They'd tell the Chief of Hydrology to go and change his study. He may not be an expert in hydrology at all, but because he thought the answer was too big, he'd say that we can't afford that kind of an answer. I know that happened at least in a couple of cases where we have a design flood, called the standard project flood in the Corps of Engineers.

In one of the offices I worked in the Chief of Hydrology came up with the standard project flood based on his best estimates of all the components that go into it. He sent it forward to the Chief of Engineering, and the Chief of Engineering looked at it and he says, "What's the biggest flood you ever had there?" Well, it was only about a quarter of the size of the standard project flood. He says, "Oh, that's way too big." You go back and cut that thing down considerable, he says, "That's way too big. It's going to cost us too much money to design for that."

So the hydrology group was busy redoing it trying to cut the parameters here and there and everywhere to make the final result less. While they were doing that, along comes the biggest storm they've ever had, that was almost as big as the standard project flood that they had already presented. So the Chief of Engineering immediately says, "Cancel my order." But you see that can happen. If they are not kind of an independent group, they get those political pressures.

For example, if a project has a close B:C ratio, it won't quite make 1: 1 ratio, why they may get pressure to move their pencil in the direction that gets more benefits. They have to have the choice of doing the best job they can without having somebody trying to alter their answer for them.

One of the reasons that the Corps paid money to the Weather Service, National Weather Service, to do the extreme rainfall analysis for probable maximum floods was because we didn't want the people in the Corps to be pressured by district engineers or chiefs of engineering divisions or planning divisions or whoever when coming up with their best estimate of the probable maximum precipitation.

They were able to work independently without regard to economics of projects--to work independently strictly on the technical, meteorological aspects of the estimates. It's good to have that freedom, not to have somebody pushing you for a high answer or a low answer. So, I guess, that's one of the things that the Chief's office really ought to continue to give those people at least enough independence so that they don't have that pressure on them all the time.

Q: Well, that sounds like it's one of those areas that needs to be protected and that's why I gather you really fought ...

A: I did all I could to try to keep it as a separate unit ... and I think most people realize that that's an important element. But, some would still like to bust it up and put the parts that they use the most in their own office. It would spoil the whole operation.

Q: Now how many hydrologists would a normal district have in their office?

A: Well, it depends a whole lot on how big of a work load they had. Well, back when I was working in the Garrison District, for example, they had one GS-12 as a Chief of Hydrology, Hydrology Section. They had one, two, three--three GS-11's. Then they had three or four GS-9's, plus some GS-7's, all working on different aspects of hydrology. That wasn't really a big district.

Then they had in the branch, the Hydrology and Hydraulics Branch, another section in hydraulic design which was not quite as big but it had maybe five people in it. Another smaller section on sedimentation, there were three in that section.

The fourth section in the branch was what today are the planning people. It was a report section. But they were the planners at that time. That had several people, too. They were the ones that wrote the planning documents that went to Congress. They were a part of the Hydrology and Hydraulics Branch at that time. As they eventually evolved, they became a division comparable with the Engineering Division.

Q: So they really are pretty well staffed then?

A: Oh yes.

Q: In most cases?

A: It will depend on the work load, too, how many people they have. If they have a large staff and they don't get enough work, sometimes they can get work from another district. One of the things we did in Garrison District was work on some projects for the New England Division right after one of the major hurricanes in New England. There was a lot of investigative work going on on potential dams. We did the design work on two or three of them.

That helps keep the work load distributed around the Corps. One district has too much, why they can use other districts. Of course, they use consulting firms a lot, too. They use consulting firms more now than going to another district I think. But at that time they were encouraged to go to another district rather than go to engineering firms outside the government.

Q: Is that primarily because of the lack of manpower across the agency?

A: Well, that was a lot of it. But a lot of it was that they didn't have too much confidence, especially in the hydrology and hydraulics area, in some of the private engineering firms. But, nowadays, they are a lot more competent than they used to be in that particular area. Most of them hadn't done enough work in that area to really say they were experts at it.

I don't know--with the small number of dams that the Corps is designing nowadays, it won't be too long before they won't have any experts on how to design dams. Then they'll have to go to private industry because a lot of the private firms get the experience in foreign countries designing projects for another country or for the World Bank.

