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# Revisions Recommended For The Benefit-Cost Analysis For The Planned Tomahawk Lake Project In Kansas

Corps of Engineers  
(Civil Functions)  
Department of the Army

***BY THE COMPTROLLER GENERAL  
OF THE UNITED STATES***

RED-75-382

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JULY 2, 1975

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

B-181401

C The Honorable Larry Winn, Jr.  
House of Representatives

R Dear Mr. Winn:

This is our report on the review of the Corps of Engineers' benefit-cost analysis for the planned Tomahawk Lake in Kansas. We made the review pursuant to your May 30, 1974, request. 305

W Formal comments were obtained from the Secretary of the Army and have been considered in our report. 20

We want to invite your attention to the fact that this report contains recommendations to the Secretary of the Army which are set forth on pages 15 and 21. 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 report. We will be in touch with your office in the near future to arrange for copies of the report to be sent to the Secretary and the four committees to meet the requirements of section 236. 1500  
> 300

Sincerely yours,  
*Thomas A. Meade*

Comptroller General  
of the United States

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ABBREVIATIONS

BOR	Bureau of Outdoor Recreation
GAO	General Accounting Office
OCE	Office of the Chief of Engineers
OMB	Office of Management and Budget

## GLOSSARY

Affluence factor	A factor that represents the effect of increasing per capita income on the unit value of real property and contents.
Interest rate	The interest rate used in the economic evaluation of proposed water resource projects for discounting future benefits and computing costs or otherwise converting benefits and costs to a common time basis.
Economic costs	The value of all goods and services (land, labor, and materials) used to construct, operate, and maintain a project or program; interest during construction; and all other identifiable expenses, losses, liabilities, and induced adverse effects connected therewith, whether in goods or services, whether tangible or intangible, and whether or not compensation is involved.
Enhancement benefits	The expected value from increased or higher use of property made possible by the greater protection provided by the project. May also be called land enhancement or induced growth benefits.
Flood plain zoning	A legal means used by the community to preclude construction of flood damageable property in the flood plain.
Induced costs	All uncompensated adverse effects caused by the construction and operation of a program or project, whether tangible or intangible.
Incremental allocation (flood control)	The difference in flood control capability in the basin with and without the project is determined and the flood control benefits are assigned to a project according to the specific increment of flood control provided by the project.

Last added	Incremental benefits achieved after completion of the last project in the stream system basin. They are considered the most rigorous of allocation tests for economic feasibility.
System allocation (flood control)	Flood control benefits are accumulated for all projects in a river basin, then redistributed in proportion to each project's flood control capability.
Urban hydrology benefits	Changes in land use, especially urbanization, may result in major alteration of a basin's drainage characteristics, particularly surface runoff. The construction of highways, parking lots, and homes increases the amount of impervious land surface which increases the flow of water during a given period. Also, improved drainage patterns act to speed up surface runoff. The result is higher flood levels and increased damages. Urban hydrology benefits represent the reduction in these damages resulting from construction of a project.

COMPTROLLER GENERAL'S REPORT TO  
THE HONORABLE LARRY WINN, JR.  
HOUSE OF REPRESENTATIVES

REVISIONS RECOMMENDED FOR THE  
BENEFIT-COST ANALYSIS FOR THE  
PLANNED TOMAHAWK LAKE PROJECT  
IN KANSAS  
Corps of Engineers (Civil  
Functions)  
Department of the Army

## D I G E S T

### WHY THE REVIEW WAS MADE

GAO was asked to review the Corps of Engineers' benefit-cost analysis for the planned Tomahawk Lake project. This is a multiple-purpose project to be located on Tomahawk Creek, Johnson County, Kansas.

### FINDINGS AND CONCLUSIONS

Tomahawk Lake--one of five projects planned for the Blue River basin--is intended to provide flood control protection, water supply, and recreation benefits.

Estimated construction costs for Tomahawk increased from \$16.4 million at the time the project was authorized in 1970 to \$40.3 million in April 1974. (See p. 5.)

Average annual costs increased from \$642,000 in 1970 to \$2.9 million in April 1974. The change is due primarily to price level increases and use of a higher interest rate for computing the project's cost. (See p 5.)

Estimated annual benefits for the Tomahawk Lake project increased from about \$1.65 million in 1970 to \$7.75 million in April 1974 and, for the most part, were flood control benefits. (See p. 5.)

#### Flood control benefits

The Corps' April 1974 analysis estimated that, on the basis of the system method for allocating common system benefits, the flood control

benefits accruing from the Tomahawk Lake project would average \$6.3 million annually. Benefits would be \$5.6 million allocated under the incremental method, assuming Tomahawk Lake is the second project constructed in the system. (See p. 8.)

The system method distributes the total flood control benefits to each project in proportion to its flood control capability. The incremental method distributes the benefits to each project according to the specific increment of flood control provided; that is, the difference in flood control capability with and without each project. (See p. 7.)

GAO favors the incremental method because it compares the benefits directly attributable to the project with the costs of providing the benefits and best fits the congressional criteria for formulating and evaluating the Blue River basin projects. (See p. 8.)

The Army told GAO that the method which best represented the economic merit of the Blue River basin projects was subjective and therefore each project was reported on both systems and incremental bases.

If the Corps had computed the April 1974 benefit estimate according to the new and proposed regulations it would have been reduced. Such regulations would:

- Restrict the use of an affluence factor (the effect of increasing per capita income on the unit value of real property and contents) to the personal property in residential structures. This would eliminate most of the \$3.5 million in annual affluence benefits because most of these benefits are associated with industrial and commercial developments.
- Require recognition of flood plain zoning by 1975 instead of 1983 and eliminate \$720,000 in annual benefits calculated for the 8-year period.

--Require reanalysis of the \$437,000 in annual benefits calculated for land enhancement which represents the increased value or higher use of property resulting from the project's flood control protection. (See pp. 9 to 12.)

Further, the benefits could be affected if more current streamflow data were used to determine flood damages. (See p. 13.)

In March 1975 the Corps revised its estimate of flood control benefits, as suggested by GAO, by excluding the affluence factor and considering the impact of flood plain zoning.

The Corps' March 1975 reanalysis allocated flood benefits to the Tomahawk Lake project of \$3 million under the systems method and \$2.5 million under the incremental method. (See p. 8.)

The revision did not include more current streamflow data or reevaluation of land enhancement benefits using the new regulation procedures. Corp officials feel that revising the analysis by using more current data and the new procedures would not be worth the time and effort involved. (See p. 14.)

