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One of the long-standing civil works missions of the U.S. Army Corps of Engineers is maintaining navigable waterways. The Philadelphia District has had this responsibility for the Delaware River, its tidal reaches, its tributaries, and inlets along the Atlantic coast since its official founding in 1866, and it continued to be an important, albeit complicated, mission into the twenty-first century. By the end of the twentieth century, much of the Philadelphia District's navigation mission focused on stretches of the Delaware River from Philadelphia to the ocean and from Philadelphia to Trenton, N.J., as well as ports and inlets in New Jersey and Delaware. The district also had responsibility for the Chesapeake and Delaware Canal, which

connected Chesapeake Bay and Delaware Bay and shortened the shipping of goods along the eastern seaboard by 150 miles. Much of the district's navigation mission involved channel deepening and maintenance dredging, and the district frequently dealt with issues of where to place dredged material and the effects of their disposal on the environment, a topic that became increasingly controversial as environmental awareness increased in the United States. Because of the economic importance of the waterways within the Philadelphia District's boundaries, the navigation mission was not only one of the district's oldest functions, but also one of its most important.

The Corps' efforts in navigation could take several forms.

Facing page: Dredging from the Delaware River, Philadelphia to Sea federal channel for pumpout to the Killcohook confined disposal facility

According to one source, it consisted of “river deepening, channel widening, lock expansion, dam operations, and dredged material disposal.”¹ It could also involve construction of jetties and other structures in inlets to develop shipping channels. Most of the Philadelphia District’s navigation work involved maintaining waterways through dredging. This was the process by which shoal material was taken from the bottom of a waterway and disposed of elsewhere, thereby keeping a channel at its authorized depth.² It involved not only the physical removal of the built-up sediments, but also

significant planning as to where they could be safely and productively deposited.

The planning, development and construction of navigation projects involved personnel from a number of the district’s branches and sections, but operation and maintenance activities (including hydrographic surveying, dredging, and dredged material management) fell entirely within the Operations Division.³ Work on existing projects was typically funded out of operation and maintenance funds appropriated by Congress, while any new navigation project was covered under the Construction General account. Under the stipulations of the Water Resources Development Act of 1986, for commercial navigation projects involving coastal ports, the federal government paid between 40 and 80 percent of construction costs and 50 percent of the cost of feasibility studies (with the nonfederal sponsor accountable for the balance), while the government footed 100 percent of the bill for reconnaissance studies.⁴

Kilcohook Confined Disposal Facility, one of eight Corps-owned and operated sites for dredged material from the Delaware River, Philadelphia to Sea federal navigation channel





Floating Plant: The District Fleet

In dredging a waterway, the Philadelphia District could use its own hopper dredges or could delegate the work to a private contractor. Between 1972 and 1980, the district used three Hopper Dredges: the *Comber*, the *Goethals*, and the *Essayons*. Each was outfitted to provide “direct pump-out of dredged material, a method of disposal developed by the Philadelphia District in the early 1960s” to “transfer . . .

material from dredge hoppers to onshore sites without intermediate rehandling.”⁵ In 1978, however, Congress passed an act that required the secretary of the army to contract out dredging operations “if he determines private industry has the capability to do such work and it can be done at reasonable prices and in a timely manner.”⁶ Accordingly, the Corps engaged private contractors for dredging work, gradually reducing its own fleet of hopper dredges. By the end of 1983, the *Comber*, *Goethals*,

The Survey Boat Shuman approaching the Chesapeake City Bridge, en route to its next assignment in the Chesapeake & Delaware Canal



From top: Hopper Dredges Comber, Goethals, and Essayons

and *Essayons* were gone, while the *McFarland* had been reassigned from the Jacksonville District to the Philadelphia District to take their place as the Corps' sole hopper dredge for the east coast.⁷

The fate of the three old dredges decisive if not dignified. They were retired in consecutive years—*Essayons* in 1981, *Goethals* in 1982, and *Comber* in 1983—and remained for some time at the U.S. Maritime Administration's National Defense Reserve Fleet in James River, Va. Eventually the latter two were acquired by the United States Navy for target practice and sunk off the coast of Puerto Rico, where they serve in perpetuity as artificial reefs (fish habitat). As for the *Essayons*, it was sold to a U.S. buyer, sent to India and cut up for scrap; and in a particularly cruel twist of irony for a vessel that had served the nation through the heart of the Cold War, its 1991 final voyage from Virginia to India was powered by a Soviet tugboat.⁸

By 2007 it appeared that the *McFarland*, by then one of only four Corps-owned seagoing hopper dredges, was bound for the same

fate as its three Philadelphia District predecessors. The prevailing argument in Congress was that, as the oldest of the four remaining vessels, it was no longer cost-effective to maintain. But after some people expressed concern over the diminishment of the nation's quick-response capabilities, the Water Resources Development Act of 2007 included a provision assigning the *McFarland* to ready reserve status, which meant continued operation—albeit for fewer days annually—and readiness for deployment.⁹

The *McFarland* was a propelled floating plant, meaning that it was “capable of dredging material, storing it onboard, transporting it to the disposal area, and dumping it.” It was also the only dredge in the world with the triple capability for direct pumpout, bottom discharge, and “sidecasting,” or boom discharge, of dredged sediments. First constructed in 1967 under the jurisdiction of the Galveston District, the *McFarland*, which had about a sixty-person crew, had a twofold mission for the Corps: dredging of the Delaware River and

other waterways along the Atlantic coast, and emergency dredging anywhere in the world. According to Joe Vilord, former captain of the *McFarland*, the dredge went wherever the work was.¹⁰

An integral part of dredging was surveying the waterway before, during, and after dredging activities. The Philadelphia District used the Survey Boat *Shuman*, as well as other vessels operating out of Fort Mifflin and the Atlantic City Field Survey Section, to perform these activities. According to one district publication, the Survey Section had two missions. Its first responsibility

The twin-hull Survey Boat Shuman, with full-service onboard capabilities to provide channel depth reports to the maritime community



was “collect[ing] and record[ing] depth measurements for use in both navigation and dredging”; its second duty was “locat[ing] and identify[ing] underwater objects that pose a potential hazard to either of those activities.” The *Shuman* could provide data to the Corps on the size of a shoal that needed dredging, as well as the type of soil in the shoal.¹¹

After survey work was done on a waterway, the actual dredging began. As mentioned earlier, the Philadelphia District devised a dredging method known as a

“direct pumpout.” According to Vilord, this meant that the dredge would make one pass along a waterway and fill up the ship with dredged material. It would then hook on to a barge, connect to the pipes on the barge, and pump the material onto a disposal site onshore before making another pass. This would continue for several days. The survey boat would then do another survey to gauge progress, more dredging would occur if necessary, and the process would repeat until the waterway had reached the desired

The Hopper Dredge McFarland, with unique triple capability for hopper, pipeline, and sidecast dredging



depth. Over time, the implementation of the Global Positioning System (GPS) enabled the Corps to be more precise in its dredging and surveying activities, which made the entire process more efficient from all perspectives.¹²

Serving on a dredge was not an easy experience. The crew of the *McFarland*, for example, generally worked two-week shifts at a time. Because the vessel operated twenty-four hours every day, posts were constantly manned. One never knew what to expect. For instance, at one point the *McFarland* had so much trouble with sea turtles being caught in the ship's filter, which prevented objects from reaching the vessel's hull, that the Marine Design Center had to develop a dredging draghead deflector to prevent them from entering the pumping system in the first place. But most of the *McFarland's* crew enjoyed their work. "It's a great lifestyle," said Captain Thom Evans. "There's always a pot of coffee on and someone to talk to."¹³

The *McFarland* (and the *Essayons* before it) did not just dredge in waterways under the



The Survey Boat Cherneski

Philadelphia District's jurisdiction.

The vessel also frequented other ports and waterways along the east coast. In 1996, for example, after Hurricane Fran had passed over the east coast, the Corps sent the *McFarland* to the Cape Fear River in North Carolina to remove material clogging its mouth. In this case, the *McFarland* worked with the Wilmington District with good results. According to Eric Stromberg, director of the North Carolina State Ports, "We were very pleased with how quickly the *McFarland* was able to restore our channel to its proper dimensions."¹⁴ Such emergency dredging responsibilities took the *McFarland* all over the eastern United States.



The bridge of the McFarland



Routine dragarm inspection

Tying up at dockside at the end of a mission



In 1995, Assistant Master Karl Van Florcke (who became captain of the *McFarland* in 1999, after Vilord's retirement) noted that the *McFarland* had visited "the ports of Philadelphia, Norfolk (Va.), Wilmington (N.C.), Charleston (S.C.), Savannah (Ga.), and Fernadina and Canaveral harbors in Florida" for emergency dredging purposes, eventually ending up in Galveston Harbor in Texas to clear shoals from the inner bar channel.¹⁵ Other emergencies also required the *McFarland* to travel out of the Philadelphia District boundaries. In 2001, for example, the *McFarland* answered a distress call from the CIC Vision in the Mississippi River Gulf Outlet stating that the ship was on fire. The crew of the *McFarland*, many of whom were trained firefighters, extinguished the blaze over an eight-hour period.¹⁶

Fire was not the only hazard that those working on dredges sometimes faced. In 1993, the Philadelphia District discovered that dredged material being deposited at the Fort Mifflin disposal area contained "unfired, live

ammunition” from “old rifle[s] and anti-aircraft” devices. The district was forced to halt dredging operations, which were being conducted by a private company at the berthing piers of the Philadelphia Navy Base.¹⁷ In 2007, the Corps was constructing a beachfill project at Surf City and Ship Bottom, N.J., when it discovered World War I-era discarded munitions in the dredged material the contractor was depositing on the beach.

Even though neither incident resulted in any personal injuries or property damage, the Corps instituted requirements for additional screening and filtering of dredged material in areas considered at risk for submerged munitions.¹⁸

By the 1970s, the largest dredging projects the Philadelphia District undertook within its own boundaries were the Delaware River, Philadelphia to the Sea Project, the Chesapeake and Delaware Canal (and Chesapeake Bay approach channels to Baltimore Harbor), the Wilmington Harbor Project, the Delaware River, Philadelphia to Trenton Project, and the Schuylkill River Project.



