ECONOMIC BENEFITS AND COSTS OF THE DICKEY-LINCOLN HYDROELECTRIC PROJECT IN MAINE

Corps of Engineers
(Civil Functions)
Department of the Army

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

RED-75-387

JUNE 19, 1975

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COMPTROLLER GENERAL OF THE UNITED STATES
WASHINGTON, D.C. 20548

B-181837

The Honorable Silvio O. Conte and
the Honorable Michael J. Harrington
House of Representatives

Pursuant to your joint request of July 15, 1974, and subsequent discussions with your offices, we have reviewed the economic benefits and costs of the proposed Corps of Engineers' Dickey-Lincoln School Lakes project, Maine. As agreed with your offices, we did not review the environmental aspects of the project because, at the time we initiated our review, the Corps was planning to make an environmental study. The Corps plans to have a draft environmental statement available in July 1976 and to file a final environmental impact statement with the Council on Environmental Quality in April 1977.

During our review we noted several pending or unsettled matters which could alter the planned project design and operations. The 1974 cost and benefit estimates have not been revised to show the impact of such changing conditions or requirements which have occurred or which have been under consideration since 1967 when project planning and funding stopped. The impacts cannot be reliably estimated until the Corps completes project design and planning studies, such as those on power marketing and transmission, power output, and environmental effects, and reaches an agreement with Canada concerning the design and operation of the project.

Currently, power output and environmental studies have been initiated. The power marketing and transmission studies and discussions with Canada have not yet started.

Corps personnel had not been involved with Dickey-Lincoln planning for 7 years, and key estimators have either retired or left the Corps. This made it difficult in some cases to determine estimators' assumptions and reasoning and data sources where supporting documentation could not be located.

We discussed the matters presented in this report with officials of the Corps of Engineers, Department of the Army;

the Department of the Interior; and the Federal Power Commission, but, as requested by your offices, we did not obtain written comments from those agencies.

As you requested, a copy of this report is being sent to Representative Robert N. Giaimo.

We believe the report would be of interest to committees and to other Members of Congress. We plan to contact you in the near future regarding this distribution of the report.

ACTING Comptroller General
of the United States

Contents

ABBREVIATIONS

EIS	Environmental Impact Statement
FPC	Federal Power Commission
GAO	General Accounting Office
GDM	General Design Memorandum
MMWEC	Massachusetts Municipal Wholesale Electric Company
NEPOOL	New England Power Pool
NEPPA	Northeast Public Power Association

COMPTROLLER GENERAL'S
REPORT TO THE HONORABLE
SILVIO O. CONTE AND
MICHAEL J. HARRINGTON
HOUSE OF REPRESENTATIVES

ECONOMIC BENEFITS AND COSTS OF THE DICKEY-LINCOLN HYDROELECTRIC PROJECT IN MAINE

Corps of Engineers (Civil Functions)
Department of the Army

D I G E S T

This report examines economic benefits and costs of a Corps of Engineers proposed multipurpose project on the St. John River near the United States-Canadian border in Maine.

Called the Dickey-Lincoln School Lakes project, it was authorized by the Congress in 1965. Project benefits are hydroelectric power, recreation, area redevelopment, and flood control. (See p. 1.)

Power would be the principal benefit to be realized--95.6 percent of total benefits. The project is intended to provide power to utilities primarily in Boston at times when the demands for power from them is the greatest. The remaining electric power output would serve other demands for power in Maine. (See pp. 1 and 4.)

About $2.2 million was spent from fiscal year 1966 through fiscal year 1968 for preconstrsuction planning and design. Funding and planning ceased in November 1967. With the appropriation of $800,000 for fiscal year 1975, the Corps resumed project planning and design and began to update the project for changed conditions and requirements. (See p. 5.)

Updating will include reviewing the project's design and cost estimates, economic and financial feasibility, and an environmental study. The Corps requested $1,060,000 for fiscal year 1976 and $335,000 for the transitional quarter to continue preconstruction planning. (See p. 5.)

The project includes construction of two earth-filled dams with hydroelectric powerplant installations and transmission lines from the project in Aroostook County to the Boston, Massachusetts area--about 410 miles. (See p. 1.) Project waters will extend into Quebec Province, Canada, and will affect operations of hydroelectric projects farther downstream in New Brunswick Province, Canada. (See p. 12.)

Construction cost of the project increased from a 1967 estimate of $297 million to $521.8 million in 1974 ($388 million for dams and reservoirs and $133.8 million for the transmission system). (See p. 5.)

In the Corps' latest analysis (July 1974), annual benefits and costs were estimated to be $50.6 million and $19.2 million, respectively--a benefit-cost ratio of 2.63 to 1. Several matters which could alter the planned project design and operations have not been resolved. (See p. 4.)

The 1974 benefit and cost estimates have not been revised to show the impact of changing conditions or requirements which have occurred or which have been under consideration since 1967 when project planning and funding stopped. (See p. 7.)

For example, it is now expected that the project will connect with the powerlines of the New England Power Pool. (See p. 8.)

Also, power studies are underway to consider the feasibility of adding a pumped storage feature to the project and to determine the project's operational characteristics and power output. (See p. 10.)

The effects of these cannot be reliably estimated until the Corps completes project design and planning studies. In addition, an assessment of the environmental effects must be done and an agreement must be reached with Canada

concerning the project's design and operation. (See p. 7.)

These unresolved matters are under study as part of the Corps' normal preconstruction planning and design procedures.

The Corps stated that it keeps the Congress informed during each annual budget submission of the progress of the project. If changes occur which would affect the project, the Corps would write to the House and Senate Committees on Public Works and Appropriations explaining the changes and their effects. (See p. 13.)

The Corps provided GAO with a schedule of expected completion dates of studies on the unresolved matters. (See p. 14.)

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CHAPTER 1

INTRODUCTION

At the joint request of Congressmen Silvio O. Conte and Michael J. Harrington (see app. I), we reviewed the Corps of Engineers' benefit-cost analysis for the proposed Dickey-Lincoln School Lakes project in Maine. Our review covered the method of computing project benefits and costs and the adequacy of supporting data.

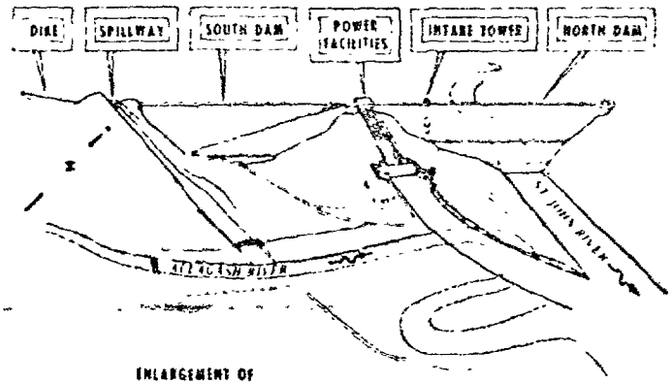
BACKGROUND

The project was authorized by the Flood Control Act of 1965 (Public Law 89-298, Oct. 27, 1965). The project will be located on the St. John River in Aroostook County, Maine, near the United States-Canadian border. The planned project benefits are hydroelectric power, recreation, area redevelopment, and flood control. The project plan involves the construction of two earth-filled dams with hydroelectric powerplant installations and transmission lines from the project to the Boston, Massachusetts, area--about 410 miles. (See illustration, p. 2.)

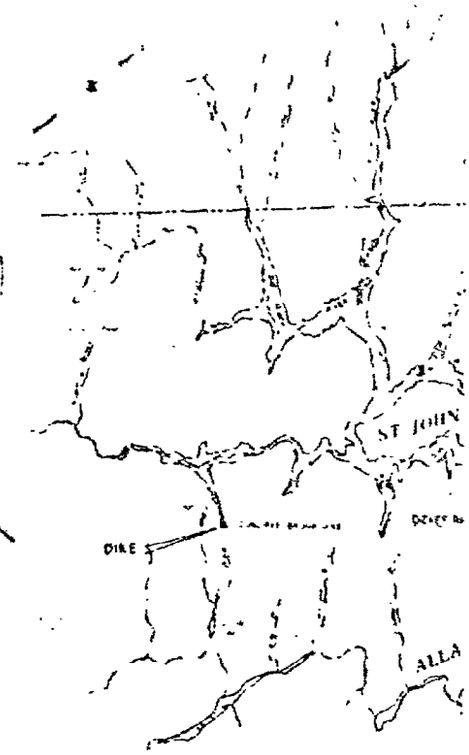
Dickey dam, the larger dam, will be 28 miles above Fort Kent, Maine, and immediately above the St. John River's confluence with the Allagash River; it will be about 2 miles across with a maximum height of 335 feet above the streambed. It will create a reservoir of 135 square miles, or 86,000 acres at maximum pool elevation, extending some 45 miles upstream. Waters from the reservoir would extend into Quebec Province, Canada, at two locations.

Lincoln School dam will be 11 miles downstream from Dickey dam and will regulate the water released from Dickey dam to provide a pattern of flows acceptable for Canadian hydroelectric projects located downstream. Its reservoir will encompass 2,150 acres at maximum pool elevation. The dam will be a little more than one-quarter of a mile across and have a maximum height of 85 feet.

The project will have a hydroelectric generating capability of 830,000 kilowatts, 760,000 kilowatts at Dickey dam and 70,000 kilowatts at Lincoln School dam. About 725,000 kilowatts are planned for peaking power--power generated to meet daily peak electrical demands of relatively short duration--to be delivered to utilities primarily in the Boston area. However, the Department of the Interior has not analyzed marketing arrangements since 1968 and has not specified the customers to whom they expect to sell the power.



