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Before the Committee on Appropriations

Old River Control Structure, Louisiana

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96*th* CONGRESS, SECOND SESSION

SPECIAL HEARING

Department of the Army
Corps of Engineers—Civil
Nondepartmental witnesses

OLD RIVER CONTROL STRUCTURE, LOUISIANA

HEARING

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON APPROPRIATIONS UNITED STATES SENATE

NINETY-SIXTH CONGRESS

SECOND SESSION

SPECIAL HEARING

Corps of Engineers—Civil
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OLD RIVER CONTROL STRUCTURE, LOUISIANA

MONDAY, DECEMBER 22, 1980

U.S. SENATE,
COMMITTEE ON APPROPRIATIONS,
SUBCOMMITTEE ON ENERGY AND WATER DEVELOPMENT,
Washington, D.C.

The subcommittee met at 9 a.m., in Senate Committee Room E, State Capitol, Baton Rouge, La., Hon. J. Bennett Johnston, Jr. (chairman) presiding.

Present: Senator Johnston.

DEPARTMENT OF THE ARMY

CORPS OF ENGINEERS—CIVIL

OLD RIVER, LA.

OPENING REMARKS

Senator JOHNSTON. Please take your seats, gentlemen.

This hearing of the Subcommittee on Energy and Water Development of the Appropriations Committee of the U.S. Senate will come to order.

We are here to think the unthinkable, to contemplate doomsday, to examine some very serious charges that have been made as to the reliability of the Old River structure, which is the structure that divides the flows of the Mississippi River, and keeps the Atchafalaya River from capturing the Mississippi River.

Will the Old River, Low Sill structure hold? Will the auxiliary structure, as added to that Old River structure, be sufficient to keep the Mississippi River in its present course; to keep the distribution of the water, 70 percent for the Mississippi River and 30 percent for the Atchafalaya River, in the present balance—is one of the most serious questions that can be asked, because upon these questions depends the economic viability of the whole lower Mississippi River Valley as well as the Atchafalaya basin.

We are here not so much because we think that the charges that have been made are correct, but because two sincere, distinguished, disinterested professors from my alma mater, Louisiana State, have seriously made these charges.

Professors Kazman and Johnson have stated that the Old River structure, sooner or later, will not be there; that sooner or later it will fail; that the process of nature is irreversible; that we cannot save the Mississippi River in its present course.

The very asking of these questions is very disturbing to people. I have been in Morgan City this last week where people are con-

cerned for their safety and their property. They are also concerned about the economic viability of that town in that they think that investments—serious investments—will not be made in Morgan City, because to do so would be to risk those investments. There has even been some concern in New Orleans along the same score.

We are not here to give palliatives to people, to try to give them false reassurance. On the other hand, we are here to seriously examine these questions, to get definite, definitive, credible answers from those who can, first of all, ask the questions properly—those who have written the report, Professors Kazman and Johnson—and those who I think can answer the questions. I have personally never seen in the field such a representative of the Corps of Engineers as we have here today, General Bratton, Chief of the U.S. Army Corps of Engineers; and General Read who is Division Engineer of the Lower Mississippi Valley Division of the Corps of Engineers, those with direct responsibility for the Old River structure or, indeed, the entire Mississippi River and Tributaries system.

Let me make it clear that we do not resent the fact that these two distinguished professors have posed these questions and have authored this thesis. If similar questions had been asked before the MGM Grand Hotel fire in Las Vegas, before Three Mile Island, before the Lake Peigneurs disaster, we would have saved lives; we would have saved hundreds of millions of dollars.

It is in the spirit of serious science that we hold this hearing today. Indeed, it is entirely conceivable that we have overlooked something in their charges or something about their thesis that we can learn and build upon and make a stronger river structure because of what they say.

I believe that we will find that the present plans of the Corps of Engineers—the present construction of the Old River structure with the auxiliary structure—will be sufficient in everybody's mind here today to show that the structure will hold; that the present force of the river will be there for decades or, indeed, time immemorial. I hope and I believe that that will be the result of this hearing.

We have the experts here to give us the definite, definitive answers to those very serious questions.

We have a distinguished witness list here today, as I mentioned. In addition to the Corps of Engineers, we have the Louisiana Office of Public Works, New Orleans Port Commission, and the Louisiana Association of Levee Boards also represented.

We want to begin our hearing with the two professors who have authored the report which has been the basis of calling this meeting. I would like to call Prof. Raphael G. Kazman, professor of civil engineering, and Prof. David B. Johnson, professor of economics at the Louisiana Water Resource Institute, Louisiana State University.

STATEMENTS OF:

RAPHAEL G. KATZMAN, PROFESSOR OF CIVIL ENGINEERING, LOUISIANA WATER RESOURCES INSTITUTE, LOUISIANA STATE UNIVERSITY

DAVID B. JOHNSON, PROFESSOR OF ECONOMICS, LOUISIANA WATER RESOURCES INSTITUTE, LOUISIANA STATE UNIVERSITY

Senator JOHNSTON. Professors Kazman and Johnson, we want to welcome you to the committee. You may proceed as you wish.

Professor JOHNSON. I think Ray will go first.

Senator JOHNSTON. We will begin with Professor Kazman followed by Professor Johnston, after which we will have an exchange and a dialog——

Professor JOHNSON. Sure.

Senator JOHNSTON. Professor Kazman?

STATEMENT OF RAPHAEL KAZMAN, PROFESSOR OF CIVIL ENGINEERING, LOUISIANA STATE UNIVERSITY

Professor Kazman. I might as well identify myself for the record. My name is Raphael Kazman. I am a professional engineer, and for the past 18 years I have been professor of civil engineering at Louisiana State University, specializing in water resources problems. I teach three graduate-level courses, one on ground water, one on surface water hydrology, and one on water resources policy.

We undertook this study basically as a result of my experience during the 1973 flood. I have been interested in the Old River control structure since it was put in. In fact, I arrived in Baton Rouge just about the time that it went into full-time operation after the tests.

I went out to the structure during the 1973 flood. I was going to walk across it and watch the water go under the low sill. When I got out of the car and got to the structure, the structure was vibrating, just about—reminded me of standing in a station when a loaded freight train zooms through at 50 miles an hour. I turned around and I abandoned all ideas of inspecting the structure. I figured that it was time for me to leave.

Two days later, the wing wall collapsed—the left wing wall collapsed. And, this was a new structure—this was 12 years after it—about 11 years after it had been completed. That caused me to start thinking; what would happen if it went out, and, forthermore, what are the forces involved that might cause such a disaster?

It took us a couple of years before we finally were able to propose a project and have it funded—the Louisiana Water Resources Institute which, as you know, Senator Johnston, is funded by the Office of Water Research and Technology. We got a 2-year grant and started to work primarily on the consequences, spending some time on the cause.

There are several reasons for believing that in the long run—and the time scale is important—first of all, we do not know when one or two or the next major floods will occur—we can surmise that they will occur with more intensity or greater discharge than in the past due to the fact that we have a lot of urbanization, new drainage districts, much land has been cleared, many reservoirs have been put in, and the reservoirs during the extreme floods just help the water get downstream—because the flood waves flow right through a series of reservoirs to the maximum capacity of the

spillways, and, even then—well—the maximum capacity of the spillways. So, if you are going to have larger floods from the same climatic conditions, that means you are going to have more frequent floods of large magnitude.

There is another consideration. A lot of the sediment going through the reservoirs has been trapped, so the water is depleted of sediment when it leaves the reservoir. It is—some people have called this "hungry water"—it tends to eat up the river bottom and eat up the river banks. So, we have got hungry water coming down the Mississippi, in a sense. You are changing the direction of an enormous mass of water moving at a fairly high speed during floods. What is going down the main channel now is being sucked into the Old River structure. So, you have got a tendency for scour on the outside of the bend, and it is very difficult to maintain this indefinitely, since underlying—the riprap you put in there is nothing but sand for—down to 15,000 or 20,000 feet.

Downstream from the structure, you have the tendency for the river to degrade, that is, for the same discharge, the river stage is lower because the slope is steeper and there is more energy available. At the structure itself, you have a maximum concentration of energy due to the flowing water.

So, if there is going to be any trouble, that is the focal point; and we have very good records as to the degradation of river below the structure.

When you have a major flood with all of these things—if the flood gets high enough—you could get a levee failure around the left or the downstream bank of the stucture—not the stucture itself—just bypass it—and that would be the same thing as a failure.

And, again, I am not talking 1 year or 2 years, but over a period of time. And, in the middle of a flood, there is very little that you can do, effectively. If you have 600,000 or 800,000 cubic feet per second going through the structure and the overbank and the low sill, 10-ton boulders don't mean very much. They get tossed around. It is an awesome power.

Now, we think that probably the first thing that ought to be done is to reduce the flow through the structure—try at least for a while to reduce the flow—and that would be best accomplished by building the auxiliary structure that has been proposed.

Our first recommendation in our report was, "Let's get that auxiliary structure built as soon as possible and put it into operation." There may be a 5-year window—we are at risk for a major flood. It all depends on the climate and the hydrology, and there is no way to predict something like this.

We think that an auxiliary structure could very well buy us 15, 20, 25 years of time. We will need every minute we can get, because New Orleans and the Baton Rouge-New Orleans industrial complex will be in dire need of fresh water.

As part of our report, Professor John Harris made what you might call a preliminary consulting evaluation of how to supply water to the industrial area and to the New Orleans area. It is elaborate; it needs to be fleshed out in additional studies, but at least the water is available. It will take a lot of retrofitting on the part of the industries that now use once-through cooling. They will

have to economize on the use of fresh water. But, again, with enough lead time, they can do this if they are serious about it and really believe that this is a reasonable probability. I think it is. If you take a 30-year period, then you have one chance in three of a 100-year flood. And, judging by our success in predicting the frequency of hurricanes—I think I have lived through about three or four 100-year hurricanes since I have been here—statistics are a rough guide to what to do, but you can't use them for support.

And, of course, the New Orleans-Baton Route industrial complex is threatened by the failure of the structure more than anything else.

Now, the other areas and other things that we talked about would occur in the presence of 1½ million or more cubic feet per second down the Atchafalaya. I think you will have—the Whiskey Bay crossing, for example—we already know that in the 1973 flood, there was a hole which was only 800 feet downstream that was deeper than the base of one of the supporting piers. The same thing seems to be happening further upstream where you are getting this constant cutting of the river bottom.

Now, this is not to say that somebody goofed. They did the best they knew how under the circumstances, and they completed all these plans even before the structure went into operation. I don't believe in Monday morning quarterbacking, and I am not saying this to cast aspersions on anybody's ability. I probably, under the circumstances, might have done the same thing. You can't tell.

So, we are worried about the transportation across the basin. We are worried about the pipelines. There were——

Senator JOHNSTON. Are you suggesting now that the bridge crossing at Morgan City——

Professor KAZMAN. No; I am talking about Whiskey Bay—Interstate 10.

Senator JOHNSTON. Did you say Interstate 10?

Professor KAZMAN. Yes; and, of course, the 190 bridge, further north.

The Morgan City bridge—there is a different set of circumstances which it may or—the approaches might go—we don't think the bridge will. But, again, it's a matter of professional opinion more than fact. We know they are going to be flooded out.

Regarding Morgan City, I don't think that we are telling them anything new. They already have gone through the 1973 flood.

If you had 1,500,000 cubic feet per second going through there instead of 700,000 or 800,000, you would have much higher water and you would flood a large part of the countryside, and you might actually flood Morgan City.

Senator JOHNSTON. Well, 1,500,000 cubic feet per second is what went through there in 1973.

Professor KAZMAN. No, sir. As I recall, the total was about 850,000 cubic feet per second, so that when you say 1½ million, nobody knows exactly what would happen. I haven't seen any studies to that effect.

So, we have the degradation of the riverbed downstream; we have the change in momentum or change in velocity of the water as it goes into the Old River control structure. We have had holes gouged in there. There is going to be a whirlpool action—I don't

see how that can be avoided—which will gouge out a hole in the forebay of the structure. We already have a hole downstream. Between the two holes, there is—I don't know—700, 800 feet of sand. And, all those—the downstream hole is already between the bottom of the piles—the upstream hole was within 30 or 40 feet of the bottom of the H-piles. What you have is a hill of sand armored with concrete which is letting half the water from the continental United States go through it. It is quite a job. I think that everything has been done that could be done, but people shouldn't think that the engineering profession is an arm of the Almighty. We can do things within limits. And, this is not very much appreciated by the general public. We do our best, but you do have failures and when you have a failure, it is a very serious matter.

And, our object here is to bring this to the attention of people and start building some backup. For example, there is going to be flooding in the basin. Well, there is no reason that I can see why they can't build some reasonably high ring-levees around the inhabited areas and keep themselves dry. If that marshy countryside goes under 10 or 15 feet of water, well, so what? Later on, it will go down and you will still be dry. It will be still be back in operation.

PIPELINE CROSSINGS

On the pipeline crossings, they have immense impact on the economic life of Eastern United States. Dr. Johnson will elaborate on this. He did the economic studies. When you cut off the gas, there is going to be some unemployment; manufacturing is going to drop; there are some widespread economic impacts that would happen should the structure go out.

There are reasons not only for Louisiana to have the structure, but for the rest of the country to have the structure, not to mention the impact on the entire lower Mississippi River project, both from a navigation standpoint, the bank stabilization. All this stuff will increase in cost to maintain navigation, to maintain the banks, as years go on. As a matter of fact, the entire system is still in an unstable condition from a geomorphologic standpoint. We are trying to buy time, and I am the first to appreciate the efforts of the Army in trying to do this—maintain this—permanently. I beg to suggest that we should be looking, as a backstop, how we can avoid some of the impacts or mitigate them.

I think I have talked more than my share of the time. That's the trouble with being a professor.

Senator JOHNSTON. Thank you very much, Professor Kazman.

Now, Dr. Kazman, you are certainly a distinguished civil engineer. Do you have a background in hydrology?

Professor KAZMAN. Well, I have written a book called, "Modern Hydrology" which—I have just applied some of the principles in this book. This book is used in graduate courses in universities throughout the country. The last time I looked, about 43 courses in various universities were using it as a text. It is published by Harper & Rowe.

Senator JOHNSTON. Very good.

Now, Dr. Kazman, does your conclusion that the Atchafalaya will become the main distributary of the Mississippi River—does that consider the actions authorized by the Congress and imple-

mented by the corps to assure that the Old River structure is fully able to control the Atchafalaya Basin, particularly the auxiliary structure that should be begun this summer and completed, I believe, in 1984?

Professor KAZMAN. Well, I am sure it will prolong the life, but I have no feeling that without a lot more than that, that you are going to have as much as 50 years out of it, because it only took 12 years for the thing to turn from being fully capable to being so questionable that, independently, the corps decided they had to build another structure.

Senator JOHNSTON. All right. You are familiar with the fact that some $50 million in work has been done since the 1973 flood, and that you have the grouting along the forebay, as well as the riprap, to a tremendous depth there, so it is not exactly like concrete being poured over the sand. It is riprap to a great depth.

