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REPORT TO THE
CONSERVATION AND
NATURAL RESOURCES SUBCOMMITTEE
COMMITTEE ON
GOVERNMENT OPERATIONS
HOUSE OF REPRESENTATIVES



Congress Needs More Information
On Plans For Constructing
The Garrison Diversion Unit
In North Dakota B-164570

Bureau of Reclamation
Department of the Interior

BY THE COMPTROLLER GENERAL
OF THE UNITED STATES

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

B-164570

The Honorable Henry S. Reuss
Chairman, Conservation and Natural
Resources Subcommittee
Committee on Government Operations
House of Representatives

Dear Mr. Chairman:

According to your November 14, 1973, request and our subsequent discussions with your office, we are reporting on our review of the planning and construction of the Garrison Diversion Unit in North Dakota by the Bureau of Reclamation, Department of the Interior. We will report to you separately on your request of February 11, 1974, about the legal aspects of the ongoing Garrison Diversion Unit water quality dispute with Canada, which are under consideration.

We have evaluated Department of the Interior comments on our preliminary report on the estimated cost of constructing the Garrison Diversion Unit (B-164570, May 15, 1974) and have incorporated them in this report. We discussed our findings and conclusions with Bureau of Reclamation and Fish and Wildlife Service officials, but as your office requested, we did not obtain written comments from those agencies or from the Department of the Interior.

We do not plan to distribute this report further unless you agree or publicly announce its contents. In this connection, we want to invite your attention to the fact that this report contains recommendations to the Secretary of the Interior which are set forth on pages 17 and 22. As you know, section 236 of the Legislative Reorganization Act of 1970 requires the head of a Federal agency to submit a written statement on actions he has taken on our recommendations to the House and Senate Committees on Government Operations not later than 60 days after the date of the report and to the House and Senate Committees on Appropriations with the agency's first request for appropriations made more than

60 days after the date of the report. We understand that you will distribute copies of the report to the Secretary and the four committees for the purpose of setting in motion the requirements of section 236.

sincerely yours,

A handwritten signature in cursive script, reading "James B. Stewart". The signature is written in dark ink and is positioned above the typed name.

Comptroller General
of the United States

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ABBREVIATIONS

FWS	Fish and Wildlife Service
GAO	General Accounting Office

COMPTROLLER GENERAL'S REPORT
TO THE CONSERVATION AND
NATURAL RESOURCES SUBCOMMITTEE
COMMITTEE ON GOVERNMENT
OPERATIONS
HOUSE OF REPRESENTATIVES

CONGRESS NEEDS MORE INFORMATION
ON PLANS FOR CONSTRUCTING THE
GARRISON DIVERSION UNIT IN
NORTH DAKOTA
Bureau of Reclamation
Department of the Interior
B-164570

D I G E S T

WHY THE REVIEW WAS MADE

The Subcommittee Chairman asked GAO to review the Bureau of Reclamation's planning and construction of the Garrison Diversion Unit, a multipurpose water resources development project in North Dakota.

GAO made its review primarily to find out whether

- the project's estimated construction costs were within its authorized cost ceiling and
- the project's estimated benefits included in the justification document would be realized in view of planned changes in project development.

In its preliminary report to the Subcommittee (May 15, 1974, B-164570), GAO said the Bureau had probably understated by from about \$42.1 million to about \$66.1 million. the total Federal obligations in its fiscal year 1975 budget submission for the Garrison project.

GAO also said that, since the Bureau might have to adopt an alternative plan to settle a water quality dispute with Canada, the Bureau should formally report the dispute and its possible effects on project costs to the appropriate oversight and appropriations committees. (See p. 1.)

FINDINGS AND CONCLUSIONS

The Garrison project was authorized on August 5, 1965, by Public Law 89-108. The act provided for irrigating 250,000 acres, supplying municipal and industrial water for 14 towns and cities, and developing 36 major and several minor fish and wildlife areas and 9 major recreation areas.

The bureau estimated that as of December 31, 1973, the project, scheduled for completion in 1990, was 18 percent complete.

In its budget submission for fiscal year 1975, the Bureau estimated Federal obligations for the project at \$362.8 million (See pp. 2, 3, and 7.)

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The Bureau needs to fully inform the appropriate congressional oversight and appropriation committees of the increases in total estimated cost. These increases would cause the Garrison project to exceed its authorized cost ceiling.

The Bureau also should tell the committees of the additional estimated project cost increases which may be required to settle an ongoing boundary water dispute with Canada.

Project costs

The authorization act established a cost ceiling for the Garrison project of \$207 million, plus or minus any increases or decreases justified by ordinary fluctuations in construction costs.

The Bureau's \$362.8 million total estimated project cost was probably understated by \$72.6 million and it exceeds the latest estimate of the adjusted authorized cost ceiling--\$394.2 million--by about \$41.2 million.

The total estimated Garrison project cost was understated primarily because

--estimated costs representative of those actually being incurred in the construction area were not consistently included,

--an allowance for the cost of items not generally included until final designs are drawn also was not consistently included, and

--the estimated cost of land to be acquired was not based on recent land purchases in the construction area.

GAO could not precisely determine the amount understated since the Bureau had not fully assessed the costs of (1) the total effect of changes to the authorized project plan and (2) additional requirements imposed by general legislation and new construction standards. (See p. 5.)

In GAO's opinion, the continued Federal expenditures for constructing the Garrison project are at least technically legal at this time since actual costs have not yet exceeded the authorized cost ceiling. (See p. 16.)

Alternative project development

Bureau studies have shown that the quality of water flowing into Canada from the Garrison project will be decreased because the mineral content will be raised. The Government of Canada has protested construction of the project

Although the Bureau is attempting to negotiate a workable solution which would make the authorized project plan acceptable to Canada, the Bureau recognizes Canada could

--require some mitigation for any degradation of water

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flowing across the international boundary or

-allow little or no change in the quantity or quality of those waters. (See p. 18.)

The Bureau has developed seven alternative plans for modifying the Garrison project if Canada does not accept the authorized plan. Each proposal would provide for full development of 250,000 acres for irrigation.

But Bureau estimates available for five of the alternatives indicate total estimated Garrison project costs would be increased by from \$4.2 million to \$35 million, depending on the alternative selected. (See p. 19.)

As of September 20, 1974, the Bureau had not formally told the Congress about the ongoing boundary water dispute with Canada and its potential effect on Garrison project costs. (See p. 20.)

Authority for project changes

Five major construction changes were being made to the authorized project plan. The Bureau has not developed the total effect of these changes on project costs, but current plans provide for benefits essentially the same as those specified in the authorization documents. (See p. 23.)

In GAO's opinion, the Bureau has the authority to make project changes if they can be made within the authorized cost ceiling and do not greatly alter the project purposes and resulting benefits used as a basis for the project's authorization by the Congress. (See p. 28.)

Canal seepage and operational wastes

Although Bureau studies had not been completed, preliminary indications were that canal seepage and operational wastes would be greatly reduced under a revised plan to

- increase the use of canal linings and pipe and
- switch from a gravity to a sprinkler irrigation system.

Canal seepage is the water that soaks into the base and sides of canals and laterals that convey water from its source to its point of use.

Operational wastes include water lost when farmers refuse to accept it, leaks in canal walls and other structures, and consumption by vegetation along the delivery system.

Although estimated canal seepage and operational wastes were within the Bureau's allowable limits (15 to 40 percent and 5 to 35 percent, respectively) under both plans, the revised plan emphasizes the most economical means of conserving water. Canal seepage and operational wastes are reduced from 23.4 and 10

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percent, respectively, under the authorized plan to 8.6 and 5 percent, respectively, under the revised plan.

In total, GAO estimated, and the Bureau agreed, that under the revised plan, the average annual diversion requirement (871,000 acre-feet of water) could be reduced by 200,000 acre-feet of water annually.

Bureau officials said such a reduction could give the Bureau previously unavailable options for

- reducing the capacity of canals and other construction required to deliver project waters where they are needed or
- using the water supply to irrigate more land or generate more power than originally anticipated. (See p. 30.)

Fish and wildlife development

The Bureau of Reclamation and the Fish and Wildlife Service had made or were considering several changes affecting development of the fish and wildlife portions of the authorized Garrison project plan.

None of these changes were expected to reduce the total acreage allocated to fish and wildlife development originally envisioned when the Garrison project was authorized. (See p. 36.)

RECOMMENDATIONS OR SUGGESTIONS

The Secretary of the Interior should require the Bureau to update total estimated cost of the Garrison project to include:

- Estimated costs representative of costs actually being incurred in the construction area.
- Allowances for costs of items not generally included until final designs are drawn.
- Estimated costs for additional requirements established by general legislation and new construction standards.
- Estimated costs for changes to the authorized project plan. (See p. 17.)

The Secretary should also:

- Advise the appropriate congressional oversight and appropriation committees promptly if total estimated costs exceed the Garrison project authorized cost ceiling.
- Include the authorized Garrison project cost ceiling in future budget justifications. (See p. 17.)
- Formally advise the appropriate congressional oversight and appropriation committees about the ongoing water quality dispute with Canada since the potential effect on total estimated

Garrison project cost would be to further exceed the authorized cost ceiling. (See p. 22.)

AGENCY ACTIONS AND UNRESOLVED ISSUES

At the Subcommittee's request, GAO did not obtain written comments from the Department or the Bureau of Reclamation and the Fish and Wildlife Service on this report. However, GAO discussed its findings and conclusions with officials of the Bureau and the Service and considered their comments in preparing this report.

GAO did obtain a copy of Interior's comments to the Subcommittee on GAO's preliminary report (B-164570, May 15, 1974) on the estimated cost of constructing the Garrison Diversion Unit.

The Department generally agreed the authorized appropriation ceiling and estimated total Federal obligations the Bureau used to justify its fiscal year 1975 budget submission needed updating.

The Department said more recent Bureau studies show estimated total Federal obligations included in the fiscal year 1975 budget submission for the Garrison project were understated and exceeded a June 1974 recomputation of the authorized appropriation ceiling based on North Dakota price indexes.

The Department added that the North Dakota price indexes were not completed until January 24, 1974, and came too late to be used for computing the appropriation ceiling for fiscal year 1975. The Department also reiterated Bureau objections to certain methods GAO used to compute its estimate of total Federal obligations.