Q: That still wouldn't affect the hydrologists as much would it? Because they still have a lot of the other things they have to do-flood control, etc.

A: Well it wasn't so apt to impact those as some of the people like the structural designers especially. It's a tough thing when you're running out of big projects to design. You have these people with all this expertise, what do you do with them? You have to retrain them or do something. They can't just sit there twiddling their thumbs so you want to keep them because you might get another job to design. But that can only go on for so long and then pretty soon you lose your experts. They go off somewhere else and get a job.

So it's been tough through the years to maintain the kind of capability you'd like to have in each district office. Some of the divisions have tried to use one of their districts--they'll say, "We'll make one of our districts the prominent experts in that area, and we'll move the best people we have from the other districts to that particular district. And then they will help all the other districts so that you don't have to try to maintain a full staff in each district."

Q: Has that worked relatively well?

A: Well, as far as I know, it's been okay. I think SWD [Southwestern Division] are the ones that did it more than anybody. But some districts don't maintain much of an H&H staff, they just go to HEC or the Waterways Experiment Station to get their help--the in-house Corps help and then use consultants. So it's a real mixed bag, I guess, the way the various districts handle their cluota of people, how they use them and how they feel they have the most demand for them.

Two Types of Personnel in the Corps: Lew Blakey and Al Cochran

Q: We were talking the other day, too, about the people you had worked with. One of the people that I hadn't talked about, but I guess I should, is Lew Blakey, who was in a number of different positions.

A: Well, I guess one of those things you could say from my experience with the top people in the Corps--there are kind of two types. One is a person who is kind of concerned about his own prominence. He's trying to build up his own stature by writing professional papers, by being active in professional societies, and getting his name on his papers as much as he can, trying to do things he can to draw attention to his own capabilities. He spends a lot of time doing that and not as much time working for the agency.

Then there's the other type who is real--they're all real good--but I mean this other type who doesn't really give a hoot about being prominent and well recognized and all that sort of thing. He just does a hell of a good job where he is, Al Cochran was one of the latter type. He knocked himself out trying to do the very best he could for the Corps of Engineers. Working nights and spending a lot of extra hours and getting the best help he could. He didn't worry about his own stature too much. He just worried about getting the job done.

But, I don't know why he was that way, other than maybe he felt that being Chief of Hydrology and Hydraulics, he wasn't really looking for a different job, he was satisfied where he was. But other people that try to be recognized, not only do they like the idea of being recognized as a top authority but it helps them get higher paid positions.

But each of these type of people benefit the Corps, you know. It benefits the Corps that one of their people is recognized throughout the world as being the top expert in some particular discipline. How they happen to get that recognition may have taken some of their time from their normal work to get that recognition, but still it benefits the Corps to a great deal. So it's kind of hard to judge one person, which one does the most good for the Corps in the long run. But they both do a lot for the Corps.

Frank Snyder was kind of the opposite from Al. He was concerned with coming up with new innovations and things like that. He liked to work on research type things and develop new ways to do things. He'd write professional papers and everybody knew who he was, and he did a lot of international work. He retired relatively young to go into private work.

But he was really a lot more recognized throughout the world than Al was because of his international activities and his working on research type things that other people finally used. Everybody knows Frank Snyder's unit hydrograph method, and he got recognition from Ohio State for being an outstanding civil engineer. He's had a lot of recognition.

Gail Hathaway was the same way. He liked to be recognized for what he did. I was **leading** up to what you asked me about Lew Blakey, how am I going to fit Lew into this category? Well, Lew, I think, is from my standpoint--he was guy who got things done that the generals wanted done. If they thought it was important that all of these reports get in on time, why he'd get them in on time. Now they may have suffered because they got in on time because they did not have the same quality, but he got them in.

If the general said he wanted something in, then by God, he got them in one way or another. It did not make any difference how hard he had to work or who he had to push, he'd get them done. But he and I had some differences a lot of times about what was more important, getting the report in on time or having a high quality report. You can take different viewpoints on that. I felt pretty strongly you ought to get the highest quality reports you could get to begin with, and then you didn't have to worry about changes.