ENLARGEMENT OF
DICKEY DAM



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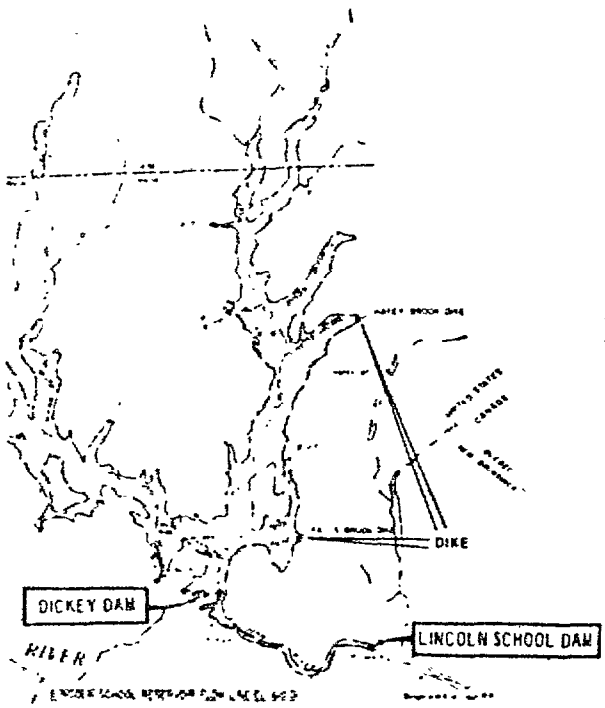

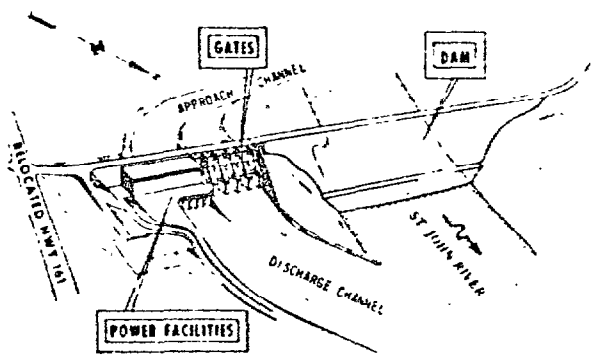

ENLARGEMENT OF
LINCOLN SCHOOL DAM

UPPER SAINT JOHN RIVER
WATER RESOURCES DEVELOPMENT

DICKEY AND LINCOLN SCHOOL LAKES

MULTIPLE PURPOSE PROJECT
INCLUDING POWER
JANUARY 1, 1975

DEPARTMENT OF THE ARMY
NEW ENGLAND DIVISION CORPS OF ENGINEERS

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See chapter 2 for a detailed discussion. The remaining project power output will serve longer duration demands in Maine.

ROLES OF FEDERAL AGENCIES IN DICKEY-LINCOLN PLANNING

Corps of Engineers

The Corps is responsible for designing, evaluating, and constructing the project, except for required power transmission facilities. The Corps is the focal point for project cost estimates and economic and financial analyses.

Department of the Interior

The Interior is responsible for marketing electric power from the project, including identifying recipients of the power; determining power revenues necessary to recover Federal investment; and designing and acquiring transmission facilities required to market the power. Cost estimates for the transmission system are developed by the Interior for the Corps.

Federal Power Commission

The Federal Power Commission (FPC) estimates the value of project power used in benefit computations and advises the Corps on the demand for power output.

PROJECT BENEFITS AND COSTS

In the Flood Control Act of 1936 (33 U.S.C. 701a), the Congress delcared that Federal project benefits should exceed costs. This act led to the development of analytical procedures for evaluating the benefits and costs of proposed water resources projects. Federal water resource construction agencies develop and report benefit-cost analyses to the Congress to show the economic feasibility of proposed projects. Such analyses are an important part of the congressional and agency decisionmaking process. The Congress seldom authorizes water resource projects unless the benefit-cost ratios exceed unity (estimated project benefits exceed the estimated project costs).

From the time Dickey-Lincoln was authorized in 1965, the benefit-cost ratio has increased from 1.8 to 1 to the present ratio of 2.6 to 1. The following table shows annual

benefits and costs of the project, as shown in the 1967 General Design Memorandum[1] (GDM) and as estimated at July 1974.

Estimates of Annual Benefits and Costs

Project benefits	GDM estimate 1967 (note a) (000 omitted)	Percent of total	Current estimate July 1974 (note b) (000 omitted)	Percent of total
Power:				
Marketed in Maine	$ 3,440	16.3	$10,987	21.7
Marketed in Boston	16,063	76.3	33,932	67.0
Total	19,503	92.6	44,919	88.7
Downstream (note c)	1,050	5.0	3,500	6.9
Total	20,553	97.6	48,419	95.6
Recreation (note d)	-	-	1,250	2.5
Flood control	40	.2	70	.1
Area redevelopment (note e)	467	2.2	891	1.8
Total annual benefits	$21,060	100.0	$50,630	100.0
Total annual costs	$10,651		$19,243	
Benefit-cost ratio	1.98 to 1		2.63 to 1	

a/Estimate analyzed by GAO.

b/Estimates shown in the fiscal year 1976 budget justification. These estimates are based on the July 1974 estimate.

c/Value of increases in power production at downstream Canadian hydroelectric projects due to regulated flows from Lincoln School dam.

d/Recreation benefits were added as a project purpose in 1969.

e/Represents the value of project employment expected from construction and operation of the project.

1/Includes the basic project plan of development, extent of major features of development, estimated benefits and costs, operating requirements, real estate requirements, and the extent of local cooperation. The Corps plans to update the GDM with a supplement in 1976.

The initial construction cost estimate supporting project authorization in 1965 was $303 million ($227 million for dams and reservoirs and $76 million for the transmission system). The 1967 estimate had decreased to $297 million ($218 million for dams and reservoirs and $79 million for the transmission system). The Corps, as of July 1974, estimated the construction cost at $521.8 million ($388 million for dams and reservoirs and $133.8 million for the transmission system). Our review of the Dickey-Lincoln project centered around the 1967 estimate and the Corps' July 1974 estimate.

PROJECT STATUS

About $2.2 million was spent from fiscal year 1966 through fiscal year 1968 for preconstruction planning and design. Funding and planning ceased in November 1967. With the appropriation of $800,000 for fiscal year 1975, the Corps resumed project planning and design and began to update the project for changed conditions and requirements. Updating will include reviewing the project's design and cost estimates, economic and financial feasibility, and an environmental study.

The Corps requested $1,060,000 for fiscal year 1976 and $335,000 for the 1976 transition quarter to continue preconstruction planning. Construction and land acquisition funds have not been requested. The Corps anticipates requesting such funds in its fiscal year 1979 budget request.

SCOPE OF REVIEW

We made our review primarily at the Corps' New England Division, Waltham, Massachusetts; the Bureau of Reclamation's Engineering and Research Center, Department of the Interior, Denver, Colorado, which was responsible for the transmission design and cost estimate; and the Federal Power Commission, New York City, and held discussions with officials of these agencies at their headquarters offices in Wasnington, D.C. In addition, we interviewed officials of the following private and public utility organizations--the New England Power Pool (NEPOOL), the Massachusetts Municipal Wholesale Electric Company (MMWEC), and the Northeast Public Power Association (NEPPA)--in Massachusetts.

At the Corps, we reviewed records and data supporting its 1967 benefit and cost estimates and analyses and its annual procedure for updating project costs and benefits. We did not review the flood control or area redevelopment benefits since they constituted only 2 percent of the

project's total benefits. Further, although Corps policy permits area redevelopment benefits to be included in project plans for information, it precludes their use in determining a project's economic justification.

As agreed with Congressman Harrington's office and Congressman Conte, we did not review the environmental aspects of the project because, at the time we initiated our review, the Corps was planning to make an environmental study, as required by the National Environmental Policy Act of 1969 (42 U.S.C. 4332).

During our fieldwork, the Corps initiated action on the environmental study. The Corps plans to have a draft environmental statement available in July 1976 and to file a final environmental impact statement (EIS) with the Council on Environmental Quality in April 1977.

CHAPTER 2

CHANGING CONDITIONS COULD HAVE AN IMPACT ON DICKEY-LINCOLN COST AND BENEFIT ESTIMATES

Our review was made principally to determine the accuracy and completeness of the Corps' cost and benefit estimates for Dickey-Lincoln. We noted several pending or unsettled matters which could alter the planned project design and operations.

The 1974 cost and benefit estimates have not been revised to show the impact of such changing conditions or requirements which have occurred or which have been under consideration since 1967 when project planning and funding stopped. The impacts cannot be reliably estimated until the Corps completes project design and planning studies--such as those on power marketing and transmission, power output, and environmental effects--and reaches an agreement with Canada concerning the project's design and operation.

The following sections describe the major unresolved conditions that could have an impact on the project's benefits and costs. We asked the Corps to estimate when these matters would be resolved and their impact on the project. Their comments have been considered in preparing this report and are included as appendix II.

Chapter 3 contains information on the economic and financial feasibility determination for the project, and chapter 4 contains information on the estimated construction cost of the project.

MARKETING AND TRANSMISSION STUDIES ARE NEEDED

Under the Flood Control Act of 1944, the Interior is responsible for marketing Federal power. The act states that preference in the sale of this power is to be given to public bodies and cooperatives. The Interior analyzes preference customer marketing arrangements and the transmission system which will transmit the power to these customers.

