DELAWARE RIVER MAIN CHANNEL DEEPENING PROJECT

(PENNSYLVANIA, NEW JERSEY, AND DELAWARE)

SUPPLEMENT

TO

COMPREHENSIVE ECONOMIC REANALYSIS REPORT

DECEMBER 2002

U.S. Army Corps of Engineers, Philadelphia District

North Atlantic Division
February 2004

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Delaware River Main Channel Deepening Project
(Pennsylvania, New Jersey, and Delaware)

Supplement

1. Executive Summary

In December 2002, the Philadelphia District completed an analysis of benefits that would be generated by deepening the main navigation channel of the Delaware River to a controlling depth of 45-feet Mean Low Water (MLW). The analysis was documented in a report entitled: Comprehensive Economic Reanalysis Report dated December 2002.

Following the December 2002 analysis, Maritrans, the principal lightering company, received and reviewed the December 2002 reanalysis report and lightering benefits model. As a result of its review, the lightering company provided comments on the methodology and results, the most significant of which were: 1) Maritrans believed that the Corps model overestimated cost per barrel lightered since it did not account for the volume lightered off-shore; and 2) operational considerations would preclude the company from reducing the size of its fleet, even recognizing that there would be a significant reduction in volumes lightered under the with project condition.

In order to address these comments, a refinement of the crude oil transportation cost savings benefits was undertaken. The refinement was based upon comments received from Maritrans and receipt of additional lightering operations information. The refined analysis uses a simulation model to estimate the resource cost savings that would result from reduced lightering operations under with-project conditions.

The February 2004 supplemental report also includes a review of any potential significant changes to other benefiting commodities and contains the results of studies conducted to bring the project into compliance with the General Conformity Rule of the Clean Air Act.

The purpose of this report is to:

- Describe the refined analysis used to estimate crude oil transportation cost savings;
- Review estimates of benefits for other commodity types based on additional data on vessel movements that have occurred since preparation of the December 2002 report;
- Present findings of studies to bring the project into compliance with the General Conformity Rule of the Clean Air Act.
- Present the results of the modified analysis on project justification.

The results of the February 2004 supplement indicate that the total average annual project benefits are $24,249,000, average annual project costs are $21,025,000, and the project benefit-cost ratio at a 5-5/8 % discount rate is greater than unity (1.15 to 1). Based on the February 2004 refinement, average annual net project benefits have decreased by approximately $579,000 from the December 2002 report to $3,223,000.

2. Adjustments to the Method for Estimating Lightering Cost Reduction Benefits

Two changes have been made to the modeling methodology used in the December 2002 report. The first of these changes involves the data used in the modeling effort. Maritrans, the Corps' Waterborne Commerce Statistics Center (WCSC), and three of the five principal Delaware River refineries (Sun, Phillips 66 and Valero), have each provided actual lightering operations data, including: volume lightered, load times, discharge times and locations, and transit times. This new data has been used to modify and adjust the assumptions and estimates used in the December 2002 analysis. The WCSC data provided tanker movement information for each of the oil refineries.

Specific lightering vessel information could not be obtained from two of the five refineries (Motiva and Coastal). Three attempts were made by the Corps, DRPA, and Maritrans in March – May of 2003 to obtain this information; however these companies did not authorize release of their proprietary data by Maritrans. In the case of Motiva and Coastal, since it was not possible to obtain the requested data, follow up letters were sent to the refineries in June 2003 to offer to discuss the modeled results with them (see Attachment 1). A response was received from Coastal in September 2003. This letter is also included in Attachment 1, as is an internal memorandum responding to the issues raised in Coastal's September 2003 letter.

The inclusion of the additional input data from Maritrans, WCSC, and the three refineries results in nearly 99% of the 96 million barrels lightered at Big Stone Beach Anchorage and offshore in 2000 being directly accounted for in the revised model. In addition, individual lightering operations and vessel movements have been identified.

The second change made to the lightering cost reduction model is the way that the cost of lightering operations are estimated and included in the analysis of NED benefits. The December 2002 analysis calculated the cost per barrel lightered based on total vessel operating costs for a 3-vessel lightering fleet, the proportion of time at sea and at port, and the number of barrels lightered at Big Stone Anchorage. For with project conditions, the calculated reduction in lightering volumes (31 percent) was equivalent to the capacity of one of the 3 vessels. Therefore, as a proxy for resource cost reductions, the more expensive of the smaller vessels was removed from the fleet, total fleet costs were recalculated, and then divided by the reduced volumes lightered to derive the with project condition cost per barrel lightered. Lightering benefits were then calculated as the difference between without and with project condition lightering costs (cost per barrel lightered times number of barrels lightered).

In response to the first comment from the lightering company, the model was revised to calculate the reduction in resource costs required to conduct lightering operations within the entire Delaware River system (including both at-anchorage and offshore lightering). Also, rather than developing a cost per barrel lightered based on total lightering volumes and total fleet costs, a model has been developed to simulate actual lightering operations by assigning lightering vessels to each arriving tanker and calculating tanker unloading times, lightering vessel and tanker transit times, and lightering vessel and tanker offloading times at the dock. Simulated future vessel deployments are used to estimate the cost of each individual lightering operation under with and without-project conditions over the period of analysis. The reduction in resource costs required to conduct lightering operations within the entire Delaware River system is calculated as the:

- Reduction in fuel costs, since this will adjust immediately due to the reduction in lightering trips; and
- Reduction in the costs of hull replacement, crew, lubes and stores, maintenance and repair, and administration.

The issue has been raised that some of these costs may not change in response to the reduction in lightering under with project conditions. Clearly, there are some costs (e.g., fuel, stores, etc.) that are fully “variable”, i.e. they adjust immediately in relation to the number of vessel trips/hours at sea. Other cost components (e.g., contract labor, vessel maintenance) also adjust to changes in number of vessel trips/hours at sea, albeit not as quickly. Still other cost components (e.g., vessel capital costs) will adjust more slowly to changes in demand for lightering services. The critical issue, however, is whether these costs should be considered adjustable for a project that will be in operation from 2008 (pre-base year) to 2058 (end of period of analysis). Given the five-year lead time before the project is operational, and the subsequent 50 year period of analysis, all costs (including vessel capital costs) are considered adjustable over the project life to significant shifts in demand for lightering services. The next section of the report discusses alternative employment opportunities for lightering resources that will no longer be required in the Delaware River system due to implementation of the project.

The model uses vessel operating costs (VOC’s) and hourly fuel consumption costs developed specifically by WRSC-IWR for each of the 3 vessels in the current Delaware River lightering fleet. The implicit assumption is that any future vessels that may enter the lightering fleet will display similar operating cost characteristics as the existing fleet. While this may, in fact, not be the case, there is no rational basis at this time to project the characteristics or timing of potential future changes in lightering vessel operating costs.

The model also employs actual lightering operation duration data and actual transit duration data provided by the lightering company, several of the receiving refineries, and WCSC. The simulation model assigns individual vessels to each lightering operation based on decision rules developed from observed year 2000/2001 data on current lightering operations (see Attachment 2 for a modeling flow-chart and model documentation, and also see Sim_Model_Demo.xls for an expanded presentation of simulation model inputs, outputs, and linkages to cost calculations). An assessment of alternative decision rules is also presented in the Sensitivity Analysis section of this report.

3. Basis for Lightering Cost Reduction Benefits

The NED benefits quantified in this section of the report are the reduced costs of transportation realized through operational efficiencies (reduced lightering) that will result from navigation improvements at the harbor. Large crude oil vessels that currently lighter in the naturally deep water of the lower Delaware Bay will continue to carry equivalent tonnage into the system, but will be able to travel to the dock more fully laden in a deepened channel, thereby reducing the need for lightering. Reduced lightering costs result in reduced production and distribution costs and thereby increase the net value of the national output of goods and services.

Contracted lightering operations in the Delaware River System are primarily conducted by a single firm that also conducts lightering operations in the Gulf of Mexico and, to a lesser extent, for several other east coast refineries. In addition, several of the refineries conduct their own offshore lightering operations for tankers bound for the Delaware River, or contract with another lightering firm to operate the refineries' lightering vessels. This analysis expects, consistent with Corps guidelines and observations of past industry practices, that the lightering industry would adjust lightering fleet capacity to future conditions, whether the depth of the Delaware River channel is at 40 or 45 feet.

When calculating the NED benefits resulting from proposed navigation improvements, it is typically assumed that any productive resources no longer required will be available for productive use elsewhere in the nation. The resource cost savings associated with these "freed" resources are considered a positive contribution to the nation's productive capacity, and an NED benefit of a navigation improvement project.

An analysis has been conducted to verify that adequate alternative deployment opportunities exist for the portion of Delaware River lightering resources that will no longer be required once the main ship channel is deepened to 45 feet. Typically, in an analysis of the NED benefits of navigation improvements, the business management decisions of a firm concerning alternative employment of the resources made extraneous by the improvements are not included in the analysis. From a national perspective, identification of the next best use of the resources saved (and the cost of those resources in their next best use) does not impact the expectation that the national need for resources will be reduced by the project. Although it is not appropriate to forecast the business management decisions of an individual firm for the purpose of estimating NED benefits, a listing of possible alternative employment decisions is provided below. The lightering firm may choose to execute any one of these management decisions, or all of them, or any combination that the firm considers appropriate, if the Delaware River channel is deepened.

Expand other operations within the Delaware River system: The firm has extensive contacts in this market area, including existing contracts. Some of the refiners, such as Valero and Tosco/Phillips 66 have recently chosen alternative lightering options. Under with project conditions, this market is the most logical place for the firm to aggressively pursue replacement of the business that will be lost due to channel deepening.

Expand operations in Virginia and New York Harbor: The firm has existing contacts in this market area and has been able to conduct some business there. The shallow depth of the Arthur Kill in New York Harbor causes most, if not all, tankers to lighter before entering the channel. Because the firm has already found a niche in this market, it is reasonable to expect that there may be opportunities for further expansion in this market area, especially in conjunction with more aggressive marketing of Tosco/Phillips, the owner of the Bayway, NJ Refinery.

Reallocate vessels between the Gulf and the Delaware fleets: In the recent past, the firm has exhibited flexibility in bringing additional resources from the Gulf to the Delaware for portions of the year. It is reasonable to assume that the transfer of resources could also go in the other direction, i.e., bring resources from the Delaware to the Gulf. By reallocating resources within the firm, the firm may be able to better match its available resources with the resource requirements of conducting its business. This is in fact one of the potential responses to the deepening project suggested by Maritrans' officials during our interview notes, which were later confirmed by them. It is also the expected practice of an economically rational firm faced with declining demand in one of its several markets.

Lease or sell extraneous resources: There are a limited number of Jones Act compliant vessels available for service in the US. It has also been noted that there are no new Jones Act compliant vessels being built at the present time that could enter the trade. Given this limited supply of vessels, it likely to be the case that there is (and will be) a market for vessels that meet Jones Act conditions. Certainly, the market for imported crude oil is continuing to grow, albeit at a slow rate. The lightering vessels in the Delaware fleet have an excellent safety and performance record which should add to their marketability.

Refit vessels for "clean" service: The vessels currently operating in the Delaware River lightering fleet are considered "dirty" vessels because they carry crude oil. These vessels, or ones like them, could be refit to carry refined petroleum products. A cleaned vessel could enter the Jones Act restricted coastwise trade in transporting refined product, either by its current owner, or a new owner. However, due to the high costs of refitting vessels for clean service, this alternative is unlikely, unless one of the lightering vessels is completely removed from service in the Delaware River.

Expand into the market for transport of other "black" oils: The U.S. domestic black oil marine transport market (of which the Delaware River is part) exhibits high volumes of commodity transport and broad geographic distribution of origin and destination ports on the U.S. East and Gulf coasts. This market provides more than adequate alternative employment opportunities for the lightering resources saved due to navigation improvements at the Delaware River.

Attachment 3 provides an analysis that characterizes the types, quantity and reasonableness of potential alternative uses of the Delaware River lightering resources within the domestic marine transport industry.

The physical and cost characteristics of the existing Delaware River System lightering fleet is used in the analysis as the best approximation of physical and cost characteristics for the future fleet under both without and with project conditions. While it is expected that shifts will occur in the future fleet, this assumption is reasonable given that there are no significant changes predicted to occur within the system, i.e., similar tankers will be arriving with similar loads destined for the same refineries. The only expected change resulting from the project is the reduction in volume of lightering required under with-project conditions. The reduction in lightered volume will result in a reduction in the resources required to conduct lightering, freeing these resources for possible alternative uses and resulting in NED resource cost savings.

The operational characteristics of the existing fleet are also expected to represent the operational characteristics of the future fleet. Operational characteristics, such as the time it takes to load, offload, and transit the system, or observed vessel deployment protocols are expected to continue into the future under without and with-project conditions. The only expected changes in operational practices will be the reduced time to lighter, due to the reduced volumes that will need to be offloaded from tankers that will be able to transit the channel more fully laden under with project conditions.

4. Estimation of Without and With-Project Lightering Resource Costs

As in the December 2002 model, a series of spreadsheets are used in the revised analysis to estimate the volume of crude oil lightered for each arriving tanker call in every year of the period of analysis (2008 – 2058). Each arriving tanker call and associated lightering volume is taken from the spreadsheet model and input into the lightering operations simulation model, which assigns a lightering vessel to lighter the arriving tanker based upon a set of decision rules derived from past practices.

The simulation of lightering vessel operations and deployment are outputs of the simulation model that are used in conjunction with lightering vessel operating costs to estimate total lightering operations costs. Lightering vessel operating costs have been developed by WRSC-IWR in cooperation with the lightering company. The cost of delivering the crude oil remaining on the tanker after lightering is calculated in the spreadsheet model using the standard FY 2002 WRSC-IWR vessel operating costs.

In order to verify the simulation model, a test was conducted by simulating year-2000 lightering vessel deployments and comparing them to actual year 2000 data. The simulated year-2000 lightering vessel deployment patterns very closely match observed year-2000 deployment patterns Table 1 presents year-2000 and year-2008 simulated vessel deployments.

Table 1
Simulated Lightering Vessel Trips with 40 Foot Channel

	Year 2000 Modeled		Year 2008 Modeled	
Tanker (42,000 DWT)	192	40.8%	199	40.5%
Tug/Barge (62,000 DWT)	152	32.3%	151	31.0%
Tug/Barge (33,000 DWT)	127	27.0%	143	28.5%
Total	471	100%	493	100%

For each year that the simulation model is run (2008 – 2018, 2028, 2038, 2048, and 2058), an input table is created from the spreadsheet model that identifies the date and time for anticipated arriving tanker calls, and the amount to be lightered from each vessel. For special offshore lightering operations (i.e., trips to the Tosco Refinery in Linden, NJ and the Giant Refinery in Yorktown, VA), the source of data is the actual WCSC 2000 database, adjusted for expected commodity growth in future years.

For offshore lightering calls to the Delaware refineries, the source of data is the 2000 WCSC database, adjusted for two Stena V Class vessel calls per month that have recently replaced four Suezmax calls per month, as per discussions with a representative of Sun Oil. This replacement reduces annual offshore lightering from 10.5 million barrels in 2000 to approximately 7 million barrels. Future offshore lightering volumes are expected to grow at the same rate as other crude oil deliveries (0.2 percent annually).

For anchorage calls, the source of data is the spreadsheet model that shows the growth in tonnage for each arriving tanker, and the resulting lightering needs for those vessels. The order of arrival for years 2008 and beyond is determined using a random number generator, since it is unreasonable to assume that these vessels would observe the same exact call pattern year after year.

The simulation model calculates the amount of operating time (loading, transiting, and discharging) for each lightering vessel deployment based upon regression analyses of loading and discharging times and volumes, and average transit times calculated from the lightering company's operation data for year-2000 (see Attachment 4 for a detailed discussion of operating time calculations and regression analyses). Total annual lightering operations costs for each of the three lightering vessels are calculated using annualized fixed costs, hourly fuel costs for transiting, and average hourly fuel costs for loading and discharging operations.

Vessel operating costs developed for the three-vessel lightering fleet are used as the basis for comparison between the without and with-project conditions. The fleet has been relatively stable since 2000, consistently conducting offshore and Big Stone Beach Anchorage operations as well as intermittent trips to Linden, NJ and Yorktown, VA.

As shown in Table 2 below, over the past five years there have been a significant number of lightering trips performed by vessels other than the Maritrans 300, the Integrity, and the Maritrans 400. The number of vessels performing lightering services in the Delaware Bay over the five year period was: eight vessels in 1997, six in 1998, seven in 1999, six in 2000, and four in 2001. This historical data demonstrates that alternative sources of vessels have been used to supply Delaware Bay periodic surge lightering needs, or to be brought into service for temporary duty when one of the primary vessels is out of service for maintenance or repairs.

Table 2
Lightering Trips by Vessel

Vessel	1997		1998		1999		2000		2001	
	Trips	%	Trips	%	Trips	%	Trips	%	Trips	%
Integrity, Maritrans 300, Maritrans 400	319	58%	364	77%	389	86%	501	98%	465	100%
Other Vessels	235	42%	110	23%	63	14%	12	2%	1	0%
Total	554	100%	474	100%	452	100%	513	100%	466	100%

In addition to other, non-Delaware River based lightering vessels performing lightering services within the Delaware River system; the Delaware River-based lightering vessels also perform lightering trips outside the system. Between 1997 and 2001, Delaware River based lightering vessels delivered an average of 3 million barrels annually to the Phillips/Tosco Bayway, Linden, NJ facility and the Yorktown, VA Giant refinery.

Fleet Utilization

The three vessel fleet has, on average from 2000-2002, and logged 808 work days per year, which is the equivalent of approximately 269 work days per vessel per year based on data compiled from information provided by the lightering company and WCSC. The maximum number of work days per vessel, per year is 295, and the minimum is 245.

It is assumed that the current fleet composition and observed utilization levels have been selected to balance the demands of customer satisfaction with the costs of vessel availability (i.e., that the existing fleet is sized efficiently for the current level of lightering that it performs). The data shows that the lightering company keeps tanker delays to an acceptable level by maintaining a level of excess capacity. Current lightering vessel deployment provides an adequate amount of reserve lightering capacity to handle surges in demand without causing excessive delays and is considered to be an appropriate allocation of lightering resources.

Vessel utilization is determined by the volume of crude transported and the number of lightering trips, as well as weather delays, time for maintenance and repairs, and external constraints imposed by the refiners. The refiners are a major factor in vessel utilization because even though a tanker may be sitting at the anchorage and a lightering vessel may be available, limitations in berth space, pipeline space, and storage tank space for the type of crude on the vessel could cause the refiner to postpone lightering until the limitations are removed. The lightering company, the refineries, and the pilots have all indicated that this occurs frequently. Therefore, the lightering operator is constrained to some degree in their ability to optimize vessel utilization.

As the volume of crude oil deliveries increase in the future without-project condition (approximately 0.2% per year), the current three vessel fleet will need to be augmented at some point to handle the anticipated growth in lightering volumes. This is consistent with the historic record shown in Table 2 above.

For modeling purposes, it was assumed that additional lightering resources would be required if any lightering vessel is projected to work more than 295 days per year (the observed maximum over the 3-year period from 2000-2002). While it may be possible for one or more of the vessels to work more than 295 days per year in the future, allowing higher levels of utilization could result in unacceptable reductions in the timeliness of lightering service. Tradeoffs exist in the cost of more efficient lightering versus increased tanker delays. These tradeoffs cannot be estimated because the available data on the time tankers spend at anchorage does not distinguish between the time spent waiting for lightering, versus the time spent for the various other reasons tankers wait at anchorage. Therefore, using a higher level of vessel utilization would underestimate the total costs of the lightering operation to both the tanker and the lightering vessel. A sensitivity analysis has been conducted to evaluate the impacts on lightering cost reduction benefits from assuming higher utilization levels and is presented later in the report.

The simulation model is based on <u>hours</u> of operation and not <u>days</u> of operations, so the 295 operating days actually equates in the model to 7,080 operating hours (295 days * 24 hours). If all three vessels were to work at the observed maximum number of days and at year-2000 productivity levels, the total volume lightered that could be accommodated by the existing fleet would be slightly more than 99.5 million barrels per year (this is approximately the lightering volume projected for 2012 under without-project conditions and closely matches the 100 million barrel capacity figure cited by the company). This high level of vessel utilization may or may not be achievable in practice, but it is used to represent the working capacity of the three vessel fleet.

Once the growth in future tonnage exceeds the capacity of the three vessel fleet, additional lightering resources will be required to conduct Delaware River lightering operations. This analysis assumes that additional lightering resources can be obtained in proportion to the increase in lightering demand. In other words, if lightering demand increases by 10% over the maximum capacity of the existing fleet, it is assumed that additional lightering resources equivalent to 10% of the current fleet capacity can be obtained. This assumption is supported by the historic record provided in Table 2, which shows that a number of other vessels have been brought into part-time service in the Delaware River lightering service over the past five years (and the Delaware River vessels have also worked part-time outside of the Delaware River over the same period).

The costs of additional lightering resources are calculated proportionally by the model for each vessel projected to work more than 7080 hours (295 days). For example, if the simulation model were to project that a lightering vessel must work 7,788 hours in a given year (a 10% increase over 7080), then the annual cost for conducting that 7,788 hours of lightering would be calculated proportionally as 110% of the base-case cost (i.e., 10% more than the cost of conducting 7080 hours of lightering). This approach essentially assumes that additional lightering resources can be obtained at a cost proportional to the hourly cost of the existing lightering fleet. Because there would likely be additional transaction costs associated with bringing additional vessels into part-time service in the Delaware River, this is a slightly conservative assumption that may somewhat underestimate total future with and without project condition lightering costs.