He didn't view it that way in a lot of cases in some of his jobs. He must have been good, you know, because he got a lot of good jobs. He got moved around a lot, and he got the kind of jobs he wanted, but he seemed to be good at them. I don't know of any of the generals that didn't like him. Whoever he worked for, they all seemed to like him real well.

But I had my differences with him about his planning reports because it would bother the hell out of me if a survey report was due in on a particular date and the guy in hydraulics and hydrology that was supposed to review it was off on vacation at that time. So it didn't get reviewed, it went in anyway, whether it was reviewed or not. But it got there on time. That was what was important to get the job done.

Personally in some cases like that I'd rather see it delayed. But then again I wasn't the guy that was managing reports either. My credits weren't for getting the report out on time, my credits were for making sure the thing was right. So it all depended on where

you're sitting, what the priorities were. But, obviously, when people have two different goals, they're going to lock horns once in awhile. And we did occasionally.

Q: Yes, well, I locked horns with Lew, too. I didn't come anywhere near winning_

A: Oh, he was a tough person to battle with. He went after me a couple of times. But a lot of times, I think, generals kind of used him, too. They thought he was willing to take on all kinds of adversity to get something done. Save them a lot of headaches. So they let him go ahead and do it, even though they may not agree wholeheartedly with everything he was doing, why not let him fight the battle for them. He'd do it. So, it all depends on your outlook and where you're sitting whether he was doing a real good job or not as good of a job. But Lew and I got along fine as long as we weren't working on something together. If we were just talking about the weather and so forth, why we could do that pretty peacefully.

Survey *Reports*

Q: Well, there is certainly a very great price to pay when you begin to sacrifice quality for time. Especially, I imagine in your area where you really need to be careful in what you're doing?

A: One of the biggest problems I think we had was headquarters never did come to a final or a straightforward position on what they wanted with survey reports. They were always vacillating back and forth. One day it would be we want just the rough estimate of what the answer should be and then we'll take care of it when we get into the general design phase. We'll do all the detailed work and fix things up when we get into the general design phase. That's all right if you do it, but they didn't do it.

Then when they got to the general design phase, "Oh, well, that's suppose to have been all settled in the survey report. We shouldn't have to rehash this stuff." I'd say, "Well, you guys didn't do anything in the survey report. How can you say that it's all done if you didn't do it in the survey report, you've got to do it some place." Now I never did have a particular concern about whether it got done up front in the survey report or whether it got done later in the General Design Memorandum as long as it got done.

But I got hit both ways. The planning people said, "We don't want to spend a lot of money on hydrology and hydraulics on the survey report. We'll do it in a General Design Memo." I'd say, "Well, okay." Then I get to the General Design Memo, and the guy in charge of the General Design Memo, he'd say, "Oh, they did that in the survey report.

We don't have any money for doing that." I'd say, "Well, you can't play both games. You've got to do it one way or the other. " So a lot of times we had trouble getting the studies done that we needed done because of that game, it went back and forth all the time.

Q: Well, wasn't one of the things that Gianelli, Dawson, and Page all came down on was that these survey reports were not done well enough to really make a decision on some of these projects?

A: Well, a lot of them are like that, yes. There were a lot of them that remained in Gianelli's office for a long time. I remember Lew reporting to our staff meetings how many survey reports he had gotten in that particular period and how many were stacked up over at the Secretary's office, none of them going forward. Just sitting over there.

It always used to seem to me--here I'm concerned about the quality of those reports and he's concerned about getting them in to the Secretary's offices who are just going to stack them up in the comer some place--why not use that time to improve on the quality of those reports. So we never did see eye to eye on that because he didn't get any credit for a report that was out there being massaged and improved. He got credit when it came into the office.

But what you're saying is quite right. They were concerned about it. They weren't getting all the information they needed to make decisions, but I think a lot of it was just that the Administration didn't want the reports. They didn't want them sent forward because that meant that Congress might start appropriating some money for projects that the Administration didn't want to spend.