The Interior studies of electric power marketing and transmission, completed before 1967, formed the basis for the project transmission cost estimates of $78.8 million, which comprised about 26 percent of total project construction costs. The Interior identified the Boston area as the location likely to receive most of the project's peaking power and assumed Federal construction of transmission lines from Dickey-Lincoln to Boston--about 410 miles.

The marketing arrangements have not been analyzed since about 1968 and the last transmission design analysis was done in 1966.

Transmission facilities

From 1966 when the transmission system was designed, until recently, the cost estimate had been based on the assumption that the Federal Government would construct the transmission lines from Dickey-Lincoln to Boston. Corps, Interior, and FPC officials now expect the transmission lines to be integrated with the since-established powerlines of NEPOOL, an organization of predominantly investor-owned utilities. This could reduce federally constructed powerlines but would probably mean paying NEPOOL for use of its transmission network. However, project transmission design, as well as the costs and benefits computations, continue to assume most of the peaking power will be transmitted over Federal lines to the Boston area.

Officials of FPC--a participant in the electric utility industry's regional reliability councils which encourage interconnection and coordination of power systems to assure the adequacy and reliability of electric power supply--told us that the existing project transmission design was no longer relevant, because of more recent developments, such as NEPOOL. They said that building a Federal line from Dickey to Boston could not be justified. According to FPC, the probable design would include building a line to connect to the existing industry network, and strengthening portions of existing industry lines.

The Interior told us that its present goal was to have industry construct and maintain any lines needed for the project.

According to Corps, Interior, and industry representatives, the Federal investment and annual costs for transmission facilities may vary depending on the agreements reached with NEPOOL; what new facilities would be required to integrate with its system; and whether new additions would be federally or privately built and financed. The effect of such changes on the project's costs and operation needs to be studied.

Integration of the transmission system with industry could effect some savings in initial Federal investment. However, the annual transmission costs used in benefit-cost and repayment analyses could become higher than the current Corps estimates because industry normally seeks to recover

its investment over a shorter period and at higher rates of return than does the Federal Government.

The current Corps estimate includes one-half ($3.06 million) of the annual transmission costs in the benefit-cost and repayment analyses. The Corps' justification is that half the costs can be recovered through charges to utilities for sharing the use of federally built transmission lines when not fully utilized for Dickey-Lincoln or by limiting the construction of Federal transmissions to that required to connect with industry lines. However, the Corps did not have any documentation to support the basis of the 50-percent reduction and said that the estimate was a judgment based on Corps experience.

In February 1975 Corps and Interior officials met to discuss restudying the marketing of the project's power, including determining preference customer demands and whether power can be distributed over the industry transmission system. Interior officials agreed to make the studies soon if the Corps provided the funds. The officials told us that the Interior would not request such funds until the Secretary of the Interior officially decided to support the project. On April 15, 1975, the Interior furnished the Corps with its funding estimate.

The Corps said that the marketing and transmission studies must be completed in time for their results to be included in the draft EIS scheduled for completion in July 1976. As of May 14, 1975, the Corps and the Interior had not reached agreement on the scheduling of the studies.

Marketing of peaking power

In the March 1968 hearings held before the Subcommittee on Public Works, House Committee on Appropriations, the Interior presented a list of public utilities in New England that projected peaking power needs they would like met by Dickey-Lincoln. These requirements would consume a large part of the project's peaking power output. The Interior, however, has not specified the customers to whom it expects to sell the power. According to Corps and Interior officials, this probably will not be done until the project is under construction since this is Interior's normal practice in marketing power.

To determine the likelihood of marketing project peaking power to preference customers in Massachusetts and other States in New England, we obtained power demand projections for 1985 from FPC and from a study prepared for NEWEC. The projections show that Maine, New Hampshire, and Vermont

preference customer requirements would total about 150,000 kilowatts of a total project peaking power capacity of about 725,000 kilowatts, excluding consideration of transmission losses. Maine accounts for only about 75,000 kilowatts. Thus the balance could be available for preference customers in Massachusetts, Connecticut, or Rhode Island.

POWERPLANT DESIGN AND OPERATING PLAN NEEDS STUDYING

Power studies determine the project's power-generating capability and are the basis for power benefit computations. Therefore the project's power benefits and costs could be affected by the outcome of new power studies.

The power studies, which have been undertaken by the Corps, will determine the feasibility of adding a pumped storage feature which would replenish the main reservoir by pumping back water releases to obtain increased power capability at the project and to analyze the project's operational characteristics and power output based on future New England power demand data.

The Corps said that it was too early to define the magnitude of project cost increases for adding a pumped storage feature but that additional features would not be added to the project without being incrementally justified.

The results of the power studies will be summarized in a Hydropower Design Memorandum scheduled for completion in March 1976. This memorandum will provide basic information on the number, type, and size of units comprising the project's power installation.

After the approval of the power studies and the GDM Supplement, powerplant design studies will be initiated. The preliminary design for the powerplant will be completed by May 1977.

The power studies are also important to the Canadians. The New Brunswick Province has been vitally concerned with the operation of the project since its inception, according to the Corps, because of the Province's three downstream hydroelectric facilities. Officials of Canada's New Brunswick Electric Power Commission also have an interest in the project and would like the project operation viewed from a basinwide perspective to maximize total power output.

The Corps stated that, until specific data is developed through various power studies within the New England Division, no logical system evaluations of the project's

impacts on downstream plants can be made. The Corps added that once an initial basic plan is established as economically and environmentally sound, it can be used as a point of reference for further studies with the New Brunswick Electric Power Commission. The Corps said it was impossible to make firm determinations of the related impacts on benefits and costs.

ASSESSMENTS OF SOCIAL, ECONOMIC, AND ENVIRONMENTAL IMPACTS NEEDED

Legislation passed since 1967, including the National Environmental Policy Act of 1969 (42 U.S.C. 4332) and section 122 of the River, Harbor, and Flood Act of 1970 (Public Law 91-611) require the Corps to prepare detailed studies of social, economic, and environmental impacts of proposed water resources projects.

The Corps has contracted with an environmental consulting firm for preparing a scope of work plan for the project's EIS. This is intended to identify all major environmental, social, and economic impacts of the project and to outline the work necessary to prepare the EIS. The scope of work plan is scheduled for completion in July 1975. The Corps said that the scope of work plan would be used as a planning guide for contracts to be awarded to evaluate specific impact areas identified by the plan as significant. A draft EIS is scheduled for completion in July 1976; a final EIS is scheduled for filing with the Council on Environmental Quality in April 1977.

Consideration of the environmental, social, and economic impacts, both beneficial and adverse, is necessary to to the Corps' planning and decisionmaking process. These impacts cannot be fully identified until the EIS work is completed.

Also, in accordance with section 313 of the Federal Water Pollution Control Act Amendments of 1972 (Public Law 92-500), the Corps must comply with Federal, State, interstate, and local requirements respecting control and abatement of pollution. This requirement could increase project costs. The water quality standards will require redesign of the water intake structures that carry water from the reservoir to the powerplant to permit drawing water from multiple levels, rather than at one level as envisioned in the 1967 project design. The Corps has not estimated the cost impact of this change. The water quality studies have been initiated by the Corps.

TREATY OR AGREEMENT WITH CANADA MUST BE NEGOTIATED

According to the Corps, a treaty or agreement with Canada on the project's design and operation must be negotiated before construction because the Dickey reservoir would inundate land in Quebec Province and would alter riverflows and thereby affect the operations of downstream hydroelectric dams in New Brunswick Province.

When funding ceased for the project in 1967, negotiations with Canada on land damages and design and operation of Dickey-Lincoln had reached the draft treaty stage. The Corps held preliminary discussions with Canadian utility officials in September 1974 and said they planned to request the Department of State to reopen negotiations with Canada.

Corps officials said that, in the preliminary discussions, Canadian representatives expressed several ideas on the Dickey-Lincoln project's design and operation that differed from the 1967 plan. These ideas ranged from changes in the pattern of water releases from the project to inclusion of a new capability for pumped storage.

Changes in the project's design and operation could have an impact on the project's costs and benefits. It was not practical at this time to identify changes which might be made to reach an agreement with Canada, the Corps said.

RECREATION BENEFITS NEED REFORMULATING

In accordance with Senate Document 97 (87th Cong., 2d sess.), Supplement No. 1, recreation benefits for water resource projects are computed by estimating annual recreation attendance during the life of the project and by assigning a dollar value for each visit. The dollar value of a recreation visit is based on implied willingness to pay.

Recreation benefits were added to the project in February 1969. The recreation benefit is a preliminary estimate of general recreation, hunting, and fishing activities. The Corps indicated that the project will receive and support an average annual use of about 833,300 recreation days at a unit value of $1.50 per recreation day, amounting to $1,250,000 annual benefits. Due to the location and accessibility of the project, a major portion of visitors were expected to come from Canada. The Corps told us there was no supporting documentation available for the recreation days and choice of the unit value used.

The benefits have not been updated since the original estimate. The Corps told us that the amount of recreation benefits would be reformulated and presented as a Recreation Resource Appendix to the GDM Supplement.

CONCLUSIONS

The results of the studies for resolving the changing conditions and requirements concerning power marketing and transmission, powerplant design and operation, and environmental matters could alter the planned project's design, operations, benefits, and costs. We believe the Corps should resolve these matters during its review process for the GDM Supplement so that the project changes and their impact on the project's benefits and costs can be reasonably estimated and reported to the Congress for its evaluation of future appropriation requests.