Under future without-project conditions in the year 2008, the simulation model estimates that an additional 2,185 working hours beyond the capacity of the existing fleet will be required (23,425 working hours minus 21,240 total three vessel working capacity = 2,185). The costs of these additional hours are based upon deployments projected by the simulation model. In 2008, the simulation model projects an additional 18 hours for the 33,000 DWT tug/barge, 1,017 hours for the 62,000 DWT tug/barge, and 1,150 hours for the 42,000 DWT tanker. Again, since it is not possible to predict what actual vessels might be brought into temporary or permanent service to meet future demand, it was also not possible to calculate their costs in the same manner as was done for the existing fleet. Therefore, it was assumed that any vessels used in the future to supplement the existing fleet would have the same cost structure as the existing fleet; and existing lightering fleet costs were used to calculate the costs of the additional hours of excess lightering service requirements. Similar calculations are conducted under with-project conditions. Due to the reduction in lightering requirements under with-project conditions, the first year additional resources beyond the three vessel fleet are required, under with-project conditions, is significantly extended until 2044.

5. Estimation of Benefits Due to Reduced Lightering

With-project resource cost savings are calculated as the proportional reduction in the costs of hull replacement, crew, lubes and stores, maintenance and repair, and administration; as well as the reduction in total fuel costs. The reduction in the costs of hull replacement, crew, lubes and stores, maintenance and repair, and administration is based upon the proportion of with-project vessel operating hours to without-project vessel operating hours. This approach to calculating resource savings is consistent with USACE policy, which is to use the change in vessel transportation costs – as a proxy for resource reductions – as the measure of project benefits. This approach focuses on the reduction in economic resources that would be required for conducting Delaware River lightering operations during the 50-year period of analysis, and does not attempt to predict in detail how any specific firm would conduct its future operations over the near or long term.

Lightering vessel operating costs were developed specifically for this study. The Corps of Engineers Water Resources Support Center, Institute for Water Resources (WRSC-IWR) compiles information on deep draft and shallow draft vessel operating costs and publishes them approximately bi-annually in a series of Economic Guidance Memorandums. The published deep draft vessel operating costs were used in this analysis for all vessel categories, except lightering vessels. Because of the unique nature of the lightering vessels at the Delaware River (one U.S. flag double-hulled tanker and two large tug/barge combinations); the standard published vessel costs were not considered applicable for this cost component of this study. Therefore, WRSC-IWR was requested to compile vessel operating costs specifically for this lightering fleet. These vessel-specific operating costs were developed in close cooperation with the lightering company. Table 3 presents a generic example of a future annual cost savings calculation for a Delaware River lightering vessel.. Cost savings are based on the difference in the proportion of the resource costs of the vessel consumed in Delaware River lightering operations under with and without project conditions.

Table 3
Sample Future Annual Vessel Cost Calculation

	Without Project	With Project
Total Barrels Lightered	36,863,601	29,380,968
Total Operational Hours	8,230	6,951
Total Resource Cost	$ 10,180,668	$ 7,631,170

Lightering service providers can be expected to respond to changes in future lightering demand by adjusting their fleet costs to continue to efficiently meet future lightering volume requirements under both without and with-project conditions. As described previously, over the 50 year project planning period, the lightering service providers have many other fleet configuration and deployment options (some of which have been exercised in the past), including seeking other spot market or contract work, swapping one or more vessels for smaller ones from the Gulf or elsewhere, or selling a vessel to one of the refiners or some other operator. An analysis of the U.S. domestic marine transport industry (see Attachment 3) indicates a large volume of domestic marine transport and a broad geographic distribution of black oil deliveries between east coast and gulf coast states. Based upon a WCSC dataset that did not include most offshore and anchorage based lightering, over 59 million short tons were transported in the Maine-Virginia region of the U.S. East Coast in the year 2001, of which 15.5 million tons (26%) was crude oil. For comparison purposes, the difference between without and with-project tons lightered is approximately 3.5 million tons. In summary, because the analytic horizon for the deepening project is 50 years, and the first year of project benefits is 2008, there is both time and flexibility for lightering service providers to explore alternative fleet utilization and to rationalize fleet composition to adjust to the reduction in demand resulting from the deepening project.

Table 4 presents total lightering operations resource costs under without and with project conditions, and cost savings that would accrue over the study period, as estimated in the December 2002 Report and in this report. Total lightering operations resource costs are higher for both without and with project conditions using the current estimation method because this method includes offshore lightering and special lightering trips and is based upon more complete operations data than the December 2002 estimate.

Table 4
Lightering Operations Costs 2008-2058

	December 2002			February 2004		
	Without Project Costs	With Project Costs	Cost Savings	Without Project Costs	With Project Costs	Cost Savings
Present Value	$318,761,320	$180,270,596	$138,490,724	$469,161,430	$364,574,970	$104,586,460
Annualized Costs	$19,871,584	$11,238,071	$8,633,513	$28,219,316	$21,928,607	$6,290,710

Note: Costs annualized for 50 years at 5.625% in Dec 2002 and 5.625% in Feb 2004

In the current analysis, benefits resulting from with-project lightering operations resource savings account for approximately 53% of crude oil delivery transportation cost savings and 26% of total benefits. The difference between total project benefits calculated in the December 2002 analysis and calculated in the current revision is due to the revised lightering resource cost estimation method and the use of more complete lightering operations data in the revised analysis.

6. Recalculation of Tanker and Total Crude Oil Benefits

There has been a small increase in transportation cost savings for non-Motiva bound tankers transiting the deepened channel more fully laden. This increase is due to the use of more complete information about tanker offloading times for lightering and dock-side discharge.

Delay reduction benefits for Motiva-bound tankers transiting the federal channel that were claimed in the December 2002 report have been eliminated in the current analysis. Additional information has been obtained that indicates the depth of Motiva's access channel (about 3 miles long) is significantly less than the depth of the Delaware River (40-foot) channel. For this reason, Motiva cannot take advantage of the full existing depth of the Federal channel, much less the 45-foot deepening project.

The effect of these two changes has been a decrease in tanker benefits from $6,165,000 in the December 2002 report to $5,487,000 in February 2004.

Overall, total crude oil benefits are currently estimated at $11,778,000, compared to $14,799,000 in the December 2002 report.

7. Container Benefits

Introduction

The December 2002 analysis of benefits to containership services resulting from deepening the Delaware River main channel was based upon interviews conducted in the summer and fall of 2002. These interviews identified two potentially benefiting container services. The services included:

- The East Coast of South America to the East Coast of the US service (ECSA to ECUSA, aka TANGO: main carrier, Columbus Line / Hamburg-Süd); and
- The eastbound round-the-world, Australia-New Zealand to the East Coast of the US service (ANZ to ECUSA, aka EBANZ: main carrier, P&O Nedlloyd).

In the intervening time between December 2002 and December 2003, the new two container services have established stable port rotations, loading patterns, and operating procedures. As a result, containership operations at the Delaware River have been reviewed and shippers re-contacted in order to determine whether the without project conditions presented in the December 2002 report were still valid, and to make any necessary revisions to the benefit analysis.

This review included extensive correspondence and follow up interviews with the carriers between August and December 2003, and interviews and correspondence with local refrigerated warehouse operators and terminal operators conducted in December 2003. Based on the information obtained during this review, it was determined that modifications to existing conditions, future without-project conditions, and future with-project conditions were warranted. The revised containership benefit analysis resulted in an increase in estimated benefits from $3,491,000 (as calculated in the December 2002 report) to $6,124,000.

This section of the report describes the updated analysis of containership benefits, and is organized as follows. The next section presents existing conditions, including a discussion of conditions that have changed since the December 2002 analysis. The existing conditions section also includes a discussion of the Philadelphia area's refrigerated goods infrastructure and a synopsis of the landside cost analysis conducted as a part of the containership-based benefits analysis. Section three presents the future without-project condition and without-project transportation costs. This section includes a discussion of the likelihood and sustainability of the without-project condition. The fourth section presents the with-project condition and with-project transportation costs. Section five presents the benefits calculations. In addition, there are two attachments which contain supporting information. Attachment 5 contains updated containership operations data. Attachment 6 presents a more detailed discussion of the landside cost analysis.

Existing Conditions

Observed Changes in Containership Operations

Identification of containership-based benefits is based upon observations of current actual operations, including sailing drafts, port rotations, and cargo handling practices. Observations of containership operations at the Delaware River during 2003 indicate a number of differences from the projections presented in the December 2002 report. Sailing draft and port-of-call data for all 2003 containership arrivals by the two services are shown in Attachment 5, Table 5-1. The most significant of these observed differences include:

- Containerships on both services are sailing at deeper drafts than anticipated in the Dec02 report, due to the high proportion of heavy weight refrigerated cargo (reefer) TEUs on these vessels,
- Due to depth constraints at the Delaware River, the ECSA to ECUSA service has shifted from its original port rotation, so that the Port of New York and New Jersey (Port of NYNJ) is now the port of call prior to Philadelphia (this shift has occurred much sooner than was originally anticipated)[1],
- A portion of the time-sensitive Philadelphia-bound refrigerated cargo on the ECSA to ECUSA service is being offloaded at New York and trucked to Philadelphia now that the Port of NYNJ is the prior port of call,
- Containerships on the ANZ to ECUSA to Europe service are currently arriving at Philadelphia with observed sailing drafts considerably deeper than anticipated by the shippers as part of the fall 2002 interviews, and
- Containerships on the ANZ to ECUSA to Europe service are arriving at Philadelphia with relatively less Europe-bound export cargo (loaded at Savannah) than anticipated by the shippers as part of the fall 2002 interviews.

Each of the observations cited above are current as of the writing of this report. These recent operational changes have also caused the carriers to revise their future plans. As a result, future without and with-project conditions have been revised based upon observations of existing operations, extensive discussions with the carriers, and interviews with Philadelphia-area refrigerated warehouse operators. The following paragraphs discuss existing conditions for the two container services.

Existing Conditions: ECSA to ECUSA Service

Hamburg-Süd (which owns Columbus Line, Aliança, and the Inter-American services of Crowley American Transport), in coordination with six slot sharing partners[2], currently operates two separate containership services, SAMBA and TANGO, that provide weekly

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[1] While PONYNJ is also still at a controlling depth of 40 feet, the Port of NYNJ has a wider window than the Delaware River in which to operate with the tide because the constraining Port of NYNJ channels (6 miles) are much shorter than the constraining Delaware River Channel (100 miles).

[2] CSAV, Libra, Maersk/Sealand, P&O Nedlloyd, Lykes Line, Evergreen

service from the east coast of South America to the east coast of the United States (see Table 5 below). The SAMBA service deploys six 2,500 TEU containerships that have a maximum sailing draft of 36 feet. The SAMBA service extends from Paranagua in south-central Brazil to New York. This service does not currently call at Philadelphia and this service does not contribute to project benefits.

The TANGO service deploys six 3,800 TEU vessels that have a maximum sailing draft of 41 feet. The southern most port for the TANGO service is Buenos Aires, Argentina and the northern terminus is New York. This service currently calls at Philadelphia as its second port of call in the U.S. The vessels on this service are currently depth constrained at the Delaware River Channel. Due to depth constraints at the Delaware River, the TANGO service port rotation has recently been modified so that New York has replaced Philadelphia as the first U.S. east coast port-of-call.

Table 5
East Coast of South America to East Coast USA Services

TANGO	
Ports of Call (in order)	New York, **Philadelphia**, Baltimore, Norfolk, Charleston, Jacksonville, Miami, Rio de Janeiro, Santos, Buenos Aires, Rio Grande, Pecem (alt.), Suape (alt.)
Vessels	6 containerships at 3,800 TEU each, 800 reefer slots
Frequency	Weekly, round trip time 42 days
Partners	Hamburg- Süd (incl. Columbus line/Aliança/Crowley American Transport), CSAV, Libra, Maersk Sealand, P&O Nedlloyd, Lykes Line, Evergreen
SAMBA	
Ports of Call (in order)	Norfolk, New York, Charleston, Jacksonville, Freeport, Miami, Puerto Cabello, Resife, Santos, Paranagua, Sao Francisco do Sul, Salvador
Vessels	6 containerships at 2,500 TEU each, 180-320 reefer slots
Frequency	Weekly, round trip time 42 days
Partners	Hamburg- Süd /Columbus Line, Aliança, Crowley American Transport, CSAV, Libra, Maersk Sealand, P&O Nedlloyd, Lykes Line, Evergreen

Source: www.hamburg-sued.com, also available at www.columbusline.com and www.ponl.com

The port rotations, schedules, and vessel characteristics for these two ECSA to ECUSA services (SAMBA and TANGO) were developed through negotiations among the multiple slot sharing partners who ship containers on these services. The schedules and port rotations for the two services were developed to achieve as many direct service calls as possible, while maintaining weekly service to each port of call. In order to maximize the number of direct service calls, the two services do not call at all the same ports. For example, the smaller vessels on the SAMBA service make calls to the following ports not serviced by the TANGO service: Freeport, Puerto Cabello, Resife, Paranagua, Sao Francisco do Sul, and Salvador. In order to maintain weekly service, the SAMBA string vessels do not call at ports served by the TANGO string vessels in southern Brazil or Argentina, and in the U.S., they do not call at Philadelphia or Baltimore. There is only one South American port that is called on by both services, Santos, Brazil (however, they call at separate port terminals in Santos). The two services were developed to be complementary, but were not developed to include regular transshipment between services.

Discussions with the Director of Operations for Hamburg-Süd North America, the major carrier on both the SAMBA and TANGO services, indicated that the lack of adequate depth in the Delaware River has already significantly affected container traffic through the port of Philadelphia and affected Hamburg-Süd's preferred port rotation for the TANGO service (personal communication 18Jul02). According to the company representative, Hamburg-Süd preferred their previous port rotation for the TANGO service, which had Philadelphia as their first port of call in the U.S., with subsequent visits to New York and various ports along the southeast U.S. coast (personal communication 18Jul02). The first port allows for the timeliest delivery of time-sensitive cargo and a number of Hamburg-Süd's larger customers preferred to see the vessels call first at Philadelphia, since the most time sensitive goods on the vessels (refrigerated produce and meat) is bound for the Philadelphia area (personal communication 18Jul02).

However, the rapid growth in trade on this new service resulted in the 41 foot design draft vessels being filled at or near capacity much sooner than was anticipated. This forced TANGO service vessels to bypass Philadelphia on several calls, because of channel depth constraints. Faced with either having to light loading vessels, and/or incurring schedule delays to wait for the tide when calling first at Philadelphia, Hamburg-Süd chose instead to change to New York as their first call, with Philadelphia as a second stop. Although these vessels are also currently depth constrained in the Port of NYNJ channels (40 feet at the present), the Port of NYNJ has a wider window than the Delaware River in which to operate with the tide because the constraining Port of NYNJ channels (6 miles) are much shorter than the constraining Delaware River Channel (100 miles)[3]. Unloading first at New York reduces sailing drafts sufficiently to allow Columbus Line vessels unrestricted access to Philadelphia (i.e., at less than 37 foot sailing draft).

[3] The deepening of PONYNJ is currently underway and Ports Newark and Elizabeth will have 45' MLW access by Fall of 2004.

Based on discussions with the Director of Operations for Hamburg-Süd North America (personal communication 18Jul02) and a review of sailing draft data for vessels entering New York Harbor, it was confirmed that the 3,739 TEU containerships (41 foot design draft, DWT 51,101) in the TANGO service are currently arriving from South America at the Port of NYNJ with maximum sailing drafts of up to 40 feet. U.S. Coast Guard Vessel Traffic Services (VTS) data from the Bay Ridge Anchorage in PONYNJ also confirm these arrival drafts.

A current operational adaptation to existing Delaware River depth constraints is that some Philadelphia-bound time-sensitive goods on the TANGO service (that would otherwise be offloaded at Philadelphia if it were the first port of call) are now being offloaded at the Port of NYNJ and trucked to refrigerated warehouses and distribution centers in the Philadelphia area. These time sensitive goods are mainly chilled produce from South America. According to the carrier representative, approximately 560 TEUs per call are offloaded at the Port of NYNJ (first port of call) and 195 TEUs are offloaded at Philadelphia (second port of call). Of the 560 TEUs offloaded at the Port of NYNJ, 20% or 112 TEUs (70 containers) are immediately placed on trucks for express delivery to Philadelphia (personal communication 20Aug03). The annual volume of time-sensitive containers on this weekly service that is currently trucked from New York to Philadelphia is 3,640 containers (70*52 = 3,640).

Existing Conditions: ANZ to ECUSA Service

P&O Nedlloyd, in coordination with five slot sharing partners[4], operates two round-the-world weekly services that deliver goods between Australia-New Zealand (ANZ) and the U.S. east coast, EBANZ and WBANZ (see table 6 below). EBANZ is an east bound round-the-world service that originates in Australia, passes through the Panama Canal, stops at the port of Manzanillo, Panama (located on the Atlantic Ocean side of the Canal, then calls on U.S. east coast ports before continuing east to Europe and then on through the Suez Canal, returning to ANZ. The EBANZ service consists of ten 4,100 TEU vessels that are specialty containerships which include 1,300 reefer slots[5]. These specialty vessels were ordered and built specifically for this service because of the high volume of refrigerated imports for ANZ to the U.S. East Coast (specifically, the Philadelphia region). These vessels have a maximum sailing draft of 42’ 02”. The EBANZ service started as a regularly scheduled service in December 2002. During the first few months of the service, the Port of NYNJ was included after Philadelphia and prior to Europe, however, the Port of NYNJ is no longer a port of call for this service.

The same slot sharing partners also operate the WBANZ service, which is a west bound round-the-world service. The WBANZ service consists of twelve 2,200 TEU vessels

[4] Columbus Line, Contship, CMA CGM, Compagnie Maritime Marfret, and Hapag-Lloyd

[5] According to World Cargo News (Issue: Mar 2002), at the time of their introduction in 2002, this class of vessels was the largest reefer containerships in the world fleet.

with 446 reefer slots. This service does not currently call at Philadelphia and this service does not contribute to project benefits.

Table 6
Australia – New Zealand to East Coast USA Services

EBANZ	
Ports of Call (in order)	Melbourne, Sydney, Brisbane, Auckland, Napier, Port Chalmers, Manzanillo (Panama), Savannah, **Philadelphia**
Vessels	10 containerships at 4,100 TEU each, with 1,300 reefer slots
Frequency	Weekly
Partners	P&O Nedlloyd, Columbus Line, Contship, CMA CGM, Compagnie Maritime Marfret, Hapag-Lloyd
WBANZ	
Ports of Call (in order)	New York, Norfolk, Savannah, Manzanillo (Panama), Auckland, Brisbane, Sydney, Melbourne, Adelaide, Fremantle
Vessels	12 containerships at 2,200 TEU each, 446 reefer slots
Frequency	Weekly
Partners	P&O Nedlloyd, Columbus Line, Contship, CMA CGM, Compagnie Maritime Marfret, Hapag-Lloyd

Source: www.hamburg-sued.com, also available at www.columbusline.com and www.ponl.com

The Port of Manzanillo, Panama is on the Atlantic Ocean side of the Panama Canal (the canal has a controlling depth of 39 feet). The Manzanillo International Terminal (MIT) started operations in April, 1995 at a location near the Atlantic opening of the Panama Canal immediately adjacent to the Colon Free Trade Zone (CFZ). MIT offers efficient and reliable port services to shipping lines transiting the Panama Canal or serving the Caribbean Region. MIT was developed primarily to provide transshipment services and is used extensively to "top off" large containerships which must transit the Panama Canal light loaded. MIT is the largest and most productive transshipment hub in Latin America[6], transshipping over 1 million TEUs in 2000. Manzanillo International Terminal has a storage capacity of 27,000 TEU and 500 connections for reefer boxes.

6 The Port of Manzanillo, Panama has been named one of the top 10 most efficient ports in the world by Containerization International

On the EBANZ service, P&O Nedlloyd and their slot sharing partners load additional containers at Manzanillo after transiting the Panama Canal for delivery to the U.S. East Coast. Controlling depths at the containership berths in MIT are 14 to 15 meters (46-50 feet) deep, allowing the service partners the opportunity to fill their vessels to maximum sailing draft after transiting the Panama Canal.

The vessels on the EBANZ service are currently arriving at Philadelphia from Savannah light loaded, with sailing drafts typically ranging from 36 feet to 40 feet (both because of Delaware River channel constraints and because they off load somewhat more than they on load at Savannah). Although the P&O Nedlloyd standard operating procedures identify 10% of vessel sailing draft as desired under keel clearance, a coordinated effort is being conducted to accommodate vessels on this service that arrive with extreme drafts. That effort includes: vessel arrival at the beginning of a rising tide; pilot cooperation in bringing a vessel sailing with as much as a 40 foot draft up the 40 foot channel; and immediate off loading upon arrival at the Packer Avenue terminal. These operational procedures are considerably different from shippers' expectations provided as part of the fall 2002 interviews, during which they indicated that expected maximum sailing drafts would be no more than 37 feet.

It is also important to note that because of the high proportion of refrigerated cargo carried on the EBANZ service, vessels on this service are more likely to need to utilize their maximum sailing draft than would a similarly sized vessel carrying a like number of non-reefer TEUs. This means that vessels on the EBANZ service are more likely to achieve their maximum sailing draft due to the heavy weight of the refrigerated cargo. Data provided by the Packer Avenue Terminal indicates that, on the EBANZ service, the average weight of a twenty foot container is 17.5 tons and the average weight of a forty foot container is 25.9 tons. Based on summary year to date data provided by PONL, the EBANZ service discharged an average of 930 TEUs (701 containers) per week at the Packer Avenue Terminal in 2003, of which approximately 700 TEUs (574 containers) are Philadelphia-bound. Based upon an analysis of data about refrigerated cargo on the EBANZ service provided by the Packer Avenue terminal in Philadelphia (and confirmed in an e-mail from PONL representatives), the container to TEU ratio for this trade is 0.82, indicating that 700 TEUs is the equivalent of 574 containers. This represents a mix of approximately 78% 20 foot containers and 22% 40 foot containers.

