ENGINEERING (PRELIM.)	5,000	0	0	0	5,000
30. P. 4 VALUE ENGINEERING (FINAL)	5,000	0	0	0	5,000
PROJECT MANAGEMENT	50,000	0	0	0	50,000
PLANNING,ENGINEERING & DESIGN	525,000	0	0	0	525,000
31 CONSTRUCTION MANAGEMENT					
CONSTRUCTION MANAGEMENT	400,000	0	0	0	400,000
TOTAL PED & CONSTRUCTION	925,000	0	0	0	925,000

** PROJECT DIRECT SUMMARY - LEVEL 2 **

		QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST
30	PLANNING,ENGINEERING & DESIGN						
30. A	PLANNING		98,000	0	0	0	98,000
30. B	ENGINEERING AND DESIGN PRIOR TO		5,000	0	0	0	5,000
30. D	ENVIRONMENTAL & REGULATION ACTIV		67,000	0	0	0	67,000
30. E	DESIGN RELATED ENGINEERING		122,000	0	0	0	122,000
30. F	DESIGN MEMORANDUM		28,000	0	0	0	28,000
30. H	PLANS AND SPECIFICATIONS		70,000	0	0	0	70,000
30. J	ENGINEERING DURING CONSTRUCTION		75,000	0	0	0	75,000
30. M	COST ENGINEERING		10,000	0	0	0	10,000
30. P	PROJECT MANAGEMENT		50,000	0	0	0	50,000
	PLANNING,ENGINEERING & DESIGN		525,000	0	0	0	525,000
31	CONSTRUCTION MANAGEMENT						
	CONSTRUCTION MANAGEMENT		400,000	0	0	0	400,000
	TOTAL PED & CONSTRUCTION		925,000	0	0	0	925,000

** PROJECT DIRECT SUMMARY - LEVEL 3 **

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST
30 PLANNING,ENGINEERING & DESIGN						
30. A PLANNING						
30. A. 1 WITHOUT PROJECT CONDITIONS		7,000	0	0	0	7,000
30. A. 2 STUDY MANAGEMENT		70,000	0	0	0	70,000
30. A. 3 ECONOMIC ANALYSIS		21,000	0	0	0	21,000
PLANNING		98,000	0	0	0	98,000
30. B ENGINEERING AND DESIGN PRIOR TO						
30. B. 1 REAL ESTATE		5,000	0	0	0	5,000
ENGINEERING AND DESIGN PRIOR TO		5,000	0	0	0	5,000
30. D ENVIRONMENTAL & REGULATION ACTIV						
30. D. 1 ENVIRONMENTAL ANALYSIS		8,000	0	0	0	8,000
30. D. 2 CULTURAL RESOURCES		25,000	0	0	0	25,000
30. D. 3 CHEMICAL TESTING		7,000	0	0	0	7,000
30. D. 4 FISH AND WILDLIFE		15,000	0	0	0	15,000
30. D. 5 ENVIRONMENTAL ASSESSMENT		8,000	0	0	0	8,000
30. D. 6 COORDINATION FOR ENV. ASSESSMENT		2,000	0	0	0	2,000
30. D. 7 WATER QUALITY CERTIFICATION		2,000	0	0	0	2,000
ENVIRONMENTAL & REGULATION ACTIV		67,000	0	0	0	67,000
30. E DESIGN RELATED ENGINEERING						
30. E. 1 SHIP SIMULATION		50,000	0	0	0	50,000
30. E. 2 SURVEYS		20,000	0	0	0	20,000
30. E. 3 VERIFY DISPOSAL AREAS		6,000	0	0	0	6,000
30. E. 4 SHOALING STUDY		10,000	0	0	0	10,000
30. E. 5 GROUNDWATER ANALYSIS		5,000	0	0	0	5,000
30. E. 6 DESIGN ANALYSIS		25,000	0	0	0	25,000
30. E. 7 PREPARE FOR E2 MEETING		6,000	0	0	0	6,000
DESIGN RELATED ENGINEERING		122,000	0	0	0	122,000
30. F DESIGN MEMORANDUM						
30. F. 1 DRAFT DM		20,000	0	0	0	20,000

** PROJECT DIRECT SUMMARY - LEVEL 3 **

	QUANTY UOM	LABOR	EQUIPMNT	MATERIAL	SUPPLIES	TOTAL COST
30. F. 2 FINAL DM		8,000	0	0	0	8,000
DESIGN MEMORANDUM		28,000	0	0	0	28,000
30. H PLANS AND SPECIFICATIONS						
PLANS AND SPECIFICATIONS		70,000	0	0	0	70,000
30. J ENGINEERING DURING CONSTRUCTION						
30. J. 3 ALL OTHER ENGR. DURING CONSTRUC.		75,000	0	0	0	75,000
ENGINEERING DURING CONSTRUCTION		75,000	0	0	0	75,000
30. M COST ENGINEERING						
COST ENGINEERING		10,000	0	0	0	10,000
30. P PROJECT MANAGEMENT						
30. P. 1 VERIFY PLAN		2,000	0	0	0	2,000
30. P. 2 COORDINATION		38,000	0	0	0	38,000
30. P. 3 VALUE ENGINEERING (PRELIM.)		5,000	0	0	0	5,000
30. P. 4 VALUE ENGINEERING (FINAL)		5,000	0	0	0	5,000
PROJECT MANAGEMENT		50,000	0	0	0	50,000
PLANNING,ENGINEERING & DESIGN		525,000	0	0	0	525,000
31 CONSTRUCTION MANAGEMENT						
CONSTRUCTION MANAGEMENT		400,000	0	0	0	400,000
TOTAL PED & CONSTRUCTION		925,000	0	0	0	925,000

M-CACES INITIAL DREDGING COSTS

PIPELINE DREDGE ESTIMATE

A — BID ITEM # 2

YARDAGE ESTIMATE

1 PROJECT — SALEM RIVER - HYD DREDG - 18'

2 LOCATION — SALEM, NJ — INVIT. NO. >

3 DESCRIPTION OF WORK — INITIAL DREDGING; DISPOSAL AREA - KILLCOHOOK

4 EXCAVATION

			REMARKS
A. REQUIRED		1,282,438 C.Y.	4,104,000 s.f. of Dredging Area
B. PAY OVERDEPTH	+	0 C.Y.	
C. MAX. PAY YARDAGE	=	1,282,438 C.Y.	(YARDAGE USED ON BID FORM)
D. O.D. NOT DREDGED	-	0 C.Y.	
E. NET PAY YARDAGE	=	1,282,438 C.Y.	(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)
F. NON-PAY YARDAGE	+	507,700 C.Y.	3.3 Average feet of overdigging
G. GROSS YARDAGE	=	1,790,138 C.Y.	(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)

Estimated by: Jose Alvarez — 22 Jan 1991 — Checked by: ________

PRODUCTION WORK SHEET

B BID ITEM # 2

PIPELINE DREDGE TIME

			REMARKS
1 SIZE OF DREDGE....PIPELINE........>		27 INCH	
2 POWER OUTPUT......MAIN PUMP........>		4,000 HP	Chart is based on 4000 Horsepower.
3 MAXIMUM LINE LENGTH		36,000 L.F.	
4 AVERAGE LINE LENGTH		26,000 L.F.	Actual Pipeline
5 NUMBER OF BOOSTERS IN LINE		1	Each Booster is 4200 Horsepower.
6 PRODUCTION.........(BASED ON)......>		27,000 L.F.	26,000 L.F. + 1000 Equiv. feet of pipe.
A. CHART PRODUCTION		710 C.Y./HR	Adjusted Chart is based on 8200 Total Horsepower in line.
B. BOOSTER FACTOR	x	0.9	10% LOSS IN PUMPING TIME PER BOOSTER
C. MATERIAL FACTOR	x	1.55	SAND (MUD >= 2.0 > SAND >= 0.7 > ROCK)
D. BANK FACTOR	x	1.1	11.74 FT. AVERAGE BANK HEIGHT
E. OTHER FACTOR	x	0.9	
F. NET PRODUCTION	=	980 CY/HR	
G. OPERATING HRS/DAY	x	16	
H. OPERATING DAYS/MONTH	x	28	
I. CUBIC YARDS/MONTH	=	439,201	
J. DREDGE TIME		4.08 MONTHS	1,790,138 C.Y.(GROSS) DIVIDED BY 439,201 C.Y./MONTH
K. CLEANUP	+	0.41 MONTHS	10% ADDITIONAL DREDGING TIME
7 TOTAL DREDGE TIME	=	4.48 MONTHS	286,036 Pay c.y. per month

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

PRODUCTION WORK SHEET

C EXCAVATION COSTS BID ITEM # 2

			REMARKS
1 PLANT OWNERSHIP COSTS		$79,085 PER MO	
2 OPERATING COSTS	+	$657,891 PER MO	
3 PIPELINE COSTS BASED ON SAND			DETERMINED BY MATERIAL FACTOR ON SHEET B, ITEM 6 D.
A. FLOATING PIPELINE	+	$53,600 PER MO	8,000 LIN. FEET @ $6.70 PER L.F./MO
B. SUBMERGED PIPELINE	+	$79,200 PER MO	18,000 LIN. FEET @ $4.40 PER L.F./MO
C. SHORELINE	+	$0 PER MO	0 LIN. FEET @ $3.00 PER L.F./MO
D. PARTIALLY UTILIZED PIPELINE	+	$23,500 PER MO	10,000 LIN. FEET @ $2.35 PER L.F./MO(50% OF RATE)
4 BOOSTER(S)	+	$156,000 PER MO	1 BOOSTERS @ $156,000 EACH
5 SPECIAL COSTS	+	$70,000 PER MO	
6 TOTAL MONTHLY COST	=	$1,119,276	
7 DREDGE TIME	x	4.48 MO	
8 SUBTOTAL	=	$5,018,265	
9 ADDITIONAL COSTS	+	$0 L.S.	
10 SUBTOTAL	=	$5,018,265	
11 OVERHEAD 12.0%	+	$602,192	SUBTOTAL---> $5,620,457
12 PROFIT 10.0%	+	$562,046	SUBTOTAL---> $6,182,503 Planning Estimate
13 BOND 1.0%	+	$61,825	
14 NET PAY YARDAGE COST	=	$6,244,328	
15 NET PAY YARDAGE	/	1,282,438 CY	FROM SHEET A, ITEM 4 E.
16 UNIT COST	=	$4.87 PER CY	
17 MAX PAY YARDAGE	x	1,282,438 C.Y.	FROM BID SCHEDULE (SEE SHEET A, ITEM 4 C.)
18 TOTAL DREDGING COST	=	$6,245,473	FOR BID SCHEDULE

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

##

M   MONTHLY OWNERSHIP & OPERATING COSTS

##

			REMARKS
1 CURRENT FUEL PRICE		$0.95 /GAL	
2 AVERAGE PLANT USEAGE		7 MO/YR	
3 CURRENT INTEREST RATE		10 % /YR	
4 MENU ITEM SELECTED................>		27 " DREDGE	Planning Estimate
		4,000 HP	MAIN PUMP CHART HORSEPOWER
5 DREDGE COSTS......................>		$79,085 /MO	PLANT OWNERSHIP COSTS
	+	$657,891 /MO	OPERATING COSTS ($295,223 /MO PAYROLL)
	=	$736,976 /MO	TOT. DREDGE COSTS (AVE. CREW RATE= $27.93 /MANHOUR INCLUDING FRINGE BENEFITS & TAXES)
6 BOOSTER INFORMATION		4,200 HP	PUMP MOTOR
7 COST PER BOOSTER		$156,000 /MO	(INCLUDES LABOR, OPER. & OWNERSHIP)
8 NUMBER OF BOOSTERS	x	1	(MOBILIZATION & DEMOB. INFORMATION)
9 TOTAL BOOSTER COST	=	$156,000 /MO	(MOBILIZATION & DEMOB. INFORMATION)

10 FLOATING PIPELINE		8,000 LIN. FEET @	$4.90 PER L.F./MO (MUD RATE) =	$39,200 PER MONTH
11 SUBMERGED PIPELINE	+	24,000 LIN. FEET @	$3.40 PER L.F./MO (MUD RATE) =	$81,600 PER MONTH
12 SHORELINE	+	4,000 LIN. FEET @	$2.10 PER L.F./MO (MUD RATE) =	$8,400 PER MONTH
13 TOTAL PIPELINE	=	36,000 LIN. FEET	(MOBILIZATION & DEMOB. INFORMATION)	$129,200 PER MONTH

Estimated by: Jose Alvarez   22 Jan. 1991   Checked by: ________

>DREDGE SIZE = 27 in. pipeline >MAIN PUMP = 4,000 H.P.

>ANNUAL % = 5.65 % >LIFE = 30 yrs >SALV = 10% >USE = 7 working months per year

PIPELINE COSTS PER L.F. PER MONTH

TYPE OF PIPELINE	MATERIAL PUMPED MUD	SAND	ROCK
FLOATING	$4.90	$6.70	$10.40
SUBMERGED	$3.40	$4.40	$7.10
SHORELINE	$2.10	$3.00	$4.90

MATERIAL FACTORS

DESCRIPTION	INPLACE DENSITY		FACTOR
MUD & SILT	1200	GR/L	3
MUD & SILT	1300	GR/L	2.5
MUD & SILT	1400	GR/L	2
LOOSE SAND	1700	GR/L	1.1
LOOSE SAND	1900	GR/L	1
COMPACTED SAND	2000	GR/L	0.9
STIFF CLAY	2000	GR/L	.5-.7
COMPACTED SHELL	2300	GR/L	.4-.6
SOFT ROCK	2400	GR/L	.3-.5
BLASTED ROCK	2000	GR/L	.2-.3

STANDARD DREDGE PRODUCTION BASED ON PIPELINE LENGTH

5,500 L.F. OF PIPE	1500 C.Y. PER HOUR
11,000 L.F. OF PIPE	980 C.Y. PER HOUR
15,500 L.F. OF PIPE	420 C.Y. PER HOUR

BANK FACTORS

BANK HEIGHT	1	2	3	4	5	6	7	8	9
FACTOR	NA	0.43	0.55	0.65	0.78	0.9	1	1.1	1.1

PLANT OWNERSHIP

	NO.	TOTAL VALUE $	DEPRECIATION RATE %	A AMOUNT $	INTEREST RATE %	B AMOUNT $	CFC RATE %	C AMOUNT $
DREDGE	1	$5,000,000	3.00	$150,000	5.65	$282,500	4.52	$226,000
TUGS	2	$500,000	4.50	$22,500	5.72	$28,606	4.24	$21,200
DERRICK BARGE	1	$120,000	4.50	$5,400	5.72	$6,865	4.24	$5,088
WORK BARGE	2	$200,000	4.75	$9,500	5.49	$10,974	4.39	$8,779
FUEL/WATER BARGE	1	$110,000	4.75	$5,225	5.49	$6,036	4.39	$4,828
YARD EQUIP(MISC.)	LS	$80,000	10.00	$8,000	5.50	$4,402	4.40	$3,522
CREW/WORKBOAT	1	$75,000	9.50	$7,125	5.72	$4,291	4.24	$3,180
SKIFF w/MOTOR	2	$16,000	7.92	$1,267	5.65	$904	4.52	$723
TOTALS			A=	$209,017	B=	$344,578	C=	$273,320

BID ESTIMATE A + B = $553,595 per year divided by 7 months/year= $79,085 per month (Bid Est.)

MOD. ESTIMATE A + C = $482,338 per year divided by 7 months/year= $68,905 per month (Mod. Est.)

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

>DREDGE SIZE = 27 in. (menu items 6 & 14)

OPERATING COSTS

PAYROLL (24 HR OPR)	NO.	RATE	AMOUNT	
PROJECT MGR				
SUPERINTENDENT				
CAPTAIN	1	per month	$3,000	
CHIEF ENGR.	1	"	$2,800	
CIVIL ENGR.	1	"		
OFFICE MGR				
OFFICE PERSONNEL	1	"	$1,800	
SUBTOTAL....			$7,600	
TAXES,INS.,FRINGES......		33.7%	$2,564	
MANAGEMENT PAYROLL.....>			$10,164	per w/mo
LEVERMAN	3	$18.85	$56.55	
WATCH ENGINEER	3	$18.15	$54.45	
DREDGE MATES	2	$16.76	$33.52	
TUG MASTERS	2	$17.63	$35.26	
TUG MATES	3	$14.83	$44.49	
MAINTENANCE ENGINEERS		$17.89	$0.00	
EQUIPMENT OPERATORS	3	$19.00	$57.00	
WELDERS	2	$17.63	$35.26	
OILERS	2	$15.18	$30.36	
DECKHANDS	12	$14.65	$175.80	
ELECTRICIAN	1	$17.63	$17.63	
GENERAL DUMP FOREMAN	1	$17.89	$17.89	
DUMP FOREMAN	2	$16.50	$33.00	
YARD AND SHORE MEN	6	$14.65	$87.90	
CREW TOTAL (3 SHIFTS)	42 MEN		$679.11	per hour

WAGES (UNION)

WORK 56 HRS /WK			
PAY 64 HRS /WK 4.34WKS/wMO		$188,630	
TAXES,INS.,FRINGES......	45.7%	$86,266	
CREW PAYROLL...........>		$285,059	per w/mo
+ MANAGEMENT PAYROLL.....>		$10,164	per w/mo
PAYROLL COSTS.........>		$295,223	per w/mo

BOOSTER	4,200 HP	$156,000

PLANT		
EST. TOTAL PLANT	5,800 HP	
FUEL		$101,948
WATER,LUBE,SUPPLIES		$30,000
DREDGE WEAR(PUMP,PIPE,CUTTER)		$85,000
REPAIR & DRYDOCK		$95,800
YARD COST		$17,770
INSURANCE		$19,830
LAY UP		$12,320
PLANT COSTS...........>		$362,668
+ PAYROLL COSTS..........>		$295,223

MONTHLY OPERATING COSTS= $657,891

Taxes, insurance and fringes on labor:
(based on Decision Number 88-FL-0196)

Social Security		7.7%
Workman's Compensation		7.5%
State Unemployment Comp.		6.2%
Federal Unemployment Comp.		0.8%
Fringes...	$2.71 per hour	14.7%
(Not based	8 paid hol.	1.9%
on O.T.)	8.0%vacation	7.0%
TAXES,INS.,FRINGES......CREW...		45.7%
-(BENEFIT DIFERENTIAL)		12.0%
TAXES,INS.,FRINGES......MANAGEMENT..		33.7%

(ave. gross crew wage = $27.93 per manhour)

Estimated by: Jose Alvarez

 22 Jan 1991

Checked by: ________

PRODUCTION WORK SHEET

P BID ITEM # 2

PRODUCTION FACTOR COMPUTATIONS

PRODUCTION FACTORS FOR A 27 " DREDGE

STANDARD DREDGE PRODUCTION BASED ON CHART HORSEPOWER

UP TO	5,500 L.F. OF PIPE	1,500 C.Y./HR
AT	11,000 L.F. OF PIPE	980 C.Y./HR
AT	15,500 L.F. OF PIPE	420 C.Y./HR

Chart Horsepower from information sheet = 4000
Total Available Horsepower = 4000
Number of Boosters = 1
Booster H.P. from information sheet = 4200

(Total Available Horsepower +
Number of Boosters x Booster H.P.) / Chart H.P) =
Chart Adjustment Factor

(4000 H.P. + 1 Booster(s) x 4200 H.P.) / 4000 H.P. =
2.05 Chart Adjustment Factor (C.A.F.)