Of course, you are familiar with the fact that the piles go down some 90 feet, and even though they might not——

Professor KAZMAN. To minus 90.

REHABILITATION OF OLD RIVER CONTROL STRUCTURE

Senator JOHNSTON. All right.

First of all, do you think those steps taken to rehabilitate the Old River structure are proper, or could you suggest other things that could be done with respect to the Old River structure?

Professor KAZMAN. I haven't—I make no claims to have studied all the plans or know all the details, and I don't know that I would be qualified to make better suggestions. I am personally satisfied that if that is what the corps has decided after their tests, that's probably the best anybody can do.

I am not sure that the best anybody can do is going to be enough in the long run. That's where the thing is. It is like Mount St. Helens. Once something happens, you just make the best of it. And, you take a flood like the one that—DeSoto seemed to have encountered—and there's no telling. It's one of these things that—you have to be prepared. Even the corps has never said that their levee system and everything else is permanent. They say it's good for the project flood.

Now, the project flood was determined back in 1933 or 1934. Things have changed. Maybe the project flood is all right; maybe it's a—instead of a 1,000-year flood, it's a 100-year flood now.

Senator JOHNSTON. You are familiar with the corps' plans for the auxiliary control structure?

Professor KAZMAN. In general, yes.

Senator JOHNSTON. And, you do endorse the plans for the Old River control structure——

Professor KAZMAN. Well, I——

Senator JOHNSTON [continuing]. Or you have no reason to suggest an alternative or to say——

Professor KAZMAN. No; I——

Senator JOHNSTON [continuing]. That those plans are not——

Professor KAZMAN. I have absolutely no reason to suggest at all. I can suggest that they get it in place as soon as possible.

Senator JOHNSTON. All right.

So, you are not here today to suggest that the steps that have been done to rehabilitate the Old River structure or to build the auxiliary structure are in any way deficient?

Professor KAZMAN. No; absolutely—I am in favor of doing everything possible—as soon as possible.

Senator JOHNSTON. And, you are not familiar with the details of either what has been done to the Old River structure or the plans for the auxiliary structure? Am I correct in that?

Professor KAZMAN. In general, yes; in detail, no. That is, I know that they are armoring—they are putting rocks in upstream and downstream—they are armoring the channel, trying to keep erosion from happening, stabilizing the bank, but the details—I have a full-time job—and I was——

Senator JOHNSTON. Well, what I am getting at is, do you think that, based upon what the corps may say here today in giving more of the details, you may be persuaded that perhaps you were in error in concluding that eventually—some time in the next two or three decades—that we would lose the Old River structure?

Professor KAZMAN. Well, I am perfectly willing to listen to all of the information with an open mind. But the forces of geomorphology that I referred to are still operative, and the problem is that I can't visualize the works lasting for long—very long—periods of time, under the circumstances.

First of all, I don't know the magnitude of the floods or the severity of the floods or the duration of the floods. You can do your best, and I am sure that the corps is doing its best, and if it gets the money, it may be able to do the things more elaborately than they plan to now. I don't know. I think they should, because we have got to buy the time. Now, what happens—if we use the time properly, that is, the habitants of the area—the cities, the industries—use the time property, why, then, when the flood comes or when the thing happens—and I think it will—we will be able to operate without too much disruption. If we don't, Dave's economics just scratches the surface. It will be like having Mount St. Helens in a very inhabited area.

Senator JOHNSTON. Well, now, you have mentioned that breach might come, not at the Old River structure, but in one of the accompanying levees, and I believe you said that the result would be essentially the same; is that correct?

[Professor Kazman nods head affirmatively.]

Senator JOHNSTON. Well, that would assume that a breach in the levee would almost immediately scour out the new channel, virtually equal to the existing channel. Are you saying that that could happen in a flood?

Professor KAZMAN. I think it could crevasse as it happened before, but this would be one mighty crevasse if it happened right next to the structure, because you would already have a lot of momentum going in that general direction, and it would just eat through it like a hot knife through butter.

I am very much impressed by the Mississippi River at flood.

Senator JOHNSTON. Well, that could happen anywhere along the levee system, could it not?

Professor KAZMAN. Yes, it could; but, as I say, the focal point it seems to me is that particular area, which was a natural point for diversion, anyway.

Senator JOHNSTON. When you say that we are likely to lose the Old River structure some time within the—well—I think you say that we may have fifteen, 20 to 25 years with the auxiliary structure—does that mean a total of fifteen to twenty to 25 years, or 15 to 25 years in addition to what we have already got?

Professor KAZMAN. If I knew when the floods and how big the floods were, I could give you a much better answer. I don't know, that is just a gut feeling as to the occurrence of floods.

Now, we might have a dry period; we might have 10 or 15 years of very low waters. And, therefore, you wouldn't have any danger. I am talking—as a hydrologist—I am interested in the extremes.

Senator JOHNSTON. Well, are you saying that the Old River structure will not hold the project flood or that a flood in excess of the project flood is more likely than the statisticians say?

Professor KAZMAN. I would rather think that the project flood might be a pretty good test. I don't know the details. Nobody can tell the details. When you get a major flood like this, so much is going on, you can't really know what's happening—where the scour is happening. The wing wall, I understand, was a kind of a surprise when it collapsed. And, this is a brand new structure; they had done all the tests; they thought they were right. They had every reason, I believe, to think that they were all right.

There are a lot of unknowns here. We are dealing with the Mississippi River.

PROJECT FLOOD

Senator JOHNSTON. Now, the flood of 1973 was essentially a project flood, was it not?

Professor KAZMAN. No, sir; no, sir.

Senator JOHNSTON. How far did it miss the project flood?

Professor KAZMAN. Oh, at least 25 percent, and that means it's a much more frequent than project flood.

Senator JOHNSTON. And, it is essentially the project flood which you think that it cannot contain, and, in addition to that, you are saying that the Old River structure, as augmented by the auxiliary structure, is in danger from the project flood, and, in addition to that, a flood in excess of the project flood is not only thinkable, but in the next few-decade time span, likely?

Professor KAZMAN. Well, you are pinning me down and the whole profession down in this respect. These are some of the things that we can't really know. We can just surmise.

Now, let's take a look at the major floods. After the 1927 flood, you had one in 1936; you had another one in 1937; I think you had one in 1949; in 1973; and something of the same thing in 1974. You had some pretty fair size floods in the last 50 years.

If we get another one and, as I am saying, the tendency is for large discharges to be more frequent, because we have improved the continental United States. We have improved the drainage; stuff goes faster. We have got reservoirs. If those reservoirs are full when a major flood happens, all the spillways have to be opened and you get flood waves moving down the river much faster.

We don't know how the peaks synchronize. In fact, I don't see how you can figure out how the peaks synchronize.

It seems to me that a reasonable man would have to believe that there will be at least two or three major floods in the next 80 years, and maybe even more than that. Now, whether that would be the project flood, just below the project flood, more than the project flood, I don't know.

Senator JOHNSTON. Now, in 1979, prior to the completion of the repairs resulting from the previous flood, the Old River structure operated without difficulty during that major flood.

Doesn't the performance during the 1979 flood indicate that the Old River structure can sustain future floodflows without significant danger?

Professor KAZMAN. Well, I am sure it will up to a point. I can't predict—it's impossible to predict exactly the circumstances of failure because things happen at the same time in various places, and it can be compounded. You have a flood and despite the best efforts, a barge gets locked in there and you get a flood—you get an extra flood wave because you have blocked it off.

I remember once, they closed—at low water, they closed the Old River control structure for repairs, back about 1964, I think—after a barge had hit it—and the water level in New Orleans rose 7 feet overnight. And, they were rounding up barges for 2 days below New Orleans. These are the sort of unforeseen events. This is not a structure that you can build like an apartment house or an office complex where you can predict what's wrong. You can make structural analyses. This is Mother Nature herself from the continental United States, and there is nobody that can say exactly what is going to happen or exactly when it is going to happen, even more seriously.

I am happy that the structure didn't have any trouble during the floods since 1973, and I trust it will keep on that way for 20 or 25 years, but that's about as far as I feel I can go.

Senator JOHNSTON. Thank you very much indeed, Professor Kazman.

Professor Johnson?

STATEMENT OF DAVID B. JOHNSON, PROFESSOR OF ECONOMICS, LOUISIANA STATE UNIVERSITY

Professor JOHNSON. My name is David B. Johnson. I am professor of economics at Louisiana State University, director of the division of economic and business research, and director of the masters of public administration program.

I have done numerous theoretical and applied economic studies during my 14- or 15-year career as an economist.

I have a few brief comments, Senator Johnston.

The purpose of our report was not to alarm individuals; in fact, we found out that those individuals most directly impacted were quite alarmed already—were already quite concerned and quite alarmed primarily as a result of the 1973 flood.

I think the purpose of our report was to generate some discussion, and both Professor Kazman and I in all of our talks and in all of our presentations and in the book itself state that this is a very pilot preliminary study meant to generate discussions such as this, which I think are very, very good for our State and for the country,

and also to alert people, not necessarily in Louisiana, although there, too, but around the country that there is a potential problem that needs to be discussed, that needs to be addressed, and it is not a local problem. It will affect people in Washington, D.C.; and North Carolina; and New York City, as well.

I think to some extent we have achieved that objective, from newspaper reports that we have received, and I am encouraged that there is an increasingly detailed, intelligent discussion about not only the Old River control structure, but about auxiliary effects as well.

When we started this project—it has been a few years ago and it has been very much a part-time study—we did not know an auxiliary structure was in the works, and we did not know that it was proposed. We are very happy to hear now that the Corps of Engineers is going ahead with the auxiliary structure, and we hope and would expect the Congress to fund the completion of that structure.

There are, I think, four major points that one might list as being germane to this general topic. The first one, and on one, I think, the corps and Professor Kazman and I would be in general agreement, is that the Old River control structure is at least not as sound as we thought it was 10 years ago, and that until that auxiliary structure gets completed, we in Louisiana and citizens in the southeastern and eastern part of the United States run some risk. We run some exposure if we have a major flood in the next year, in the next 2 years, or the next 5 years. The degree of that risk, I think, is unknown. I think the corps would agree with us that there is some risk; otherwise, they would not be building the auxiliary structure in the first place.

Secondly, there is the long run problem. Can man, through his best efforts as exemplified by the actions of the Corps of Engineers—can we over the next 20 years, 50 years, 100 years, keep that river going down its present channel? I think that is the second topic. And, I think there, perhaps—I am going to say—Professor Kazman and the Corps of Engineers might have somewhat different viewpoints. I am not an expert in that area.

The third point, I think, is that even if we all agree that the Old River control structure there now will stand, that the auxiliary structure will protect us for ad infinitum, what happens periodically when we have a major flood and an increased volume of water goes down the Atchafalaya?

Some of the economic effects that I described in my section are not necessarily solely related to the failure of the Old River control structure. They are, again, perhaps, a repeat of what happened in 1973 or perhaps even a greater volume of water going down after the auxiliary structure gets in. What happens to the bridges, to the pipelines, to Morgan City, with this increased volume of water going down the Atchafalaya? And, I think that issue has to be addressed as well as whether that structure is going to last ad infinitum.

I think a fourth question—and one which I am hearing increasingly from some of my colleagues, and I understand that in the university—that's not a representative sample of the entire Nation—I do not share these views, but I would like to report to them what I have been hearing increasingly in the last 3 months,

coming primarily from environmentalists, marine biologists, and a few economists—and that addresses the question of, should the Mississippi River be allowed to change its course? Should we gradually start planning for the eventual change in the course of the Mississippi River? Let it seek its natural course. And, they cite as benefits, increased hurricane protection from the marshlands, decreased flood protection costs for New Orleans, the area below Baton Rouge, increased nursery fishing grounds, increased natural environment enlargement. I am not an expert in these areas, but these questions and arguments have been raised.

Now, based on the work I have done, I would think that they would have to come up with an enormously large benefit from allowing the Mississippi to go down its present course.

Senator JOHNSTON. I will be able—glad to ask that question. The port commission in New Orleans—they will be testifying a little bit later.

Professor JOHNSON. They might have different views, but we don't think the Port is going to be that significantly affected by a change—become a salt-water estuary rather than a fresh water—but let them address that.

ECONOMIC IMPACT OF CHANGE IN RIVER FLOWS

What are some economic costs? Now, the costs we addressed in our book were limited very much by time, money, and other resources. We decided not to look at all the costs nor the benefits of allowing the Mississippi River to change direction, or if the Old River control structure should fail, or if indeed it should stay in its place and we have repeated high water floods.

I looked at some that I thought would have an impact, not only locally, but nationally. They were the highway and railroad bridges that could possibly be destroyed through scouring, natural gas and oil pipelines that could be ruptured—in fact, a number of them ruptured in 1973—what would be some alternatives in those cases, flooding damages.

I did not look at such things as relocation costs or the cessation of oil and gas exploration and development in the basin, nor the delays and the capital losses that would ensue from that.

We did not look in detail at the effects on shrimp, oysters, and crayfish, although, basically, our view was, from what we could learn was that in the shorter run, there would be losses, but in the long run—again going along with this environmentalist argument—that in the long run, the nursery areas in the central basin would probably be improved and we would have an increased catch in those areas.

We did not look at the value of Government capital investment roads and so forth in the basin that would ensue from a destruction of the Old River control structure, and perhaps additional flood control measures.

We looked solely at some, and, of course, that data is in the book, and the high figure I came up with was roughly $4 billion. That was a pessimistic outcome of those things I looked at.

But, I think if one totaled all of the potential costs and if one had a real pessimistic outlook on the destruction of that structure and the pessimistic view on the subsequent viability of bridges, pipe-

lines, and railroads and so forth, that we would be talking probably in the area of $10–20 billion, rather than $4 billion.

PIPELINE CROSSINGS

I might just mention here, to get it on the record, that there are seven major pipelines crossing the basin, and it was not an easy task, although I thought originally it would be, to find out where the gas going through those pipelines went. And, after a little bit of detective work and tracking down a number of different people and studies, the best I could do was reported in our book, but it will affect through reliability of natural gas supplies something like 20, 25 States in the east and southeast.

Of course, these States could also be affected through cessation of travel on the Interstate 10 in terms of reliability of truck deliveries, vacation travel, and so forth.

So, we want to stress that any possible outcome of—that would be a pessimistic outcome of—the destruction of the Old River control structure is not just confined to the basin and it is not just confined to Louisiana. It is, in the sense, a real national problem, and, indeed, it should be. The Mississippi River does collect waters from a good part of the United States.

Senator JOHNSTON. Thank you, Dr. Johnson.

What steps should be taken, other than the steps with respect to the Old River control structure and the auxiliary structure, to avoid ruptures in pipelines and other problems?

Professor JOHNSON. I think some of the steps are being taken now. To give you an example—I talked to one man from a pipeline company and he was saying, "Glad your report came out. It is going to help me convince my boss that we need to do something."

And, then, the earlier pipelines have done it. No. 1 is construct aerial crossings, or to go down with the new—relatively new technique they use for horizontal boring which enables you to get quite a ways underneath the riverbed.