One of the major commodities imported to Philadelphia by the EBANZ service is Australian meat. Other commodities imported to Philadelphia on this service include Australian wine and produce, and New Zealand meat, produce, and dairy products. Historically, imported meat was frozen for shipping, but the availability of large reefer containerships on a weekly service has resulted in an increase in the volume of chilled meat imports from Australia (chilled meat was previously transported solely via air, at much greater cost). USDA data (see USDA Economic Research Service (www.fas.usda.gov)) indicates a nearly five-fold increase in the volume of chilled Australian beef imports between 2000 and 2002, and a continued increase in 2003. The volume of imported frozen beef has increased by 4% during the same time period (2000 to 2002). This shift towards chilled versus frozen meat has also been identified by the carriers and the warehouse operators during recent interviews (personal communication

18Dec03). The growth rates in both fresh and frozen meat imports are quite strong, and could potentially accelerate even more rapidly if the recently completed trade agreement between the U.S. and Australia is approved by Congress.

A comparative review of unit values shows the impetus for the increase in chilled/fresh meat imports. Based on USDA data, in 2003, the unit value of imported fresh beef was 2.6 times greater than the unit value of frozen beef. Assuming a twenty-ton load per container, a box of fresh product has a value of $106,410 and a box of frozen product has a value of $40,818. Extrapolation of year-to-date changes between 2002 and 2003 indicates that there were 18,048 total import boxes of Australian beef during 2003 (assuming 20 tons per box) of which 16,662 contained frozen beef and 1,386 contained fresh beef.

Data provided by the Australian Dept. of Agriculture, Fisheries, and Forestry (www.affa.gov.au) indicates that, in 2003, approximately two-thirds of Australian frozen and chilled beef exports to the US arrived at the US east coast and the remaining one-third arrived at the US west coast. The vast majority of US east coast imports are delivered to the Delaware River ports for delivery to the Philadelphia area distribution centers and processing facilities. Applying the AFFA east coast/west coast ratio to the USDA data cited above indicates that 11,163 boxes of frozen Australian beef and 929 boxes of fresh Australian beef arrived at US east coast ports in 2003[7].

Existing Conditions: Philadelphia Area Refrigerated Infrastructure

In order to confirm current shipping practices, interviews have been conducted with operators of three major refrigerated warehouse distribution centers in the Philadelphia area. The warehouses included in the interview process handle at least 85% of New Zealand dairy imports through the port of Philadelphia, nearly all of the meat imported from Australia and New Zealand, and approximately 75% of the South American produce. Warehouse operators were contacted for information to gain an additional understanding of shipping practices from the standpoint of the shippers' customers. These warehouse operators interact, on a daily basis, with both the ocean carriers that are landing the product and in turn report to the importers, who demand timely inspections and delivery to their customers.

There is an extensive refrigerated warehouse/distribution center infrastructure that has developed in the Philadelphia area, which shifted from the Port of NYNJ region in the 1970's. This infrastructure includes many large footprint refrigerated warehouses and USDA inspection facilities. The major cause of the shift in location from the Port of NYNJ to the Philadelphia area is that refrigerated warehousing is a very land-intensive operation. Because of the high cost and limited availability of land in the New York metropolitan area, this industry (which services a broad geographic region), relocated to the Philadelphia area. None of the carriers or warehouse operators interviewed for this

[7] Note that these totals do not include New Zealand meat imports, which are not reported in the same fashion, but exceed the volume of Australian beef imports to North America by 47%

analysis expects refrigerated warehouse development to return to the Port of NYNJ area in the future. They also did not believe that the additional trucking costs currently being incurred for transporting a subset of Philadelphia-bound goods from the Port of NYNJ provided a sufficient financial incentive to shift this highly capital-intensive infrastructure back to the New York / New Jersey region (personal communication 18Dec03).

The reason that some time-sensitive goods are landed at the Port of NYNJ and trucked to Philadelphia-based distributors (rather than simply remaining on the ship until it calls at the Delaware River) is that the retail value and marketability of chilled meat and produce is very sensitive to the passage of time, and falls at an increasing rate as the end of its shelf life approaches. The importers (who sell the products in the US for the foreign growers) check the product for dates of origin to determine the amount of remaining shelf life to assign to the goods. The remaining shelf life is an important quality attribute of the goods. The longer the remaining shelf life of the goods, the higher their value is in the wholesale market. In instances where the remaining shelf life is short or the demand for the good has changed quickly, chilled goods will be frozen to minimize spoilage. Frozen goods typically retail for a much lower price than chilled goods, as the USDA data for imported Australian meat cited above indicates. The handling of chilled meat and produce is conducted to limit dwell and storage time, almost as a just-in-time inventory system. In many cases, the retail advertisements for sale of the imported products are placed in the newspapers even before the vessel has arrived in port. This tight schedule for chilled meat and produce is turning the inspection/distribution service into a 24 hour, seven day per week operation.

Most typically, the additional cost of trucking some time-sensitive goods from the Port of NYNJ to Philadelphia-based distributors would be negotiated as an increase in the average price across all of that customer’s freight. This practice reduces the impact of additional transportation costs, since that the extra cost of transporting a small proportion of their product by truck from PONYNJ is spread over their total shipments. The overall volume of time-sensitive goods trucked from ports other than Philadelphia to Philadelphia-based distributors is a small percentage of the total volume of imported refrigerated product handled by these distributors. Warehouse operators interviewed for this analysis indicated that from 5% to 20% of their import volume (individual estimates were 5%, 5%-10%, and 10%-20%) is trucked from ports other than Philadelphia (personal communication 18Dec03).

Trucking of time-sensitive goods from other ports to Philadelphia-based distributors only occurs in a minority of shipments, but is nevertheless a common practice. Each warehouse operator interviewed indicated they regularly receive time sensitive goods from other ports (personal communication 18Dec03). This practice is expected to increase in the near future because of: 1) an ongoing food industry shift from frozen product to chilled product, which is more time-sensitive, 2) a consolidation of round-the-world shipping services, and 3) the inability of shipping liner services to add additional ports of call to already time-constrained service routes.

Landside Transportation Cost Analysis

As described in the Existing Conditions: ECSA to ECUSA service section, depth constraints at the Delaware River have resulted in the South America to US East Coast TANGO service shifting to the Port of NYNJ as the first U.S. port of call on the north-bound leg of the service. Although currently at the same controlling depth as the Delaware River, the shorter channel length at the Port of NYNJ allows these vessels to more easily use the tide and arrive at the Port of NYNJ more deeply laden than they can arrive at Philadelphia. The existing landside infrastructure in Philadelphia, which includes U.S. Department of Agriculture (USDA) inspection facilities, refrigerated goods handling and transport facilities at the port, and privately operated value added processing facilities requires that Philadelphia be the destination for these goods. Some time sensitive Philadelphia-bound refrigerated cargo are currently landed at the Port of NYNJ and trucked to local Philadelphia destinations. This cargo is typically South American produce (rather than meat products), because box weights are more often within the over-the-road weight limits.

Discussions with the carriers indicate that under with-project conditions (45 ft MLW controlling depth at the Delaware River), Philadelphia would once again become the port of call prior to the Port of NYNJ and that the time sensitive cargo now being trucked from the Port of NYNJ to Philadelphia would be landed in Philadelphia (personal communication 20Aug03 and 17Dec03). Because these additional landside transportation costs would be eliminated under the with-project condition, they constitute a transportation cost savings attributable to the deepening project. Therefore, an analysis of landside transportation costs was conducted to identify the differential in transportation costs that are incurred when Philadelphia-bound refrigerated cargo is routed through the Port of NYNJ (or other potential alternative ports), rather than through the Delaware River ports.

Due to the proximity of the Port of NYNJ to Philadelphia, landside transportation between the two ports is almost exclusively conducted by truck (rather than by rail). In the landside cost analysis, Philadelphia-bound refrigerated containers were converted into truckloads based upon observed industry practices and over-the-road weight restrictions. Port-specific terminal lift fees, assessments and gate fees were added to the trucking costs to provide a comprehensive estimate of landside transportation costs. The additional transportation cost for Philadelphia-bound refrigerated cargo landed at the Port of NYNJ was calculated at $308 per container for chilled or frozen meat and $258 per container for chilled or frozen produce.

The landside transportation cost analysis was presented to the carriers for their review. The carriers concur with the findings of the landside transportation cost analysis with a single exception (personal communication 17Dec03 and correspondence dated 27Jan04 and 17Feb04). The carriers identified an incidental bundling and chassis return fee of $100, which is incurred in those instances when containers and chassis are dropped off in Philadelphia and not immediately returned to the Port of NYNJ. Typically, the container is fully stripped within a few hours of arrival at the warehouse and the driver returns the empty box and chassis to the Port of NJNY. The landside transportation cost analysis is based upon this typical operating practice. Because no data was available to determine how often the $100 incidental fee is incurred, it was not included in the transportation cost reduction benefits. The full landside transportation cost analysis is presented in Attachment 6.

Future Without-Project Conditions

Future without-project conditions are based on a number of assumptions. These assumptions are conservative in the areas of future vessel size and growth in commodity volume. Because there is little historical record for these existing containership services from which future operations could be forecasted, it has been assumed that future containership operations will be similar to existing practices. The without-project condition is therefore based on existing vessels deployed on existing services, and does not claim any benefits from growth in future commodity movements beyond the base year that would require increases in vessel size or the number of calls.

Benefits resulting from future growth in commodity volumes during the planning horizon are not claimed in the analysis. The only growth accounted for in the analysis is growth to the base year (2009). PONL representatives anticipate that the current weekly volume of Philadelphia-bound TEUs to increase from the current volume of 700 TEUs (574 containers) to 1,100 TEUs (902 containers) by 2009. This expected near term rate of growth for Philadelphia bound cargo on ANZ service (8% annually) is highly consistent with the actual rate of growth in Australian meat imports to the U.S. from 1992 to 1998 (7% annually). Because of the high value of the Philadelphia-bound cargo on the EBANZ service, PONL representatives indicated that the increase in volume will displace some non-Philadelphia-bound cargo off of this service and onto other services (personal communication 17Dec03).

The containerships deployed on the TANGO and EBANZ services (which are depth constrained at the Delaware River) are currently operating near capacity and are expected to operate at or near capacity in the future. Based on historic trends, future growth in commodity volumes could reasonably be expected to be served by increasing the number or size of vessels. However, as stated previously, the vessels on the EBANZ service are unique because nearly one-third of their container slots (1,300 out of 4,100) are rigged for refrigerated cargo. Given the unique capability of these vessels, there are no existing larger size containerships that could replace them, and new vessels with a similar number of reefer slots would need to be ordered to supplement them. Because new orders have not yet been placed, it is uncertain when new vessels would be brought into service to handle the anticipated commodity growth. For this reason, benefits associated with commodity growth over the period of analysis (2009-2058) are not included in the benefit calculations.

Without-Project Conditions: ECSA to ECUSA Service

The current controlling depth conditions at the Delaware River would continue into the future under without-project conditions. Given the depth constraints, existing containership operations are also expected to represent future without-project condition containership operations. While port rotations and ports of call on containership service strings do shift over time, the main carrier on the service indicated that no change in the current rotation is anticipated at this time.

Expected without-project condition containership operations include the continuance of the Port of NYNJ as the first port of call for the TANGO service and trucking time-sensitive cargo from the Port of NYNJ to Philadelphia. Because the Port of NYNJ will have a controlling depth of 45 feet MLW by 2009 (and is expected to have a depth of 50 feet MLW shortly thereafter), the TANGO service vessels will be able to access the Port of NYNJ at their full design draft of 41 feet. Port Elizabeth and Port Newark are expected to have 45 foot access by the fall of 2004. However, this analysis does not claim any additional benefits for additional cargo that could be carried on the vessels and might be trucked from the Port of NYNJ to Philadelphia.

As cited above, Philadelphia-bound refrigerated cargo that is currently landed at the Port of NYNJ incurs an additional cost of $258.00 per container as compared to Philadelphia-bound refrigerated cargo landed at Philadelphia. The total annual cost differential is estimated to be $939,120 (3,640*$258.00 = $939,120).

The future sustainability of current operations, *i.e.*, trucking some time-sensitive cargo from the Port of NYNJ to local Philadelphia distribution centers, is supported by five significant factors:

- There is an extensive refrigerated warehouse/distribution center infrastructure in the Philadelphia area that does not exist at the Port of NYNJ. There are no indications that the Port of NYNJ is planning significant expansion of its refrigerated warehouse/distribution center infrastructure, or has the space to do so (in fact, land side infrastructure to service existing Port of NYNJ container traffic is already significantly space constrained).

- The retail value and marketability of chilled meat and produce is very sensitive to the remaining shelf life of the product. According to discussions with refrigerated warehouse operators (personal communication 18Dec03) and given the values apparent in the USDA data cited above, the value-added by timely delivery of the product greatly exceeds the $258 additional transportation cost per box.

- The additional cost of trucking some time-sensitive goods from the Port of NYNJ to Philadelphia-based distributors would be negotiated as an increase in the average price across all of that customer's freight. This practice reduces the impact of additional transportation costs, because it is not incurred on every shipment. Alternatively, these additional transportation costs may be borne by the shipper out of the cost savings resulting from not needing to light load the vessels to enter the Delaware River before New York.

- Trucking of time-sensitive goods from other ports to Philadelphia-based distributors is a common industry practice. Each warehouse operator interviewed indicated they regularly receive time sensitive goods from other ports (personal communication 18Dec03).

- There are few, if any, reasonable alternatives for timely delivery of time-sensitive goods from the ECSA to the ECUSA other than the current services. Although there are many carriers engaged in this trade, they share slots on a very limited number of services and vessels, and trends towards industry consolidation and slot sharing are continuing.

One possible alternative to the expected without-project condition for the ECSA to ECUSA service would be transshipment of goods from the TANGO service to the SAMBA service and modification of the SAMBA port rotation to include Philadelphia. This potential alternative without-project condition scenario was presented to the carrier representative for consideration. The carrier representative rejected this as a viable alternative for two reasons (personal communication 08Dec03). The first reason is that Santos, Brazil, the only South American port the two services have in common, is not configured as a transshipment port. This difficulty is exacerbated by the fact that the two services call at two different terminals at the port. The carrier representative estimates the cost of transshipment at Santos to be between $300 and $400 per container. The difficulty of coordinating transshipment at Santos would also add time to the SAMBA and TANGO schedules, and would likely not save sufficient time for delivery to Philadelphia.

Second, the carrier representative indicated that it would be highly unlikely that the port rotations for the SAMBA and TANGO services would be further modified solely due to the single factor of 70 boxes which require trucking from the Port of NYNJ to Philadelphia (personal communication 08Dec03). The carrier representative stated that 25 different schedule scenarios, port rotations, and vessel configurations were considered during negotiations among the six sharing partners before the current schedules for the SAMBA and TANGO services were agreed upon (personal communication 08Dec03).

Without-Project Conditions: ANZ to ECUSA Service

Vessels currently deployed in the EBANZ service have a maximum sailing draft of 42’2” and are depth constrained at the Delaware River Channel. This depth constraint is expected to continue in the future without-project condition. Interviews and correspondence with carrier representatives at P&O Nedlloyd were conducted to update the without-project conditions identified in the December 2002 report, to verify assumptions, and to test alternative without-project condition scenarios.

Under without-project conditions, discussions with P&O Nedlloyd personnel indicate that plans for future operations of this service include the removal of Savannah from the port rotation in order to make more space on the vessels available for near-term growth in higher value Philadelphia-bound cargo (personal communication 17Dec03). P&O Nedlloyd expects that growth in Philadelphia bound cargo will require that Savannah be removed from the port rotation in approximately 2006 – 2007 (personal communication

17Dec03). U.S. exports to Europe currently loaded at Savannah would be transported to Europe on a different service after 2006 – 2007 (personal communication 17Dec03).

Under without-project conditions, containerships in the EBANZ service are expected to continue existing operations, with the exception that Savannah would no longer be a port-of-call for EBANZ vessels. These operations include the continued weekly delivery of, on average, approximately 700 Philadelphia-bound TEUs (574 containers) at sailing drafts in the 38 ft. to 40 ft. range, which is less than the vessel's maximum sailing draft of 42'2". By 2009, PONL expects that an additional 400 TEUs (328 containers) will be Philadelphia-bound, containing refrigerated goods that are destined for processing facilities in the Philadelphia area (personal communication 17Dec03). The total volume of Philadelphia-bound containers that would be available for the EBANZ service is 1,100 TEUs (902 containers).

Under without project conditions, approximately 450 TEUs per vessel call (369 containers) that would otherwise go directly to Philadelphia on EBANZ vessels could not be accommodated due to channel depth constraints. These containers would instead be transported to the Port of NYNJ on separate services that transit the Panama Canal and stop at Manzanillo before continuing on to the U.S. east coast (personal communication 17Dec03). Of these 450 TEUs, 50 would be bound for Montreal and Toronto, Canada. The 400 remaining TEUs (328 containers) would be Philadelphia-bound, containing refrigerated goods that are destined for processing facilities in the Philadelphia area (personal communication 17Dec03). According to P&O Nedlloyd representatives, two existing services that could be used to transship the 328 containers of Philadelphia bound cargo at Manzanillo are the Caribbean Express (CRX) and Pacific Atlantic Express (PAX) services (personal communication 17Dec03 and correspondence dated 17Feb04), both of which transit the Panama Canal and call at New York, but not Philadelphia (see www.ponl.com).

These 328 containers would be transported from the Port of NYNJ to Philadelphia by truck. The without-project condition transportation cost of using the Port of NYNJ as alternative routing for Philadelphia-bound cargo includes the additional costs incurred due to the cost of trucking the cargo from the Port of NYNJ to Philadelphia.

There is an estimated $0.22 per container at-sea transportation cost savings between transporting from Manzanillo, Panama to Philadelphia on a nominally rated 4,112 TEU containership and transporting from Manzanillo, Panama to the Port of NYNJ on a Caribbean Express CRX vessel (4,000 TEU) or a Pacific Atlantic Express PAX vessel (5,000 TEU)[8]. However, because the at-sea cost differential per container ($0.22) is so small, it is not used in the benefits analysis.

The cost of trucking this cargo from the Port of NYNJ to Philadelphia is based on a trucking cost differential of $308.00 per container. This trucking cost differential is

[8] based upon interpolation of transportation costs identified in the Corps' FY03 EGM 03-06 Deep Draft Vessel Operating Costs and assuming an average 4,500 TEU vessel calling at the Port of NYNJ

slightly higher than the trucking cost differential used for the ECSA to ECUSA service because these ANZ-based containers are expected to contain mostly chilled meat which is typically heavier than South American produce and would require overweight permits. The total annual cost differential is estimated to be $5,253,248 (328*52*$308.00 = $5,253,248). This cost differential includes differences in gate fees, port lift fees, ILA assessments, and trucking costs between the Packer Avenue Terminal at Philadelphia and the Port of NYNJ. This cost differential represents the incremental annual transportation cost of using the Port of NYNJ as an alternative port for this Philadelphia-bound cargo, under the 40-foot without project condition.

Extensive discussions were held with P&O Nedlloyd representatives to identify whether there are any viable alternatives to landing Philadelphia-bound time-sensitive goods in the Port of NYNJ and trucking them down to Philadelphia-area warehouses (personal communication 17Dec03 and correspondence dated 17Feb04). One alternative would be to re-route existing alternative services (Caribbean Express CRX (4,000 TEU vessels) and Pacific Atlantic Express PAX (5,000 TEU vessels)), which currently do not call at Philadelphia. This option is not viable because these long, multi-ocean services do not have time available in their schedule to add calls to Philadelphia without dropping another port. A second option would be to replace Philadelphia with P&O Nedlloyd's Baltimore terminal as a port of call, but adding Baltimore to the EBANZ service schedule is not viable because slot sharing partners have expressed their unwillingness to use Baltimore as an alternative to Philadelphia. A third option would be to add a second string to the EBANZ service that would also call at Philadelphia. P&O Nedlloyd representatives do not consider this to be a viable option in the foreseeable future because there isn't a sufficient volume of trade for other ports along the service route to justify a second string. In addition, there are few appropriately sized ships available that could be applied to this second string, and those that are available would be very expensive to charter under current industry conditions.

Alternative ocean transport is not considered economically viable or practical by the carrier, given current and expected future marine transport industry conditions, which include increased consolidation of multiple carriers sharing slots on large vessels, new building of Panamax and Post-Panamax vessels, and high demand for chartered vessels. The best alternative that satisfies customers' requirements is to transship the goods at Manzanillo, Panama to an alternative service to the Port of NYNJ, then truck the goods to Philadelphia-area warehouses. To put this additional trucking cost into perspective, the additional cost per box, $308, is the equivalent to $19.35 per ton (assuming 16 tons per box). USDA statistics indicate that the import value of chilled Australian beef is approximately $5,300 per ton. The additional cost per ton equates to 0.36% of the import value.

In order to demonstrate that the without-project condition is the least-cost, long-term solution to the challenges of without-project cargo flows, an analysis of alternative without-project condition scenarios was conducted. This analysis of alternative without-project condition scenarios includes estimated total transportation costs for each alternative and identification of any operational constraints associated with the alternatives. This analysis was presented to PONL and the findings were confirmed by a company representative (correspondence dated 17Feb04).