ADJUSTED DREDGE PRODUCTION CHART BASED ON C.A.F.

UP TO	11,275 L.F. OF PIPE	1,500 C.Y./HR
AT	22,550 L.F. OF PIPE	980 C.Y./HR
AT	31,775 L.F. OF PIPE	420 C.Y./HR

27,000 L.F. OF PIPE
710 CY/HR

BANK FACTORS 11.74 FT. AVERAGE BANK HEIGHT
1.1 BANK FACTOR

FROM CHART BANK	FACTOR	INTERPOLATIONS FROM CHART IF	USE
0	NA		
		(bank<1)	NA
1	NA		
		(1<=bank<2)	NA
2	0.43		
		(2<=bank<3)	1.5989
3	0.55		
		(3<=bank<4)	1.424
4	0.65		
		(4<=bank<5)	1.6562
5	0.78		
		(5<=bank<6)	1.5888
6	0.9		
		(6<=bank<7)	1.474
7	1		
		(7<=bank<8)	1.474
8	1.1		
		(8<=bank<9)	1.1
9	1.1		
		(9<=bank)	1.1

MATERIAL FACTOR CHOSEN = 1.55 SAND
(MUD >= 2.0 > SAND >= 0.7 > ROCK)

MENU ITEMS:
0 MUD
1 SAND
2 ROCK

MENU ITEMS:
0 BID ESTIMATE
1 MOD. ESTIM.

PIPELINE COSTS PER L.F. PER MONTH

TYPE OF PIPELINE	MATERIAL PUMPED MUD	SAND	ROCK
FLOATING	$4.90	$6.70	$10.40
SUBMERGED	$3.40	$4.40	$7.10
SHORELINE	$2.10	$3.00	$4.90

MENU ITEM AUTOMATICALLY CHOSEN:
(0 MUD,1 SAND,2 ROCK) 1 SAND

FLOATING	$6.70 PER L.F./MO
SUBMERGED	$4.40 PER L.F./MO
SHORELINE	$3.00 PER L.F./MO

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

D MOB & DEMOB BID ITEM # 1

27 " Dredge

	MOBILIZATION # DAYS		MOBILIZATION $/DAY		MOBILIZATION TOTAL	DEMOBILIZATION # DAYS		DEMOBILIZATION $/DAY		DEMOBILIZATION TOTAL
1. PREPARE DREDGE FOR TRANSFER	2	x	$11,459	=	$22,919	2	x	$12,084	=	$24,169
2. PREPARE PIPELINE FOR TRANSFER	5	x	$4,635	=	$23,173	3	x	$4,860	=	$14,579
3. TRANSFER ALL PLANT 50 MILES @ 100 miles/day =	0.5	x	$30,741	=	$15,370	0.5	x	$30,741	=	$15,370
4. MARINE INSURANCE	L.S.			=	$1,500	L.S.			=	$1,500
5. PERMANENT PERSONNEL & MISC.	L.S.			=	$820	L.S.			=	$820
6. PREPARE DREDGE AFTER TRANSFER	2	x	$12,003	=	$24,006	2	x	$11,378	=	$22,756
7. PREPARE PIPELINE AFTER TRANSFER	2	x	$4,860	=	$9,719	2	x	$4,635	=	$9,269
8. OTHER				=	$0	L.S. (CLEANUP)			=	$16,550
	SUBTOTAL MOBILIZATION				$97,507	SUBTOTAL DEMOBILIZATION				$105,013

9. SUBTOTAL MOBILIZATION & DEMOBILIZATION		= $202,521	
10. OVERHEAD	12.0%	+ $24,302	$226,823 <--SUBTOTAL
11. PROFIT	10.0%	+ $22,682	$249,505 <--SUBTOTAL
12. BOND	1.0%	+ $2,495	
13. TOTAL MOBILIZATION & DEMOBILIZATION		= $252,000	

Planning Estimate

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

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6 MOB & DEMOB   BID ITEM # 1

##

27 " Dredge

6. PREPARE DREDGE AFTER TRANSFER

	MOBILIZATION	DEMOBILIZATION
25 men @ 8 hrs/day @ $27.93 per hour =	$5,586	$5,586
Support equipment with operators @ $500 /day	$500	$500
Plant ownership per day =	$4,292	$4,292
Fuel (plant idle) @ $1,000 /day	$1,000	$1,000
Subsistence 25 men @ $25.00 per day =	$625	----
COST PER DAY	$12,003	$11,378

7. PREPARE PIPELINE AFTER TRANSFER

	MOBILIZATION	DEMOBILIZATION
9 men @ 8 hrs/day @ $27.93 per hour =	$2,011	$2,011
Pipeline ownership per day =	$2,124	$2,124
Subsistence 9 men @ $25.00 per day =	$225	----
Support equipment with operators @ $500 /day	$500	$500
COST PER DAY	$4,860	$4,635

Estimated by: Jose Alvarez   22 Jan 1991   Checked by: ________

M-CACES MAINTENANCE DREDGING COSTS

PIPELINE DREDGE ESTIMATE
A
YARDAGE ESTIMATE

BID ITEM # 2

1 PROJECT SALEM RIVER - HYD DREDG - 18'

2 LOCATION SALEM, NJ INVIT. NO. >

3 DESCRIPTION OF WORK MAINTENANCE DREDGING; DISPOSAL AREA - KILLCOHOOK

CYCLE: 3 YEARS

4 EXCAVATION

			REMARKS
A. REQUIRED		188,100 C.Y.	4,000,000 s.f. of Dredging Area
B. PAY OVERDEPTH	+	0 C.Y.	
C. MAX. PAY YARDAGE	=	188,100 C.Y.	(YARDAGE USED ON BID FORM)
D. O.D. NOT DREDGED	-	0 C.Y.	
E. NET PAY YARDAGE	=	188,100 C.Y.	(YARDAGE USED TO FIGURE UNIT PRICE PER C.Y.)
F. NON-PAY YARDAGE	+	103,700 C.Y.	0.7 Average feet of overdigging
G. GROSS YARDAGE	=	291,800 C.Y.	(YARDAGE USED TO FIGURE PRODUCTION TIME & COST)

Estimated by: Jose Alvarez 22 Jan 1991 Checked by: ________

PRODUCTION WORK SHEET

B BID ITEM # 2

PIPELINE DREDGE TIME

			REMARKS
1 SIZE OF DREDGE....PIPELINE........>		27 INCH	
2 POWER OUTPUT......MAIN PUMP.......>		4,000 HP	Chart is based on 4000 Horsepower.
3 MAXIMUM LINE LENGTH		36,000 L.F.	
4 AVERAGE LINE LENGTH		26,000 L.F.	Actual Pipeline
5 NUMBER OF BOOSTERS IN LINE		1	Each Booster is 4200 Horsepower.
6 PRODUCTION.........(BASED ON)......>		27,000 L.F.	26,000 L.F. + 1000 Equiv. feet of pipe.
A. CHART PRODUCTION		710 C.Y./HR	Adjusted Chart is based on 8200 Total Horsepower in line.
B. BOOSTER FACTOR	x	0.85	15% LOSS IN PUMPING TIME PER BOOSTER
C. MATERIAL FACTOR	x	3	MUD (MUD >= 2.0 > SAND >= 0.7 > ROCK)
D. BANK FACTOR	x	0.43	2 FT. AVERAGE BANK HEIGHT
E. OTHER FACTOR	x	1	
F. NET PRODUCTION	=	778 CY/HR	
G. OPERATING HRS/DAY	x	16	
H. OPERATING DAYS/MONTH	x	28	
I. CUBIC YARDS/MONTH	=	348,708	
J. DREDGE TIME		0.84 MONTHS	291,800 C.Y.(GROSS) DIVIDED BY 348,708 C.Y./MONTH
K. CLEANUP	+	0.08 MONTHS	10% ADDITIONAL DREDGING TIME *
7 TOTAL DREDGE TIME	=	0.92 MONTHS	284,349 Pay c.y. per month

PRODUCTION WORK SHEET

C EXCAVATION COSTS

BID ITEM # 2

				REMARKS
1 PLANT OWNERSHIP COSTS			$79,085 PER MO	
2 OPERATING COSTS		+	$657,891 PER MO	
3 PIPELINE COSTS BASED ON MUD				DETERMINED BY MATERIAL FACTOR ON SHEET B, ITEM 6 D.
A. FLOATING PIPELINE		+	$39,200 PER MO	8,000 LIN. FEET @ $4.90 PER L.F./MO
B. SUBMERGED PIPELINE		+	$61,200 PER MO	18,000 LIN. FEET @ $3.40 PER L.F./MO
C. SHORELINE		+	$0 PER MO	0 LIN. FEET @ $2.10 PER L.F./MO
D. PARTIALLY UTILIZED PIPELINE		+	$17,333 PER MO	10,000 LIN. FEET @ $1.73 PER L.F./MO(50% OF RATE)
4 BOOSTER(S)		+	$156,000 PER MO	1 BOOSTERS @ $156,000 EACH
5 SPECIAL COSTS		+	$59,000 PER MO	
6 TOTAL MONTHLY COST		=	$1,069,709	
7 DREDGE TIME		x	0.92 MO	
8 SUBTOTAL		=	$984,650	
9 ADDITIONAL COSTS		+	$0 L.S.	
10 SUBTOTAL		=	$984,650	
11 OVERHEAD	12.0%	+	$118,158	SUBTOTAL---> $1,102,808
12 PROFIT	10.0%	+	$110,281	SUBTOTAL---> $1,213,089 Planning Estimate
13 BOND	1.0%	+	$12,131	
14 NET PAY YARDAGE COST		=	$1,225,220	
15 NET PAY YARDAGE		/	188,100 CY	FROM SHEET A, ITEM 4 E.
16 UNIT COST		=	$6.51 PER CY	
17 MAX PAY YARDAGE		x	188,100 C.Y.	FROM BID SCHEDULE (SEE SHEET A, ITEM 4 C.)
18 TOTAL DREDGING COST		=	$1,224,531	FOR BID SCHEDULE

M   MONTHLY OWNERSHIP & OPERATING COSTS

			REMARKS
1 CURRENT FUEL PRICE		$0.95 /GAL	
2 AVERAGE PLANT USEAGE		7 MO/YR	
3 CURRENT INTEREST RATE		10 % /YR	
4 MENU ITEM SELECTED................>		27 " DREDGE	Planning Estimate
		4,000 HP	MAIN PUMP CHART HORSEPOWER
5 DREDGE COSTS......................>		$79,085 /MO	PLANT OWNERSHIP COSTS
	+	$657,891 /MO	OPERATING COSTS ($295,223 /MO PAYROLL)
	=	$736,976 /MO	TOT. DREDGE COSTS (AVE. CREW RATE= $27.93 /MANHOUR INCLUDING FRINGE BENEFITS & TAXES)
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7 COST PER BOOSTER		$156,000 /MO	(INCLUDES LABOR, OPER. & OWNERSHIP)
8 NUMBER OF BOOSTERS	x	1	(MOBILIZATION & DEMOB. INFORMATION)
9 TOTAL BOOSTER COST	=	$156,000 /MO	(MOBILIZATION & DEMOB. INFORMATION)

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11 SUBMERGED PIPELINE	+	24,000 LIN. FEET @	$3.40 PER L.F./MO (MUD RATE) =	$81,600 PER MONTH
12 SHORELINE	+	4,000 LIN. FEET @	$2.10 PER L.F./MO (MUD RATE) =	$8,400 PER MONTH
13 TOTAL PIPELINE	=	36,000 LIN. FEET	(MOBILIZATION & DEMOB. INFORMATION)	$129,200 PER MONTH

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LOOSE SAND	1900	GR/L	1
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BANK FACTORS

BANK HEIGHT	1	2	3	4	5	6	7	8	9
FACTOR	NA	0.43	0.55	0.65	0.78	0.9	1	1.1	1.1

PLANT OWNERSHIP

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TUG MATES	3	$14.83	$44.49
MAINTENANCE ENGINEERS		$17.89	$0.00
EQUIPMENT OPERATORS	3	$19.00	$57.00
WELDERS	2	$17.63	$35.26
OILERS	2	$15.18	$30.36
DECKHANDS	12	$14.65	$175.80
ELECTRICIAN	1	$17.63	$17.63
GENERAL DUMP FOREMAN	1	$17.89	$17.89
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+ MANAGEMENT PAYROLL.....>		$10,164 per w/mo
PAYROLL COSTS.........>		$295,223 per w/mo

BOOSTER 4,200 HP $156,000

PLANT		
EST. TOTAL PLANT	5,800 HP	
FUEL		$101,948
WATER,LUBE,SUPPLIES		$30,000
DREDGE WEAR(PUMP,PIPE,CUTTER)		$85,000
REPAIR & DRYDOCK		$95,800
YARD COST		$17,770
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LAY UP		$12,320
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Taxes, insurance and fringes on labor:
(based on Decision Number 88-FL-0196)

Social Security		7.7%
Workman's Compensation		7.5%
State Unemployment Comp.		6.2%
Federal Unemployment Comp.		0.8%
Fringes...	$2.71 per hour	14.7%
(Not based	8 paid hol.	1.9%
on O.T.)	8.0%vacation	7.0%
TAXES,INS.,FRINGES......CREW...		45.7%
-(BENEFIT DIFERENTIAL)		12.0%
TAXES,INS.,FRINGES......MANAGEMENT..		33.7%

(ave. gross crew wage = $27.93 per manhour)

##

PRODUCTION WORK SHEET

P   BID ITEM # 2

PRODUCTION FACTOR COMPUTATIONS

##

PRODUCTION FACTORS FOR A 27 " DREDGE

STANDARD DREDGE PRODUCTION BASED ON CHART HORSEPOWER

UP TO	5,500 L.F. 0F PIPE	1,500 C.Y./HR
AT	11,000 L.F. 0F PIPE	980 C.Y./HR
AT	15,500 L.F. 0F PIPE	420 C.Y./HR

Chart Horsepower from information sheet = 4000
Total Available Horsepower = 4000
Number of Boosters = 1
Booster H.P. from information sheet = 4200

(Total Available Horsepower +
Number of Boosters x Booster H.P.) / Chart H.P) =
Chart Adjustment Factor

(4000 H.P. + 1 Booster(s) x 4200 H.P.) / 4000 H.P. =
2.05 Chart Adjustment Factor (C.A.F.)

ADJUSTED DREDGE PRODUCTION CHART BASED ON C.A.F.

UP TO	11,275 L.F. 0F PIPE	1,500 C.Y./HR
AT	22,550 L.F. 0F PIPE	980 C.Y./HR
AT	31,775 L.F. 0F PIPE	420 C.Y./HR

27,000 L.F. 0F PIPE
710 CY/HR

BANK FACTORS   2 FT. AVERAGE BANK HEIGHT
0.43 BANK FACTOR

BANK	FROM CHART FACTOR	INTERPOLATIONS FROM CHART IF	USE
0	NA		
		(bank<1)	NA
1	NA		
		(1<=bank<2)	NA
2	0.43		
		(2<=bank<3)	0.43
3	0.55		
		(3<=bank<4)	0.45
4	0.65		
		(4<=bank<5)	0.39
5	0.78		
		(5<=bank<6)	0.42
6	0.9		
		(6<=bank<7)	0.5
7	1		
		(7<=bank<8)	0.5
8	1.1		
		(8<=bank<9)	1.1
9	1.1		
		(9<=bank)	1.1

MATERIAL FACTOR CHOSEN = 3 MUD
(MUD >= [illegible] > SAND >= 0.7 > ROCK)

MENU ITEMS:
0 MUD
1 SAND
2 ROCK

MENU ITEMS:
0 BID ESTIMATE
1 MOD. ESTIM.