The McFarland hooks up to Mooring Barge #2 for direct pumpout to the disposal site



In addition, the district performed maintenance dredging on smaller projects under the Continuing Authorities Program. According to Section 107 of the River and Harbor Act of 1960, as amended, the district could construct new channels or extend existing projects, as long as the Corps' expenditures on those projects did not exceed \$2 million.¹⁹

The Delaware River Dredging Disposal Study

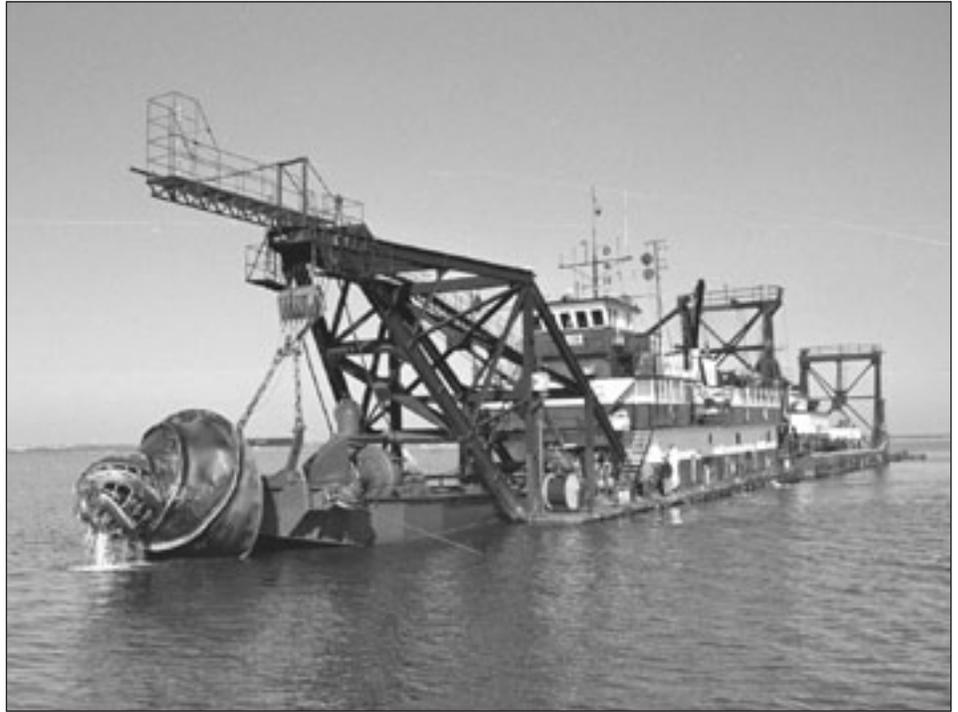
One of the Philadelphia District's main navigation functions was the dredging of waterways to maintain their authorized depth. According to one Corps publication, maintenance dredging was "the repetitive removal of naturally recurring deposited bottom sediment such as sand, silt, and clays in an existing navigation channel." Together with "occasional enlarging and deepening of navigation channels," the practice was "essential to accommodate commercial and recreational vessels."²⁰ As mentioned previously, the district was responsible

for maintaining numerous waterways through dredging. However, gaining approval for maintenance dredging was not always easy, in part because of the perceived environmental impact of the process. Environmentalists questioned whether material dredged from the bottom of rivers and waterways contained toxins that would harm the environment and expressed concern about the ever-increasing amount of dredged spoils that had to be deposited somewhere. The Corps did not pretend that dredging produced no adverse environmental effects, but it sought ways to minimize those effects. For example, as early as 1975, the Corps admitted that maintenance dredging on the Delaware River could "produce temporary local turbidity" which could "release pollutants into the water." Especially in the 1990s and 2000s, the agency explored ways to minimize these environmental effects and to reuse dredged material in beneficial ways, such as for beach nourishment, ecosystem restoration, or building and road construction. In addition, the

Corps began publishing newsletters such as *Environmental Effects of Dredging* to provide a forum for scientists, engineers, and others to discuss how to minimize impacts on the environment.²¹

As dredging continued in the twentieth century, it became more difficult to find areas to dispose of the material. As Lt. Col. Ralph Locurcio, former District Engineer of the Philadelphia District, explained, “Because the Delaware runs through such an urbanized area, trying to find places to put the muck that you dredge up out of the river becomes an issue” because “there just aren’t too many open lands where you can put this stuff.”²² The district estimated in the 1970s that its existing sites would be “filled to capacity by the 1990s.”²³

Some people were concerned about the cost of maintenance dredging and dredging disposal. Between 1956 and 1978, the federal government bore all the costs of disposal area preparation, requiring local sponsors to provide only “lands, easements, rights-of-way, and spoil disposal areas



Dredging in the Delaware River, Philadelphia-to-Sea federal navigation channel

necessary for construction of the project and for subsequent maintenance when and as required.”

As Col. James G. Ton, District Engineer of the Philadelphia District from 1978 to 1981, noted, this meant “that the States only furnish the land for disposal areas, as well as any necessary clearing.” In 1978, the chief of engineers began requiring local sponsors to bear site preparation costs, much to the displeasure of local and state governments. This led to the deferral of several maintenance dredging projects under the Philadelphia District’s purview.²⁴



Depositing of dredged material via pipeline at the Fort Mifflin CDF

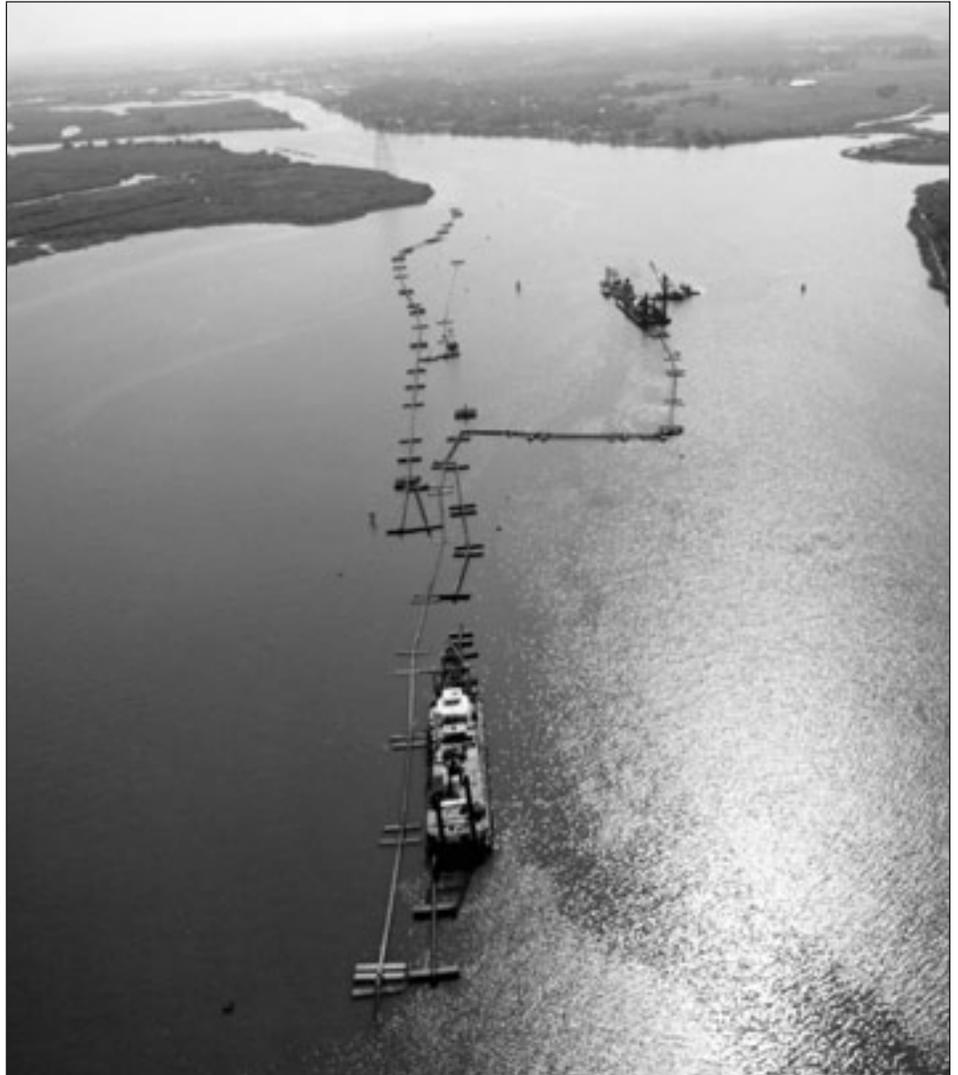
Other problems arose because existing dredged disposal sites were quickly reaching maximum capacity. In the 1970s and 1980s, the district turned its attention to developing a long-term strategy for disposing of dredged materials. In 1974, the Delaware River Basin Commission (DRBC) had requested that the Philadelphia District prepare, in the words of one historian, “a long-range regional disposal plan which would minimize environmental degradation.”²⁵ This plan would focus on how to dispose of dredged material in the tidal Delaware River, the

tidal tributaries of the river, and Delaware Bay. It would identify specific sites that both the Corps and its private contractors could use to dispose of dredged material “with minimum degradation of the natural environment.” After the passage of this resolution, the Senate Committee on Public Works authorized the development of “a regional dredging spoil disposal plan for the tidal Delaware River, its tidal tributaries and Delaware Bay.” The Philadelphia District received funding for this study in fiscal year 1978 and commenced its investigations. Congress directed the Corps to include Indian River Inlet and Bay in the study.²⁶

In June 1979, the Philadelphia District released a reconnaissance report outlining both long-term and short-term disposal plans. In preparing the report, the Corps had coordinated with the DRBC, the Delaware Valley Regional Planning Commission, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and the U.S. Geological Survey, as well as with Delaware and New Jersey environmental departments.