The Corps also included, for the first time, urban hydrology benefits--a type of flood control benefit from controlling effects of future urbanization on water runoff. (See p. 12.)

Net effect of the revisions was to reduce flood control benefits attributable to the Tomahawk Lake project from \$6.3 to \$3.0 million. (See p. 7.)

Urban hydrology benefits, representing 27 percent of the flood control benefits, were based on undocumented assumptions and judgmental factors. Corps officials told GAO that these benefits were reasonable and that the time and effort involved in obtaining additional documentation was not warranted. (See p. 13.)



### Cost estimates

In April 1974 the Corps estimated that the Tomahawk Lake project would cost \$40.3 million. GAO found that about \$8.1 million of these costs were not adequately supported. The Army said these costs were reviewed and supporting documentation had been obtained. GAO found that the costs were supported, except for the proposed sewerline cost estimated at \$3,460,000.

The sewerline was to be constructed across the bottom of Tomahawk Lake. Environmental considerations, however, might necessitate an alternate route around the lake, greatly increasing the cost. District officials said the cost estimate would be documented when the location of the sewerline was resolved. (See pp. 20 and 21.)

### Induced costs

The Corps concluded that the induced costs--uncompensated adverse effects caused by construction and operation of a project--would be minor. Local officials said costs would increase in the following areas:

- Police protection.
- Road construction and maintenance outside project boundaries.
- Development and maintenance of ambulance service.
- Fire protection.

GAO's review indicated that the Corps did not consider such costs in its benefit-cost analyses. The Army said induced costs and indirect benefits were not included in the analyses since it was determined they were relatively minor, offset each other, and would not affect the benefit-cost ratio. (See pp. 19 to 20.)

## RECOMMENDATIONS

The benefit-cost analysis is an essential factor for determining the economic feasibility of a water resource project. Therefore, such analyses should consider pertinent beneficial and adverse effects, realistically represent the expected conditions with and without the project, and be fully documented and supported.

GAO therefore recommends that the Secretary of the Army have the Corps

- make adequate tests to determine the effect of current streamflow data on flood control benefits and the impact of the revised regulations on claimed enhancement benefits,
- fully document the assumptions and judgmental factors supporting urban hydrology benefit computations,
- decide on the sewerline location and prepare the related cost estimate, and
- quantify the project's induced costs and the indirect benefits for inclusion in the benefit-cost analyses. (See pp. 15 and 21.)

On April 1, 1975, Johnson County voters defeated a levy proposal to finance construction and maintenance of recreational facilities at the three lakes in their jurisdiction. On May 19, a district official told GAO the effect of the election results could not be fully assessed at that time.

## CHAPTER 1

### INTRODUCTION

At the request of Congressman Larry Winn, Jr., we reviewed the Corps of Engineers' benefit-cost analysis for the planned Tomahawk Lake project in Kansas. We reviewed the Corps' method of and procedures for computing the project's benefits and costs and the supporting documentation.

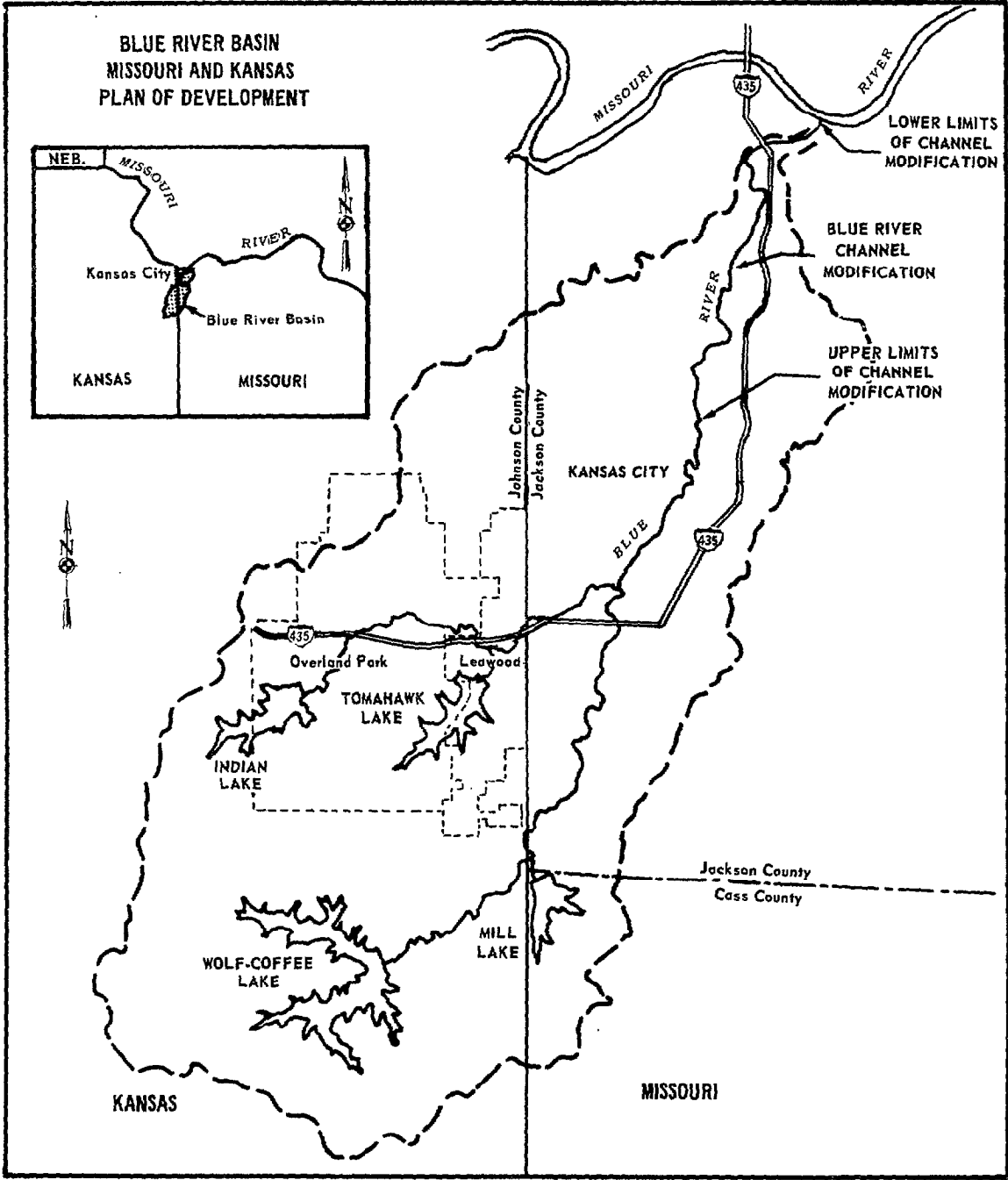
Tomahawk Lake is one of five projects planned for the Blue River basin and will be within the corporate limits of Leawood and Overland Park, Kansas. The five projects were authorized by the Flood Control Act of 1970 (Title II of Public Law 91-611, Dec. 31, 1970) on the basis of the Corps' 1968 survey report and recommendation for the comprehensive development of the Blue River basin, as set forth in House Document 332, 91st Congress.