PIPELINE COSTS PER L.F. PER MONTH

TYPE OF PIPELINE	MATERIAL PUMPED MUD	SAND	ROCK
FLOATING	$4.90	$6.70	$10.40
SUBMERGED	$3.40	$4.40	$7.10
SHORELINE	$2.10	$3.00	$4.90

MENU ITEM AUTOMATICALLY CHOSEN:
(0 MUD,1 SAND,2 ROCK)   0 MUD

FLOATING	$4.90	PER L.F./MO
SUBMERGED	$3.40	PER L.F./MO
SHORELINE	$2.10	PER L.F./MO

Estimated by: Jose Alvarez   22 Jan 1991   Checked by: ________

D   MOB & DEMOB   BID ITEM # 1

27 " Dredge

	MOBILIZATION			DEMOBILIZATION		
	# DAYS	$/DAY	TOTAL	# DAYS	$/DAY	TOTAL
1. PREPARE DREDGE FOR TRANSFER	2 x	$11,459 =	$22,919	2 x	$12,084 =	$24,169
2. PREPARE PIPELINE FOR TRANSFER	5 x	$4,635 =	$23,173	3 x	$4,860 =	$14,579
3. TRANSFER ALL PLANT 50 MILES @ 100 miles/day =	0.5 x	$30,741 =	$15,370	0.5 x	$30,741 =	$15,370
4. MARINE INSURANCE	L.S.	=	$1,500	L.S.	=	$1,500
5. PERMANENT PERSONNEL & MISC.	L.S.	=	$820	L.S.	=	$820
6. PREPARE DREDGE AFTER TRANSFER	2 x	$12,003 =	$24,006	2 x	$11,378 =	$22,756
7. PREPARE PIPELINE AFTER TRANSFER	2 x	$4,860 =	$9,719	2 x	$4,635 =	$9,269
8. OTHER		=	$0	L.S. (CLEANUP)	=	$16,550
	SUBTOTAL MOBILIZATION		$97,507	SUBTOTAL DEMOBILIZATION		$105,013

9. SUBTOTAL MOBILIZATION & DEMOBILIZATION		= $202,521	
10. OVERHEAD	12.0%	+ $24,302	$226,823 <--SUBTOTAL
11. PROFIT	10.0%	+ $22,682	$249,505 <--SUBTOTAL
12. BOND	1.0%	+ $2,495	
13. TOTAL MOBILIZATION & DEMOBILIZATION		= $252,000	

Planning Estimate

Estimated by: Jose Alvarez   22 Jan 1991   Checked by: ________

##

E   MOB & DEMOB   BID ITEM #   1

##

27 " Dredge

1. PREPARE DREDGE FOR TRANSFER	MOBILIZATION	DEMOBILIZATION
25 men @ 8 hr/day refurbishing @ $27.93 per hour =	$5,586	$5,586
Supplies & small tools @ $91 /day	$91	$91
Support equipment with operators @ $500 /day	$500	$500
Plant ownership		
Basic plant $79,085 /month		
Booster(s) $51,480 /month (1 @ $156,000 x 33%)		
$130,565 /month divided by 30.42 days/month =	$4,292	$4,292
Fuel (plant idle) @ $990 /day	$990	$990
Subsistence 25 men @ $25.00 per day =	----	$625
COST PER DAY	$11,459	$12,084

2. PREPARE PIPELINE FOR TRANSFER	MOBILIZATION	DEMOBILIZATION
9 men @ 8 hrs/day @ $27.93 per hour =	$2,011	----
9 men @ 8 hrs/day @ $27.93 per hour =	----	$2,011
Supplies & small tools @ $500 /day	$500	$500
Pipeline ownership $129,200 /month		
divided by 30.42 days/month x 50% =	$2,124	$2,124
Subsistence 9 men @ $25.00 per day =	----	$225
COST PER DAY	$4,635	$4,860

Estimated by: Jose Alvarez   22 Jan 1991   Checked by: ________

F MOB & DEMOB	BID ITEM #	1

27 " Dredge

3. TRANSFER PLANT	MOBILIZATION	DEMOBILIZATION
13 men/shift (2-12 hour shifts/day) @ $27.93 per manhour =	$8,714	$8,714
Plant ownership per day =	$4,292	$4,292
Pipeline ownership per day =	$2,124	$2,124
Plant costs $362,668 /month (Operating costs minus payroll)		
divided by 30.42 days/month x 50% =	$5,961	$5,961
Subsistence 26 men @ $25.00 per day =	$650	$650
Towing vessel(s): 750 H.P. Rental Tug @		
$6,000 per day (towing)		
$3,000 per day (return to port)		
$9,000 per day x 1 towing vessel(s) =	$9,000	$9,000
COST PER DAY	$30,741	$30,741

4. MARINE INSURANCE $1,500 each tow (MOB & DEMOB)

5. PERMANENT PERSONNEL & MISC.	MOBILIZATION	DEMOBILIZATION
3 men @ 8 hrs/day @ $27.93 per hour @ 1 DAY	$670	$670
Travel Expenses $50 per man	$150	$150
Local hire @ $0 /day	$0	----
TOTAL	$820	$820

Estimated by: Jose Alvarez   22 Jan 1991   Checked by: ________

##

6 MOB & DEMOB BID ITEM # 1

##

27 " Dredge

6. PREPARE DREDGE AFTER TRANSFER

	MOBILIZATION	DEMOBILIZATION
25 men @ 8 hrs/day @ $27.93 per hour =	$5,586	$5,586
Support equipment with operators @ $500 /day	$500	$500
Plant ownership per day =	$4,292	$4,292
Fuel (plant idle) @ $1,000 /day	$1,000	$1,000
Subsistence 25 men @ $25.00 per day =	$625	----
COST PER DAY	$12,003	$11,378

7. PREPARE PIPELINE AFTER TRANSFER

	MOBILIZATION	DEMOBILIZATION
9 men @ 8 hrs/day @ $27.93 per hour =	$2,011	$2,011
Pipeline ownership per day =	$2,124	$2,124
Subsistence 9 men @ $25.00 per day =	$225	----
Support equipment with operators @ $500 /day	$500	$500
COST PER DAY	$4,860	$4,635

COST ESTIMATE

FOR ALTERNATIVES

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 12 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	0	AC	$0.00	$0	$0	$0
	TOTAL, FISH AND WILDLIFE FACILITIES				$0	$0	$0
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$0	$0	$0
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	0	C.Y.	$0.00	$0	$0	$0
	TOTAL, DREDGING COST				$0	$0	$0
	TOTAL CONSTRUCTION COSTS				$0	$0	$0
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$0	$0	$0
31.-.-.-	CONSTRUCTION MANAGEMENT				$0	$0	$0
	SUBTOTAL				$0	$0	$0
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$0	$0	$0
	TOTAL, LANDS AND DAMAGES				$0	$0	$0
	TOTAL PROJECT COSTS				$0	$0	$0
	(ROUNDED)				$0	$0	$0

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 12 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$0	$0	$0
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	0	C.Y.	$0.00	$0	$0	$0
	SUBTOTAL, DREDGING COST				$0	$0	$0
12.0.-.-	TOTAL CONSTRUCTION COSTS				$0	$0	$0
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$0	$0	$0
31.-.-.-	CONSTRUCTION MANAGEMENT				$0	$0	$0
	TOTAL PROJECT COSTS				$0	$0	$0
	(ROUNDED)				$0	$0	$0

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH:	12 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	4 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$252,000	$63,000	$315,000
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	90000	C.Y.	$7.11	$639,900	$159,975	$799,875
	SUBTOTAL, DREDGING COST				$891,900	$222,975	$1,114,875
12.0.-.-	TOTAL CONSTRUCTION COSTS				$891,900	$222,975	$1,114,875
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$133,785	$33,446	$167,231
31.-.-.-	CONSTRUCTION MANAGEMENT				$89,190	$22,298	$111,488
	TOTAL PROJECT COSTS				$1,114,875	$278,719	$1,393,594
	(ROUNDED)				$1,115,000	$279,000	$1,394,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 12 FEET   D/A: KILLCOHOOK   ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990   CYCLE: 4 YEARS   DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$0	$0	$0
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	0	C.Y.	$0.00	$0	$0	$0
	SUBTOTAL, DREDGING COST				$0	$0	$0
12.0.-.-	TOTAL CONSTRUCTION COSTS				$0	$0	$0
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$0	$0	$0
31.-.-.-	CONSTRUCTION MANAGEMENT				$0	$0	$0
	TOTAL PROJECT COSTS				$0	$0	$0
	(ROUNDED)				$0	$0	$0