The bullet points listed below present the total transportation costs per box for the 328 containers that cannot be transported to Philadelphia on existing 4,112 TEU vessels under without-project condition channel constraints. These per box transportation costs include marine transport, port and truck fees, and rail fees.

The expected without-project condition used in the benefits analysis has the lowest per box total transportation cost and represents the least-cost, long-term solution to without-project condition cargo flows. The cost estimates presented below are based upon the same costs used in the containership benefits analysis. Each of the higher cost alternatives also includes unfavorable logistical issues, such as: vessels with not enough reefer slots, Philadelphia not being in the existing port rotations, and longer delivery times. Table 7 identifies the per box marine, landside (port and truck), and rail costs for each alternative.

Without-Project Condition – Applied in the Benefit Analysis

- 328 Boxes per week cannot be accommodated on EBANZ vessels
- Boxes will be transshipped at Manzanillo, Panama and landed at Port of NYNJ via existing Caribbean Express CRX weekly service and/or Pacific Atlantic Express PAX weekly service, neither of which call on Philadelphia
- CRX service has 3,510 - 4250 TEU vessels with 150 – 400 reefer plugs, and PAX service has 4,612 – 4,890 TEU vessels with 350 – 452 reefer plugs. Because both PAX and CRX are weekly services, combined they equate to 500-852 reefer slots per week.
- Boxes will be trucked to Philadelphia from Port of NYNJ
- This is the expected future without project condition supported by principal carrier, PONL
- Total Transport Cost per box = $1,111 (least cost transportation alternative)

Alternative 1: Use Existing WBANZ Service (West-Bound round-the-world service)

- 328 Boxes per week cannot be accommodated on EBANZ vessels
- WBANZ service uses 2,200 – 2,600 TEU vessels with 446 – 447 reefer plugs
- Boxes to be landed at PONYNJ – Philadelphia not in port rotation
- Boxes will be trucked to Philadelphia from Port of NYNJ
- Scenario not favored by PONL because ship reefer slots are currently carrying NY-bound cargo. In addition, the vessels are traveling west-bound, so refrigerated ANZ cargo would have to travel westward through the Suez Canal and through Europe before arriving at the US east coast, resulting in lengthier travel times.
- Does not allow for transshipment at Manzanillo, Panama, since Manzanillo follows New York in the port rotation
- Total transport cost per box = $1,222 (not least cost alternative)

Alternative 2: Use Port of LA/LB with Land bridge

- 328 Boxes per week cannot be accommodated on EBANZ vessels
- existing Pacific Southwest Service (PSW) uses 1,550 - 1850 TEU vessels with 205 - 325 reefer slots vessels
- Insufficient reefer slots, even if all dedicated to Philadelphia bound cargo
- Boxes landed at Los Angeles and transported via rail service to Philadelphia
- Adds up to four days travel time
- Industry trend is towards all water service when available
- Total transport cost per box = $1,731 (not least cost alternative)

Alternative 3: Add vessels on a new Manzanillo to Philadelphia Service

- 328 Boxes per week cannot be accommodated on EBANZ vessels
- Two vessels required to maintain weekly Manzanillo to Philadelphia direct service
- Assumes 600 TEU vessels
- Assumes EBANZ vessels bring ANZ cargo to Manzanillo
- Transshipment at Manzanillo
- Vessels would need to be refit for additional reefer slots – these costs not included in analysis
- Total transport cost per box = $1,456 (not least cost alternative)

Table 7
Transport Cost per Container

Alternative	Marine Cost	Landside Cost	Rail Cost	Total Cost
W/out Proj. Condition – Applied Scenario	$381	$730	$-	$1,111
#1 WBANZ w/Stop at NY	$492	$730	$-	$1,222
#2 LA/LB w/land bridge	$335	$276	$1,120	$1,731
#3 Add two 600 TEU vessels Manz-Phil	$799	$657	$-	$1,456

Note: Landside costs include Port fees and trucking fees
Rail costs include drayage to and from rail facilities

The information presented above supports that the expected without project condition is the least cost, most viable alternative to transport the excess boxes that could not be accommodated on the EBANZ service. In addition, the costs used in the analysis for alternative without project conditions 1-3 do not include the additional capital costs that would be required for the vessels to be refitted to carry the additional reefer cargo. Therefore, the cost differentials presented above should be considered low estimates of the differences in costs between the expected without-project condition and the alternative scenarios. It is also important to note that if the carriers had considered any of the above alternatives as economically and logistically feasible, they most likely would have selected that alternative instead of incurring the capital cost of building a new fleet of ten 4,112 TEU vessels with 1,300 reefer slots each.

With-Project Conditions

Navigation improvements under with-project conditions include deepening the Delaware River Channel to 45 feet MLW. At this controlling depth, vessels currently deployed on the TANGO and EBANZ services would not be depth constrained in the channel. Similar to the without-project condition assumptions, the with-project condition is based on existing vessels deployed on existing services and future growth in commodity volumes during the project life is not claimed in the benefit analysis.

With-Project Conditions: ECSA to ECUSA Service

Under with-project conditions, the Hamburg-Süd representative explained that two operational changes would be expected. One change would be that Philadelphia would again become the first east coast US port of call on the TANGO service because of the time-sensitive cargo destined for Philadelphia. Another change would be that the containerships on the TANGO service would likely be loaded to their maximum sailing draft capacity of 41 feet (personal communication 18Jul02). It should be noted that the Hamburg-Süd representative, as well as a representative of P&O Nedlloyd (a slot sharing partner on this service), both indicated that vessels on this service “max out” by draft, rather than “cube out” by container slots, due to the extremely heavy weight of the refrigerated commodities carried from South America.

With Philadelphia as the first port of call, the time-sensitive cargo currently being trucked to Philadelphia from the Port of NYNJ would be delivered directly to Philadelphia. The annual transportation cost differential of $939,120, incurred due to trucking goods from the Port of NYNJ would be eliminated, and therefore is a transportation cost savings attributable to the deepening project.

With-Project Conditions: ANZ to ECUSA Service

Under with-project conditions, the nominally rated 4,112 TEU vessels on the EBANZ service would be able to arrive at a maximum draft of 42’2”. Representatives of P&O Nedlloyd anticipate that this additional sailing draft would sufficiently accommodate the 400 Philadelphia-bound TEUs (328 containers) that under without-project conditions would be transported to the Port of NYNJ on an alternative service (personal communication 17Dec03). Calculations using the immersion factor listed in EGM 02-06 Deep Draft Vessel Operating Costs (186 tons per inch) and the average TEU weight (16 tons per TEU) calculated from data collected at the Packer Avenue Terminal, verify that an additional 400 TEUs (328 containers) would cause the vessel to draft an additional 34 inches. Given that existing condition sailing drafts that range from 36 feet to 40 feet, the expectation that there is sufficient draft available for these containers is reasonable.

Under with-project conditions, there would be no need to use the Port of NYNJ as an alternative port for Philadelphia-bound cargo. The vessels on the ANZ to ECUSA to Europe service would deliver approximately 1,100 TEUs (902 containers) per call to Philadelphia, which is consistent with estimates used in the Dec. 2002 report and information provided by the Philadelphia Regional Port Authority. The annual transportation cost differential of $5,253,248, that would be avoided by not trucking goods to Philadelphia from the Port of NYNJ is a transportation cost savings attributed to the project.

There would be some additional transportation costs incurred under the with-project condition that would partially offset the transportation cost savings cited above. Under with-project conditions, representatives of P&O Nedlloyd anticipate that there would be some time-sensitive New York-bound cargo that would be landed in Philadelphia and trucked to New York. It is expected that the EBANZ service would discharge 60 twenty-foot containers of Australian wine per week at Philadelphia for expedited delivery to New York. The difference between the cost of landing the goods at the Port of NYNJ and trucking them to a local New York destination and the cost of landing the goods in Philadelphia and trucking them to the New York destination is an added transportation cost that must be netted out of the project benefits.

This additional transportation cost is calculated using the same port and truck fee analysis that was used to calculate project benefits. Trucking fees from Philadelphia to local New York destinations are $350 per box, whereas trucking fees from the Port of NYNJ to local New York destinations are $185 per box, resulting in an additional cost of $165 per box. However, port fees will be reduced if the goods are landed in Philadelphia rather than at the Port of NYNJ ($237 Philadelphia port fee vs. $380 Port of NYNJ port fee, for a cost reduction of $143), which nearly offsets the additional trucking costs. Therefore, the additional transportation costs for time-sensitive goods landed in Philadelphia and trucked to New York under the with-project condition is $22 per box ($165 - $143) and $68,640 per year ($22 * 60 * 52 = $68,640). This additional transportation cost is netted out from the with-project transportation cost savings attributable to the EBANZ service, resulting in a total transportation cost savings of $5,184,608 ($5,253,248 - $68,640 = $5,184,608).

In order to place the EBANZ service-based benefits in perspective, the total annual transportation costs for all EBANZ Philadelphia-bound containers (574 boxes per week via direct call plus 328 boxes per week via alternative delivery) are presented in Table 8 for each of the alternative without-project condition scenarios. A comparison of total annual transportation costs under the without project condition ($42.9 million) to the NED benefits calculated for containership operations on this route ($5.3 million) indicates that expected cost savings are approximately 12% of the expected without-project condition total transportation costs for these containers.

Table 8
Total Transport Costs for All Philadelphia-Bound Containers

Alternative	Weekly Costs	Annual Costs
W/out Proj. Condition-Applied Scenario	$ 825,465	$42,924,186
#1 WBANZ w/Stop at NY	$ 861,780	$44,812,569
#2 LA/LB w/land bridge	$1,028,716	$53,493,252
#3 Add two 600 TEU vessels Manz-Phil	$ 938,560	$48,805,132

Note: Costs are for 902 containers per week (574 via direct call to Philadelphia and 328 via alternative delivery).

Total Containership Benefits

Total containership benefits include transportation cost savings for the two existing ECSA to ECUSA (Tango) and ANZ to ECUSA (EBANZ) services. These benefits do not include any transportation cost savings for Canada-bound cargo that would be landed at either Philadelphia or New York, and also do not consider potential future shifts to larger sized containerships. In addition, containership benefits do not account for expected growth in cargo volume during the project life. Annual transportation cost savings for the ECSA to ECUSA Tango service are estimated to be $939,120. Annual transportation cost savings for the ANZ to ECUSA EBANZ service are estimated to be $5,184,608. Total estimated annual containership-based benefits are $6,123,728.

8. Dry Bulk Benefits

Also as part of the refined analysis, data on vessel movements for the intervening period since preparation of the December 2002 report was collected to determine whether the trends used in the December 2002 analysis to estimate future commodity growth for bulk cargo were still valid.

Blast Furnace Slag

Blast furnace slag deliveries were projected to grow from 6 calls in 2001 to 17 calls by 2009. The six calls observed in January/-July 2003 and the associated sailing drafts of the vessels are consistent with the projections contained in the December 2002 report.

Steel Slabs

The December 2002 analysis for future steel slab deliveries was based upon 19 observed calls in 2001. Steel slab deliveries were projected to grow to 23 calls per year by 2009. Data provided by the Maritime Exchange indicates that twenty-three calls to Packer Avenue were made in 2002. Eleven calls have been observed from January 2003 through

July 2003, including one trip to Camden, NJ, which equates to 19 calls for a full year, roughly in line with prior projections. The cyclical nature of the domestic market for steel, plus the recent effects of imported steel tariffs, was factored into the analysis and results in a certain level of expected year-to-year volatility in this commodity. Historically, this market has shown year-to-year fluctuations and is not considered indicative of a departure from the projected growth trend.

In summary, previous trends were confirmed, resulting in no change in the bulk cargo benefit category (other than adjustment for the updated discount rate). Information on this portion of the analysis is included in Attachment 5.

9. Air Quality Impacts (General Conformity- Clean Air Act)

Introduction

The Delaware River Main Channel Deepening Project (Project) proposes to deepen the main channel from –40 feet to –45 feet mean low water (MLW). The proposed Project extends from the Ports of Camden, New Jersey and Philadelphia, Pennsylvania to the mouth of Delaware Bay, and follows the alignment of the existing federally authorized channel. In addition to the channel deepening, several berths at the various oil refineries and port facilities along the Delaware River will also be deepened as part of the federal project. The costs of the berth deepening's will be borne by the facility owners and are not part of the Federal Project costs. However, based on the recommendation from the Environmental Protection Agency (EPA) the emissions from the berth deepening's have been included as part of the General Conformity analysis. A majority of the oil refinery berths and port terminals are located in the upstream reaches of the river near the Philadelphia/Camden area.

Purpose

The purpose of this study was to determine the air emissions for the different types of equipment that will be used to construct the Project, in order to address the requirements of General Conformity (GC) of the Clean Air Act. Based on the results of the air emissions analysis, an emission mitigation plan was developed that demonstrates compliance with the Clean Air Act requirements.

Federal Clean Air Act

The Environmental Protection Agency's Office of Air Quality Planning and Standards has set National Ambient Air Quality Standards (NAAQS) for six principal pollutants, called "criteria" pollutants. They are carbon monoxide (CO), nitrogen dioxide (NOx), ozone (VOC), lead (Pb), particulates (PM2.5 and PM10), and sulfur dioxide (SOx). The 1990 Federal Clean Air Act Amendments directed EPA to develop two federal conformity rules. Those rules (promulgated as 40 CFR Parts 51 and 93) are designed to ensure that federal actions do not cause or contribute to air quality violations in areas that do not meet the NAAQS. The rules include transportation conformity, which applies to transportation plans, programs, and projects; and general conformity, which applies to all other projects, which would include the proposed Delaware River Main Channel Deepening Project.

Under EPA rules, each state may promulgate its own conformity regulations. State conformity regulations must be consistent with EPA's regulations for state programs (40 CFR 51, Subpart W), but can be more stringent than federal regulations, provided the more stringent requirements apply equally to Federal and non-Federal entities (40 CFR 51.851(b)). Delaware, Pennsylvania, and New Jersey do not have more stringent regulations than the federal requirements.

Conformity determination is a two-step process: (1) applicability analysis and (2) conformity analysis. Applicability analysis is achieved by comparing the project's annual emissions to "de minimis" pollutant thresholds outlined in the conformity rule. The more severe the "non-attainment" status of a region, the smaller the corresponding "de minimis" thresholds are set. Federal actions are assumed to conform to the most recent federally approved State Implementation Plan (SIP) if total direct and indirect emissions caused by the federal action are less than the "de minimis" thresholds. The definitions of total direct and indirect emissions for conformity determination distinguish emissions by timing and location rather than the type of emission source.

Direct emissions occur at the same time and place as the federal action. Indirect emissions include those that may occur later in time or at a distance from the federal action. In addition, the conformity rule limits the scope of indirect emissions to those that can be quantified and are reasonably foreseeable by the federal agency, and those, which the federal agency can practicably control through its continuing program responsibility. If emissions from a proposed federal action exceed a "de minimis" threshold, a formal conformity analysis is required.

Local Setting

Construction equipment associated with the Delaware River Main Channel Deepening Project would contribute criteria pollutants within ten counties in three states (Delaware, Pennsylvania, and New Jersey). All ten counties are in "non-attainment" status for both VOC and NOx, and two counties in maintenance status for CO. The Federal Conformity limits according to 40 CFR 93.153 for the "non-attainment status in each county are as follows:

Table 9
Non-Attainment Status

Non-Attainment Status	**Applicable Counties**		
	Delaware	Pennsylvania	New Jersey
VOC			
Severe – 25 tons/year	K, NC	De, Ph	Ca, Cu, Gl, Sa
Marginal – 50 tons/year	Su		
Moderate – 50 tons/year			CM
NOx			
Severe - 25 tons/year	K, NC	De, Ph	Ca, Cu, Gl, Sa
Marginal – 100 tons/year	Su		
Moderate – 100 tons/year			CM
CO			
Maintenance – 100 tons/year		Ph	Ca

County Key: Ca = Camden; CM = Cape May; Cu = Cumberland; De = Delaware;
Gl = Gloucester; K = Kent; NC = New Castle; Ph = Philadelphia; Sa = Salem;
Su = Sussex.

The Delaware River Main Channel Deepening Project would trigger a conformity analysis if its emissions exceeded the respective “de minimis” limits in any of the counties, or 10 percent of the “non-attainment” area’s total emissions for that pollutant.

There are more than one non-attainment areas in the Project area. After discussion with EPA it was determined that the Project emissions could be characterized as taking place in a single, combined non-attainment area. This area would take on the most severe classification for each pollutant of concern (e.g. 100-tons for CO; 25-tons for NOx and 25-tons for VOC).

Emission Sources

The emission sources for the Delaware River Main Channel Deepening Project consist of marine and land-based mobile sources that will be utilized during the six-year project construction (five year for the federal project and one year for the berthing areas). The marine emission sources include the various types of dredges (clamshell, hydraulic, and hopper) as well as all support equipment. The land-based emission sources include both off-road and on-road equipment. The off-road equipment consists of the heavy equipment utilized to construct and maintain the disposal sites. The on-road equipment is made up of employee vehicles and any on-road trucks utilized for the Project. The marine emission sources and off-road equipment consist primarily of diesel-powered engines. The on-road vehicles are a combination of gas and diesel-powered vehicles.

The equipment utilized to construct the Delaware River Main Channel Deepening Project and the operational information was derived from the Project cost estimates. The estimates included detailed information on the type and size of equipment required for each contract, type of material dredged, dredging and disposal location, hours of operation, and labor requirements. Information regarding work performed at the various disposal sites was detailed in additional estimates and spreadsheets.

The Project cost estimates also include detailed construction cost estimates for deepening of the berths at each of the benefiting oil refineries and port terminals. Estimates were provided for the following locations: Sun Oil Company (Marcus Hook), Phillips 66 (Marcus Hook), Valero (Paulsboro), Sun Oil Company (Ft. Mifflin), Coastal Eagle Point (Westville), Packer Avenue Terminal (Philadelphia), and Beckett Street Terminal (Camden).

Emission Estimates

Once the operational information for the various engines was obtained from the Project cost estimates, the engine load factors and emission factors were determined using EPA guidelines. The EPA currently has an extensive compilation of air emission factors for various types of equipment (Compilation of Air Emission Factors, AP-42). There have been recent updates to EPA's methodology for developing emission factors as newer engines are developed and tested. The latest EPA technical report for large compression-ignition marine diesel engines is prescribed in "Analysis of Commercial Marine Vessels Emissions and Fuel Consumption Data", EPA420-R-00-002, February 2000. This report was utilized to determine the load factors and emission factors for the various pieces of marine equipment.

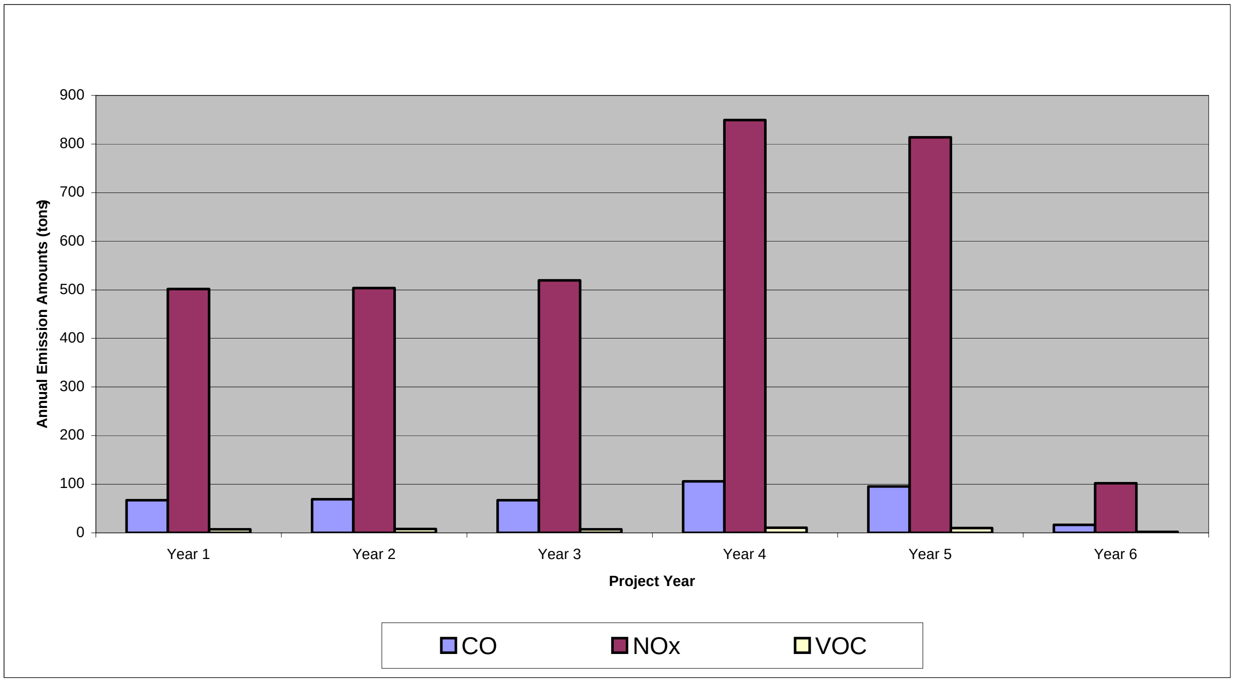
The off-road land-based emissions were calculated utilizing a current EPA computer model. The model, called NONROAD, calculates emissions for non-road equipment types, categorizing them by horsepower rating and fuel type. This model was utilized for the equipment used to construct and maintain the upland disposal sites and habitat sites.

The remaining sources of air emissions are employee vehicles and other over-the-road vehicles utilized during construction. EPA has developed a mobile source emissions model, MOBILE6, to calculate emissions from different vehicle types under various operating conditions.