Work included evaluating bottom sediments in the Delaware River navigation channel and compiling an inventory of fish and wildlife that might be affected by dredging and disposal. In addition, the Corps' Waterways Experiment Station in Vicksburg, Mississippi, conducted a Dredged Material Research Program to provide "answers to questions of why and under what circumstances does the disposal of dredged material produce adverse environmental impacts." This work "produced tested, viable, cost-effective methods and guidelines for reducing the impacts of conventional disposal alternatives."²⁷

In preparing the reconnaissance study, the district considered ten alternatives for dredging disposal. These included dewatering disposal sites, increasing the height of containment dikes, reusing dredged material, reducing the amount of dredging, acquiring new upland sites for dredging, and disposing of material in open water. Ultimately, the district concluded that all of these alternatives should be studied further so the Corps could "more



Maintenance dredging, Salem River, N.J.

formally document attempts at extending the useful life of disposal areas and to more formatively analyze potential new sites."²⁸

The district proceeded with Phase II studies of the alternatives, continuing to work with interested parties to develop dredging disposal plans that were environmentally sound. As part of the Phase II program, the district held



Loading of dried-out dredged material to be transported offsite by third parties for beneficial re-use

public meetings to give “citizens a chance to sound off about where to put the material after its 18 active disposal areas are exhausted in the 1990s.”²⁹ The Corps also used the meetings as a way to inform the general public about its plans. In a March 1980 gathering in Delaware, for example, Deputy District Engineer Lt. Col. Joel Callahan provided an overview of the Corps’ dredging responsibilities on the Delaware River, explaining that the river had “more than 15 port areas and two open-bay areas which handle significant amounts of waterborne commerce along the Delaware River and Bay from

Trenton to the sea.” Callahan said, “Dredging is vital to the effective operations of these port areas.” He listed the major commodities that were shipped along the Delaware, which include petroleum, metal products, sugar, nonmetallic minerals, scrap metals, coal, chemicals and allied products, and farm products. Because “one out of every ten jobs in the Delaware Valley is related to the ports along the Delaware,” Callahan said maintaining the navigation channel through dredging was “vital to the economy and well-being of the entire region.”³⁰

Several disposal sites existed in the area, including seven for the Delaware River, Philadelphia to the Sea and the Schuylkill River, two for Wilmington Harbor, and nine for the Delaware River, Philadelphia to Trenton. But by 1999, all these sites would reach their capacity (the Wilmington Harbor sites would reach theirs by 1983). If solutions were not found to this dilemma, the district argued, dredging would cease along the Delaware River, adversely affecting the area’s economy. To

address concerns about possible toxicity of dredged material, Callahan said the district conducted “a total chemical analysis of the composition of the material” before each mission and shared the results with various agencies (such as the EPA, the U.S. Fish and Wildlife Service, and state environmental agencies) to receive their concurrence before proceeding. He mentioned the possibility of the Corps using some of the dredged material to create wetlands, thereby enhancing the environment.³¹ However, some people continued to believe that dredging was harmful to the environment.

After obtaining input from the public, the Philadelphia District continued with its review of the alternatives presented in the reconnaissance plan, including “real estate studies, economic and environmental studies, public involvement and agency coordination and aerial survey data.”³² The district had removed nearly eight million cubic feet of material a year as part of three Delaware River navigation projects, combined with the Christina River,

Wilmington Harbor, and Schuylkill River projects (defined as the “deep draft” dredging projects). The Corps investigated whether the huge amount of material could be reduced through “changes in certain dredging operation practices” and through channel realignments and other methods, “without significantly increasing the safety hazard to navigation.”³³

In June 1984, the Corps released its recommendations for a disposal plan along the Delaware River and its tributaries. This report explained that federal and nonfederal dredging produced over eleven million cubic yards

The Wilmington Harbor South confined disposal facility





Another view of the Wilmington Harbor South disposal site

of material each year, an amount that would increase as projects were added. The district determined that, in the worst-case scenario (in which every proposed project was authorized), it would have a shortfall in disposal of 335 million cubic yards. In a more probable scenario, the shortfall would be just over 78 million cubic yards. The district recommended both a short-term and a long-term strategy to deal with the deficit. In the short term, the Corps recommended “extend[ing] leases at existing sites, acquire[ing] and us[ing] advanced dewatering equipment, continu[ing] to make

dredge material available for re-use and consider[ing] acquiring one additional site.” For the long-term, the district recommended “continu[ing] past management practices and incorporat[ing] new development, as appropriate, . . . acquire[ing] long term leases or land in fee where appropriate and consider[ing] acquiring five new disposal sites.”³⁴

The report suggested that the long-range recommendations be implemented “at least 5 years prior to the exhaustion of disposal capacity to allow sufficient time to carry out the site acquisition and preparation phase.” In addition to helping guide its own future decisions about acquiring disposal sites, the Corps believed the information it had gathered from the study could provide states with a starting point for their own dredging disposal plans.³⁵ With these recommendations in place, the Corps hoped to have adequate dredged material storage capacity for years to come.

By the time the report was published, the advanced dewatering equipment had already been

acquired and was “operating successfully” on Cherry Island, where dredged material from Wilmington Harbor was disposed. The report noted that the Corps could obtain “more efficient use of existing and potential new disposal sites.”³⁶

However, even with these general recommendations, the district still had to deal with specific dredging sites. Before the dredging disposal study was finalized, the Philadelphia District acquired a new site for Wilmington Harbor. The Corps first received authorization to dredge Wilmington Harbor, located at the confluence of the Christina and Delaware Rivers, in 1896. Throughout the twentieth century, the district performed this function, maintaining the harbor to a depth of thirty-five feet. Most of the dredged material was placed on Cherry Island, but by 1983 it was apparent that this site would soon be filled. The Corps undertook a study of alternatives, resulting in a 1985 recommendation to develop “an approximately 326-acre area between the mouth of the Christina River and Pigeon Point as a

disposal area.”³⁷ Later that year, the Corps filled “a subtidal mudflat in the upper Delaware Estuary. . . to create a dredged-material disposal area” known as the Wilmington Harbor South site.³⁸ The creation of this site apparently fulfilled the needs of disposal, as dredging continued at Wilmington Harbor.³⁹ The Wilmington Harbor South Disposal Area won a 1992 Federal Design Achievement Award from the National Endowment for the Arts, recognizing the district’s “. . . Contribution to Excellence in Design for the Government of the United States of America.”⁴⁰

Meanwhile, environmental concerns about dredging and its effects continued to be expressed in the 1980s, 1990s, and 2000s. In the 1980s, for example, the Delaware Basin Fish and Wildlife Management Cooperative (an amalgamation of representatives from the National Marine Fisheries Service, the U.S. Fish and Wildlife Service, and Pennsylvania, New Jersey, and Delaware) recommended that bucket dredging in the Delaware River and Bay be halted from March through May and from

September through November because of concerns that “increased turbidity and related effects in the water” would “adversely affect shad migration.” These recommendations had no force of law, but the Philadelphia District made a policy decision to follow any suggestions the group offered; accordingly, the district did no dredging during those periods, even though this action resulted in shorter periods when the Corps could dredge. In 1990, the cooperative recommended that hydraulic dredging be

halted on reaches of the Delaware River each spring to ensure that striped bass eggs were not displaced by dredging. However, in making this recommendation, the cooperative did not have hard evidence that the dredging actually harmed striped bass. The Philadelphia District conducted its own study of the issue and determined not only that the dredging would not adversely affect striped bass but that bucket dredging did not have harmful effects on the shad. The district presented

Dredging in Wilmington Harbor



these findings to the cooperative in 1993, and the cooperative agreed to let the district lift the ban on fall bucket dredging and spring hydraulic dredging. According to one account, the Philadelphia District's coordination with and willingness to listen to the cooperative "enhanced its relations with the group, exemplifying what the Corps means when advancing the benefits of partnering with other agencies and commissions."⁴¹

The district exhibited this same spirit of cooperation during other projects. In 2007, the district unveiled its plans to use 20 acres of the 330-acre Palmyra Cove Nature Park to deposit 55,000 cubic yards of sediment from the Delaware River. The Nature Park had actually been constructed on an old dredging disposal site in the late 1990s, under an agreement among the Corps, the New Jersey Department of Environmental Protection, and the Burlington County Bridge Commission, with the understanding that seventy acres of the site could still be used for dredging disposal. However, because of funding issues, the



Dredge pumpout at Palmyra Cove, where part of the original disposal area was converted into a nature center

Corps had not been able to do much maintenance dredging of the Philadelphia to Trenton channel in the intervening years and, as explained in one article, "the site's original purpose faded from local memory." When the district proposed to use part of the site for dredging disposal, some environmental groups saw it as an attempt to destroy the Nature Park, and they quickly objected.⁴²

The district's project team directly engaged these critics, assuring them "that the Corps would take great pains to disturb the center as little as possible." When the disposal occurred, the district was true to its word, leaving opponents surprised but

also satisfied. As Clara Ruvolo, director of the Nature Park, said, “The Army Corps lived up to its promise to preserve the Dragonfly Pond, accomplishing a difficult job with minimal disruption.” In Ruvolo’s eyes, Corps personnel treated their critics with respect, “engag[ing] them in dialogue and express[ing] an interest in their opinions.” Such willingness to communicate allowed the district to defuse a potentially volatile situation.⁴³

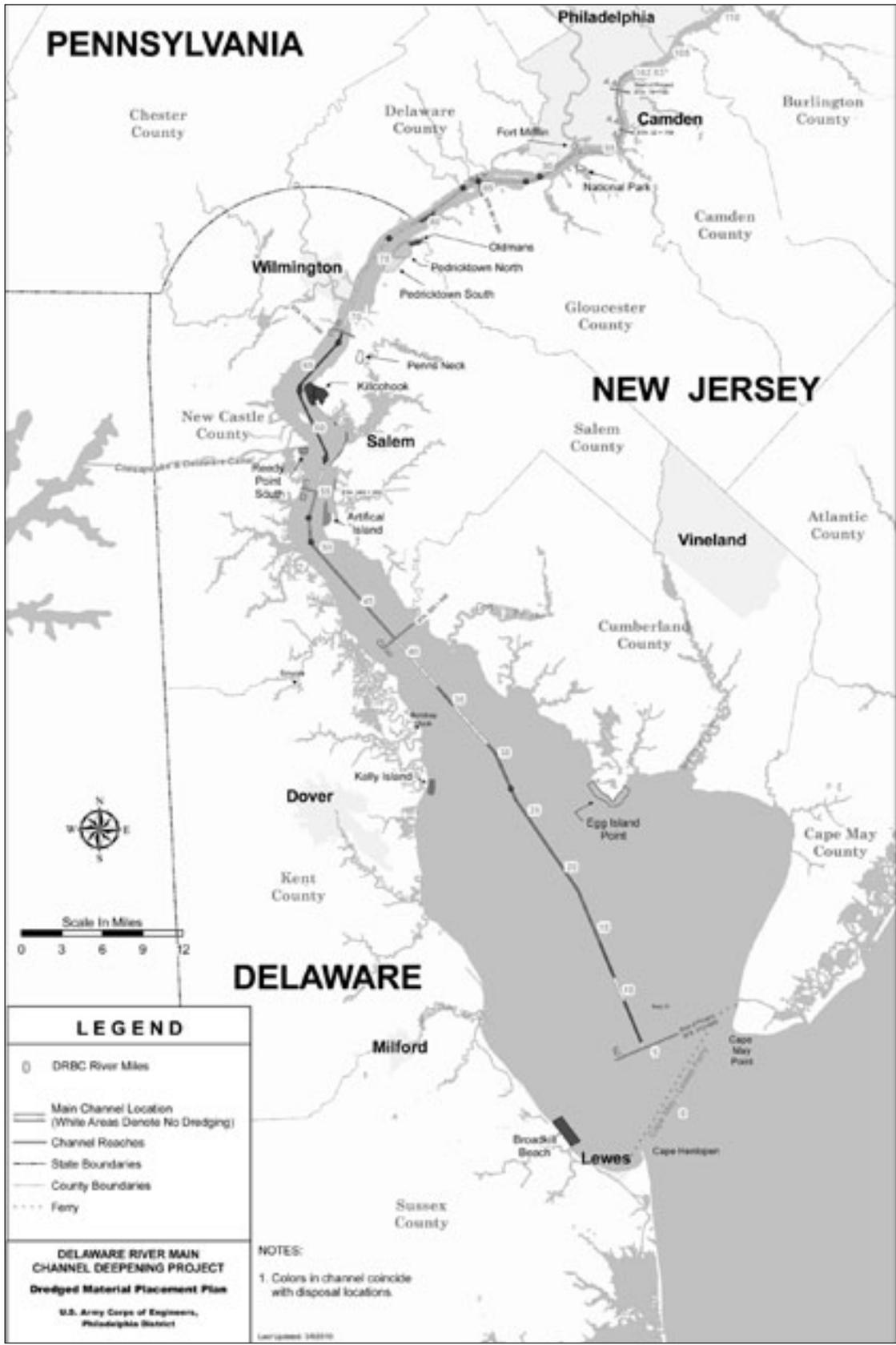
Delaware River Main Channel Deepening

Though most of the district’s year-to-year navigation activities (and the Corps’) fell under the heading of operations and maintenance, the end of the twentieth century saw the emergence of two large-scale improvement projects—both to deepen existing navigation channels. But just as not all the proposed dams from the 1962 comprehensive study were built, only one of these two projects—the Delaware River Main Channel Deepening—would move forward to eventual construction,

and that only after multiple challenges and delays. (The other was the proposed Chesapeake and Delaware Canal deepening, discussed later in this chapter.)⁴⁴