Second, I would think that natural gas pipeline companies need to talk more to each other in terms of "What do we do if pipeline A, B, C, and D should happen to fail?"

I may not have talked to the correct people in the companies, but the best that I could get was, either they hadn't given it a great deal of thought, or if they had, they said, "Well, we'll reroute our gas or oil through a neighboring pipeline."

The problem might be, their neighbor might be out as well. So, I think that there should be some discussion about rerouting the gas around the basin.

Senator JOHNSTON. Do you mean around the basin altogether or——

Professor JOHNSON. Right; around the basin altogether. In some cases, it is possible where you have connections on both sides of the basin, you can interconnect with other pipelines. And, that's one possibility—to have these standby relationships established so that if you have a cessation suddenly within a week of three or four major pipelines, that you have some plan that will provide natural gas throughout the country.

Senator JOHNSTON. First of all, let me ask you, with respect to gas pipelines, can these alternatives, in your judgment and in

Professor Kazman's judgment, be undertaken at relatively small expense?

Professor JOHNSON. I have some estimates of the cost of replacing a pipeline, and if I recall, replacement cost for an aerial bridge is roughly about $2 million, I think, in 1977 prices, so we may be talking about $3 million in current prices.

Senator JOHNSTON. Should those aerial bridges be replaced prior to the flood and built stronger or better or higher or——

Professor JOHNSON. I think for some pipeline companies, yes. I think some that are in the areas where they are most likely to erode, that that company—and they know best their own business—I don't want to tell them what to do—they can weigh the cost and the benefits, their alternative routes, but I would suggest that they would look at that alternative—for those pipeline companies that are in the areas—unconsolidated clays—that have their pipelines that are not buried relatively deeply.

Senator JOHNSTON. Now, for those that are already built, should we create a new mechanism at the Federal level to continue to permit them—before they were built in the first place, of course, they were permitted—but should we have some new regulatory scheme to require replacement of those which might be faulty in there?

Professor JOHNSON. I would not suggest that, Senator. I am very very leery of regulatory schemes, and they often impose unknown costs on those that are regulated and on consumers.

Senator JOHNSTON. Now, let me say that I agree.

Professor JOHNSON. Right. I think that a notice, perhaps sent out from your office, might jog some people to think about it, saying that this is a problem that we are concerned about in this country, and I am sure you are concerned about it. Have you considered this or that? I think that would be helpful, although I am sure that most of the pipeline companies are aware of the problem. I am not certain; at least at the time we were doing the work, which was 2 or 3 years ago, we were not able to find definitive plans of what they would do in the case of disruption.

WHISKEY BAY BRIDGE

Senator JOHNSTON. Let me ask both of you this question.

Is the design of the bridge at Whiskey Bay on I–10 sufficient, or should that be beefed up?

Professor KAZMAN. Well, I would think that we need to somehow or another get those foundations deeper, either—and we propose in the report—either consolidate the material below the base of the bridge piers——

Senator JOHNSTON. Would you pull the microphone closer to you, please?

Professor KAZMAN [continuing]. We should consolidate—there are several different alternates—from my experience of my doing some mining, why, you can preconsolidate what they call loose ground. We have got plenty of loose ground underneath those bridges, mostly sand. Now, it is possible to use a consolidating agent like AM–9 or some other chemical agent to essentially build a deep rock underpinning for these piers. Now, whether this is feasible, I am not positive. It would be done through water, and I

don't know that anybody has ever tried that in water, although they have consolidated water-bearing material with this AM-9 or similar grout.

Senator JOHNSTON. Now, if you had to put relative percentages on the risk, which would be the higher risk, the failure of the Old River structure or the failure of the bridge at Whiskey Bay, with a project flood with the Old River structure working properly, but with 1½ million cubic feet per second?

Professor KAZMAN. Well, I think the Whiskey Bay crossing would be at a greater risk.

Senator JOHNSTON. In other words, even though the Old River structure would be holding up, you might lose Whiskey Bay in a project flood?

Professor KAZMAN. I would say "definitely," and also the U.S. 190 bridge or bridges.

Senator JOHNSTON. Did you say, "also 190?"

Professor KAZMAN. Oh, yeah; that's even more——

Professor JOHNSON. In the same area.

Professor KAZMAN. They are upstream, and, again, the river is cutting. The bottom—the stages for the same flow are going down, which means the river is generally cutting its way down. It's a degrading river.

Senator JOHNSTON. What should the Congress do, if anything, with respect to I-10 and the U.S. 190 bridges?

Professor KAZMAN. It seems to me that the State highway departments——

Professor JOHNSON. National departments.

Professor KAZMAN [continuing]. Or the—either on a national basis or the local department of transportation ought to take a look at the situation and do some monitoring during high water and see the progress of these various scour holes downstream from the bridge piers, and, then, take a good, hard look and see whether they want to go down with sheet piling—I don't know—they might want to preconsolidate with AM-9 or a similar consolidating agent, or they might want to build some new piers and jack the structure onto these new piers as has been done with some skyscrapers in New York—Spencer, White and——

Senator JOHNSTON. You are not suggesting—I mean—this is primarily, of course, a State function.

Professor KAZMAN. That's right.

Senator JOHNSTON. Then you are not suggesting that the Congress do anything other than provide the form for bringing out the information and make them aware of our findings?

Professor JOHNSON. Well, I think it is an interstate Federal highway, as is U.S. 190. And, I don't view the waters going underneath the bridge as being totally a local problem. I think the Congress has a responsibility there in the first place.

I think, when the bridges and the electrical transmission towers and the pipelines and the railroad bridges were put in, that we just did not foresee the volume of water that was coming down and would be coming down in the future, and they were built solidly and logically at that time, but things have changed. And, I think—well—we would suggest, first of all, that you get some teams of qualified people that can devote more time to it than we were able

to devote to it and take a hard look at it. But don't just take the depth soundings on low water. Take those soundings out there during the high water and find out what is happening to the scour holes and what is the possibility of these bridges going.

CONCLUSION ON NEED FOR AUXILIARY CONTROL STRUCTURE

Senator JOHNSTON. All right.

Dr. Johnson, you mentioned that your report was started prior to your knowledge of the planning and design of the auxiliary structure. Would that change your conclusion any?

Professor JOHNSON. Well, I come to this as a layman, and perhaps that may be useful or not useful. I don't know the engineering aspects to it. But, I think both Ray and I would agree that putting in the auxiliary structure is an absolute necessity, and the sooner we get that in, the easier we are going to breathe. Certainly, I would think that that is going to, for some period of time, reduce the possibility of a failure. It is probably also going to reduce, but to a much lesser extent, the economic problems in the Atchafalaya Basin.

The long-run consequences—how long that is going to stay and whether we are going to have to meet 15 years from now and also look at that structure and talk about building a third or a fourth or a fifth structure—I think those are things that we need to also consider.

I am sure, at similar hearings in 1958, that the argument was, if we put in that structure, we have it contained.

Well, it's less than 20 years later now after the Old River control structure became operational in 1962 or 1963, and we are talking about a new one now.

I think Professor Kazman's view—and he's well respected in this area—is that over the long run, it's going to be difficult if not impossible to maintain it.

I would think, as an economist and one who is a layman in the engineering area, my view would be, we might be able to maintain the Mississippi River down its present course, but at an ever increasing cost.

Senator JOHNSTON. Gentlemen, let me say that I appreciate very much your being here. I think you have achieved the purpose of opening the dialog, which I think is a very useful purpose.

While I hope that the corps can convince you, me, and everyone that steps taken to control the river and keep it in its present course will be sufficient to satisfy everyone and to give confidence, nevertheless, I think these are questions that ought to be asked.

In all fairness, I think, in terms of time and resources, the corps does have more time, more money, more resources. You very honestly said that this as a part-time study limited by time, money, and resources, albeit by distinguished professors, and, therefore, I think that—I hope you will—and I know you will—stay here and listen to the corps and perhaps we can call on you for some followup questions later in light of their testimony.

Professor KAZMAN. All right.

Senator JOHNSTON. Thank you very much, gentlemen, for excellent testimony.

Professor JOHNSON. Thank you, Senator.

STATEMENT OF LT. GEN. JOSEPH K. BRATTON, CHIEF OF ENGINEERS, U.S. ARMY CORPS OF ENGINEERS.

Senator JOHNSTON. Next, we want to welcome to the committee Lt. Gen. J. K. Bratton, who is the Chief of Engineers, U.S. Army Corps of Engineers; and Maj. Gen. William E. Read, who is the Division Engineer of the Lower Mississippi Valley Division; and Col. Thomas A. Sands, District Engineer of the New Orleans District of the Corps of Engineers.

General Bratton and gentlemen, we are very honored to have you here today. We appreciate the importance which you give to this hearing and we know the importance you give to the Old River structure.

Please proceed.

General BRATTON. Thank you very much, Senator Johnston.

I welcome the opportunity, certainly, to appear before you this morning and discuss the problem of control of the Mississippi River and the associated Atchafalaya River Basin.

One point I would like to make clear right from the start is the great seriousness which the Corps of Engineers views the control of the Mississippi River and the proper functioning of the control structure that has been built for it. We regard it as our single most important civil works project today.

We welcome this hearing, because we feel that the discussion can only benefit the committee, certainly, and also the public—the interested public here in the State of Louisiana—in making clear our views and our plans regarding the project.

We believe that Professor Kazman and Professor Johnson have surfaced in a very good way the potential problem if the river is not controlled. We believe we have a suitable, adequate, and functioning plan for control of the river, and General Read in a few moments will discuss in some detail the plan in its entirety.

The key element in controlling the Mississippi River is control of its natural tendency to take a shorter route to the Gulf of Mexico via the Atchafalaya River is controlling the balance of flow between the Atchafalaya and the Mississippi main stem.

If the Mississippi River obviously would change its course—depart from its present main stem—there would be some calamitous results. We would leave the major ports of New Orleans and Baton Rouge on a saline estuary and sever them from the Mississippi Inland Waterway System, flood the Atchafalaya Basin, and disrupt pipelines, highways, other communications across that part of Louisiana. Losses are estimated to be in the several billion dollars in the worst case, with substantial unquantifiable impact on human lives, social disruption, and some years to adjust to the situation, despite the expense.

The recent report presents the results of a study of the significance of the Old River control structure in helping control floods on the lower Mississippi. It recognizes that if the existing structure becomes unable to control the distribution of flow between the lower Mississippi and the Atachafalaya Basin, grave physical and economic consequences could result. The report also recognizes the need for an auxiliary structure to reduce the flow through the present low sill structure and to help safeguard it. And, in that respect, these observations of the professors in their report are correct.

The authors have also pointed out that the capture of the Mississippi by the Atchafalaya would entail consequences disastrous to the State of Louisiana and to a large part of the Nation. Their conclusions are much the same as those that were reported to Congress in the early 1950's which resulted in the original authorization by Congress of the Old River project.

We clearly do not believe that this capture of the Mississippi by the Atchafalaya is inevitable, and it can be prevented.

The present structure we regard as adequate to maintain control under normal conditions, including major flood conditions. The structure was damaged in the 1973 flood. Part of that damage can be and is being repaired; part of it cannot be. The problems resulting from that flood have been mostly alleviated by modifying the operation of the structure and extensive rehabilitation of the structure. The stability of the low sill structure in its present form was illustrated last year, when a flood equal to about 90 percent of the severe 1973 flood occurred, and with no resulting problems on the low sill control structure.

Our present rehabilitation program is nearing completion, and it should provide for dependable operation of the project under all normal operating conditions. An auxiliary structure to improve operational reliability during emergency conditions will begin construction this coming summer and is scheduled to become operational near the end of 1985. Congress has specifically appropriated funds for both the rehabilitation work on the existing structure and the construction of the auxiliary structure.

To assure completion on schedule, this work is receiving the highest priority in the formulation of our fiscal 1982 budget which will be sent to Congress next month. Once the auxiliary structure is completed, it will provide a high level of technical assurance that control of flow diversion at the Old River will be maintained.

A remaining potential deficiency at the present Old River control is the possibility that flows through the structure might be constricted by some abnormal occurrence, such as loose barges being pulled into the Old River structure flowway or other marine equipment being drawn in. If it is necessary to close the structure to remove an errant barge, the differential head in water and the resulting pressure by having high water levels on the upstream side coming from the Mississippi and low level waters on the lower side flowing to the Atchalfalaya would greatly increase the danger of failure during a period of even moderate flows. This deficiency, however, will be corrected by the auxiliary structure, and we are taking other measures at this time to assure that any incident of marine equipment or barges being pulled into the present Old River structure can be avoided.

I would like to assure you that damage to the low sill structure in 1973 has been effectively dealt with, and that, with completion of the auxiliary structure in 1985, the intent of Congress in authorizing the Old River control project in 1954 will continue to be carried out.

With your permission, sir, I would like to ask General Read, who is the Division Engineer of the Lower Mississippi Valley Division and who is to become the president of the Mississippi River Commission, to present in some detail how the project at Old River

works, how it was designed, and how important it is to the overall flood control and navigation system on the Mississippi and Atchafalaya.

That concludes my prepared statement, Mr. Chairman.

With your permission, I would like for General Read to move into his presentation and, then, we are prepared, after his, to accept any questions.

Senator JOHNSTON. Thank you very much, General Bratton.

STATEMENT OF MAJ. GEN. WILLIAM E. READ, DIVISION ENGINEER, LOWER MISSISSIPPI VALLEY DIVISION

General READ. Thank you, sir. It is a pleasure to be here this morning.

If I may, I will start on my statement, which is a prepared statement, and it does have slides associated with it. I believe the first one is up.

America's greatest river, the Mississippi, has made major contributions to the physical and the economic growth of the Nation.

I wonder if we may have the light switched back on, please? Thank you.

It is a navigation artery of great importance to the Nation's transportation system, carrying an ever-increasing commerce. Coursing through the heart of America, it supplies water for the cities and industries that have located along its banks. More and more, the Mississippi's importance is emphasized as America continues to grow. This great river is truly one of the Nation's outstanding assets. Uncontrolled, it would be just as a great a liability.

The Mississippi River always has been a threat to the security of the valley through which it flows. De La Vega, in his history of the expedition begun by DeSoto, described the first recorded flood of the Mississippi as severe and of prolonged duration, beginning about March 10, 1543, and cresting about 40 days later. By the end of May, the river had returned to its banks, having been in flood for about 80 days.

Since that time, explorers, traders, farmers, men of commerce, and engineers have known, sometimes too well, the Mississippi in flood.

The Mississippi River has the fourth largest drainage basin in the world, exceeded in size only by the watersheds of the Amazon, the Congo, and the Nile Rivers. It drains 41 percent of the area of the 48 contiguous states. The basin covers more than 1,245,000 square miles, including all or part of 31 States and two Canadian Provinces, and roughly resembles a funnel which has as its spout the Gulf of Mexico. Waters from as far east as New York and as far west as Montana contribute to flows in the lower river.

