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VALUE OF THE CORPS OF ENGINEERS CIVIL WORKS PROGRAM TO THE NATION

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Prepared for Directorate of Civil Works
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by

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Background.

On 9 May, 1995, Dr. Zirschky, Acting Assistant Secretary of the Army for Civil Works asked the Director of Civil Works, MG Genega to determine *the net cost or benefit of the Civil Works program to the U.S. Treasury. In other words, does the country get a positive return on the $3.6 billion invested in the program?*

Subsequently, Programs Division (CECW-B) contacted the Corps Institute for Water Resources (IWR) and requested assistance in responding to Dr. Zirschky's request. IWR prepared three options, a detailed project by project accounting, a macro economic model approach, and a quick analysis using available data on benefits by project purpose. CECW-B pursued the least cost option so as to provide the most timely estimate and discussion of the analysis.

Summary of Results

Table 1 shows Corps annual budget and a summary of the annual benefits of the Corps infrastructure to the nation and the impacts on the U.S. Treasury from project outputs and related economic activities associated with the Corps Civil Works Programs. Estimates are based on available data and analyses from a variety of sources. Monetary values are in 1993-1994 constant dollars. Estimates are considered to be generally gross.

Table 1

Summary of Annual Value of Corps Programs

	ANNUAL CORPS BUDGET FOR GI, O&M, AND CONSTRUCTION (1994)	NATIONAL ECONOMIC DEVELOPMENT BENEFITS	FEDERAL TAX REVENUES	OTHER REVENUES	SAVINGS TO US TREASURY
TOTAL	$3.6 BILLION	$32.6 BILLION	$22.6 BILLION	$1.3 BILLION	$6.3 BILLION

The annual rate of return on the Corps accumulated water resources capital stock is estimated to be 26%. (Calculations are shown on page 4.)

Summary of the Approach and Scope of the Analysis

Through the Corps of Engineers, the nation has made a series of water resource investments. These investments constitute a ***portfolio*** or a capital stock which provides an annual stream of benefits to the nation. These benefits are realized as flood damages prevented, reduced transportation cost (navigation), hydropower, recreation and water supply forms. The Corps' annual budget serves either to maintain the benefit stream (operations, maintenance, research and development, and major rehab) or to increase the portfolio and therefore the future benefit stream (new construction, planning and research and development). Evaluation of gross annual benefit estimates for each project purpose can provide an estimate of the annual rate of return on the Corps portfolio. This approach is analogous to how an individual investor would estimate the rate of return on a common stock portfolio built up over a period of years.

The analysis requires a defined portfolio. This information is readily available and can be described in terms of the dollar value of the capital stock of Corps investments. Work in this area has been accomplished as part of the Federal Infrastructure Strategy Program. The study estimated the *Gross capital stock* which refers to the total amount of investment the Corps has put in place over the years, added up at a particular point in time, after subtracting out accumulated retirements of investments. When depreciation is taken into account, and depreciated capital subtracted out as well, the resulting figure is referred to as *net capital stock.* Obviously, net capital stock is always going to be less than gross capital stock.

The resulting portfolio, defined by the capital stock and an estimated National Economic Development (NED) benefit stream provides context for answering questions related to the value of the Corps CW budget. This will help people to understand what the country buys with its annual investment of $3.6 billion. Using the portfolio context, operation and maintenance expenses are necessary to sustain the benefit stream. Failure to invest in maintenance, major rehabilitation, research and development, planning studies and new construction will result in the gradual reduction in capital stock (from normal decay) and in turn the benefit stream.

The impact to the treasury can also be estimated. There are the direct payments from the Corps to the Treasury each year, hydropower and water supply revenues, for example. These numbers are readily available. There are also the

federal tax receipts from economic activity induced or facilitated by the Corps portfolio. Estimation of federal tax revenue impacts is problematic and requires a number of assumptions about how non market output (recreation, flood control and navigation) translate into tax revenues. A description of how the estimates of federal tax revenues were developed is discussed below.