In the late 1800s, the Philadelphia District assumed responsibility for maintaining the federal shipping channel in the Delaware River, which ran 106 miles from Trenton, N.J., to Delaware City, Del., at a depth of eighteen feet. As ships traversing the river became larger, it was necessary to deepen the channel. By the Second World War, the authorized depth was forty feet, and the district had three separate navigation projects covering the river: Delaware River, Philadelphia, Pa., to Trenton, N.J. (first adopted in 1930); Delaware River, Philadelphia to the Sea (adopted in 1910); and Camden, N.J. (adopted in 1919).

To maintain the Delaware River main channel at forty feet, the Corps had to conduct periodic dredging. In 1975, it estimated that it had removed approximately one billion cubic yards of material from the river, including



six million cubic yards annually from the Philadelphia to the Sea stretch alone. These operations ensured safe passage for the “over 100 million tons of waterborne commerce”⁴⁵ that traversed the river each year, making it “the second largest port-complex in the United States.”⁴⁶

In 1970, the House Committee on Public Works passed a resolution requesting that the Philadelphia District conduct a Delaware River Comprehensive Navigation Study “to address the problems at waterways of Federal interest,” including the main Delaware River channel, the Chesapeake and Delaware Canal, waterways tributary to the Delaware River, and the area’s port system. Four years later, the Senate Committee on Public Works charged the district with producing a regional dredging plan for the Delaware River. Finally, to supplement these studies, Congress authorized the Philadelphia District in 1983 to examine whether the main channel of the Delaware River needed to be deepened to accommodate larger ships. In 1992,

the district completed a feasibility study that addressed these issues.⁴⁷

Recognizing that many large vessels, including oil tankers, could not traverse the forty-foot channel fully loaded, the Corps recommended in the feasibility study that it deepen the channel—which it defined as stretching “from deep water in the Delaware Bay to the Beckett Street Terminal in Philadelphia Harbor, a distance of about 102.5 miles”—to forty-five feet. This recommendation was based on a calculation of the highest ratio of benefits to costs among alternatives that were both technically and environmentally sound. While channel widths would not change, twelve bends would have to be widened for improved navigational safety. To maintain the channel depth at forty-five feet, the Corps estimated it would need to dredge a total of 52,523,300 cubic yards initially and then annually remove 756,000 cubic yards through maintenance dredging. The district recommended various locations for the disposal of this material, mostly former sites in southern New

Jersey, and suggested that some of the material be used for “wetland/island creation.” Total cost for the project, according to the district, would be \$278,293,000, of which \$93,937,000 would be the responsibility of the nonfederal sponsor.⁴⁸

Congress accepted the Corps’ plans for the Delaware River main channel, authorizing the project for construction under the Water Resources Development Act of 1992.⁴⁹

The Philadelphia District moved into the design phase of the project, completing its general design memorandum in 1996. Although it was based largely on the 1992 feasibility study report, the design plan included an updated total dredging estimate of 33 million cubic yards, down a third from the original forecast of 50 million. It was also more specific about placement of dredged material from the Delaware Bay “for wetland restoration at Egg Island Point, New Jersey and Kelly Island, Delaware, and for stockpiling of sand for later beach nourishment work at Slaughter and Broadkill beaches

in Delaware.”⁵⁰ The updated price tag was more than \$300 million, of which the nonfederal sponsor, the Delaware River Port Authority (DRPA), would contribute approximately 35 percent, as well as lands and rights-of-way.⁵¹

Although many individuals and organizations supported the project—including the Delaware River Port Authority, which saw the deepening as meeting its “requirement for a more efficient channel to keep the nation’s fourth busiest port complex competitive with others on the east coast”⁵² — others expressed misgivings about the environmental impact. Led by an organization called Delaware Riverkeeper, environmental interests questioned the effects that deepening the Delaware River main channel would have on landscapes, aquatic populations, and the river itself, including whether the project “would resuspend toxic substances in the water, degrade water quality, permit salt water intrusion into groundwater supplies used for drinking and other purposes, or significantly harm fish and wildlife.” The district worked with



One of the district's federally owned and operated confined disposal facilities for dredged material at Fort Mifflin, Pa.

various local and state agencies to address these concerns, producing a supplemental environmental impact statement in 1997 and holding public meetings in 1998 to respond to criticisms of the project.⁵³

The outcome of these meetings led to one substantive change in the dredged material disposal plan. The original recommendation involved using underwater sand “stockpiles” in the lower part of the bay, but in response to concerns about the effect on local

oyster beds, the district came up with an alternative of pumping sand directly onto the beach at no significant additional cost. The Corps issued a Record of Decision for the project in December 1998, signifying its compliance with the National Environmental Policy Act.⁵⁴

In addition to the final design and supplemental EIS, the Corps updated its economic analysis of the project. An increase in depth from forty to a forty-five feet would allow for “more efficient

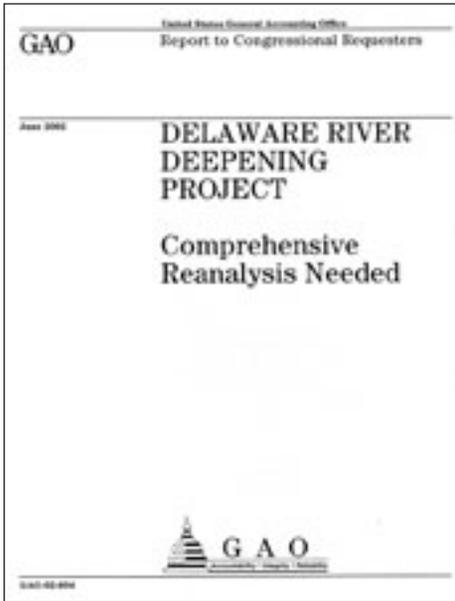
vessel loading, reduced lightering (double-handling of crude oil in transfer from tankers to barges) in the lower Delaware Bay, and attraction of more efficient container and dry bulk vessels.” The Corps calculated the project’s benefit-cost ratio at 1.4, with estimated annual benefits of \$40 million as a result of transportation efficiencies. Recognizing these benefits—along with the prospects for “an improved business climate” for the Delaware River ports and the potential for job creation—the

DRPA authorized the expenditure of \$50 million for the project in November 1999. In the words of one publication, this “clear[ed] the last major financial hurdle for the \$311-million dredging project.”⁵⁵

But opponents who had focused primarily on environmental issues soon challenged the project’s economic merits as well. The original financial estimates (done in 1992) were more than five years old; to receive construction funds, the Corps had to conduct an economic reevaluation. After the

Container ships docked at Packer Avenue Marine Terminal, Port of Philadelphia, on the Delaware River





Report by the Government Accountability Office on its first audit of the Delaware River Main Channel Deepening Project

Philadelphia District published its 1998 limited reevaluation report (the economic update mentioned earlier) confirming a favorable benefit-cost ratio, critics charged the Corps with overstating project benefits, thereby skewing the project's economic justification. As these concerns became more pronounced, Senator Robert Torricelli (D-N.J.) and Congressman Robert Andrews (D-N.J.) requested that the GAO review the 1998 limited reevaluation report to see whether "the Corps of Engineers' economic analysis accurately and appropriately considered the benefits and costs of the project."⁵⁶

The GAO commenced what amounted to an audit, issuing its findings in 2002. According to the GAO, the Corps' study "contained or was based on miscalculations, invalid assumptions, and outdated information." These included misapplications of growth rates for shipping traffic in the Delaware River channel, an inconsistent discounting of the project's future benefits, and the use of different years when presenting dollar values for benefit categories. The

GAO said it could only verify \$13 million of the project's estimated \$40 million a year in benefits and that the Corps' limited reevaluation report did "not provide a reliable basis for deciding whether to proceed with the project."⁵⁷ Despite differences of opinion on some of the details, the district accepted the GAO's findings and recommendations, emphasizing that any mistakes by the project team were unintentional—they were primarily a byproduct of constantly changing shipping traffic and highly complex mathematical models.⁵⁸

By way of formal response to the GAO's unfavorable report, Maj. Gen. Robert Griffin, Director of the Corps' Civil Works Division, suspended work on the channel deepening and called for a "comprehensive economic reanalysis" of the project, declaring that "GAO criticism of our 1998 report was well founded." The Philadelphia District contracted with David Miller & Associates to conduct the examination, giving them access to "all documents, assumptions, economic models, and actions leading to the preparation" of

the 1998 limited reevaluation report. In December 2002, after examining these documents and considering the “many changes in the dynamics of the Port of Philadelphia that have occurred since the original 1992 project feasibility study,” David Miller & Associates reported that the project was still economically sound, although its benefit-cost ratio was now 1.18, rather than 1.4. The Corps also had an external review panel evaluate the project’s economics; the panel agreed that the project was economically justified.⁵⁹ However, an oil lightering company raised questions about the figures used to delineate the costs of oil lightering. The Corps released a supplement to its report in February 2004 that gave an updated project cost of \$264.6 million but only minor changes to the benefit-cost ratio, which now stood at a still-favorable 1.15.⁶⁰