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 14 FEET   D/A: KILLCOHOOK   ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990   DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	4.5	AC	$18,525.00	$83,362	$20,840	$104,202
	TOTAL, FISH AND WILDLIFE FACILITIES				$83,362	$20,840	$104,202
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$243,350	$60,838	$304,188
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	393729	C.Y.	$5.62	$2,212,757	$553,189	$2,765,946
	TOTAL, DREDGING COST				$2,456,107	$614,027	$3,070,134
	TOTAL CONSTRUCTION COSTS				$2,539,469	$634,867	$3,174,336
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$500,000	$0	$500,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$300,000	$0	$300,000
	SUBTOTAL				$3,339,469	$634,867	$3,974,336
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$262,186	$55,732	$317,918
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$31,823	$5,978	$37,801
	TOTAL, LANDS AND DAMAGES				$294,009	$61,710	$355,719
	TOTAL PROJECT COSTS				$3,633,478	$696,577	$4,330,055
	(ROUNDED)				$3,633,000	$697,000	$4,330,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 14 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$8,550	$2,162	$10,8[illegible]
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	14000	C.Y.	$5.62	$78,680	$19,670	$98,[illegible]
					-----------	------------	------------
	SUBTOTAL, DREDGING COST				$87,330	$21,832	$109,1[illegible]
12.0.-.-	TOTAL CONSTRUCTION COSTS				$87,330	$21,832	$109,1[illegible]
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$13,100	$3,275	$16,375
31.-.-.-	CONSTRUCTION MANAGEMENT				$8,733	$2,183	$10,91[illegible]
					-----------	------------	------------
	SUBTOTAL				$109,163	$27,290	$136,453
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$23,229	$4,939	$28,168
					-----------	------------	------------
	TOTAL, LANDS AND DAMAGES				$23,229	$4,939	$28,168
	TOTAL PROJECT COST				$132,392	$32,229	$164,621
	(ROUNDED)				$132,000	$32,000	$164,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH: 14 FEET　　D/A: KILLCOHOOK　　ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990　　CYCLE: 4 YEARS　　DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	--------	JOB	L.S.	$240,900	$60,225	$301,125
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	147600	C.Y.	$6.63	$978,588	$244,647	$1,223,235
	SUBTOTAL, DREDGING COST				$1,219,488	$304,872	$1,524,360
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,219,488	$304,872	$1,524,360
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$182,923	$45,731	$228,654
31.-.-.-	CONSTRUCTION MANAGEMENT				$121,949	$30,487	$152,436
	TOTAL PROJECT COSTS				$1,524,360	$381,090	$1,905,450
	(ROUNDED)				$1,524,000	$381,000	$1,905,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 14 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 CYCLE: 4 YEARS DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	————	JOB	L.S.	$11,100	$2,775	$13,875
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	6800	C.Y.	$6.63	$45,084	$11,271	$56,355
	SUBTOTAL, DREDGING COST				$56,184	$14,046	$70,230
12.0.-.-	TOTAL CONSTRUCTION COSTS				$56,184	$14,046	$70,230
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,428	$2,107	$10,535
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,618	$1,404	$7,022
	TOTAL PROJECT COSTS				$70,230	$17,557	$87,787
	(ROUNDED)				$70,000	$18,000	$88,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 16 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	5.5	AC	$18,525.00	$101,888	$25,472	$127,360
	TOTAL, FISH AND WILDLIFE FACILITIES				$101,888	$25,472	$127,360
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$245,370	$61,342	$306,712
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	776030	C.Y.	$5.35	$4,151,760	$1,037,940	$5,189,700
	TOTAL, DREDGING COST				$4,397,130	$1,099,282	$5,496,412
	TOTAL CONSTRUCTION COSTS				$4,499,018	$1,124,754	$5,623,772
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$500,000	$0	$500,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$300,000	$0	$300,000
	SUBTOTAL				$5,299,018	$1,124,754	$6,423,772
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$499,449	$106,165	$605,614
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$34,498	$6,646	$41,144
	TOTAL, LAND AND DAMAGES				$533,947	$112,811	$646,758
	TOTAL PROJECT COSTS				$5,832,965	$1,237,565	$7,070,530
	(ROUNDED)				$5,833,000	$1,238,000	$7,071,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 16 FEET   D/A: KILLCOHOOK   ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990   DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$6,630	$1,658	$8,288
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.3	EXCAVATION AND DISPOSAL	20984	C.Y.	$5.35	$112,264	$28,066	$140,330
	SUBTOTAL, DREDGING COST				$118,894	$29,724	$148,618
12.0.-.-	TOTAL CONSTRUCTION COSTS				$118,894	$29,724	$148,618
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$17,834	$4,458	$22,291
31.-.-.-	CONSTRUCTION MANAGEMENT				$11,889	$2,972	$14,861
	SUBTOTAL				$148,617	$37,154	$185,771
01.-.-.-	LANDS AND DAMAGES						
01.0.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$29,580	$6,289	$35,869
	TOTAL, LAND AND DAMAGES				$29,580	$6,289	$35,869
	TOTAL PROJECT COSTS				$178,197	$43,443	$221,640
	(ROUNDED)				$178,000	$43,000	$221,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH: 16 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 CYCLE: 3 YEARS DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$241,700	$60,425	$302,125
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	148200	C.Y.	$6.61	$979,602	$244,900	$1,224,502
	SUBTOTAL, DREDGING COST				$1,221,302	$305,325	$1,526,627
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,221,302	$305,325	$1,526,627
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$183,195	$45,799	$228,994
31.-.-.-	CONSTRUCTION MANAGEMENT				$122,130	$30,532	$152,662
	TOTAL PROJECT COSTS				$1,526,627	$381,656	$1,908,283
	(ROUNDED)				$1,527,000	$382,000	$1,909,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 16 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 CYCLE: 3 YEARS DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$10,300	$2,575	$12,875
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	6300	C.Y.	$6.61	$41,643	$10,411	$52,054
	SUBTOTAL, DREDGING COST				$51,943	$12,986	$64,929
12.0.-.-	TOTAL CONSTRUCTION COSTS				$51,943	$12,986	$64,929
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$7,791	$1,948	$9,739
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,194	$1,298	$6,492
	TOTAL PROJECT COSTS				$64,928	$16,232	$81,160
	(ROUNDED)				$65,000	$16,000	$81,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 17 FEET　　D/A: KILLCOHOOK　　ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990　　DATE: 22 JAN 19991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	6.5	AC	$18,525.00	$120,412	$30,103	$150,515
	TOTAL, FISH AND WILDLIFE FACILITIES				$120,412	$30,103	$150,515
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$246,420	$61,605	$308,025
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	1077123	C.Y.	$4.99	$5,374,844	$1,343,711	$6,718,555
	TOTAL, DREDGING COST				$5,621,264	$1,405,316	$7,026,580
	TOTAL CONSTRUCTION COSTS				$5,741,676	$1,435,419	$7,177,095
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$525,000	$0	$525,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$400,000	$0	$400,000
	SUBTOTAL				$6,666,676	$1,435,419	$8,102,095
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$633,201	$134,596	$767,797
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$37,173	$7,315	$44,488
	TOTAL, LANDS AND DAMAGES				$670,374	$141,911	$812,285
	TOTAL PROJECT COSTS				$7,337,050	$1,577,330	$8,914,380
	(ROUNDED)				$7,337,000	$1,577,000	$8,914,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 17 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$5,580	$1,395	$6,975
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	24369	C.Y.	$4.99	$121,601	$30,400	$152,001
	SUBTOTAL, DREDGING COST				$127,181	$31,795	$158,976
12.0.-.-	TOTAL CONSTRUCTION COSTS				$127,161	$31,795	$158,976
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$19,077	$4,769	$23,846
31.-.-.-	CONSTRUCTION MANAGEMENT				$12,718	$3,180	$15,898
	SUBTOTAL				$158,976	$39,744	$198,720
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$32,731	$6,959	$39,690
	TOTAL, LANDS AND DAMAGES				$32,731	$6,959	$39,690
	TOTAL PROJECT COSTS				$191,707	$46,703	$238,410
	(ROUNDED)				$192,000	$47,000	$239,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH:	17 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$241,830	$60,458	$302,288
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	164100	C.Y.	$6.56	$1,076,496	$269,124	$1,345,620
	SUBTOTAL, DREDGING COST				$1,318,326	$329,582	$1,647,908
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,318,326	$329,582	$1,647,908
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$197,749	$49,437	$247,186
31.-.-.-	CONSTRUCTION MANAGEMENT				$131,833	$32,958	$164,791
	TOTAL PROJECT COSTS				$1,647,908	$411,977	$2,059,885
	(ROUNDED)				$1,648,000	$412,000	$2,060,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 17 FEET   D/A: KILLCOHOOK   ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990   CYCLE: 3 YEARS   DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$10,170	$2,542	$12,712
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	6900	C.Y.	$6.56	$45,264	$11,316	$56,580
	SUBTOTAL, DREDGING COST				$55,434	$13,858	$69,292
12.0.-.-	TOTAL CONSTRUCTION COSTS				$55,434	$13,858	$69,292
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,315	$2,079	$10,394
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,543	$1,386	$6,929
	TOTAL PROJECT COSTS				$69,292	$17,323	$86,615
	(ROUNDED)				$69,000	$17,000	$86,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 18 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	7	AC	$18,525.00	$129,675	$32,419	$162,094
	TOTAL, FISH AND WILDLIFE FACILITIES				$129,675	$32,419	$162,094
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$246,490	$61,622	$308,112
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	1254387	C.Y.	$4.87	$6,108,865	$1,527,216	$7,636,081
	TOTAL, DREDGING COST				$6,355,355	$1,588,838	$7,944,193
	TOTAL CONSTRUCTION COSTS				$6,485,030	$1,621,257	$8,106,287
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$525,000	$0	$525,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$400,000	$0	$400,000
	SUBTOTAL				$7,410,030	$1,621,257	$9,031,287
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$739,874	$157,271	$897,145
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$38,510	$7,649	$46,159
	TOTAL, LANDS AND DAMAGES				$778,384	$164,920	$943,304
	TOTAL PROJECT COSTS				$8,188,414	$1,786,177	$9,974,591
	(ROUNDED)				$8,188,000	$1,786,000	$9,974,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 18 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$5,510	$1,378	$6,888
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	28051	C.Y.	$4.87	$136,608	$34,152	$170,760
	SUBTOTAL, DREDGING COST				$142,118	$35,530	$177,648
12.0.-.-	TOTAL CONSTRUCTION COSTS				$142,118	$35,530	$177,648
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$21,318	$5,330	$26,648
31.-.-.-	CONSTRUCTION MANAGEMENT				$14,212	$3,553	$17,765
	SUBTOTAL				$177,648	$44,413	$222,061
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$35,920	$7,637	$43,557
	TOTAL, LANDS AND DAMAGES				$35,920	$7,637	$43,557
	TOTAL PROJECT COSTS				$213,568	$52,050	$265,618
	(ROUNDED)				$214,000	$52,000	$266,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH:	18 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$241,950	$60,488	$302,438
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	180600	C.Y.	$6.51	$1,175,706	$293,926	$1,469,632
	SUBTOTAL, DREDGING COST				$1,417,656	$354,414	$1,772,070
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,417,656	$354,414	$1,772,070
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$212,648	$53,162	$265,810
31.-.-.-	CONSTRUCTION MANAGEMENT				$141,766	$35,442	$177,208
	TOTAL PROJECT COSTS				$1,772,070	$443,018	$2,215,088
	(ROUNDED)				$1,772,000	$443,000	$2,215,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH:	18 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$10,050	$2,512	$12,562
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	7500	C.Y.	$6.51	$48,825	$12,206	$61,031
	SUBTOTAL, DREDGING COST				$58,875	$14,718	$73,593
12.0.-.-	TOTAL CONSTRUCTION COSTS				$58,875	$14,718	$73,593
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,831	$2,208	$11,039
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,888	$1,472	$7,360
	TOTAL PROJECT COSTS				$73,594	$18,398	$91,992
	(ROUNDED)				$74,000	$18,000	$92,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 19 FEET   D/A: KILLCOHOOK   ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990   DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R B	MITIGATION COSTS	8	AC	$18,525.00	$148,200	$37,050	$185,250
	TOTAL, FISH AND WILDLIFE FACILITIES				$148,200	$37,050	$185,250
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$248,140	$62,035	$310,175
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	2020045	C.Y.	$4.54	$9,171,004	$2,292,751	$11,463,755
	TOTAL, DREDGING COST				$9,419,144	$2,354,786	$11,773,930
	TOTAL CONSTRUCTION COSTS				$9,567,344	$2,391,836	$11,959,180
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$550,000	$0	$550,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$600,000	$0	$600,000
	SUBTOTAL				$10,717,344	$2,391,836	$13,109,180
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$1,099,998	$233,821	$1,333,819
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$41,185	$8,318	$49,503
	TOTAL, LANDS AND DAMAGES				$1,141,183	$242,139	$1,383,322
	TOTAL PROJECT COSTS				$11,858,527	$2,633,975	$14,492,502
	(ROUNDED)				$11,859,000	$2,634,000	$14,493,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 19 FEET　　D/A: KILLCOHOOK　　ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990　　DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$3,860	$965	$4,825
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	31391	C.Y.	$4.54	$142,515	$35,629	$178,144
					------------	------------	------------
	SUBTOTAL, DREDGING COST				$146,375	$36,594	$182,969
12.0.-.-	TOTAL CONSTRUCTION COSTS				$146,375	$36,594	$182,969
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$21,956	$5,489	$27,445
31.-.-.-	CONSTRUCTION MANAGEMENT				$14,638	$3,660	$18,298
					------------	------------	------------
	SUBTOTAL				$182,969	$45,743	$225,712
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$39,082	$8,309	$47,391
					------------	------------	------------
	TOTAL, LANDS AND DAMAGES				$39,082	$8,309	$47,391
	TOTAL PROJECT COSTS				$222,051	$54,052	$276,103
	(ROUNDED)				$222,000	$54,000	$276,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH:	19 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$243,290	$60,822	$304,112
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	226200	C.Y.	$6.16	$1,393,392	$348,348	$1,741,740
	SUBTOTAL, DREDGING COST				$1,636,682	$409,170	$2,045,852
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,636,662	$409,170	$2,045,852
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$245,502	$61,376	$306,878
31.-.-.-	CONSTRUCTION MANAGEMENT				$163,668	$40,917	$204,585
	TOTAL PROJECT COSTS				$2,045,852	$511,463	$2,557,315
	(ROUNDED)				$2,046,000	$511,000	$2,557,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH:	19 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$8,710	$2,178	$10,888
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	8100	C.Y.	$6.16	$49,896	$12,474	$62,370
	SUBTOTAL, DREDGING COST				$58,606	$14,652	$73,258
12.0.-.-	TOTAL CONSTRUCTION COSTS				$58,606	$14,652	$73,258
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,791	$2,198	$10,989
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,861	$1,465	$7,326
	TOTAL PROJECT COSTS				$73,258	$18,315	$91,573
	(ROUNDED)				$73,000	$18,000	$91,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 20 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	8.5	AC	$18,525.00	$157,462	$39,366	$196,828
	TOTAL, FISH AND WILDLIFE FACILITIES				$157,462	$39,366	$196,828
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$248,620	$62,155	$310,775
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	2575619	C.Y.	$4.45	$11,461,505	$2,865,376	$14,326,881
	TOTAL, DREDGING COST				$11,710,125	$2,927,531	$14,637,656
	TOTAL CONSTRUCTION COSTS				$11,867,587	$2,966,897	$14,834,484
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$550,000	$0	$550,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$600,000	$0	$600,000
	SUBTOTAL				$13,017,587	$2,966,897	$15,984,484
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$1,411,316	$299,996	$1,711,312
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$42,523	$8,653	$51,176
	TOTAL, LANDS AND DAMAGES				$1,453,839	$308,649	$1,762,488
	TOTAL PROJECT COSTS				$14,471,426	$3,275,546	$17,746,972
	(ROUNDED)				$14,471,000	$3,276,000	$17,747,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 20 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$3,380	$845	$4,225
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	35068	C.Y.	$4.45	$156,053	$39,013	$195,066
	SUBTOTAL, DREDGING COST				$159,433	$39,858	$199,291
12.0.-.-	TOTAL CONSTRUCTION COSTS				$159,433	$39,858	$199,291
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$23,915	$5,979	$29,894
31.-.-.-	CONSTRUCTION MANAGEMENT				$15,943	$3,986	$19,929
	SUBTOTAL				$199,291	$49,823	$249,114
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$41,131	$8,749	$49,880
	TOTAL, LANDS AND DAMAGES				$41,131	$8,749	$49,880
	TOTAL PROJECT COSTS				$240,422	$58,572	$298,994
	(ROUNDED)				$240,000	$59,000	$299,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH: 20 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 CYCLE: 3 YEARS DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$244,450	$61,112	$305,562
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	272100	C.Y.	$5.84	$1,589,064	$397,266	$1,986,330
	SUBTOTAL, DREDGING COST				$1,833,514	$458,378	$2,291,892
12.0.-.-	TOTAL CONSTRUCTION COSTS				$1,833,514	$458,378	$2,291,892
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$275,027	$68,757	$343,784
31.-.-.-	CONSTRUCTION MANAGEMENT				$183,351	$45,838	$229,189
	TOTAL PROJECT COSTS				$2,291,892	$572,973	$2,864,865
	(ROUNDED)				$2,292,000	$573,000	$2,865,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 20 FEET | D/A: KILLCOHOOK | ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 | CYCLE: 3 YEARS | DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$7,550	$1,888	$9,438
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	8400	C.Y.	$5.84	$49,056	$12,264	$61,320
					------------	------------	------------
	SUBTOTAL, DREDGING COST				$56,606	$14,152	$70,758
12.0.-.-	TOTAL CONSTRUCTION COSTS				$56,606	$14,152	$70,758
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,491	$2,123	$10,614
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,661	$1,415	$7,076
					------------	------------	------------
	TOTAL PROJECT COSTS				$70,758	$17,690	$88,448
	(ROUNDED)				$71,000	$18,000	$89,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 22 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	12	AC	$18,525.00	$222,300	$55,575	$277,875
	TOTAL, FISH AND WILDLIFE FACILITIES				$222,300	$55,575	$277,875
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$248,530	$62,132	$310,662
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	3636762	C.Y.	$4.23	$15,383,503	$3,845,876	$19,229,379
	TOTAL, DREDGING COST				$15,632,033	$3,908,008	$19,540,041
	TOTAL CONSTRUCTION COSTS				$15,854,333	$3,963,583	$19,817,916
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$550,000	$0	$550,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$650,000	$0	$650,000
	SUBTOTAL				$17,054,333	$3,963,583	$21,017,916
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$1,937,882	$411,926	$2,349,808
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$51,885	$10,993	$62,878
	TOTAL, LANDS AND DAMAGES				$1,989,767	$422,919	$2,412,686
	TOTAL PROJECT COSTS				$19,044,100	$4,386,502	$23,430,602
	(ROUNDED)				$19,044,000	$4,387,000	$23,431,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 22 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$3,470	$868	$4,338
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	50730	C.Y.	$4.23	$214,583	$53,647	$268,230
	SUBTOTAL, DREDGING COST				$218,058	$54,515	$272,573
12.0.-.-	TOTAL CONSTRUCTION COSTS				$218,058	$54,515	$272,573
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$32,709	$8,177	$40,886
31.-.-.-	CONSTRUCTION MANAGEMENT				$21,806	$5,452	$27,258
	SUBTOTAL				$272,573	$68,144	$340,717
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$47,205	$10,029	$57,234
	TOTAL, LANDS AND DAMAGES				$47,205	$10,029	$57,234
	TOTAL PROJECT COSTS				$319,778	$78,173	$397,951
	(ROUNDED)				$320,000	$78,000	$398,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH:	22 FEET	D/A:	KILLCOHOOK	ESTIMATOR:	JOSE ALVAREZ
PRICE LEVEL:	APRIL 1990	CYCLE:	3 YEARS	DATE:	22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$245,540	$61,385	$306,925
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	342300	C.Y.	$5.71	$1,954,533	$488,633	$2,443,166
	SUBTOTAL, DREDGING COST				$2,200,073	$550,018	$2,750,091
12.0.-.-	TOTAL CONSTRUCTION COSTS				$2,200,073	$550,018	$2,750,091
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$330,011	$82,503	$412,514
31.-.-.-	CONSTRUCTION MANAGEMENT				$220,007	$55,002	$275,009
	TOTAL PROJECT COSTS				$2,750,091	$687,523	$3,437,614
	(ROUNDED)				$2,750,000	$688,000	$3,438,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 22 FEET | D/A: KILLCOHOOK | ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 | CYCLE: 3 YEARS | DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$6,460	$1,615	$8,075
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	9000	C.Y.	$5.71	$51,390	$12,848	$64,238
	SUBTOTAL, DREDGING COST				$57,850	$14,463	$72,313
12.0.-.-	TOTAL CONSTRUCTION COSTS				$57,850	$14,463	$72,313
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$8,678	$2,170	$10,848
31.-.-.-	CONSTRUCTION MANAGEMENT				$5,785	$1,446	$7,231
	TOTAL PROJECT COSTS				$72,313	$18,079	$90,392
	(ROUNDED)				$72,000	$18,000	$90,000

SALEM RIVER

INITIAL PROJECT COSTS

DEPTH: 24 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
06.-.-.-	FISH AND WILDLIFE FACILITIES						
06.2.R.B	MITIGATION COSTS	16	AC	$18,525.00	$296,400	$74,100	$370,500
	TOTAL, FISH AND WILDLIFE FACILITIES				$296,400	$74,100	$370,500
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$248,580	$62,145	$310,725
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	4287280	C.Y.	$4.11	$17,620,721	$4,405,180	$22,025,901
	TOTAL, DREDGING COST				$17,869,301	$4,467,325	$22,336,626
	TOTAL CONSTRUCTION COSTS				$18,165,701	$4,541,425	$22,707,126
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$550,000	$0	$550,000
31.-.-.-	CONSTRUCTION MANAGEMENT				$650,000	$0	$650,000
	SUBTOTAL				$19,365,701	$4,541,425	$23,907,126
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$2,267,158	$481,919	$2,749,077
01.D.P.-	WETLANDS, MITIGATION	---------	JOB	L.S.	$65,260	$14,337	$79,597
	TOTAL, LANDS AND DAMAGES				$2.332,418	$496,256	$2,828,674
	TOTAL PROJECT COSTS				$21,698,119	$5,037,681	$26,735,800
	(ROUNDED)				$21,698,000	$5,038,000	$26,736,000

SALEM RIVER

INITIAL ASSOCIATED COSTS

DEPTH: 24 FEET D/A: KILLCOHOOK ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$3,450	$862	$4,312
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	59055	C.Y.	$4.11	$242,716	$60,679	$303,395
	SUBTOTAL, DREDGING COST				$246,166	$61,541	$307,707
12.0.-.-	TOTAL CONSTRUCTION COSTS				$246,166	$61,541	$307,707
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$36,925	$9,231	$46,156
31.-.-.-	CONSTRUCTION MANAGEMENT				$24,617	$6,154	$30,771
	SUBTOTAL				$307,708	$76,926	$384,634
01.-.-.-	LANDS AND DAMAGES						
01.D.M.-	DISPOSAL AREA REPLACEMENT	---------	JOB	L.S.	$55,047	$11,712	$66,759
	TOTAL, LANDS AND DAMAGES				$55,047	$11,712	$66,759
	TOTAL PROJECT COSTS				$362,755	$88,638	$451,393
	(ROUNDED)				$363,000	$89,000	$452,000

SALEM RIVER

MAINTENANCE PROJECT COSTS

DEPTH: 24 FEET　　D/A: KILLCOHOOK　　ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990　　CYCLE: 3 YEARS　　DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$245,340	$61,335	$306,675
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
12.0.2.B	EXCAVATION AND DISPOSAL	387000	C.Y.	$5.64	$2,182,680	$545,670	$2,728,350
	SUBTOTAL, DREDGING COST				$2,428,020	$607,005	$3,035,025
12.0.-.-	TOTAL CONSTRUCTION COSTS				$2,428,020	$607,005	$3,035,025
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$364,203	$91,051	$455,254
31.-.-.-	CONSTRUCTION MANAGEMENT				$242,802	$60,700	$303,502
	TOTAL PROJECT COSTS				$3,035,025	$758,756	$3,793,781
	(ROUNDED)				$3,035,000	$759,000	$3,794,000

SALEM RIVER

MAINTENANCE ASSOCIATED COSTS

DEPTH: 24 FEET — D/A: KILLCOHOOK — ESTIMATOR: JOSE ALVAREZ
PRICE LEVEL: APRIL 1990 — CYCLE: 3 YEARS — DATE: 22 JAN 1991

ACCOUNT CODE	DESCRIPTION	ESTIMATED QUANTITY	UNIT	UNIT PRICE	AMOUNT	CONTINGENCY	TOTAL PROJECT COST
12.-.-.-	DREDGING						
12.0.A.-	MOBILIZATION, DEMOBILIZATION AND PREPARATORY WORK	---------	JOB	L.S.	$6,660	$1,665	$8,325
12.0.2.-	PIPELINE DREDGING						
12.0.2.B	SITE WORK						
	EXCAVATION AND DISPOSAL	10500	C.Y.	$5.64	$59,220	$14,805	$74,025
	SUBTOTAL, DREDGING COST				$65,880	$16,470	$82,350
12.0.-.-	TOTAL CONSTRUCTION COSTS				$65,880	$16,470	$82,350
30.-.-.-	PLANNING, ENGINEERING AND DESIGN				$9,882	$2,470	$12,352
31.-.-.-	CONSTRUCTION MANAGEMENT				$6,588	$1,647	$8,235
	TOTAL PROJECT COSTS				$82,350	$20,587	$102,937
	(ROUNDED)				$82,000	$21,000	$103,000

APPENDIX D

ENVIRONMENTAL DOCUMENTATION

CULTURAL RESOURCE
INVESTIGATION
AT NEW CUT, SALEM RIVER,

IN CONNECTION WITH

PROPOSED DREDGING OF SALEM RIVER, CITY OF SALEM, ELSINBORO TOWNSHIP, AND PENNSVILLE TOWNSHIP, SALEM COUNTY, NEW JERSEY

PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
CONTRACT DACW 61-86-M-0211, TASK B

BY
EDWARD F. HEITE AND LOUISE B. HEITE
SOPA

P. O. BOX 53
CAMDEN, DELAWARE 19934

AUGUST 1986

Louise B Heite
Edward Heite

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FIGURES

ABSTRACT

This is a report of a cultural resource survey in New Cut, on the Salem River in Salem County, New Jersey. The Corps of Engineers proposes to widen the channel through this artificial cut.

The authors were engaged to conduct a pedestrian survey of the island that was created when New Cut was dredged. The objective of the survey was to determine if a previously-reported prehistoric site exists and, if possible, to estimate its significance.

A small peninsula in Pennsville Township, adjacent to the Penns Neck Bridge, also was included in the project. The authors found evidence of human occupation on the island, but the previously reported site was not evident in the cut banks. No further archæological surveys are recommended in connection with the channel work. This study was carried out to satisfy provisions of the Environmental Policy Act, Executive Order 11593, and 36CFR 50, 66, and 800, and other applicable laws and regulations that require public agencies to consider prehistoric and historic resources.