The projects, a channel modification to the main stream (Blue River Channel Modification) and four multi-purpose projects (Wolf-Coffee Lake, Tomahawk Lake, Indian Lake, and Mill Lake), were authorized to provide flood control, water quality enhancement, and recreation opportunities. Municipal water supply was later substituted for water quality enhancement. The map on the next page locates the five authorized projects.

### PROJECT STATUS

Funds to initiate preconstruction planning were appropriated in 1972 for Wolf-Coffee Lake, in 1973 for the channel modification, and in 1975 for Tomahawk Lake and Indian Lake. The Corps has allocated \$1,417,000 of the funds appropriated to the projects through December 31, 1974. The following table shows the amounts allocated to the individual projects.

<u>Project</u>	Funds allocated through <u>FY 1974</u>	Funds appropri- ated for <u>FY 1975</u>	FY 1975 funds allocated through <u>12-31-74</u>
Channel	\$ 65,000	\$ 400,000	\$245,000
Tomahawk Lake	-	150,000	150,000
Indian Lake	-	50,000	50,000
Wolf-Coffee Lake	507,000	400,000	400,000
Mill Lake	-	-	-
Total	<u>\$572,000</u>	<u>\$1,000,000</u>	<u>\$845,000</u>



In its fiscal year 1976 budget request for Tomahawk Lake, the Corps requested \$200,000 for fiscal year 1976 and \$75,000 for the 1976 transitional quarter for planning purposes.

As part of its postauthorization planning process, the Corps has undertaken a restudy of the Blue River system to reaffirm the basic planning decisions of the 1968 survey report and/or to reformulate the projects in response to changed conditions. This restudy is referred to as Design Memorandum No. 1--System Phase I Formulation and Economic Evaluation (phase I report).

The Corps' Kansas City, Missouri, district office completed its initial draft of the phase I report on April 1, 1974, and submitted it to the Missouri River division engineer for review and approval. On April 4, 1974, the division engineer concurred in the report and submitted it to the Office of the Chief of Engineers (OCE) for review and approval. On March 17, 1975, OCE approved the report.

The system plan OCE approved included the channel modification and Tomahawk, Indian, and Wolf-Coffee Lakes. Because Mill Lake had an unfavorable benefit-cost ratio and would provide relatively little flood protection, it was not recommended for construction. The district felt, however, that the project might become viable in the future due to the rapid pace of development in the area.

On April 1, 1975, Johnson County voters defeated a levy proposal to finance the construction and maintenance of recreational facilities at the three lakes in their jurisdiction. On May 19, 1975, a district official said the effect of the election results could not be fully assessed at that time. (Johnson County's role in recreational development at the three lakes is discussed on pages 15 and 16.)

#### BENEFITS AND COSTS

Flood control is the major benefit expected from the Blue River projects. In April 1974 the district reported flood control benefits amounting to \$24.4 million for the five projects, or about 84 percent of total benefits.

After our fieldwork was completed and during OCE's review of the phase I report, the flood control benefits were reduced to \$13.3 million, or 74 percent of total benefits. OCE approved this revision on March 17, 1975.

The economic costs and the April 1974 and March 1975 benefit-cost ratios for the projects follow.

<u>Project</u>	Total economic cost (note a)	April 1974 benefit-cost <u>ratio</u>	March 1975 benefit-cost <u>ratio</u>
Channel	\$ 73,900,000	1.53	0.84
Tomahawk Lake	42,545,000	2.67	1.55
Indian Lake	37,762,000	2.56	1.57
Wolf-Coffee Lake	40,907,000	2.14	1.53
Mill Lake	<u>13,941,000</u>	2.04	1.45
Total system	<u>\$209,055,000</u>	2.19	1.32

a/Includes initial construction costs and interest during construction.

#### SCOPE OF REVIEW

We examined the documentation supporting the Corps' benefit-cost analysis for the planned Tomahawk project. We made our review at the Corps' Kansas City, Missouri, district office which did the benefit-cost studies for the project. We talked with

- officials of the Kansas City district office;
- officials of OCE in Washington, D.C.;
- local government officials with an interest in, and responsibility for, various portions of the project; and
- local residents concerned about the construction of the project.

CHAPTER 2

PROJECT BENEFITS

The estimated benefits and costs for the Tomahawk Lake project have changed several times since the 1968 survey report recommending development of the Blue River basin. Pertinent benefit and cost estimates are summarized in the following table.

Annual benefit and cost estimates				
Survey report April <u>1968</u>	FY 1974 budget <u>request</u>	Phase I report		
		<u>April</u> 1974	<u>March</u> 1975	
----- (000 omitted) -----				
Annual benefits:				
Flood control	\$ 1,061	\$ 1,426	\$ 6,285	\$ 3,039
Water quality	106	230	-	-
Water supply	-	-	265	265
Recreation	<u>480</u>	<u>480</u>	<u>1,200</u>	<u>1,200</u>
Total	<u>\$ 1,647</u>	<u>\$ 2,136</u>	<u>\$ 7,750</u>	<u>\$ 4,504</u>
Construction cost	\$16,400	\$29,600	\$40,267	\$40,267
Total annual cost	642	2,128	2,898	2,898
Benefit-cost ratio	2.56 to 1	a/ 1 to 1	2.67 to 1	1.55 to 1
Price level	July 1967	July 1972	July 1973	July 1973
Interest rate (note b)	3.25%	5.5%	5.625%	5.625%

a/The 1 to 1 benefit-cost ratio mentioned by project opponents.

b/The interest rate used in the economic evaluation of proposed water resource projects for discounting future benefits and computing costs or otherwise converting benefits and costs to a common time basis.