The study did not include an analysis of values of the emergency operations program, regulatory program or environmental restoration since monetary values do not exist for those outputs. The value of R&D and planning is captured but not specifically identified in the efficiencies accruing to project formulation, design, construction and operations from improved procedures and technologies.

While there are a number of sources of estimates on the employment impacts and regional benefits of the Corps program, this study did attempt to measure those, given the short time frame. Future work could develop a consistent analytical framework to address other economic impacts of the Corps program. The focus of this study is on the monetary benefits and treasury impacts of the Civil Works program.

Return on Investment of the Corps Capital Stock.

The approach entails computing NED benefits by summing available estimates of annual flood damages prevented, navigation cost savings, hydropower generation market values, recreation visitor benefits and water supply storage values shown in Table 3. From this value, subtract annual O&M costs, and divide that result by the depreciated value of the Corps capital stock as shown in table 2. The number is an estimate of the annual rate of return on the Corps capital stock and is the annual return to the nation from the accumulated investments over the years. A shortcoming of the analysis is that it does not account for the non-Federal contributions to the capital stock and operations and maintenance which contribute to the benefit stream. Nor does the analysis account for associated private investments (e.g. land side facilities at ports). Thus, the rate of return values estimated as accruing to Corps expenditures alone are overstated.

Table 2

VALUE OF THE CAPITAL STOCK OF CORPS PROJECTS

CORPS OF ENGINEERS CAPITAL STOCK	DEPRECIATED REPLACEMENT VALUE AS OF 1993 (1993 DOLLARS)
NAVIGATION	$31.5 Billion
FLOOD CONTROL	$52.4 Billion
MULTIPLE PURPOSE	$35.2 Billion
TOTAL	$119.1 Billion

Source: Infrastructure in the 21st Century Economy: An Interim Report - Vol. 3

Data on Federal Capital Stocks and Investment Flows (IWR, 1994)

The annual return on the accumulated investment in the Corps infrastructure (capital stock) is estimated to be 26% as calculated below:

Depreciated Value of Corps Capital Stock = $119.1 billion Annual project NED benefits = $32.6 billion Annual O&M cost = $1.6 billion
Annual rate of return on Corps infrastructure = ($32.6 billion - $1.6 billion)/$119.1 billion = 26 %

The basis for the individual calculations of benefits by project purpose is given in the Appendix.

Revenues to the U.S. Treasury

Estimates of tax revenues to the federal treasury are based on applying average tax rates to the annual national income generated by economic activity associated with each project output. Estimates of other additions to the treasury include revenues from power sales and water supply storage contracts, flood emergency assistance payments avoided and casualty loss tax deductions not taken as a result of flood protection.

Based on income generated from activities associated with Corps project outputs, annual income taxes to the Treasury are estimated to be $22.6 billion. Revenues from the Inland Waterway Trust Fund are $103 million and from the Harbor Maintenance Trust Fund, $621 million. Revenues from Hydropower generation sales and water supply storage contracts are estimated at $515 million and $13 million respectively. Flood protection provides $2.1 billion in federal tax casualty loss deductions not taken and $4.2 billion in emergency assistance payments not expended by the treasury. Total annual revenues and savings to the Treasury related to the Civil Works program are estimated to be $30.2 billion.

Table 3 shows the estimates by project purpose along with the annual Corps budget.

TABLE 3

ANNUAL BUDGET, BENEFITS AND REVENUES TO THE U.S. TREASURY FROM CORPS CIVIL WORKS PROGRAMS

PROJECT PURPOSE	ANNUAL CORPS BUDGET FOR GI, O&M, AND CONSTRUCTION (1994)	NATIONAL ECONOMIC DEVELOPMENT BENEFITS	FEDERAL TAX REVENUES	OTHER REVENUES AND SAVINGS TO THE TREASURY
Flood Damages Prevented	$1,460.4 Million	$18.4 Billion		Disaster Relief Costs Saved $4.2 Billion Casualty Loss Tax Write-offs Not Taken $2.1 Billion
Inland Navigation	$731.8 Million	$5.50 Billion	$4.0 Billion	User Trust Fund $ .103 Billion
Deep Draft Navigation	$697.0 Million	$1.54 Billion	$14.5 Billion	Harbor Maintenance Fees $ .646 Billion
Recreation	$202.1 Million	$1.40 Billion	$4.1 Billion	User Fees $ .025 Billion
Hydropower	$316.0 Million	$5.00 Billion		Sale of Power $ .515 Billion
Water Supply	$88.3 Million	$.775 Billion		Water Supply Contracts $ .013 Billion
Other	$75.7 Million			
TOTAL	$3,571.3 Million	$32.6 Billion	$22.6 Billion	$7.6 Billion

The basis for the calculations is given in the Appendix.