Some people continued to express environmental concerns, especially about the potential of stirring up toxic substances from the bottom of the channel that could harm humans, fish, and

wildlife. The district’s response was summarized in a presentation made by Philadelphia District Engineer Lt. Col. Tim Brown in Dover, Del., in 2001. Directly countering the charge that “deepening the ship channel, including bend widening, and deepening berthing areas will stir up long-buried toxins,” Brown explained that the district, in concert with the EPA, the U.S. Fish and Wildlife Service, the National Marine Fisheries Service, and state environmental agencies of Delaware, Pennsylvania, and New Jersey, had conducted studies “to determine actual contaminant concentrations.” These studies found that concentrations in bottom sediments were at a “low to medium” level, “meaning they are in a range that will not adversely affect drinking water supplies, water quality, or wildlife.” Some people had charged the Corps with trying to “mask ‘hot spots’” of contamination by using an averaging method, but Brown disputed this claim. “The point I want to emphasize is that the sediment analysis entailed review of all of the 12,000 data points to determine the overall



June 2008 signing ceremony for the Project Partnership Agreement with the Philadelphia River Port Authority to deepen the Delaware River Main Channel from 40 to 45 feet

environmental impact of deepening the river,” he said.⁶¹

In addition to the question of toxic sediments, Brown addressed a perception that the deepening would adversely affect oyster populations and other aquatic populations in the Delaware Bay. He said the district had “set up pre-construction monitoring to establish baseline information” that would help it gauge “the ongoing effects of the project” on “oysters, horseshoe crabs, shorebirds, blue crabs and sand builder worms.” In addition, the district would schedule annual maintenance dredging “around appropriate seasonal environmental

windows to minimize impact on marine habitat.” Finally, Brown showed that, although some adverse effects might occur, the district was prepared to keep those effects negligible.⁶²

Economic and environmental concerns about the main channel deepening continued to linger in the 2000s, resulting in delays to the project. The situation worsened when the Delaware River Port Authority pulled out of its agreement to be the nonfederal sponsor on the project, in part because of conflicting interests that fell largely along state lines and rendered long-term regional support for the project uncertain. Fortunately, the Philadelphia Regional Port Authority agreed to become the sponsor and, after significant negotiations, the Philadelphia District and the port authority signed a Project Partnership Agreement on 23 June 2008. According to the Philadelphia District newsletter, this represented “a major step forward in a 15-year effort to deepen the Delaware River.”⁶³ Construction would get under way at last in March 2010.⁶⁴



Although this project did go to construction, comparisons with the never-built Tocks Island Dam are tempting: two major projects by the Philadelphia District, both encountering opposition that was expressed at first in environmental terms. But while the demise of Tocks Island was heavily influenced by the nascent but rapidly growing environmental movement in the United States, the delay

of the Delaware River deepening had far more to do with the after-effects of the Water Resources Development Act of 1986, which instituted nonfederal cost sharing for civil works projects. This meant that where competing state and local interests were at stake, resolution of their differences was essential to determine whether—or at least when—a Corps project would come to fruition.⁶⁵

The Delaware River at Marcus Hook

The Chesapeake and Delaware Canal

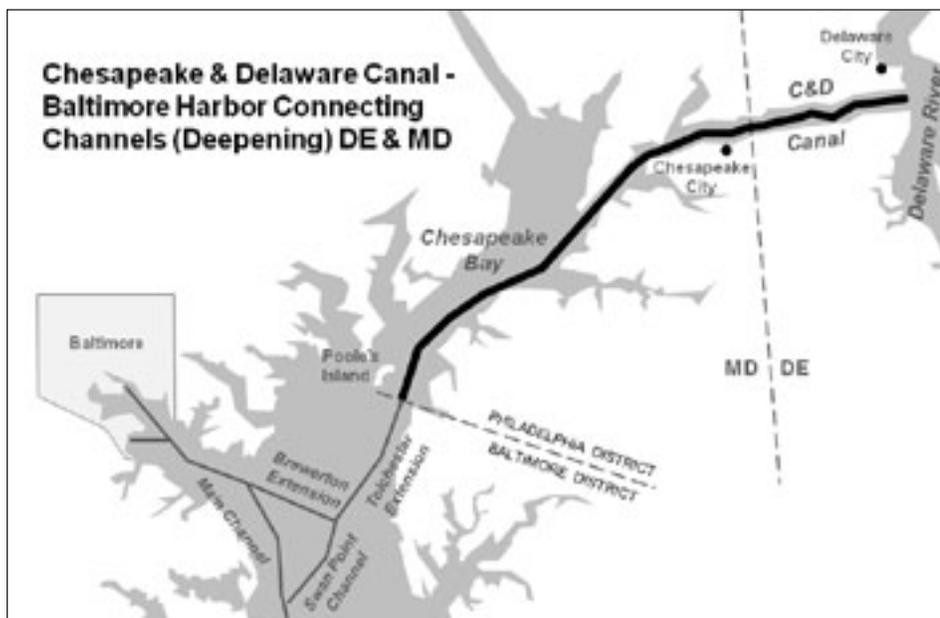
The Philadelphia District encountered difficulties of a somewhat similar nature when it proposed deepening the Chesapeake and Delaware (C&D) Canal. Again, both environmental and economic objections were voiced; in this case, the latter proved substantive and were decisive in halting the project short of construction.

A nineteen-mile-long waterway linking the Chesapeake Bay with the Delaware Bay, the C&D Canal first began transporting vessels in 1829 as a private venture. In 1919, the federal government purchased the waterway and authorized

the Corps to convert it into a sea-level canal and enlarge it to a depth of twelve feet. In 1933, the Philadelphia District received jurisdiction over the canal, and Congress authorized additional modifications in 1935, 1939, and 1954, eventually directing the Corps to deepen it to 35 feet and widen it to 450 feet. The district completed these modifications in 1975.⁶⁶

In September 1988, the House Committee on Public Works and Transportation passed a resolution asking the district to review reports relative to the C&D Canal “to determine the feasibility of measures to promote and encourage the efficient, economic and logical development of the channel system serving the Port of Baltimore and Delaware River Ports.” Specifically, the committee wanted the Philadelphia District to examine the canal and determine “current and future shipping needs, adequacy of channel depth and dimensions, [and] clearances and other physical aspects affecting water-borne commerce.”⁶⁷

Map of the Chesapeake & Delaware Canal Deepening Project





In 1990, the Philadelphia District issued a reconnaissance report addressing these issues. It noted that its objectives for the C&D Canal were to “provide adequate and safe navigation channels,” to ensure the most “efficient, economic use of the canal,” to “minimize degradation of the natural environment,” and to “protect fish and wildlife resources during initial construction and project maintenance.” The district suggested deepening the canal to 37 feet and widening the channel to 438 feet. It concluded that such deepening would “not cause an incremental increase in the average annual maintenance

dredging requirements since no new dredging areas are involved.” The report said that implementing this plan would provide economic benefits in terms of more efficient vessel movement through the canal, resulting in a benefit-cost ratio of 1.2 for the project. Declaring “that there is a Federal interest in further study of improvements to the canal and the connecting channels,” the district recommended that it conduct “further studies for navigational improvements.”⁶⁸

Accordingly, the district began a feasibility study in partnership with the Maryland Department of Transportation for the channel

A car carrier ship on the C&D Canal

deepening. The work involved coordinating with the Maryland Port Authority (MPA), the Delaware Department of Natural Resources and Environmental Control (DNREC), and other interested groups on the effects of the deepening on fish, wildlife, and the environment. In 1992, the district held a meeting with the MPA and the DNREC to review the process the Corps would undertake to complete its studies on the deepening. The Corps informed the other agencies that it was conducting chemical analyses of sediments in the canal, a study on striped bass in both Chesapeake and Delaware bays, and evaluations of proposed upland and aquatic disposal areas. The Corps believed that “all of these studies plus input on canal flows, salinity impacts, and groundwater resources will provide the basis for the development of an environmental impact statement for any proposed modifications.”⁶⁹

By the time the district released its draft feasibility study and environmental impact statement in January 1996, its plans for the

C&D Canal had changed. Further analysis had shown that the most cost-effective approach was to deepen the canal to 40 feet, with an allowable overdepth of 1 foot and a “constant width” of 450 feet. Additionally, the district recommended “the enlargement of the Reedy Point flare, bend widening at Sandy Point and construction of an emergency anchorage at Howell Point.” It estimated that these features would require the dredging of an additional eighteen million cubic yards of material, which it would deposit in several different “upland disposal areas” along the canal and in an “overboard proposed site” near Pooles Island in Chesapeake Bay. Finally, the Corps would use some of the material for an ecosystem restoration project the Baltimore District was doing at Hart-Miller Island. According to the district, this work would cost approximately \$84 million, but it “would not result in any significant long-term adverse impacts on the environment,” because the Corps would take great pains to ensure that dredging operations would not harm fish and wildlife.⁷⁰



Despite the district's assurances, its plans for the C&D Canal drew opposition from environmental groups and local residents. According to former Deputy for Program Management Richard Maraldo, four persons—who referred to themselves as The Concerned Citizens—led the charge, attacking the proposed plan for both its economics and its environmental impacts. “They said it wasn’t necessary,” Maraldo explained, and that “it would change the flow between

The District's project office in Chesapeake City, Md., where dispatchers monitor and control C&D Canal traffic 24/7





The C&D Canal looking east toward the Chesapeake City Bridge and the District's project office (on the peninsula at the top center of the photo)

the Delaware and Chesapeake and ruin the ecology of the Chesapeake Bay."⁷¹

Amid this opposition, in July 1996 the district conducted a public meeting at Bohemia Manor High School in Chesapeake City to explain the proposed deepening. Project representatives pointed