At the start of our fieldwork, district officials and the division engineer were recommending approval of the April 1974 benefit analysis. Consequently, we devoted our efforts toward evaluating this analysis as it applied to Tomahawk Lake. We reviewed the method of and procedures for computing the project's benefits and costs and the supporting documentation.

The increase in flood control benefits in the April 1974 analysis resulted from a more thorough field study of flood damages made during 1972 and 1973, different methods used to compute flood damages, and an increase in development since 1961 along Interstate Highway 435. The increase in annual costs resulted from price-level increases and from the higher interest rate used to compute the project costs.

We questioned certain aspects of the method used to compute the flood control benefits in the April 1974 analysis. After we completed our fieldwork, the Corps accepted some of our proposals and revised its flood control benefit estimate. OCE approved the revised benefit estimate and the phase I report on March 17, 1975.

The March 1975 revision did not affect the recreation and water supply benefits. We concluded that the recreation benefits were reasonable if the high-quality recreation development plan was achieved. However, Johnson County voters recently defeated the proposed levy to finance construction and maintenance of recreational facilities at the Federal projects, which may affect the quality of the recreational development.

Although we questioned the Corps' policy in computing the water supply benefits, we did not assess the Corps' position because the amount of the benefits involved would not materially affect the benefit-cost ratio.

#### FLOOD CONTROL BENEFITS

Flood control benefits are defined as the reduction in all forms of damage from inundation of property and the increase in net returns from higher use of property made possible by lowering the flood hazard. Benefits are estimated by determining the project's capability to reduce flood stages throughout the range of possible floods and computing possible damages to existing and future development that would be prevented by the reduced flood stages.



We reviewed the supporting data for the April 1974 benefit computations and questioned the method and procedures used in computing the flood control benefits. Specifically, our review disclosed that the benefits

--would be affected by the method used to allocate the system's common flood control benefits to individual projects,

--would be considerably reduced if the district recomputed them according to the methods specified in new and proposed Corps regulations, and

--could be affected by using current streamflow data.

After our fieldwork most of the flood control benefits were recomputed according to the methods specified in the new and proposed Corps regulations. Current streamflow data, however, was still not used. We also noted that the revision included benefits resulting from the effect of future urbanization on peak discharges--a type of benefit which was not included in the April 1974 analysis. These changes reduced the flood control benefits allocated to Tomahawk from \$6.3 million to \$3 million.

#### Allocating system benefits

The Corps allocates flood control benefits for a series of projects within a river basin by two methods: the system method and the incremental method. The system method distributes the flood control benefits from all projects in the system to each project in proportion to its flood control capability. This tends to understate the flood control benefits for projects installed first and overstate the benefits for projects installed last. The incremental method determines the difference in flood control capability in the basin with and without each project. Then flood control benefits are assigned according to the specific increment of flood control provided by each project.

The district used both methods to allocate flood control benefits to the Tomahawk Lake project. The two methods resulted in markedly different benefit-cost ratios, as shown in the following table.

Flood control benefits

<u>Method</u>	<u>April 1974</u>		<u>March 1975</u>	
	<u>Flood control benefits</u>	<u>Benefit-cost ratio</u>	<u>Flood control benefit</u>	<u>Benefit-cost ratio</u>
System	\$ 6,285,000	2.67 to 1	\$3,039,000	1.55 to 1
Incremental				
First				
added	10,750,000	4.21 to 1	(a)	(a)
Second				
added	5,578,000	2.43 to 1	2,542,000	1.38 to 1
Last				
added	3,287,000	1.64 to 1	1,478,000	1.02 to 1

a/Not computed.

Although the Corps allocates benefits under both methods, the system method is the primary method used in reporting project justification. For example, benefits were allocated under the system method in the project's economic feasibility report in the authorizing document for the Blue River projects.

Senate Document 97 (87th Cong., 2d sess.) provided the governing criteria for formulating, evaluating, and reviewing plans for water and related land resources. The Water Resources Council, pursuant to the Water Resources Planning Act of 1965 (42 U.S.C. 1962), issued new principles and standards, effective October 25, 1973, which superseded Senate Document 97 as the governing criteria for water resource project formulation. The Council also established guidelines for determining whether a proposed project should be formulated under the new principles and standards or under Senate Document 97. Under such guidelines, the Corps continues to apply Senate Document 97 to the Blue River projects.

Senate Document 97 states that tangible benefits shall exceed project economic costs. It defines benefits as increases or gains in the value of goods and services which result from conditions with the project, compared to conditions without the project. We therefore believe that the incremental method determines a project's economic feasibility best according to Senate Document 97.

## Impact of new and proposed regulations

In computing flood control benefits, the protection value afforded existing property and projected future investment was considered. Flood control benefits in the April 1974 analysis were greatly influenced by future growth estimates. Over \$17.2 million, or 71 percent, of the \$24.4 million in flood control benefits computed for the total Blue River system was attributed to future development.

Two Corps regulations affecting the method of computing future flood control benefits have been proposed since the district submitted its phase I evaluation in April 1974. One regulation, covering flood plain zoning and enhancement benefits, became effective on August 15, 1974; the other, covering use of an affluence factor, was at the Office of Management and Budget (OMB) for review at the completion of our fieldwork. OMB approved the regulation and a Corps official told us it would soon become effective.

These regulations have a marked impact on the amount of future flood control project benefits by

- restricting the use of an affluence factor in computing benefits to personal property in residential buildings,
- requiring recognition of the impact of flood plain zoning as a result of the Flood Disaster Protection Act of 1973, and
- requiring a more stringent assessment of enhancement benefits.

During our fieldwork, district officials said these regulations would not apply to the Tomahawk Lake project since the phase I report had been submitted to OCE before the regulations went into effect.

However, the district did provide us with the following breakdown of those flood control benefits, which represented 74 percent of the total flood control benefits for the project, that the new and proposed regulations would affect.

Benefits to be affected:	<u>Amount</u>
Affluence factor	\$3,511,000
Flood plain zoning	720,000
Enhancement	<u>437,000</u>
Total	<u>\$4,668,000</u>

After we completed our fieldwork, the district reevaluated flood control benefits, eliminated affluence factor benefits, and assumed flood plain zoning in 1975 instead of 1983. The Corps said the method for computing enhancement benefits was not changed because the time and cost involved in applying the new procedures was not justified.