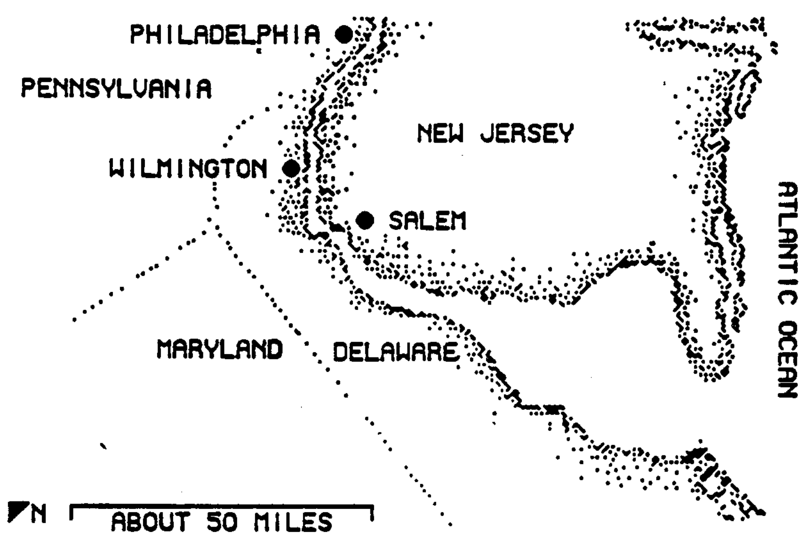
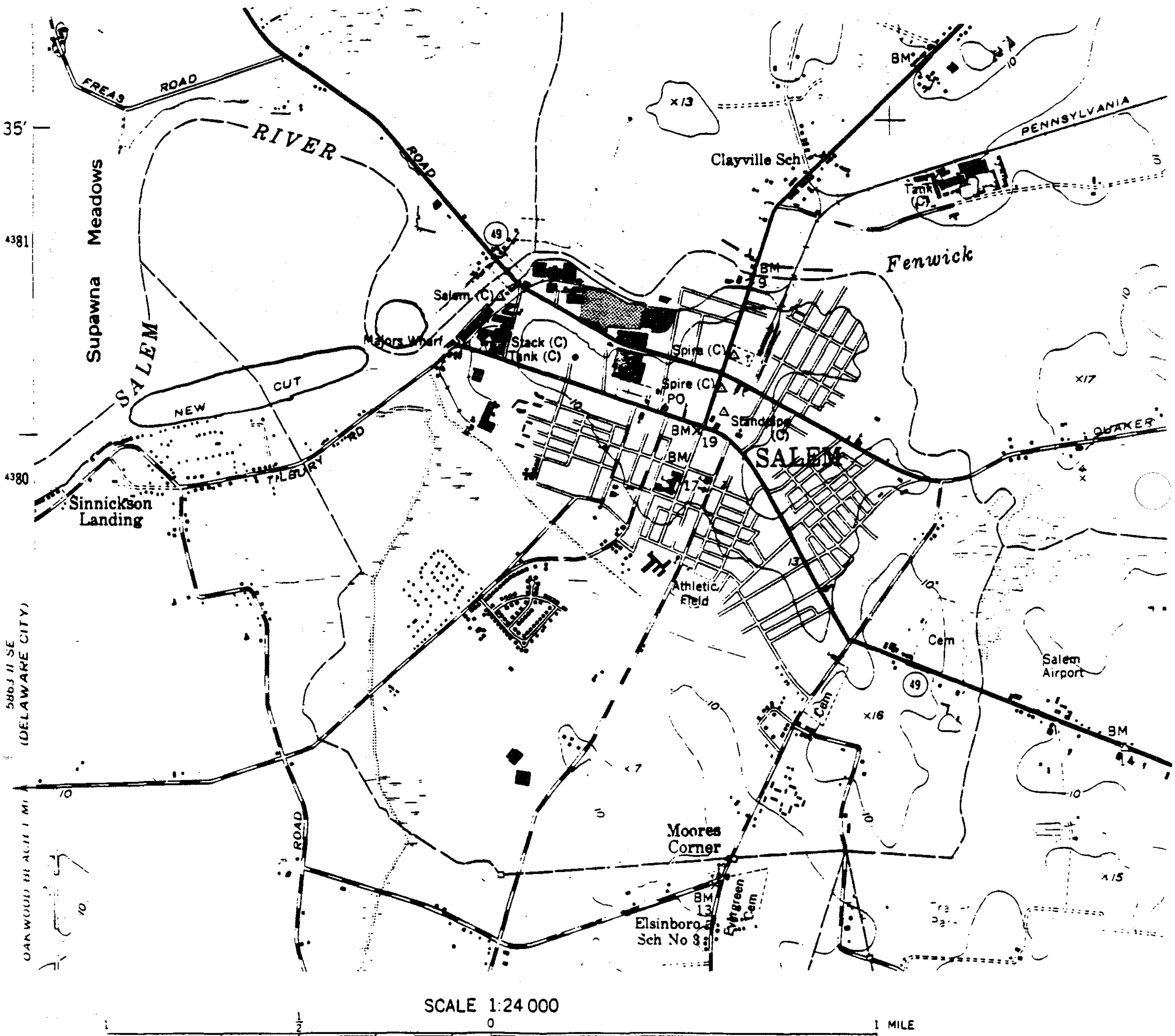


Figure 1

Regional map

Figure 2
General location map

Detail of U. S. Geological Survey Salem quadrangle, 7.5' series, 1948, photorevised 1970, showing the project area outlined.



SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

NEW JERSEY

QUADRANGLE LOCATION

INTRODUCTION

United States Army, Corps of Engineers, proposes to widen the channel of Salem River betwen Salem and the Delaware River. Pursuant to the National Historic Preservation Act of 1966 as amended, Environmental Policy Act, Executive Order 11593, and 36CFR 50, 66, and 800, and other applicable laws and regulations that require public agencies to consider prehistoric and historic resources, several cultural resource investigations have been conducted.

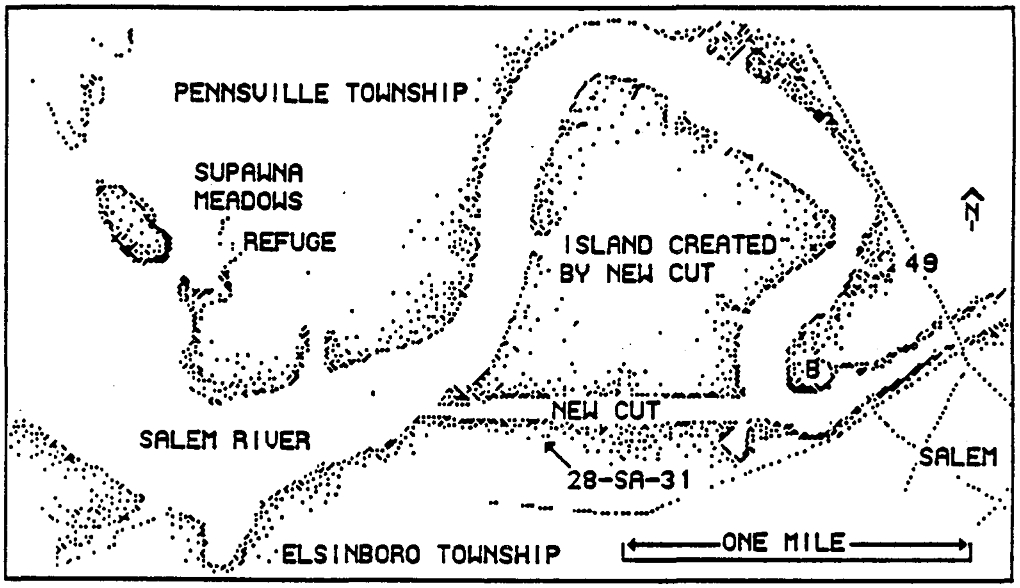


Figure 3

Location sketch map, showing the features discussed.

In May 1985, the present authors conducted a reconnaissance-level assessment of cultural resources in the vicinity of this project, including several designated disposal areas (Heite and Heite May 1985). That study uncovered hearsay evidence of prehistoric finds along the course of the New Cut. One site, designated in the New Jersey State Museum survey as 28-Sa-31, is reported to have been in the New Cut vicinity. The authors visited the islands of the study area twice during 1986, on June 27 and July 19, to conduct pedestrian survey.

PROJECT LOCATION AND LAND USE

The project area lies in Salem city and in Pennsville and Elsinboro townships, Salem County. It consists of the New Cut and a small peninsula, marked B on the map, Figure 3. The island on the north bank of the cut was created when the river was shortened around 1926. Dredged material from that project was deposited along the south bank of the cut, creating a tract of high ground that is now a residential neighborhood. The eastern end of the south bank is undeveloped except for the Barber's Basin marina.

Across the river, at a place marked B on figure 3, is a marshy peninsula that may be removed as part of the project. It is included in the study.

PREHISTORIC AND HISTORIC OVERVIEW

Man has lived on the shores of the Delaware River and its tributaries for at least ten millenia, possibly longer. Previous studies have shown that all possible disposal areas must be considered potentially significant until proven otherwise (McHugh 1983). Custer (1984) has published an ecological model for prehistoric settlement in Delaware, which probably is equally applicable for New Jersey. The shore zone's prehistory, according to Custer's model, was affected most significantly by fluctuations in sea level, which has generally risen since the end of the Pleistocene. During twelve millenia, the Delaware has evolved from a flowing fresh river in late Pleistocene times to the present drowned estuary.

When the Paleo people first entered the present Delaware estuary, the climate was far different from the present. Glaciers were retreating, pouring masses of debris and floods of fresh water onto the plains that now constitute South Jersey and Delmarva. The streams that were to become the Delaware and the Susquehanna writhed and twisted, cutting new channels and blocking old ones as they pushed the South Jersey and Delmarva landmasses farther into the rising ocean.

Glacial streams, as the Delaware was, can be unpredictable. Instead of gradually sending a regular seasonal supply of meltwater into the lowlands below, glaciers store meltwater in huge lakes, breaking forth every few years in massive surges, known in Iceland as *jökulhlaups*. When a *jökulhlaup* comes down the valley, pent-up water, ice, sand and boulders sweep all before them. Great blocks of ice are swept down the river, to be buried for years before they finally melt away entirely. A valley subject to such devastating periodic floods is not particularly inviting to settlement.

The frigid dry ground around a glacier supports only a fragile groundcover of grasses. Overgrazing, floods, fire, or even the hoofprints of animals, can expose the ground to wind erosion of the most violent kind (Gudmundsson and Kjartansson 1984; Williams 1985: 33). Throughout the region, deposits of æolian soils testify to great wind-borne soil movements that occurred before the forest cover developed.

Into this hostile environment came the region's first people, stalking the great Pleistocene herbivores. Their spearpoints and other debris can be found most commonly along ridgetops throughout the area. Fluted points of the Paleo people have been found along the main river, but there are no reports of Paleo period sites in the tidal wetlands, which were dry land during those times, when the ocean lay eighty miles eastward of its present shore (Chesler 1982:32, 56).

The region's present estuarine resources had not yet developed during much of the Archaic period, which coincides with the Atlantic climatic episode (6540-3110 BC), the transition between Pleistocene and Holocene environments (Custer 1984: 63). Most reported sites of the Archaic period in South Jersey are found along bodies of water, as are sites of later origin. Multicomponent sites characterize the lower river and bay environments (Chesler 1982: 72).

Archaic people began to use the diverse lithic sources that are found as cobbles among the riverside gravels. Whereas the Paleo hunters went to great pains to find quality cryptocrystaline silicates, their Archaic successors were satisfied with quartz, quartzite and rhyolite (Custer 1984: 67). Archaic people were beginning the long progress toward a sedentary lifestyle, establishing base camps in resource-rich areas where they could live for much of the year.

Custer hypothesizes that macro-band base camps of the Archaic period may have been located at the confluences of tributaries with the Delaware in places now deeply buried in silt and covered by the waters of the river and bay (Custer 1984: 73).

Sites of the Woodland period Riggins Complex of Salem and Cumberland counties are concentrated in the Cohansey and Maurice river drainages, often on sandy islands in salt marshes (Chesler 1982:66). Late Woodland sites in New Jersey tend to cluster along the rivers, with larger sites on the main trunks of the Delaware's tributaries.

Early Woodland people in Delaware tended to establish their macro-band base camps along rivers where fresh and salt waters meet. From these sites they would seasonally migrate in small bands to the bayside marshes (Custer 1984:132). The late Woodland period in Delaware was characterized by increasingly sedentary village life and incipient agriculture, still centered in mid-drainage. On the coastal marshes Delaware Woodland sites tend to be smaller than the ones in mid-drainage.

The Delaware Bay region was initially settled by Dutch traders during the first quarter of the seventeenth century. The Dutch settlements were limited to a short-lived whaling station at Zwaanendael, near the present Lewes, Delaware, and to a somewhat later fort and trading station at Fort Nassau in the present state of New Jersey, near Gloucester. The whaling station, which was established in 1631, was destroyed within the year by hostile Indians.

The Dutch monopoly on Delaware Bay settlement ended in 1638, when a band of Swedish settlers under the leadership of Peter Minuit established a community on the banks of the Christina River in the vicinity of present-day Wilmington. Minuit had been in the New World before this time, and probably had seen the area during a trading or exploratory venture. The Swedish colony was the brainchild of the Swedish king Gustavus Adolphus, but he died before colonizing actually began. His daughter and heir, Christina, under the guidance of her chief minister Axel Oxenstierna, continued her father's effort. Because her interests lay elsewhere, Christina approached colonization without much energy. The Swedish colony survived nevertheless, although it received virtually no support from its mother country .

In 1641 a small group of Englishmen from New Haven settled on Varckens Kill (Salem River) in the vicinity of the present Salem, foreshadowing Fenwick's colony there by thirty-five years. The Dutch governor Stuyvesant protested this incursion, but the New Englanders remained. Later that year, the Swedish government chose an experienced military leader, Johann Printz, to be their colony's governor. He was instructed to win the new English settlers to acceptance of Swedish rule (Johnson 1930: 68).

Printz tried the English for trespass in 1643. They exhibited Indian deeds to much of the east bank of the river and to some of the west as well, which Printz chose not to recognize. In spite of being found guilty of trespass, the English stayed on (Johnson 1930: 230-233). Near the English colony, Printz built Fort Elfsborg on a point in the river that would effectively control the channel. During its eight-year effective life, Elfsborg was able to force Dutch ships to strike their flags (Myers 1912: 27).

On another occasion, the same year, Elfsborg was visited by mutineers from the party of Sir Edmund Plowden, who held a dubious English grant to the Delaware drainage, which he called New Albion. When he came to settle in 1643, some of his men mutinied and went over to the Swedes. The Swedes returned the mutineers, but were unwilling to recognize the New Albion grant. Despite vigorous Dutch protests, Elfsborg was ultimately defeated by mosquitoes, who made it uninhabitable.

Although the New Sweden colony received at best sporadic support from Sweden, the Dutch perceived it as a threat to their control of Delaware Bay. In 1651, the Dutch moved their main fortification on the Delaware from New Jersey to Fort Casimir at the present site of New Castle, Delaware. The reason given for this move was to allow closer monitoring of the Swedes, whom the Dutch suspected of draining off the fur trade. Actually, the fur trade was more probably dwindling as a result of depletion of the wildlife resources; the Swedish colony did not receive enough support from home to make effective trading competitors.

The Swedes captured the Dutch fort in 1654 without incident, but the following year Peter Stuyvesant personally not only recaptured the Dutch fort, but also took control of Christinaham and terminated New Sweden. This action also was without incident. The Swedish colonists were encouraged to stay, with the promise of religious toleration and confirmation in their land and property in exchange for political loyalty to the Dutch. Most stayed.

Dutch control lasted until 1663, when the English attacked the Dutch holdings in the New World as part of the larger Anglo-Dutch Wars. Charles II granted to his brother James, Duke of York, all the territory from Maine to the east bank of the Delaware. James promptly dispatched a loyal supporter, Richard Nicholls, as Deputy Governor, to take and administer the territory.\

In September of 1664, after they had occupied New Amsterdam, Nicholls and the other commissioners sent Captain John Carr to the Delaware to subdue the Dutch. Carr's instructions required him to act with great restraint, and to use force only as a last resort. He was to offer the people all the liberties enjoyed by the English on English lands, and also freedom of conscience in religion and a continuance for at least six months of their civil government, provided that they take an oath of allegiance to England. Only Vice-Director Alexander d'Hinojossa, the commander of the Dutch forces in Fort Casimir, and a handful of soldiers resisted. Carr reduced them handily.

The colony fell, without much in the way of military action. The English offered generous terms of surrender to all settlers, including again promises of religious toleration and confirmation of their landholdings.The New Jersey proprietary was established on the southern part of the Duke's grant, but actually in the middle of the land under his courts' jurisdiction. The courts at New Castle and Upland [now Chester, Pennsylvania] continued to exercise jurisdiction over the territory that is now New Jersey until after the colonists there had established themselves. Overall, the transition from New York administration to New Jersey went smoothly except in the Salem Tenth.

Major John Fenwick, a New Jersey proprietor, came to America with a group of followers and promptly established a government based at Salem. New York's Governor Sir Edmund Andros, also an old soldier, was unwilling to share power with a part-owner of the new proprietary. Fenwick settled at Salem and began granting lands and holding courts, in defiance of Andros and the courts at New Castle. In the ensuing power struggle, Andros jailed Fenwick.

Ultimately Andros was obliged to recognize the new colony, but only after more regular government had been established by the other New Jersey proprietors. William Penn, a New Jersey proprietor, got his first taste of New World administration when he helped Fenwick financially in return for the tract known today as Penn's Neck between the Salem and Delaware rivers.

By the 1680's, landholding patterns in the area had taken on a characteristic configuration: farms consisted of long, narrow tracts running across the necks from riverbank to riverbank, or from riverbank to the ridge between streams, often a nominal mile deep. Each neck consitituted a kind of *de facto* political subdivision. But the compact settlements of continental European immigrants of the middle seventeenth century had been replaced by the time of Penn's grant (1682) by a dispersed rural settlement of mostly native-born residents with a common mixed but not yet homogenous ethnic heritage.

Penn's receipt of the Delaware counties in 1682 changed the orientation of the nearby countryside away from New Castle and towards Philadelphia.The New Jersey, proprietary, without a metropolis of its own, looked to the other Quaker colony for commercial services. Water transportation remained the main means of commerce between Philadelphia and the rest of the Delaware Valley for another two and a half centuries. The Penn family continued to hold large tracts in Penn's Neck, Salem County, into the eighteenth century; some areas of good farmland near the project area were not granted until the third decade of the eighteenth century.

A second era of fort-building began early in the nineteenth century, with construction of batteries on Pea Patch Island and later on the New Jersey and Delaware shores. Chastened by the ease with which the British had attacked our major cities during the War of 1812, the United States embarked upon a program of coast defense, much of which was never tried in combat. To protect Philadelphia and the Chesapeake and Delaware Canal, batteries were built on the New Jersey and Delaware shores. The battery on Pea Patch Island, which grew to become the great Fort Delaware, was constantly modernized into the twentieth century. Forts Mott and duPont on the shores facing the island were among the last coast defense installations erected. Although the forts never fired on an enemy, they remained government installations until after World War II.