The Department said new estimates were being developed for the fiscal year 1976 budget submission. If these new estimates also show the authorized appropriation ceiling will be exceeded, the Department will prepare proposed legislation for increasing the authorized appropriation ceiling.

GAO recognizes that the North Dakota indexes were not approved until January 24, 1974. However, on the basis of GAO's use of this index to compute the authorized appropriation ceiling, it appears the Bureau had ample time to revise its computation for the appropriation hearings held March 20 and 21, 1974.

GAO also found the Bureau's objections to certain GAO pricing methodologies were based on limited cost experience on selected Garrison project contracts rather than on available, more complete cost data or the procedures used. (See p. 16.)

Regarding the ongoing dispute with Canada, the Department said the Bureau's May 1974 draft report entitled, "Irrigation Return Flows to the Souris River and Canada, Garrison Diversion Unit," had

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CHAPTER 1

INTRODUCTION

As the Chairman, Conservation and Natural Resources Subcommittee, House Committee on Government Operations, requested on November 14, 1973 (see app.I), and as later arranged with the Subcommittee, we reviewed the planning and construction of the Bureau of Reclamation's Garrison Diversion Unit, a multipurpose water resources development project in North Dakota. We made our review primarily to find out whether the project's estimated construction costs were within its authorized cost ceiling and whether certain estimated project benefits included in the project justification document would be realized in view of planned changes in project development.

Specifically, we reviewed matters relating to:

- Project costs.
- Proposed alternative project development.
- Changes to the authorized project plan.
- Canal seepage and operational wastes.
- Fish and wildlife development.

In our preliminary report to the Subcommittee (B-164570, May 15, 1974) we said that (1) the Bureau had probably understated by from \$42.1 million to about \$66.1 million the total Federal obligations for the Garrison project in its fiscal year 1975 budget. We also said that, since the Bureau might have to adopt an alternative plan to settle a water quality dispute with Canada, the Bureau should formally tell the appropriate oversight and appropriation committees about the dispute and its possible effects on project costs.

This report presents our findings on these matters, except for the legal aspects of the ongoing Garrison Diversion Unit water quality dispute with Canada. We will report separately on these legal aspects, which are under consideration.

PLANS FOR DEVELOPMENT

Garrison was authorized on August 5, 1965, by Public Law 89-103 (79 Stat. 433). The plan for the initial stage of project development was sent to the Congress on February 3, 1960, and was printed as House Document 325, 86th Congress, 2d session. A Bureau report, revised February 1965, supplemented House Document 325, and presented the plan authorized by the Congress. The plan provided for irrigating, by a gravity flow system, 250,000 acres; supplying municipal and industrial water for 14 towns and cities; and developing 36 major and several minor fish and wildlife areas and 9 major recreation areas.

Water for project operations is to be pumped through the project's Snake Creek pumping plant from Lake Sakakawea (formerly Garrison Reservoir) into Audubon Lake. The Corps of Engineers constructed both of these lakes. The water is to flow, by gravity, from Audubon Lake east through the McClusky Canal to Lonetree Reservoir. At Lonetree Reservoir the water is to be regulated to irrigate the Lincoln Valley area, to flow north through the Velva Canal to the Karlsruhe and Souris areas, east through the New Rockford Canal to the New Rockford and Warwick-McVillie areas and Devils Lake, and south by the James River to the LaMoure and Oakes areas. The James River's flow is to be regulated at the existing Jamestown Dam.

Construction of project features is scheduled for completion in 1990. (See app. II for a map showing the development plan.)

Environmental impact statement

On January 10, 1974, the Bureau issued its final overall environmental impact statement for Garrison, to comply with the National Environmental Policy Act of 1969 (83 Stat. 852), applicable Council of Environmental Quality Guidelines, and Department of the Interior regulations and directives. The Bureau said that the cumulative assessment of impacts was based on what was known and the best possible projections into the future. The impact statement discusses the primary

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beneficial impacts for which Garrison was designed. The primary adverse impacts noted were the degradation of streamflows in the project area due to irrigation return flows and the reduction of land in private ownership.

The Bureau said that water resource projects the size of Garrison take many years to plan and complete and that not all problems could be fully resolved in advance. It said that studies of the quality of irrigation return flows and their effects on streams, fish and wildlife resources, and changing area needs were continuing. Also, since there may be minor changes in physical conditions, operating plans, engineering and construction techniques, and costs of different types of construction, the Bureau plans to issue additional environmental impact statements. Such statements will include development plans for a sprinkler irrigation system and results of continuing water quality studies.

STATUS OF CONSTRUCTION

As of December 31, 1973, Garrison project construction was about 18 percent complete--the Snake Creek pumping plant was 93 percent complete and the McClusky Canal was 62 percent complete. About \$66.7 million had been obligated, of which about \$64.8 million had been spent, and about \$7.4 million remained to be obligated from the fiscal year 1974 appropriation.

The President's budget for fiscal year 1975 includes an appropriation request of \$10.6 million for Garrison. These appropriations are programmed primarily for continuing construction on the McClusky Canal, including \$2 million for starting construction on a 3.6-mile section of the canal and \$800,000 for purchasing additional rights-of-way for Lonetree Reservoir.

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CHAPTER 2

PROJECT COSTS

Appropriations for Garrison are limited by the authorization act which states, in part, that:

"Sec. 6. There is hereby authorized to be appropriated for construction of the Garrison diversion unit as authorized in this Act, the sum of \$207,000,000, plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indexes applicable to the types of construction involved herein."

Section 6, in effect, gives the Congress control over appropriations (total Federal obligations) by establishing an appropriation ceiling. However, congressional control depends on the adequacy of the cost information given to the Congress. We estimate that the total Federal obligations included in the Bureau's fiscal year 1975 appropriation justification (\$362.8 million) probably was understated by about \$72.6 million and that the Bureau's latest estimate of the authorized cost ceiling, as adjusted for ordinary fluctuations in construction costs, could be exceeded by about \$41.2 million.

AUTHORIZED APPROPRIATION CEILING

Bureau instructions, dated June 21, 1973, state that, if estimated total Federal obligations exceed the appropriation ceiling, either the project must be redesigned to place total costs within the ceiling or the Bureau must ask the Congress for additional ceiling authority. These instructions also prescribe the methods for applying the pertinent cost indexes needed to determine the authorized appropriation ceiling, as adjusted for ordinary fluctuations in construction costs.

In January 1974 the Bureau approved special cost indexes for North Dakota, because price increases there were more rapid than those covered by the Bureau's standard construction cost indexes. But the Bureau did not use the North

Dakota indexes to update the authorized appropriation ceiling for the fiscal year 1975 appropriations hearings held in March 1974.

The Bureau's justification for its fiscal year 1975 budget request for the Garrison project did not include the authorized appropriation ceiling. According to Bureau officials, mention of the ceiling in the justification material was on an exception basis and was reported only if the existing ceiling was inadequate and legislation was required to raise the ceiling. They said that, when the justification material was prepared--before approval of the special North Dakota indexes--both the authorized appropriation ceiling and the estimated total Federal obligations were \$363 million.

In our opinion, the appropriate oversight and appropriation committees need to be told of the relationship between the estimated total Federal obligations and the authorized congressional ceiling for the Garrison project. We computed the ceiling for fiscal year 1975 by updating the original plan with the special North Dakota cost indexes. This procedure followed the Bureau's instructions issued June 21, 1973, and resulted in a ceiling for Garrison of approximately \$378.5 million (at January 1973 prices).

Bureau officials later computed the ceiling in the same way, except they further increased the authorized ceiling by \$15.7 million on the basis of a newly developed index for land. Thus the Bureau's latest estimate of the authorized ceiling for the Garrison project is \$394.2 million as of June 1974. The total increase over the \$207 million ceiling initially authorized by the Congress is \$187.2 million (\$394.2 million less \$207 million)--a 90.4-percent increase, due to ordinary fluctuations in construction cost.

TOTAL FEDERAL OBLIGATIONS

In its 1965 supplemental report to the Congress, the Bureau estimated total Federal obligations for the development for Garrison to be about \$206.7 million (at January 1962 prices). In supporting the appropriation justification for fiscal year

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1975 for Garrison, the Bureau estimated the total Federal obligations to be about \$362.8 million¹ (at January 1973 prices).

The Bureau's explanation for the increase in estimated total Federal obligations follows.

¹This amount is overstated by \$5.5 million because the Bureau incorrectly included the value of donated land. Bureau officials said that they would correct this overstatement in the fiscal year 1976 appropriation justification.

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Bureau Computation of Estimated Total
Federal Obligations for the Garrison Project Appropriation
Justifications for Fiscal Year 1975

	<u>Amount</u> <u>(millions)</u>
Estimated total Federal obligations at authorization	\$206.7
Additions:	
Excess of actual cost over original estimated cost on completed construction:	
McClusky Canal	\$24.6
Snake Creek pumping plant	<u>4.0</u> \$ 28.6
Automation equipment not included in original plan	2.4
Value of donated land	5.5
Expected price increases:	
Based on application of standard Bureau unit prices to uncompleted construction (except for the Oakes- east side and La Moure areas)	106.1
Based on application of North Da- kota unit prices to uncompleted construction in the Oakes-east side and La Moure areas	10.5
Based on application of an allow- ance for items not included until final construction designs are drawn (Oakes-east side and La Moure areas only)	<u>3.0</u>
Total additions	<u>156.1</u>
Estimated total Federal obligations in the Bureau's fiscal year 1975 budget submissions for the Garrison project	<u>\$362.8</u>

Bureau instructions, dated March 22, 1965, state that the total estimated project cost is used to support the annual request for construction funds and that it should be kept current for this purpose. An instruction, dated March 5, 1957, states that the procedures for making cost estimates must be followed so that the Congress, the Bureau, and other Federal agencies will not be misled by erroneous or obsolete estimates of the probable costs of a project or unit.

In our opinion the Bureau's estimate of total Federal obligations was not current and could be understated by about \$72.6 million, as shown below.