When major uncertainties exist that could affect the project's benefits and costs, the Corps should describe, both in the GDM Suppplement and in its budget documents submitted to the Congress, alternative plans which are being considered and their potential impact on project costs and benefits. For example, if agreement on project design and operation has not been reached with Canada, the Corps should present the Canadian position along with a discussion of plans to resolve the differences and the probable impact of such plans on the project's benefits and costs.

CORPS COMMENTS

We discussed this report with Corps officials who told us that the unresolved matters were being studied as part of their normal preconstruction planning and design procedures.

The Corps told us also that the annual budget hearings before the respective congressional Appropriations Subcommittees would continue to be the vehicle by which Congress is informed of progress on the project. However, should changes occur during the year which result in a major impact on the project--for example, a major increase in project cost; a major change in scale of the project, its features, or benefits--a letter would be written to the House and Senate Committees on Public Works and Appropriations explaining the significant change and its impact on the project.

Also, we were told that the updating procedures would vary, depending on the status of preconstruction planning. As a minimum, the cost estimate and benefits would be updated annually utilizing price level indexes. The power

values for use in determining power benefits would continue to be updated annually, predicated on the operational scheme available at the time of analysis. As planning progresses and changes are incorporated into the project plan, the effect of these changes on the project cost estimate and benefits, if applicable, will be shown. The latest available data would be included in the economic data provided to the Appropriations Subcommittees commensurate with required submission dates for budgetary data.

The schedule below summarizes the Corps' expected dates of completion for studies on the unresolved project matters.

	Responsible agency	Expected completion
Marketing and transmission studies	Interior	(Must be completed for inclusion in draft environmental statement--July 1976)
Power studies	Corps	March 1976
Preliminary powerplant design	Corps	May 1977
EIS	Corps	Draft: July 1976 Final: April 1977
Treaty or agreement with Canada	State Department	(a)
GDM Supplement, including Recreation Resource Appendix and a reanalysis of unit prices	Corps	July 1976

a/Must be completed before construction begins.

The above events will be summarized in the GDM Supplement, except for the preliminary powerplant design.

CHAPTER 3

PROJECT ECONOMIC AND FINANCIAL FEASIBILITY

Proposed Federal water resources projects are tested for economic feasibility through benefit-cost analyses to determine whether total project benefits exceed total project costs. Another economic test made by the Corps is the comparability one which provides that the separable hydroelectric costs should be less than the costs of the most likely alternative means of providing equivalent service in the absence of the project, evaluated on a basis of taxes, interest, and other financial factors comparable with the determination of project costs. In addition, hydroelectric power projects like Dickey-Lincoln are tested for financial feasibility through repayment analyses to determine whether the project costs attributable to producing power can be recovered through sale of the power.

ECONOMIC FEASIBILITY

In making its economic feasibility analysis for Dickey-Lincoln, the Corps followed Senate Document 97 which contains the governing criteria for formulating and evaluating plans for water resources projects. Although Senate Document 97 has been superseded by the new principles and standards issued by the Water Resources Council on October 25, 1973, the Corps continues to apply Senate Document 97, as permitted by Council procedures, to certain projects already authorized, including Dickey-Lincoln.

The Corps' estimated July 1974 benefit-cost ratio for Dickey-Lincoln was 2.63 to 1, based on annual benefits of $50.6 million and annual costs of $19.2 million.

As provided by Senate Document 97, power benefits should represent the value of power to the users as measured by the amount that they should be willing to pay for such power. The usual practice is to measure the benefit in terms of the cost of providing the annual amount of power available from the project by the most likely alternative means that would exist in the absence of the project. This cost is obtained by using power values provided by FPC and certain Corps estimates. (See p. 18 for the computations.) The annual power benefits for Dickey-Lincoln are $44.919 million.

The downstream power benefits of $3.5 million annually are estimated values of increases in power production at downstream Canadian dams due to the project's regulation

of streamflow. They comprise 6.9 percent of the project's benefits. A draft treaty prepared in 1966 provided that the United States and Canada would each receive half of the value of the total increase in downstream power.

Whether the United States receives any benefit from the increased Canadian power production will depend on the treaty or agreement the two countries sign. We were unable to review the downstream benefit estimate because supporting documentation for the values was not available.

The economic costs of a project with power usually are expressed as an equivalent annual charge, consisting of interest on the investment, amortization of the project investment in 100 years, and operation and maintenance, including major replacements and repairs. Appendix III provides a detailed discussion of how the annual benefits and costs were derived.

Selection of most likely alternative means

The Corps has relied on FPC to determine the most likely alternative power sources and to estimate the costs of constructing and operating the alternatives.

Based on Interior's 1967 determination to market most of the project's power in the Boston area and some in Maine, the FPC assumed that the alternative generating capacities would be operated by investor-owned utilities. FPC valued project power based on such utilities' costs to provide similar power using oil-fired generators.

The FPC in 1974 established the alternatives to Dickey-Lincoln as oil-fired, steam-generating plants to supply intermediate-duration demands in Maine and gas turbine generators to supply short-duration peaking demands in the Boston area. Most gas turbines are run by the expanding gases created in the burning of fuel oil. Fuel oil costs accounted for about 52 percent of the cost of the most likely alternative used in computing the power benefits in July 1974 for Dickey-Lincoln.

Because the benefit-cost comparison for Dickey-Lincoln was based on a project life of 100 years, the power benefit estimate is based on the expectation that industry would continue to use, for the same period, gas turbine and oil-fired steamplants as the most likely sources for future peaking and intermediate power demands.

FPC officials explained that power values are based on a straight-line projection of current costs and practices,

because it is not their function, in developing power values, to speculate on future developments. They did note, however, that they would expect fuel oil to become more expensive in the future.

Gas turbines alternatives--Boston area

NEPOOL and MMWEC officials corroborated FPC's selection of gas turbine generators as the most likely alternative source of peaking power for the Boston area in the absence of Dickey-Lincoln. The rationale for this selection is described below.

From 1968 tnrough 1972 FPC considered a pumped storage hydroelectric project as the likely alternative to supply peaking power. In 1973 this selection was changed to gas turbines because of lower construction costs and difficulties in obtaining licenses for pumped storage projects due to concerns for adverse environmental impacts. NEPOOL representatives noted the following reasons for currently favoring gas turbines over pumped storage.

--Unexpectedly high construction cost experiences on two recent pumped storage developments.

--Difficulties in raising capital.

--Failure to install sufficient amounts of nuclear-generating plants that could provide low-cost pumping energy to fill the reservoir for such projects.

Other common sources of peaking power, besides pumped storage and gas turbines, are diesel units and conventional hydroelectric installations. There are, however, according to FPC, no remaining undeveloped hydroelectric sites of major size in New England aside from Dickey-Lincoln. Diesel units generally are not used on large power systems to supply powerloads because available sizes are too small. Additionally, industry plans for future installations do not show a great amount of diesel or hydroelectric capacity.

Thus the selection by FPC of the only remaining viable alternative--gas turbine generators--has a reasonable basis.

Oil-fired steamplant alternative--Maine

FPC's selection of an oil-fired steamplant designed to meet intermediate-duration demands in Maine is supported by industry plans and practices.

Traditionally, intermediate-duration demands have been supplied using older, less-efficient oil-fired steamplants. Recently, however, industry has begun installing oil-fired steamplants specifically designed to serve intermediate-duration loads. A NEPOOL-member utility has installed several such intermediate plants since 1972, and a Maine utility is planning one for installation in an area which may receive Dickey-Lincoln power.

A 1971 NEPOOL study of the economics of Dickey-Lincoln assumed an intermediate oil-fired steamplant to be a logical alternative to Dickey-Lincoln intermediate-duration hydroelectric power. Also, an Interior official suggested such a plant as an alternative for intermediate-duration hydroelectric power.

Estimated costs to provide power by alternative means

The value of power from the most likely alternatives to the project was estimated in "capacity values" and "energy values." Capacity value represents the annual fixed costs to private utilities of making available 1 kilowatt of generating capacity. The energy value represents costs per kilowatt-hour, including fuel costs, which vary with energy output.

The total value of power benefits generated at Dickey and Lincoln School Lakes dams was computed by combining FPC's estimated power values, Corps estimates for the project's generating capacity and average annual energy production, and with estimates of losses incurred in transmitting the power to customers. The July 1974 computations are shown in the following table.

	FPC power value		Transmission loss factor		Project capacity and energy output		Total
Gas turbine generators--Boston area:							
Capacity	$18.50/kw/yr.	X	.905	X	725,000 kW	=	$12,138,000
Energy	3.0¢/kwh	X	.929	X	782 million kWh	=	21,794,000
							33,932,000
Oil-fired steamplant--Maine:							
Capacity	$57.00/kW/yr.	X	.95	X	135,000 kW	=	5,686,000
Energy	1.5¢/kwh	X	.95	X	372 million kWh	=	5,301,000
							10,987,000
Total:							
Capacity	-		-		330,000 kW		17,824,000
Energy	-		-		1,154 million kWh		27,095,000
Total							$44,919,000

FPC developed the fixed and variable costs for power values from historical data reported to them by utilities and from industry projections of costs for construction of planned facilities. In the case of the gas turbine generators and oil-fired steamplants, investor-owned utilities have built many plants of these types.