#### Affluence factor

In the April 1974 analysis the district included flood control benefits derived from using an affluence factor. This factor accounted for 56 percent, or \$3.5 million, of the total flood control benefits claimed for the Tomahawk Lake project. The Corps defined this factor as the effect of increasing per capita income on the unit value of real property and its contents.

In 1973 OMB notified the Corps that revised regulations and guidelines were required for projecting real and personal property economic growth rates on its water resource projects. The Corps was told that without such guidelines there was no uniform basis for approving projects whose calculated benefits were partially or totally dependent on the affluence factor.

The Chief, Office of Civil Functions, Office of the Secretary of the Army, instructed the Corps to comply with the OMB directive and recommended a study to establish "empirically tested techniques for making real and personal property value projections."

A Corps task force evaluated the appropriateness of applying an affluence factor on various types of investments. The Chief of the task force said the results of a thorough analysis did not justify application of such a factor to commercial and industrial property. Consequently, a new regulation was drafted which limited application of an affluence factor to the value of personal property in residential buildings.

#### Flood plain zoning

In 1968 Congress passed the National Flood Insurance Act (42 U.S.C. 4001) establishing the National Flood Insurance Program giving property owners the opportunity to buy flood insurance at federally subsidized rates. For property owners to be eligible for such insurance, however, the local communities must adopt and enforce land-use and control measures.

It later became clear that the voluntary nature of the National Flood Insurance Program was a serious problem and, without mandating provisions for sound flood plain management, no real steps toward reducing flood losses would be made. The Congress therefore passed the Flood Disaster Protection Act of 1973 (87 Stat. 975) which expands the 1968 Flood Insurance Program by creating incentives for flood-prone communities to enter the program and thereby make insurance available to their citizens.

Specifically, the Flood Disaster Protection Act requires that localities with special flood hazards participate in the National Flood Insurance Program for Federal agencies to approve financial assistance for property acquisition or construction in the locality after July 1, 1975. Local communities now are under strong pressure to adopt land-use and control measures by July 1, 1975.

The Corps acknowledged the act by issuing a regulation on August 15, 1974, which required that benefit computations be based on the assumption that flood damageable property would not be built in flood plains after July 1975.

Flood plain zoning would affect the construction of flood damageable property on the flood plain by controlling land use. When the Corps completed its survey report of the Blue River basin in 1968, there was little effective flood plain zoning in the basin. Since then the National Flood Insurance Program has been carried out and the municipal and county governments in the Blue River basin have been under increasing pressure to restrict development in the flood plain. Consequently, in the phase I economic analysis, the district assumed that flood plain management would become a reality in the whole flood plain by the time the Blue River projects are operational in 1983.

District officials said that, when the phase I study was made in 1973, the importance of flood plain zoning in 1975 was not known. They also said that the regulation would not apply to the Tomahawk Lake project since the phase I report on the project had been submitted to OCE before the regulation went into effect.

#### Enhancement benefits

The district's flood control benefits include \$437,000 each year for enhancement or induced growth. Such benefits represent the expected value from increased or higher use of property resulting from the project's added protection.

On August 15, 1974, the Corps revised its regulations which changed the method of computing such benefits. The revision was necessary because existing methods overstated urban enhancement benefits by failing to consider that almost all flood plain development could locate at other flood-free sites. Under the new procedures, the benefits would show only the locational advantage in using the flood plain compared to using existing flood-free land.

District officials said the revised regulation did not apply to the Tomahawk Lake project because the phase I report was submitted to OCE for approval before the regulation went into effect. They also said a benefit recomputation would require a special study.

The March 1975 revision used the old procedures for computing enhancement benefits. A district official told us that the cost and time involved in applying the new procedures did not justify the effort to recompute enhancement benefits.

In view of the amount of benefits involved, we believe that the Corps should, on a test basis, determine the impact of the revised regulations.

#### Urban hydrology benefits

Changes in land use, especially urbanization, may result in major alteration of a basin's drainage characteristics, particularly surface runoff. Highway, parking lot, and home construction increases the amount of impervious land surface thus increasing the flow of water during a given period which will cause increased flood damages. Urban hydrology benefits represent damage reduction resulting from project construction.

The April 1974 benefit analysis recommended by the district officials and the engineer division did not include urban hydrology benefits, although they had been computed for a sensitivity analysis. During OCE's review of the phase I report, a decision was made to include these benefits as part of the approved analysis.

We briefly reviewed the computation support for the urban hydrology benefits. We were unable to obtain support for the important assumptions made in the district's hydrology study of the effects of increased urbanization. In addition, district engineering personnel involved in the study said that the assumptions were heavily dependent on

their judgment. We noted that research carried out by organizations and individuals other than the Corps concluded that urbanization could have a great impact on streamflows.

Corps officials maintained that the urban hydrology benefits claimed for the Tomahawk Lake project had been thoroughly reviewed and were reasonable. They felt that, although the supporting documentation might not have been as complete as it could have been, the time and effort required to fully support the benefits was not warranted.

However, because the urban hydrology benefits are large (27 percent of the flood control benefits claimed for the Tomahawk Lake project in the March 1975 analysis), we believe that the Corps should fully document the assumptions and judgmental factors supporting the urban hydrology benefit computations.

#### Streamflow data used

Engineering studies must be made to determine the probability of floods of various sizes. Flood damages with and without the project are estimated for various floods. The flood frequency is estimated from historic streamflow information. The streamflows used for the initial Blue River basin study covered the period of 1939 through 1964. To reduce the engineering work involved, this same data was used in the phase I report to determine flood control benefits. A district official stated that more current streamflow data was not used since it would not materially affect the amount of flood control benefits.

To assess the validity of using this data, we requested an analysis of the flood damage for one of the eight portions of the flood plain using the most current data available. For this test, the district used streamflow data covering the period 1939 through 1973. This analysis disclosed a 12 percent reduction in the average annual damages by using the longer time frame. The portion analyzed represented 4 percent of the Blue River basin's total average annual damages.

District officials stressed that the 12 percent reduction in the one portion may not apply equally to all areas. They noted that a complete engineering reevaluation might show little change in damages since other portions of the basin would be flooded more frequently if more current flowage data were used.

## AGENCY COMMENTS AND OUR EVALUATION

In commenting on our proposal that the Corps recompute flood control benefits for the Blue River basin projects by excluding the affluence factor and considering the impact of flood plain zoning, the Army told us (see app. I) that our proposal had been adopted and that the Corps had reanalyzed the Tomahawk Lake project accordingly. The reanalysis shows an incremental (second position) benefit-cost ratio of 1.4, system 1.55, and last added 1.02.