Summit Bridge

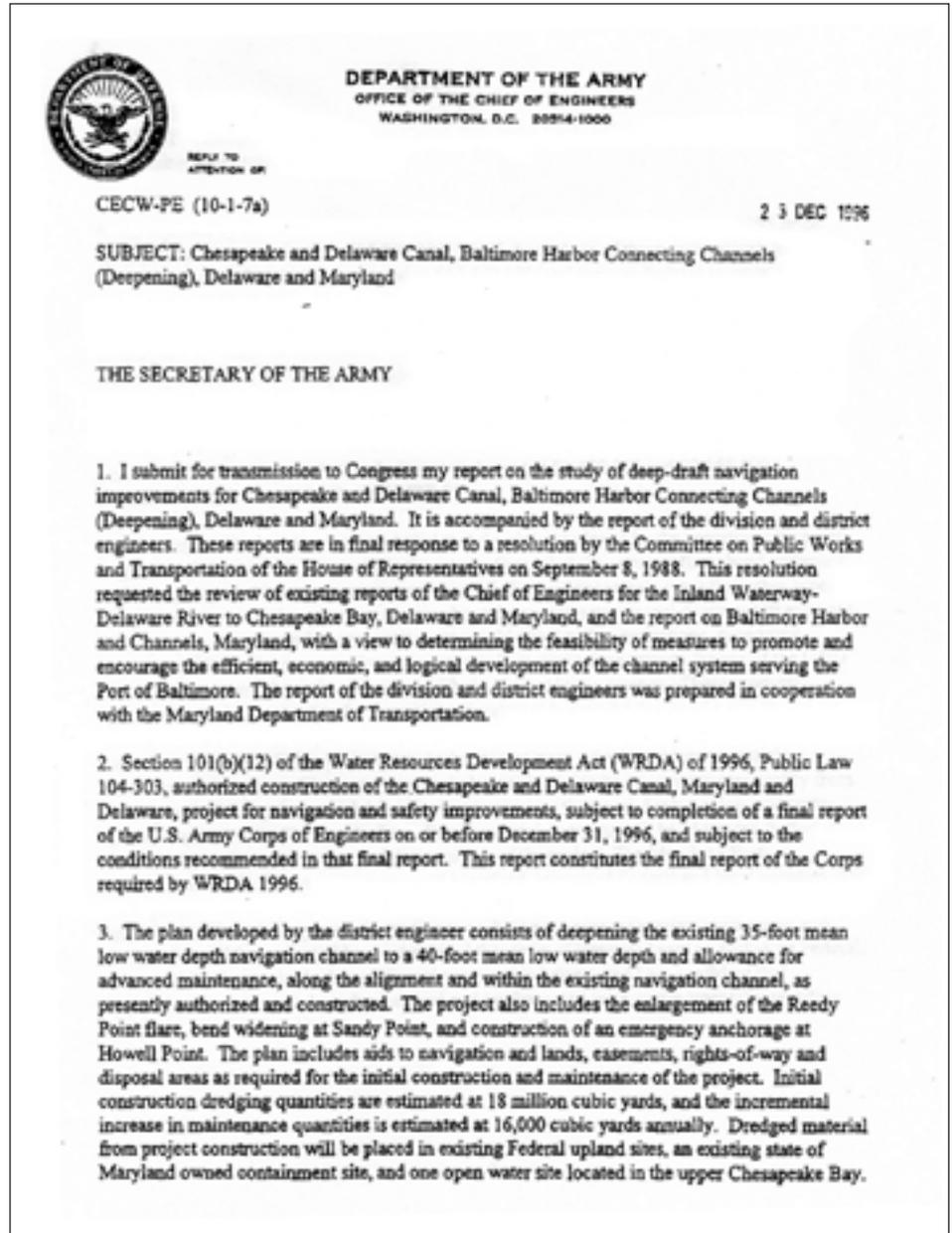


out that the district had prepared its recommendations in coordination with a variety of stakeholders, including the C&D Canal Citizens' and Technical Advisory Committees, the U.S. Coast Guard, the Association of Maryland Pilots, the Pilots' Association for the Bay, and River Delaware. The district had also held workshops in Chesapeake City "to address the concerns the community had regarding potential impacts on their community from structural improvements to the Canal." As for the selected plan, it not only provided economic benefits, but also allowed for "adequate and safe navigation channels . . . and techniques and protection of fish and wildlife resources," whereas the channel currently "present[ed] constraints to efficient vessel movements."⁷²

According to one newspaper account, many of those attending the public meeting came away still skeptical, believing "that the analysis done by the Corps may be inadequate." Some expressed concern that increased dredging would lead to groundwater

contamination or that it would worsen erosion along the banks of the canal. District representatives did their best to address these concerns, acting, according to the reporter, “in a professional manner,” but some of their answers were not enough to satisfy all those in attendance.⁷³

Noting these concerns, the Corps finalized its environmental impact statement and feasibility report (lowering its estimate of project costs to \$82.8 million), and Congress authorized the project in the Water Resources Development Act of 1996.⁷⁴ In December 1996, Chief of Engineers Lt. Gen. Joe N. Ballard completed his final report to Congress, indicating that the plan was “engineeringly sound” and “economically justified.” However, Ballard noted that several questions remained regarding “the appropriate channel depth, whether or not recent improvements at other east coast ports would affect traffic projections,” and how much time vessels would save using the canal. According to Ballard, such concerns would



have to be “resolved and a channel depth selected before the design of a project can be initiated.” Ballard also recognized that the public meetings had raised questions about “possible impacts on groundwater quality from the disposal of dredged material, loss

The first page of Lieutenant General Joe Ballard’s report to Congress on the Delaware River Main Channel Deepening Project

of groundwater into the canal, bank erosion, and water quality impacts in the Chesapeake Bay.” He said these issues needed to be addressed in the preconstruction and engineering and design phases. “I am confident that improvements to the canal can be designed and implemented in an environmentally sound manner,” he concluded.⁷⁵

With the approval of Ballard and Congress, the district began the preconstruction and engineering design phase of the project in April 1997, with the Maryland Port Administration serving as the local sponsor. The district focused first on Ballard’s question regarding how deep the channel should be, given changes in recent years to “port call patterns, railroad mergers, trends in transportation alliances, and the deepening of New York Harbor to 40 feet.” The district also conducted studies on stream bank erosion and groundwater effects in response to the specific concerns of the public.⁷⁶ After conducting these studies, the district released a draft economic reevaluation of the deepening in June 1999 that called

for the canal to have a depth of 39 feet, with channel widths of 434 to 600 feet.⁷⁷

Before the district finalized these recommendations, however, Corps Headquarters and the North Atlantic Division called for a review of the plan, stating that “multiple reviews, correspondence and coordination have raised issues needing address.”⁷⁸ One of these “issues” may have been the fact that, in July 1999, seven of Maryland’s congressional representatives asked Assistant Secretary of the Army for Civil Works Joseph Westphal why the Corps did not stay with its original recommendation of deepening the canal to 40 feet, since “all major competing ports on the East Coast have at least 40 feet of water and many have approved plans to deepen to 45 feet.”⁷⁹ However, by the early 2000s, traffic to and from the Port of Baltimore had fallen off “to the point where the project’s economics no longer supported the recommendation” to deepen the canal.⁸⁰ Corps leaders decided to suspend all canal deepening action in 2001, because, according to one district

report, “recent downturns in Port of Baltimore container ship traffic” made the project no longer economically justifiable. Work on the preconstruction and engineering design was halted, and as of 2008 it showed no sign of resuming.⁸¹

Despite the cessation of the canal deepening project, the Philadelphia District continued to provide maintenance dredging to maintain the C&D Canal’s thirty-five foot depth. It was also responsible for operating the canal out of its Chesapeake City Project Office, located next to the historic 1837 pumphouse that housed the district-run C&D Canal Museum.⁸²

Operational duties involved directing traffic on the canal through an electronic system and establishing “rules governing the dimensions of vessels and other specific conditions and requirements to govern the movement of vessels through the waterway.”⁸³ This was no small feat—in 2007, more than fifteen million tons of cargo passed through the canal, constituting “approximately 40 percent of the ship traffic in and out of Baltimore.”⁸⁴ To accomplish



The C&D Canal Museum, featuring the waterwheel and pumping engines from the Old Pump House

these operations, the district had several controllers working on eight-hour rotations to keep the canal open 24 hours a day, 7 days a week, 365 days a year. The controllers monitored canal traffic “through state-of-the-art fiber optic and microwave links ... [and] closed-circuit television and radio systems,” thereby maintaining a safe system.⁸⁵ The district also had to deal with accidents and other issues on the canal; for example, in 1973 a freighter hit the railroad bridge, rendering the bridge inoperable, and in 2001 a tugboat sank in the canal. In both cases, the district worked quickly to restore





In 1995, a new state-owned bridge (foreground), later named after Senator William V. Roth, Jr., came alongside the Corps' St. Georges Bridge (background) as the primary span across the C&D Canal. Congress transferred it to the Corps in 2007

operations and minimize effects on the shipping industry.⁸⁶ In such ways, the district helped maintain navigability of the C&D Canal.

The district's ownership, operation, and maintenance responsibilities for the canal also applied to the highway bridges that spanned it; in some years, repairs or upgrades to just one of these bridges accounted for well over half the total project budget. Since the late 1960s four bridges had been upgraded: the Chesapeake

City Bridge in Maryland, and the Summit, St. Georges, and Reedy Point Bridges in Delaware.⁸⁷ Under the Water Resources Development Act of 2007, the district also became responsible for the U.S. Senator William V. Roth Jr. Bridge, which since its 1995 opening had belonged to the state of Delaware as part of its north-south limited access toll road, Delaware Route 1. The Roth Bridge and the adjacent St. Georges Bridge were at the center of a controversy that arose

in the late 1990s over whether the newer span was intended as a “replacement bridge” (the position of the Department of the Army, which had sought to demolish the St. Georges Bridge) or a “relief bridge” (the term used by the state of Delaware in insisting that both structures were critical on the basis of traffic projections). WRDA 2007 resolved the issue in favor of the state.⁸⁸

* * * * *

In some ways, the Philadelphia District’s navigation mission from 1972 to 2008 could be characterized as an era of unfulfilled plans. Two of the largest navigation projects on which the district worked during this period—the Delaware River Main Channel and C&D Canal deepening—had not reached fruition by the end of 2008 (although the former did get under way very soon after). Both projects highlighted the changing

Reedy Point Bridge, easternmost of five Corps-owned high-level highway bridges spanning the C&D





The Chesapeake City Project Office has specially designed truck-mounted equipment for below-deck bridge inspections and maintenance

political environment in which the Corps had to operate. As with dam building in the 1970s, the district had to balance a variety

of interests, including those of state and local governments, in its channel deepening activities. The district showed a willingness to work with its critics to reach solutions that were acceptable to all parties, and it showed a continued commitment to environmental quality and sustainability as it conducted the necessary dredging and other operations essential to the navigation mission. By upholding its reputation for being both responsive and reliable, the Philadelphia District developed partnerships with other agencies and groups that would enhance its navigation work in the twenty-first century. 🏰

¹ Nicole T. Carter and Betsy A. Cody, "The Civil Works Program of the Army Corps of Engineers: A Primer," CRS Report for Congress, 20 September 2006, CRS-2 <<http://www.nationalaglawcenter.org/assets/crs/RS20866.pdf>> (14 May 2010).

² Anthony DePasquale, Chief of Operations Division, conversation with Joshua Pollarine, 19 May 2010 [informal conversations held with district personnel hereafter referred to as conversation]. For more information on the dredging process, see U.S. Army Corps of Engineers, Philadelphia District, "Dredging the Delaware," July 1967, File Dredging Techniques, Box 1115, Philadelphia District-AR.

³ U.S. Army Corps of Engineers, Philadelphia District, "Organization Charts," September 2008, document provided by Edward Voigt, Philadelphia District.