It is often said that Bienville was wrong when, against the advice of his chief engineer, he decided to establish his headquarters at a location which has come to be the city of New Orleans. Surely the site was ill suited to human habitation, so much so that the engineer's first act was to design and subsequently construct the first levees built along the Mississippi. A simple earthen embankment has in due course grown into the complex system of works which protects and preserves the entire alluvial valley extending from Cape Girardeau, Mo., to the Gulf of Mexico. Today, our major focus

will be on that part of the system from the latitude of Old River to the Gulf of Mexico.

Below the latitude of Old River, the important elements of the system include the following: first, levees along both banks of the Mississippi: second, channel improvement works to stablilize the channel of the Mississippi River in the interest of preserving the levee system and providing conditions favorable to navigation; third, the leveed Atchafalaya Basin Floodway and its artificial intakes, Morganza Floodway and the West Atchafalaya, which permit the Atchafalaya Basin to carry flow in an orderly fashion and without flood damage to improvements located adjacent to the basin; fourth, Bonnet Carré Spillway, a relief valve which insures that the safe capacity of the levees at and below New Orleans is not exceeded; fifth, the deep-draft navigation channel serving the ports of New Orleans and Baton Rouge; sixth, the shallow-draft navigation system which allows the movement of bulk cargo to, through, and from the major ports, New Orleans and Baton Rouge; and, finally, seven, Old River control, which, as we shall subsequently explain, represents the key to the proper functioning of all of the above elements.

Not included in these elements are the hundreds of miles of shallow-draft navigation arteries in coastal Louisiana. These include the Mississippi River between Old River and Baton Rouge, the Gulf Intracoastal Waterway and many feeder channels such as the Barataria Bay Waterway, the Atchafalaya River, the Bayous Chene, Boeuf, and Black project.

Movement of the Nation's commerce is very much dependent on the proper functioning of these waterways. All would be seriously disrupted should the lower Mississippi change its course.

The effectiveness and proper functioning of the various elements just described are totally dependent upon the maintenance of stability in the master distributary relationship which exists between the lower Mississippi and the Atchafalaya Rivers. The forces of nature act to alter that relationship rather than to maintain it. Old River control is the key to stability. So long as it is intact and effective, flows can be divided between the Mississippi and Atchafalaya Rivers in proportions that will restrain uncontrolled growth of the Atchafalaya. The continued effectiveness of the existing flood control and navigation systems depend on the maintenance of this distribution. Indeed, the well-being of the millions of citizens of south Louisiana and the continued operation of highly important navigation systems depend upon this stability.

In our view, Professors Kazman and Johnson have rather accurately described the catastrophe that would follow the loss of control. Based on the authorizing law, the 1954 Flood Control Act, the Old River control complex is operated to distribute latitude flows in the same way that the natural system existed as of 1950 would have distributed them. Now, at that time, approximately 70 percent of the total latitude flow was passed to the gulf in the lower Mississippi and 30 percent via the Atchafalaya. Latitude flow is defined as the total flow at the latitude of Old River and includes the flows of the Mississippi River and the Red, Ouachita, and Black.

The individual features of the Old River project are; one, a low sill structure—a reinforced concrete control structure with 11 gate bays, each 44 feet wide and controlled by vertical lift steel gates; two, an overbank structure—a reinforced concrete control structure with 73 bays, each 44 feet wide and controlled by hinged timber panels; three, a navigation lock, which has a length of 1,200 feet and a width of 75 feet; four, an inflow channel connecting the low sill structure with the Mississippi River; it is about 2,200 feet long; five, an outflow channel connecting the low sill structure with the Red River; it is about 7 miles long; six, levees—the levee system is strengthened and extended as necessary to link the project with the existing main line levee system; and, seven, a closure dam—the closure dam is located in the natural Old River channel and consists of a hydraulically placed sand core with a hauled clay cover.

Now, in the way of background—prior to 1831, the Mississippi River made a large meander loop to the west of the project area. This loop connected to the Red River, which became a tributary, and the Atchafalaya River, which became a distributary. In 1831, Capt. Henry Shreve cut off the loop to improve navigation. The upper portion of the loop eventually silted up, but the lower portion remained open and became known as Old River, a 7-mile long stream connecting the Mississippi and the Red and Atchafalaya Rivers.

The direction of flow in Old River varied, depending upon whether the Mississippi or the Red River was higher. During floods on the Mississippi, Old River functioned as a natural floodway, diverting excess flood waters out of the Mississippi River and into the low lying Atchafalaya Basin, which empties into the Gulf of Mexico separately.

In 1928, as a result of repeated flooding in the Mississippi's alluvial valley, Congress authorized a comprehensive flood control plan. At the latitude of Old River, the design flood equals a flow of about 3 million cubic feet per second. In recognition of the fact that it would be impossible to convey a flood of this size solely by the use of levees along the Mississippi River, the plan formulated in 1928 proposed preservation and continued use of the broad, overbank flood plain adjacent to the Atchafalaya River for conveyance of one-half of the design flood, or about 1,500,000 cubic feet per second. Therefore, a gap was left in the levee system to allow the natural Old River channel to continue to function as an outlet for flood waters.

Diversions from the Mississippi into the Atchafalaya Basin were planned so as to limit the flow below Old River to one million, 500,000 cubic feet per second, the capacity of the leveed channel. The existence of this gap did involve a potential danger. This is because the distance from Old River to the Gulf of Mexico via the Mississippi River is over 300 miles, while the distance via the Atchafalaya channel is about 140 miles. This makes the Atchafalaya a potential route for the Mississippi to adopt. Such changes in course have occurred throughout geologic history, and the various deltas formed are still evident in modern-day southern Louisiana. Bayous Teche, Lafourche, and others are remnants of ancient courses of the Mississippi River.

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The conditions in both the Atchafalaya River and in Old River were observed carefully. These observations clearly demonstrated that the annual volume of flow from the Mississippi through Old River into the Atchafalaya River was gradually increasing with time. In 1900, about 12 percent of the total annual latitude flow was carried by the Atchafalaya River. And, by 1940, the percentage had increased to 20 percent and by 1950, to 30 percent.

Now, due to the changing conditions in the Old, Atchafalaya, and Mississippi Rivers, a major definitive study was begun in 1950 by the Mississippi River Commission to evaluate the threat of the Mississippi River changing its course to that of the Atchafalaya. The study was comprehensive and included a complete review of all available hydrologic, hydraulic, geologic, and economic data. The findings of the report left no doubt that if nothing were done, the Mississippi River would soon change its course.

After carefully studying all possible solutions, the Mississippi River Commission recommended that the uncontrolled link, Old River, be dammed up and replaced with a controlled connection that would make it possible to divert the optimum amounts of water in the Atchafalaya Basin under normal and flood conditions, and to prevent the Mississippi River from adopting the Atchafalaya as its course.

The project was authorized by the Flood Control Act of 1954 as a modification of the Mississippi River and tributaries project.

Construction of Old River project began in 1955. The first two features completed were the low sill and overbank structures, the former to pass low and medium flows from the Mississippi River to the Atchafalaya in a controlled manner, and the latter to operate with the low sill structure during floods. Inflow and outflow channels were constructed to connect the low sill structure with the Mississippi and Red Rivers. To avoid severing an important navigation artery, a navigation lock was constructed just south on the junction of the Old and the Mississippi Rivers. Existing levees were enlarged as required and new levees were constructed to close the gap in the levee line and, as the last step, a closure dam was constructed to block flow through the natural Old River channel.

The project was placed in full operation in 1963. The plan of operation is to regulate the diversion of flow through the Old River structure so that 30 percent of the total latitude flow will be passed down the Atchafalaya River and 70 percent will be passed down the Mississippi River. This is the flow distribution that occurred in 1950 and which was determined to be desirable proportions.

The designers of the project recognized that river conditions are dynamic and that in particular, the Atchafalaya River could be expected to continue to enlarge its channel and to increase its discharge capacity at its upper end, resulting in a general lowering of flowlines in the upper Atchafalaya River and a decrease in tailwater elevations at the low sill structure. The low sill structure was provided with gates so that the correct distribution, that is, the 30 to 70 percent, can be maintained although the river conditions may be changing. As the tailwater elevations have actually increased somewhat, so that the differential head required to maintain the desired flow distribution has gradually increased. This placed increasing stress on the structure.

The operation of the low sill structure has resulted in the formation of a large scour hole, as much as 130 feet deeper than the original bottom, in the outflow channel. This scour hole is a function of energy generated by the water passing through the low sill structure and is located about 800 feet downstream of the structure, thus posing no threat to it. Operation has also resulted in a deepening of 20 to 30 feet in a portion of the inflow channel to the low sill structure. Deeper scour holes have formed intermittently in the inflow channel during rising stages, but have tended to fill with sediment when the stages begin receding.

In addition to the scour caused by operation of the structure, on two occasions, unattended marine vessels have been drawn into the low sill structure from the Mississippi River. This happened in April of 1967 when eight barges were drawn in and in December 1965 when four barges were drawn in.

While the impact of the barges did not cause any direct structural damages, the removal of the barges required that most or, in some cases, all of the gates of the structure be closed. This resulted in differential heads up to 25 feet at the low sill structure. Reopening the gates with such a high differential head also resulted in severe scour problems in the outflow channel. Such marine accidents also carry a danger of spillage of dangerous materials into the waterways or a fire that could damage the structure.

In 1973, the low sill structure was seriously damaged. The 1973 flood was the first flood to occur on the Mississippi River with the Old River project in operation. As the flood neared its crest, turbulence around the south inflow training wall of the low sill structure formed a large scour hole which progressed to the point that the training wall was completely undermined. Also, portions of the upstream concrete approach apron, the main structure, and the stilling basin were undermined. The scour hole was up to 50 feet deep below the base of the structure. As the gated section of the structure was the only part supported by piles, when the scour hole developed and began undermining the structure, the upstream training wall and the upstream apron both failed. Due to its pile foundations, the main structure did not fail. The stilling basin did not fail because the undermining beneath it was limited to a small area.

As soon as the scour hole was discovered, emergency repair work was begun. About 250,000 tons of riprap were placed to fill the hole in front of the structure and to construct a riprap dike to replace the failed training wall. The void under the structure and stilling basin, which was revealed by drilling through the concrete structure to the foundation below, was filled with a specially designed cement grout.

As the emergency repair work was progressing, the New Orleans District was also engaged in detailed hydraulic, foundation, and structural analyses to determine, as nearly as possible, the safe limits to which the low sill structure could be operated and the long-range impacts of the damages. The studies concluded that, although the structure had been seriously and permanently damaged, its residual capability was substantial and could be improved by various rehabilitation measures. As a result, a program of major

rehabilitation was approved for the low sill and the overbank structures.

The rehabilitation program included modifying the gates of the low sill structure to improve hydraulic flow conditions, providing additional channel scour protection for the inflow and outflow channels, replacement of damaged piezometers under the low sill structure, cleaning of drainage systems under the low sill structure, repair of severely eroded areas in the stilling basin of the low sill structure, and modifications to the tailbay of the overbank structure. Completion of this rehabilitation work is scheduled in 1981.

In addition to those rehabilitation measures, studies were made of the tendency for the Mississippi River to turn into the Old River inflow channel.

Historic surveys show that the Mississippi River has been in the same general alinement in the vicinity of the Old River control structure since 1933, although the thalweg has migrated back and forth within that alinement. The thalweg is the deepest part of the channel.

After the Old River control structure became operational in 1963, the thalweg moved toward the west bank and has become narrower and deeper. It now follows the west bank as it approaches the Old River control structure, moves out to midchannel as it passes the structure, and then moves back to and follows the west bank again downstream from it.

To assure that the alinement of the Mississippi River in the vicinity of Old River remains in its same present course, articulated concrete mattress and stone revetments have been constructed to stabilize and hold in place the streambanks and the entrance to the low sill structure inflow channel.

The west bank of the river is now continuously protected from 4 miles above the structure to 2 miles below it. In addition, both banks and the bottom of the inflow channel of the Old River control structure are stabilized with concrete mattress or stone.

The use of dikes and dredging to realine the thalweg of the Mississippi River near the Old River control structure has been studied. However, from hydraulic tests conducted at the Waterways Experiment Station, it was concluded that the effectiveness of such a plan was questionable. The results of the model tests also showed that a reduction of scour in the inflow channel would result from controlling flow through the Old River control structure with the gate modifications which were part of the rehabilitation plan. Such flow control together with stabilization of the inflow channel and the adjacent banks of the Mississippi River will prevent the thalweg of the Mississippi River from turning into the Old River control structure inflow channel during either low or major flood flows.

To further assure that flow control at Old River is safely maintained, carefully defined operational limits have been adopted on major flood flows. Strict limits were placed on the differential heads at which the low sill structure could be operated, and a surveillance program was established by which the structure's performance is carefully monitored. This program includes monitoring and analyzing inflow and outflow channel cross sections, differen-

tial head, vibration, uplift, alinement, and deflection of the low sill structure. River traffic is also carefully monitored to reduce the chances for errant traffic to be drawn into the structure. A new and more effective picketboat is being constructed, and a radar surveillance system for marine traffic on the Mississippi River is being procured.

The low sill structure stilling basin was inspected by divers September 9–12, 1980. This was the third inspection since the stilling basin was repaired in 1976. The inspection revealed some additional concrete erosion and spalling in the stilling basin. A contract to repair these areas is under way and is expected to be completed this month.

Another contract for the removal of grout in the downstream manholes and in the collector pipes in the stilling basin has just been awarded to permit the installation of the new piezometers in the stilling basin.

The emergency repairs and rehabilitation work accomplished have enabled us to continue to control the distribution of flow and have given us confidence in the ability of the project to meet normal operational requirements. However, we are still faced with the fact that, due to the change in its foundation conditions, the low sill structure has been permanently impaired and now has less structural capacility than it originally had. Specifically, the maximum differential head to which the structure can now be safely subjected is adjudged to be 22 feet, whereas it was originally designed to withstand a differential head of 37 feet. Therefore, we remain concerned about the ability of the low sill structure to deal with emergency situations which could result in differential heads in excess of 22 feet.

While the foundation deficiency cannot be remedied by direct means, it can be dealt with effectively by the construction of an auxiliary structure, the existence of which will allow control of differential heads to within the safe limits.

In October 1977, the New Orleans District submitted a letter report which supported the construction of an auxiliary structure. In August 1979, the district submitted a general design memorandum recommending design and construction of an auxiliary structure. The report was approved by the Office of Chief Engineers in December 1979. The auxiliary structure will have six gated bays with an inflow channel from the Mississippi River and an outflow channel connecting to the existing outflow channel. Realinement of the main line levees and of Louisiana Highway 15 on top of the levees is required. Guide levees are provided parallel to the channels. The auxiliary structure will be operated together with the low sill structure so that the authorized flow distribution will be maintained. In short, the actual distribution of flow between the Mississippi and the Atchafalaya Rivers will remain unchanged from that which existed in 1950. The only change will be that the flow will be diverted through two structures instead of the existing one. This type of operation will act to reduce both hydraulic and structural stress on the low sill structure and improve needed operational flexibility. It will reduce the potential for an emergency condition and will dramatically improve the capability with dealing with

emergencies that do occur and will allow us to more easily make inspections of and the normal repairs to the low sill structure.