In comparing the systems method to the incremental method for assigning flood control benefits, the Army told us that the systems method was appropriate when properly supplemented by other information. The Army said that once a development plan for a project was properly formulated according to the guidelines of Senate Document 97, the method which best represented the plan's economic merit was subjective and that no one benefit-cost ratio provided a complete description of a project's worth. For this reason, each project in the Blue River plan was reported on a systems, next-added (incremental), and last-added basis.

Although we continue to believe that the incremental approach best measures a project's economic effectiveness by comparing increased benefits to costs, we recognize that the best method of determining the flood control benefits is highly subjective. Therefore we feel the Corps' procedure of reporting benefits under each approach when it requests project authorization and appropriations is reasonable. As shown on page 8, the benefit-cost ratio can vary considerably, depending on the method used to compute flood control benefits.

In replying to our suggestion that current streamflow information be used to estimate flood frequencies, the Army said the costs associated with a complete revision of the basin hydrology was not warranted by the increased accuracy likely to be obtained. Also, the Army said that there were uncertainties associated with many of the variables involved in computing flood damages and that refining one variable does not necessarily lead to a more accurate overall answer.

Although the Army's contention may prove to be correct, it seems to us that test analyses should be made to provide a reasonable basis for concluding that a detailed basin hydrology study would not result in a considerable change in flood control benefits. Also, we believe that the large



amount of urban hydrology flood control benefits recently claimed for the project should be adequately documented and that the impact of the revised regulations for computing enhancement benefits should be determined.

### RECOMMENDATIONS

We therefore recommend that the Secretary of the Army have the Corps make tests to determine the impact of the revised regulations on the claimed enhancement benefits and the effect of current streamflow information on flood control benefits and fully document the assumptions and judgmental factors supporting the urban hydrology benefit computations.

### RECREATION BENEFITS

Recreation benefits for water resource projects are computed by estimating annual attendance during the life of the project and assigning a dollar value for each visit. Projected recreation attendance at proposed projects is based on attendance at similar completed projects and population growth projections. The dollar value of a recreation visit is based on implied willingness to pay. Recreation values range from 50 cents to \$1.50 each day for general recreation usually associated with water resource projects.

The Corps estimated 960,000 visits each year for the Tomahawk Lake project based on a rate of 1,130 visitors each year per water surface acre at the multi-purpose pool level. The Bureau of Outdoor Recreation (BOR), Department of the Interior, noted that the projected visitation was high for a project this size but agreed with the Corps' estimate because of the project's proximity to an urban area and the high quality of the facilities planned. The Corps, with concurrence from BOR, assigned a value of \$1.25 a visit. Total recreation benefits were valued at \$1,200,000 annually and no future increase in recreation visitation was expected since the project would be fully developed initially.

The Federal Water Project Recreation Act (16 U.S.C. 460) established a cost-sharing policy for recreation facilities at Corps projects. The policy states that the Federal government would share the separable cost of recreation development with local public interests on a 50-50 basis provided that local public interests agreed to operate and maintain such facilities at 100-percent local expense.

The Board of County Commissioners in Johnson County, Kansas, had passed resolutions for support and sponsorship of recreational development at the Tomahawk, Indian, and Wolf-Coffee Lake projects. The county's share of the initial recreational construction costs would approximate \$16.7 million, and annual operation and maintenance costs would total about \$940,000 for the three projects. However, the county would incur these costs over a period of years because the three lakes would not be constructed at the same time. A county commissioner told us the county could finance these costs through collection of user fees; bond issues; increased revenues due to growth in the tax base; and increased taxes, if passed by voters.

on April 1, 1975, Johnson County voters decisively defeated a levy proposal to finance construction and maintenance of recreational facilities at Tomahawk, Indian, and Wolf-Coffee Lakes. On May 19, 1975, a district official told us that the effect of the election results could not be fully assessed at that time.

Because of Tomahawk's proximity to Kansas City and because of the high quality of development planned, we concluded that the projected attendance and associated benefits computed for the Tomahawk project were reasonable. However, should the quality of the recreation facilities be reduced as a result of the proposal's defeat, estimates of attendance and the recreation benefits might have to be revised.

#### WATER SUPPLY BENEFITS

Municipal and industrial water supply is considered the financial responsibility of the municipalities or other non-Federal public bodies that are to benefit from the project. Johnson County indicated a need for the water supply storage that could be made available at both the Tomahawk and Wolf-Coffee Lakes projects and on September 4, 1973, assured the Corps that the county would reimburse the Government for the cost of the water supply facilities.

According to its procedures, the Corps computed benefits on the basis of the most likely, least costly alternative source of water supply. The district determined that this source would be a well field along the Kansas River and computed water supply benefits of \$265,000 annually (3.4 percent of total project annual benefits).

A consultant for the county determined that a direct draw from the Kansas River would be the least costly alternative source of water supply. A county official said this would be the most likely alternative if Tomahawk Lake was not constructed. The computed annual benefits based on this alternative would be \$155,000.

District officials said that the county's alternative could not be used since it was Corps policy that an existing Federal project could not be used to evaluate benefits for water supply storage at a proposed Federal project. Since the Kansas River water supply is controlled by a number of Corps reservoirs (Milford, Tuttle Creek, and Perry), this would, in effect, constitute an existing Federal project.

We did not assess the reasonableness of the Corps' position because the amount of benefits involved would not materially affect the project's benefit-cost ratio.

### CHAPTER 3

#### PROJECT COSTS

The district's cost estimates were supported for most items with the exception of the estimates for improvements on the land to be acquired, for certain expenses associated with the acquisition of real property, and for some of the relocation costs.

Project costs in the phase I report totaled about \$40.3 million, and we found that about \$8.1 million were not supported. We also identified certain induced costs which officials of local governments said they would incur as a result of the project but which were not included in the district's economic evaluations. Induced costs are all uncompensated adverse effects caused by a project's construction and operation.

#### COST ESTIMATES

We questioned the amounts of some items in the district's detailed cost estimate because the items did not adequately support the estimate. The costs for the following items were questioned.