Benefit Cost Analysis of the Annual Corps Budget for Any Given Year

Any attempt to estimate the benefits of the Corps CW budget for a specific year is problematic. The following discussion is provided to demonstrate the speculative nature of such an estimate. Since the regulatory program, emergency operations and work for others is not part of the monetary analysis of this report the relevant portion of the Corps CW budget is O&M, Construction, GI, and MR&T. In FY 95 that was about $3.1 billion out of a total of $3.5 billion.

The return on the investment in any given year of the $3.1 spent for O&M and new construction is difficult to estimate without making a number of speculative assumptions. For example, assuming that the $3.1 billion simply disappears and no other entity picks up the expense then the

existing capital stock and the associated returns on the investment portfolio will diminish at some rate (no data on the rate of decay that would result are available, however). The decay rate in the capital stock and associated benefits would be uneven across project purposes, however.

For example, for local flood control, O&M is generally performed by non-federal sponsors and the value of the stock and benefit flows from local flood control would diminish more slowly than, for example, inland navigation.

For purposes of discussion, a rough estimate was made of the benefit-cost ratio of continuing the Corps maintenance, new construction and GI programs. Assuming operations continue but not maintenance, new construction and GI studies and an average 10% reduction in project outputs each year over 50 years we can compute the present value of the lost benefits and maintenance, construction and GI costs not expended. Annual maintenance (less operations costs), new construction and GI costs are $2.5 billion which would have a present value of $32.6 billion over the next 50 years. NED Benefits lost over 50 years has a present value of $233 billion. By comparing the present values of the benefits (i.e. NED benefits not lost) to the present value of the cost of continuing maintenance, construction and GI, the benefit-cost ratio of continuing Corps annual maintenance, new construction and GI at current levels would be about 7.4 to 1. Under this scenario fully half of the annual benefits would be lost by year six. A positive B/C ratio is obtained for continued maintenance, construction and GI for decay rates as low as .7% per year. In other words, it would still pay to continue to maintain and construct at current levels even if the degradation rate of the capital stock and therefore the benefit stream was very small. Obviously, ceasing operations would have more immediate and greater adverse impacts on benefit flows.