The air emissions were determined on an annual basis for each piece of equipment. The emissions were then totaled on an annual basis for all equipment (regardless of where the construction was taking place). The annual emissions for the Project were then compared to the "de minimis" threshold level for the combined non-attainment area.

Figure 1 displays the annual emissions estimated for the Project. It was found that the NOx emissions exceed the "de minimis" threshold limits in every year of the Project. The NOx emissions from the Project varied from 102 tons per year to 849 tons per year. In addition, the CO emissions were 106 tons in Year 4, which also exceeds the "de minimis" limits. The VOC emissions were under the "de minimis" limits for all years of the Project.

Figure 1: Emissions Summary



The General Conformity ruling (40 CFR 93.158(a)(2)) states that once a project has exceeded the established de minimis threshold(s) for VOC or NOx, emissions from the project must be reduced "so that there is no net increase in emissions of that pollutant." Furthermore, for CO and PM10 emissions, the General Conformity ruling (40 CFR 93.158(a)(4)) states that for an area wide air quality analysis, the results must show that the action does not cause or contribute to any new violation of any standard in any area. Since the air quality analysis shows an exceedance of the de minimis levels established in 40 CFR 93.153(b) for NOx (all years) and CO (Year 4 only), a conformity determination will be required which demonstrates that the responsible Federal Agency has required all reasonable mitigation measures associated with their action and provide written documentation including all air quality analyses supporting the conformity determination. Consequently, the project is required to reduce or offset its annual emissions of NOx (all years) to zero and CO (Year 4 only) to below the required threshold level. It is envisioned that all mitigation measures associated with reducing NOx emissions for the project will also reduce CO emissions below the required de minimis threshold levels without any additional CO mitigation measures being required.

Emission Reduction Methods

Since it is practicably infeasible to reduce the on-site emissions to zero, a combination of on-site and off-site emission reduction were considered.

The on-site emission reduction methods consisted of modifying construction methods, increasing construction duration, applying emission reduction technologies, or combinations of all three. Analyses of modifying construction methods determined that their associated cost increases were unacceptable to the Project. Likewise, increasing the construction duration to achieve conformity was unrealistic due to the magnitude of NOx exceedance. Consequently, the only viable alternative for on-site emission reduction was the application of emission control technologies. The emission control technologies for the on-site alternatives varied, depending on the engine size. For the larger marine engines, the on-site emission control methods were identified as follows:

1) Electrification (EL).
2) Engine replacement (ER).
3) Engine Replacement with Direct-water-injection (ER w/DWI).
4) Selective catalytic reduction (SCR).

For the smaller marine engines and non-road engines, the on-site emission control methods were identified as follows:

1) Diesel particulate filters (DPF).
2) Engine replacement (ER).

Off-site emission reduction opportunities are not directly involved in construction of the Project; however, all off-site mitigation methods considered take place in the Project non-attainment area where the emissions are generated. Off-site emission reduction opportunities were identified as follows:

1) Electrification of existing diesel-powered hydraulic dredges and booster pumps performing annual maintenance dredging within the Project air shed.
2) Engine replacement on local ferries currently operating on the Delaware River within the Project air shed.
3) Engine replacement on various local tugboats currently operating on the Delaware River operating within the Project air shed.
4) Engine replacement on the Corps' hopper dredge *McFarland* that performs annual maintenance dredging within the Project air shed.

For each of the aforementioned off-site emission reduction opportunities, consideration for their implementation schedules was made assuming a start date in 2004. It was determined from consultation with District staff that electrification of the hydraulic dredges and booster pumps used for annual maintenance dredging could be implemented within one year (ready for service in 2005). For the engine replacement of both local ferries and tugboats implementation was estimated at two years (ready for service in

2006). For engine replacement on the Corps' hopper dredge *McFarland,* implementation was estimated at three years (ready for service in 2007). Consequently, emission reduction plans were developed that considered the various implementation schedules.

In order to compare the relative cost-effectiveness of the different opportunities, a cost per ton analysis was performed. An order of magnitude emission reduction and potential cost associated with each of the emission reduction opportunities cited above were determined. The on-site emission reduction methodologies do not mitigate the NOx or CO (Year 4) emissions to levels that satisfy the GC requirements. The off-site emission reduction alternatives however, when combined with the on-site methods, did reduce the NOx and CO (Year 4) emissions so there is no net increase in emissions, per the GC requirements.

Emission Reduction Plans

Based on the preliminary findings described above, specific emission reduction strategies were developed. These plans include the following technologies: selective catalytic reduction (SCR) for on-site equipment; and combinations of electrification (EL), engine replacement (ER), and selective catalytic reduction (SCR) for off-site equipment. Furthermore, consideration was given to allowances for compliance monitoring and testing.

Three emission reduction plans were developed utilizing various combinations of the emission reduction methods and opportunities described above. Table 10 describes the emission reduction components of each plan alternative.

Table 10
Emission Reduction Plans

	Plan		
Emission Reduction Method	**1**	**2**	**3**
On-Site:			
SCR	X	X	X
Off-Site:			
O&M (EL) – Various Ranges	X	X	X
McFarland (ER with SCR)	X		
Ferries (ER) – Various Vessels		X	
Tugs (ER) – 2,750-hp Average Vessel			X

Common to all plans was the application of SCR to the major on-site dredging plant (e.g. hydraulic dredges, hopper dredges and booster pumps). For the off-site emission reductions, the plans used various combinations of Operation & Maintenance (O&M)

electrification, *McFarland* engine replacement with SCR, ferry engine replacement, and tugboat engine replacement to achieve GC, depending on the respective components implementation schedule.

Figure 2 presents a total project cost comparison for each plan considered. Tables 11a and 11b provide a comparison of the emission reduction benefits and cost for each of the three plans, respectively.

Figure 2
Emission Reduction Plan Cost Comparison

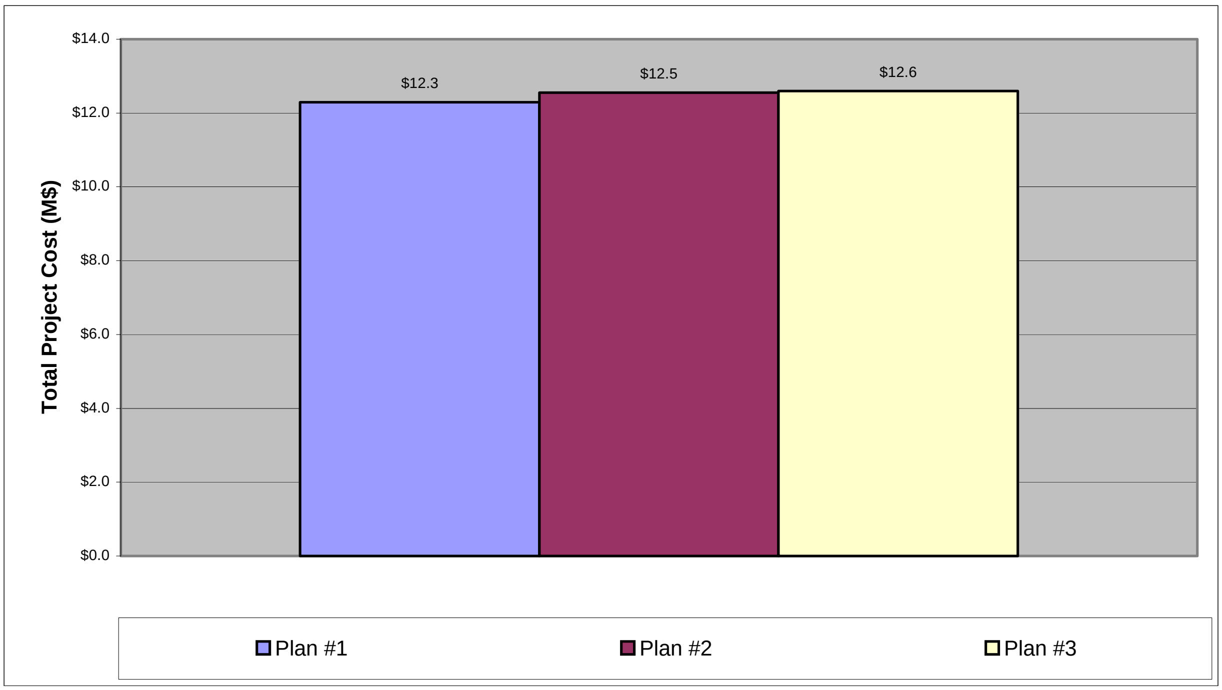


Table 11a

Emission Reduction Plan Summary Comparison

Baseline

	EMISSIONS (tons) - with No Project Emission Reduction					
	Plan #1		Plan #2		Plan #3	
Year	CO	NOx	CO	NOx	CO	NOx
Year 1	67	**502**	67	**502**	67	**502**
Year 2	69	**504**	69	**504**	69	**504**
Year 3	67	**519**	67	**519**	67	**519**
Year 4	**106**	**849**	**106**	**849**	**106**	**849**
Year 5	95	**814**	95	**814**	95	**814**
Year 6	17	**102**	17	**102**	17	**102**
Total	421	3,290	421	3,290	421	3,290

On-Site

	EMISSIONS (tons) - Residual Project Emissions					
	Plan #1		Plan #2		Plan #3	
Year	CO	NOx	CO	NOx	CO	NOx
Year 1	28	**84**	28	**84**	28	**84**
Year 2	35	**114**	35	**114**	35	**114**
Year 3	33	**131**	33	**131**	33	**131**
Year 4	**39**	**128**	**39**	**128**	**39**	**128**
Year 5	33	**124**	33	**124**	33	**124**
Year 6	17	**102**	17	**102**	17	**102**
Total	183	682	183	682	183	682

Overall (On-Site & Off-site)

	EMISSIONS (tons) - Residual Project Emissions					
	Plan #1		Plan #2		Plan #3	
Year	CO	NOx	CO	NOx	CO	NOx
Year 1	17	-13	17	-13	17	-13
Year 2	22	-5	1	-8	-18	-12
Year 3	-23	-56	-23	-13	-41	-8
Year 4	-17	-60	-18	-17	-35	-12
Year 5	-23	-64	-23	-21	-41	-16
Year 6	-39	-85	-39	-43	-57	-38
Total	-63	-282	-85	-115	-175	-100

Note: values in ***bold*** *print and box represent exceedances of the GC threshholds.*

Table 11b

Emission Reduction Plan Summary Cost Comparison

		EMISSIONS (tons)					
		Plan #1		Plan #2		Plan #3	
		CO	NOx	CO	NOx	CO	NOx
On-Site	**% Benefit Achieved by Proposed On-Site Emission Reduction**						
	(%)	57%	79%	57%	79%	57%	79%
	Cost of Proposed On-Site Emission Reduction[1]						
	($$)	$6,291,000		$6,291,000		$6,291,000	
	Cost/Ton of Proposed On-Site Emission Reduction						
	($/ton)	$26,409	$2,412	$26,409	$2,412	$26,409	$2,412
Off-Site	**Tons Avoided by Proposed Off-Site Emission Reduction**						
	(%)	58%	29%	64%	24%	85%	24%
	Cost of Proposed Off-Site Emission Reduction[1,3]						
	($$)	$5,492,000		$5,695,000		$5,697,000	
	Cost/Ton of Proposed Off-Site Emission Reduction						
	($/ton)	$22,311	$5,693	$21,249	$7,143	$15,915	$7,285
Overall (On-Site & Off-Site)	**Overall % Benefit Achieved by Proposed Emission Reduction Alternative**						
	(%)	115%	109%	120%	103%	142%	103%
	Overall Cost of Proposed Emission Reduction Alternative[2,3]						
	($$)	$12,295,000		$12,548,000		$12,600,000	
	Overall Cost/Ton of Proposed Emission Reduction Alternative						
	($/ton)	$25,384	$3,441	$24,787	$3,685	$21,135	$3,717

Notes: *1) excludes costs of monitoring & testing.*
2) includes costs of monitoring & testing.
3) excludes installation costs of equipment

All three plans achieve GC for both CO and NOx and the cost differential is only $305,000 from Plan #1 to Plan #3.

Figures 3 and 4 demonstrate Plan #1's GC compliance for both CO (Year 4) and NOx emissions on an annual basis compared to the unmitigated "baseline" emissions for each pollutant.

Figure 3
Plan #1 CO Mitigation Summary

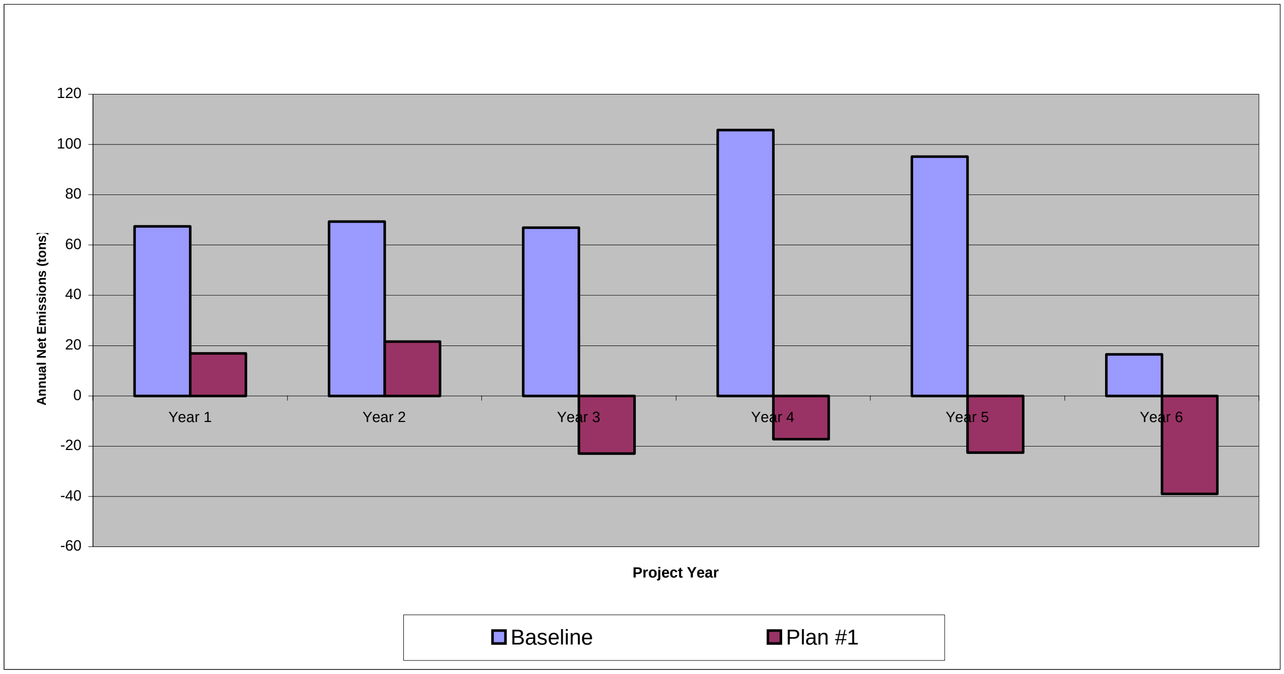
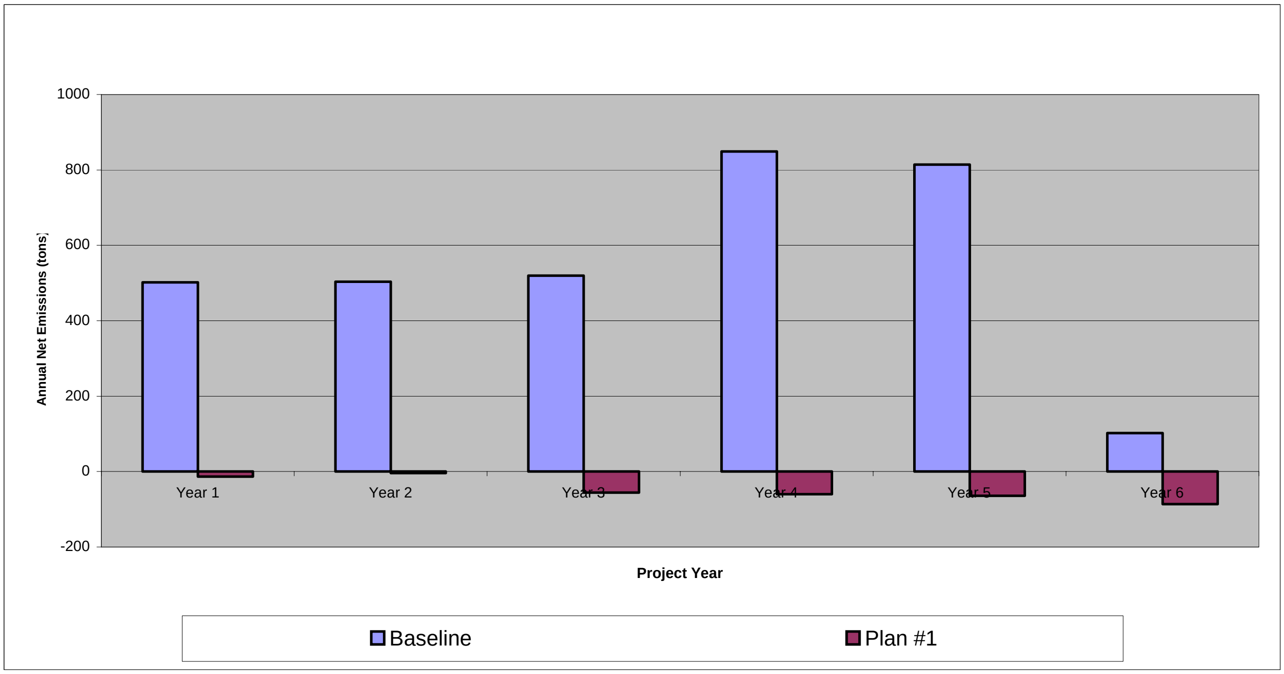


Figure 4
Plan #1 NOx Mitigation Summary



Conclusions

The analysis conducted herein clearly demonstrates that several viable options (i.e., Plan #1, Plan # 2 or Plan #3) exist to allow the Project to achieve GC compliance for CO (Year 4) and NOx. More detailed information is available in the "General Conformity Analysis and Mitigation Report" prepared by Moffatt & Nichol, February 2004. The results of this analysis will be coordinated with all appropriate Federal, State and Local agencies and Metropolitan Planning Organizations (MPO) as well as the public under the General Conformity Rule of the Clean Air Act (40 CFR 93, Subpart B). From that coordination, a plan (s) will be selected. To be conservative, the alternative with the highest cost (Plan #3), estimated at $12,600,000, was applied in the economic analysis.

10. Summary of Benefits and Costs

Table 12 below presents a summary of current benefits and costs compared to those contained in the December 2002 report.

Changes in crude oil benefits and containerized cargo benefits have been discussed above. The only changes made to the benefit calculations for petroleum products, blast furnace slag, steel slabs, and beneficial use cost savings for Broadkill Beach were changes that account for the updated discount rate. The only adjustment to costs are the inclusion of the first cost for the air emissions mitigation plan and the change in discount rates. Overall, the results of the discount rate refinements, changes in crude oil and container benefits, and the addition of air emission mitigation costs have changed the project benefit cost ratio from 1.18 to 1.15. Net NED benefits have declined from $3,802,000 to $3,223,000.

Table 12
Average Annual Benefits by Commodity Type
(May 2002 Price Level)

Benefit Type	**Average Annual Benefits Dec02** **5 7/8 % Discount Rate**	**Average Annual Benefits Feb04** **5 5/8 % Discount Rate**
Transportation Cost Savings		
Crude Oil	$14,799,000	$11,778,000
Petroleum Products	$355,000	$352,000
Containerized Cargo (Vegetables, Fruit, Eggs, Meat requiring refrigeration)	$3,491,000	$6,124,000
Blast Furnace Slag	$1,811,000	$1,807,000
Steel Slabs	$3,598,000	$3,605,000
Subtotal Transportation Cost Savings	**$24,054,000**	**$23,665,000**
Beneficial Use Cost Savings at Broadkill Beach	$605,000	$583,000
Total Project Benefits	**$24,659,000**	**$24,249,000**
Total Project Costs	**$20,857,000**	**$21,025,000**
Benefit-Cost Ratio	**1.18**	**1.15**
Average Annual Net Benefits	**$3,802,000**	**$3,223,000**

Preconstruction, Engineering and Design (PED) costs of $10,025,000 were previously expended, and therefore are considered “sunk costs” and not included in the project economic analysis. However, for information purposes, if these costs were included the project benefit-cost ratio would remain positive, at 1.11 to 1.

Also, if the Project were evaluated at the previous year FY 2003 discount rate that was used in the December 2002 report, the project benefit-cost ratio would remain positive, at 1.11 to 1.

11. Sensitivity Analyses

Seven sensitivity analyses were conducted for this analysis, four related to crude oil benefit calculations and three related to containership benefits. Each of the sensitivity analyses are discussed below.

Crude Oil Benefit Sensitivity Analyses

Three sensitivity analyses assess the impacts on project benefits of altering the decision rules used in the simulation model. The fourth sensitivity analysis assesses the impacts on project benefits of altering the full capacity assumptions for the lightering fleet.

The decision rules used in the simulation model are based upon observed lightering vessel deployments from 1997 through 2001. These observations indicate very strong deployment patterns concerning offshore lightering and deployments to the Motiva facility. The two decision rules concerning offshore lightering and deployments to Motiva are operationally sound and were not modified in the sensitivity analysis.