Detailed design work on the auxiliary structure began in October 1979. Construction is scheduled to begin in July 1981 with a scheduled completion in November 1985.

The feasibility of constructing hydropower generating facilities at the Old River control project is currently being investigated by the city of Vidalia, which has obtained a preliminary permit for site investigation from the Federal Energy Regulatory Commission. The design of the auxiliary structure is being conducted in a manner which will not unduly constrain the possibilities for development of hydro potentials in the area.

The rehabilitation of the low sill structure has rendered the Old River project fully capable of dealing with the full range of normal conditions, including major floods. It reflected this capability in 1979, despite the fact that some of the rehabilitation measures described previously were incomplete. The 1979 flood produced a peak discharge only 10 percent lower than the flood of 1973, and not only was the 1979 flood accommodated without distress to the low sill structure, but it was distributed between the Mississippi and the Atchafalaya Rivers in full conformity with the authorizing law. Because we were able to exert the required control, the peak flow in the Atchafalaya at Simmesport in 1979 was nearly one-fourth less than it had been in 1973.

However, even with the rehabilitation program completed, the structure still remains subject to potential damage from possible emergency conditions which could severely overstress the structure. This deficiency will be corrected by construction and operation of the auxiliary structure.

In summary, the considerations which led the Congress in 1954 to authorize Old River control are today even more compelling. The project as constructed remains conceptually sound and, though physically impaired to some extent, remains technically sound as well. The rehabilitation measures accomplished since 1973, in combination with the auxiliary structure which is to be started next July, will provide an effective means of insuring, for the foreseeable future, that the lower Mississippi will remain in its current course.

This completes my prepared statement, Mr. Chairman. We will be glad to answer your questions.

FUNDING REQUIREMENT

Senator JOHNSTON. Thank you very much, General Read.

Now, first of all, for General Bratton or General Read, as chairman of the Appropriations Subcommittee which provides the money, do you have sufficient money, do you have sufficient congressional authority, to conduct any and all work which you consider to be appropriate at the Old River structure?

General READ. Yes, sir.

Let me address the authority aspect first.

Under the 1954 Flood Control Act which authorized the Old River control structure, the Chief of Engineers was given discretionary authority to make modifications. Through that and through title 33 United States Code—I believe it is section 5 which

authorizes us to do repairs and reconstruction—the determination was made by the Assistant Secretary of the Army for Civil Works this last fall that we do have the authority to proceed on this.

As concerns the money, we have in the fiscal year 1981 budget $5,100,000, less $500,000 we are taking for slippage and savings, which we believe is fine for us to get on with the work the way we have it planned. This is the best schedule that we can accommodate, and certainly with the priority which my boss has indicated previously, and with your interest and the interest I think there is in this project, we do not envision any problem on the funds.

Senator JOHNSTON. In short, you are able to proceed at the full corps capability at all times. We have given you enough money for that.

General READ. That is correct, sir.

As a matter of fact, I would say that we have, by virtue of our moving out, been able to beat the times I think that were last presented to the committee.

STRUCTURAL INTEGRITY

Senator JOHNSTON. Now, the key question here is, General Read—to boil this whole thing down—is the Old River control structure and the auxiliary structure which will supplement it sufficient in your judgment to guarantee that the Mississippi River will stay in its present course, that the Atchafalaya River will not capture the Mississippi, and that these control structures will not fail?

General READ. Sir, I believe that our judgment is clear on that, that that is in the affirmative. We believe that with the rehabilitation work that has taken place on the low sill structure and the overbank structure and it will be completed by this next summer, and with the introduction of the auxiliary structure which we now see going under contract this summer and being completed in 1985, that that capability exists as far as we can see into the future.

Senator JOHNSTON. And, that means into the next century somewhere?

General READ. I guess that I would answer that most candidly by saying that engineers are certainly not soothsayers or perfect in their prognostication of what is going to happen in the future, but I think that we are capable of dealing with change, and I think that the way that I would respond is that we, as best we can see—with the conditions that exist—that it is just like I indicated. I would not personally rule out that some time in the remainder of this century that we would not come in to the Congress and say we wanted to change something or we wanted to adapt something because of some changing conditions. But, I would put that into the category of normal things that would happen on any project.

PROJECT FLOOD CONDITIONS

Senator JOHNSTON. Now, general, the project flood is 3 million cubic feet per second above the Old River control structure; is that correct?

General READ. At the latitude, yes, sir.

Senator JOHNSTON. All right.

And, the flood of 1973 was how big?

General READ. Let me ask one of our people if he has got a number on that, sir—2 million and roughly 280,000 cubic feet per second.

Senator JOHNSTON. Now, was that split evenly between the Mississippi and the Atchafalaya? What was the flow rate in the Atchafalaya?

General READ. As I recall, the flow rate on that was about in the 800 to 900 range.

This is Mr. Resta, Chief of our Engineering Division.

Mr. RESTA. During the 1973 flood, the flow down the Atchafalaya River at the bottom of the floodway was approximately 1-million ft ^{3}/s.

Senator JOHNSTON. One million cubic feet per second.

Mr. RESTA. Actually, 963,000 ft ^{3}/s.

General READ. That was at the bottom. You see, we talk about the latitude flood which is up at the latitude of Old River Landing.

Senator JOHNSTON. And, coming into the Atchafalaya—immediately below the structure, what was the flow rate, 800,000 to 900,000 cubic feet per second?

Mr. RESTA. In the Mississippi, sir, or the Atchafalaya?

Senator JOHNSTON. I mean the Atchafalaya.

Mr. RESTA. The flow at Simmesport during the 1973 flood peaked at 781,000 ft ^{3}/s.

Senator JOHNSTON. I see.

Now, first of all, general, tell us about the project flood. What is the definition of the project flood? I know that is the flood for which you design, but——

General READ. This is a flood which is determined jointly between the Corps of Engineers and the National Weather Service, and it is the most severe flood on the lower Mississippi River which might be reasonably expected to occur.

Senator JOHNSTON. Now, you have heard Professor Kazman state that the project flood was determined many years ago before the urbanization of much of the valley, that now the runoff is faster and the water is more clarified and more hungry, I think, is the term he used——

General READ. Yes, sir.

Senator JOHNSTON [continuing]. And, therefore, he puts at question the use of 3-million cubic feet per second as a definition of a project flood, that he thinks that it is more likely that the flood will be greater.

What is your response to that?

General READ. Sir, as a result of the 1973 flood, there was a relook taken, and as a consequence of it, we had some adjustments of flow lines and things of that nature in the Mississippi River. At that time, there was a relook made of the project flood and it was decided, because of the relook, that it would remain exactly where it was, and I don't think there was any change to it at all.

Mr. RESTA. That is correct.

Senator JOHNSTON. So, in your judgment, the project flood definition is still adequate?

General READ. It is still, in our judgment, sir, a valid project flood.

Senator JOHNSTON. All right.

Have you placed a percentage chance of the project flood, like we use the hundred-year——

General READ. Yes, sir.

Senator JOHNSTON [continuing]. Flood level, that flood which is expected to occur once every hundred years or 1-percent chance per year for the purpose of flood insurance.

What is the chance of a project flood?

General READ. Estimating the frequency of such a flood which exceeds what has occurred is of doubtful accuracy. Such a prediction uses all of the data that are available, and then extrapolates from there data using several methods of analysis. Each method comes up with a different figure but, to my recollection, the estimated frequency falls in the category between 500 and 800 years. These numbers are not precise and only reflect the general frequency range of such a flood.

Mr. RESTA. Yes, sir; that is correct.

General READ. Every 500 to 800 years.

Senator JOHNSTON. So, we are all right for the next few months, anyway.

General READ. Sir, I would say that I certainly hope it doesn't take place during my watch.

Senator JOHNSTON. All right.

When you say here that "the emergency repairs and rehabilitation work accomplished have enabled us to continue to control the distribution of flow and have given us confidence in the ability of the project to meet normal operational requirements", those normal operational requirements are the project flood which in turn is that which is expected to occur every 500 to 800 years.

General READ. Yes, sir.

Senator JOHNSTON. So, you have confidence of the ability of this structure with its auxiliary structure to be there for, in effect, 500 to 800 years.

General READ. We think that it would accommodate that flood.

Now, sir, I am not one that would tell you today, "I think that same structure will be there 500 to 800 years from now" because——

Senator JOHNSTON. But, I mean——

General READ [continuing]. The structure, the way you phrased it, we think it is capable of taking the project floods—that is correct, sir.

Senator JOHNSTON. OK. And, what is the life of the project in terms of just the engineering integrity of the structure?

Mr. RESTA. The usable life of major structures, such as the low sill structure, the main stem levees that comprise the MR & T project, is generally indefinite if the Federal Government properly maintains them. The project life of the engineered system that we are speaking of is generally indefinite, sir, certainly on the order of 100 years.

General READ. And, sir, if I may, I would like to interject an earlier comment that I made, and that is that we do periodically find—like we identified to you in my statement, that we went—we had divers down in September, again, looking at the conditions on the low sill—and we found that there had been some erosion of

concrete. And, so, that as part of this maintenance of this structure for this kind of life, then we immediately get busy and get a contract and go down and repair that. And, so, that's really what we are looking at, is the continuing maintenance effort on these.

Senator JOHNSTON. Now, General Read, the piles down under the structure extend 90 feet; is that correct?

General READ. Yes, sir.

Senator JOHNSTON. All right. Now, as a layman, I look at your diagrams and I see that you had scour holes 130 feet deep. Now, the scour holes were not that deep in the—right immediately under the structure but in the backbay on the lower side where the water comes down.

General READ. Yes, sir; beyond the tailbay.

Senator JOHNSTON. And, they also had scour holes less deep than that, but I believe also under 90 feet or so in the forebay.

Now, as a layman, would you explain to me why we don't have to worry that holes that deep would come under the structure, undermine the 90 feet of piles and sweep the structure down to Morgan City as the wing wall itself collapsed?

General READ. Sir, I will start on the forebay side. As was indicated in my presentation, you saw that there was, in fact, scouring underneath the forward edge and we lost that training structure. We have gone in with a special grout and put it under the structure itself, and then we have gone in with the riprap and replaced the wing wall.

Now, over the period of time since then, we have what we call armored the forebay area by use of articulated concrete mattress and rock so that we effectively have provided a protective coat, if you will, against the forces of the river.

Now, one of the reasons, too, you would get scour and you would tend to get a greater action is if the river started moving coursewise, and I, in part of my discussion, talked to the efforts that we have taken to maintain the thalweg of the river so that it will continue down the Mississippi.

Now, on the back side, the 130-foot hole, we did not get that kind of depths underneath the structure itself. On the tail bay side—the 130-foot scour hole that was referred to is downstream some 800 feet from the structure—was generated and appears now to have pretty well stabilized at that particular elevation. We have, in fact, there, too, come in and taken remedial action by stabilizing efforts such as rock and articulated mattress so that we feel confident that they will hold. rock and articulated mattress so that we feel confident that they will hold.

Senator JOHNSTON. Well, is there something about the engineering configuration here that would dictate that water action does not dig holes that deep immediately under it, but tends to do so more on the forebay and afterbay? Is that a proper question? Is that clear?

General READ. Well, we tend to construct our features or facilities such that the structure itself is protected from undermining and the water is safely passed through the structure.

Now, what do you think of the description of the professor who stated that essentially what you have here is a big mound of sand with a little coating of concrete, and once you pierce that coating of

concrete, it will—it is likely to melt away—I think he said—"like a hot knife through butter". Is that incorrect?

Professor KAZMAN. No; I didn't talk about the height. If it ever gets through the levee on the downstream side of the structure, it would cut through like a crevasse. Going under the structure is something else again. I don't know what would happen there.

Senator JOHNSTON. Well, let us deal with the question of the levee break. Suppose you had a break in that levee—and, first of all, tell us how likely that is—would it be likely to cut quickly a new channel which, in turn, would be difficult to contain?

General READ. Well, I think that, first of all, this is one of the reasons we have such a continuing dialog with the levee board people to make sure that the levees are properly maintained so that the likelihood of such an eventuality is small to remote. We don't think that there is much likelihood of that because of good maintenance on the levees.

When we do have a problem during a flood fight where you do see the indicated failing of a levee, we, of course, are involved with the people in the area, doing everything we can, first of all, to see that it doesn't happen, and, then, if it does, to be taking all of the steps that we can to minimize the flows that would be passing through there.

Now, in response directly to the indications by Professor Kazman, I think that it is purely hypothetical as to how far it would go, because it would be contingent upon the circumstances at that time as to where you are in the flood, how much actually went through and to what degree it was pierced. We would think that by our remedial actions, we would be doing all that we could to minimize the effect, but it becomes a very broad range depending upon when you set up this hypothetical situation, that the cut would take place.

Senator JOHNSTON. If there was a cut in the levee at that point, after the water went down, let's say, some 80 days, after the flood DeSoto observed, could you then plug that levee break and plug the new channel that was dug?

General READ. Well, this was really the point I was getting at, sir. If we say—if we use the 80 days as you mentioned, a lot would have to do with whether it occurred at the front end of the 80 days or the rear end of the 80 days. And, really, it becomes very speculative as to what degree that this is taking place as to when you come in and assess the damage and what you would have to do then for restoration. It would be hard to give you a definitive answer, sir. You would have to see the circumstances that existed there.

LOSS OF OLD RIVER CONTROL STRUCTURE

Senator JOHNSTON. All right.

Let me ask you this, General Read:

If the worst happened and we had different scenarios of breaks—you lost the Old River structure or you had a break in the new levee—any of those scenarios—in the worst scenario, would it still be possible with the expenditure of sufficent money and time and effort to keep the channel of the Mississippi—to keep 70 percent of the flow in the Mississippi?

In other words, could we reclaim a break once it happened?

General READ. I would ask Mr. Resta to address that.

Mr. RESTA. I think almost anything is possible, given enough money and time and so forth, sir.

Senator JOHNSTON. I mean within practical limits.

Mr. RESTA. The worst scenario for losing control in the vicinity of Old River would be for that to occur during the early part of a very large flood. Capture of the Atchafalaya by the Mississippi would be initiated during such a flood if control could not be regained during that flood. The degree to which that process would develop before the end of the hydrograph, as General Read has pointed out, is very difficult to estimate. But, once the water did recede, then, it might be possible with an expenditure of a large amount of money to regain the distribution flow that is presently authorized. We cannot be positive that the expenditure of a reasonable amount of money would restore the authorized distribution, assuming the worst of all possible hydrograph scenarios.

I think it is important to remember, though, that as late as 1950 a flood about equal in magnitude to the 1973 flood was passed down the Mississippi River and that Old River was an uncontrolled, natural opening. The increase in flow going down the Atchafalaya during the pre-1950, 1950, and post-1950 period generally occurred at the same rate. There was no dramatic instantaneous irreversible occurrence during the 1950 flood. Even though the upper Atchafalaya has increased in size since then, I don't think we can say with confidence that if a flood for which the project has been designed occurred in the near future, and we lost control at Old River, that it would cause an instantaneous irreversible capture of the Mississippi by the Atchafalaya.