GAO Computation of Estimated Total Federal Obligations
for the Garrison Project Appropriation Justification
for Fiscal Year 1975

	Amount (millions)
Estimated total Federal obligations per Bureau's fiscal year 1975 appropriation justification for the Garrison project	\$362.8
Additions:	
Repricing, based on application of North Dakota unit prices to uncomple- ted construction previously costed on the basis of standard Bureau unit prices	\$40.8
Repricing, based on application of an allowance for items not included until final construction designs are drawn (uncompleted construction other than Oakes-east side and La Moure areas)	27.0
Increases in land costs based on recent Bureau purchases	15.7

	<u>Amount</u> <u>(millions)</u>
Increased cost for a project change (realignment of the New Rockford Canal) not previously included in estimated total Federal obligations	<u>.7</u>
Total additions	\$84.2
Less deletions or decreases in project cost:	
Value of donated land	5.5
Project changes not previously in- cluded in estimated total Federal obligations:	
Change from gravity to sprinkler irrigation systems (Oakes-east side and La Moure areas only)	4.3
Elimination of Stump Lake Outlet Canal	<u>1.8</u>
Total decreases in project cost	<u>11.6</u>
Net understatement of estimated total Federal obligations per Bureau's fiscal year 1975 appropriation justification for the Garrison project	<u>72.6</u>
Adjusted estimated total Federal obliga- tions for the Garrison project's fiscal year 1975 appropriation justification	<u>\$435.4</u>

In our opinion, the Bureau's estimate of total Federal obligations was understated because

--the increased costs of future construction were not consistently recognized and

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--the estimated cost of land to be acquired was not based on recent purchases.

Moreover, we could not determine precisely the amount by which estimated total Federal obligations were understated because the Bureau had not fully assessed the costs of (1) the total effect of actual and proposed changes to the authorized project plan and (2) the additional requirements imposed by general legislation and new construction standards.

Inconsistent methods of computing costs

The Bureau's cost estimates for the fiscal year 1975 appropriation justification were based upon two different price systems. The unit prices of the two irrigation areas to be constructed first, the Oakes-east side and the La Moure areas, were developed by the Bureau's Engineering and Research Center, whose officials told us that the prices were based on actual construction costs experienced in North Dakota. The costs of the remainder of the project were based upon standard Bureau unit prices for construction, which, the Bureau said, understated costs actually being incurred in North Dakota.

Also, for the Oakes-east side and the La Moure areas, the Bureau added an "allowance for unlisted items" of 10 percent of the listed items in the cost estimate, to compensate for items generally not included until the final design of a project feature is developed. This complied with the recommendations included in a letter, dated March 19, 1973, from the Chief of the Center's Division of Planning Coordination to all Bureau regional directors. According to this letter, the allowance should be included in estimated costs because experience had shown that some projects which had excluded the allowance had deficient cost estimates when final designs were drawn and bids for construction received. The letter also said that, even if the allowance caused estimated costs to exceed the authorized ceiling, it was better to recognize and face the problem in the advance planning stage than to pass it on to the construction stage. However, the Bureau excluded the allowance from the estimated cost of the project's other five irrigation areas.

We repriced the entire project (except those areas already repriced) using the Bureau methodology the Center developed for the Oakes-east side and La Moure areas; that is, using

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prices based on those incurred in North Dakota and a 10-percent allowance for unlisted items. This repricing resulted in a \$67.8 million increase in estimated total Federal obligations--\$40.9 million because of higher unit prices and \$27 million because of the allowance.

In commenting on the methods we used to reprice the project, the Bureau said that an April 1974 reanalysis of the North Dakota unit prices the Center developed showed that actual cost incurred on the Garrison project would be about \$28 million less than the \$40.9 million we computed. The Bureau agreed that the allowance for unlisted items should be included for all seven irrigation areas, but recommended using 7 percent rather than the 10 percent included in its fiscal year 1975 budget submission for the Oakes-east side and La Mour areas.

After considering the bases for the Bureau's comments, we decided to retain our repricing methodology and the resulting cost increases it produced. The Bureau's views were based on limited cost experience on selected Garrison project contracts rather than on available, more complete cost data or the procedures the Center used to develop the North Dakota unit prices and the estimate for allowances for unlisted items.

For example, the Bureau's reanalysis of the Center's North Dakota unit prices was based on a comparison of about one-half of the total field costs for one McClusky Canal contract. The comparison showed actual cost experience to be about 13 percent lower than that computed by the Center. Our comparison of the Center's North Dakota unit prices with the total costs for six McClusky Canal contracts showed actual cost experience to be only 6 percent lower.

Regarding the allowance for unlisted items, Bureau officials told us at the conclusion of our fieldwork in July 1974 that the Bureau had not made an analysis to support its recommended use of 7 percent. Our analysis of the six McClusky Canal contracts showed that 66 items amounting to about \$2.9 million--or about 13.8 percent of the original estimates, as indexed--were not in the original estimates but were included in the final list of items on which contractors were asked to bid when the final designs were drawn.

Land costs not based on recent purchases

About 11,000 acres of land have been purchased in the Lonetree Dam and Reservoir area. The cost of this land in the Bureau's fiscal year 1975 budget submission is the original estimated cost indexed to January 1973 rather than the price the Bureau has actually paid, which is much higher than the estimated cost.

In addition, for land not yet purchased (190,000 acres, according to one Bureau estimate), the Bureau included estimated land prices which were substantially less than the prices paid for purchased land. The repriced value (\$104 per acre) of land used by the Bureau for the Oakes-east side and the La Moure areas is less than the average prices, \$129.04 and \$126.18 an acre, paid for the land purchased during fiscal years 1972 and 1973, respectively. It is also considerably less than the average price (\$180.71 an acre) paid for about 4,100 acres during fiscal year 1974.

On the basis of the average per acre price paid in fiscal year 1973, the current estimated land cost understated expected land cost by about \$7.8 million. Later, Bureau officials told us they had updated the estimated cost of land included in the fiscal year 1975 budget submission on the basis of more recent purchases. We revised our estimate to recognize these purchases, increasing land costs by \$15.7 million.

Costs of project changes not included

The Bureau scheduled construction funds for the Oakes and La Moure irrigation facilities, the New Rockford Canal, and the James River improvements for fiscal year 1976. Each of these features includes major design changes, but none of the changes were considered in the Bureau's cost estimate for the fiscal year 1975 budget submission. For example, even though the Bureau plans to build a sprinkler irrigation system, estimated costs included for irrigation facilities are those for the gravity system which was originally planned. The same is essentially true for other changes in the project plan--the estimated costs of items eliminated or changed were simply transferred to the items which replaced them.

By not adjusting cost estimates for planned design changes, the Bureau is not following its Instruction 152.3.7, which states that:

"These estimates shall be maintained and kept current by the appropriate operating office with the aid of the Chief Engineer on all design changes and additional work. Changes in the estimates shall be made as often as required by the appropriate regional or operating office* * *."

Although all of the planned changes in the project have not been studied, Bureau officials maintained that each change would result in a decrease in total cost. We analyzed the Bureau's four completed studies and noted several errors.

--The Bureau's study of the realignment of the New Rockford Canal shows that the new plan, plan 5A, will cost less (\$17.5 million) than the original plan, plan 2 (\$24.1 million). However, the study compared plan 5A with a revised plan 2, not the original plan carried in the cost estimate for the fiscal year 1975 budget submission. A comparison of plan 5A with the cost of the original plan 2 shows that plan 5A will cost about \$700,000 more than plan 2.

--The Bureau's study of the change from the gravity to the sprinkler irrigation system for the Oakes-east side area showed a cost decrease from \$29.8 million under the gravity system to \$23.6 million under the sprinkler system, resulting in savings of \$6.2 million. However, the Bureau's study had errors in computation, used prices from different time periods, and omitted indexing for 1 year. Although the sprinkler system will be less expensive than the gravity system, the savings will probably be about \$3.6 million (at January 1973 prices) instead of \$6.2 million as claimed by the Bureau.

--The Bureau's cost analysis of the change from a gravity irrigation system (\$15 million) to a sprinkler irrigation system (\$13.4 million) for

the La Moure area shows a \$1.6 million saving. However, prices the Bureau used in the study were not comparable; i.e., different unit prices were used for the same items. Application of comparable and appropriate prices reduced the saving to about \$700,000 (at January 1973 prices).

--The Bureau's study of the change from a gravity to a sprinkler irrigation system for the Oakes-west side area showed a saving of \$3.9 million (at January 1968 prices). However, when compared to the official cost estimate, the saving resulting from the change was only \$240,000 (at January 1968 prices). We believe, since this study is about 5 years old, it would have to be updated with January 1973 prices before the effect of this change on the current cost estimate (at January 1973 prices) could be assessed.

Another proposed change, eliminating the Stump Lake Outlet Canal, will result in a cost decrease. If the canal is eliminated and no substitute item replaces it, there will be a saving of about \$1.8 million (at January 1973 prices).

Bureau officials told us that the effect of project changes on costs would be included in estimated total Federal obligations before appropriations are requested for their construction.

Costs of additional requirements
not considered

Certain general legislation and new construction standards have placed requirements on the Bureau which were not included in the originally authorized plan. The increases in estimated costs resulting from such requirements are not included in the estimated total Federal obligations. Examples follow.

--Public Law 87-874 (76 Stat. 1196) authorized the Bureau to build roads and bridges to higher standards when replacing road and bridges displaced by construction.

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- The National Environmental Policy Act of 1969 (83 Stat 852) requires that environmental impact statements be prepared, and the Bureau intends to make additional environmental statements which will include more information than it gave in the overall statement it issued recently.
- The Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970 (84 ac. 1894) requires Federal agencies to pay losses, expenses, and allowances to individuals who are relocated as a result of a Federal program.
- State and Federal antipollution laws placed requirements on the Bureau which did not exist at the time of the project's authorization.

The Bureau has not yet determined the increase in estimated costs resulting from these additional requirements for uncompleted construction. However, it had incurred increased costs of \$3.7 million for items on which construction was underway or completed through February 1974.

Bureau officials told us that they would update project costs for the additional requirements when they were able to develop a means for estimating the costs for the uncompleted construction. However, they indicated that the increased costs resulting from legislation enacted after the Garrison project authorization should not be charged against the authorized appropriation ceiling.

We believe that significant legal questions arise as to whether, and to what extent, legislation enacted after project authorization that imposes additional requirements associated costs may be viewed as an authorization for carrying such additional costs apart from the original project authorization. We plan to consider these questions separately and to submit our conclusions to the Subcommittee. In any event, we believe that, by accumulating these costs and reporting them to the Congress in some form, the Bureau would give the Congress more complete information on total project costs.