The simulation model also imposes a hierarchy upon lightering vessel selection for anchorage-based lightering. If the amount to be lightered exceeds 265,000 barrels (the capacity of the 42,000 DWT tanker and the 33,000 DWT tug/barge), and the 62,000 DWT tug/barge is available, then the 62,000 DWT tug/barge will be deployed first. However, if the 62,000 DWT tug/barge is not available, or if the amount to be lightered is less than 265,000, then the deployed vessel is selected randomly from the available vessels. Under the first sensitivity analysis, this decision rule is modified so that, rather than randomly select from available vessels, the least cost available vessel is selected first (i.e., first the 33,000 DWT tug/barge (if available), then the 62,000 DWT tug/barge (if available), and then the 42,000 DWT tanker). Selection of the least cost available vessel instead of random selection causes the 33,000 DWT tug/barge to be selected slightly more often than observed data suggests (see Table 13). This selection of the least cost vessel increases lightering vessel cost savings by 7.6% more than the base-case scenario in year-2008, however, the potential cost savings are unlikely because the least cost vessel is selected less frequently, not more frequently, in actual practice. The historic record indicates that there must be operational considerations that are more important than relative vessel cost that guide deployment decision making.

The other simulation model decision rule that concerns the 33,000 DWT tug/barge restricts the 33,000 DWT tug/barge from being deployed to Sun facilities. Although the 33,000 DWT tug/barge did make regular anchorage-based lightering trips to the Sun facilities in 2000 and 2001, in the development of the simulation model it was found that the model performed better, in terms of mimicking total observed vessel deployments, when the 33,000 DWT tug/barge was restricted from servicing the Sun facilities (see Table 7). Relaxing the restriction on the 33,000 DWT tug/barge deployments to Sun facilities increases the deployment of the 33,000 DWT tug/barge to more than 32% of total trips. The increase in the total number of predicted trips by 33,000 DWT tug/barge causes lightering vessel cost savings in year-2008 to decrease by 2.4% less than the base-case scenario. However, as in the previous case, this sensitivity analysis again results in a much higher percentage of trips for the 33,000 DWT tug/barge than have been observed in the historical record.

Table 13
Sensitivity Analysis: Deployments Base Case, and Modified 33,000 DWT Decision Rule Scenarios

Vessel	Year-2008 Modeled Base Case		Year 2008 Select Vessel by Cost		Year 2008 Without Sun Anchorage-based Restriction	
Tanker (42,000 DWT)	199	40.4%	198	39.3%	191	38.6%
Tug/Barge (62,000 DWT)	151	30.6%	156	31.0%	143	28.9%
Tug/Barge (33,000 DWT)	143	29.0%	150	29.8%	161	32.5%
Total	493	100%	504	100%	495	100%

The third sensitivity analysis assesses the impact of the simulation model decision rules that identify the lightering vessel capacity for each vessel call. Although the lightering vessels could potentially have loaded more barrels on most occasions (i.e., the total volume to be lightered from the tanker was greater than or equal to the lightering vessel's capacity), there must be other factors, such as refinery capacity or scheduling issues that cause the lightering vessels to load to less than full capacity. Therefore, based upon a review of the data for anchorage based lightering for Sun tankers, the lightering vessel capacity for each anchorage-based call was a randomly selected value between 85% and 100% vessel capacity (see Attachment 4 for a detailed discussion of the vessel call capacity analysis). This decision rule was not applied to offshore and NYVA trips, which use the stated vessel capacity, because test runs of the random capacity decision rule resulted in offshore and NYVA trips carrying impractically small loads.

Tables 14 and 15 present the number of calls for each lightering vessel predicted by the simulation model under various vessel capacity scenarios. Using the stated vessel capacity as the simulation model decision rule considerably understates actual year-2000 vessel calls and creates over-efficiencies in modeled vessel deployment. Using the 75% to 100% decision rule overstates the proportion of calls allocated to the 33,000 DWT tug/barge, although the total number of calls more closely resembles year-2000 observations. The 85% to 100% decision rule was preferred because it maintains the appropriate proportions of vessel call allocation while predicting 92% of all vessel calls.

Table 14
Sensitivity Analysis: Deployments Base Case, and Modified Decision Rule Scenario (Random Vessel Call Capacity Year-2000)

Vessel	Year-2000 Modeled Base Case		Year 2000 Modeled Stated Capacity		Year 2000 Modeled 85% to 100%	
Tanker (42,000 DWT)	192	40.8%	182	41.8%	172	39.7%
Tug/Barge (62,000 DWT)	152	32.3%	145	33.3%	138	31.9%
Tug/Barge (33,000 DWT)	127	27.0%	108	24.8%	127	28.4%
Total	471	100%	435	100%	496	100%

Table 15
Sensitivity Analysis: Deployments Base Case, and Modified Decision Rule Scenario (Random Vessel Call Capacity Year-2008)

Vessel	Year-2008 Modeled Base Case		Year 2008 Modeled Stated Capacity		Year 2008 Modeled 75% to 100%	
Tanker (42,000 DWT)	199	40.4%	193	41.7%	211	40.6.0%
Tug/Barge (62,000 DWT)	151	30.6%	143	30.9%	157	30.2%
Tug/Barge (33,000 DWT)	143	29.0%	127	27.4%	152	29.2%
Total	493	100%	463	100%	520	100%

The fourth sensitivity analysis assesses the impact of increasing the assumed annual capacity of each vessel in the fleet. In the base case, the assumed maximum capacity for each vessel is 7,080 working hours (295 working days). This maximum capacity is somewhat greater than the average observed annual utilization, but is no greater than the maximum observed utilization of any of the vessels over the 5 years for which we have data. At utilization levels greater than 295 working days, additional lightering resources are assumed to be required.

In this sensitivity analysis, the maximum annual working capacity for all vessels is increased another 10% to 324 days, or 7,776 working hours. This level of utilization would likely require changes in existing operational protocols, or a reduced level of customer service, in order to be achieved. Using this modified working capacity, in 2008 the 62,000 DWT tug/barge is working at 104% of capacity and the 42,000 DWT tanker at

106% of capacity, under without-project conditions. The 33,000 DWT tug/barge doesn't achieve more than 100% capacity until 2017, under without-project conditions. Under with-project conditions, the 42,000 DWT tanker is the only vessel to achieve 100% working capacity throughout the 50-year planning horizon, in approximately year 2055.

The results of this sensitivity analysis, presented in Table 16, indicate that increasing the maximum working capacity of the entire lightering fleet to 110% of the observed single vessel maximum historic working capacity reduces annualized lightering cost savings by $480,600.

Table 16
Sensitivity Analysis: Increased Vessel Annual Working Capacity
Impacts On Lightering Costs

	Without Project Lightering Costs	With Project Lightering Costs	With Project Cost Savings	Benefit/Cost Ratio
Base Case	$28,219,316	$21,928,607	$6,290,710	1.2
Increased Working Capacity	$26,088,407	$20,278,276	$5,810,131	1.1
Difference	($2,130,909)	($1,650,331)	($480,579)	

Note: Costs annualized for 50 years at 5.625%

Containership Benefits Sensitivity Analyses

The following discussion presents a set of sensitivity analyses for containership benefits. The sensitivity analyses estimate the influence on containership benefits, total project benefits and BCRs, for three factors:

- Landside transportation cost estimates;
- Container volume estimates; and
- New York-bound time-sensitive container volume estimates.

Landside Transportation Cost Estimates

The influence of landside transportation cost estimates are assessed in the sensitivity analyses by re-estimating containership benefits for two alternative cost assumptions. The first alternative assumption is that the $100 chassis return fee identified by PONL (that was not included in the base case analysis) would be included in the trucking fee for goods being trucked from the Port of NYNJ to Philadelphia destinations. The second alternative assumption is that the Port of NYNJ ILA assessment (which does not have a comparable charge in the Delaware River) is reduced by 50% from $130 to $65. Although there is no empirical evidence that the ILA assessment would be reduced by this amount, this sensitivity analysis identifies the impact of reducing the relative difference in port fees between New York and Philadelphia on containership benefits and total project benefits.

Container Volume Estimates

The influence of container volume estimates for the two services are assessed by increasing and decreasing the base case container volume estimates by 20%. While somewhat arbitrary, the plus-or-minus 20% variation provides an adequate range to assess the influence of the container volume estimates on benefits, especially since the base case analysis incorporates a no-growth assumption for future container volumes on the benefiting services.

New York-Bound Time-Sensitive Container Volume Estimates

PONL indicated during an interview that under with-project conditions an estimated 60 boxes of time-sensitive cargo would be trucked from Philadelphia to destinations in the New York region when Philadelphia again replaces New York as the first port of call. The additional cost of transporting the 60 boxes is included in the base case analysis. The sensitivity analysis assesses the influence of both reducing the volume of New York-bound time sensitive cargo to zero (assuming some unspecified alternative transport) and of doubling the base case estimate to 120 boxes per call.

Containership-based Sensitivity Analysis Results

The table below presents the results of the sensitivity analyses. The largest positive impact on containership-based benefits occurs under the scenario that includes the chassis return fee to NYNJ in the trucking cost estimate. The largest negative impact on benefits occurs under the scenario that reduces the ILA assessment by 50%.

Table 17
Containership Benefits Sensitivity Analyses Results

	Containership Benefits			Project Benefits	
	ECSA to ECUS	ANZ to Phil	Total	Net Benefits	BCR
Base-Case	$,939,120	$5,184,608	$6,123,758	$3,223,463	1.15
Landside Costs					
Add Chassis Return Fee	$1,303,120	$6,578,208	$7,881,328	$4,981,033	1.24
Reduce ILA Assessment	$673,400	$3,873,168	$4,546,568	$1,646,273	1.08
Container Volume					
Base-Case plus 20%	$1,126,944	$6,235,258	$7,362,202	$4,461,907	1.21
Base-Case less 20%	$751,296	$4,133,958	$4,885,254	$1,984,959	1.09
Time-Sensitive NY Boxes					
None	$939,120	$5,253,248	$6,192,368	$3,292,073	1.16
Double Base-Case	$939,120	$5,115,968	$6,055,088	$3,154,793	1.15

Summary

Project justification remains positive under all of the container benefit sensitivity analyses. The maximum variation in containership-based benefits in all sensitivity analyses conducted ranges from -26 percent to +29 percent of the base case. The benefit-cost ratio varies from the base case value of 1.15 to a maximum value of 1.24 (+7 percent) and a minimum value of 1.08 (-5 percent).

12. Cost Sharing

Public Law 99-662, the Water Resource Development Act of 1986, as amended by the Water Resources Development Act of 1996, has established the basis for Federal and non-Federal cost sharing and responsibilities in the construction, and operation and maintenance of Federal water resources projects. In addition, the sponsor could receive credits towards the non-Federal cost share as dictated by Section 308 of the Water

Resources Development Act of 1999, Public Law 106-53; and Section 306 of the Water Resources Development Act of 2000, Public Law 106-541.

Non-Federal Cost Share

The non-Federal sponsor will pay at the outset of construction, 25 percent of the total costs of all General Navigation Features (GNF), which consist of the Federal navigation channel, the anchorage area, construction of dredged material disposal areas and implementation of a mitigation plan to bring the project into compliance with General Conformity standards of the Clean Air Act. In addition, the non-Federal sponsor will provide all lands, easements, and rights-of-way, including lands for dredged material disposal facilities that are necessary for the construction, operation or maintenance of the GNF. Finally, the non-Federal sponsor will perform all relocations that are necessary for the construction, operation or maintenance of the GNF.

The sponsor is also responsible for an additional 10 percent of the cost of GNF, less the value of lands, easements, rights-of-way, relocations, and deep draft utility relocations, including those lands necessary for dredged or excavated material facilities. These costs may be repaid with interest over a period not to exceed 30 years.

Associated costs, estimated at $22,561,000, are a non-Federal responsibility. Associated costs are the costs that must be expended by local service facilities in order to benefit from the deepening project. These include costs to dredge berthing facilities and any structural modifications to dockside facilities.

Federal Cost Share

The Federal government is responsible for 75 percent of the cost of GNF as well as the cost of navigation aids. Operation and maintenance costs for the Federal navigation channel project, disposal areas and navigation aids are a Federal cost.

Cost sharing arrangements for the 45-foot project are displayed in Table 18. The Federal Government is responsible for 75% of the costs for GNF features. The sponsor is responsible for 25% of the costs for GNF and the full costs of lands, easements, rights-of-way and relocations. In addition the sponsor is also responsible for an additional 10% of the GNF less credit for lands, easements, rights-of-way and relocations. Since the 10 percent of the GNF exceeds the cost of lands, easements, rights-of-way and relocations by $12,401,673, the sponsor must pay this difference following construction, or over a 30-year period at the Federal discount rate.

Table 18
Cost Sharing of Project Construction
(May 2002 Price Level)

Item	Cost
General Navigation Features (GNF)	$231,046,730 (A)
Aids To Navigation	$322,000
Lands, Easements, Rights-of-Way, Relocations	$10,703,000
Associated Costs (Local Service Facilities)	$22,561,000
Total Project Cost	**$264,632,730**

Cost Apportionment

Table 19 displays the apportionment of costs between Federal and Non-Federal interests.

Table 19
Cost Apportionment
(May 2002 Price Level)

	Federal	Non-Federal	Total
General Navigation Features (GNF)	(75% x A) $173,285,048	(25% x A) $57,761,683	$231,046,730
Long term repayment	(-10% x A) -$23,104,673	(+10% x A) $23,104,673	$0
Aids To Navigation	$322,000	N/A	$322,000
Lands, Easements, Rights-of-Way, Relocations	N/A	$10,703,000	$10,703,000
Credit of Lands, Easements, Rights-of-Way, Relocations	$10,703,000	-$10,703,000	$0
Associated Costs		$22,561,000	$22,561,000
Total Project Cost	**$161,205,375**	**$103,427,356**	**$264,632,730**
Rounded	**$161,205,000**	**$103,427,000**	**$264,633,000**

A = Total cost of General Navigation Features

13. Recommendation

In December 2002, a comprehensive economic reanalysis was completed and subsequently approved. The analysis was documented in a report entitled: Comprehensive Economic Reanalysis Report dated December 2002.

Following the December 2002 analysis, Maritrans, the principal lightering company, received and reviewed the December 2002 reanalysis report and lightering benefits model. As a result of its review, the lightering company provided comments on the methodology and results.

In order to address these comments, a refinement of the crude oil transportation cost savings benefits was undertaken. The refinement also reviewed any potential significant changes to other benefiting commodities and conducted studies to incorporate project compliance with the General Conformity Rule of the Clean Air Act. The additional analysis and studies presented in this supplement reiterates that the project is economically justified.

It is recommended that this report serve as a supplement to the December 2002 Comprehensive Economic Reanalysis Report.

Thomas C. Chapman, P.E.
Lieutenant Colonel, Corps of Engineers
District Engineer

Attachments 1-6

Attachment 1

Correspondence

DEPARTMENT OF THE ARMY
PHILADELPHIA DISTRICT, CORPS OF ENGINEERS
WANAMAKER BUILDING, 100 PENN SQUARE EAST
PHILADELPHIA, PENNSYLVANIA 19107-3390

REPLY TO
ATTENTION OF
Planning Division

2 5 JUN 2003

Mr. John Gibson
Vice President and General Manager
Coastal Eagle Point Oil Company
PO Box 1000
I-295 & US Route 130 South
Westville, New Jersey 08093

Dear Mr. Gibson:

The Philadelphia District, U.S. Army Corps of Engineers is conducting a re-analysis of crude oil benefits associated with potential navigation improvements to the main channel of the Delaware River from Big Stone Anchorage to Philadelphia, PA and Camden, NJ. The most significant aspect of these improvements is the proposed deepening of the main channel from 40 ft. to 45 ft. below Mean Low Water (MLW).

In the assessment of potential project benefits, the Corps is calculating transportation cost savings that would result from the deeper channel. An important component of transportation cost savings resulting from a deeper channel would be the reduced need for lightering for future crude oil deliveries to refineries along the Delaware River. In order to calculate the reduced need for lightering and the reduced transportation costs associated with less lightering and more efficient tanker movements, the Corps has developed a modeling method that forecasts future crude oil deliveries by tankers and lightering operations by a lightering fleet.

Our analysis predicts that transportation cost saving will result from a reduction in resources required to deliver crude oil to the Coastal refinery (among others), if the channel were to be deepened to 45 ft. MLW. If you would like to discuss our analysis to confirm that it reflects existing and expected future conditions regarding crude oil deliveries to your refinery, please contact Mr. Bob Selsor of my staff, at (215) 656-6569.

Thank you in advance for your cooperation in this matter.

Sincerely,

Minas M. Arabatzis
Chief, Planning Division

Department of the Army
Philadelphia District, Corps of Engineers
Wanamaker Building, 100 Penn Square East
Philadelphia, PA 19107

Attn: Minas M. Arabatzis – Planning Division

September 3, 2003

Ref: 45' Channel Deepening Project

Dear Sir:

In response to your letter date June 25, 2003, we have attached our findings of prior investigations into the cost benefits associated with the deepening of the main channel to 45'.

Crude Oil Processing:

Coastal is physically limited to process approximately 140,000 bbl/day of crude; while refinery processes and products may change slightly over time this will not increase with a deeper channel.

Maritime Operations:

Coastal uses Suezmax (950 – 1000 MB) and Panamax (550 – 600 MB) tankers. Crude parcels are sized for purchase in the above volumes with variances of only +/- 5%. A deeper channel would not benefit the ship by allowing it to load more and claimed savings by the ACOE due to this are not realistic

Lightering Costs and Associated Savings

A 45' channel would reduce the typical quantity of crude lightered on a Suezmax ship by approximately 124,500 Bbls. Savings would result from this, **if all other factors remained constant**. In addition, time savings resulting from reduced lightering, and demurrage reductions could add further to the annual savings.

Crude lightering in the Delaware river is presently handled by Maritrans using 3 pieces of equipment with rates and equipment levels maintained to handle the 90-95 million Bbls currently lightered in a typical year, and 270 days per year utilization per vessel.

Coastal Eagle Point Oil Company
ROUTE 130 AND I-295 • P.O.BOX 1000 • WESTVILLE NJ 08093-1000 • 856/853-2100 • FAX 856/853-2105

If the channel was deepened to 45' and the annual quantity lightered reduced to 50-60 million Bbls then Maritrans would have to either reduce the available equipment and/or raise prices to offset the loss of revenue. Ultimately, a significant loss of revenue could result in Maritrans abandoning lightering operation at Big Stone Beach altogether, forcing Coastal to invest in their own lightering equipment and operations

In summary, the potential for significant savings from crude lighterings exist, however, not to the extent stated by the ACOE and subject to any increase in rates or reduction in equipment which would significantly reduce or eliminate these savings.

Position on Channel Deepening

While Coastal understands that a deeper channel would be beneficial to some users and is desirable for the port as a whole, Coastal is unable to support the stated savings and considers it possible that their transportation costs could increase under with-project conditions. Their rationale is based upon their view of the dominant position that Maritrans has in the lightering market.

Coastal other main concern is with the docks and notes that while the berths have historically have been subject to scour and dredging costs have been insignificant, costs associated with berth modifications necessary to accommodate deeper vessels are unknown at this time and may be prohibitive.

In light of the above, Coastal's position is to wait and see, and to respond to prevailing conditions (physical and economic) that accompany channel deepening if this project proceeds.

Sincerely:

Andrew R. Mortensen
Loss Control Supervisor – CEPOC
(856) 853 4414
andrew.mortensen@elpaso.com

David Miller & Associates, Inc.

Memo

To: Files

From: Jerry Diamantides

Date: September 10, 2003

Re: Response to Issues Raised in a Letter Coastal Refinery dated September 3, 2003

The letter from Coastal Refinery, dated September 3, 2003, generally confirms modeling assumptions used in the benefits analysis and confirms the overall findings of the analysis; however, the letter does confuse NED benefits estimated by the analysis and financial benefits that may accrue to the Coastal refinery. Each of the issues raised in the letter is discussed below, using the same topic headings identified in the letter.

Crude Oil Processing

The statement that the Coastal refinery processing capacity will be the same under without and with-project conditions is fully consistent with the assumptions of the analysis.

Maritime Operations

The statement that vessels would not load more under with-project conditions is consistent with the assumptions of the analysis. The model assumes that each vessel arrives at the Coastal refinery with the same load under both without and with-project conditions, only the amount lightered changes.

Lightering Costs and Associated Savings

The statements under this heading are consistent with model assumptions and calculations. The letter states that approximately 124,500 fewer barrels would be lightered from a Suezmax tanker under with-project conditions. The model calculates approximately 140,000 fewer barrels, applying standard tanker immersion factors. The statements concerning Maritrans fleet utilization are also consistent with model assumptions. The letter concurs with the basic concept of the analysis, which is that a deeper channel would reduce the need for lightering resources in the Delaware River system. The issue of future fees that the lightering company might charge or what firm might provide lightering services in the future is not relevant to the analysis. It is assumed that there will continue to be a market for lightering services in the Delaware River system and that this market will be more or less competitive in the long run.

Position on Channel Deepening

The letter agrees that deepening the channel would be beneficial to the harbor as a whole, but identifies a concern over the potential impact the deepening may have on the firm's relationship with Maritrans. This issue is not relevant to the calculation of NED benefits. Nonetheless, the analysis does consider and discuss potential alternative future lightering scenarios to substantiate the assumption that a market for lightering services will continue under with-project conditions.

The statement concerning the unknown and potentially prohibitive costs of dock modifications that would be required under with-project conditions is noted. However, Coastal representative was the point of contact who attended meetings with the Corps consultants and who presumably reviewed the consultants' findings concerning the costs of dock modifications. These costs were included in the benefit-cost analysis and were also subject to a test of economic rationality to confirm that it would be in the refinery's best economic interest to make the berth modifications.