MEADOW BANKS

Marshes, or meadowlands, were among the most valuable resources for the first European settlers. Each Dutch grant to a farm included proportions of meadow and of upland. In some cases the meadow portion of a farm was separated from the upland, but the two parts were regarded as a single entity.

New Castle and Salem, the first substantial settlements on the river, both were built on sandspits in the midst of tide marshes. Both communities had, from the beginning, town marsh lands held in common by the townspeople. Both communities erected communal dykes to drain the fens and keep out the river.

Meadowlands were the source of hay and grazing for livestock. Cattle thrived on the rich, fine freshwater marsh grasses which were the dominant plant species at higher elevations, while the saltier grasses were used as bedding. Even today, some riverfront hay meadows in South Jersey are divided into small tracts of ten acres or so. These small holdings are a legacy of the day when landlocked farmers needed the salt hay for livestock bedding, and so owned and maintained hayfields that sometimes were far from the home farms. Surplus hay was sent upriver, to be used as horse bedding, as packing material, or as core material for hollow iron castings. Salt marsh hay was a truly versatile and profitable agricultural product.

People on the east and west sides of the Delaware used the marshlands differently. During the latter part of the eighteenth century, thousands of acres of formerly undeveloped wetlands on both sides of the river were dyked and drained. A fad for meadow draining developed around the 1750's, when meadows along the Schuylkill at Philadelphia were successfully drained for cultivation. Farmers throughout the valley saw such successes and tried to emulate them at home.

A New Jersey act in 1788 permitted local farmers to form companies to drain meadows. Groups of landowners could incorporate to reclaim the lowgrounds and assess the affected properties for the cost of maintaining the drainage works.

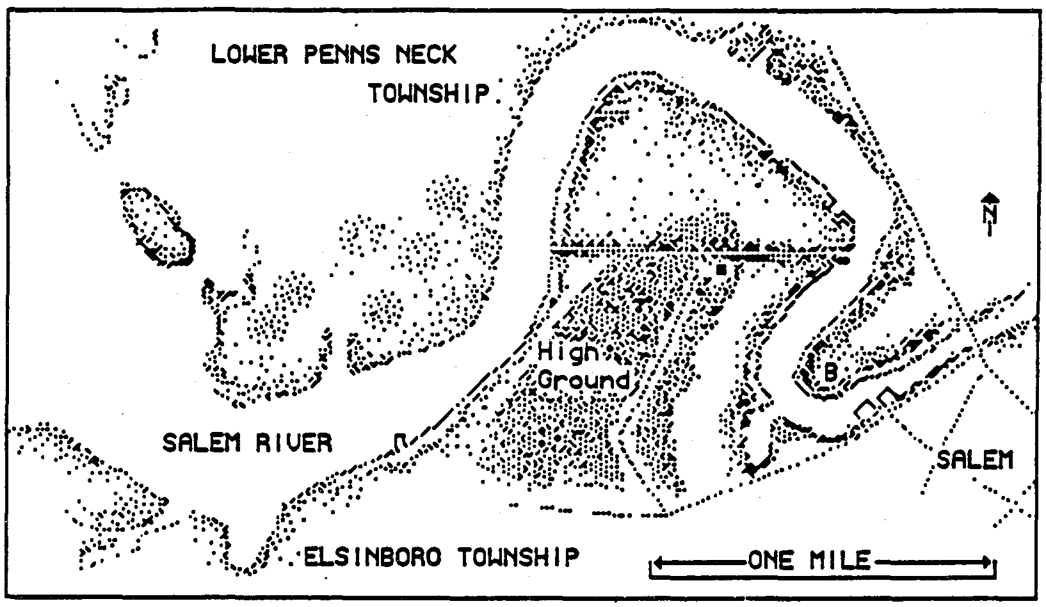


Figure 4

Project area before New Cut

This sketch map is based upon the 1848 Coast and Geodetic Survey *Map of Delaware Bay and River* (Heite and Heite June 1986, Figure 3) The high ground, through which the cut now passes, supported crops. The entire peninsula was banked. Sluice gate sites are marked by piles of crushed rock and occasional waterlogged timbers at the mouths of streams along the old course of the river.

The farmers of Salem and Cumberland Counties set out to reclaim their broad meadowlands with ambitious systems of private dykes and sluice gates. In Salem County alone, there were 71 meadow bank companies, the earliest chartered in 1794. Meadow banking and swamp draining continued through the nineteenth century, until thousands of acres were under control. Only constant maintenance could hold back the water, and maintenance was expensive. Laborers, called "mud men," were needed to keep the dykes in repair.

By the 1930s, experienced mud men were becoming hard to find and money was even scarcer. When the banks began to wash out, the bank companies had no money to repair them. The once rich Mannington Meadow grasslands are now a huge pond, crisscrossed by old dykes.

During the Depression, the Civilian Conservation Corps went to work draining the marshes to help reduce the mosquito population. Soon after the CCC left, muskrat trappers began destroying the drainage works. The trappers reasoned that their "marsh rabbits" preferred wetter marshes. Since trapping was a major source of income, the marshes remained undrained for a while.

NAVIGATION

The Delaware of the Pre-Revolutionary period was busy with shallops carrying farm goods and grain bound for Philadelphia and returning with the treasures of Europe and the Orient. Farmers in central Delaware and South Jersey could take their tea from Chinese porcelain thanks to the shallopmen. Shallopmen and bay pilots were bankers, commercial agents, and news-carriers of the wider world to the farmers and small merchants who lived along the tidal streams and congregated at the landings. The shallop trip from Kent County, Delaware, to Philadelphia took five days, but the ordeal was considered commonplace and acceptable.

Sailing vessels from down the bay carried farm products to Philadelphia even after the steamboats were introduced early in the nineteenth century. A steamer could carry passengers swiftly, but sailboats could carry bulk goods more cheaply. Each river had its line of regular packets converging on Philadelphia. Steamboats gradually displaced sailing vessels in the bay trade, but both schooners and steamers were still routinely carrying freight along the rivers as late as World War II. The last was the Wilson Line, which ended its days as a purely excursion line from Wilmington to Riverview Park to Philaelphia.

Salem played an important role in the bay trade. Because of its location off the end of the Chesapeake and Delaware Canal, Salem's captains were keenly interested in that project. A typical steamer line of the nineteenth century would run from Philadelphia, to Salem, through the canal to Baltimore or other Chesapeake ports.

PHYSICAL GEOGRAPHY AND ENVIRONMENT OF THE PROJECT AREA

The project area consists of a tongue of high ground, surrounded by salt marsh. Until the present century, the Salem River looped northward around this peninsula. The marshes were banked, reclaiming considerable acreage. At least half of the peninsula was planted in crops, and a farmstead was located near its center.

A wharf, near the present west end of New Cut, was the first fast ground inside Salem River. The 1848 chart shows a wharf on this site, and the authors found pilings on the island just north of the mouth of the new cut. Such a geographical advantage would have been a strong inducement for early settlers.

Except for the natural high ground, most of the study area has been tide marsh since first settlement. While the meadow banks were in place, the arable land expanded, only to shrink again when the banks broke.

Attempts to make landfall on the peninsula in Pennsville Township below the bridge (B on the sketch maps) were unsuccessful because of the current. The islands that make up this peninsula are subject to intense tidal action, even at the time when slack water is alleged to be due. Although these islands were shown as banked meadow in the 1848 map, no signs of riprap, gates, or banks survive. The county assessment map shows the peninsula as subidvided into many parcels, seven of which would be included in the projected removal. Today they are considerably smaller than the acreages shown on the maps.

FINDINGS

Prehistoric site 28-Sa-31, if it ever existed, could not be confirmed. An adequate view of the surface did not reveal any evidence of either a prehistoric site or an historic site along the north bank of New Cut. The peninsula in Pennsville Township is entirely saltmarsh and is unlikely to contain any archæological sites.

These negative findings do not apply to the high ground on the island, which is designated as salt marsh on virtually all the maps. Because it was the first high ground to be encountered by people coming upriver, this site has a high probability of having been settled during the seventeenth century. Such sites elsewhere in the Delaware valley have yielded extremely early settlers' sites.

No sites potentially eligible for the National Register are likely to be affected by the proposed dredging.

RECOMMENDATIONS

We do not recommend any further archæological and historical investigations in connection with the dredging, provided that work is confined to the present cut and its adjacent beaches. If the high ground on the island should be chosen as a disposal area for dredged material, we recommend a thorough phase II survey of that site. Because the island is infested with rank growth and a vigorous insect population, we recommend late fall, winter, or spring excavations there.

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HEITE CONSULTING
FIRM PROFILE AND QUALIFICATIONS

Heite Consulting is a two-person archæological and historical research firm. They specialize in historical background studies and in reconnaissance-level archæological surveys. During the past five years, the Heites have completed contracts in Delaware, New Jersey, Pennsylvania, Maryland, and Virginia.

Louise Heite, principal investigator for historical background studies, is both an historian and an archæologist, specializing in social history. Her doctoral dissertation, to be completed in 1986, is a study of neighborhood development in Wilmington, Delaware. Her MA thesis was a history of New Castle's formative period, 1651-1681.

Her previous historical studies include Wilmington Boulevard (1980-1982) and the Mary C. I. Williams School site (1984). Mrs. Heite recently completed an historical and archæological study of the duPont Station community at Denney's Road, Kent County, for the Delaware Department of Transportation.

Edward Heite has served as Historic Registrar and Chief of the Bureau of Archives and Records Management for the State of Delaware. He was previously archæological historian for the Virginia Historic Landmarks Commission. Recent clients include the United States Army Corps of Engineers, Delaware Department of Transportation, and the Borough of West Conshohocken, Pennsylvania.

Both are members of the Society of Professional Archæologists, certified in theoretical/archival research and historical archæology. Edward Heite is also certified by SOPA in field research and cultural resource management. They meet the professional standards for historians and archæologists set forth in the Secretary of the Interior's standards and guidelines for archæology and historic preservation (*Federal Register*, Vol. 48, No. 190, Thursday, September 29, 1983, pages 44716 - 44742).

APPENDIX D

WATER QUALITY STANDARDS

PAGE

Water Quality Standards

NEW JERSEY DEPARTMENT OF
ENVIRONMENTAL PROTECTION
Surface Water Quality Criteria for SE Waters
7:9-4.14(c)

(Expressed as maximum concentrations unless otherwise noted)

Substance	Criteria
1. Bacterial quality (Counts/100 ml)	i. Fecal Coliforms: (1) Fecal coliform levels shall not exceed a geometric average of 200/100 ml nor should more than 10 percent of the total samples taken during any 30-day period exceed 400/100 ml.
	ii. Samples shall be obtained at sufficient frequencies and at locations during periods which will permit valid interpretation of laboratory analyses. As a guideline and for the purpose of these regulations, a minimum of five samples taken over a 30-day period should be collected, however, the number of samples, frequencies and locations will be determined by the department or other appropriate agency in any particular case.
3. Dissolved oxygen (mg/l)	i. 24 hour average not less than 5.0, but not less than 4.0 at anytime (see paragraph viii below).
	ii. Supersaturated dissolved oxygen values shall be expressed as their corresponding 100 percent saturation values for purposes of calculating 24 hour averages.
4. Floating, colloidal, color and settleable solids; petroleum hydrocarbons and other oils and grease	i. None noticeable in the water or deposited along the shore or on the aquatic substrata in quantities detrimental to the natural biota. None of which would render the waters suitable for the designated uses.
	ii. For "Petroleum Hydrocarbons" the goal is none detectable utilizing the Federal EPA environmental Monitoring and Supprot Laboratory Method (Freon Extractable - Silica Gel Adsorption - Infrared Measurament); the present criteria, however, are those of paragraph i. above.

5. pH (Standard Units) — i. 6.5-8.5

6. Radioactivity — i. Prevailing regulations adopted by the U.S. Environmental Protection Agency pursuant to Sections 1412, 1445, and 1450 of the Public Health Services Act, as amended by the Safe Drinking Water Act (PL 93-523).

7. Solids, Suspended (mg/l) (Non-filterable residue) — i. Noone which would render the waters unsuitable for the designated uses.

8. Solids, Total Dissolved (Filterable Residue) (mg/l) — i. None which would render the water unsuitable for the designated uses.

9. Taste and odor producing substances — i. None offensive to humans or which produce offensive taste or odoors in water supplies and biota used for human consumption. None which would render the waters unsuitable for the designated uses.

10. Temperature and Heat Dissipation Areas — i. Thermal Alterations (Temperatures shall be measures outside of heat dissipation areas)

(i) No thermal alterations which owuld cause temperatures to deviate from ambient by more than 2.2°C (4°F), from September through May, nor more than 0.8°C (1.5°F) from June through August, nor cause temperatures to exceed 29.4°C (85°F).

ii. Heat Dissipation Areas

(1) Streams

(i) Not more than one-quarter (1/4) of the cross section and/or volume of the water body at any time.

(ii) Not more than two-thirds (2/3) of the surface from shore too shore at any time.

(iii) These limits may be exceeded by special permission, on a case-by-case basis, when a discharger can demonstrate that a larger heat dissipation area meets the tests for a waiver under Section 316 of the Federal Clean Water Act.

(2) Lakes, Ponds, Reservoirs, Bays or Coastal

		Waters: Heat dissipation areas will be developed on a case-by-case basis.
10. Toxic Substances (General)	i.	None, either alone or in combination with other substances, in such concentrations as to affect humans or be detrimental to the natural aquatic biota, produce undesirable aquatic life, or which would render the waters unsuitable for the designated uses.
	iii.	Toxic substances shall not be present in concentrations that cause acute or chronic toxicity toa quatic biota, or bioaccumulate within an organism to concentrations tant exert a toxic effect on that organism or render it unfit for consumption.
	iv.	The concentrations of nonpersistent toxic substances in the State's waters shall not exceed one-twentieth (0.05) of the acute definitive LC50 or EC50 value, as determined by appropriate bioassays conducted in accordance with N.J.A.C. 7:18.
	v.	The concentration of persistent toxic substances in the State's waters shall not exceed one-hundredth (0.01) of the acute definitive LC50 or EC50 value, as determined by appropriate bioassays conducted in accordance with N.J.A.C. 7:18.

11. Toxic Substances (ug/l):

i.	Aldrin/Dieldrein	(1)	0.0019
ii.	Ammonia, un-ionized (24 hr. average)	(2)	0.1 of acute definitive LC50 or EC50
iii.	Benzidine	(1)	0.1
iv.	Chlordane	(1)	0.0040
v.	Chlorine, Total Residual (TRC)	(1)	10.0
vi.	DDT and Metabolites	(1)	0.0010
vii.	Endosulfan	(1)	0.0087
viii.	Endrin	(1)	0.0023
ix.	Heptachlor	(1)	0.0036

	x. Lindane	(1)	0.004
	xi. Polychlorinated biphenyls (PCB's)	(1)	0.030
12.	Turbidity (Nephelometric Turbidity Unit-NTU)	ii.	Maximum 30-day average of 10 NTU, a maximum of 30 NTU at any time.

DELAWARE RIVER BASIN COMMISSION
WATER QUALITY REGULATIONS

Description. Zone 5 is that part of the Delaware River extending from R.M. 78.8 to R.M. 48.2, Liston Point, including the tidal portions of the tributaries thereof.

Zone 6 is Delaware Bay extending from R.M. 48.2 to R.M. 0.0, the Atlantic Ocean, including the tidal portions of the tributaries thereof.

Stream Quality Objectives

A. Limits

1. The waters of the Basin shall not contain substances attributable to minicipal, industrial, or other discharges in concentrations or ammounts sufficient to preclude the specified water uses to be protected. Within this requirement:

   a. the waters shall be substantially free from unsightly or malodorous nuisances due to floating solidds, sludge deposits, debris, oil, scum, substances in concentrations or combinations which are toxic or harmful to human, animal, plant, or aquatic life, or that produce color, taste, odor of the water or taint fish or shellfish flesh;
   b. the concentration of total dissolved solids, except intermittent streams, shall not exceed 133 percent of background.

2. In no case shall concentrations of substances exceed thosoe values given for rejection of water supplies in the United States Public Health Service Drinking Water Standards.

B. Nondegradation of Interstate Waters. It is the policy of the Commission to maintain the quality of interstate waters, where existing quality is better than the established stream quality objectives, unless it can be affirmatively demonstrated to the Commission that such change is justifiable as a result of necessary economic or social development or to improve significantly another body of water. In implementing this policy, the Commission will require the highest degree of waste treatment determined to be practicable. No change will be considered which would be injurious to any designated present or future use.

* NJDEP standards for zone 5 are the same as DRBC regulations.

C. Stream quality objectives

1. Zone 5

Dissolved oxygen

a. 24-hour average concentration shall not be less than
   1) 3.5 mg/l at R.M. 78.8,
   2) 4.5 mg/l at R.M. 70.0,
   3) 6.0 mg/l at R.M. 59.5.
b. During the periods from April 1 to June 15, and September 16 to December 31, the dissolved oxygen shall notn ave a seasonal average less than 6.5 mg/l in the entire zone.

Zone 6

a. 24-hour average concentration shall not be less than 6.0 mg/l;
b. not less than 5.0 mg/l at any time unless due to natural conditions.

2. Temperature
   a. Shall not be raised above ambient by more than
      1) 4° F (2.2° C)) during September through May, nor
      2) 1.5° F (0.8° C) during June through August;
   b. nor shall maximum temepratures exceed 86°F (30.0°C) in zone 5 or 85°F (29.4°C) in zone 6 measured outside of designated heat dissipation areas as described in 4.30.6.F.

3. pH. Between 6.5 and 8.5.