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CONCLUSIONS

The Bureau needs to fully inform the appropriate congressional oversight and appropriation committees of the increases in estimated total Federal obligations which would cause the Garrison project to exceed its authorized appropriation ceiling. We estimate that the total Federal obligations included in the Bureau's fiscal year 1975 appropriation justification (\$362.8 million) probably were understated by about \$72.6 million and that the Bureau's June 1974 estimate of the authorized appropriation ceiling, as indexed for the fiscal year 1975 budget (\$394.2 million), could be exceeded by about \$41.2 million.

In our opinion, the continued Federal expenditures for constructing the Garrison project are at least technically legal at this time since actual costs have not yet exceeded the authorized cost ceiling.

AGENCY COMMENTS

The Department of the Interior, in commenting on our preliminary report (B-164570, May 15, 1974) on the estimated cost of constructing the Garrison Diversion Unit, generally agreed that the authorized appropriation ceiling and estimated total Federal obligations the Bureau of Reclamation used to justify its fiscal year 1975 budget submission for the Garrison project needed updating. The Department said that final tabulations of the North Dakota price indexes were not completed until January 24, 1974, and came too late to be used for computing the authorized appropriation ceiling for the fiscal year 1975 budget submission. Although the Department reiterated the Bureau's objection to certain of our repricing methodologies (see p. 11), the Department said that more recent Bureau studies showed that the estimated total Federal obligations included in the fiscal year 1975 budget submission for the Garrison project were understated and exceeded the June 1974 recomputation of the authorized appropriation ceiling based on the North Dakota indexes.

The Department also said that new estimates were being developed for the fiscal year 1976 budget submission. If these new estimates also show that the authorized appropriation ceiling will be exceeded, the Department will prepare proposed legislation for increasing the authorized appropriation ceiling.

We recognize that the North Dakota indexes were not approved until January 24, 1974. However, on the basis of our use of this index to compute the authorized appropriation ceiling, it appears to us that the Bureau had ample time to revise its computation for the appropriation hearings held March 20 and 21, 1974. As explained on page 11, the Bureau's objection to certain of our pricing methodologies were based on limited cost experience on selected Garrison project contracts rather than on available, more complete cost data or the procedures the Center used to develop the North Dakota unit prices and the estimate for allowances for unlisted items we used to reprice the Garrison project.

RECOMMENDATIONS

The Secretary of the Interior should require the Bureau of Reclamation to update total estimated cost for the Garrison project to include:

- Estimated costs representative of costs actually being incurred in the construction area.
- Allowances for the costs of items not generally included until final designs are drawn.
- Estimated costs for additional requirements established by general legislation and new construction standards.
- Estimated costs for changes to the authorized project plan.

The Secretary should also:

- Advise the appropriate congressional oversight and appropriation committees promptly if total estimated costs exceed the Garrison project cost ceiling.
- Include the authorized Garrison project cost ceiling in future budget justifications.

CHAPTER 3

ALTERNATIVE PROJECT DEVELOPMENT

The Bureau had considered several alternatives to the authorized Garrison project plan, but the only ones (other than the construction and fish and wildlife changes discussed later) that progressed beyond the talking stage were those that pertained to the ongoing boundary water dispute with Canada.

BOUNDARY WATER DISPUTE WITH CANADA

On April 29, 1969, the Canadian Embassy in Washington, D.C., in a Note Verbale to the U.S. Department of State, said it appeared that Garrison might increase flows in the Souris River in Canada with possible adverse consequences for irrigation and other water uses. On October 23, 1973, the Canadian Embassy requested that the United States place a moratorium on all further construction of the Garrison Diversion Unit until the two countries reached an understanding that would protect Canadian rights and interests.

The Bureau has made a series of studies to examine existing conditions in the Souris River, predict the quality and quantity of return flows to the river from irrigation in the Souris Loop area, evaluate the effects of the return flows upon the river, and provide information about the effects that the project will have on Canada. A Bureau draft report, "Irrigation Return Flows to the Souris River and Canada, Garrison Diversion Unit," was released in May 1974.

The report states that the quality of water flowing into Canada from the Souris River will be decreased after the Garrison project is completed. According to that report, irrigation of the Souris Loop of the Garrison project will result in about 107,000 acre-feet of water's being added to the Souris River each year from project return flows. The mineral content of these additional flows will be greater than the Souris River's historic average mineral content and will result in an increased salinity level for the river. Bureau estimates of the impact of these return flows follow.

Estimated Changes in Mineral Contents
of the Souris River
(total dissolved solids)

<u>Historic average</u>	<u>Estimated return flows average</u>	<u>Range of return flows during initial soil leaching</u> High	<u>Low</u>	<u>Total estimated eventual flow</u>
----- (milligrams per liter) -----				
796	980	1,200	900	885

The Bureau is attempting to negotiate a workable solution which would make the authorized project plan acceptable to Canada. However, the Bureau recognized, in its May 1974 draft report, that Canada could either require some mitigation for any degradation of water flowing across the international boundary or allow little or no change in the quantity or quality of those waters.

ALTERNATIVES FOR FULL GARRISON
DIVERSION UNIT DEVELOPMENT

The Bureau has developed seven alternative plans for modifying the Garrison project if Canada does not accept the authorized plan. Each proposal would provide for full development of 250,000 acres for irrigation. According to the Bureau's report, any one of these alternatives could increase the Garrison project's construction cost. Bureau estimates available for five of the alternatives range from \$4.2 million to \$35 million. The alternatives being considered are:

- Diluting return flows to the Souris River with Missouri River water.
- Treating return flows to the Souris River to decrease salinity.
- Compensating Canada with additional fresh water.

- Providing a reservoir on Deep River to store and control return flows for release during periods when salinity and nutrient levels of the Souris River would not be significantly affected.
- Diverting return flows to the Devils Lake chain for use in restoring and stabilizing lake levels.
- Diverting return flows to the Missouri River basin for reuse on other lands.
- Shifting lands to be irrigated to lands in North Dakota not drained by the Souris or Red Rivers.

Bureau officials considered it premature to include the estimated cost of any of these alternatives in its revised estimate at this time. They said that these costs would be included in the justification material given to the Congress if and after an alternative had been selected. Their return flow study indicated that a decision would have to be made by July 1979.

PARTIAL DEVELOPMENT OF
GARRISON DIVERSION UNIT

In a letter to GAO dated December 27, 1973, the Acting Deputy Assistant Secretary of the Interior said that a large part of Garrison could be developed without any effect on the Souris River or on the Red River, which also flows into Canada. He said that, with the Snake Creek pumping plant, McClusky Canal, Lonetree Reservoir, and certain other supply works, including the New Rockford Canal, major project benefits, among them 77,500 acres of irrigation, could be provided without effect on the Souris or Red Rivers. Since then the irrigation acreage has been refined to 81,000 acres but a Bureau official said that such a development probably was not economically justified because the expected costs probably would exceed the expected benefits.

A Bureau regional official said that any alternative to the authorized project plan to resolve the Canadian issue must have 250,000 acres for irrigation to be within the project plan authorized by the Congress. He said the 81,000 acres were simply those acres which could be served from the existing

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project plan without design changes and without any adverse effect on waters flowing from the project into Canada. He said additional acreage would have to be identified to bring the total irrigation acreage up to 250,000 acres.

NO ADDITIONAL DEVELOPMENT OF
GARRISON DIVERSION UNIT

The Bureau has not developed alternative proposals for using the water allocated by the authorization act to Garrison for project purposes if construction of Garrison is stopped. A Bureau official said that, without additional construction to complete the McClusky Canal, Lonetree Reservoir, and other project features, such as the New Rockford Canal, the potential benefits available from using the completed construction would not offset the costs to operate the Snake Creek pumping plant to provide the water.

As of December 31, 1973, the estimated cost to complete the existing construction contracts was about \$7.2 million. But even these contracts would not complete construction of the McClusky Canal.

Bureau officials told us that there were some potential alternative uses for water allocated to Garrison, such as:

- Development of coal resources in North Dakota.
- Sale to non-Federal irrigation projects.
- Power generation at projects operated by the Corps of Engineers on the Missouri River.

AGENCY COMMENTS

The Department of the Interior, in commenting on our preliminary report, said that the Bureau's May 1974 draft report entitled, "Irrigation Return Flows to the Souris River and Canada, Garrison Diversion Unit," had received wide publicity through news releases. The Department said also that the news releases should accomplish the objective of formally advising the Congress about the water quality problem with Canada and its possible effects on project costs.

In our opinion news releases are not adequate substitutes for formally advising the appropriate congressional oversight and appropriation committees.

RECOMMENDATION

The Secretary of the Interior should formally advise the appropriate congressional oversight and appropriation committees about the estimated Garrison project cost increases which may be required to settle the ongoing water quality dispute with Canada. Although it may not be necessary to request an increase in the authorized cost ceiling at this time, the committees should be made aware that the effect of the alternatives under consideration might be to further exceed the project's authorized cost ceiling.

CHAPTER 4

AUTHORITY FOR CHANGES TO THE AUTHORIZED PROJECT PLAN

Five major design changes were being made to the authorized Garrison plan. One of these changes, substituting a sidehill canal for the New Home Dam and Reservoir on the McCusky Canal, has been completed. The following planned design changes have not been completed.

- Construction of a sprinkler irrigation system to replace the gravity irrigation system originally planned.
- Realignment of the New Rockford Canal to reroute the James River Feeder Canal and eliminate the Hamburg Dam and Reservoir and 34.3 miles of channel improvements in the James River.
- Curtailment of channel improvements on the James River below the New Rockford area.
- Elimination of the Stump Lake outlet to the Sheyenne River.

Also a new plan may be adopted for developing fish and wildlife areas. Smaller individual areas in natural wetlands may be substituted for some of the areas in the authorized plan. (See ch. 6.)

Section 1 of Public Law 89-108 states that the general plan for the Missouri-Souris Unit, as modified by the report in House document 325, is confirmed and approved under the designation "Garrison diversion unit," and that:

" * * * the construction of a development providing for the irrigation of two hundred and fifty thousand acres, municipal and industrial water, fish and wildlife conservation and development, recreation, flood control, and other project purposes shall be prosecuted by the Department of the Interior substantially in accordance with the plans set out in the Bureau of Reclamation report dated November 1962 (revised February 1965) supplemental report to said House Document Numbered 325."