In addition, the sale of the Coastal facility to Sun Oil is currently pending (with the sale expected to be closed by the end of the calendar year). How this will affect tanker and lightering operations at the Coastal facility cannot be determined at this time.

Attachment 2

Delaware River Deepening Simulation Model Documentation Aug03 Draft Revision – Offshore Lightering

The following is an in depth description of the simulation modeling process. The simulation model is used in the analysis to:

- Forecast lightering vessel utilization, so that the costs of lightering can be estimated;
- Compare Forecasted lightering fleet deployment and vessel utilization scenarios to actual deployment and utilization, in order to check the reasonableness of the scenarios; and
- Calculate the amount of time (hours) tankers may have to wait for lightering service, in order to assess the "customer service" impacts of each deployment and utilization scenario.

The spreadsheet Sim_Model_Demo.xls presents the simulation model input (from the tanker spreadsheet models), simulation model output for year-2008, and identifies the simulation model output that is input into the cost calculations. Summations of the simulation model output are used to populate the tables and formulae found in Maritrans Benefits August 2003.xls, which calculates the total annual lightering costs under without and with-project conditions. The simulation model output includes annual summation data for barrels lightered and operational hours. This summation data is imported into the Maritrans Benefits August 2003.xls spreadsheet. The imported data appears as hard numbers, i.e., not linked, in the spreadsheet because of the import process. A summation check is performed as a part of the import process to ensure that the correct data is imported to the appropriate location. The modeling and calculation process presented in Sim_Model_Demo.xls is repeated for the years 2008 – 2018, 2028, 2038, 2048, and 2058. Intervening years that are not modeled have costs calculated through interpolation.

GENERAL GUIDELINES AND PROCESSING RULES

A lightering vessel can be in one of three places:

- In Port (offloading or sitting idle)
- In Transit (to or from a lightering job)
- At Boats (on loading at anchorage, offshore, or in NY / VA)

The following eight times are noted for each lightering trip:

- The hour at which the lightering vessel leaves port and begins the outbound transit to a lightering job
- The hour at which the lightering vessel arrives at the mother ship
- The hour at which the lightering vessel begins to on load materials
- The hour at which the lightering vessel stops on loading materials

- The hour at which the lightering vessel leaves the mother ship and begins the return journey to the port
- The hour at which the lightering vessel arrives at the port
- The hour at which the lightering vessel begins to offload materials
- The hour at which the lightering vessel stops offloading materials (this is also the first hour at which the lightering vessel becomes available for the next lightering job).

For each year the model is run, an input table is created from the spreadsheet model that identifies the date and time for anticipated mother ship calls, and the amount to be lightered from each vessel. For special (NY / VA) lightering calls, the source of data is the actual WCSC 2000 database. The volume of material delivered on these calls is held constant throughout the period of analysis. For offshore lightering calls, the source of data is the 2000 WCSC database adjusted for two Stena V Class vessel calls per month that replace four Suezmax calls per month, as per discussions with a representative of Sun Oil. This replacement reduces annual offshore lightering from 10.5 million barrels in 2000 to approximately 7 million barrels. Future offshore lightering volumes will grow at the same rate as other crude oil deliveries. For anchorage calls, the source of data is the spreadsheet model that shows the growth in tonnage for each mother ship, and the resulting lightering needs for those vessels. The order of arrival for years 2008 and beyond is determined using a random number generator, since it is unreasonable to assume that these vessels would observe the same exact call pattern year after year.

Some mother ships carry so much material that more than one lightering trip is required to complete the lightering job. When two lightering vessels receive material from the same mother ship, the second vessel may not begin to on load until the first vessel has finished. Lightering vessels do not receive material from more than one mother ship at a time. If no lightering vessel is available for a lightering job, then the mother ship simply waits until one becomes available.

If the amount to be lightered exceeds 265,000 barrels, the model first looks to see whether the 62,000 DWT tug/barge barge is available for lightering. If the amount to be lightered is less than or equal to 265,000 barrels, or if the 62,000 DWT tug/barge is not available, the model looks to the 42,000 DWT tanker prior to looking for the 62,000 DWT tug/barge next and then 33,000DWT tug/barge to check for vessel availability. This selection order was preferred to other possible selection scenarios based upon the resulting number of calls and deployment distribution among the types of lightering vessels (see Attachment 4 and sensitivity analyses).

The lightering vessel's capacity for each call is randomly selected from capacities between 85% and 100% of the vessels stated capacity. This decision rule is explained in detail in the sensitivity analysis section and in Attachment 4.

The 62,000 DWT tug/barge does not lighter to the Motiva refinery, and the 33,000 DWT tug/barge does not lighter to the Sun refineries.

Attachment 3
Delaware River Lightering Vessel Alternative Employment Potential

When calculating NED benefits resulting from navigation improvements, it is typically assumed that any productive resources no longer required will be available for productive use elsewhere in the nation. The resource cost savings associated with these “freed” resources are considered a positive contribution to the nation’s productive capacity, and an NED benefit of the project.

In the case of lightering resources that are no longer required due to potential navigation improvements at the Delaware River, the question has been asked whether the productive function of the lightering fleet is so unique, or that alternative employment opportunities are so few and distant, that there is no practical alternative use of these resources. In order to evaluate this issue, an analysis has been conducted of alternative employment opportunities for the Delaware River lightering fleet. Consideration has also been given to the reasonableness of assuming that some or all of these resources may be employed part-time in the Delaware River system and part-time elsewhere under with-project conditions. The potential for part-time employment of lightering resources based outside the Delaware River system is also an issue for the without project condition, since once the growth in lightering exceeds the capacity of the existing lightering fleet additional lightering resources will be required to meet Delaware River lightering requirements.

An analysis of potential alternative uses for the lightering resources saved due to navigation improvements at the Delaware River was conducted to identify potential demand for excess lightering resources within “reasonable” proximity of the Delaware River. This “zone of demand” for lightering vessels based in the Delaware River system has been determined through a review of the origins and destinations of other vessels used in the U.S. domestic marine transport industry.

The intent of the analysis is to characterize the types, quantity and reasonableness of potential alternative uses of lightering resources within the domestic marine transport industry, and not to identify specific employment opportunities or fleet redeployment decision making for an individual firm. Whether a particular firm avails itself of these opportunities is a company-specific business decision that cannot and should not be part of a legitimate NED analysis.

The analysis of potential alternative uses is based upon a review of the WCSC domestic data for marine transport of petroleum and petroleum products. Lightering vessels operating in the Delaware River system are limited in the types of petroleum products they can reasonably transport, because of the costs associated with switching cargo from one petroleum product to another. Liquid petroleum cargo is typically categorized as either “clean” or “black” oils. “Clean oils” include more highly refined petroleum products with API values above 26, indicating low viscosity, and include gasoline, jet fuel, kerosene, etc. "Black oils" include crude and less refined or residual products with API values less than 26, such as numbers 4, 5, and 6 fuel oil, gas oil and lubricating oils.

Switching cargo from black oil to clean oil is a costly process that includes cleaning of tanks, lines, and pumps and refitting of vessel equipment. Therefore, vessels typically carry either clean oil or black oil, but generally do not switch from one to another.

Lightering vessels operating in the Delaware River system lighter crude oil and therefore would not reasonably be considered available for alternative employment in the transport of clean oil unless they were completely converted for exclusive use in the clean oil transport service. However, switching from one type of black oil to another is a relatively low cost operation (one estimate given was $10,000[9]). Vessels that lighter crude in the Delaware River therefore have the potential to also engage in transport of other types of black oil, as well as transport of crude to other destinations.

The extent of the domestic market for marine transport of black oil is indicated by the WCSC data. Specific black oils, such as numbers 4, 5, and 6 fuel oils, are not individually identified by the WCSC data, but the WCSC categorization of petroleum and petroleum products can be divided into clean oil and black oil categories. Black oil categories in the WCSC domestic data include the following five commodity designations: 1) Petroleum Oils/Oils from Bituminous Minerals/Crude, 2) Fuel Oils, NEC (not elsewhere classified), 3) Gas Oils, 4) Other Medium Oils from Petroleum and Bituminous Minerals, and 5) Other Light Oils from Petroleum and Bituminous Minerals. These black oil categories exclude lubricating oils, clean oils, and other petroleum products that may have API values higher than 26.

Table 3-1 summarizes the 2001 domestic marine transport of black oils for the entire US, the East Coast and Gulf Coast region, and for individual East Coast and Gulf Coast states, based upon the state of transport origin. The data does not include information for calls that have the origin identified as "offshore", "anchorage", or "open waters". The data exhibits a large volume of domestic marine transport and a broad geographic distribution of black oil deliveries between east coast and gulf coast states. Overall, crude oil transport is approximately only one-third of the total volume of black oil transport. In only two states is the volume of crude oil transport greater than transport of other black oils: Alabama and Delaware. In the Maine-Virginia region of the U.S. East Coast, over 59 million short tons were transported in the year 2001, of which 15.5 million tons (26%) was crude oil. For comparison purposes, the difference between without and with-project tons lightered is approximately 3.5 million tons.

[9] Personal communication with Operations personnel at K-Sea Transport Corp. dated August 6, 2003

Table 3-1
WCSC Domestic Data for Shipping States (Short Tons) 2001

State of Origin	Fuel Oils, NEC	Gas Oils	Other Light Oils from Petroleum & Bituminous Minerals	Other Medium Oils from Petroleum & Bituminous Minerals	Petroleum Oils/Oils from Bituminous Minerals, Crude	Grand Total	Total W/out Crude
All	78,741,755	13,676,978	51,913,612	8,688,496	85,970,946	238,991,787	153,020,841
AL	433,466	158,163	512,151	49,876	1,429,167	2,582,823	1,153,656
CT	501,269		62,004			563,273	563,273
DE	437,628	113,098	1,017,185		12,557,479	14,125,390	1,567,911
FL	3,239,751	96,212	52,437	276	162,570	3,551,246	3,388,676
GA	257,900	124,038	93,770	48,370		524,078	524,078
LA	14,421,685	4,222,008	11,043,907	2,451,695	9,962,180	42,101,475	32,139,295
MA	302,692		456,708			759,400	759,400
MD	1,126,132	19,469	185,507		3,810	1,334,918	1,331,108
ME	130,147		20,940			151,087	151,087
MS	876,841	840,386	1,078,992	119,287	105,084	3,020,590	2,915,506
NC	389,971		505	787		391,263	391,263
NH			17,277			17,277	17,277
NJ	4,267,755	571,596	6,815,212	662,854	1,394,749	13,712,166	12,317,417
NY	11,256,263	509,396	5,583,718	455,849	1,426,658	19,231,884	17,805,226
PA	4,072,094	923,612	1,482,040	151,597	31,113	6,660,456	6,629,343
RI	3,440		81,020			84,460	84,460
SC	107,236		2,661				109,897

Table 3-1
WCSC Domestic Data for Shipping States (Short Tons) 2001

						109,897	
TX	19,270,194	4,174,502	6,223,183	3,965,319	4,036,304	37,669,502	33,633,198
VA	935,256	113,701	1,540,999	94,095	124,043	2,808,094	2,684,051
Gulf &EC	62,029,720	11,866,181	36,270,216	8,000,005	31,233,157	149,399,279	118,166,122
VA to MA	22,902,529	2,250,872	17,241,670	1,364,395	15,537,852	59,297,318	43,759,466

Additional analysis was conducted to explore the demonstrated ability of vessels that carry crude to switch to transporting other types of black oil. Review of the 2001 WCSC data indicates that of the 370 domestic vessels identified as having carried crude from ports in East Coast and Gulf Coast states, 142 of these vessels also made trips carrying other types of black oils, including black oils in the WCSC categories Fuel Oils, NEC (not elsewhere classified), Gas Oils, Other Medium Oils from Petroleum and Bituminous Minerals, and Other Light Oils from Petroleum and Bituminous Minerals. Table 3-2 presents a summary of vessels observed switching among crude oil and black oils by state of trip origin. Table 3-3 presents the number of calls those vessels made in 2001. Among these black oil transport calls in 2001 are six trips by the Maritrans 300 and one by the Integrity, all carrying Gas Oils, which include trips to NY, NJ, and VA.

The summary data indicate that there is substantial cargo flexibility within the domestic marine transport industry for varieties of black oil.

Table 3-2

Vessels Transporting Crude and Other Black Oils
WCSC Domestic Data 2001

State (Call Origin)	Total Vessels Transporting Crude	Total Vessels Transporting Both Crude and Other Black Oils
CT	0	0
DE	6	1
FL	4	0
GA	0	0
LA	166	52
MA	0	0
MD	1	1
MS	10	0
NJ	5	3
NY	16	16
PA	3	2
RI	0	0
TX	153	63
VA	6	4
Totals	370	142

Table 3-3
Vessel Calls for the Transport of Crude and Other Black Oils
WCSC Domestic Data 2001

State (Call Origin)	Total Black Oil Calls (incl. Crude)	Total Crude Calls	Total Black Oil Calls (excl Crude) by vessels that also Transport Crude
CT	32	0	0
DE	199	30	1
FL	133	5	0
GA	131	0	0
LA	7,608	1,753	411
MA	131	0	0
MD	132	1	7
MS	344	14	0
NJ	1,621	12	12
NY	1,890	40	457
PA	595	3	31
RI	10	0	0
TX	7,525	638	697
VA	337	7	35
Totals	20,688	2,503	1,651

Individual vessels have exhibited flexibility, not only in the types of black oils carried, but also in the geographic markets they service. As an example, a detailed review was made of the 2001 deployments of the barge Texas, operated by the Seaboard Barge Corp. The Texas was chosen for this example because it has been used previously in the Delaware River system (10 anchorage-based lightering trips in the year 2000).

WCSC data for the year 2001 indicate that the barge Texas carried black oils categorized as Fuel Oils, NEC (not elsewhere classified), Gas Oils, and Other Light Oils from Petroleum and Bituminous Minerals in addition to carrying black oils in the Petroleum Oils/Oils from Bituminous Minerals/Crude category. In that year, the vessel was deployed from Louisiana to Maine, making 47 calls in 11 states.

In summary, a detailed review of the WCSC data indicates that the U.S. domestic black oil marine transport market exhibits high volumes of commodity transport and broad geographic distribution of origin and destination ports on the U.S. East and Gulf coasts. This provides substantial support for the assertion that there are more than adequate alternative employment opportunities for all, or a portion of, the Delaware River lightering fleet.

Attachment 4

Lightering Vessel Load Rates Analysis and Lightering Vessel Call Capacity Analysis

Simulation Modeling – Lightering Vessel Fleet

The purpose of the simulation modeling is to forecast the total amount of annual operational time required for the Delaware River system lightering fleet to perform at sea and at anchorage lightering operations for both without and with-project conditions. Total operational time depends upon 1) the total number of lightering calls for each vessel, 2) the amount of crude lightered per call, 3) the time it takes to load the lightering vessel and to discharge at the dock (including setup/breakdown), and 4) round trip lightering vessel transit times. Regression equations were calculated for lightering vessel loading and discharge time and average transit times based on the operational data provided by the lightering company, Maritrans. These regression equations were used in the simulation modeling to forecast the total amount of lightering vessel operational time required for each lightering call, as described below.

Lightering vessel operations data for tankers calling at Sun, Valero, and Phillips/Tosco facilities in the year 2000 were released to the study team by the lightering company with the approval of the refineries. Approval was not granted by two facilities (Motiva and Coastal) for release of lightering vessel operations data for tankers, so although this data was requested (see Attachment A), it was not available to the study team. The lightering vessel operations data that was provided includes: 1) the names of the lightering vessel and tanker, 2) location of each lightering operation, 3) commencement date and time for the lightering vessel loading, 4) end date and time for the lightering vessel loading, 5) commencement date and time for the lightering vessel discharge, 6) end date and time for the lightering vessel discharge, 7) discharge dock location, 8) estimated lightering volume (round to 000s), and 9) miscellaneous notes for some of the lightering events.

The lightering vessel operations data described above was used to estimate lightering vessel loading and discharging rates (bbls./hr) for each lightering call, based upon a regression analyses of volume lightered per call. Lightered volumes were available from both the WCSC data and the Maritrans operations data. The two datasets agreed quite closely. The decision was made to use the volume data from WCSC in the model, since it was recorded to the barrel level, while the Maritrans data was rounded to thousands of barrels. Lightering vessel loading and discharge times were taken from the Maritrans operational data set.

Ten separate regression equations were calculated. Eight separate loading and discharge time regression equations were calculated for anchorage based and offshore lightering operations for the Integrity and the Maritrans 400 ((1 loading plus 1discharge) x 2 vessels x 2 lightering locations). Only two anchorage based regression equations were calculated for the Maritrans 300, which does not conduct offshore lightering operations in the modeled scenarios ((1 loading plus 1discharge) x 1 vessel x 1 lightering location).

Five obvious outliers were removed from the regression input data in order to improve the explanatory power of the regression equations. The offshore data showed very little variability and the offshore regressions have low explanatory power. However, this is not so critical, since none of the modeled lightering movements require the regression equations to predict any lightering events that are outside of the upper or lower limits of the input data.

The lightering operations data did not separately identify set-up or break-down times or transit times for each lightering call. The loading and discharging times presented in the data were assumed to be inclusive of set-up, break-down, maneuvering, and any other incidental components of the operation. This assumption was presented to the lightering company for verification (see Attachment 1), but there was no response. The constant term in the regression equations is therefore assumed to capture these relatively fixed components of operational time that may not be directly related to the volume of crude lightered.

Transit times also were not specifically identified in the lightering vessel operations data. Therefore, one-way transit times were calculated as the difference between the date/time of the end of lightering vessel loading and the date/time of the beginning of lightering vessel discharge times, then doubled to calculate total transit time (assuming a return to the prior lightering location). Average total transit times were calculated from the data for each lightering vessel from the anchorage and offshore lightering locations to each facility (with the exception of the Maritrans 300, which does not lighter offshore in modeled scenarios, and the Maritrans 400, which does not call at Motiva in modeled scenarios).

The simulation model identifies the time of tanker arrival, lightering location (offshore or anchorage), the total volume to be lightered, the specific lightering vessel called into service, and the availability of that vessel. Given this information, the simulation model calculates the start time of the lightering vessel loading process and selects the appropriate regression equation in order to calculate total load time and loading end time. Once the loading end time is calculated the simulation model selects the appropriate transit time and calculates the discharge start time. The simulation model then calculates total discharge time based upon the results of the appropriate regression equation and volume of crude delivered. Total loading and discharge time and total transit time are then calculated as the sum of the inputs described above.

Spreadsheet Modeling – Transoceanic Tanker Fleet

The tanker spreadsheet model uses a weighted average lightering vessel loading rate that is based upon the results of the lightering vessel load rate regression equations. The weighted average loading rate is used to calculate the amount of time the tanker is engaged in each anchorage and offshore lightering operation. Average lightering vessel load rates are calculated by the simulation model for each year that the simulation model is run, and then weighted by the proportion of the total volume lightered by each vessel that year. Tanker discharge rates at the dock were provided by the refiners.

In the benefits calculations, any reductions in tanker lightering operations time under with-project conditions are considered a cost savings. However, in the benefit model, the cost saving from reduced lightering time (since the tanker will only need to be lightered to 45 feet, rather than 40 feet) is typically more than offset by the costs of increased time the tanker spends discharging more crude at the dock.

A weighted average loading time was selected for use in the tanker spreadsheet model, instead of directly linking to the individually calculated vessel call loading rates in the simulation model. This was done due to the convenience of using a weighted average and the minimal analytical benefit that would be gained from using the individually calculated rates.

Lightering Vessel Call Capacity Analysis

An analysis was performed to compare modeled year-2000 lightering vessel calls to observed year-2000 lightering vessel calls in order to verify and calibrate the simulation model. Based on the results of this analysis, minor changes have been made to the simulation model decision rules in order to improve simulation model accuracy in predicting the number and distribution of lightering trips. The following table shows the results of modeling year-2000 lightering vessel calls under the revised set of decision rules.

Table 4 – 1
Modeled Vessel Calls Under Revised Decision Rules

	Year 2000 Modeled		Year 2008 Modeled	
Tanker (42,000 DWT)	192	40.8%	199	40.5%
Tug/Barge (62,000 DWT)	152	32.3%	151	31.0%
Tug/Barge (33,000 DWT)	127	27.0%	143	28.5%
Other	0	0%	0	0%
Total	471	100%	493	100%

Under the previous set of decision rules, the year-2000 model results closely matched the distribution of vessel calls among the types of lightering vessels, but underestimated the total number of vessel calls This underestimation of total vessel calls was primarily due to model decision rules that allowed the lightering vessels to fill to capacity if there is sufficient volume to be transferred. Review of the WCSC year-2000 data indicated that vessels seldom filled to their stated capacity. A similar review of the 2001 data indicated that none of the vessels were filled to stated capacity that year.

Although the Maritrans vessels could potentially have loaded more barrels on most occasions (i.e., the total volume to be lightered was greater than or equal to the vessel's capacity), there must be other factors, such as refinery capacity or scheduling issues that cause the lightering vessels to load to less than full capacity. As a result, the previous set of simulation model decision rules made more efficient use of lightering vessel capacity than is evidenced in actual operations.

Therefore, an analysis of lightering vessel loading patterns was conducted in order to develop a set of modified decision rules that would more closely match observed loading patterns. Based upon a review of the data for anchorage based lightering for Sun tankers, the simulation model decision rules were modified. For each anchorage based lightering call, the vessel capacity for that call was a randomly selected value between 85% and 100% vessel capacity. This decision rule adjustment increased the modeled year-2000 lightering vessel calls to a higher percentage of observed calls and still maintained a close match with the observed distribution of vessel calls among the three lightering vessels.

The decision rules were not modified for offshore and NYVA trips.