Senator JOHNSTON. Let me ask this question to all of you. If you were contemplating the investment of your family fortune in Morgan City, La., and your adviser said that it is a good investment, but we will lose everything if the Mississippi River changes it course, and we want to be certain sure, would you invest your money?

General Read?

General READ. If all of the efforts that we have ongoing in this—and we overlap, sir, as I think you are probably aware, in different projects that are addressed here—but I think that if all of these projects do come to fruition, that I would be willing to make an investment down there. I certainly, today, would make the observation that, based purely upon the Old River that we are talking about—the Old River control structure—that I would not have a reservation in terms of its aspect of the problem. But, the problem at Morgan City as you are well aware, is not just the Old River project that we are talking about.

Senator JOHNSTON. Mainly, the ring levee and the mud boxes.

General READ. There are other aspects to it, so if you limit it strictly to the Old River aspect, then, I very candidly would not have reservations in investing——

Senator JOHNSTON. You would have no reservations at all?

General READ. I personally would not. I would let Colonel Sands, the district engineer, answer.

DESIGN PERFORMANCE OF OLD RIVER CONTROL STRUCTURE

Colonel SANDS. Senator, the way you phrased your question, you said that if the only risk involved was a capture of the Mississippi by the Atchafalaya, I wouldn't hestitate one instant to invest my family fortune—which is probably less than $1,000 at the moment. [Laughter.]

Senator JOHNSTON. We are working on a pay raise for you.

Colonel SANDS [continuing]. In that particular area.

I do have every confidence, and I would like to emphasize two things here; No. 1 is, the Atchafalaya Basin carries one-half of the project flood. The Old River control structure system itself only contributes one-fifth of that project flood to the Atchafalaya Basin. And, second, we are confident that, as it exists today, the Old River control struture is fully capable of performing the mission for which it was designed for. The only risk that is involved—and while we agree with the comments Professor Johnson made that we agree that there is a risk—I guess the perspective of those risks are different—we view the problem only when there is a marine incident or some other incident that occurs that requires us to close the gates of the structure. Its ability to pass the floodflows in the quantity of water that is necessary, we have every confidence in. So, we obviously are going to do everything that we can between now and the time the auxiliary structure does come into operation to make sure that we don't do anything that would cause his differentials at that structure outside of the safe limits that we feel that it can operate.

INTERSTATE 10 AND U.S. 190 BRIDGES

Senator JOHNSTON. Do you have any opinion on the ability of the bridges on I–10 at Whiskey Bay or on U.S. 190 to withstand the full project flood of 1½ million cubic feet per second?

Colonel SANDS. No, sir; I quite honestly don't. The channel sizes, as you are well aware—the Atchafalaya Basin channel is enlarging, so we would expect that the main channel would still continue to carry a portion, but during a project flood, the entire Atchafalaya Basin floodway from guide levee to guide levee is going to be in the flow regime, but I personally am not aware nor, I don't think, have we investigated within the corps the stability of those particular structures. They obviously did hold up very well when you did have the quantity of flows within the system in 1973.

Senator JOHNSTON. But that was only about half of a project flood; is that correct?

Colonel SANDS. Well, that was about two-thirds of the Atchafalaya basin portion of the project flood.

Senator JOHNSTON. Well, should we do anything at the Congressional level to look into the integrity of the I–10 and U.S. 190 bridges?

Colonel SANDS. I am not sure that we are at the position where we can give you satisfactory advice on that unless some other folks know something more than I do.

General READ. Well, I would say that we should defer to the State taking a look at that first—that would be my judgment.

Senator JOHNSTON. Would you recommend that we recommend to the State that they take a look at it?

General READ. I think that probably, as a result of the discussions here today at your hearing, sir, that it is quite likely they will do that on their own.

Senator JOHNSTON. You respect the comity of your jurisdiction and theirs very much, I understand, but as I read you, you think that probably it might be a good idea, in the spirit of absolute safety, for them to do so; is that correct?

General READ. Yes, sir; I think it is never imprudent to look at something like that.

Senator JOHNSTON. All right.

Now, General, would you tell me what the danger is from a barge? I know you had eight barges in 1963 and four barges in 1965—now, first of all, the barge is not likely to come and knock the structure down, in effect.

General READ. Sir, the basic problem is that when we have the barge hit the structure, as you correctly indicated, probably it is not going to do that much structural damage, but the difficulty is that with the water flowing through, it is extremely difficult to impossible to pull it out or withdraw it until you close some or all of the gates in the structure so that you can get what you might call a "still water" condition. Then you can actually manage pulling the barge out.

Senator JOHNSTON. Well, I understand that, but while the barge is in there, does it do any damage, does it do any harm, and does it hurt the flow regime designed to control the flood?

General READ. It is usually disruptive and creates some turbulence in the gate bay in which it is involved, yes, sir. But, that is really sort of a minor aspect of it. The real concern we have is getting it withdrawn from the structure so that we can then get the structure operating the way it was designed.

Senator JOHNSTON. But you could wait until after the flood to do that.

General READ. The problem that we are talking about with the barge could happen in something that could be termed only relatively moderate flows, not a project flood, because, you see, we would need to get it out so that we would be able to operate the project correctly. To do that, we would need to close the gates, and when we the gates, the water builds up on the inflow side. On the outflow side the water level goes down—and here's where we run into that problem that we identified of the differential head—and we very quickly could exceed the 22-foot head which we think is about the "max" we should go for stability.

Senator JOHNSTON. But, what I am getting at is the problem of the errant barge——

General READ. Yes, sir.

Senator JOHNSTON [continuing]. Is not connected to a flood?

General READ. No, sir.

Senator JOHNSTON. If you caught the barge in at the time of a flood, you could wait for the water to go down before you closed the gates in order to withdraw the barge.

General READ. Sir, I think if the thing occurred at a flood, that would be one of our least problems—if we had an errant barge during a major flood.

Senator JOHNSTON. And, you could wait until after the flood—80 days, if necessary—in order to withdraw the barge.

General READ. Well, it is hard to speculate on the circumstance that it might be creating. We might—we might for some reason want to get it out of there, and I would certainly, as a responsible person for that, would like to have the flexibility of being able to get it out of there so I could make that thing work the way it was designed.

Senator JOHNSTON. All right.

Now, let us say that you catch a barge now and you have to—you could not leave the barge in there, obviously, for years; is that correct?

General READ. Yes, sir.

Senator JOHNSTON. So, you would have to withdraw it and you would not have to—would you have to run, therefore, the risk of the 37 feet of head?

General READ. Sir, I guess the scenarios you are building is if one runs in there tomorrow, what do we do?

Senator JOHNSTON. Right.

General READ. And, I would rather wait until tomorrow and decide that, sir.

Senator JOHNSTON. Will you call Professor Kazman? [Laughter.]

General READ. No, sir; I don't think that would be necessary.

I think that, really, what would be required is to look at its configuration and see if we could get it out without total closure because, see, when the barge goes in there, it's—if you have ever seen barges go into these structures, they go in in different ways and they can get in there such that they are stuck or they can get pushed across the side so that it is possible, maybe, to do some winching to them. It might be possible just to restrict certain gates because, if you will recall in my testimony, I indicated that in some cases, we were able to get them out by just closing certain of the gates and not all of them. In a couple of instances, because of the configurations, I would imagine, at the time, they had to close all the gates. So, you would have to build the total scenario as to exactly how it was configured as to what method we would go about to get it out.

Senator JOHNSTON. But, you are confident that could do it under some circumstances; in other words, that we are not going to lose the structure between now and 1985 when the auxiliary structure is completed?

General READ. Well, the way I would prefer to answer that, sir, is, yes, we are confident of that because we feel that we have taken the actions necessary to try to see that that barge doesn't get in there, sir. We have introduced a number of measures that would preclude that errant barge from getting in so we think this is a case of preventive medicine is better than actually the cure—having to go through a cure.

ALTERNATIVES TO EXISTING LOW SILL STRUCTURE

Senator JOHNSTON. All right.

In view of the damages which have occurred to the existing low sill structure and the fact that it cannot be operated as originally designed, why is a replacement structure not considered more appropriate than an auxiliary structure, or along with an auxiliary structure?

General READ. Sir, When the New Orleans District did its studies on this, one of the alternatives considered was a new structure. When it was considered in light of cost and adequacy, where adequacy would include reliability and safety and effectiveness, the best solution came out to be to put in the auxiliary structure. But, it was an alternative that was considered.

Senator JOHNSTON. All right.

General, now you also have—the Corps of Engineers has in its Vicksburg office—a big scale model of the Mississippi River—the lower Mississippi—how long is that model—several hundred yards, is it not?

General READ. Sir, I will have to ask somebody on that.

Mr. RESTA. Are you speaking of the hydraulic model of the Mississippi Basin?

Senator JOHNSTON. Yes.

Mr. RESTA. I don't recall the exact length; we can certainly furnish it for the record.

Senator JOHNSTON. Let us say that it is a very big model and it is designed to test the action of the water—the hydrology under different flood conditions—and that model has been useful, has it not, in the design and the prediction as to what the Old River structure is going to do. Am I correct in that?

General READ. Yes, sir.

Senator JOHNSTON. OK.

General READ. I would ask one of the others that have worked throughout the design phase on that to maybe address it, sir.

Mr. RESTA. Yes, sir, we used that model as well as a number of models of various types and various scales at the waterways experiment station in Vicksburg to analyze all aspects of the Old River control problem, and we are using those models right today to help us design the details of the auxiliary structure.

SUMMATION OF TESTIMONY

Senator JOHNSTON. In summing up, may I ask if this is a correct summation of your testimony—the collective testimony of the Chief, General Read, and Colonel Sands—that the Old River structure, as strengthened since the 1973 flood and particularly as to be augmented by the auxiliary control structure, is sufficient to give confidence—total confidence—that the system will operate under normal conditions, those normal conditions including the project flood, and the project flood being that which will occur every 500 to 800 years, and that this gives you confidence that the system will not fail; is that correct?

General READ. That would be my position, sir.

Senator JOHNSTON. Is that your position, Chief?

General BRATTON. That is my position also, sir.

Senator JOHNSTON. Colonel Sands?

Colonel SANDS. Yes, sir, with the proviso as you stated, with the auxiliary structure in place, we also feel that we are capable of

handling those emergency situations that would be put within the safe limits of the structure itself.

Senator JOHNSTON. All right.

So, we can have confidence that the Old River structure will not fail under those conditions.

Colonel SANDS. That is correct.

Senator JOHNSTON. All right.

Secondly, that you have all that you need from the Congress in terms of authorization and in terms of money to bring that Old River structure—that auxiliary structure—to completion at the earliest possible feasible date.

General READ. That is correct, sir.

Senator JOHNSTON. Is there anything else that we should be doing in the Congress to insure the safety of people in the lower Mississippi River valley—safety of persons or property?

General READ. Well, this last one, sir, is an area that includes an awful lot of projects that are involved, and I think that you would have to go through each one of those and discuss it on its own merit.

Senator JOHNSTON. Well, the answer would be—with respect to the Old River structure and auxiliaries and anything else that connects with that problem of the capture of the Mississippi River by the Atchafalaya—the answer would be "no" to that?

General READ. That would be correct, sir.

Senator JOHNSTON. But, the answer would be decidedly "yes" with respect to these multitudinous other projects?

General READ. That is correct, also, sir.

Senator JOHNSTON. And, as we balance the budget next year—and I hope to help President Reagan do that—we should not sacrifice these projects on the lower Mississippi Valley which do insure the safety of lives and property; is that correct?

General READ. Well, I think that is the decision you all will have to make, sir.

Senator JOHNSTON. Well, to put it another way, unless we are willing to sacrifice the lives and property to the hazards of flood, we had better continue those projects and, in some instances, accelerate them; is that correct?

General READ. Again, I think you will have to make that decision, sir. You have your role, sir, and I have mine.

Senator JOHNSTON. And, your role is under the orders of the President of the United States.

Well, General Bratton, General Read, and Colonel Sands, I want to thank you very much for being here.

I think you have reassured us all and given excellent testimony.

To those of you who may not know, the Corps of Engineers is recognized worldwide as the preeminent engineering organization in the world. Their record with respect to flood control has been without peer anywhere in the world. While they have gotten occasional criticism for carrying out the orders of Congress—and it should have been the Congress who should have gotten that criticism—in my judgment, they are the best Federal agency of any kind and sort because I think that they do the best work, they maintain the highest standards, they have the greatest expertise in

what they do. They are not Federal bureaucrats, at least as far as I am concerned, but the highest kind of public servant.

Thank you very much, gentlemen.

INTRODUCTION OF WITNESSES

Next, we want to call our three good friends and three distinguished experts, whom we would like to call as a panel—Arthur Thies, chief engineer for the Louisiana Office of Public Works; Herb Haar, who is associate director of the New Orleans Port Commission; and Jerry Dyson, who is executive director of the Louisiana Association of Levee Boards. All three of these gentlemen contribute tremendously to our work in the Congress, all three have testified before my subcommittee many times, and are also recognized for their expertise.

Gentlemen, we are under, as you know, time constraints. General Bratton must be back in Washington for an appointment tonight, so if we may restrict each of you to a summary of about 5 minutes, I would appreciate that. We will include your prepared statements in full in the record following your oral remarks.

Mr. Thies, would you begin, please?

STATEMENT OF ARTHUR THIES, CHIEF ENGINEER, LOUISIANA OFFICE OF PUBLIC WORKS

Mr. THIES. Thank you, Senator Johnston.

I am Art Thies, the chief engineer for the State of Louisiana, office of public works, and I will make my comments brief, because I believe that General Read has adequately stated the engineering concepts of the M. R. & T. program and the engineering concepts of the Old River control structure.

The department of transportation and development, office of public works, is the agency of the State of Louisiana responsible for comprehensive plan and orderly development of water resources in the State, including flood control, hurricane protection, drainage, water conservation, irrigation, and navigation projects.

In addition, we also serve as the engineering staff and advisers for the some 23 levee districts throughout the State of Louisiana.

The office of public works has prepared, then, a brief statement to your subcommittee on the energy and water development to express our suport for the need, the necessity to maintain the integrity of the Old River control structure.

General Read has already, as I indicated, made an adequate presentation and a most complete presentation of the engineering aspects of the M. R. & T. program and——

Senator JOHNSTON. Do you concur with the Corps of Engineers in that we can have full confidence in the Old River structure as augmented by the auxiliary structure to contain the project flood?

Mr. THIES. Yes, sir; and my comments will be directed toward that end.

The office of public works has previously made a similar statement to the Mississippi River Commission at the occasion of their low-water inspection on October 24, 1980, at Morgan City, La., and the comments we have today are very similar to those we made to the Mississippi River Commission and in the context that you stated.