⁴ Carter and Cody, "The Civil Works Program of the Army Corps of Engineers: A Primer," CRS-3 – CRS-4.

⁵ Unpublished Morgan Draft District History, 76-77.

⁶ Act of 26 April 1978 (92 Stat. 218).

⁷ Unpublished Morgan Draft District History, 77; "Hopper Dredges" <<http://www.globalsecurity.org/military/systems/ship/dredge-hopper.htm>> (20 May 2010); "McFarland Stays in Corps Dredge Fleet," *The Observer* (November 1994): 8; Joe Vilord interview by Paul Sadin, 13 January 2009, Blackwood, New Jersey, transcript, 13. Vilord was the captain of the *McFarland* until his retirement in the 1990s. According to one source, the main private dredger in the Delaware River was the American Dredging Company. Lewis Caccese, Chief, Construction-Operations Division, to Actg. Ch, Engineering Div., 13 September 1978, File General Dredging & Disposal Input Data, Box 1115, Philadelphia District-AR; Edward Voigt, Chief, Public & Legislative Affairs, Philadelphia District, personal communication with Joshua Pollarine, 4 April 2011.

⁸ Voigt personal communication.

⁹ Voigt personal communication.

¹⁰ Vilord interview, 4; Voigt personal communication.

¹¹ Quotations in "Shuman Delivers More and More for Its Customers," *The Observer* (January/February 2001): 8; see also "Aboard the Surveyboat Shuman; An 'Inside' Look at Survey Branch," *The Observer* 12 (April 1993): 1, 4-5, 8.

¹² Vilord interview, 7-8.

¹³ Quotations in "A Virtual Tour Aboard the McFarland," *The Observer* (Summer 2005): 10-11; see also "McFARLAND and Marine Design Center Assist with Study to Save Sea Turtles," *The Observer* (July 1993): 9.

¹⁴ "McFARLAND Answers the Call Again, Keeps Key N.C. Port Open for Business After Hurricane Fran," *The Observer* (October 1996): 3.

¹⁵ Quotation in "Technical Innovations to Protect Turtles . . ." *The Observer* (September 1995): 6.

¹⁶ "McFarland Crew Members on the Front Lines Battling Blaze in Gulf," *The Observer* (Summer 2001): 8.

¹⁷ "Ammunition Found in Dredge Material from Navy Base," *The Observer* (April 1993): 2.

¹⁸ Gebert interview, 26; "Group: Surf City Alerted to Ordnance; Surfriders Say They Warned of Danger in Beach Project," [pressofAtlanticCity.com](http://www.surfriderjsc.org/press.asp?pid=2), 27 March 2007 <<http://www.surfriderjsc.org/press.asp?pid=2>> (20 May 2010).

¹⁹ U.S. Army Corps of Engineers, Philadelphia District, "Delaware River Dredging Disposal Study, Transcript, Initial Public Meeting, 6 March 1980," 7, Loose Papers, Box 1115, Philadelphia District-AR; U.S. Army Corps of Engineers, Philadelphia District, *Small Projects Program* (pamphlet) (Philadelphia: Philadelphia District, U.S. Army Corps of Engineers, n.d.), n.p.; Voigt personal communication.

²⁰ U.S. Army Corps of Engineers, Philadelphia District, "Dredging" <<http://www.PhiladelphiaDistrict.usace.army.mil/dredge/d2.htm>> (26 May 2010).

²¹ U.S. Army Engineer District, Philadelphia, "Delaware River, Trenton to the Sea and Schuylkill River and Wilmington Harbor Tributaries, New Jersey, Pennsylvania, Delaware, Final Environmental Impact Statement," Box 503, Philadelphia District-AR. For an exam-

ple of *Environmental Effects of Dredging*, see Vol. D-92-1 (March 1992), in File Del. Bay—Thin Layering Dredge Material, Box 247, Philadelphia District-AR.

²² Locurcio interview, 24.

²³ Unpublished Morgan Draft District History, 78.

²⁴ Quotations in Colonel James G. Ton, District Engineer, to MG James J. Johnson, Division Engineer, U.S. Army Engineer Division, Atlantic Division, ca. November 1978 [date is unclear on letter], File Federal Diking Policy Info., Box 1115, Philadelphia District-AR; see also Ton to Mr. Austin P. Olney, Secretary, Delaware Department of Natural Resources and Environmental Control, September 27, 1978, File General Dredging & Disposal Input Data, Box 1115, Philadelphia District-AR.

²⁵ Unpublished Morgan Draft District History, 78.

²⁶ Quotations in U.S. Army Corps of Engineers, Philadelphia District, "Delaware River Dredging Disposal Study: Phase I, Reconnaissance Report," June 1979, 1-2, Box 503, Philadelphia District-AR [hereafter referred to as Dredging Disposal Reconnaissance Report]; see also Lieutenant Colonel Joel T. Callahan, Acting District Engineer, to Honorable Bill Bradley, United States Senate, 20 March 1980, Loose Papers, Box 1115, Philadelphia District-AR.

²⁷ Dredging Disposal Reconnaissance Report, 4, 10.

²⁸ Dredging Disposal Reconnaissance Report, 56-57, 65-66.

²⁹ Elliot Goldberg, "Sites Sought for Dumping River Spoils," *The Gloucester County Times* (Woodbury, N.J.), 22 February 1980, copy in Loose Papers, Box 1115, Philadelphia District-AR.

³⁰ U.S. Department of the Army, U.S. Army Corps of Engineers, Philadelphia District, "Delaware River Dredging Disposal Study: Transcript, Initial Public Meeting, 6 March 1980," 4-5, Loose Papers, Box 1115, Philadelphia District-AR [hereafter referred to as Dredging Disposal Study Public Meeting Transcript].

³¹ Dredging Disposal Study Public Meeting Transcript, 8-11, 39, 41-43.

³² "General Investigations," 24 February 1981, File Dredge Disposal Sites, Box 1115, Philadelphia District-AR.

³³ Leonard J. Lipski, Chief, Hydrology & Hydraulics Branch, to Chief, Policy Planning Section, 13 July 1981, File Federal & Non-Federal Historical Dredging Quantities, Box 1115, Philadelphia District-AR.

³⁴ U.S. Army Corps of Engineers, Philadelphia District, "Delaware River Dredging Disposal Study," June 1984, Syllabus, copy in Philadelphia District-Library.

³⁵ Philadelphia District, "Delaware River Dredging Disposal Study," Syllabus, 179. In 1991, for example, the Maryland Port Administration drafted a "Dredged Material Management Master Plan." Many of its recommendations were similar to those that the district suggested in its plan. See "C&D Canal Deepening, Initial Disposal Screening, August 1991," 1, File 1110-2-1150a Planning & Development Correspondence—Drafts, Box 4, Accession No. 077-03-0001, RG 77, FRC; Port of Baltimore to Ms. Barbara Stratton, Planning Division, Philadelphia District Corps of Engineers, 22 February 1991, File 1110-2-1150a Planning & Development Correspondence—Disposal Measures, Box 4, Accession No. 077-03-0001, RG 77, FRC.

³⁶ Philadelphia District, "Delaware River Dredging Disposal Study," Syllabus, 179; see also "C&D Canal Deepening, Initial Disposal Screening, August 1991," 1, File 1110-2-1150a Planning & Development Correspondence—Drafts, Box 4, Accession No. 077-03-0001, RG 77, FRC; Port of Baltimore to Ms. Barbara Stratton, Planning Division, Philadelphia District Corps of Engineers, 22 February 1991, File 1110-2-1150a Planning & Development Correspondence—Disposal Measures, Box 4, Accession No. 077-03-0001, RG 77, FRC.

³⁷ U.S. Army Corps of Engineers, Philadelphia District, "Draft Environmental Impact Statement: Wilmington Harbor Federal Navigation Project, Dredged Material Disposal Area," April 1985, I, copy in Philadelphia District-Library.

³⁸ W. H. Burton, J. S. Farrar, F. Steimle, and B. Conlin, "Assessment of Out-of-Kind Mitigation Success of An Artificial Reef Deployed in Delaware Bay, USA," *ICES Journal of Marine Science* 59 (2002): S106.

³⁹ See U.S. Army Corps of Engineers, Philadelphia District, “Project Factsheet: Wilmington Harbor, New Castle County, DE, January 2010” <http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-dp/projects/factsheets/DE/SOM_WilmingtonHarbor.pdf> (27 May 2010). This document explains that the Corps had contracted out dredging of Wilmington Harbor to the Norfolk Dredging Company.

⁴⁰ Voigt personal communication.

⁴¹ “Partnering Effort Results in Extended Dredging Season,” *The Observer* (August 1993): 1, 3.

⁴² “Palmyra Cove Effort Wins Over Skeptics,” *The Observer* (Winter 2007/2008): 10–11.

⁴³ “Palmyra Cove Effort Wins Over Skeptics,” *The Observer* (Winter 2007/2008): 10–11.

⁴⁴ Voigt personal communication.

⁴⁵ Quotations in U.S. Army Engineer District, Philadelphia, “Delaware River, Trenton to the Sea and Schuylkill River and Wilmington Harbor Tributaries, New Jersey, Pennsylvania, Delaware, Final Environmental Impact Statement,” Box 503, Philadelphia District-AR; see also U.S. Army Corps of Engineers, Philadelphia District, “Delaware River Main Channel Deepening Project” <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/drmc.htm>> (14 May 2010).

⁴⁶ Unpublished Morgan Draft District History, 74–75. One source noted that Philadelphia was “the world’s largest freshwater port.” U.S. Army Corps of Engineers, Philadelphia District, “Serving You,” File 1110-2-1150a Planning & Development Correspondence, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁴⁷ Quotation in U.S. Army Corps of Engineers, Philadelphia District, “Delaware River, Philadelphia, Pennsylvania to Wilmington, Delaware: Interim Feasibility Study and Environmental Assessment,” June 1985, Syllabus, copy in Philadelphia District-Library; see also U.S. Army Corps of Engineers, Philadelphia District, “Delaware River Comprehensive Navigation Study, Main Channel Deepening: Final Interim Feasibility Report,” February 1992, Syllabus (hereafter referred to as “Final Interim Feasibility Report”), copy at Morgan Library, Colorado State University, Fort Collins, Colorado.

⁴⁸ “Final Interim Feasibility Report,” Syllabus, 261–263.

⁴⁹ Voigt personal communication; Water Resources Development Act of 1992 (106 Stat. 4797).

⁵⁰ U.S. Army Corps of Engineers, Philadelphia District, “Delaware River Main Channel Deepening Project: Supplemental Environmental Impact Statement,” July 1997, Syllabus, copy at Morgan Library, Colorado State University, Fort Collins, Colorado.