<u>Items</u>	<u>Amount</u>
Lands and damages:	
Improvements on 25 farm sets and/or suburban homes at 34,500 each	\$ 862,500
Relocation assistance costs	1,605,752
Relocations:	
Roads	1,480,000
Commercial pipelines	500,000
Powerlines, telephone lines, and waterlines	240,000
Sewerlines	<u>3,460,000</u>
Total	<u>\$8,148,252</u>

The district estimated the real estate improvement value of the property to be acquired for the Tomahawk Lake project at \$862,500. The estimate was for 25 farm sets or suburban homes at \$34,500 each. A district official said the estimator observed the properties to be acquired but did not prepare any reports or other documentation to show location, size, number of facilities, or similar information to support the unit price. The district later provided support for a revised estimate of \$977,000.

The district estimated relocation assistance cost and the cost of recording fees, transfer taxes, and other expenses associated with acquiring the real property at \$1,605,752. These estimates were not supported. At our request, the district revised the estimate and reduced it by \$1,350,752.

The district estimated the cost of relocating roads at \$1,480,000. District officials could not locate any supporting data for \$480,000 of the cost nor could they explain how this amount was derived. Detailed data supported the remaining \$640,000 but about \$240,000 of this amount could not be adequately explained.

The district had not retained any of the supporting data for the estimated cost of relocating the commercial pipelines. In addition, the costs for the relocation of the powerlines, telephone lines, and waterlines were estimated as a percentage of road cost. Since the road cost was inadequately supported, we also questioned the validity of these estimates.

The district estimated the proposed lakebottom sewerline cost at \$7,840,000. Since the sewerline would cost an estimated \$4,380,000 if the lake was not built, only \$3,460,000 was attributed to the lake. District officials could not furnish the detailed data to support the estimate. At our request the district revised the estimate, showing how it believed the \$3,460,000 was derived. This estimate, however, was not supported with verifiable data on the specifics of the estimate.

#### INDUCED COSTS

Senate Document 97 provides that all uncompensated adverse effects induced by the project's construction and operation be considered in the proposed project's economic evaluation. Induced costs include estimated net increases in the cost of government services directly resulting from the project and net adverse effects on the economy, such as increased transportation costs.

District officials said they did not include induced costs in the economic analysis because they considered such costs to be minor. However, opponents of the Tomahawk Lake project said it would cause additional police protection and road maintenance costs for Leawood.

We discussed the potential for additional police costs with the chiefs of police for Leawood and Overland Park. The Overland Park police chief said that the city would require one patrol car and four or five additional officers at an estimated cost of \$63,000 annually to monitor the area under its jurisdiction at Tomahawk Lake.

The Leawood police chief said that his city would require 17 additional police officers at a cost of \$275,000 annually to monitor the area under its jurisdiction.

In assessing the possibility of increased road maintenance cost, we contacted several local government agencies responsible for the areas adjoining other existing Corps reservoirs within the Kansas City district. The local officials said costs increased when a Corps reservoir was built and put into operation within their jurisdiction. The Jefferson County engineer said access roads to Lake Perry generally required about three times the maintenance of a comparable county road used only by residents. The Osage County commissioner said that the gravel roads near Pomona Lake and Melvern Lake would last a year with normal usage by local residents and normal maintenance but that the roads could be torn out in one weekend by the heavy lake traffic.

The officials also said that other costs resulted from these reservoirs. The Jefferson County commissioner mentioned that the county spends between \$60,000 and \$70,000 a year on ambulance services. He said that without the influx of lake visitors each weekend, the county could reduce the service level. An official from Wichita, Kansas, told us that, because of periodic grass fires during the dry months, the city had to provide fire protection at the Corps' Chaney Reservoir.

#### AGENCY COMMENTS AND OUR EVALUATION

As a result of our review, the Army said that the cost estimates were examined and the supporting data documented for the \$8.1 million cost items we questioned. We found that \$3.46 million of this amount, covering the cost of the proposed lakebottom sewerline, was not supported.

District officials told us that support was not prepared for the lakebottom sewerline because the Corps was reluctant to authorize sewer trunklines across the bottom of lakes because of environmental considerations. We were told that it would be a waste of time to document the estimate because the lakebottom route for the sewerline might not be used.

The alternative to a sewerline across the Tomahawk Lake bottom is two sewerlines constructed around the perimeter of the lake--one along the north side and another along the south side. In July 1973 the district estimated \$15,560,000 for the two sewerlines around the lake. If this estimate were used, \$7,720,000 would be added to the Tomahawk Lake project cost.

District officials agreed that the sewerline estimate could greatly increase, but they indicated that a precise estimate would not be developed until a decision was made on which sewerline plan to use. Corps headquarters officials said that a deadline date for the decision has not been established.

The Army said certain induced costs in the benefit-cost analysis were recognized in the system formulation but, for project justification, induced costs and indirect benefits were not included in the benefit-cost ratio because they were relatively minor, offset each other, and would not affect the ratio.

Our discussions with local officials indicated that the induced costs, such as police protection and road maintenance costs, may not be minor. We believe the project economic analysis should consider uncompensated adverse effects caused by the project's construction and operation, consistent with Senate Document 97 guidelines.

#### RECOMMENDATIONS

We recommend that the Secretary of the Army have the Corps decide on the sewerline location and prepare the related cost estimates. Also, the induced costs and the claimed indirect benefits, to the extent practicable, should be quantified for inclusion in the project's benefit-cost analysis.

APPENDIX I

LARRY WINN, JR.  
KANSAS

COMMITTEES:  
SCIENCE AND ASTRONAUTICS  
SUBCOMMITTEES:  
MANNED SPACE FLIGHT  
SPACE SCIENCE AND APPLICATIONS  
INTERNATIONAL COOPERATION IN SCIENCE  
AND SPACE  
FOREIGN AFFAIRS  
SUBCOMMITTEES:  
AFRICA  
INTERNATIONAL ORGANIZATIONS  
AND MOVEMENTS  
TASK FORCE ON  
LABOR-MANAGEMENT RELATIONS

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House of Representatives  
Washington, D.C. 20515

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May 30, 1974

B-181401

The Honorable Elmer B. Staats  
Comptroller General  
General Accounting Office  
Washington, D. C.

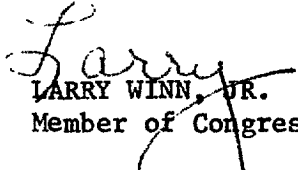
Dear Elmer:

It is my understanding that you received a letter, dated April 19, from Ms. Jinny Oberlander, City Clerk of Leawood, Kansas. The letter forwarded a resolution from the City's Governing Body requesting that the General Accounting Office review the latest benefit-cost ratio computed by the Corps of Engineers for Tomahawk Reservoir in the Kansas City area.