Our review of selected cost data used by FPC to determine the power values showed that this data was supported by operating and financial data reported to FPC by utilities and by representative costs we obtained through discussions with utility representatives. Appendix III discusses the major cost items used to establish the power values.

Federal interest rate of 3-1/4 percent

Construction costs for a project are mostly incurred before the project is put into operation. Benefits, however, are realized over the operating life of the project.

To make a valid comparison of benefits and costs, the Corps must reduce the benefits and costs to a common-time basis, either by discounting to present dollar value or by some equivalent method. The Corps' preferred method for placing benefits and costs on a common-time basis is by deriving equivalent annual values.

The interest (or discount) rate to be used in evaluating costs and benefits has been set annually since fiscal year 1968 by the Water Resources Council. The formula used to establish the annual rates is based on the average yield (during the preceding fiscal year) of interest-bearing, marketable U.S. securities which have terms of 15 years or more remaining to maturity, provided that in no event shall the rate be raised or lowered by more than one-quarter of 1 percent in any year. The interest rates since fiscal year 1968 have been:

Fiscal year	Rate
1968	3-1/4
1969	(a)
1970	4-7/8
1971	5-1/8
1972	5-3/8
1973	5-1/2
1974	5-5/8
1975	5-7/8

a/3-1/4 percent in effect to December 24, 1968; 4-5/8 percent in effect for remainder of FY 1969.

The Water Resources Development Act of 1974 (Public Law 93-251, Mar. 7, 1974) contains a clause which freezes the interest rate for certain projects when local assurances for cost sharing were furnished before December 31, 1969. Section 80(b) of the act states that:

> "In the case of any project authorized before January 3, 1969, if the appropriate non-Federal interests have, prior to December 31, 1969, given satisfactory assurances to pay the required non-Federal share of project costs, the discount rate to be used in the computation of benefits and costs for such project shall be the rate in effect immediately prior to December 24, 1968, and that rate shall continue to be used for such project until construction has been completed, unless otherwise provided by a statute enacted after the date of enactment of this Act."

In the case of Dickey-Lincoln, the project benefit which requires cost sharing is recreation. The Federal Water Project Recreation Act (16 U.S.C. 460ℓ-13) requires a non-Federal public entity to bear one-half of the separable construction costs of the project allocated to recreation and to bear the full cost of operating and maintaining the recreation facilities. In compliance with the act, the Governor of Maine, in a letter dated February 24, 1969, certified assurance of the capability and willingness of the State of Maine to provide the required local cooperation and reimbursement. Therefore, consistent with the requirements of the Water Resources Development Act of 1974, the Corps is using 3-1/4 percent as the Federal interest rate in its benefit-cost analyses.

The benefit-cost ratio can be greatly affected by the interest rate used in the economic analyses. In 1974 the Corps computed the impact on the benefit-cost ratio if the fiscal year 1975 rate of 5-7/8 percent, or the 6-7/8 rate proposed by the Water Resources Council's October 1973 principles and standards, had been used in the economic analysis.

A comparison of the benefit-cost ratio at the different interest rates follows.

Interest rate (Percent)	Benefit-cost ratio
3-1/4	2.6 to 1
5-7/8	1.5 to 1
6-7/8	1.3 to 1

COMPARABILITY TEST

The Corps, in accordance with Senate Document 97, made a comparability test for the project. Corps officials make this test on all hydroelectric power projects. The test requires that the separable hydroelectric power costs should be less than the costs of the most likely alternative means of providing equivalent power in the absence of the project, evaluated on a basis of taxes, interest, and other financial factors comparable with the determination of project costs.

The Corps' comparability test showed annual project costs of $19,243,000 and alternative costs of $41,276,000, resulting in a ratio of 2.1 to 1 in favor of the project. This indicates that, if alternatives could be built at a 3-1/4 percent interest rate and tax-free status similar to the project, the cost of providing power from the alternatives would exceed project cost by about 2 to 1. (See app. IV for the Corps' computation.)

Although the Corps used the total economic cost for the project cost, rather than just the separable hydroelectric power costs, and included a tax component in the project cost, this did not affect the outcome of the test. If corrected, the test would have been favorable to the project by a slightly greater margin. The questionable 50 percent reduction in annual transmission costs, discussed in chapter 2, was also applied in this test. Without this 50 percent reduction, the annual project costs used in this test would have been $3.06 million, or about 16 percent, higher than the Corps' reduced figure. The outcome of the test would still be favorable to the project if the full amount were included.

FINANCIAL FEASIBILITY

In addition to the economic analysis, hydroelectric power projects, like Dickey-Lincoln, are tested for financial feasibility through repayment analyses. These analyses determine whether the project costs attributable to producing power can be recovered through sale of the power.

Section 5 of the Flood Control Act of 1944 (16 U.S.C. 825s) requires the Secretary of the Interior to market electric power from Federal projects at rates sufficient to recover power production and transmission costs, including amortization of capital investment with interest over a reasonable period which has been administratively set at 50 years.

To meet this requirement, the Interior makes repayment analyses to determine the costs that must be recovered and to determine whether recovery of such costs can reasonably be expected through sale of the power. At the time of suspension of project funding in 1967, the Interior had made repayment analyses for Dickey-Lincoln and concluded that project costs allocable to power--about 96 percent--could be recovered through sale of project power over 50 years. Since then, the Corps has made the repayment analyses which show that the project is financially feasible.

The New England Division's 1974 repayment analysis showed project costs attributable to producing power could be recovered through the sale of the power. The New England Division, in making the 1974 repayment analysis, used an interest rate of 5-7/8 percent to determine the financial costs allocable to power. The Interior had, however, directed the use of 6-1/8 percent for fiscal year 1975 project planning. New England Division officials agreed and recomputed the repayment analysis using 6-1/8 percent. The recomputation showed that project costs attributable to producing power still could be recovered through sale of the power.

CHAPTER 4

CONSTRUCTION COST ESTIMATES

The Corps' July 1974 construction cost estimate of $521.8 million was based on the 1967 estimate updated for price escalation to July 1974 prices. A comparison of the 1967 and 1974 cost estimates is shown on the following page. The 1967 cost estimates for Dickey-Lincoln were based on historical data, labor and equipment rates, and manufacturers' and equipment suppliers' quotes. The 1974 cost estimate was developed by applying construction cost indexes annually to the cost categories of the 1967 estimate.

In our analysis of the Corps' bases for estimating the major items in the 1967 estimate, we looked at cost estimates for excavation and fill, powerplants, and transmission facilities. These items accounted for about 79 percent of project costs, excluding contingencies and indirect costs.

Our analysis, however, was hampered because Corps personnel had not been involved with Dickey-Lincoln planning for 7 years, except for annual updating by price indexes, and key estimators responsible for the 1967 estimates have either retired or left the Corps. This made it difficult, in some cases--particularly with excavation and fill costs--to determine the estimators' assumptions and reasoning and data sources where supporting documentation could not be located. We were therefore unable to reach a conclusion on the overall accuracy of the 1967 estimate. We did find that the Corps' estimate of dam costs was overstated by about $4.26 million because the indexes had not been correctly applied.

The 1974 Corps cost estimates have not been revised to show the impact of changing conditions or requirements which have occurred or which have been under consideration since 1967 when project planning and funding stopped. These matters are discussed in chapter 2.

After we completed our audit work, an engineering firm, under contract with the Corps, completed an estimate of the dam portion (about 84 percent of project costs, excluding transmission) of the project's cost, based on the 1967 design and conditions. The estimate for January 1975 costs was about $7 million, or 2 percent, below the Corps' estimate for the same items updated to January 1975 prices using indexes.

Comparison of Cost Estimates

1967 and 1974

	1967		1974		1967-74	
	Amount (000 omitted)	Percent	Amount (000 omitted)	Percent	Amount of increase (000 omitted)	Percent of total increase
Dams:						
Excavation and fill	$ 64,040	21.6	$117,099	22.4	$ 53,059	23.6
Powerplants	63,417	21.3	109,164	20.9	45,767	20.4
Lands, damages, relocation, and clearing	22,644	7.6	31,004	6.0	8,360	3.7
Other	26,760	9.0	57,452	11.0	30,692	13.7
Total	176,861	59.5	314,739	60.3	137,878	61.4
Contingencies	20,039	6.7	35,361	6.8	15,322	6.8
Engineering, design, and administration	21,500	7.3	37,900	7.3	16,400	7.3
Project costs excluding transmission costs	218,400	73.5	388,000	74.4	169,600	75.5
Transmission:						
Transmission facilities	53,905	18.1	-	-	-	-
Contingencies	11,775	4.0	-	-	-	-
Administrative and general	13,140	4.4	-	-	-	-
Transmission costs	78,820	26.5	[a]133,820	25.6	55,000	24.5
Total project costs	$297,220	100.0	$521,820	100.0	$224,600	100.0

a/Interior's July 1974 estimate for tranmission was provided in total only.

EXCAVATION AND FILL

Costs for earth and rock excavation and filling operations consist of quantity estimates multiplied by cost estimates per unit of material. Quantity estimates are based on the design dimensions for the project dams and topography of the sites. The 1967 cost estimate for excavation and fill was $64.0 million, exluding contingencies.

The lack of documentation and the absence of the estimators to explain the basis or to verify many assumptions and figures used to compute unit costs made it impracticable for us to verify the prices. Therefore, and because the Corps was planning to contract for a new estimate of unit prices in early 1975, we did not review the 1967 estimates further.

POWERPLANTS

Powerplants for the Dickey and Lincoln School dams consist of powerhouse structures, turbines, generators, switchyards, transformers, and associated equipments.