APPENDIX

DATA SOURCES, ASSUMPTIONS AND CALCULATIONS

	FLOOD CONTROL BENEFITS AND IMPACTS ON U.S. TREASURY
VARIABLES	FLOOD DAMAGES PREVENTED = $18.4 BILLION RESIDENTIAL DAMAGES PREVENTED = 60% BUSINESS DAMAGES PREVENTED = 21% UNINSURED RESIDENTIAL PROPERTY = 80% TAXPAYERS WHO ITEMIZE =57% US AVERAGE ADJUSTED GROSS INCOME OF ITEMIZERS = $56,930 MARGINAL FEDERAL TAX RATE = 28% AVERAGE FLOOD DAMAGE PER EVENT (FIA DATA BASE) = $22,000 FEDERAL DISASTER ASSISTANCE PER DOLLAR OF FLOOD DAMAGE FROM GREAT FLOOD OF 93 = $.23
KEY ASSUMPTIONS	FIA DAMAGE DATA REPRESENTATIVE OF ALL FLOOD PRONE RESIDENTIAL PROPERTIES AVERAGE AGI REPRESENTATIVE OF FLOOD PLAIN HOUSEHOLDS DISASTER ASSISTANCE PER $ DAMAGE DURING FLOOD OF 93 REPRESENTATIVE OF ALL FLOOD DAMAGE EVENTS
COMPUTATIONS	NED BENEFITS = DAMAGES PREVENTED = $18.4 BILLION SAVINGS TO TREASURY FROM CASUALTY LOSS DEDUCTIONS NOT TAKEN FOR RESIDENTIAL PROPERTIES .6 X .8 X .57) X ($18.4 BILLION) = RESIDENTIAL DAMAGES PREVENTED FOR HOUSEHOLDS THAT ITEMIZE = $5.0 BILLION AVERAGE LOSS DEDUCTION = ($22,000) - ($56,930 X .10%) = $16,307 DEDUCTIBLE FLOOD LOSSES = ($16,307/$22,000) X ($5.0 BILLION)= $3.7 BILLION RESIDENTIAL TAX WRITEOFFS AVOIDED =($3.7 X .28) = $1 BILLION SAVINGS TO TREASURY FROM CASUALTY LOSS DEDUCTIONS NOT TAKEN FOR BUSINESS PROPERTIES (.21 X $18.4 BILLION) X (.28) = $1.1 BILLION SAVINGS TO TREASURY FROM DISASTER ASSISTANCE PAYMENTS NOT MADE = ($18.4 X .23) = $4.2 BILLION
SOURCES	DEPARTMENT OF THE TREASURY, OFFICE OF TAX ANALYSIS (FAX MATERIAL, 1994) PHONE DISCUSSION WITH FIA PERSONNEL (JULY, 1994) INFORMAL PHONE SURVEY OF CORPS FIELD PERSONNEL (JULY, 1994) USACE ANNUAL FLOOD DAMAGE REPORT TO CONGRESS FOR FY 93 (COE, 1994)

UNRESOLVED ISSUES/ OMISSIONS	PROPORTION OF DAMAGES PREVENTED BY PROPERTY TYPE ARE BASED ON BEST GUESSES BY SELECTED DISTRICT PERSONNEL AND ARE CONSIDERED VERY GROSS ESTIMATES TREASURY IMPACTS FROM AGRICULTURE DAMAGES PREVENTED ARE NOT INCLUDED

	INLAND NAVIGATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	TRANSPORTATION SAVINGS PER TON = $8.61 TONS SHIPPED = 650 MILLION NATIONAL INCOME PRODUCED FROM TRANSPORTATION SAVINGS = $19 BILLION AVERAGE INDIVIDUAL AND BUSINESS TAX RATE = 19.6%
KEY ASSUMPTIONS	
COMPUTATIONS	NED BENEFITS = ($8.61 X 650 MILLION) = $5.5 BILLION INCOME TAXES TO TREASURY = ($19 BILLION X .196) = $3.7 BILLION INLAND WATERWAYS TRUST FUND TO TREASURY = $103 MILLION
SOURCES	THE PUBLIC VALUE OF INLAND WATERWAYS: SOME STATISTICAL EVIDENCE, (C. JAKE HAULK, PHD, 1994) ASSESSMENT OF ALTERNATIVE ASSUMPTIONS OF OUTLAYS AND REVENUES FOR THE INLAND WATERWAYS TRUST FUND (IWR, 1995)
UNRESOLVED ISSUES/ OMISSIONS	INCOME TAXES GENERATED BY NAVIGATION RELATED ECONOMIC ACTIVITY IN THE ABSENCE OF CORPS UNKNOWN

	DEEP DRAFT NAVIGATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	TRANSPORTATION SAVINGS = $1.534 BILLION NATIONAL INCOME PRODUCED FROM PORT INDUSTRY = $74 BILLION AVERAGE INDIVIDUAL AND BUSINESS TAX RATE = .196 HARBOR MAINTENANCE TRUST FUND = $646 MILLION
KEY ASSUMPTIONS	
COMPUTATIONS	BENEFITS = TRANSPORTATION SAVINGS = $1.534 BILLION INCOME TAXES TO TREASURY = ($74 BILLION X .196) = $14.5 BILLION OTHER REVENUES = HARBOR MAINTENANCE TRUST FUND = $646 MILLION