The Bureau has interpreted the above section of the act to mean that it has authority to adopt advancements in technology and operating methods to carry out the authorized project purposes, as long as such changes are within the projects' authorized cost ceiling. Bureau officials told us that such changes could be made without obtaining prior approval of the Congress.

As chapter 2 points out, we are unable to assess the total effect of the major changes on project costs. This can be done only after the Bureau completes cost studies for the features of the Garrison project affected by these changes.

Present plans, however, provide for full development of 250,000 acres of irrigation, as well as development of 146,530 acres of fish and wildlife habitat for management by the Fish and Wildlife Service and the North Dakota State Game and Fish Department. (See ch. 6). In addition, the Bureau plans to provide a stable water supply of 40,000 acre-feet of water for 15 or more towns and unidentified industrial users and 9 new recreation areas. Two recreation areas already exist in the Jamestown Reservoir. In our opinion, these plans provide for benefits essentially the same as those specified in the authorization document.

The design changes mentioned on page 23 included one of the items (shift from gravity to sprinkler irrigation system) specified in the Subcommittee's request. Details on this design change are discussed below.

SWITCH FROM GRAVITY TO SPRINKLER IRRIGATION AND ITS EFFECTS

The authorized plan calls for irrigation development by gravity flow of 250,000 acres. In 1967, however, one of the eight irrigation districts organized to receive and distribute project irrigation water to users adopted a resolution to request that the Bureau design and construct the most modern and efficient irrigation distribution system possible, including underground pipe, hard-surface canal lining, and other modern features. The Bureau was asked to consider lands which could be served by either a sprinkler or a gravity irrigation system. The other seven districts have since adopted similar resolutions.

As a result of its studies, the Bureau is considering a sprinkler irrigation system for the entire project and has included that system in the project plan. The Bureau approved the sprinkler irrigation system for the Oakes-west side area in September 1968. Bureau approval was predicated on water users' ability to pay the annual expenses for operation, maintenance, and replacements under a closed-pipe system and to meet required contracted repayments.

Advantages resulting from change
to sprinkler irrigation system

The irrigation district, in submitting its resolution to the Bureau asking for a more modern and efficient irrigation system, said that such a system was needed because more labor was required to construct and operate a gravity irrigation system and the potential for irrigation in the area was increased under a sprinkler system, because sprinklers were adaptable to more classes of land.

The Bureau studies for the Oakes and La Moure areas, the project irrigation areas scheduled to be constructed first, showed that several other benefits would be available from the change to a sprinkler irrigation system.

- Right-of-way needs would be reduced because irrigation areas would be more compact.
- Most land leveling would be eliminated, so topsoil would not be displaced.
- Water would be used more efficiently because it could be applied in light and frequent applications; therefore less drainage would be required and return flows from the project would be reduced.
- Total wetland losses would be small because irrigation areas would be compacted.
- Using buried pipe instead of open ditches would reduce hazards to people and animals; cause less disruption to farming operations, utilities, and roads; and reduce seepage losses and operational wastes.

--Sprinkling could be used for frost control and crop cooling, to increase productivity.

These advantages have not been quantified in terms of the benefits to individual participating farmers or the project as a whole, but the Bureau did study the effect of the change to a sprinkler irrigation system on the costs to farmers and to the project. These cost studies have been made for the Oakes and La Moure irrigation areas only. The Bureau has scheduled studies for the other irrigation areas during the period 1977 to 1980.

Irrigation cost studies

The two Bureau studies show that investment costs to the farmer and the project will be less under the sprinkler irrigation system than under the gravity irrigation system but that the annual costs to the farmer for operation, maintenance, and replacements will be slightly higher under the sprinkler irrigation system.

The Bureau's cost comparison studies for the sprinkler and gravity irrigation systems for the farmers in the Oakes-east and west side and La Moure areas were based on a farming operation with 160 acres of corn, which is the principal crop to be grown with irrigation water in these areas. As shown below in the results of the Bureau's 1972 study, with the sprinkler irrigation system, investment costs to the farmers would be \$3,900 less and annual costs for operation, maintenance, and replacements would be \$3.30 an acre more.

	<u>Irrigation system</u>	
	<u>Gravity</u>	<u>Sprinkler</u>
Investment cost	\$23,800	\$19,900
Annual cost per acre	27.18	30.48

After the Bureau study results were made available to all members of the irrigation districts in the Oakes and La Moure areas, 97 percent of the votes cast by members (845 to 24) were for adopting the sprinkler irrigation system.

We noted several computational errors the Bureau made in its 1972 study through inconsistently using unit prices, using outdated prices, and incorrectly applying construction cost

indexes. We updated the Bureau's studies to compare costs for gravity and sprinkler irrigation systems for a farming operation with 160 acres of corn at 1973 prices. The following table shows the results of our analysis.

	<u>Irrigation system</u>	
	<u>Gravity</u>	<u>Sprinkler</u>
Investment cost	\$33,640	\$27,740
Annual cost per acre	37.21	37.28

The investment cost to a farmer was \$5,900 less with a sprinkler system, instead of the \$3,900 the Bureau had computed, and the annual costs for operation, maintenance, and replacements were \$0.07 an acre more with a sprinkler system, instead of the \$3.30 an acre the Bureau had computed.

Farmers in the project area indicate that they are able to obtain capital for investment purpose more easily than they can locate farm labor. For example, one farmer said that he was unable to hire help to drive his air-conditioned tractor, let alone work in the mud changing syphon hoses and opening flood gates for a gravity irrigation system. Bureau officials told us that the gravity irrigation system would require more farm labor than would a sprinkler irrigation system.

To insure that capital is available for irrigation development in North Dakota, the North Dakota Legislature authorized issuing debentures to provide loan money to farmers, effective July 1, 1973.

Effect of change on project costs

The Bureau's studies of the effect of the change from a gravity to a sprinkler irrigation system on project costs showed that a sprinkler system would be cheaper than a gravity system.

	<u>Investment cost</u>		
	<u>Irrigation system</u>		
	<u>Gravity</u>	<u>Sprinkler</u>	<u>Savings</u>
Oakes area:			
West side (at January 1968 prices)	\$14,290,000	\$10,430,000	\$3,860,000
East side (at January 1972 prices)	29,790,000	23,570,000	6,220,000
La Moure area (at January 1973 prices)	14,990,000	13,390,000	1,600,000

We adjusted the Bureau's studies to update price information for the Oakes-east side area, correct computation and cost-indexing errors, and apply unit prices consistently. The following chart shows the results we obtained.

	<u>Investment cost</u>		
	<u>Irrigation system</u>		
	<u>Gravity</u>	<u>Sprinkler</u>	<u>Savings</u>
Oakes area:			
West side (at January 1968 prices)	\$10,670,000	\$10,430,000	\$ 240,000
East side (at January 1973 prices)	31,978,610	28,419,420	3,559,190
La Moure area (at January 1973 prices)	14,990,000	14,313,910	676,090

Although the adjusted savings are less than the savings the Bureau claimed, our analysis showed that the contention that a sprinkler irrigation system for the Oakes and La Moure areas would be cheaper was reasonable.

CONCLUSIONS

The Bureau has the authority, within the authorizing act for Garrison, to make project changes if they can be made within the authorized cost ceiling and do not greatly alter the project purposes and resulting benefits used as a basis for the project's authorization by the Congress.

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We are unable to assess the total effect of the major changes on project costs. This can be done only after the Bureau completes its cost studies for the features of the Garrison project affected by these changes.

CHAPTER 5

CANAL SEEPAGE AND OPERATIONAL WASTES

Seepage is the water that soaks into the base and sides of canals and laterals that convey water from its source to its point of use. Operational wastes include water lost when farmers refuse to accept the water, outflows through breaks in canal walls, leaks past gates and other structures, and consumption by vegetation along canals and laterals.

Bureau instructions, issued before Garrison was authorized, contain general criteria on seepage losses and state that allowable seepage and operational wastes can range from 15 to 40 percent and 5 to 35 percent of the average annual diversion, respectively. According to the Bureau instructions, the ranges are necessary because of the wide differences in soil, crop, water supply, and climatic conditions for irrigation projects.

In December 1967, after project authorization, the Bureau issued revised instructions which further refined its policy on canal seepage and operational wastes and emphasized the most economical method of conserving water. The Bureau's current policy states that:

"It is the policy of the Bureau of Reclamation in order to conserve water and to secure other benefits to consider fully the lining or placing in pipe of all constructed waterways for the conveyance and distribution of project water supplies. In those instances where the recommendations do not call for lining or pipe, full justification will be required."

On the basis of the results of soil tests, the estimates of the value of water, the cost of canal construction, and the cost of canal lining, the Bureau determines which conditions make it economical to line canals. The trade-off--whether the water savings warrant the additional cost to line the canal--is the value of the water saved through the canal lining plus the construction costs saved by reducing the canal's capacity versus the cost to line the canal to save the water.

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ESTIMATE OF CANAL SEEPAGE LOSSES AND OPERATIONAL WASTES UNDER A GRAVITY IRRIGATION SYSTEM

The Bureau's 1965 supplemental report, which included the project plan authorized by the Congress, said that the average annual water diversion from Lake Sakakawea for project purposes would be 871,000 acre-feet under a gravity irrigation system, as shown below.

	<u>Acre-feet</u>	<u>Percent</u>
Farm delivery	343,000	39.4
Seepage and operational wastes	291,000	33.4
Fish, wildlife, and recreation uses	134,000	15.4
Reservoir evaporation	62,000	7.1
Municipal and industrial uses	<u>41,000</u>	<u>4.7</u>
Total	<u>871,000</u>	<u>100.0</u>

In addition, 216,000 acre-feet of water were estimated to remain as return flows in project watersheds, and some of this would be available for project use.

To determine what the total diversion would be, the Bureau began by estimating the total water required at the point of use for irrigation, recreation, fish and wildlife, and municipal and industrial purposes. These requirements were then backed from the point of use through the project conveyance system to the Snake Creek pumping plant where the diversion was made. Anticipated water losses from the diversion to the point of use--seepage, operational wastes, and reservoir evaporation--were added, to estimate the total diversion requirement.

The Bureau estimated seepage for Garrison to be about 203,900 acre-feet, or 23.4 percent of the total annual diversion, and operational wastes to be about 87,100 acre-feet, or 10 percent of total annual diversion. Estimated seepage and operational wastes were both within the Bureau's criteria.