The 1967 cost estimate for powerplants, excluding the excavation and fill portion and contingencies, was $63.4 million--$52.4 million for Dickey and $11 million for Lincoln School--and was based on an estimate prepared by the Corps' North Pacific Division. The North Pacific Division had developed the estimate with a computer-adapted program or model used to project relationships between powerplant costs and key design parameters. According to North Pacific Division officials, cost input for the program was taken from low bids for 11 power projects in the northwest and manufacturers' price catalogue data.

Both North Pacific Division and Interior officials said that estimates obtained by this method were normally used in deciding among alternative designs before project authorization and that a more exact estimate should be developed in the postauthorization stage.

The Corps chose to use North Pacific Division's 1967 powerplant estimate over a higher Interior estimate that had been used previously. Estimators' notes in the project files indicate that the Corps felt the North Pacific Division's estimate was more up to date. However, documentation was not available in the Corps' files to support this judgment or to provide a basis for making a thorough analysis of the total powerplant cost estimate.

TRANSMISSION SYSTEM

The 1967 estimated cost of the transmission system for Dickey-Lincoln was prepared by the Interior. The estimate of $53.9 million, exluding contingencies and administrative and other costs, assumed construction of a federally financed 410-mile transmission system from the project to Boston. Except for an underestimate of the cost for capacitor stations, we did not find any discrepancies in the 1967 estimate.

In developing its estimate, the Interior made

--a survey of the proposed location of transmission facilities, including aerial reconnaissance, discussions of transmission construction with utilities experienced in the locale, and a study of foundation geology in the area;

--a design analysis to determine the types, sizes, and quantities of transmission equipment needed, such as poles, lines, insulators, and other hardware; and

--a pricing analysis which applied unit prices to the equipment requirements set out in the engineering design study and which included prices for land rights-of-way and clearing and costs to erect the transmission poles, lines, and hardware.

We reviewed the bases and computation accuracy for major cost items in Interior's transmission estimates. Of the $53.9 million, about $37 million was for towers and conductors which were developed in considerable detail using bid abstract data and supplier quotes.

Series capacitor stations, according to Interior officials, were estimated at $1.2 million using best judgment because the Interior lacked cost experience. Subsequent Interior experience has shown that the cost of the two stations were underestimated. An Interior official estimated for us in November 1974 that the capacitor stations would cost a total of about $3.9 million instead of about $1.9 million in the 1974 cost estimate.

Interior officials said that a restudy of the system was needed and would probably change the design somewhat and the related costs. They cited, as examples, the probable use of steel towers instead of wooden poles and the following of ground contours rather than straight paths, in

accordance with environmental concerns. These officials could not estimate the cost impact of such design changes.

APPLICATION OF COST INDEXES

The Corps' dam estimate was overstated by $4.26 million, or 1.2 percent, because it applied cost indexes improperly.

Corps officials said that, lacking funding to reanalyze project costs after 1967, the Corps used construction cost indexes to cover the rise in project dam and reservoir costs during the 1967-74 period.

The cost indexes used included:

--The Department of the Interior, Bureau of Reclamation's "Construction Cost Trends," which were based on Reclamation's cost experience on similar projects and other relevant data.

--Handy-Whitman Public Utility Cost Indexes for hydroelectric generation plant construction.

Both indexes are suggested for use in the Corps' cost estimating manual and appear in Engineering News Record, an industry periodical. FPC officials used these same indexes in estimating cost increases for their purposes.

The Corps used the Reclamation indexes to estimate the overall increase in construction costs and used the Handy-Whitman indexes to estimate the relative movement of prices in New England, compared to the price change in the geographic area covered by Reclamation indexes.

Reclamation, which prepared the estimate for transmission costs for the 1967 GDM, also updated the transmission costs for the Corps using the Reclamation indexes.

The Corps used Reclamation's indexes adjusted for geographic differences applying them annually and rounding totals. The Corps applied each incremental annual increase in the indexes to the preceding year's updated, rounded cost. Interior officials, responsible for maintaining the indexes, said that the proper way to use the indexes was to apply the total incremental increase in the indexes, since the base year, to the base year's costs.

The Corps, by not following Interior's procedure for updating, overstated the dam estimate by $4.26 million or

1.2 percent. The Interior, in updating transmission costs, followed the proper procedure.

ENGINEERING FIRM ESTIMATE OF DAMS AND RESERVOIRS COSTS

Although the project design and cost estimates have not yet been restudied to assess impacts due to changed conditions since 1967 (see ch. 2), a reestimate of a portion of project costs was done early in 1975 by an engineering firm under contract to the Corps. This price estimate was based on the 1967 design and conditions.

The engineering firm estimate made at January 1975 prices, covered the majority of dams, powerplant, and reservoirs costs, or about 84 percent of project costs, excluding transmission costs. The firm's estimate of $350.7 million was within 2 percent of the Corps' estimate of $357.7 million for the same items, updated to January 1975 prices using indexes.

The engineering firm's estimate was published after we completed our fieldwork and was not covered in our review.

CONGRESS OF THE UNITED STATES
HOUSE OF REPRESENTATIVES
MICHAEL J. HARRINGTON
FOREIGN AFFAIRS COMMITTEE

B-181837

July 15, 1974

The Honorable Elmer Staats,
Comptroller General
General Accounting Office
441 G Street, N. W.
Washington, D. C. 20548

Dear Mr. Staats:

Last month, the House of Representatives approved an $800,000 appropriation for preconstruction planning of the Dickey-Lincoln hydroelectric project in Northern Maine.

During the course of the debate, numerous questions were raised regarding the costs and benefits of the project, both economic and environmental. While the Army Corps of Engineers' analyses indicate that the dam is economically justified, the accuracy and completeness of these analyses were questioned by a number of Members and environmental groups.

In order to resolve the issue, we would appreciate it if the General Accounting Office would conduct its own study of the economic costs and benefits of the project, including the environmental costs associated with the construction of the dam.

Dickey-Lincoln has been discussed and debated for ten years. If it is economically and environmentally justified, construction should proceed without delay. If the costs of the dam exceed its benefits, then it should be terminated. Only a completely impartial analysis of the project can resolve the issue to the satisfaction of both the supporters and opponents of the project.

Yours sincerely,

Michael J. Harrington
Member of Congress

Silvio O. Conte
Member of Congress

MJH:msw

APPENDIX II

DEPARTMENT OF THE ARMY
OFFICE OF THE CHIEF OF ENGINEERS
WASHINGTON, D.C. 20...

REPLY TO
ATTENTION OF:

DAEN-CWE-B

20 February 1975

Mr. Harold Pichney, Assistant Director
United States General Accounting Office
Washington, D.C. 20548

Dear Mr. Pichney:

This is in reply to your recent letter requesting my views on certain matters pertaining to the Dickey-Lincoln School Lakes projects in the State of Maine.

I have attached a detailed response to your questions which is organized in the same sequence and format as that of your letter. I hope the information provided therein is satisfactory.

Sincerely yours,

W. C. GRIBBLE, JR.
Lieutenant General, USA
Chief of Engineers

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as

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DETAILED RESPONSE TO QUESTIONS RAISED IN JANUARY 1975 GAO LETTER

The response furnished in the following paragraphs are in the same sequence as presented in your letter. The major discussion items are also identified consistent with your format. For items (2) through (5) the comments include, when possible, a plan and relative time-table for resolving the referenced items as requested. An assessment of possible and probable impacts on the project of the items cited is not feasible at this time.

A seven year layoff is a significant lapse of time - particularly during this era of rapid change. The complexities of a project the size of Dickey-Lincoln School Lakes are formidable and are compounded by the introduction of new personnel. Project development should be viewed as a continuing process conducted within the framework of revised water resource policies, updated engineering criteria, environmental concerns, high power and energy needs, and a broad spectrum of coordination. All of these factors can cause or contribute toward project modifications or adjustments. These changes can only be identified, however, as preconstruction planning proceeds and the complex interrelationships of these influencing factors have time to surface. Preliminary activity was initiated on the project in September 1974 under continuing obligational authority pending the President's review of the FY 1975 Appropriations Act and its inflationary effect. The FY 1975 funds were allotted in early November 1974 and full scale activity was resumed at that time.

The context of the following remarks should be viewed within the benefit of this short time frame.

(1) REVISED PRICE ESTIMATE FOR THE 1967 DESIGN

-- A contract was awarded in January 1975 to Stone and Webster Engineering Corporation, a large engineering firm with extensive experience in the construction of hydroelectric facilities, to provide an estimated construction cost for specific project features included in the General Design Memorandum (GDM) dated May 1967. The estimate will be based on 1 January 1975 price levels. The specific items to be updated include: (a) reservoir clearing; (b) construction of the Dickey and Lincoln School dams consisting of embankment placement; outlet works, spillway, penstocks and headworks; (c) construction of the three saddle dikes and (d) construction of the power plants at each site including the powerhouses, turbines, generators, governors, switchyards and all ancillary electrical and mechanical equipment.

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These major items comprised about 84% of the total project cost included in the 1967 GDM. The remaining items consist of engineering and design and supervision and administration (10%); lands and damages (4%) and miscellaneous construction features (2%) such as relocations, access roads, recreation facilities, permanent operating equipment and housing and service facilities. The updated estimate for lands will be accomplished by contract and by in-house forces. The update for the timberlands segment of real estate costs will be accomplished by contract with an expert firm knowledgeable in timber appraising within the State of Maine. The remaining real estate costs are being reviewed in-house and will be based on recent sales data for the area. The miscellaneous construction items are minimal and are not susceptible to firm definition. Price escalation will be applied to these items. Design and supervision costs will be principally based on the current percentage of construction cost.