SOURCES	ANALYSIS OF COASTAL PORT DREDGING AND THE EFFECTS ON TRANSPORTATION COST SAVINGS (DRI/MCGRAW-HILL, 1994) PUBLIC PORT FINANCING IN THE UNITED STATES (MARITIME ADMINISTRATION, 1994) THIRD ANNUAL REPORT TO CONGRESS ON THE STATUS OF THE HARBOR MAINTENANCE TRUST FUND (1994)
UNRESOLVED ISSUES/ OMISSIONS	TAX COLLECTIONS IN ABSENCE OF THE CORPS UNKNOWN OTHERS MAY CONTINUE TO DREDGE

	RECREATION BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	DAY USE VISITS (388.1 MIL), $/VISIT ($3.33) CAMPING VISITS (8.7 MIL), $/VISIT ($16.82) CAMPING AND USE FEES ($25 MILLION) INCOME GENERATED FROM ACTIVITY RELATED TO CORPS RECREATION PROGRAM ($21 BILLION) AVERAGE BUSINESS AND INDIVIDUAL INCOME TAX RATE (19.6%)
KEY ASSUMPTIONS	
COMPUTATIONS	NED BENEFITS = (388.1 X $3.33) + (8.7 X $16.82) = $1.4 BILLION TAX REVENUES TO TREASURY = ($21 BILLION X .196) = $4.1 BILLION FEE REVENUES TO TREASURY = $25 MILLION
SOURCES	A SUMMARY OF THE NATIONAL AND STATE ECONOMIC EFFECTS OF THE 1994 USACE RECREATION PROGRAM (WES, 1995 DRAFT) REGIONAL RECREATION DEMAND MODELS FOR LARGE RESERVOIRS: DATABASE DEVELOPMENT, MODEL ESTIMATION AND MANAGEMENT APPLICATIONS (WES, MARCH 1995)
UNRESOLVED ISSUES/ OMISSIONS	INCOME GENERATED WITHOUT CORPS PROGRAM NOT KNOWN FEES RETURN TO CORPS IN FOLLOWING YEAR

	HYDROELECTRIC POWER BENEFITS AND REVENUES TO THE TREASURY
VARIABLES	RETAIL MARKET VALUE PER KW ($.07) ANNUAL ENERGY GENERATED (70 BILLION KWH) REVENUES FROM SALES TO PMAs ($515 MILLION)

KEY ASSUMPTIONS	AVERAGE MARKET VALUE FOR ENERGY APPLIES TO CORPS POWER GENERATED
COMPUTATIONS	NED BENEFITS = (70 BILLION KWH X $.07) = $5 BILLION REVENUES TO TREASURY = $515 MILLION
SOURCES	SURVEY OF CORPS AND POWER MARKETING AGENCIES (CORPS, 1994)
UNRESOLVED ISSUES/ OMISSIONS	

	M&I WATER SUPPLY STORAGE BENEFITS AND REVENUES TO TREASURY
VARIABLES	ACRE FEET UNDER CONTRACT (6.2 MILLION) $ AVERAGE MARKET VALUE PER ACRE FOOT ($125.00) $ VALUE OF CONTRACT STORAGE ($644 MILLION) 50 YEAR PAYBACK PERIOD
KEY ASSUMPTIONS	MARKET VALUE = NATIONAL AVERAGE COST OF WATER SUPPLY (A LOW END ESTIMATE OF VALUE)
COMPUTATIONS	NED BENEFITS = (6.2 MIL AF) X ($125) = $775 MILLION REVENUES TO THE TREASURY = ($644/50YR) = ~ $13 MILLION
SOURCES	WATER SUPPLY CONTRACT DATA BASE (CORPS, 1988) WATER INDUSTRY DATA BASE (AWWA, 1992) LESSONS LEARNED FROM THE CALIFORNIA DROUGHT (IWR, 1993)
UNRESOLVED ISSUES/ OMISSIONS	IRRIGATION WATER SUPPLY NOT INCLUDED M&I CONTRACTS ARE IN NOMINAL DOLLARS INTEREST ON CONTRACTS NOT AVAILABLE AND NOT INCLUDED