ASA/CW Review of Work

Q: Well, how did you find the Assistant Secretary's office as far as the quality of their review of your kind of work?

A: Well, they really didn't have anybody over there that could review our work. I don't think I ever remember anybody over there that knew much about hydrology and hydraulics except Jack Ford. Their work was more in the planning area, in a general overall picture. They had the economists over there, too. Of course, Ed Dickey? his primary expertise is economics. But most of the others that were over there had backgrounds in planning or

economics or environmental work or something like that. They weren't usually in the particular technical discipline. They were more in the broad range planning type things.

Q: So they weren't really the engineers that could make a real estimate of the engineering involved?

A: The sad part of it was--Gianelli, he thought he knew all the stuff but he didn't. He certainly didn't know hydrology and hydraulics or if he did, he hid it pretty clearly, because we'd go over there and talk to him about dam safety and you could tell he wasn't the least bit interested in what you're saying to him. He'd sit there and listen to you, I mean he'd sit there--you knew he wasn't absorbing any of it or really thinking it was worth his while. He just did it because it was kind of forced on him.

Once in awhile you had some people that got involved in pseudo-technical matters, like when Jack Ford was over there, he got involved with OMB on trying to set up some criteria, technical criteria for making decisions on where the Federal interest stopped and the community interest started when it come to stormwater management.

I got involved with him on some of that because OMB didn't just want to come right out and say flat out, "We're not going to do anything in areas smaller than ten square miles or something like that." They wanted some sort of a technical reason for turning down projects or turning down work. So we had to develop kind of a hydrologic model about certain size floods or--anyway we came up with a manual that described a Federal interest, where you stopped it. It was based on a lo-year flood in a certain size area.

So, anyway, they got a technical procedure that wasn't strictly arbitrary. But the sad part of it was the technical procedure was so loose, it was based on average conditions, and you don't hardly ever have average conditions anywhere, [it's] either greater or less. But it did serve their purpose so that OMB could say, "Okay, well, that won't meet our criteria or requirements so we won't do anything in that area."

Dam Design Criteria

Q: They basically wanted a formula that they could put this project up against and say it doesn't meet it?

A: Well, the same way with the Secretary's office when it come to dam safety. They wanted some sort of a formula that they could turn down repairs on a dam. They wouldn't turn down repairs on a dam without all kinds of studies. Not only that but they wanted to keep the studies going and going and going to delay decisions but it still ended up where they had to make a decision.

The Secretary's office never wanted to be in a position of saying that they turned down repairs on, or rehabilitation of a dam for dam safety. If they turned it down and the thing failed, look where they would be. So they never wanted to be in that position. So they always had you restudying it or trying to come up with some special criteria that would get them off the hook. You know saying that here is a new criteria for evaluating dam safety and it meets that, the dam meets the criteria so we don't have to do anything to it. You know that would frustrate me a little bit when they would do that sort of thing.

When it came to which dams they would put some money in fixing them, they would pick the one that cost the least amount of money, not the one that needed it the most. All that used to aggravate me. They would pick a dam which I thought should have been way on the bottom of the priority because it wasn't going to cost as much to fix that one. But then they looked better because they were fixing some of them.

Q: Well, how did that settle with the Congressional people who were interested in this kind of thing because it's a very high visibility safety issue to the general public, especially after all those problems they had in the late 70's?

A: One of the things that is pretty obvious are the structural features of a dam. If something becomes obvious structurally that it's got a crack in the concrete that is a serious crack or it's got a seepage problem, really a severe seepage problem and something might happen, the whole dam might go out or something like that, you didn't have too much trouble getting money to fix that. That type of a fix, and they call that rehabilitation, they didn't call that dam safety because they could identify an exact physical problem and so they got money for that without too much problem.

But when they got into things like the probable maximum flood? the present day estimate of the probable maximum flood, if it was bigger than the one that they used to design it with originally or maybe they didn't even use the probable maximum flood originally, would that dam withstand the present day probable maximum flood, and in a lot of cases they wouldn't.