-- The manner in which succeeding updates of costs are conducted will depend upon the stage of preconstruction planning. If planning has not progressed to the point of revising project features then the annual update will be based on 1 October 1975 price levels. This estimate will be the result of the January 1975 repricing updated to October 1975 by using cost indices because design changes and related estimates will not have been completed by that time. The next significant reanalysis of unit prices will be conducted during the preparation of the Supplement to the General Design Memorandum which is scheduled for completion in July 1976. The project estimate will subsequently continue to be refined as Feature Design Memorandums for specific project components are completed. The most detailed estimate, however, is developed in conjunction with the preparation of contract plans and specifications. For a project the size of Dickey-Lincoln School Lakes, the total project cost could, at some point in time, be updated concurrently by a combination of cost indices, feature design memorandums and contract plans.

(2) UPDATING PROJECT DESIGN

-- All of the project components will be re-analyzed for the GDM Supplement consistent, of course, with the degree of accuracy inherent in the early stages of preconstruction planning. Two major areas are currently being addressed namely the requirement for multi-level discharge capability in the interest of water quality and the feasibility of modifying the project to include pumped storage generating facilities.

The project design does not currently include multilevel discharge capability. Water quality studies have been initiated to identify the various levels within the proposed impoundment at which withdrawal may be required. It is anticipated that by mid-1975 studies will have reached a point at which reasonable determinations can be made. This schedule is predicated on the applicability of available mathematical modeling

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techniques to the project. Should physical models be required the study period would be extended. As soon as the required levels are defined, redesign of the power intake facilities and possibly the diversion tunnel will be required. Engineering layouts of various schemes to accommodate the water quality features should be completed by the end of 1975. It is impossible at present to cite the relative impact of this change on the project cost although it would appear to be minor relative to the total project cost.

The feasibility of including pumped storage was going to be examined at the time earlier preconstruction planning activity was terminated. Our current studies will evaluate the economic feasibility of adding reversible units to obtain increased power capability at the site. The pumped storage aspect would also enhance the project's operational flexibility. The power studies should be essentially firm by the Fall of 1975. Again it is too early to define the magnitude of project cost increase. However, additional units would not be added to the project without being incrementally justified. Accordingly any increase in project cost would have to be offset by increased power benefits.

Other activities such as the investigation of construction materials, reanalysis of spillway design flood and diversion hydrology to reflect hydrologic events since 1967 and environmental considerations may also require design modifications. In essence the individual project components will be evaluated within the totality of the project and changes incorporated in the GDM Supplement to assure the most economical project consistent with its functional integrity. The GDM Supplement is scheduled for a July 1976 completion.

-- Power studies have been initiated. The NED is presently awaiting New England projected power demand data for future years to be furnished by the Federal Power Commission (FPC). Computer simulation studies will be conducted similar to those performed in the earlier planning effort. The analysis will evaluate the project's output utilizing FPC load data and simulating 40 years of hydrologic record. In addition, as previously noted, pumped storage will also be considered. The study results will be summarized in a Hydropower Design Memorandum scheduled for submission in March 1976. This document will present the results of the power studies and provide basic information on the number, type and size of units comprising the project's power installation.

Subsequent to approval of the Hydropower DM and the GDM Supplement when project layout is reasonably firm, studies will be initiated on the power plant. These studies will be accomplished in two stages. Stage 1 entails preliminary design of the powerhouse to determine the most suitable type of structures and equipment. This preliminary design stage is culminated in a document entitled Preliminary Design Report (PDR) which serves as

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the basis for proceeding with Stage 11 work. The PDR for Dickey-Lincoln School Lakes is scheduled for completion in May 1977. Stage 11 consists initially of preparing feature Design Memorandums, including drawings, which detail the power plant structure, equipment and development of the site. Subsequent to approval of the Design Memorandum, Stage 11 proceeds into the preparation of construction drawings, specifications and estimates. Completion of Stage 11 is scheduled for FY 1980. With reference to impact on project cost it can be seen from the sequence outlined that estimates will be developed and refined through the various stages. No evaluation is possible at this time.

No meetings have been held to date with the investor owned sector of the New England Power Pool (NEPOOL). Accordingly there is no knowledge of NEPOOL's interest in "influencing the project." A Planning Committee of NEPOOL has conducted an independent study of the project. Its study concluded that the project's capacity would be "fully effective capacity to the interconnected New England System if it were dispatched in a peaking assignment during the 1985-86 power year." The study focused solely on the project's peaking capability and was based on the stringent criteria of loading the project after dispatching existing hydroelectric and pumped storage projects. No economic considerations were included in the investigation. Until NED's power studies are completed and coordination established with NEPOOL, through the Department of Interior, there is no basis for defining the need for added studies. It is felt, however, that the project will be inherently flexible enough to effectively fit within the NEPOOL system.

The Province of New Brunswick has been vitally concerned with the operation of the project since its inception because of the Province's three downstream hydro facilities. Representatives of the New England Division met with officials of the New Brunswick Electric Power Commission (NBEPCO) in September 1974. The purpose of the meeting was to inform the Commission that preconstruction planning was being resumed on Dickey-Lincoln School Lakes and to renew contacts following the seven year hiatus. The Commission representatives noted their continued keen interest in the project and desire that the operation of the project be viewed from a basin wide perspective to maximize total power output. No specific data were presented. Subsequent to the meeting, a 1967 preliminary draft report on the effects of Lincoln School operation on downstream New Brunswick power plants was forwarded to NBEPCO for its review and comment. The draft report had been completed during the late stages of the earlier planning activity and had not been seen by the Commission. The report basically reflects the impact of a 70 MW installation at Lincoln School in lieu of the previously planned 34 MW facility. The draft was forwarded in November 1974. No comments have yet been received.

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Until specific data is developed through various power studies within NED no logical system evaluations on downstream plants can be realized. Once an initial basic plan is established as economically and environmentally sound it can be used as a point of reference for further studies with New Brunswick should the need exist. In the interim as NED's studies are being developed, NED will maintain coordination with the NBEPCO. It is anticipated that by late 1975 meaningful determinations can be made. It is impossible at this time to make firm determinations of the related impacts on benefits and costs.

(3) DEPARTMENT OF THE INTERIOR'S MARKETING OF POWER AND TRANSMISSION STUDIES

-- The timing with respect to conclusively determining the recipients of project power has not yet been established. As noted in your letter the Interior Department has statutory responsibility for marketing the project's power. NED anticipates that Interior will not proceed with definitive marketing and transmission plans until construction of the project is underway and that prior to that time, only studies of sufficient depth to determine marketability in accordance with the principles of the 1944 Flood Control Act and evaluate the financial feasibility of the project will be performed.

Dickey-Lincoln School Lakes would be the first Federal power project in New England. There is no DOI marketing agency specifically responsible for the New England area. It is important that the Interior Department become involved in early discussions with NEPOOL, which is the mutual marketing vehicle of major New England utilities, and with potential customers. The NED had a preliminary meeting with the Regional Field Coordinator of Interior on 30 December 1974 to establish coordination with the appropriate personnel. A meeting with the Department of Interior Washington personnel has been scheduled for early February.

-- The entire question of transmission should be addressed in the early stages of preconstruction planning. The design and cost are functions of the scope of facilities required. The scope can now only be reasonably defined through Interior discussions with NEPOOL officials to explore the feasibility of common transmission facilities. A NEPOOL Planning Committee has recently completed a study of Dickey-Lincoln School Lakes transmission. This report will be made available to Interior for its review. The scope and alignment of the transmission lines will also have to be known to provide for a reasonable basis for an environmental assessment which will be included in the Environmental Impact Statement for the total project.

-- The major issue involved in the use of existing transmission facilities would appear to be determining the appropriate charges for the transmission of power over NEPOOL facilities. However, the Interior

Department in connection with their marketing responsibilities, most likely could provide better information in response to this question.

(4) ENVIRONMENTAL REQUIREMENTS

-- The EIS will address all significant environmental, economic and social impacts allied with the project. As an initial step, a contract is scheduled to be awarded in February 1975 to a consulting firm to prepare a comprehensive scope of work for the EIS. The contractor will be required to identify - through numerous interviews and extensive literary research - all significant project-induced environmental, social and economic impacts that should be discussed in the EIS. In addition methodology for measuring the various impacts will be recommended. The scope of work contract is scheduled for completion in July 1975. Using the scope of work as a planning guide, subsequent contracts will be let to evaluate specific impact areas identified as significant. A draft EIS is scheduled for completion in July 1976.

-- The GDM Supplement will be completed concurrently with the draft EIS. As presently envisioned the major impact areas will be discussed in summary form within the GDM Supplement. The in-depth discussions would reside in the EIS document.

(5) AGREEMENT WITH CANADA ON PROJECT'S DESIGN AND OPERATION

-- A letter has been drafted fo transmittal to the State Department requesting that negotiations be reopened with the Canadian government. The specific timing relative to negotiations will be within the purview of the State Department. The Corps is ready to provide technical assistance.

-- The major issues focus on the benefits to be derived at downstream Canadian plants within the Province of New Brunswick and the flooding of lands within the Province of Quebec.