I would like to support the City's request in this matter. Considerable local controversy exists relative to the anticipated benefits and costs of this Corps' project. I would therefore very much appreciate having the benefit of an independent review of the figures involved.

I thank you in advance for your cooperation in this matter, and I look forward to hearing from you at your earliest convenience.

Most sincerely,

  
LARRY WINN, JR.  
Member of Congress

LW:lar

cc: V. M. Dostal, Esq.





DEPARTMENT OF THE ARMY  
OFFICE OF THE ASSISTANT SECRETARY  
WASHINGTON, D.C. 20310

10 APR 1975

Mr Henry Eschwege  
Director, Resources and Economic  
Development Division  
U. S. General Accounting Office  
Washington, D. C. 20548

Dear Mr. Eschwege:

This responds to your request for comments on the draft report "Review of the Benefit-Cost Analysis for the Planned Tomahawk Lake Project in Kansas" (OSD Case #4007).

The report recommends that the Secretary of the Army require the Corps of Engineers to recompute the flood control benefits for projects in the Blue River Basin by using the incremental approach; by using more current streamflow data; and by excluding the affluence factor and considering the impact of flood plain zoning. The report also recommends that the Corps obtain sufficient documentation to support the project cost estimates or prepare new estimates and that the Corps evaluate the validity of claims by local governments that they will incur induced costs for police protection and road maintenance because of the project and include such costs in the benefit-cost analysis, if justified.

As stated in the report, the Corps has computed the flood control benefits for the Tomahawk project by the incremental approach and the systems approach. However, we would like to explain why we think the systems approach is the proper method to use in cases such as this. According to Senate Document 97 a plan may be a system of projects, a multiple purpose project, or a single purpose project. A plan is economically sized if tangible benefits exceed tangible costs, each separable element provides benefits in excess of its costs, maximum net benefits are achieved, and there is no more economical means of obtaining the output. In addition, Senate Document No. 97 provides for departures from the scale of development based on the above criteria to take into account intangibles or other considerations warranting modification. These criteria were applied on the Blue River plan and the system is properly sized even though it deviates somewhat from the economic optimum based upon the need to provide a sufficient level of protection to a major metropolitan area.



## APPENDIX II

Mr. Henry Eschwege:

Once a plan is properly formulated in accordance with the guidelines of Senate Document 97, the selection of the method which best represents its economic merit is subjective. In fact, no one benefit-cost ratio provides a complete description of a project's economic merit. For this reason, each project in the Blue River plan is reported on a system, next-added (incremental), and last-added basis. The last added analysis indicates the economic return from the last increment of a plan. The system analysis provides a sounder basis for the equitable allocation of costs between purposes.

The statement in the report that the incremental approach is best because it compares the benefits directly attributable to each project with the costs associated with providing the benefits is misleading. The incremental benefits are predicated on a prescribed order or sequence of implementation. As illustrated on page 9 of the draft report, the benefit-cost ratio for the Tomahawk Lake project could vary from 1.6 to 4.2 depending on whether the project is assumed to be the first-added project or the third-added project. Therefore, it is not considered appropriate or logical to have an individual project's contribution toward the benefits produced by the system to be dependent on whether it is second or third in the construction sequence. The system benefit distribution represents a fair-share apportionment of the joint benefits and does not change in the event the sequence of construction is modified. Using an incremental approach, projects in the first position have large joint costs allocated to flood control relative to water supply, recreation and other functions; those in last position have small costs so allocated. In the case of Tomahawk, the allocation is not severely affected one way or the other.

In summary, the system distribution approach for assigning flood control benefits for evaluation and reporting purposes is appropriate, when properly supplemented by other information.

The report also recommends that more current streamflow data be used in computing flood control benefits. We believe that in this case, the costs associated with a complete revision of the basin hydrology are not warranted by the increased accuracy likely to be obtained. There are uncertainties associated with many of the variables involved in computing flood damages. Refinement of one variable does not necessarily lead to a more accurate overall answer. The Corps has considered the most current streamflow data and has used a reasonable evaluation of measuring flood control benefits.

Mr. Henry Eschwege:

The report further recommends that the flood control benefits from the Blue River Basin projects be recomputed by excluding the affluence factor and by considering the impact of flood plain zoning unless the appropriateness of computing benefits for the affluence factor and for damageable property growth in the flood plain is convincingly established. Since your review, the Corps has reanalyzed Tomahawk Lake under affluence guidelines approved recently by the Office of Management and Budget and under an assumption of flood plain zoning in 1975 (EC 1105-2-12). Results of this analysis show an incremental (second position) benefit-cost ratio of 1.4, system 1.55, and last added 1.02. A benefit cost ratio of 1.55 will be shown in the next request for funds to Congress.

In response to the recommendation that the Corps obtain sufficient documentation to fully support certain cost items discussed in Chapter 3 of the report or prepare new estimates, the review by the GAO brought to light some weaknesses in supporting data for relocations and real estate cost estimates. As a result of the GAO review, the estimates have been reviewed and the supporting data documented for the \$8.1 million in cost estimates which had not been adequately supported.

The last recommendation of the report concerns the evaluation of the validity of certain induced costs and the inclusion of such costs in the benefit-cost analysis. The possibility of induced costs for certain municipal services was recognized in the system formulation. For impact study purposes, induced costs were explored and computed to the extent that they were reasonably quantifiable. However, for project justification, induced costs as well as indirect benefits were not included in the benefit-cost ratio as it was determined that they were relatively minor, offset each other, and would not affect the benefit-cost ratio.

The Blue River Basin flood control plan, consisting of a channel improvement and Tomahawk, Indian, and Wolf-Coffee lakes, has been subjected to a wide range of tests. These tests included flood plain zoning, costs, affluence regulations, present and future hydrologic conditions, and flood insurance programs. Based on the results of these tests, and incorporating the latest affluence and flood plain zoning guidance, we believe that the Corps has properly

APPENDIX II

Mr. Henry Eschwege:

identified and computed the benefits and costs of the system. The Phase I report was approved on 17 March 1975, so the Corps is working to complete advanced engineering and design on these system elements.

The opportunity to comment on this draft report is appreciated.

Sincerely,

A handwritten signature in cursive script that reads "Charles R. Ford".

Charles R. Ford  
Deputy Assistant Secretary of the Army  
(Civil Works)