4. Phenols. Maximum 0.01 mg/l, unless exceeded due to natural conditions.

5. Threshold odor number. Not to exceed 24 at 60°C.

6. Synthetic detergents (M.BB.A.S.). Maximum 30-day average 1.0 mg/l.

7. Radioactivity.
   a. alpha emitters - maximum 3 pc/l (picocuries per liter)
   b. beta emitters - maximum 1,000 pc/l.

8. Zone 5

Fecal coliform. Maximum geometric average
a. 770 per 100 milliliters from R.M. 78.8 to R.M. 59.5,
b. 200 per 100 milliliters from R.M. 59.5 to R.M. 48.2.

Samples shall be taken at such frequency and location as to permit valid interpretation.

Zone 6. Maximum geometric average 200 per 100 milliliters. Samples shall be taken at such frequency and location as to permit valid interpretation.

9. Zone 6 Only

<u>Coliform.</u> MPN (most probable number) not to exceed U.S. Public Health Services shellfish standards in designated shellfish areas.

10. <u>Turbidity.</u> Unless exceeded due to natural conditions
   a. maximum 30-day average 40 units,
   b. maximum 150 units.

11. <u>Alkalinity.</u> Between 20 and 120 mg/l.

12. <u>Heat dissipation areas.</u> The limitations specified above may be exceeded by special permit in heat dissipation areas designated on a case-by-case basis, subject to the following conditions:

   a. <u>Maximum length.</u> As a guideline, heat dissipation areas shall not be longer than 3500 feet, measured from the point where the waste discharge enters the stream.

13. <u>Adjacent heat dissipation areas.</u> Where waste discharges would result in heat dissipation areas in such close proximity as to impair protected uses, additional limitations may be prescribed to avoid such impairment.

14. <u>Other considerations.</u>

   a. The rate of temperature change in designated heat dissipation areas shall not cause mortality of fish or shellfish.

   b. The determination of heat dissipation areas in tidal waters shall take into special consideration the extent and nature of the recieving waters so as to meet the intent and purpose of the criteria and standards, including provisions for the passage of free-swimming and drifting organisms so that negligible or no effects are produced on their populations.

DELAWARE WATER QUALITY STANDARDS

1. General criteria for all tidal portions of stream basins (includes DRBC zones 5 and 6)

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
Temperature	Same as DRBC Regulations	
Dissolved Oxygen	Same as DRBC Regulations	
pH	Same as DRBC Regulations	
Total Alkalinity	mg/L as $CaCO_3$	Shall not be less than 20 mg/L at any time.
Total Acidity	mg/L as $CaCO_3$	Shall not exceed alkalinity by 20 mg/L at any time.
Alpha Emitters	Same as DRBC Regulations	
Beta Emitters	Same as DRBC Regulations	
Taste, Odor & Color Causing Substances		None in concentrations which cause tastes, odors, color, or impact tastes to edible fish flesh and aquatic and marine life.
Toxic Substances	mg/L	None in concentrations harmful (synergistically or otherwise) to humans, fish, wildlife and aquatic life. The Environmental Protection Agency's Water Quality Criteria Series published in October of 1980 shall be used as guidelines for determining harmful concentration levels.

(Continued)

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
Specific Toxic Substances		
DDT	g/L	0.001 g/L
Toxaphene	g/L	0.70 g/L
Endrin	g/L	0.0023 g/L
PCB's	g/L	0.030 g/L
Lindane	g/L	0.004 g/L
Methoxychlor	g/L	0.04 g/L
Total Residual Chlorine	mg/L	0.01 mg/L
Phenolic Compounds	mg/L	Shall not exceed 0.01 mg/L
Turbidity	Nephelometric or Formazine Turbidity Units	Shall not exceed 150 units.
Fecal Coliform	Colonies/100 mL	Based on five or more consecutive samples taken on separate days, the fecal coliform bacterial level should not exceed a geometric mean of 200/100 mL nor should more than 10 percent of the total samples taken during a 30 day period exceed 400/100 mL.

2. Tidal portions of stream basins designated as a source of shellfish

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
Total Coliform	MPN/100 mL	The following standards of the State Board of Health will govern: The coliform median MPN of the water shall not exceed 70/100 mL, and not have more than 10 percent of the samples ordinarily exceed an MPN of 330/100 mL for a 3 decimal dilution test (or 230/100 mL where the 5 tube decimal test is used) in those portions of the area most

(Continued)

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
		probably exposed to fecal contamination during the most critical hydrographic and pollution condition in designated shellfish areas. Sample shall be taken at such frequency and location as to permit valid interpretation.
Total Residual Chlorine	mg/L	None.

3. Delaware River (PA-DE line, RM 78.8 to Liston Point, RM 48.2).

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
Fecal Coliform (above RM 59.5)	Colonies/100 mL	Based on a minimum of not less than five consecutive samples taken on separate days, the fecal coliform bacterial level should not exceed a geometric mean of 770/100 mL.
Fecal Coliform (below RM 59.5)	Colonies/100 mL	Based on a minimum of not less than five consecutive sample taken on separate days, the fecal coliform bacterial level should not exceed a geometric mean of 200/100 ml, nor should more than 10 percent of the total samples taken during a 30 day period exceed 400/100 mL.

(Continued)

INDICATOR	UNIT OF MEASUREMENT	CRITERIA
Dissolved Oxygen (This criteria is subject for review pending the outcome of the model. Analysis of Delaware Estuary Dissolved Oxygen Objectives conducted by DRBC.)	mg/L	During April 1 - June 15 and Sept. 16 - Dec. 31 seasonal average concentration shall not be less than 6.5 mg/L in the entire zone. At no time shall the daily average concentration be less than 3.5 mg/L at Mile 78.8(A), 4.5 mg/L at Mile 70.0(B), and 6.0 mg/L at Mile 59.5(C). Note: (A) PA-DE line (B) 3/4 mile south of the mouth of the Christina River (C) 1/2 mile north of the Chesapeake and Delaware Canal
Temperature	^{o}F	No heat may be added except in designated mixing zones which would cause temperature to exceed 86^{o}F (30^{o}C) or which would cause the temperature to be raised more than 4^{o}F (2.2^{o}C) during September through May or to be raised by more than 1.5^{o}F (0.83^{o}C) during June through August.

STATE OF DELAWARE SURFACE WATER CRITERIA GUIDELINES FOR HEAVY METALS AND TOXIC SUBSTANCES TO PROTECT SALTWATER AQUATIC LIFE BASED ON USEPA CRITERIA*

Substance (µg/l unless otherwise noted)	Saltwater Criteria	
	Max. Permissible	24-hr. Avg.
Metals		
Arsenic(trivalent inorganic)	508	---
Beryllium	---	---
Cadmium	59	4.5
Chromium (hexavalent)	1,260	18
(trivalent)	10,300(t)	---
Copper	23	4.0
Lead	668(t)	25(c)
Mercury	3.7	.025
Nickel	140	7.1
Selenium(inorganic selenite)	410	54
(inorganic selenate)		
Zinc	170	58
Toxics		
Benzene	5,100(t)	700(c)
Carbon tetrachloride	50,000(t)	---
Chlorobenzene	160(t)	129(c)
Chloroform	---	---
Cyanide (free)	30(t)	2.0(c)
DDT & Metabolites	0.13	.0010
Phenol	5,800(t)	---
Phthalate Esters	2,944(t)	3.4(c)
PCB	10(t)	.030

* Delaware Water Quality Standards reference the EPA publication "Quality Criteria for Water" (1976) for many heavy metals and toxic substances criteria. The EPA updated and amended its criteria in November 1980 (45 FR 79318).

(c) Indicates chronic toxicity concentration for selected organisms based on limited data.

(t) Indicates acute toxicity concentration based on limited data.

(e) Indicates criterion is calculated based on hardness of 50 mg/l $CaCo_3$.

B. Effluent Quality Requirements

(1) Public safety.

a. Temperature. Maximum 110°F (43.3°C) where readily accessible to human contact.

(2) Limits.

a. Oil. Not to exceed 10 mg/l; no readily visible oil.

b. Debris, scum, or other floating materials. None.

c. Toxicity.

(i) Not more than 50 percent mortality in 96 hours in an appropriate bioassay test with a 1:1 dilution. Wastes containing chlorine may be dechlorinated prior to the bioassay test.

(ii) Notwithstanding the results of the tests prescribed in paragraph (i) above, the substances listed below being accumulative or conservative, shall not exceed the following specified limits in an effluent.

	limit mg/l
Arsenic	0.1
Barium	2.0
Cadmium	0.02
Chromium (hexavalent)	0.10
Copper	0.20
Lead	0.10
Mercury	0.01
Selenium	0.02
Zinc	0.60

(iii) Persistent pesticides - not to exceed one one-hundredth of the TL_{50} value at 96 hours as determined by appropriate bioassay.

d. Odor. Not to exceed a threshold number of 250.

e. BOD. In Zones 2, 3, 4 and 5 a waste shall receive not less than zone percent reduction in addition to meeting allocation requirements.

On January 26, 1972 the Delaware River Basin Commission adopted Interpretive line No. 1, as Resolution No. 72-1, directing that the following numerical ions be used as guidelines by the Commission staff in administering Sections 3.10.3.A, 4.A, 3.10.4.C, and 3.10.4.D of the Water Quality Standards, and that they be stered in accordance with the procedures of the Basin Regulations - Water Quality.

ream Quality Objectives

) Limits.

a. Toxic substances.

(i) The concentration of a toxic substance in Basin waters shall not exceed one-twentieth of the TL_{50} value at 96 hours, as determined by appropriate bioassays, except in designated mixing areas. Criteria for combinations of toxic substances will be based upon the same principle.

(ii) The substances listed below shall not exceed the specified limits or one-twentieth of the TL_{50} value at 96 hours, whichever is lower.

	limit mg/l
Arsenic	0.05
Barium	1.0
Cadmium	0.01
Chromium (hexavalent)	0.05
Lead	0.05
Mercury	0.005
Selenium	0.01
Silver	0.05

(iii) The concentration of a persistent pesticide[1] in Basin waters shall not exceed one one-hundredth of the TL_{50} value at 96 hours, as determined by appropriate bioassay.

b. Oil. No readily visible oil.

istent pesticides are defined as natural and synthetic materials having a half-life of ter than 96 hours, which are used to control unwanted or noxious animals or plants. y include fungicides, herbicides, insecticides, fumigants and rodenticides.

Table D-1 TIDAL RANGE AND TIDAL CURRENT DATA

	Tidal Range[1]				Average Tidal Current Speed and Direction[2]					
	Location		Mean	Spring	Location		Maximum flood tide		Maximum ebb tide	
	Lat	Long	Ft	Ft	Lat	Long	Knots	Degrees	Knots	Degrees
Salem River Project										
	(At Salem)				(Entrance)					
Salem River	39° 35°	75° 28°	5.6	6.1	39° 34.2°	75° 30.1°	1.5	062	1.6	245
					(1.1 mi. E of)					
Reedy Point	39° 34°	75° 34°	5.5	6.0	39° 33.58°	75° 32.47°	1.8	354	1.7	179

Source: 1 USDOC, NOAA, NOS, 1984
2 USDOC, NOAA, NOS, 1983

Table D-2

Violations of Stream Water Quality Criteria
Salem River Watershed

Waterways	Sampling Station	Milepoint	DO	F. Coliform	TDS	pH	BOD_5 (1)	NH_3-N (2)	Total PO_4^{-3} as P (4)
					Parameters				
Salem River	SAM 010	26.30	1/41 (3)	0/3	0/2	0/4	10/40	0/4	20/27
Salem River	SAM 020	25.80	1/6	1/1	0/2	0/3	2/5	1/3	5/5
Salem River	SAM 030	24.00	3/20	3/3	0/2	0/4	7/7	0/1	6/6
Salem River	SAM 031	23.50	13/51	2/2	*	0/2	10/43	0/2	3/3
Salem River	SAM 040	21.70	4/6	1/1	0/2	0/4	2/6	0/3	5/5
Salem River	SAM 050	20.80	19/36	3/4	0/3	0/3	11/19	0/2	16/17
Salem River	SAM 060	14.50	2/5	0/1	0/3	2/5	6/6	**	6/6
Major Run	SAT 010	22.90, 0.5	1/2	0/1	0/2	0/2	0/2	0/2	2/2
Game Creek	SAT 020	16.00, 0.3	3/4	2/2	0/2	0/2	1/3	0/2	1/2
Percentage of stations violating Criteria			100%	67%	0%	11%	89%	12.5%	100%

Note: (1) BOD_5 Criterion is based on California Water Quality Criteria (5 mg/l).

(2) Analyzed for freshwater area, based on unionized NH_3 Criterion (0.02 mg/l).

(3) a/b, a - Number of samples which violated Criteria, b - Total number of samples.

(4) Total PO_4^{-3} as P should not exceed 0.1 mg/l in streams not discharging directly to lakes or impoundments, 0.05 mg/l in any stream at the point where it enters any lake or reservoir, or 0.025 mg/l within a lake or reservoir.

* No available information.

** Tidal Water Area.

Source: NJDEP, 1979.

Table D-3

NPDES Listed Municipal and Institutional Dischargers

Map #	NPDES Permit #	Discharger	Municipality	Receiving Waters	Treatment Process	Design Capacity mgd	1977-78 Avg. Flow mgd	1977-78 Average Daily Effluent Quality: BOD_5 mg/l	BOD_5 kg/day	S.S. mg/l	S.S. kg/day
P9	0028797	Salem Co. Vo-Tech. School	Mannington	Major Run Creek	Primary Extended Aeration	0.015	0.003*	203	5.1	13	0.3
P6	0024856	City of Salem	Salem	Salem River	Primary	1.25	0.591	75.5	162.2	26.9	58.6
P5	0022250	Woodstown Sewerage Authority	Woodstown	Trib. to Salem River	Secondary Standard Trickling Filter	0.300	0.260	31	29.8	19	18.9
P3	0020761	N.J. Turnpike Authority	Oldmans	Layton Lake	Secondary High Rate Trickling Filter	0.15	0.064	8.1	1.95	2.95	0.71

* 5 mo. period in 1977

NPDES Listed Industrial Dischargers

Map #	NPDES Permit #	Discharger	Municipality	Receiving Waters	Treatment Process	Design Capacity mgd	Discharge Serial #	1977-78 Avg. Flow mgd	1977-78 Average Daily Effluent Quality: BOD_5 mg/l	BOD_5 kg/day	S.S. mg/l	S.S. kg/day
P4	0004308	Richman Ice Cream	Pilesgrove	Salem River	Industrial	0.03	001	0.027	2670	241.6	570	53.6
P8	0005614	Mannington Mills	Salem	Pledger Creek	Process Cooling	-	001	0.179	-	-	59.7	40.0
P7	0005151	Anchor Hocking Corp.	Salem	Fenwick Creek		-	002 001	0.02 0.15	- -	- -	20.6 10.7	0.71 6.7

Table D-4

DELAWARE RIVER BASIN COMMISSION
SUMMARY OF 1982 AND 1983 WATER QUALITY - ZONE 5

Parameter		Marcus Hook RM 78	Oldmans RM 75	Cherry Is. RM 71	New Castle RM 66	Pea Patch RM 61	Reedy Is. RM 55	Appoquinimink RM 51
Dissolved Oxygen (mg/l)	Ave	5.9	5.9	6.4	6.7	7.1	7.6	7.5
	Max	11.5	11.3	11.6	10.7	11.0	11.6	11.7
	Min	1.6	2.6	2.4	3.2	4.2	4.8	5.3
	#	35	35	35	36	36	34	32
Fecal Coliform (#/100ml)	Ave*	131	82	69	52	33	25	16
	Max	5100	3700	3900	3600	260	480	70
	Min	10	10	10	10	5	10	10
	#	35	32	35	34	35	36	31
Total Phosphate (mg/l)	Ave	0.13	0.14	0.12	0.16	0.13	0.13	0.12
	Max	0.20	0.21	0.25	1.0	0.30	0.45	0.30
	Min	0.02	0.10	0.02	0.02	0.02	0.01	0.02
	#	31	19	32	32	30	32	29
Nitrate nitrogen (mg/l)	Ave	1.9	1.9	1.9	1.8	1.8	1.6	1.4
	Max	2.9	2.7	2.7	2.7	2.4	2.2	1.9
	Min	1.0	1.1	1.1	0.07	1.1	0.8	0.6
	#	35	19	35	36	36	35	32
Ammonia Nitrogen (mg/l)	Ave	0.30	0.28	0.28	0.3	0.27	0.26	0.24
	Max	0.90	0.75	1.05	1.1	0.95	1.15	[illegible]
	Min	0.10	0.10	0.10	0.1	0.01	0.10	[illegible]
	#	35	19	35	36	36	35	32
pH	Ave	7.2	7.4	7.3	7.3	7.3	7.4	7.4
	Max	7.8	7.8	7.8	8.2	8.3	8.3	8.0
	Min	6.2	6.7	6.3	6.3	6.1	6.0	6.5
	#	35	24	35	36	36	34	31
Alkalinity	Ave	418	42	41	41	42	46	50
	Max	51	58	59	60	61	77	77
	Min	26	19	27	23	24	23	25
	#	35	19	35	36	36	35	32
Phenols	Ave	0.007	0.03	0.011	0.020	0.045	0.130	0.124
	Max	0.052	0.255	0.165	0.210	0.330	0.830	0.460
	Min	0.005	0.005	0.011	0.005	0.005	0.003	0.005
	#	34	18	34	33	34	33	31
BOD_5	Ave	2.6	2.5	2.5	2.5	2.4	2.4	2.4
	Max	4.6	3.5	3.7	3.8	3.0	2.4	2.4
	Min	2.4	2.1	2.4	2.4	2.4	2.4	2.4
	#	35	20	35	35	36	35	32
Chlorophyll	Ave	10	9	8	9	7	6	5
	Max	24	21	41	34	21.0	21	15
	Min	0	0	0	0	0	0	0
	#	34	19	35	34	36	35	3[illegible]