So you'd see if that dam needs some modification so it will pass the present day standard of a probable maximum flood. Trying to convey the real need for doing that was a lot harder than showing somebody that it was physically crumbling. You'd say, "Well, we've got a bigger flood than we had before." If that big flood comes it will be overtopped and might drown everybody downstream. The response would be "But that's rare, though--it's not going to happen, the chances of that hitting this particular dam are rare."

We'd say, "Yes, you can do that kind of a manipulation if you want and decide how infrequently that big flood would hit this dam if you knew how to do it, which you don't know how to do." You can do some studies and say, "Well, this is so rare we don't need to worry about it." The answer to that is, "Yes, but there are many dams in the United States."

They're all over the country. Everywhere where there is a stream almost, there's a dam. Maybe it won't hit the one you were interested in, but it's going to hit some of them somewhere. If you don't design them all for a high level of protection, sooner or later, some of them are going to start failing because those big floods happen here, there, and everywhere. But it's hard to convince people. That's always been a big battle.

You'd get the economist-type people who would say, "Well, we need to do a benefit/cost type analysis on everything we do." That's always been the vogue in the Federal Government. How much are we going to get back for what we spend? They force people to do that type of an economic approach on almost everything they do, even though they can't do it with any degree of accuracy. They require some sort of an estimate of that sort of thing.

I used to get upset when people would start saying, "Well, they're going to do probability estimates of floods out to the probable maximum flood which is the biggest one..." Nobody knows what the probability of that is because, as we talked earlier, you only have at most about a hundred years of records at any one location. Maybe a few hundred years at rare places, but that won't tell you what is going to happen in terms of thousands of years, and that's where you're dealing. I argued with them again and I said, "Suppose it's a l0,000-year flood, as opposed to a 5 0 , 0 0 0 -flood. Which difference does it make to you? I mean how can you tell."

If somebody tells you that that dam was designed for a l0,000-year flood and someone else says, "Well, this other one is a better dam because this was designed for a 50,000-year flood, does that mean anything to you." It doesn't mean anything to me, so I don't see how it can mean anything to you. But if they tell me it's designed for a bigger flood, which can happen, then I have some feeling for the need to do that. But when they start throwing these rare numbers at me, they don't tell you anything really.

Q: They become a source of confusion more than anything else then?

A: Well, sure, and then they start throwing in economic analysis with those rare risks. When you start thinking about that, the dam fails and 10,000 people are drowned, what is their life worth? How do you go about deciding what an average life is worth? Besides that, who are those people going to be? The ones living right downstream from the dam, it's not something like an airplane where you don't know the victim, a victim in an airplane could be anybody. Anybody that flies airplanes. But the people--right downstream from a dam--don't want the dam design based on a benefit/cost ratio. They want it safe.

Safety Problems

Q: Maximum safety?

A: So anyway, you run into those kinds of problems and justifiably so because there are only so many dollars to go around and you can't spend all the dollars on dam safety, you've got to spend dollars on welfare--all kinds of other things. So there's always going to be this debate on the best way to spend your money.

Q: When you were doing these dam safety studies and investigations, what impressions did you have, based on your studies, of the people who designed these dams? I mean the Corps has a reputation for being extremely conservative in it's design philosophies. You said some of these dams didn't even take into account the probable maximum flood.

A: Well, either they didn't take [it] into account or they made a reduced version of it. The Bureau of Reclamation had that problem. Of course, for many years they had a different procedure for justifying their projects and paybacks on their projects. Irrigation and hydropower, those are project benefits that have to be repaid by the beneficiaries.

The people that are getting the power have to pay for it. The people who are getting the irrigation water -have to pay for that. So they have to have somebody to pay for them. Therefore, whoever pays has to pay for this extra safety. It goes along with the project--having to pay for that extra safety.

To get projects that were acceptable to the beneficiaries, they had to try to be as low cost as they could. Otherwise, they wouldn't get anybody to pay for their projects. So they kind of went overboard in cutting down on the size of their design floods, arguing that,

being in the mountainous areas, they didn't need to worry about floods as big as the ones that we were looking at over in the plains. They said, "Well, storms won't move as far in the mountains. You can't transpose a major storm from one location to the other in the mountain areas like you can out in the open area where you don't have big mountains."