The Bureau computed seepage, according to instructions, by using comprehensive studies and the Moritz formula. This

formula for approximating seepage losses is widely used throughout the country by engineers engaged in designing irrigation projects.

Soil tests were made in each of the areas to be irrigated, to determine the permeability of soils where canals and laterals would be constructed. Cost estimates were made for canal lining to reduce seepage and for canal construction.

The Bureau estimated the value of an acre-foot of water saved by lining canals and laterals over a 100-year period by considering the:

- Gain in power: revenues from power plants at and below Garrison on the Missouri River.
- Reduction in costs of drainage construction and expenses for operation and maintenance, for each additional acre-foot of water saved.
- Reduction in the pro rata share of investment costs allocated to irrigation, which is interest free, from Corps of Engineers' projects in the Pick-Sloan Missouri Basin Program.

The Bureau made firm estimates of seepage in its 1965 supplemental report for the Oakes, La Moure, Warwick-McVille, and Lincoln Valley areas where canal layouts were available. It projected seepage in the Karlsruhe, Souris, and New Rockford areas because only semidetalled plans were available for these areas. The Bureau's estimated operational wastes for Garrison were based on its experience with similar projects.

ESTIMATE OF CANAL SEEPAGE LOSSES AND
OPERATIONAL WASTES UNDER A
SPRINKLER IRRIGATION SYSTEM

The Bureau has not assessed the total diversion requirements or seepage and operational wastes for the entire Garrison project under a sprinkler irrigation system nor has it projected a date for completing these studies. A study has been completed for seepage and operational wastes in the

Oakes-west side area, and these results were used for projections on the Oakes-east side area and the Oakes Canal. A comparison of the seepages and operational wastes under the gravity and sprinkler irrigation systems follows.

	<u>Acre-feet annually</u>	
	<u>Oakes-west side area</u>	<u>Oakes area total</u>
Gravity system	13,510	29,630
Sprinkler system	<u>3,580</u>	<u>11,930</u>
Reduction with sprinkler system	<u>9,930</u>	<u>17,700</u>
Percent reduction	<u>74</u>	<u>60</u>

We estimated, and Bureau officials agreed, that the diversion could possibly be reduced by as much as 200,000 acre-feet to a total average annual diversion of 671,000 acre-feet under a sprinkler irrigation system. Canal seepages would be about 57,450 acre-feet, or 8.6 percent of the total annual diversion. Operational wastes could be reduced to about 33,550 acre-feet, or 5 percent of total annual diversion. Estimated seepage and operational wastes are both within the Bureau's criteria.

Basically, the same procedures were used for analyzing losses under a sprinkler irrigation system for the Oakes area as were used under the gravity irrigation system. A major change, placing all flows of less than 50 cubic feet per second in pipe, resulted in replacing 261 miles of open canals and laterals with 66 miles of closed pipe. Overall, this change will eliminate about 1,400 miles of open canals and laterals for Garrison. The water value has also been updated.

We were told that, as construction proceeded, tests were made to measure seepage so that lining could be installed where needed and that engineers at the Engineering and Research Center were continually studying new methods for lining canals so that more canals could be lined at less costs.

The Bureau is also considering the use of closed pipe for flows in excess of 50 cubic feet per second, possibly up to 100 cubic feet per second.

POTENTIAL EFFECTS OF REDUCED WATER LOSSES
UNDER SPRINKLER IRRIGATION SYSTEM

Water saved due to changing from a gravity to a sprinkler irrigation system provide potential benefits in certain ways. Bureau officials told us that they had the following options open to them.

- A reduction in the annual diversion would result in increased generation capability and power revenues at Corps of Engineers' power plants and in reduced operating costs for Garrison because the pumping periods at the Snake Creek pumping plant could be shortened.
- Additional acreage could be irrigated in Garrison.
- Water could be sold for non-Federal irrigation projects.
- Canal and lateral capacities could possibly be reduced but delivery requirements during peak-demand periods would have to be considered.

The Bureau has not developed a specific plan and has not assessed the effect of any of these options.

CONCLUSIONS

Although the Bureau has not completed its studies, preliminary indications are that canal seepage, operational wastes, and the annual average diversion requirement would be substantially reduced under revised plans to (1) increase the use of canal linings and pipe and (2) switch from a gravity to a sprinkler irrigation system. Although estimated canal seepage and operational wastes were within the Bureau's allowable limits (15 to 40 percent and 5 to 35 percent, respectively) under both plans, the revised plan emphasizes the most economical means of conserving water. Canal seepage and operational wastes are reduced from 23.4 and 10 percent, respectively, under the authorized plan to 8.6 and 5 percent, respectively under the revised plan.

In total, we estimated, and the Bureau agreed, that under the revised plan, the average annual diversion requirement (871,000 acre-feet of water) could be reduced by 200,000 acre-feet of water annually. Bureau officials said that such a reduction could give the Bureau previously unavailable options for (1) reducing the capacity of canals and other construction required to deliver project waters where they are needed or (2) using the water supply to irrigate more land or generate more power than originally anticipated.

CHAPTER 6

FISH AND WILDLIFE DEVELOPMENT

Fish and wildlife development is an important purpose of the Garrison project. According to the authorized project plan, wildlife habitat losses caused by the construction of such project features as canals, pumping plants, and drains are to be offset through the development of new and existing fish and wildlife areas.

The Fish and Wildlife Service (FWS) has, since the late 1950s, played a major role in planning fish and wildlife mitigation and enhancement measures. Its 1962 report on "Fish and Wildlife Resources in Relation to the Garrison Diversion Unit Initial Stage," prepared according to the Fish and Wildlife Coordination Act (16 U.S.C. 661), became an integral part of the Garrison plan the Congress approved in 1965.

Although there may be a change in the basic approach used to develop fish and wildlife areas, there is no plan to reduce the total benefits to be realized.

APPROVED PLAN

The initial fish and wildlife plan called for the development of 36 major and a number of minor areas, encompassing 146,530 acres, to enhance fish and wildlife values and to mitigate damages to waterfowl habitat attributed to project construction. State game and fish departments in North and South Dakota were to manage 10 of these areas, about 39,000 acres, and FWS was to manage the other areas.

The development areas were all in proximity to project canals because a water supply was the major determining factor for area selection. It was estimated that from 100,000 to 165,000 acre-feet of water would have to be diverted annually to the fish and wildlife areas to provide a dependable water supply and to permit intensive management of marsh and water habitat.

With the exception of eliminating two major areas, the Hamburg Diversion Dam and the Renzienhausen Slough, caused by realignment of the New Rockford Canal and a change in the location of lands to be irrigated in the Oakes-east side area after the project was authorized, the fish and wildlife areas the Bureau described in its final overall environmental statement issued in January 1974 were the same as those proposed by FWS in 1962. The environmental statement noted that replacement acreage for the eliminated areas would be identified by FWS so that there would be no overall change in costs and benefits from those included in the authorized project plan.

A major criticism of the original plan was that there would be a net loss of about 17,500 acres of wetland. This figure, based on developmental plans under the gravity irrigation system, considered creating about 22,000 acres of new water and marsh habitat, while losing or altering about 39,500 acres of wetland by project construction. The Bureau has since approved and adopted a sprinkler irrigation system. Data in the environmental statement shows that a net gain of 563 acres of wetland is expected under the sprinkler irrigation system.

	<u>Type of irrigation</u>	
	<u>Gravity</u>	<u>Sprinkler</u>
	(acres)	
Total lands for water and marsh (note a)	56,175	56,175
Less existing wetlands to be managed	<u>34,100</u>	<u>28,662</u>
New water and marsh to be developed	22,075	27,513
Less water and marsh to be lost or altered	<u>39,533</u>	<u>26,950</u>
Net gain or loss (-) of wetlands	- <u>17,458</u>	<u>563</u>

^a Does not include 90,355 acres of upland habitat

ALTERNATIVE PROPOSAL

In February 1974 an FWS official in Bismarck told the Bureau that FWS had begun a complete reevaluation of the fish and wildlife development plan. FWS said that the original plan, although probably valid on facts then known and wildlife management practices used at that time (before 1962), failed to consider major innovations in wildlife research and management principles discovered in the last 15 years.

FWS said that its original plan may threaten existing natural ecosystems and questioned whether the planned development areas would, in fact, offset wetland losses the project caused. FWS said that the need for water in the development areas no longer was as critical as previously believed, particularly when it involved adding water to existing wetlands. FWS is appraising restoration of small, natural wetland areas which may more effectively offset the losses caused by construction of project features.

Overall, FWS still plans to develop 146,530 acres for fish and wildlife; however, the average size of individual areas included in the alternative plan may be considerably less than that initially planned. For those areas which the FWS reevaluation identified as not needing a water supply, an FWS official told us that substitute natural wetlands, which have been drained or altered, would be selected for restoration and development. These substitute lands will not necessarily be in the same location as the original sites but may be anywhere within the boundaries of the Garrison Conservancy District.

The FWS preliminary reevaluation of the first lands to be acquired under the new policy was expected to be completed by October 1974. It was uncertain, at the end of our review, whether 8,000 acres which the Bureau had acquired concurrently with acquiring project lands for construction would still be needed under the new policy.

LAND ACQUISITION

Bureau policy is to acquire fee title to lands which are to be managed as fish, wildlife, and recreation areas. Land easements, which are generally obtained for power transmission lines and small irrigation project features, do not provide for the total land use and control which, according to the Bureau, are needed in fish, wildlife, and recreation areas.

FWS officials said that fee title was necessary if lands were to be managed. Failure to have full control over lands would inhibit management prerogatives over the long term.

As of June 1, 1974, the Bureau had purchased about 50 percent of the 43,300 acres needed for the McClusky Canal

and Lonetree Reservoir and about one-third of the 25,300 acres wanted for fish and wildlife areas in that segment of the project. House report 93-530, page 120, in commenting on measures to mitigate fish and wildlife losses said that, when land acquisition for mitigation purposes was required, it should be carried out before or concurrently with project construction. The Bureau has made concurrent acquisitions when landowners hold titles to lands which are needed for both fish and wildlife development and project construction. Landowners holding title to only desired fish and wildlife lands are requested to sell these lands when project construction is completed to the point where the fish and wildlife lands can be supplied with water.

CONCLUSION

The Bureau of Reclamation and FWS had made or were considering several changes affecting the development of fish and wildlife portions of the authorized Garrison project plan. None of these changes were expected to reduce the total acreage allocated to fish and wildlife development originally planned when the Garrison project was authorized.