* Geometric Mean

Source: DRBC, 1984

Table D-5

DELAWARE RIVER BASIN COMMISSION
SUMMARY OF 1982 AND 1983 WATER QUALITY - ZONE 6

Parameter		Smyrna (RM 44)	Ship John (RM 37)	Mahon (RM 31)
Dissolved Oxygen (mg/l)	Ave	7.7	7.6	7.6
	Max	12.1	11.9	12.8
	Min	5.2	5.3	5.1
	#	32	32	32
Fecal Coliform (#/100ml)	Ave*	12	12	11
	Max	60	60	60
	Min	10	10	10
	#	33	33	30
Total Phosphate (mg/l)	Ave	0.11	0.16	0.16
	Max	0.23	0.60	0.30
	Min	0.01	0.04	0.04
	#	30	29	29
Nitrate Nitrogen (mg/l)	Ave	1.2	1.0	0.7
	Max	1.9	2.0	1.0
	Min	0.4	0.6	0.3
	#	31	32	32
Ammonia Nitrogen (mg/l)	Ave	0.23	0.20	0.24
	Max	0.90	0.80	0.60
	Min	0.10	0.10	0.10
	#	32	32	32
pH	Ave	7.4	7.4	7.3
	Max	8.0	7.9	7.8
	Min	6.5	6.1	5.6
	#	31	31	31
Alkalinity (mg/l)	Ave	56	61	74
	Max	77	86	93
	Min	29	60	47
	#	32	32	32
Phenols (mg/l)	Ave	0.160	0.201	0.270
	Max	0.430	0.370	0.920
	Min	0.005	0.020	0.010
	#	31	31	31
BOD_5 (mg/l)	Ave	2.4	2.4	2.5
	Max	2.4	2.4	3.4
	Min	2.4	2.4	2.4
	#	32	32	32
Chlorophyll a (mg/l)	Ave	4	7	19
	Max	13	29	55
	Min	0	0	0
	#	32	32	32

* Geometric mean

Source: DRBC, 1984

Table D-6

FISHES KNOWN OR LIKELY TO OCCUR IN THE SALEM RIVER PROJECT AREA

Common Name	Scientific Name
Atlantic sturgeon	Acipenser oxyrhynchus
Shortnose sturgeon	A. Brevirostrum
Atlantic tomcod	Microgadus tomcod
American eel	Anguilla rostrata
Alewife	Alosa pseudoharengus
Blueback herring	A. aestivalis
American shad	A. sapidissima
Atlantic menhaden	Brevoortia tyrannus
Gizzard shad	Dorosoma cepedianum
Bay anchovy	Anchoa mitchilli
Northern pipefish	Syngnathus fuscus
Summer flounder	Paralichthys dentatus
Silvery minnow	Hybognathus nuchalis
Satinfin shiner	Notropis analostanus
Spottail shiner	N. hudsonius
Carp	Cyprinus carpio
Creek chubsucker	Erimyzon oblongus
White catfish	Ictalurus catus
Brown bullhead	I. nebulosus
Channel catfish	I. punctatus
Mumichog	Fundulus heteroclitus
Banded killifish	F. diaphanus
Atlantic silverside	Menidia menidia
Tidewater silverside	M. peninsulae
Striped bass	Morone saxatilis
White perch	M. americana
Black crappie	Pomoxis nigromaculatus
Bluegill	Lepomis macrochirus
Pumpkinseed	L. gibbosus
Bluefish	Pomatomus saltatrix
Spot	Leiostomus xanthurus
Hogchoker	Trinectes maculatus

Sources: U.S. Fish and Wildlife Service, 1981
Tyrawski 1979
U.S. Army Corps of Engineers, 1981

Table D-7

FISH CAUGHT BY OTTER TRAWL IN DELAWARE BAY

Sand tiger shark	Odontaspis taurus
Sandbar shark	Carcharhinus milberti
Smooth dogfish	Mustelus canis
Spiny dogfish	Squalus acanthias
Atlantic angel shark	Squatina dumerili
Clearnose skate	Raja eglanteria
Little skate	Raja erinacea
Winter skate	Raja ocellata
Roughtail stingray	Dasyatis centroura
Bluntnose stingray	Dasyatis sayi
Smooth butterfly ray	Gymnura micrura
Spiny butterfly ray	Gymnura altavela
Bullnose ray	Myliobatis freminvillei
Cownose ray	Rhinoptera bonasus
Atlantic sturgeon	Acipenser oxyrhynchus
Conger eel	Conger oceanicus
American shad	Alosa sapidissima
Blueback herring	Alosa aestivalis
Hickory shad	Alosa mediocris
Alewife	Alosa pseudoharengus
Atlantic menhaden	Brevoortia tyrannus
Atlantic herring	Clupea harengus harengus
Gizzard shad	Dorosoma cepedianum
Striped anchovy	Anchoa hepsetus
Bay anchovy	Anchoa mitchilli
Inshore lizardfish	Synodus foetens
Oyster toadfish	Opsanus tau
Goosefish	Lophius americanus
Silver hak	Merluccius bilinearis
Red hake	Urophycis chuss
Spotted hake	Urophycis regius
Striped cusk-eel	Rissola marginata
Ocean pout	Macrozoarces americanus
Striped killifish	Fundulus majalis
Threespine sticklee back	Gasterosteus aculeatus
White perch	Morone americana
Striped bass	Morone saxatilis
Black seabass	Centropristis striata
Snowy grouper	Epinephelus niveatus
Bluefish	Pomatomus saltatrix
Florida pompano	Trachinotus carolinus
Crevalle jack	Caranx hippos
Blue runner	Caranx crysos
Lookdown	Selene vomer
Atlantic moonfish	Vomer setapinnis
Pigfish	Orthopristis chrysoptera
Scup	Stenotomus chrysops
Silver perch	Bairdiella chrysoura

Table D-7 (Continued)

Weakfish	Cynoscion regalis
Northern kingfish	Menticirrnus saxatilis
Spot	Leiostomus xanthurus
Black drum	Pogonias cromus
Atlantic croaker	Micropogonias undulatus
Atlantic spadefish	Chaetodipterus faber
Tautog	Tautoga onitis
Striped mullet	Mugil cephalus
Northern stargazer	Astroscopus guttatus
Harvestfish	Peprilus alepidotus
Butterfish	Peprilus triacantnus
Northern searobin	Prionotus carolinus
Striped searobin	Prionotus evolans
Sea raven	Hemitripterus americanus
Grubby	Myoxocepnalus aenaeus
Longhorn sculpin	Myoxocephalus octodecemspinosus
Seasnail	Liparis atlanticus
Fringed flounder	Etropus crossotus
Smallmouth flounder	Etropus microstomus
Summer flounder	Paralichthys dentatus
Fourspot flounder	Paralichthys oblongus
Windowpane flounder	Scopnthalmus aquosus
Winter founder	Pseudopleuronectes americanus
Hogchoker	Trinectes maculatus
Orange filefish	Aluterus schoepfi
Planehead filefish	Monacanthtus nispidus
Northern puffer	Sphoeroides maculatus
Striped burrfish	Cnilomycterus scnoepfi

Source: Smith, 1982

Table D-8

SALEM RIVER BENTHIC COMMUNITY STRUCTURE
PAS APRIL 1985 SURVEY

Species	SS 1 #	SS 1 %	density /m²	SS 2 #	SS 2 %	density /m²	SS 3 #	SS 3 %	density /m²	SS 4 #	SS 4 %	density /m²
Corophium lacustre	1183	98.8	22,358.7	200	61.7	3780.0				23	43.4	434.7
Corophium sp.				4	1.2	75.6	330	94.0	6237.0	1	1.9	18.9
Polydora sp.				43	13.3	812.7						
Polydora ligni				8	2.5	151.2				6	11.3	113.4
Gammarus oceanicus	8	0.7	151.2	3	0.9	56.7				4	7.5	75.6
Gammarus sp.				7	2.1	132.3	1	0.3	18.9			
Cyathura polita	1	0.1	18.7	10	3.1	189.0	1	0.3	18.9	11	20.8	207.9
Cassidisea lunifrons	1	0.1	18.9	1	0.3	18.9	1	0.3	18.9			
Nais sp.				22	6.8	415.8	1	0.3	18.9			
Family Tubificidae				14	4.3	264.6				2	3.8	37.8
Microdeuptus sp.				9	2.8	170.1						
Polypedilum sp.	1	0.1	18.9	1	0.3	18.9	1	0.3	18.9			
Rhithropanopens harrisii	3	0.2	56.7									
Class Hirudinea				1	0.3	18.9						
Edotea triloba				1	0.3	18.9						
Melita sp.							14	4.0	264.6			
Scolecolepides viridis							1	0.3	18.9	3	5.7	56.7
Phylum Nemertea							1	0.3	18.9			
Lembos sp.										3	5.7	56.7
		1197			324			351			53	
# species		6			14			9			8	
$\bar{H}$		0.078			1.435			0.304			1.654	
e		0.044			0.544			0.138			0.796	
H_{max}		1.792			2.639			2.197			2.079	

$\bar{H}$ = Shannon-Weiner Index of Diversity ((McIntire and Overton, 1971)

e - Evenness Index (Pielou, 1966)

H_{max} = Potential Maximum Diveristy (L_n Species) (Shannon and Weaver, 1949; Margalef 1968)

Table D-9

RESULTS OF BCM MACROINVERTEBRATE SURVEY
OF OVERBOARD DISPOSAL SITE IN
SALEM COVE
JULY 26, 1983

Classification*	Sampling Stations BCM-6 Grab A	BCM-6 Grab B	BCM-7 Grab A	BCM-7 Grab B	BCM-8 Grab A	BCM-8 Grab B
NEMERTEA (proboscis worms)						
Anopla						
Paleonemerta						
TUBULANIDAE						
Tubulanus pellucidus	--	1	2	1	--	--
ANNELIDA						
Polychaeta (aquatic worms)						
Spionida						
SPIONIDAE						
Scolecolepides viridis	3	2	3	4	1	--
Oligochaeta (aquatic earthworms)						
Haplotaxida						
ENCHYTRAEIDAE						
Enchytraeus	--	2	--	1	--	--
ARTHROPODA						
Crustacea						
Isopoda (sow bugs)						
ANTHURIDAE						
Cyathura polita	--	2	1	--	51	44
Amphipoda (scuds)						
GAMMARIDAE						
Gammarus daeberi	7	5	5	10	--	--
COROPHIIDAE						
Corophium	--	--	--	--	1	1
Insecta						
Diptera						
CHIRONOMIDAE (midges)	--	--	--	1	1	--

Table D-9 (Continued)

Classification*	BCM-6 Grab A	BCM-6 Grab B	BCM-7 Grab A	BCM-7 Grab B	BCM-8 Grab A	BCM-8 Grab B
MOLLUSCA						
Bivalvia						
Pelecypoda						
MACTRIDAE						
Rangia cuneata	--	--	--	1	--	--
Total number of individuals	10	12	11	16	54	45
Total number of species	2	5	4	6	4	2

*Classification system used is as follows:

PHYLUM
Class
Order
Family
Genus species

Source: BCM Eastern Inc.

Table D-10

SEDIMENT CHEMICAL LEACHATE ANALYSIS

PARAMETER (All units are mg/ℓ unless stated)	SEDIMENT SAMPLING SITES[1] Salem River				Detectable Limit	Toxicity[2] Standards
	1	2	3	4		
Cyanide Total	BDL	BDL	BDL	BDL	0.02-0.03	0.2
Arsenic	BDL	BDL	BDL	BDL	0.01	5.0
Barium	0.5	BDL	0.3	BDL	0.05	100.0
Cadmium	BDL	BDL	BDL	BDL	0.0008	1.0
Chromium Total	0.03	BDL	BDL	BDL	0.01	5.0
Lead	BDL	BDL	BDL	BDL	0.008	5.0
Mercury	BDL	BDL	BDL	BDL	0.002	0.2
Nickel	BDL	BDL	BDL	BDL	0.006	-
Selenium	BDL	BDL	BDL	BDL	0.001	1.0
Oil and Grease (Soxhlet extraction)	BDL	8	13	9	0.05	-
Copper	BDL	BDL	BDL	0.006	0.0015	-
Zinc	0.02	0.02	0.01	0.1	0.007	-
Benzene					0.001	-
Carbon tetrachloride					0.001	-
Chlorobenzene					0.001	-
Chloroform					0.001	-
PCB					0.005	-
DDT and Metabolites					0.001	-
Phenolic Compounds (as phenols)	.003	.022	.005	.005	0.002	-
bis (2-ethylhexyl) phthalate					0.01	-
pH	6.86	4.35	7.2	7.05		
Total Organic Carbon	7	157	86	51		
Sulfate	34	64	22	34		

(1) See Figures 6 & 7 for sampling station

(2) Source: 40 CFR 261-24

BDL - Below Detectable Limit

Table D-11

SALEM COVE CHANNEL WATER AND SEDIMENT TESTING RESULTS
EPA ELUTRIATE
BCM JULY 26, 1983 SURVEY

Parameters and Units	Water Column Composite	Sampling Stations BCM-1	BCM-2	BCM-3	BCM-4	BCM-5
PESTICIDES & PCB (mg/l)						
PCB A-1016	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
PCB A-1221	<0.16	<0.16	<0.16	<0.16	<0.16	<0.16
PCB A-1232	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
PCB A-1242	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
PCB A-1248	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
PCB A-1254	<0.07	<0.07	<0.07	<0.07	<0.07	<0.07
PCB A-1260	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Aldrin	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
a-BHC	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
b-BHC	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003
d-BHC	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
g-BHC	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Chlordane	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
4,4'-DDD	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4,4'-DDE	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
4,4'-DDT	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Dieldrin	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Endosulfan I	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Endosulfan II	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Endosulfan sulfate	<0.004	<0.004	<0.004	<0.004	<0.004	<0.004
Endrin	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Endrin aldehyde	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Heptachlor	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Heptachlor epoxide	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Toxaphene	<0.003	<0.003	<0.003	<0.003	<0.003	<0.003

Table D-11 (Continued)

Parameters and Units	Water Column Composite	BCM-1	BCM-2	BCM-3	BCM-4	BCM-5
		Sampling Stations				
PURGEABLE HALOCARBONS (mg/l)						
Chloromethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromomethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Vinyl chloride	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Methylene chloride	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichlorofluoromethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
trans-1,2-Dichloroethene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chloroform	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,1,1-Trichloroethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Carbon tetrachloride	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromodichloromethane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichloropropane	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trans-1,3-Dichloropropene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Trichloroethene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dibromochloromethane and/or 1,1,2-Trichloroethane and/or cis-1,3-Dichloropropene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Bromoform	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
1,1,2,2-Tetrachloroethane and/or Tetrachloroethene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0

Table D-11 (Continued)

Parameters and Units	Water Column Composite	BCM-1	BCM-2	BCM-3	BCM-4	BCM-5
		Sampling Stations				
PURGEABLE AROMATICS (mg/l)						
Benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Toluene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Chlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ethyl benzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,3-Dichlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,4-Dichlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
1,2-Dichlorobenzene	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
METALS AND MISCELLANEOUS (mg/l)						
Di-2-Ethy-hexylphthalate	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01
Arsenic (GF)	0.006	0.008	0.011	0.006	0.004	0.005
Barium (GF)	0.013	0.202	0.188	0.318	0.176	0.150
Cadmium (GF)	<0.0005	0.0009	0.0005	0.0005	0.0007	0.0008
Cyanide	<0.005	<0.005	<0.005	<0.005	<0.005	<0.005
Chromium (GF)	0.005	<0.002	<0.002	<0.002	<0.002	<0.002
Copper	<0.03	<0.03	<0.03	<0.03	<0.03	<0.03
Mercury	0.0007	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Nickel	<0.06	<0.06	<0.06	<0.06	<0.06	<0.06
Oil & grease (Sox)	2	2	<1	<1	<1	2
Lead (GF)	<0.002	0.014	0.012	0.013	0.015	0.018
Phenols, as Phenol	0.062	0.183	<0.002	0.02	0.032	0.032
Selenium (GF)	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Zinc	0.05	<0.01	0.03	0.13	0.10	0.09
Dissolved oxygen*	6.6	--	--	--	--	
Temperature*	27.0	--	--	--	--	
pH (field)*	7.4	--	--	--	--	

*Average of 5 readings

Source: ᴗCM Eastern, 1984

Table D-5

DELAWARE RIVER BASIN COMMISSION
SUMMARY OF 1982 AND 1983 WATER QUALITY - ZONE 6

Parameter		Smyrna (RM 44)	Ship John (RM 37)	Mahon (RM 31)
Dissolved Oxygen (mg/l)	Ave	7.7	7.6	7.6
	Max	12.1	11.9	12.8
	Min	5.2	5.3	5.1
	#	32	32	32
Fecal Coliform (#/100ml)	Ave*	12	12	11
	Max	60	60	60
	Min	10	10	10
	#	33	33	30
Total Phosphate (mg/l)	Ave	0.11	0.16	0.16
	Max	0.23	0.60	0.30
	Min	0.01	0.04	0.04
	#	30	29	29
Nitrate Nitrogen (mg/l)	Ave	1.2	1.0	0.7
	Max	1.9	2.0	1.0
	Min	0.4	0.6	0.3
	#	31	32	32
Ammonia Nitrogen (mg/l)	Ave	0.23	0.20	0.24
	Max	0.90	0.80	0.60
	Min	0.10	0.10	0.10
	#	32	32	32
pH	Ave	7.4	7.4	7.3
	Max	8.0	7.9	7.8
	Min	6.5	6.1	5.6
	#	31	31	31
Alkalinity (mg/l)	Ave	56	61	74
	Max	77	86	93
	Min	29	60	47
	#	32	32	32
Phenols (mg/l)	Ave	0.160	0.201	0.270
	Max	0.430	0.370	0.920
	Min	0.005	0.020	0.010
	#	31	31	31
BOD_5 (mg/l)	Ave	2.4	2.4	2.5
	Max	2.4	2.4	3.4
	Min	2.4	2.4	2.4
	#	32	32	32
Chlorophyll a (mg/l)	Ave	4	7	19
	Max	13	29	55
	Min	0	0	0
	#	32	32	32

* Geometric mean

Source: DRBC, 1984