Attachment 5
Confirmation of Bulk Vessel and Containership Benefits

The December 2002 projections for containerized cargo, steel slabs, and blast furnace slag were reviewed for this analysis. The December 2002 projections of bulk vessel and containership movements were developed based upon commodity projections and anticipated future vessel deployments including:

- Continuation of weekly eastbound round-the-world containership service;
- Continued growth in blast furnace slag deliveries, which were expected to reach 1 million tons by 2009; and
- Continued growth in steel slab deliveries, which were expected to reach nearly 1 million tons in 2009.

Philadelphia Maritime Exchange data (January – July 2003) was obtained and reviewed to confirm the projections of bulk vessel and containership movements. The list of vessel calls during this period is presented in the Tables 5-1 through 5-4.

Bulk Vessels

Blast furnace slag deliveries were projected to grow from 6 calls in 2001 to 17 calls by 2009. The six calls observed in January/July 2003 and the associated sailing drafts of the vessels are consistent with the projections contained in the December 2002 report.

The December 2002 analysis for future steel slab deliveries was based upon 19 observed calls in 2001. Steel slab deliveries were projected to grow to 23 calls per year by 2009. Data provided by the Maritime Exchange indicates that twenty-three calls to Packer Ave were made in 2002. Eleven calls have been observed from January 2003 through July 2003, including one trip to Camden, NJ, which equates to 19 calls for a full year, roughly in line with prior projections. The cyclical nature of the domestic market for steel, plus the recent effects of imported steel tariffs, was factored into the analysis and results in a certain level of expected year-to-year volatility in this commodity. Historically, this market has shown year-to-year fluctuations and is not considered indicative of a departure from the projected growth trend.

Table 5-1

Slag Vessel Arrivals January – July 2003

Vessel	Date	Draft	Last Port	Terminal
Stefania	02Jan03	40.0	Taranto	Beckett St
Antonis P	17Jan03	40.0	Italy	Beckett St
Apollon	28Feb03	38.1	Rotterdam	Grows, PA
Four Steel	01May03	39.1	Japan	Beckett St
Unirial	07Jun03	40.0	Taranto	Beckett St
Faviola	09Jul03	40.0	Taranto	Beckett St

Table 5-2

Slag Vessel Arrivals January – July 2003

Vessel	Date	Draft	Last Port	Terminal
Castillo de Olivenzia	24Jan03	37.1	Praia Mole	Packer Ave
Castillo de Guadalupe	20Feb03	36.1	Brazil	Packer Ave
Norsul Amazonas	05Mar03	38.0	Praia Mole	Packer Ave
Marcos Dias	21Mar03	35.1	Praia Mole	Packer Ave
Red Fern	14Apl03	40.0	Taranto	Beckett St
Castillo De Olivenza	02May03	38	Brazil	Packer Ave
Norsul Recife	25May03	40	Praia Mole	Packer Ave
Norsul Santos	27Jun03	34.1	Praia Mole	Packer Ave
Marcos Dias	06Jul03	36.1	Praia Mole	Packer Ave
Norsul Rio	26Jul03	39.4	Praia Mole	Packer Ave
Castillo De Olivenza	31Jul03	Unk.	Praia Mole	Packer Ave

Containerships

The data on recent vessel movements provides support for the new weekly eastbound round-the-world containership service that was the basis for the containership benefits claimed in the December 2002 report. This new service had previously been identified by interviewing container shipping lines and by viewing future deployment schedules published by the shippers. As of the date of the previous analysis, the first several vessels of the new service had arrived in Philadelphia, but full weekly service had not yet been initiated. The vessel arrival dates shown in Table 5-3 confirm that weekly service is now in place.

Table 5-3
ECSA to ECUSA (TANGO) Vessel Calls at Packer Ave - 2003

Vessel_Name	actual_arrival_date	underway_draft
CAP SAN AUGUSTIN	1/4/2003	36.1
CAP SAN LORENZO	1/12/2003	36.3
CAP SAN NICOLAS	1/18/2003	34.7
CAP SAN MARCO	1/25/2003	33.1
CAP SAN RAPHAEL	2/1/2003	35.1
CAP SAN ANTONIO	2/9/2003	33.8
CAP SAN AUGUSTIN	2/16/2003	34.4
CAP SAN LORENZO	2/23/2003	35.6
CAP SAN NICOLAS	3/2/2003	35.4
CAP SAN MARCO	3/9/2003	35.8
CAP SAN RAPHAEL	3/15/2003	36.9
CAP SAN ANTONIO	3/22/2003	35.1
CAP SAN AUGUSTIN	3/30/2003	35.1

Table 5-3
ECSA to ECUSA (TANGO) Vessel Calls at Packer Ave - 2003

CAP SAN LORENZO	4/6/2003	36.4
CAP SAN NICOLAS	4/12/2003	35.3
CAP SAN MARCO	4/20/2003	36.9
CAP SAN RAPHAEL	4/26/2003	36.1
CAP SAN ANTONIO	5/4/2003	35.9
CAP SAN AUGUSTIN	5/11/2003	35.3
CAP SAN LORENZO	5/18/2003	36.1
CAP SAN NICOLAS	5/24/2003	36.1
CAP SAN MARCO	6/1/2003	36.1
CAP SAN RAPHAEL	6/7/2003	34.1
CAP SAN ANTONIO	6/17/2003	35.0
CAP SAN AUGUSTIN	6/22/2003	35.1
CAP SAN LORENZO	6/29/2003	34.4
CAP SAN NICOLAS	7/4/2003	36.1
CAP SAN MARCO	7/17/2003	26.0
CAP SAN RAPHAEL	7/20/2003	36.0
CAP SAN ANTONIO	7/28/2003	36.4
CAP SAN AUGUSTIN	8/3/2003	36.1
CAP SAN LORENZO	8/10/2003	36.0
CAP SAN NICOLAS	8/17/2003	36.5
CAP SAN MARCO	8/26/2003	35.1
CAP SAN RAPHAEL	8/31/2003	23.1
CAP SAN ANTONIO	9/8/2003	36.0
CAP SAN AUGUSTIN	9/17/2003	36.4
CAP SAN LORENZO	9/22/2003	35.4
CAP SAN NICOLAS	10/1/2003	36.0
CAP SAN MARCO	10/13/2003	35.1
CAP SAN RAPHAEL	10/17/2003	36.8
CAP SAN ANTONIO	10/20/2003	35.1
CAP SAN AUGUSTIN	10/25/2003	35.4
CAP SAN LORENZO	11/5/2003	35.0
CAP SAN NICOLAS	11/9/2003	36.7
CAP SAN MARCO	11/16/2003	34.1
CAP SAN RAPHAEL	11/27/2003	36.1
CAP SAN ANTONIO	12/3/2003	35.1
CAP SAN AUGUSTIN	12/8/2003	35.1
CAP SAN LORENZO	12/16/2003	36.0
CAP SAN NICOLAS	12/21/2003	36.0
CAP SAN MARCO	12/28/2003	35.1

Table 5-3
ANZ to ECUSA (EBANZ) Vessel Calls at Packer Ave - 2003

Vessel_Name	actual_arrival_date	underway_draft
COLUMBUS NEW ZEALAND	1/2/2003	33.1
CONTSHIP AUSTRALIS	1/9/2003	35.0
P&O NEDLLOYD BOTANY	1/16/2003	36.1
P&O NEDLLOYD PALLISER	1/25/2003	35.3
CONTSHIP BOREALIS	1/30/2003	34.1
P&O NEDLLOYD MAIRANGI	2/8/2003	35.1
P&O NEDLLOYD ENCOUNTER	2/13/2003	36.0
P&O NEDLLOYD PEGASUS	2/28/2003	36.1
P&O NEDLLOYD REMUERA	3/3/2003	37.0
CONTSHIP AURORA	3/8/2003	39.0
COLUMBUS NEW ZEALAND	3/15/2003	39.2
CONTSHIP AUSTRALIS	3/23/2003	36.0
P&O NEDLLOYD BOTANY	4/1/2003	38.0
P&O NEDLLOYD PALLISER	4/4/2003	37.1
CONTSHIP BOREALIS	4/16/2003	40.0
P&O NEDLLOYD MAIRANGI	4/17/2003	40.0
P&O NEDLLOYD ENCOUNTER	4/26/2003	40.0
SYDNEY EXPRESS	5/5/2003	39.1
P&O NEDLLOYD REMUERA	5/11/2003	37.2
CONTSHIP AURORA	5/19/2003	38.1
COLUMBUS NEW ZEALAND	5/24/2003	38.5
CONTSHIP AUSTRALIS	5/29/2003	38.7
P&O NEDLLOYD BOTANY	6/5/2003	38.1
P&O NEDLLOYD PALLISER	6/18/2003	38.0
CONTSHIP BOREALIS	6/19/2003	38.0
P&O NEDLLOYD MAIRANGI	6/25/2003	35.1
P&O NEDLLOYD ENCOUNTER	7/2/2003	37.1
SYDNEY EXPRESS	7/11/2003	37.0
P&O NEDLLOYD REMUERA	7/17/2003	37.1
CONTSHIP AURORA	7/25/2003	35.1
COLUMBUS NEW ZEALAND	7/31/2003	36.1
CONTSHIP AUSTRALIS	8/7/2003	36.9
P&O NEDLLOYD BOTANY	8/16/2003	39.0
P&O NEDLLOYD PALLISER	8/22/2003	36.0
CONTSHIP BOREALIS	8/29/2003	36.0
P&O NEDLLOYD MAIRANGI	9/4/2003	36.0
P&O NEDLLOYD ENCOUNTER	9/11/2003	36.0
SYDNEY EXPRESS	9/19/2003	36.0
P&O NEDLLOYD REMUERA	9/28/2003	32.0
CONTSHIP AURORA	10/3/2003	34.1
COLUMBUS NEW ZEALAND	10/9/2003	36.4
CONTSHIP AUSTRALIS	10/17/2003	36.1
P&O NEDLLOYD BOTANY	10/23/2003	36.1
P&O NEDLLOYD PALLISER	10/30/2003	36.1
CONTSHIP BOREALIS	11/9/2003	37.9
P&O NEDLLOYD MAIRANGI	11/13/2003	37.0

Table 5-3
ANZ to ECUSA (EBANZ) Vessel Calls at Packer Ave - 2003

P&O NEDLLOYD ENCOUNTER	11/21/2003	38.9
SYDNEY EXPRESS	11/28/2003	37.0
P&O NEDLLOYD REMUERA	12/6/2003	37.9
CONTSHIP AURORA	12/12/2003	35.1
COLUMBUS NEW ZEALAND	12/19/2003	36.0
CONTSHIP AUSTRALIS	12/25/2003	36.0

Although information on recent containerized vessel movements confirmed that the expected weekly service was in fact in place, the data on vessel movements showed deeper than expected arrival drafts. In addition, one of the other liner services, Hamburg-Sud's east coast of South America to east coast of the United States, has recently switched to larger vessels that have the potential to benefit from the deepening project.

In order to accurately describe existing conditions and forecast future without and with-project conditions, additional contacts were made with the carriers. Synopses of these contacts are included at the end of this attachment. The revised containership-based benefits estimate is calculated on a per-container basis. The container to TEU ratios used in the analysis were either derived from data gathered at the Packer Avenue Terminal or provided by the carrier. A different ratio was used for each carrier: 0.625 for the ECSA trips (based on communications with the Director of Operations for Hamburg-Sud North America; and 0.82 for the ANZ trips (based on the Packer Avenue data, confirmed by PONL representatives). Table 5-4below presents container data provided by PONL.

Table 5-4

Boxes & TEUs Landed/Loaded at Packer Ave on EBANZ Service 01Jan03 - 10Dec03

	Loaded Full		Loaded Empty		Discharged Full		Discharged Empty			
Partner	20' Boxes	40' Boxes	20' Boxes	40' Boxes	20' Boxes	40' Boxes	20' Boxes	40' Boxes	Total Boxes	Total TEU
ANZ	37	226	2325	611	2111	1681	1	2	6,994	9,514
CMA	10	18	104	500	34	0	0	0	666	1,184
COL	164	358	6587	3637	8782	3557	21	3	23,109	30,664
PON	266	455	7045	4120	10863	3439	7	88	26,283	34,385
CHI	78	52	252	865	454	932	3	3	2,639	4,491
CRL	186	37	0	2	847	1628	0	6	2,706	4,379
Total	741	1146	16313	9735	23091	11237	32	102	62,397	84,617

Partner Codes: ANZ = Australia New Zealand (ANZL) Lines, CMA = CMA-CGM, COL = Columbus Line / Hamburg-Süd, PON = P&O Nedlloyd, CHI = China Shipping Line, CRL = Crowley American Transport / Hamburg-Süd

In addition, an analysis of landside transportation costs for the reefer containers that are the focus of the containership-based benefits analysis was required for the revised benefits estimate. The landside transportation cost analysis was presented to the carriers for review and confirmation[10]. The analysis of landside transportation costs is presented in Attachment 6.

[10] Confirmation was received via e-mail February 17, 2004

Attachment 6

Landside Transportation Cost Analysis

Introduction

In the analysis of benefits resulting from navigation improvements at the Delaware River, transportation cost savings for containerized cargo are largely due to an anticipated shift from truck transport to direct marine transport. Currently, some Philadelphia-bound refrigerated cargo is being landed at the Port of NYNJ and trucked to destinations in the local Philadelphia area. Under with-project conditions, containerships currently arriving at Philadelphia would no longer be depth constrained and the Philadelphia-bound refrigerated cargo that is being trucked to Philadelphia from the Port of NYNJ could be loaded onto these vessels. Under this scenario, transportation cost savings are calculated as the difference between 1) the cost of marine transport to the Port of NYNJ with truck transport to the Philadelphia area, and 2) the cost of marine transport to Philadelphia with truck transport to the local destinations.

The purpose of this landside transportation cost analysis is to compare landside transportation costs between Philadelphia-bound refrigerated cargo landed at the Packer Avenue terminal in Philadelphia and the same Philadelphia-bound cargo landed at the Port of NYNJ (Newark, NJ). The landside transportation costs calculated in this analysis include all port and trucking fees incurred from the dock (at either Philadelphia or Newark) to the final destination of the cargo.

National Economic Development (NED) benefits resulting from transportation cost savings for containerized cargo are estimated according to the guidelines and procedures established in the Economic and Environmental Principles for Water and Related Land Resources Implementation Studies, February 3, 1983; the Planning Guidance Notebook, ER 1105-2-100, 22 April 2000; and the National Economic Development Procedures Manual – Deep Draft Navigation, IWR–91–R-13, dated November 1991. Containerized cargo benefits generated by navigation improvements at the Delaware River include transportation cost savings resulting from a shift in transportation mode for some cargo (marine transport to Newark, NJ with truck transport to final destinations at Philadelphia shifting to full marine transport to Philadelphia with local truck transport to final destinations). These mode shift benefits are calculated in accordance with “Chapter 3-2 Navigation, section c.(1) (b) Shift of mode for commodities with the same origin and destination providing efficiency in waterway or harbor traversed” of ER 1105-2-100, 22 April 2000. The use of trucking and port fees in the calculation of transportation cost savings is conducted in accordance with Appendix E of ER 1105-2-100, 22 April 2000, Chapter E-10 NED Benefit Evaluation Procedures: Transportation Deep-Draft Navigation, section d.(5) Step 5 – Determine Current Costs of Commodity Movements (note: costs include “necessary handling, transfer, storage, and other accessory charges”), and section d.(9) (a) (3) Traffic with Same Commodity and Origin-Destination, Different Mode.

In order to assess the potential competitiveness of alternative delivery services, stakeholders and participants in the supply chain process were interviewed to verify existing trade volumes and origins and destinations of trade, to determine existing price structures, and to identify factors that influence their routing decisions. Throughout these meetings, the exchange of interviewee-specific data and information was predicated upon the understanding that company-specific information was not to be published. Competition among ocean carriers, terminal operators, trucking companies, railway companies, and importers or exporters is high and it is therefore very important that company-specific information remains confidential.

This attachment is organized as follows. The next section presents a detailed discussion of port fees. Trucking fees and destinations are described in section three. Section four presents a summary of landside transportation costs. Carrier confirmation of this landside cost analysis is described in Attachment 5.

Port Fee Analysis

The port fee analysis is based upon data collected from the Port of New York and New Jersey and the Packer Avenue terminal, and was confirmed through additional correspondence with both of the principal carriers conducting the services in question. Individual components of port fees used in this analysis include:

- Stevedoring i.e., lift fee, (Straight time, Overtime, Meal hour, Detention Guarantee, and Lashing),
- TIR & Gate Charge,
- Assessments (ILA Unit Assessment and ILA Royalty Fee), and
- Wharfage.

Table 1. Port Fees: Containerized Cargo Philadelphia and Port of NYNJ presents a comparison of component costs and total port fees for Packer Avenue in Philadelphia and the Port of New York and New Jersey. This analysis was presented to and confirmed by representatives of Hamburg-Sud and P&O Nedlloyd.

Lift fee: The lift fee covers the movement of a container onto or off the vessel, moves within the yard, and out the gate (some terminal operators may break out the gate fee as a separate charge). This is assessed by the marine terminal operator (MTO) to loaded as well as empty containers and is charged to the carrier, who invoices the shipper/consignee accordingly. The lift fee is the same for any size of container and is not affected by mode of inland transport. Market lift rates, as determined in the analysis described above, have been applied to movements through Port of NYNJ and Philadelphia terminals.

ILA Royalty Fee – This fee is a port-neutral fee that is assessed on containers in all ILA ports.

ILA Unit Assessment (Port of NYNJ only): This is a fee that is specific to the Port of NYNJ that has been traditionally assessed based on the volume or weight of the container (whichever is higher) resulting in varying fee levels. This fee was recently standardized for all containers at $130. This fee is applicable to containers with origins/destinations

(ODs) within 260 miles of the Port of NYNJ. For containers with ODs beyond 260 miles, or those that leave the terminal by barge, the assessment drops to $25 per container. Philadelphia is well within the 260 mile radius of the Port of NYNJ and those containers with ODs in Philadelphia would therefore be assessed $130. This fee is not assessed on containers arriving or departing via Philadelphia.

Wharfage (Packer Avenue only): The wharfage fee is specific to the Packer Avenue Terminal. This fee is levied by the Philadelphia Regional Port Authority. The current charge is $2.00 per ton for containerized cargo loaded or off loaded at the Packer Avenue Terminal.

Table 6-1
Port Fees: Containerized Cargo Philadelphia and Port of NYNJ (per container)

	Philadelphia	Port of NYNJ
Lift Fee (Stevedoring)	$116	$194
Gate Fee	$28	-
Lashing	$7	$7
Detention Guarantee	$4	$4
ILA Royalty	$45	$45
ILA Assessment	-	$130
Wharfage @ 18.43 tons per box	$37	-
Totals	**$237**	**$380**

Trucking Cost Analysis

Reductions in truck transport volume and costs are a major component of transportation cost savings for containerized cargo. Trucking rates for movements between Philadelphia and Newark were based on discussions with carriers and trucking firm operators. These discussions were conducted under an understanding of strict confidentiality. In addition, information gathered during these discussions was compared to existing data and analyses for confirmation.

Investigations were conducted and contact was made with the principal carriers to see if they would provide specific information concerning their negotiated trucking rates for drays from the Port of NYNJ (Newark) to local Philadelphia destinations and from Packer Avenue to the same local Philadelphia destinations. One of the principal shipping lines in question declined to provide their trucking rates, which they considered to be confidential business information. The other agreed to allow their employee who negotiates their trucking contracts to provide information.

The principal shipping line representative that was willing to provide information presented their dray rate from Newark to Philadelphia as $250 for dry box moves and $350 for USDA reefer box moves. The difference between the two rates is due to any combination of factors particular to reefer boxes, such as the additional cost of a tri-axle chassis, overweight permitting fees, and repositioning requirements for reefer boxes. Therefore, the $350 per box rate is the relevant box type and rate for this analysis. These contract rates are inclusive of any fuel surcharges.

Additional verification of trucking costs was conducted by obtaining a price quote from an established trucking firm. A trucking firm with a large presence in the northeast market quoted the following rates:

- From the Port of NYNJ (Newark) to a local Philadelphia destination: $385 to $400 plus a 7% fuel surcharge, for a total of $412 to $428; and

- From Packer Avenue to the same local Philadelphia destination: $190 to $220 plus a 7% fuel surcharge, for a total of $203 to $235.

These rates, however, are spot-quotes that do not include the volume-based discounts that the carriers in question would receive from a trucking firm.

The $350 contract rate substantiated by two sources compares well to the specific Philadelphia-based trucker quote (spot-quote $385). The $350 contract rate was used in all landside cost calculations.

Landside Transportation Costs: Summary

Table 6-2, Landside Transportation Cost Summary, presents total port fees, total trucking fees, and total landside transportation costs per container for refrigerated Philadelphia-bound cargo landed at Philadelphia and for the same Philadelphia-bound cargo landed at the Port of NYNJ (Newark, NJ). This cost summary was presented to the carriers for review and comment. The carriers concurred with the fees presented in the analysis. One comment was made by the P&O Nedlloyd representative who stated that an incidental bundling and chassis return fee of $100 would be included in the landside cost of trucking to Philadelphia, if the driver returns to the Port of NYNJ without a container. This is not typical of the operation, generally the driver waits while the box is stripped and returns to the Port of PONYNJ with an empty container. Due to uncertainty concerning the number of times this cost would be incurred, it was not included in the calculation of landside costs.

Table 6-2
Landside Transportation Cost Summary (per container)

	Philadelphia	Port of NYNJ
Port Fees	$237	$380
Trucking Fees	$185	$350
Total Cost	$422	$730