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NINETY-THIRD CONGRESS

Congress of the United States

House of Representatives

CONSERVATION AND NATURAL RESOURCES SUBCOMMITTEE
OF THE

COMMITTEE ON GOVERNMENT OPERATIONS

RAYBURN HOUSE OFFICE BUILDING, ROOM B-349-C

WASHINGTON, D. C. 20515

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225-6427

B-164570

November 14, 1973

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

Dear Mr. Staats:

Our Subcommittee is concerned that the Bureau of Reclamation, in its work on the Garrison Diversion Unit in North Dakota, will incur costs more than double the project authorization, has substantially reduced its planned fish and wildlife areas, will incur excessive water losses from seepage at the project, and will, by the pollution resulting from the project, violate Article IV of the 1909 Boundary Waters Treaty between the United States and Canada.

Public Law 89-108 of August 5, 1965, provided for the construction by the Bureau of Reclamation of the Garrison Diversion Unit in North Dakota. The project will provide irrigation water to 250,000 acres through 1,865 miles of canals, 4 regulating reservoirs, 141 pumping plants, and 2,813 miles of drains. For the construction of the Garrison Unit, Congress established a ceiling of \$207 million "plus or minus such amounts, if any, as may be justified by reason of ordinary fluctuations in construction costs as indicated by engineering cost indexes applicable to the types of construction involved herein."

We understand that as of June 30, 1973, construction on the project was estimated to be about 16 percent complete at a cost of about \$55 million. As of January 1, 1973, we understand, the Bureau estimated it will cost another \$378 million to complete the project. The Bureau has not, as yet, sought the approval of Congress for an increase in the project authorization.

At the request of our Subcommittee, your agency recently conducted a preliminary review of the project. That review demonstrates the need for a thorough investigation by your agency of the following matters:

1. Increased Project Costs - As noted above, the bureau's current estimate of the project construction costs (\$433 million) is more than double the project authorization ceiling of \$207 million. The GAO has already deter-

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mined that several major, as well as minor, changes have been made to the project as approved by the Congress, including the elimination of the New Home Reservoir, the realignment of the New Rockford Canal, the Devils Lake restoration, and the James River improvement. Although changes in price levels, land use requirements and data sometimes require some substantial changes in projects as originally approved, we note that this project was marginal from an economic standpoint when it was approved in 1965. We therefore request that GAO determine:

- (a) how accurate the January 1973 cost estimate is;
- (b) what portion of these increased estimated costs is due to "ordinary fluctuations in construction costs" as authorized by section 6 of the 1965 Act;
- (c) what portion of these increased estimated costs is due to project changes occurring since 1965;
- (d) whether the GAO believes that the 1965 Act authorizes the Bureau to make such major changes without Congressional approval; and
- (e) whether the Bureau is authorized to proceed now with further construction (when it is aware that such construction will require an increase in the project authorization ceiling) without first informing Congress and obtaining from Congress an authorization to continue. (If the Bureau waits until it has obligated funds up to or near the ceiling, Congressional options will be severely circumscribed.)

2. Change from Gravity to Sprinkler Irrigation - We understand that the Bureau plans to shift from a gravity to a sprinkler system in the eight irrigation districts comprising the project. A 1968 Bureau study in one of eight irrigation districts, using current cost criteria based on 1965 prices, indicated that a sprinkler system would cost at least \$4 million more than a gravity system. We understand that the Bureau contends that it has authority to make this change.

- (a) We request that GAO determine:
 - (i) whether or not the Bureau has such authority; and
 - (ii) what will be the estimated increased cost of this system if installed in all the irrigation districts of this project.
- (b) Several opponents of the project and the GAO contend that the average cost of the sprinkler equipment to be used with the project is about \$3,000 per 10 acres -- far above the financial capital available to

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the smaller farmers". The CEO notes that the net farm income in this area was \$6,088 in 1971. Acting Secretary of the Interior Kent Frizzell, in an August 6, 1973, letter to the CEO, recognized that use of the sprinkler system will result in "added costs for equipment", but contends "there are offsetting long-term benefits". Some of the cited "benefits" are: "water conservation, reduction of costs in constructing drainage works, reduction in farm labor requirements, prevention of frost damage, reduction in return flows,...".

- (i) Please ascertain whether or not this contention is generally accurate and whether or not these "benefits" offset the costs to the "smaller farmers".
- (ii) What, if any, consideration did the Bureau give to the financial effect of the system on "smaller farmers"?

3. Excessive Seepage Loss - We understand that the average annual diversion requirements for the initial stage of the project will be 871,000 acre-feet. We also understand that seepage and operational waste may amount to 41 percent of the total diversion requirement, with the reservoir accounting for an additional 5 to 7 percent. The Bureau apparently maintains that this seepage loss is not excessive and assumes that the sprinkler system will reduce seepage and waste. But there appears to be a lack of criteria as to what is excessive. Furthermore, no water studies have apparently been made to quantify the water requirements of the sprinkler system. We request that the GAO review the adequacy of the Bureau's contentions and policies, procedures, and practices concerning the seepage problem.

4. Reduction of Fish and Wildlife Areas - Your agency advises us that the 1965 Bureau report on the project stated that there would be 36 major areas that would be procured by the Bureau for the development of fish and wildlife. Later information released in the 1973 draft environmental statement states that two of the major areas and some other areas will not be developed. We have been informed that, as a result of the above reductions, approximately 17,450 acres of prairie wetlands will not be included for fish and wildlife purposes in the project, which were initially included as benefits in the 1965 analysis. A July 9, 1973, memorandum of the Bureau of Sport Fisheries and Wildlife to the Bureau of Reclamation (copy enclosed) discusses a number of other deficiencies concerning the fish and wildlife aspects of the project.

(a) Please review the adequacy of steps taken or planned for fish and wildlife mitigation and enhancement in light of benefits claimed by the Bureau of Reclamation in 1965.

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(b) Enclosed is a copy of the House Committee on Government Operations' report (H. Rept. 93-530; Sept. 27, 1973) entitled "Stream Channelization: What Federally Financed Draglines and Bulldozers Do To Our Nation's Streams". Pages 109-120 discuss the extent to which construction agencies carry out mitigation measures and the timeliness of those measures. Please review the Bureau's actions concerning mitigation measures at this project in light of the concerns expressed by the Committee in that report.

(c) Please review the adequacy of land acquisition measures planned for the project for fish and wildlife and recreation purposes, including the costs of those measures and the adequacy of protection expected through the use of easements for wildlife purposes.

5. Degradation of Canadian Waters -- On April 5, 1973, the Bureau of Reclamation submitted to the Council on Environmental Quality a revised draft environmental impact statement which discusses the problem of Souris Loop Area irrigation and polluted return flows being discharged into Canada. The statement states (p. VIII, 36, 37):

"If present negotiations with Canada result in the necessity for corrective measures to handle these flows, there are several alternatives available. Reservoir sites are available on Deep River (Deep River Reservoir) and the Souris River (Westhope and Landa Reservoirs) that could be used to collect and store project return flows. If diluted flows were allowable into Canada, these return flows could be held for release with spring floods, or they could be released regularly along with dilution water from the Velva Canal system. If return flows were not allowed to cross the Canadian boundary, the water collected in these reservoirs could be evaporated, pumped back onto lands for irrigation, or transported back into the Missouri River basin.

"All of these alternatives are unacceptable under present conditions because of the great expense involved, the risk of harmful side effects upon lands and streams of the Souris Loop Area, and the effects upon other areas of North Dakota. Should negotiations with Canada dictate a solution that involves any of these alternatives, a more detailed investigation of its environmental impacts must be made." (Underlining supplied.)

In a June 15, 1973, letter to the Interior Department (copy enclosed), the Chairman of the CEQ, Russell E. Train, said:

"In view of the substantial and severe impacts of this project, including the loss of wetlands, the lowered water table, the severed farms, and the public controversy

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and international implications, I strongly recommend that construction on the Garrison Diversion Unit be suspended until these issues have been resolved." (Underlining supplied.)

In an August 6, 1973, reply (copy enclosed) the Acting Secretary, Kent Frizzell, said:

"The matter of return flows to rivers flowing into Canada has been recognized and under study for over 2 years. It is now being considered by representatives of both Governments of Canada and the United States by their representatives on a task force at the field level. In view of the fact that construction of the facilities in the Middle Souris Area is not planned to be undertaken for several years, there should be adequate time for a more detailed analysis of the potential impact and resolution of the problem. The Bureau has been negotiating with representatives of Canada to initiate a more detailed joint study of the matter of return flows. When this is completed the United States will be in a better position to negotiate on trade offs, acceptable mitigating measures, operational procedures, etc. At the present time, it is recognized that this matter is unresolved but, it is under active study and is not thought to be an insurmountable problem" (Underlining supplied.)

Mr. Frizzell rejected the CEO's recommendation for a moratorium on further construction of the project.

(a) Please determine how frequently and extensive these negotiations have been and the need for, and purpose of, "a joint study of the matter of return flows".

On October 23, 1973, the Canadian Embassy sent a note (No. 432) to the Secretary of State concerning this project (copy enclosed). Two previous notes (Nos. 313 of October 19, 1971, and No. 35 of January 25, 1972) have been sent by Canada to the Secretary of State. The latest note states:

"The Embassy reaffirms that the Government of Canada continues to be gravely concerned that return flows from the irrigation of land in the Souris Loop and areas adjacent to tributaries of the Red River will significantly and seriously degrade water quality in these two Rivers. The Government of Canada has concluded that based on studies conducted in both countries the proposal would run counter to the obligations assumed by the United States under Article IV of the Boundary Waters Treaty of 1909 that:

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"...waters herein defined as boundary waters and waters flowing across the boundary shall not be polluted on either side to the injury of health or property on the other."

* * * * *

"The Department of State will recall that the group of Canadian and U.S. officials which was to consider alternatives...has met only once. No agreement could be reached as to the terms of reference for the group and thus no progress has been achieved through this mechanism."

* * * * *

"Accordingly, the Government of Canada requests urgently that the Government of the United States establish a moratorium on all further construction of the Garrison Diversion Unit until such time as the United States and Canadian Governments can reach an understanding that Canadian rights and interests have been fully protected in accordance with the provisions of the Boundary Waters Treaty." (Underlining supplied.)