The Old River control structure complex is a feature, of course, of the M. R. & T. project in Louisiana. The M. R. & T. is, of course, the result of Federal legislation in 1928 directed toward accomplishing an overall flood control program for the Mississippi Valley to protect the several States from such disastrous floods as occurred in 1927. The U.S. Congress, through the U.S. Army Corps of Engineers, has developed a program that is being accomplished as funding permits——

Senator JOHNSTON. Let me interrupt you at that point because I want to get to the essential point here, Mr. Thies.

BRIDGE AND PIPELINE CROSSINGS

First of all, based on the testimony you have heard today, do you think that it is appropriate that the State of Louisiana take a look at these highway bridges at U.S. 190 or I–10 or pipeline crossings, or have you done that and are satisfied that that does not—further work does not need to be done on it?

Mr. THIES. The office of highways is, of course, an agency in the department of transportation and development. They developed a plan, subject to the approval of the Federal Highway Administration, for those highways crossing the basin. In that planning process, they, of course, worked directly with us and also very directly with the U.S. Army Corps of Engineers, developing that plan. They are continuing to maintain surveillance of that system as well as maintaining contact with the Corps of Engineers and us as related to the hydrographic studies on the river to determine what changes are taking place and whether or not their protection devices or the various piers on the bridge are adequate, so I would say "Yes, Senator, that is a continuing process of the State of Louisiana in evaluating the condition and the integrity of that road and bridge system."

Now, in regard to the pipelines, we are constantly in contact, as well as the Corps of Engineers, with the various pipeline companies to study these hydrographs and to make determinations as to what scouring is occurring and to what extent the pipelines are being endangered. This is, of course, of vital concern to us, because the loss of any one of those pipelines would affect the energy in Louisiana and also could affect vitally the flood control facilities. A loss of one of those pipelines by explosion or other type could very detrimentally affect the flood control system, particularly if it were in the vicinity of a levee and if there was a high-water condition. So, I would say, "Yes, we are monitoring those conditions; we are in contact with the various pipeline companies; and that this is also a continuing process by which we stay in contact with changing conditions."

Senator JOHNSTON. Well, would you share the opinion of Professor Kazman that really downstream from the Old River control structure is the greatest hazard, that there is a real hazard with highways and pipeline crossings in the event of a project flood?

Mr. THIES. Well, in the event of a project flood, you always have changing conditions as a result of scour and results of events that occur during that time. I would say that the—whether it is hazardous or not to those facilities would depend on the conditions at the time.

These structures are built, of course, to withstand those design floods and, as in any flood, when you have stages that are above natural ground conditions, you naturally are prone to have more danger at that time than they do at low water periods. So, I would say the dangers at those times are much greater than they would be at other times.

Senator JOHNSTON. Well, is this primarily the responsibility of the Department of Highways to determine the integrity and the safety of those highway bridges and other facilities?

Mr. THIES. Yes, sir.

Senator JOHNSTON. Did you have anything else to add?

Mr. THIES. Yes; I wanted to make a couple of comments, then, that the Office of Public Works has worked directly with the Corps of Engineers through all these many years, and since the initial legislation was devised in the early 1950's, we have always supported their program and we will continue to support their program. We believe that the structural analysis being done, the experiments that are being made in the Waterways Experiment Station have been conducted under the best engineering advice and information available to engineers today, and that they are making every effort to be sure that those control structures serve the intended purpose and that they are able to meet their responsibilities.

In that light, the State of Louisiana fully supports the program as it currently is developed and would, of course, solicit your support and the expeditious funding by Congress to be sure that the full capabilities of the Corps are utilized in constructing these facilities at the earliest possible date.

Senator JOHNSTON. Thank you, Mr. Thies. Your full statement will be made part of the record.

[The statement follows:]

STATEMENT OF ARTHUR R. THEIS, CHIEF ENGINEER, LOUISIANA STATE DEPARTMENT OF TRANSPORTATION AND DEVELOPMENT, OFFICE OF PUBLIC WORKS

The Department of Transportation and Development, Office of Public Works, is the agency of the State of Louisiana responsible for comprehensive plan and orderly development of water resources in the State including flood control, hurricane protection, drainage, water conservation, irrigation and navigation projects. The Office of Public Works has prepared a statement for presentation to the U. S. Senate Subcommittee on Energy and Water Development to express our support for maintaining the integrity of the Old River Control Complex.

The Office of Public Works has previously presented a statement to the Mississippi River Commission at the occasion of its Low Water Inspection on October 24, 1980, at the Morgan City, Louisiana hearing. The statement covered the same scope of events and project integrity as is being discussed here today. Our comments are therefore in general the same as previously indicated to that organization.

The Old River Control Structure Complex is a feature of the Mississippi River & Tributaries Project in Louisiana. The MR&T Project is of course the result of Federal Legislation in 1928 directed toward accomplishing an overall flood control program for the Mississippi River Valley to protect the several states from such disasterous floods as occurred in 1927. The United States Congress, through the U.S. Army Corps of Engineers, has developed a program that is being accomplished, as funding permits, to provide the flood control project required to protect the alluvial lands of these several states. A major feature of this project is the Old River Control Complex necessitated by and as a result of the Atchafalaya River's increased capability for assuming the Mississippi River flows. The Congress, acting on the recommendations of the Corps of Engineers and the State of Louisiana, recognized the fact that the Atchafalaya River could, if not controlled, capture the Mississippi River and, therefore, required

a control structure for the regulation of flows at this latitude. The State of Louisiana actively participated in the planning process with the U.S. Army Corps of Engineers to develop the Old River Control Structure. There were, during this planning period, numerous consultants utilized in developing one of the Nation's major projects in controlling a river of this magnitude. The best engineering data and the advice available at that time was utilized in the accomplishment of the structural plans. Through expeditious action by the United States Congress funds were made available to construct the facility which was completed in the early 1960's.

The Old River Structure was not fully tested against flood flows until the occurence of the 1973 flood. The Corps of Engineers, the State of Louisiana and the public in general has been made fully aware of the conditions that occurred at that structure as a result of that flood. The repairs and alterations made to that facility subsequent to that flood have, in our estimation, provided for the reinstatement of the structural integrity that existed prior to the flood. The structure's capabilities have been exhibited as a result of additional floods occurring in 1975 and 1979. It is apparent that this structure is capable of meeting its project requirements.

The State of Louisiana has actively sought, together with the Corps of Engineers, the construction of an auxiliary structure at this site in order to make this facility flexible. Changing conditions as a result of increasing heads across this facility make it necessary to have this additional facility. It is well known that conditions are changing as a result of the Atchafalaya River development. The Atchafalaya River is continuing to increase its capacity and larger flows are being carried at lower stages thereby increasing the heads across the Old River Structure.

We are confident that the plans being developed by the U.S. Army Corps of Engineers, as well as the repair work accomplished

on the existing structure, will be adequate to provide the full control and flexibility required on this dynamic river system. We have continually urged the acceleration of the planning of this facility.

We are aware of the study recently completed by educators at the Louisiana State University. The Office of Public Works cannot accept the conclusion of this report that loss of this facility is inevitable and that regardless of actions or projects accomplished, that the Atchafalaya River eventually will capture the Mississippi. We view with alarm such statements that could unduely excite the general public who is not knowledgeable in the complex flood control programs. We therefore wish the record to reflect that the State of Louisiana supports the U.S. Army Corps of Engineers' plan for the Old River Complex and agree that there is no significant danger to the public that such facility cannot provide for adequate flood control.

I appreciate the opportunity to present these views relative to that facility and will be glad to answer any questions you may have relative to our support of this program.

STATEMENT OF GERALD R. DYSON, EXECUTIVE DIRECTOR, LOUISIANA ASSOCIATION OF LEVEE BOARDS

Senator JOHNSTON. Our next witness is Jerry Dyson, executive director, Louisiana Association of Levee Boards.

Jerry, you may proceed.

Mr. DYSON. Thank you, Senator.

I want to apologize for the president of this Association of Levee Boards of Louisiana not being here this morning. Mr. James T. Marionneaux does send his apologies and regrets, and I will try to substitute for him. He had planned to present a statement and answer your questions.

I will be very brief in the interest of time. I have submitted a statement for the record and I want to point to the report which is the point of discussion here, and recognize the useful quality of that report. In the levee board's judgment, this is really great to have such an important structure—such an important element—displayed before the public, and through this process, we have achieved, I think, a better understanding and education as to what it is for, what we need to do, and what it is doing for us. And, that report, Senator, in a very negative way, in itemizing the worth, the damages, and things that can happen in converting that to dollars—that tells us the benefits that we are enjoying today. That's a negative way of telling us what the benefits are.

And, relative to that, we also feel and strongly think that these benefits, or these damages, whichever you respect, are only about half as what they should be or more. They should be doubled. I think this—Dr. Johnson alluded to this.

Senator JOHNSTON. All right.

Mr. Dyson, the corps pointed out that they worked very closely with you on insuring the integrity of the levees. Are you able to say that that levee monitoring of the condition of the levees around the Old River control structure is optimum and safe?

Mr. DYSON. Definitely and yes. It is a continuing concern and practice of working with and through the Office of Public Works, with the levee boards, with the Corps of Engineers, and the levees have been proven, Senator. The floods that have come down the Mississippi River in years as has been cited in just awhile ago discussions—this proves the levee systems. And, in the judgment of levee boards with the continued maintenance, with the continued protection, even improvements through berms, through drainage of barrow pits, through tree screens, through common practices being carried out every day, we think the system is even improving; and, because of the tests that they have gone through, that they are considerably safe. And, I might say, Senator, that the hypothesis that Professor Kazman brought forward regarding a possible levee failure near the structure and the possibility of developing a sudden blue hole—the forces of nature would be divided because water would continue through the structure, water would be going through the levee less the force as he compared it to in the days of historical occurrence. That was a single opening with much pressure behind it. And the flow could even be further diminished by use of the Morganza Floodway. So, there are opportunities and flexibilities in that system.

Senator JOHNSTON. All right.

Do you share the confidence that the Corps of Engineers has expressed here today that the Old River structure as augmented by the auxiliary structure will be sufficient to control that river in the present channel of the river during the project flood?

Mr. DYSON. Yes, sir; very definitely. And, I might add that we also agree—the levee boards agree—that if something unforseen happened just—I can't imagine the circumstances that would prevail if it did—but even if the structure were suddenly lost, a temporary control of some sort could be placed. And, while that temporary sturucture was there—riprap or whatever—another structure could be built. The auxiliary structure is certainly the thing that is needed for the present time. We are not in immediate danger of losing that control. There would be time to react. We feel confident that the program is in good hands and in good shape, and in working through the Office of Public Works, through the governor, through the industry, the citizens, we think we can get the job done.

Senator JOHNSTON. All right.

Do you share my confidence in the Corps of Engineers?

Mr. DYSON. Absolutely.

Senator JOHNSTON. Thank you very much, Jerry Dyson.

[The statement follows:]

STATEMENT OF GERALD R. DYSON, EXECUTIVE DIRECTOR, ASSOCIATION OF LEVEE BOARDS OF LOUISIANA

SUBJECT: OLD RIVER CONTROL STRUCTURE

My name is Gerald R. Dyson, Executive Director, Association of Levee Boards of Louisiana. The President, James T. Marionneaux, Maringouin, Louisiana, had previously planned to deliver this statement, but due to the rush of business and the Christmas season, he is unable to be here. He sends his apologies. I will do my best to substitute for him.

Members of the Association include all twenty-three levee districts in Louisiana, one in southeast Arkansas, the Louisiana Office of Public Works and St. Mary Parish Police Jury. The various areas of jurisdiction of our member boards include that geographical sector of Louisiana and southeast Arkansas which is vulnerable to flooding without our comprehensive flood control system. Membership composition makes the Association unique and unusual, in that all members have flood control as exclusive or major functions, and they are governmental agencies.

The ALBL was organized on February 25, 1942, and has been consistently active since. Its objectives were then as they are now: to promote and protect the interest and welfare of Louisiana Levee Boards and taxpayers; to promote continuing improvements for the best possible flood control system by assisting the Governor of Louisiana, the Office of Public Works, and other state units in obtaining aid from Congress and Federal agencies; and further generally do all things incident to these purposes.

We recognize the purpose and function of the Old River Control system as the most important, single flood control item in this Nation. Its success or failure has immediate impacts on more individuals jobs, private improvements, public improvements, natural resources, and the like, than any other single facility. The national energy crisis would be doomed to energy disaster without a successful control structure

complex. Prevention of the Mississippi River from changing its course to that of the Atchafalaya must continue to be a success story. Not only do benefits or potential damages apply to the immediate adjacent areas of the Floodway, or statewide - - - they are without question shared nationally.

The September, 1980 Report by LSU's Water Resources Research Institute serves the desirable purpose of prominently displaying before the public a continuing problem and achieving a level of information and understanding. However, we must all be aware that the potential damages accounted for in the Report is a negative sort of way to point out, identify the real benefits, - in terms of 1976 and 1977 dollars - which we enjoy today. We who represent Levee Districts are of the opinion that damages as estimated by LSU are considerably conservative, and need to be doubled, or more.

The Report features recognition of the fact that even without failure of the Old River Control Structure, any major flood could result in losses exceeding four billion dollars. We hasten to agree with this finding, and also recognize that this is not new. We who work to advance construction of the Floodway and Structures, and those who live in threatened areas, have been and remain acutely conscious of those destructive threats which come with each flood. A major flood fight to contain flood waters is certainly no stranger to the Levee Boards of Louisiana. Not a single Levee District of this State can escape the effects of the control structure system.

We in the business of daily flood control are pleased to find the Report by LSU at least recognizes "that on a short term basis some expenditures may be economically justified," with obvious reference to large amounts of monies which have already been expended and for the future. The ALBL prefers to clearly recognize that future expenditures are required, they are unquestionably justified, Congress has an obligation to provide funding on a timely basis, and there is a clear recognition in Congress of this without deep seated

opposition. In fact, the structure complex is mandatory if we are among other things, to maintain and continue environmental qualities of Louisiana and neighboring states, thereby demonstrating the logic which has generated support from the environmental community for the control structures.

The Old River Control Structure Complex is the key to a successful Mississippi River and Tributaries Flood Control Project, and without it is a disaster. Other major activities and elements are unseparable from the Structure; some are:

* Energy Impact, oil and gas production and shipping, both inland and offshore
* Navigation, for transportation goods of the Nation for import, export and internal movements.
* Distribution of flows
* Support for fish and wildlife
* Control of bank caving, channel erosion, meandering of streams
* Water supplies for domestic, industrial, agricultural and in stream uses
* Hydro-Power Production to help resolve national energy crisis.
* National economic stability
* And there are others

With so many things being placed on the line at the same time, including the risk of human lives, there is no logical alternative to a successful control structure complex. This Association firmly believes that the structures will not in the predictable future be allowed to fail, or become uncontrolable. We are confident that Congress will continue its support, the Corps of Engineers will continue its efficient programs, the Louisiana Office of Public Works will accomplish its coordination successfully as in the past, the Governor of Louisiana will not permit the overall program to lag, that industry will support and help, that Levee Boards will continue maintenance and cooperative programs, and

finally that this Association will strive to achieve meaningful accomplishments in working with others.