There was a lot of controversy between the Weather Service and the Bureau of Reclamation about transposing storms. If you didn't transpose a storm very far and there weren't any other big storms in your area, you could say that the potential was small there. So there was a lot of controversy. That was a big reason why the Corps was having a lot larger probable maximum floods than the Bureau of Reclamation.

The SCS, they used the National Weather Service to get their probable maximum precip [precipitation], same as the Corps did, but they didn't put freeboard on their dams. They would design the dam to take care of the highest level attained by that probable maximum flood without any freeboard. The Corps always added freeboard on their dams.

I guess the SCS could argue that since their dams were usually small dams, they didn't need to worry about wave overtopping, run-up and waves overtopping, as much as the Corps did on it's big dams. So they had less conservative design than the Corps. Then you get into the states and the kind of requirements they put on--a lot of states didn't have any requirements. They would let you build almost any kind of dam you wanted to, and the states wouldn't care.

Since the big dam safety study several years ago that the Corps did and many dam failures, they've gotten a lot of the states to put in requirements. A lot of the states have adopted the standards we used to investigate whether a dam was safe or not. They use the same kinds of standards that we put together to evaluate the non-Federal dams. Those standards were really not supposed to be design standards. They were supposed to be standards to look at existing projects under the concept that it's awfully hard to change an existing project. It's better to spend more money in the original design.

So we set up some criteria that weren't quite as strong as what we would have wanted them to use if they were building a new project. But just to find out whether they were reasonably safe or not. But states picked that up and said, "Well, that's design criteria." Our view of it was safety evaluation criteria, not design criteria. They say they're one and the same. But, anyway, that was interesting. At least it increased the design level most states were using.

Then they have a big problem if there's no development downstream from the dam, a lot of these states won't have a major requirement on how you build the dam. Maybe they' 11 use a 100-year flood or even less in designing the dam because there's nobody living

downstream from it. But the problem is you build a dam and before long everybody starts moving into the floodplain down below it because they figure there is not going to be any floods anymore down there, even though it may not be designed for flood control.

People move into the floodplain and then a flood comes along that's bigger than that 100-year flood and those small dams fail and people get drowned. The whole concept has changed because people have moved in downstream. That was one of the considerations we had in deciding on what kind of a flood that the dam had to be able to pass without failure. It had to do with how many people were living downstream. Would failure cause a lot of people to lose their lives or none or a few? So we had different requirements for different conditions downstream.

Q: That sounds like the airports. You build an airport and everybody moves around it, and then they say there's a safety problem because you've got all these businesses and houses around the airport.

A: They moved in there because the airport was there.

Q: Was there, right. Then the airport is the source of the safety problem.

A: Right. Well, dams in some way are like that. A lot of dams are built, and they say, "We're going to control floods and save lives by building these big dams for flood control." What happens is they have more people drowned in the reservoirs than they ever had drowned from floods downstream from there. People get in their boats and take along a keg of beer with them or a bunch of whiskey, and they get out there and get intoxicated and run into each other and fall out of their boats, and even go over the spillways like some guy did at Fort Peck.

A couple of guys were out fishing in a boat and the boat motor quit on them, and they drifted toward the spillway--real slow at first because they were quite a way from it. One guy jumped out of the boat and swam to shore and the other stayed with the boat, he kept trying to get the motor started. Pretty soon it got to the point where he couldn't swim, the water was going too fast, and he went right on over the spillway and down the chute and, of course, got killed. So those incidences are happening all the time all over the country.

Q: Well, there has been a big program in the water safety program at those reservoirs. It doesn't do any good with some people, does it?

A: Oh, absolutely not. All you have to do is go where there are boats, and you can see that a lot of people have no regard for safety at all. They charge around with those high speed motors without even knowing what they're doing. A lot of them hardly even know how to start it let alone act safely.

Q: Of course, the Corps can't control that because they don't have the authority to license those people. On the reservoir, all they can do is charge them a fee to use it,

A: Well, they have rangers that if people are misbehaving, [acting] in an unsafe manner, they can ask them to leave; but still--I don't know that they have power to arrest them and take them to jail or anything like that. But they can ask them to leave. Their rangers or whatever they call them. Water resources types.