On November 5, 1973, the Acting Secretary of State, Kenneth Rush, in a note to Secretary of the Interior Morton (copy enclosed) commented on the October 23 Canadian note as follows:

"This Note reiterates Canada's strong and consistent objection to any further development of the Garrison Diversion Unit in North Dakota which could result in degradation of waters flowing into Canada. This Note goes beyond Canada's prior expressions on the subject, and urgently requests that the United States Government establish 'a moratorium on all further construction of the Garrison Diversion Unit until such time as the United States and Canadian Governments can reach an understanding that Canadian rights and interests have been fully protected in accordance with the provisions of the Boundary Waters Treaty' between the United States and Canada." (Underlining supplied.)

Mr. Rush also said that "Canada's position is consistent with that which the Department of State has taken," and urged "that the obligation of the United States under the 1909 Boundary Waters Treaty should be very carefully weighed before further funds are expended on this project."

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November 14, 1973

(b) We request your opinion, by December 18, 1973, on whether or not the Bureau can continue to expend funds on this project when it is aware that the project, as presently planned, will violate Article IV of the 1909 Treaty.

We shall appreciate your prompt response on the foregoing questions. Our Subcommittee staff will be available to meet with representatives of your staff to discuss the scope and progress of your examination into these issues. We request that, if necessary, you discuss your findings with appropriate Interior officials, but that you do not delay your response to us in order to obtain their written comments thereon.

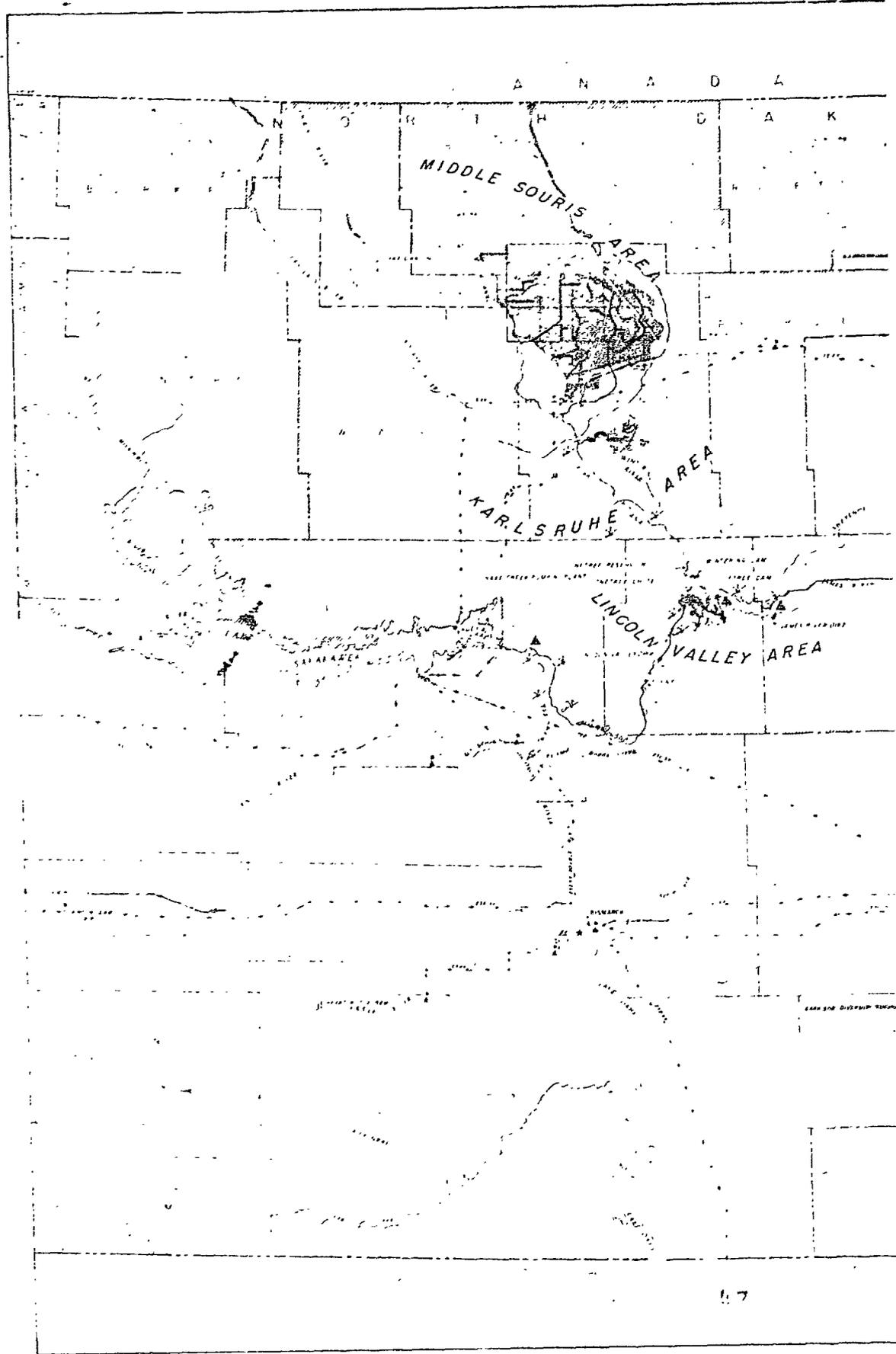
Sincerely,

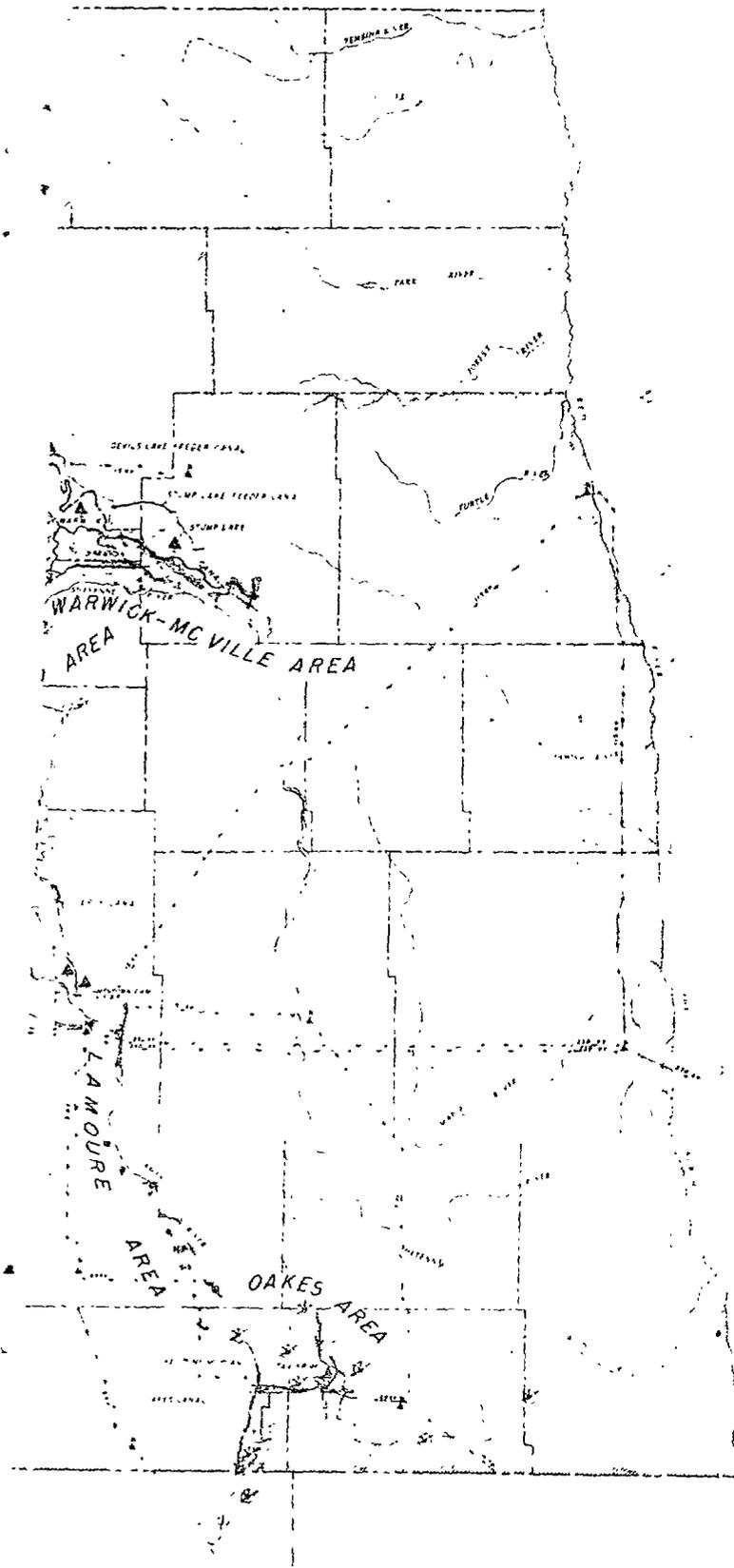
HENRY S. PELES
Chairman
Conservation and Natural Resources
Subcommittee

Enclosures

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INDEX MAP

EXPLANATION

AUTHORIZED FEATURES

- AREA BENEFITED BY PROJECT
- MAIN LATERAL
- PUMP-OUT PLANT
- CANAL
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- DAM AND RESERVOIR
- FISH AND WILDLIFE REFUGE AREA
- NATIONAL PARK SERVICE RECREATION SITE

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- TRANSMISSION LINE TOWER
- SUBSTATION
- PUBLIC POWER PLANT
- STEAM AND TELEGRAPH PLANT
- HYDROELECTRIC PLANT
- NATIONAL PARK SERVICE RECREATION SITE

UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF RECLAMATION

ALBERT G. STAMM, COMMISSIONER

BUREAU OF SPORT FISHERIES & WILDLIFE
C. W. WILSON, DIRECTOR

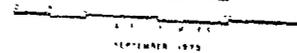
NATIONAL PARK SERVICE
RONALD W. BAILEY, DIRECTOR

PICK-SLOAN MISSOURI BASIN PROGRAM

**GARRISON DIVERSION
UNIT**

INITIAL STAGE - 250,000 ACRES
NORTH DAKOTA

MAP NO. 769-603-14-00



SEPTEMBER 1973