Therefore, the Association of Levee Boards of Louisiana must disagree with the main thrust of the Report by LSU's Water Resources Research Institute, that failure of the Old River Control Structure and permanent loss of the ability to manage flow distribution is emanent and permanent. We believe that as wear and erosion takes place that the structures will be maintained and/or repaired; if damages occur to extent of non-repairable, then replacement structures will be provided while temporary controls are in place; further continued improvements and advancements will be made for greater safety and more efficient operation. This is the predictable future for the Old River Control Structure - one of safety, security, and successful operation.

This Association wishes to go on record in support of the statement presented by the Louisiana Office of Public Works, and we look forward to working with them to achieve future improvements.

In closing, for the President of the Association of Levee Boards of Louisiana, on behalf of our member boards, I wish to compliment you, Senator Johnston, and your Committee Members, and the Committee Staff, for the alertness - insight - understanding and actions taken in support of a safe and successful Old River Control Structure Complex. Accomplishments have been particularly meaningful and outstanding under your tenure, Senator Johnston, as Chairman of the Sub-Committee. We pledge our efforts to work with the Committee in the future.

Thank you for the privilege to present this statement.

STATEMENT OF HERBERT R. HAAR, JR., ASSOCIATE PORT DIRECTOR, PORT OF NEW ORLEANS

Senator JOHNSTON. Finally, we have our good friend, Herb Haar, associate director of the Port of New Orleans. Port Commission, should I say.

Mr. HAAR. Senator, as a tail-end of this series of presentations, in the interest of time, I will not go through my statement, but I will submit it for the record, if I may.

Senator JOHNSTON. Yes.

Mr. HAAR. Just briefly summarizing, the Old River control structure is located at approximately mile three hundred and twenty on the Mississippi River. The part of the river that the deep water ports in Louisiana—Port of New Orleans and Baton Rouge, south Louisiana ports, Plaquemine Parish port commissions are concerned with are the lower 234 miles—the deep water portion. There are some 540 million tons of waterborne commerce that moves through this segment of the river every year, and that is over 25 percent of the Nation's total waterborne commerce, with a value of $30 billion.

So, we feel that there is a tremendous amount at stake on maintaining the integrity of the Old River control structure. We have confidence in what the corps has done in repairing that structure. We have confidence in the auxiliary structure that is planned to maintain the integrity of that system as it was designed, and we feel that there is so much at stake and that it is so important to Louisiana's industrial facilities along this lower deep portion of the river that the corps has come up with a plan and a program that will maintain the integrity of this system. We have full confidence in it.

Senator JOHNSTON. Thank you very much, Colonel Haar. We will include your statement in the record.

[The statement follows:]

STATEMENT OF HERBERT R. HAAR, JR., ASSOCIATE PORT DIRECTOR, PORT OF NEW ORLEANS

SENATOR JOHNSTON, I AM HERBERT HAAR, ASSOCIATE PORT DIRECTOR, PORT OF NEW ORLEANS, AND I AM HERE TODAY TO MAKE A BRIEF STATEMENT IN REGARD TO THE OLD RIVER CONTROL STRUCTURE.

THE PORT OF NEW ORLEANS, SECOND LARGEST PORT IN THE NATION, HAS AN INTEREST IN THIS STRUCTURE BECAUSE ITS CONTINUED OPERATION ASSURES AND PROMOTES THE CONTINUED VIABILITY OF THE LOWER MISSISSIPPI RIVER NOT ONLY FOR INDUSTRIES THAT GENERATE WATERBORNE COMMERCE FOR THE PORT OF NEW ORLEANS BUT ALSO FOR OTHER PUBLIC PORTS AND PRIVATE TERMINALS ON THIS 234 MILE STRETCH OF RIVER. MANY OF THESE INDUSTRIES DEPEND ON WATER FROM THE MISSISSIPPI RIVER FOR THEIR OPERATION, JUST AS THE RESIDENTS ON THIS STRETCH OF THE RIVER DEPEND UPON A FRESH DRINKING WATER SOURCE. IF THE FAILURE OF THE OLD RIVER CONTROL STRUCTURE, WHICH I DO NOT CONSIDER TO BE A PROBABILITY OR A POTENTIAL THREAT AT THIS TIME, SHOULD OCCUR AT SOME FUTURE DATE IT WOULD NOT AFFECT SIGNIFICANTLY INITIALLY THE ABILITY OF DEEPER DRAFT SHIPS TO NAVIGATE IN THE LOWER MISSISSIPPI RIVER. HOWEVER, THERE WOULD BE SUBSTANTIAL DIFFICULTY IN MAINTAINING A DEPENDABLE CHANNEL FOR BARGE TRAFFIC MOVING ON THE MISSISSIPPI RIVER FROM AMERICA'S HEARTLAND TO THE PORT OF NEW ORLEANS AND ON DEEP DRAFT FOR THE LONG TERM THERE WOULD BE A PROGRESSIVE INCREASE IN PROBLEMS ASSOCIATED WITH MAINTAINING A CHANNEL IN AN OPEN ESTUARY. HOWEVER, THE EFFECTS ON LOUISIANA AND ITS INDUSTRIES BOTH EXISTING AND POTENTIAL NEW ONES OF THE FUTURE THAT WOULD DEPEND ON FRESH WATER FROM THE RIVER WOULD BE DISASTEROUS. WE

AT THE PORT OF NEW ORLEANS, THEREFORE, ARE CONFIDENT THAT THE CORPS OF ENGINEERS' REMEDIAL ACTIONS THAT HAVE BEEN TAKEN SINCE THE 1973 GREAT FLOOD HAVE RESTORED THE INTEGRITY OF THE STRUCTURE AND THE CORPS' PLANS FOR THE CONSTRUCTION AND COMPLETION OF AN AUXILIARY STRUCTURE BY 1985 WILL PROVIDE THE LONG TERM GUARANTEE AND ASSURANCE THAT THE PUBLIC LOOKS TO THE CORPS FOR IN THIS SITUATION. I ALSO KNOW, SENATOR JOHNSTON, OF YOUR KNOWLEDGE OF THE IMPORTANCE OF THIS STRUCTURE BOTH FOR FLOOD CONTROL AND FOR MAINTAINING THE CURRENT DIVISION OF THE FLOWS BETWEEN THE MISSISSIPPI RIVER AND THE ATCHAFALAYA RIVER. I AM ALSO CONFIDENT THAT YOU WILL USE YOUR GOOD OFFICES IN THE CONGRESS ALONG WITH THE OTHER MEMBERS OF OUR LOUISIANA CONGRESSIONAL DELEGATION TO SECURE WHATEVER FUNDING IS REQUIRED IN A TIMELY FASHION FOR ANY FUTURE REPAIRS THAT MAY BE REQUIRED AND FOR TIMELY CONSTRUCTION OF THE NEW AUXILIARY STRUCTURE.

LET ME CONCLUDE BY SAYING AGAIN THAT OUR BOARD OF COMMISSIONERS OF THE PORT OF NEW ORLEANS HAS FULL CONFIDENCE IN THE WORK THAT THE CORPS HAS ACCOMPLISHED IN REHABILITATING THE EXISTING STRUCTURE AND KNOW THAT THE CORPS AND THE CONGRESS WILL GIVE THE FUNDING AND THE CONSTRUCTION OF THE NEW FACILITY TOP PRIORITY IN THE YEARS AHEAD.

NAVIGATION CHANNEL DEEPENING

Senator JOHNSTON. We have plans, as you know, to build a 55-foot channel from Baton Rouge down. That will increase the stake in the integrity of the river and keeping the Old River control structure in proper working order, will it not?

In other words, it will increase the amount of activity on the port and, therefore, the economic consequences of a change will be even greater.

Mr. HAAR. Yes, sir, the 55-foot channel—just on coal alone as we project at the Port of New Orleans for the whole lower river from Baton Rouge down to the gulf—will be moving 60—will have a capability—the seven new terminals—two existing today and the five additional ones now on the drawing board to be built on the lower river—will have a capability of 63 million tons of throughput in 1985, and 120 million tons of throughput in 1990. If you couple with this the exploding growth in the grain traffic which is going up at the rate of every 5 years of something like 50 million tons, the economics of this new 55-foot channel will be a savings of $1 billion a year in transportation costs just for grain and coal alone. So, your point is well taken, Senator. It just points up even more the dramatic economics that are involved on this deepwater portion of the Mississippi River, both to Louisiana and the Nation.

Senator JOHNSTON. I just wanted to give you a chance to put in a plug for the 55-foot channel.

Mr. HAAR. Well, you know that's my favorite subject right now, Senator.

Senator JOHNSTON. Very well.

Thank you very much, gentlemen, for your testimony

CLOSING REMARKS

I would like again to thank Professors Kazman and Johnson, who invoked this hearing by virtue of their study. I think that this has been a very useful hearing. I believe that the people should be reassured by what the corps has found and what they are doing. I think we have had some questions raised that ought to be looked into, particularly about the U.S. 190 and I-10 bridges, which commends itself to the State, particularly to the State highway department, and I am sure that they will continue to look at those studies.

How safe is safe? Well, safe is never safe enough when you are dealing with lives and with millions and millions of dollars of property.

For my own part, I share the conclusions of the Corps of Engineers that we can have full and complete confidence that the Atchafalaya River will not capture the Mississippi River, that this structure as augmented by the auxiliary structure will be there for the foreseeable future, and certainly for as long as any of us here in this room are around—I mean—as our children are around.

So, I want to thank all of the witnesses, our distinguished Corps of Engineers panel, our two LSU experts as well as our three members of the present panel, for an excellent hearing.

Thank you very much.

ADDITIONAL STATEMENTS

For the record, if there are any further statements for the record, we will—the record will remain open for 1 week so that any additional statements may be submitted. They will be included in the official hearing record. Now, they should be sent to the Committee on Appropriations, Washington, D.C., or to my office.

Thank you very much.

[The statements follow:]

LETTER FROM KENNETH DUPONT, PRESIDENT, ST. MARY INDUSTRIAL GROUP, MORGAN CITY, LA.

December 17, 1980

Senator J. Bennett Johnston
Chairman, Appropriations Subcommittee
Russell Senate Office Bldg.
Room 421
Washington, D.C. 20510

Reference: Hearing on the Old River Control Structure
and Mississippi River Flood Protection
Baton Rouge, La. - Friday, December 19, 1980.

Dear Senator Johnston:

The purpose of this letter to your appropriations subcommittee is to advise you of the St. Mary Industrial Group's (SMIG) vital interest and concern in the present Old River Control Structure. SMIG is extremely interested in flood control in the Atchafalaya Basin. Professor Raphael Kazman believes that the integrity of the Old River Control Structure has been endangered. We enclose an article entitled "Area's Fate Rests With Old River Control Structure" which appeared on October 21, 1980, in The Daily Review.

We urge your subcommittee to appropriate the necessary funds to properly maintain the Old River Control Structure and to provide for any additional structures that may be required to control flood waters in the Atchafalaya Basin.

SMIG is a non-profit organization of business and industry incorporated with 160 members whose total employment is in excess of 20,000 employees. Among SMIG's objectives are: the promotion of a better understanding of problems affecting business and industry, to render a service to the community on industrial relation matters, to encourage the application of scientific methods to the problems of business and industry, and to join and support allied associations whose goals are generally consistent with SMIG. SMIG is a member of the Construction Industry Legislative Council of Louisiana, the Associated Builders and Contractors of New Orleans, and the Louisiana Association of Business and Industry.

Very truly yours,

ST. MARY INDUSTRIAL GROUP

Kenneth Dupont

Kenneth Dupont
President

"Area's Fate Rests With Old River"

[From the Daily Review, Oct. 21, 1980]

Erosion of the river bottom resulting in large holes is endangering the integrity of the Old River Control Structure, which keeps the Atchafalaya River from capturing the flow of the Mississippi River.

That is the conclusion reached by Raphael Kazman, who along with David Johnson worte the recent report, "If the Old River Control Structure Fails."

Kazman was the guest speaker at a special meeting of the St. Mary Industrial Group Monday and noted that a hole on the downstream side caused a massive concrete wingwall to collapse around the time of the 1973 flood.

Kazman, a professor at LSU, said he was at the Old River Structure two days before the wingwall collapsed and as he got out of his car felt the whole area trembling "like a train was going by at 50 miles per hour."

Kazman said, "I got in my car and left. I was literally scared."

Two days later, Kazman said, the structure collapsed and "alerted the Corps that something was wrong."

He said the U.S. Army Corps of Engineers began taking emergency measures. He said every barge that could be found was used to drop huge rocks into the hole in an effort to shore up the structure and "by the grace of God they succeeded."

Kazman said the 1973 flood was not that serious. He said the amount of water passing Vicksburg was 1.97 million cubic feet per second, which was 10 to 12 percent less than the 1927 flood.

According to Kazman, the Corps has apparently filled the cavity, but another still exists.

He said the Corps was proposing to build an auxiliary structure, but the cost would be approximately $200 million and it would be 1985 to 1986 before it could be completed.

Therefore, much of south Louisiana would be protected by a crippled structure for the next five years, which could go "if we get a good swift flow."

However, later in the meeting, Kazman said the entire structure would not crumble like a brick wall in a hurricane. He said the experience with the wingwall in 1973 showed that the structure would not completely fail at one time.

If the structure fails, Kazman said the Mississippi River will have changed its course. He added that Morgan City would possibly have four days before it felt the impact of increased flooding.

Communities on the Mississippi River would also be impacted, but not as severely, Kazman said.

He said most of the silt in the remaining Mississippi River flow would be deposited a short distance from the structure because of a curve in the waterway. The biggest problem for New Orleans would be salt water intrusion from the Gulf of Mexico.

Not only would Morgan City be faced with increased flooding, the siltation problem would increase because as the river gets near Morgan City the velocity slows, causing the silt to drop.

Kazman said a possible alternative would be building a third outlet to the Gulf, to work in conjunction with the Lower Atchafalaya River and the Wax Lake Outlet.

He did urge the SMIG members to contact their congressmen to see that funds for the auxiliary structure at Old River are provided and that construction is allowed to take place with as few delays as possible.

STATEMENT OF J. B. LANCASTER, JR., P.E., FORTE AND TABLADA, INC., BATON ROUGE, LA.

Since the Old River project was damaged in 1973, there has been concern about its stability and its ability to function as it was designed to do. These concerns have served to greatly increase the general public's appreciation of the nature of the project and its vital function to flood control and navigation. The disastrous consequences of a failure of the Old River project to navigation on the Mississippi River, to the existing flood control system, to the environment and to the general economy of southern Louisiana are universally acknowledged. I strongly support and commend the Corps of Engineers for their vigorous efforts to rehabilitate the existing project and I support the construction of an auxiliary structure as a means to further improve the operational capability of the project.

CONCLUSION OF HEARING

Senator JOHNSTON. That concludes the hearing. The subcommittee will recess and reconvene at the call of the Chair.

[Whereupon, at 11:40 a.m. Monday, December 22, the hearing was concluded and the subcommittee was recessed to reconvene at the call of the Chair.]