-- It is impractical at this early stage to identify any changes that may be needed to reach an agreement with Canada. As previously noted the initial effort in power studies is to examine the feasibility of adding pumped storage and analyze the project's operational characteristics and power output based on future New England power demand data. These analyses will be evaluated in terms of environmental impact as well as influences on the downstream Canadian system. Until these studies are crystallized no alternatives, if needed, can be logically determined.

(6) OTHER MATTERS

-- The updating of the project cost estimate will be noted by the NED Division Engineer during his FY 1976 Budget testimony before the

APPENDIX II

Congressional Appropriations Subcommittees. The contract estimate mentioned will not be available until late March 1975. Preliminary indications are that the Division Engineer will testify in late February or early March 1975. He will note at that time that the estimate is being updated and a report will be provided the respective committees upon completion of the update.

-- The annual budget hearings before the respective Congressional Appropriations Subcommittees will continue to be the vehicle by which Congress is informed of progress on the project. However, should changes occur during the year which result in a major impact on the project -- for example, a significant increase in project cost; major change in scale of the project, its features or benefits - then a letter would be written to the Public Works and Appropriations Committees of Congress explaining the significant change and its impact on the project.

-- The updating procedures will vary dependent upon the status of preconstruction planning. As a minimum the cost estimate and benefits would be updated annually utilizing price level indices. The power values for use in determining power benefits would continue to be updated annually predicated on the operational scheme available at the time of their analysis. As planning progresses and changes are incorporated into the project plan, the effect of these changes on the project cost estimate and benefits - if applicable - will be reflected. The latest available data would be included in the economic data provided the Congressional Appropriations Subcommittees commensurate with required submission dates for budgetary data.

The scheduling of land acquisition and construction of the project is controlled by the timing of the Environmental Impact Statement. A draft EIS is scheduled for completion in July 1976 and a final EIS is scheduled for filing with the Council on Environmental Quality (CEQ) in April 1977. Under our present policy initial land acquisition or construction funds cannot be budgeted unless a final EIS is on file with CEQ by 1 January of the year preceding the budget fiscal year. Accordingly land acquisition and construction could not be budgeted until FY 1979. However, a capability to initiate these activities could be cited in FY 1978.

APPENDIX III

EXPLANATION OF ECONOMIC COST AND BENEFIT ANALYSIS

The Corps' July 1974 economic, or benefit-cost, analysis for the Dickey-Lincoln project is set forth below.

Annualized economic costs (note a)	Amount (000 omitted)	Percent of total
Interest on investment	$15,907	82.6
Amortization of investment	679	3.5
Operation and maintenance	2,072	10.8
Interest and amortization of major replacements	478	2.5
Loss of land taxes	107	.6
Total annual costs	$19,243	100.0
Annualized economic benefits		
Hydroelectric power (note b)	$48,419	95.6
Recreation	1,250	2.5
Redevelopment	891	1.8
Flood damage prevention	70	.1
Total annual benefits	$50,630	100.0

Benefit-cost ratio: $\frac{50,630}{19,243} = 2.63$ to 1

a/computed at a Federal interest rate of 3-1/4 percent and a 100-year project life.

b/Computed at an estimated private borrowing rate of 8-3/4 percent.

HOW ANNUAL ECONOMIC COSTS WERE DERIVED

To put all project-related costs on a common-time basis with annual benefits, costs for initial Dickey-Lincoln investment and estimated major replacements were converted to equal annual outlays over the project's estimated 100-year life. Remaining economic costs for the project consist of recurring outlays for project operation and maintenance and an imputed economic cost representing the loss of land taxes caused by Federal ownerhsip of the project area.

Investment amortization

Project investment consists of the estimated costs of planning and constructing the project, plus interest during construction, then applying the prescribed Federal interest rate to the total amount.

Project investment costs were converted to equivalent annual payments over the life of the project by applying an annual sinking fund factor to the investment costs. The annual amortization figure thus computed represents the amount which, if invested annually at compound interest of 3-1/4 percent, would accumulate over the 100-year project life to the amount of the project investment.

Interest on investment

Annual interest of $15,907,000 is the result of applying the prescribed Federal interest rate of 3-1/4 percent to the project investment cost. Interest on investment accounts for about 83 percent of the total annual economic cost for the project.

Operation and maintenance

The annual costs of operating and maintaining the project at full operating efficiency were estimated and include (1) salaries of personnel necessary for operation, (2) cost of labor, equipment, and supplies required for ordinary maintenance, (3) supervision, (4) overhead, and (5) periodic inspection and evaluation.

Annual operation and maintenance costs of $2,072,000 were estimated on the basis of Corps and Interior experiences.

Interest and amortization for major replacement costs

Estimated costs for major replacements over the 100-year life were converted to equal annual charges by discounting the expected replacement costs to present value using a discount rate equal to the prescribed Federal interest rate for the project of 3-1/4 percent. The figure, expressed at present value was converted to equal annual payments for interest and amortization in the same manner described above for investment costs.

The estimated annual cost of $478,000 was based on Corps and Interior experiences in major replacements.

HOW ANNUAL ECONOMIC BENEFITS WERE DERIVED

Dickey-Lincoln power benefits consist of (1) the value of electric power generated directly by Dickey-Lincoln and (2) the value of additional power output of downstream dams in Canada made possible by the project's stabilization of annual riverflows. Power benefits based on direct project output were valued in 1974 at about $44.9 million and downstream benefits at about $3.5 million. Annual economic benefits for the project consist almost entirely of hydroelectric power benefits--$48,419,000 of $50,630,000 total annual benefits--or about 96 percent.

The Corps used the estimated cost to produce the power by the most likely alternative means to value Dickey-Lincoln's expected power output. Senate Document 97 states this as the usual method of valuing what consumers should be willing to pay for such electric power.

EXPLANATION OF MAJOR COST ITEMS USED TO VALUE ALTERNATIVES

Capital investment and fuel costs represent over 70 percent of the value of the above benefits. These items are discussed below.

Capital investment costs for the designated alternatives to Dickey-Lincoln include:

--Interest charges, or the utilities' estimated cost of borrowing applied to an estimated plant investment cost (per kilowatt of generating capacity).

--An estimated annual sinking fund charge sufficient to recover the cost of the plant over its estimated life (30 years) at the utilities' estimated cost of borrowing.

The cost of borrowing used by FPC is an average cost of obtaining money for investor-owned utilities. For the Corps' July 1974 benefit-cost analysis, FPC used a borrowing rate of 8-3/4 percent.

FPC computed fuel costs for the alternatives using:

--The price per unit of fuel.
--The energy content in a unit of fuel.
--The efficiency with which the alternative electric power source converts fuel to electric energy.

APPENDIX III

These three values were combined to provide an estimate of fuel costs per kilowatt-hour of electrical energy produced.

Figures used by FPC for heat content per unit of fuel were consistent with figures obtained from annual reports of electric utilities filed with FPC, and with FPC's Monthly Fuel Cost and Quality Reports for May and June 1974.

The efficiency of fuel conversion assumed by FPC for oil-fired steamplants was corroborated by values obtained in discussions with industry officials and from FPC's annual compilation, Steam-Electric Plant Construction Cost and Annual Production Expenses for 1972.

FPC estimated that gas turbine generators would convert fuel oil to electrical energy less efficiently than industry representatives said was possible. Utilities' operating reports showed that a number of existing gas turbines did operate more efficiently than FPC had estimated. An FPC official explained that improved efficiency would be factored into the next estimate of power values. This was done in March 1975, when FPC power values reflected a 10-percent improvement in conversion efficiency for gas turbines.

Fuel oil prices estimated by FPC were consistent with prices reported to FPC by utilities. An FPC official noted, however, that fuel oil prices were unstable and rising.

APPENDIX IV

COMPARABILITY TEST
PREPARED BY THE CORPS AT JULY 1974 PRICES
(Comparably financed at 3-1/4 percent)

Alternative costs:	
Power marketed in Maine	$ 8,194,000
Power marketed in Boston	27,371,000
Downstream	3,500,000
Total	39,065,000
Adjustment for flood control (note a)	70,000
Adjustment for recreation (note a)	1,250,000
Adjustment for area redevelopment (note a)	891,000
Total alternative cost	$41,276,000
Annual cost--Dickey-Lincoln	$19,243,000
Comparability ratio	2.1 to 1

a/Flood control, recreation, and area redevelopment benefits, which are provided incidentally to construction of Dickey-Lincoln, would be foregone by the alternative. Therefore the values of these benefits were added by the Corps to the alternative to obtain a valid comparison.

1.2 percent. The Interior, in updating transmission costs, followed the proper procedure.

ENGINEERING FIRM ESTIMATE OF DAMS AND RESERVOIRS COSTS

Although the project design and cost estimates have not yet been restudied to assess impacts due to changed conditions since 1967 (see ch. 2), a reestimate of a portion of project costs was done early in 1975 by an engineering firm under contract to the Corps. This price estimate was based on the 1967 design and conditions.

The engineering firm estimate made at January 1975 prices, covered the majority of dams, powerplant, and reservoirs costs, or about 84 percent of project costs, excluding transmission costs. The firm's estimate of $350.7 million was within 2 percent of the Corps' estimate of $357.7 million for the same items, updated to January 1975 prices using indexes.

The engineering firm's estimate was published after we completed our fieldwork and was not covered in our review.

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ECONOMIC BENEFITS AND COSTS OF THE DICKEY-LINCOLN HYDROELECTRIC PROJECT IN MAINE

Corps of Engineers
(Civil Functions)
Department of the Army

BY THE COMPTROLLER GENERAL OF THE UNITED STATES

RED-75-387

JUNE 19, 1975