⁵¹ U.S. General Accounting Office, *Delaware River Deepening Project: Comprehensive Reanalysis Needed* (Washington, D.C.: U.S. General Accounting Office, 2002), 4; “Philadelphia District Project Update,” *The Observer* (August 1995): 10.

⁵² “Main Channel Deepening Draws Closer to Reality,” *The Observer* (November/December 1999): 6.

⁵³ Quotations in U.S. General Accounting Office, *Delaware River Deepening Project*, 1–2; see also “Delaware Meetings Give Public a Closer Look at Main Channel, Bethany/South Bethany Projects,” *The Observer* (May/June 1998): 4; Maraldo interview, 36.

⁵⁴ U.S. Army Corps of Engineers, Philadelphia District, “Delaware River Main Stem & Channel Deepening Project” <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/drmc.htm>> (14 May 2010); Voigt personal communication.

⁵⁵ Quotations in “Main Channel Deepening Draws Closer to Reality,” *The Observer* (November/December 1999): 6; see also Maraldo interview, 36–37. According to this report, the rest of the funding from nonfederal sponsors would come from the states of New Jersey, Pennsylvania, and Delaware.

⁵⁶ U.S. General Accounting Office, *Delaware River Deepening Project*, 1–2.

⁵⁷ U.S. General Accounting Office, *Delaware River Deepening Project*, 1–5.

⁵⁸ See Maraldo interview, 37.

⁵⁹ Quotations in “Comprehensive Economic Reanalysis of Delaware River Main Channel Deepening Project Finds Project to be Justified for Construction,” *The*

Observer (November/December 2002): 4; see also U.S. Army Corps of Engineers, Philadelphia District, North Atlantic Division, “Delaware River Main Channel Deepening Project (Pennsylvania, New Jersey, and Delaware): Comprehensive Economic Reanalysis Report,” copy at <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/reports/Final%20Main%20Report%20December%202016%202002.PDF>> (18 May 2010).

⁶⁰ U.S. Army Corps of Engineers, Philadelphia District, North Atlantic Division, “Delaware River Main Channel Deepening Project (Pennsylvania, New Jersey, and Delaware): Supplement to Comprehensive Economic Reanalysis Report, December 2002,” February 2004, copy at <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/reports/February%202004%20Del%20Riv%20Final%20Supplemental%20Report.pdf>> (18 May 2010); U.S. Army Corps of Engineers, Headquarters, “Supplemental Report Confirms Economic Justification of Delaware River Deepening after Independent Review,” Release No. PA-04-03-19 <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/nr.htm>> (18 May 2010).

⁶¹ U.S. Army Corps of Engineers, Philadelphia District, “Delaware River Main Channel Deepening Project: LTC Brown’s Testimony, Delaware River Main Channel Deepening Project, State of Delaware Public Hearing, Dec. 4 and 5, 2001, Dover, Del.” <<http://www.PhiladelphiaDistrict.usace.army.mil/cePhiladelphiaDistrict-pl/drmcdp/brown.html>> (5 May 2010).

⁶² “LTC Brown’s Testimony, Delaware River Main Channel Deepening Project, State of Delaware Public Hearing, Dec. 4 and 5, 2001, Dover, Del.”

⁶³ Quotation in “Corps and PRPA Sign Deepening Agreement,” *The Observer* (Summer 2008): 4; see also “Philadelphia District’s Project Progress Report,” *The Observer* (Autumn 2007): 3. As some personnel in the district noted, New Jersey officials began to take issue with the fact that four additional disposal sites proposed for the project were all on their side of the river, even though that had been in the plan throughout most of the 1990s. This ultimately became a nonissue, since a significant decrease in dredged material estimates made additional sites unnecessary. Nevertheless, a rift in consensus was exposed. Subsequently New Jersey, and later Delaware, withdrew support for the project, leading to the Delaware River Port Authority’s rescission from the agreement. Voigt personal communication.

⁶⁴ In September 2010, deepening was completed in “Reach C” of the channel (a 13-mile stretch south of Wilmington, Delaware.). “Delaware River Deepening Gets its First Digs at Last,” *The Observer* (Fall 2010): 6–8; Voigt personal communication.

⁶⁵ Voigt personal communication.

⁶⁶ See U.S. Army Corps of Engineers, Philadelphia District, “The Chesapeake & Delaware Canal” <<http://www.PhiladelphiaDistrict.usace.army.mil/sb/c&d.htm>> (27 May 2010); U.S. Army Corps of Engineers, Philadelphia District, *The Chesapeake & Delaware Canal* (Philadelphia, Penn.: U.S. Army Corps of Engineers, Philadelphia District, 1974); Snyder and Guss, *The District*, 94–104.

⁶⁷ As quoted in U.S. Army Corps of Engineers, Philadelphia District, “The Chesapeake and Delaware Canal—Baltimore Harbor Connecting Channels (Deepening) Delaware and Maryland, Reconnaissance Report,” February 1990, 1, File 1110-2-1150a Planning & Development Correspondence, Box 4, Accession No. 077-03-0001, RG 77, FRC [hereafter referred to as C&D Canal Deepening Reconnaissance Report].

⁶⁸ C&D Canal Deepening Reconnaissance Report, 1, 106, 117–119, 156.

⁶⁹ “Memorandum for Files,” 15 April 1992, revised 4 June 1992, attachment to Robert L. Callegari, Chief, Planning Division, to Mr. David B. Carter, Delaware Coastal Management Program, Department of Environmental Resources and Environmental Control, n.d., File 1110-2-1150a Planning & Development Correspondence Folder 2, Box 4, Accession No. 077-03-0001, RG 77, FRC.

⁷⁰ Department of the Army, Philadelphia District, Corps of Engineers, “Chesapeake and Delaware Canal—Baltimore Harbor, Connecting Channels (Deepening) Delaware and Maryland: Draft Feasibility Study and Environmental Impact Statement,” January 1996, 1-1 – 1-2, File 1110-2-1150a Planning & Development Correspondence, Accruals FY00, Box 4 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷¹ Maraldo interview, 35.

⁷² “Chesapeake and Delaware Canal-Baltimore Harbor, Connecting Channels Draft Feasibility Report, Public Meeting, 9 July 1996,” 4, 11-13, File 1110-2-1150a Planning & Development Correspondence—D Canal Feas., Box 5 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷³ Jack Shagena, “Proposed Canal Changes Draw Fire,” *The Cecil County Times*, 15 July 1996, copy in File Newspaper Articles Related to Public Meeting, C&D Canal Feas., Box 3 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁴ Water Resources Development Act of 1996 (110 Stat. 3658); “Chesapeake and Delaware Canal-Baltimore Harbor, Connecting Channels (Deepening), Delaware and Maryland: Feasibility Report and Environmental Impact Statement,” File: 1110-2-1150a Planning & Development Correspondence, C&D Canal PED, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁵ Lieutenant General Joe N. Ballard, Chief of Engineers, to The Secretary of the Army, 23 December 1996, File C&D Canal Feas. Letters, Box 3 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁶ Quotation in U.S. Army Corps of Engineers, Philadelphia District, “Design Phase Underway on Deepening Project,” C&D Update 1 (April 1998): 1–2; see also “C&D Canal Deepening Analysis: Shoreline Erosion Analysis,” draft, attachment to Richard J. Maraldo, Deputy District Engineer, Programs and Project Management, Memorandum Thru Commander, North Atlantic Division, 13 July 1999, File 1110-2-1150a Planning & Development Correspondence, C&D Canal PED, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC; U.S. Army Corps of Engineers, Philadelphia District, “Chesapeake & Delaware Canal-Baltimore Harbor Connecting Channels (Deepening), Delaware & Maryland: Hydrogeologic Report,” 1 November 1999, File 1110-2-1150a Planning & Development Correspondence, Hydrogeological Report Origins, 1 November 1999, Box 5 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁷ “Chesapeake and Delaware Canal-Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland, Preconstruction Engineering and Design Study Economic Reevaluation, Executive Summary,” June 1999, File 1110-2-1150a Planning & Development Correspondence, Debriefing to General Rhoads, 27 January 2000, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁸ U.S. Army Corps of Engineers, Philadelphia District, “Information Paper, Subject: Chesapeake and Delaware (C&D) Canal-Baltimore Harbor Connecting Channels (Deepening), Delaware and Maryland Preconstruction Engineering and Design Phase,” June 2000, File 1110-2-1150a Planning & Development Correspondence, Rhoads & NAD, 13 June 2000, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁷⁹ Ben Cardin and Steny H. Hoyer, et al. to The Honorable Joseph W. Westphal, Ph.D., Assistant Secretary of the Army (Civil Works), 6 July 1999, File 1110-2-1150a Planning & Development Correspondence, C&D Canal PED, Box 6 of 8, Accession No. 077-03-0002, RG 77, FRC.

⁸⁰ Maraldo interview, 36.

⁸¹ U.S. Army Corps of Engineers, Philadelphia District, “The Chesapeake & Delaware Canal” <<http://www.Philadelphia.District.usace.army.mil/sb/c&d.htm>> (27 May 2010).

⁸² “On the Front Page,” *The Observer* (August 1995): 2; “Renovations Completed at C&D Canal Museum,” *The Observer* (March 1996): 3. The museum was listed on the National Register of Historic Places in 1965.

⁸³ Nathan Associates Inc., “C&D Canal Feasibility: Without-Project Condition Analysis,” November 1992, 5, File 1110-2-1150a Planning & Development Correspondence Folder 3, Box 4, Accession No. 077-03-0001, RG 77, FRC.

⁸⁴ “The C&D: Where Progress Meets Preservation,” *The Observer* (December 1996): 6; “The C&D Canal: A Waterway Landmark,” *The Observer* (Spring 2007): 13.

⁸⁵ “Getting to Know C&D Canal Project Office,” *The Observer* (September/October 2000): 10–11.

⁸⁶ See Unpublished Morgan Draft District History, 81–82; Calvarese interview, 8; “C&D Canal Reopens after 7-Day Closing,” *The Observer* (Summer 2001): 6–7. In the case of the bridge accident, the district was able to reopen the bridge in 50 days and the canal in 104 days. According to the Unpublished Morgan Draft District History, “The total cost of repairs was \$1.4 million, well below the government’s original estimate of \$3.4 million, a savings accomplished through ingenuity of design and to a sense of urgency to complete the job quickly that was shared by both contractor and the District.” Because of this service, the Corps gave the district an Award of Merit “for distinguished design supervision of the repair project.”

⁸⁷ Quotation in “On the Front Page,” *The Observer* (August 1995): 2; see also “New Highway Bridge Opens Over the C&D Canal,” *The Observer* (February 1996): 4; “Maintenance Keeps Summit Bridge in Top Form,” *The Observer* (September 1996): 9; “Getting to Know C&D Canal Project Office,” *The Observer* (September/October 2000): 11.

⁸⁸ Voigt personal communication.