Stormwater Management: Chicago

Q: Let me change a little bit. You talked before about stormwater management. When I was out in Arizona talking to Major General Richard M. Wells, he talked about when he was a Chicago District Engineer and they had the TARP project, the Tunnels and Reservoir Project, that they wanted under the city. He had to come to some kind of agreement with the EPA on the proportion of stormwater to wastewater. Were you involved at all in those discussions?

A: Well, not too much. The district engineer did most of the negotiations and that sort of thing. That was a special, really a special, project because it wasn't designed necessarily for flood control. It was primarily a water quality type project to begin with. But they had to treat all that water, once they mixed the wastewater and the storm runoff, and put them in the same storage area down there. They couldn't take it out of the storage area without treating it.

So the bigger mix you have of wastewater with the stormwater, why the more treatment it takes. I'm sure that the EPA and the Corps had quite a time coming to grips with what they were going to do in terms of treatment. The idea was that they'd like to cut down on the amount they had to treat because it cost so dang much money. If they could separate the stormwater from the wastewater, why then they have not nearly as much volume connected with the wastewater. That's one of the things, most of the old cities have sewers that are combined sewers. They take both stormwater and wastewater.

So how do you get this "no pollutant" goal that the EPA was trying to get when you've got stormwater and wastewater mixed together. If you're going to meet that goal, you've got to separate all those sewers. How much would it cost to do that, to tear up all the streets in the major cities in the country and separate those storm sewers from the sanitary sewers so you could treat everything ? Otherwise, you have to treat all the stormwater along with all the wastewater. So that's the type of a problem you have--what can you do in terms of cost. You can't treat everything, it's just too expensive to treat everything.

Q: That TARP project was mainly to take the stormwater, wasn't it?

A: Yes, and wastewater.

Q: I lived in Chicago. I know what happens when you get storms of a huge dimension in the city. We use to have a basement full of it all the time.

A. Well, it's so flat. It takes a long time to get rid of it, and it doesn't runoff quickly, it stacks up all over the place. It was really probably the only way they had of helping the flood situation there because even if you build facilities, channel improvements and so forth, the slope is so flat that they can't carry a lot of water. The only way you can do it is if you put it underground like that, in storage underground, then it's not going to overflow on somebody's property.

Then you keep your pumps operating all the time, and you only have a storm occasionally so that you get it back out into the rivers when it's dry or not raining. It's just so costly to do it that way--putting in those reservoirs, underground reservoirs, huge diversion facilities, and all that costs a lot of money.

They had a few of these open pits, too, they were using in their plan where they had taken out rock from the rock quarries. I guess you've seen them when you drive around Chicago, there on the Interstate. You see them every once in a while. They would also enter into their plan.

Well, we reviewed the plans that came in. But it was so complex that you really didn't have enough time to go into all the details of the projects. In our office, we didn't have the staff that could look into it in great detail.

St. Louis

Q: Did any other cities have a similar kind of problem? I mean of that dimension, that magnitude?

A: Well, I don't know--every city has a problem with stormwater I know. But I know that the Corps got involved in a lot of interior drainage facilities. In St. Louis, they have a major levee around St. Louis, the Corps does, and it's a huge one to take care of a really big flood. So they have to have facilities to get rid of the water that runs into the interior -- I mean from the rain that accumulates over the city.

If the Mississippi River and the Missouri River stay up for long periods of time, it can't drain interior water out so they have facilities to get rid of it. Even if the river is down, they still have to have conveyance to get it through the line of protection.

So the Corps got involved in building a lot of interior drainage facilities. Increasing the size of the conduits underneath the levee with gates on them and pumping plants and all this kind of stuff. When I first came into Washington back in '58, it wasn't too long after that a lot of these reports would come in from St. Louis on their interior drainage and there was a lot of money involved in big pumps. A lot of complicated designs, and how they were going to handle the water. Because the water was coming down, ponding at the levee where all the big industry was. Any water that stayed in there was going to cause a lot of damage. So they had to get rid of it.

Q: Now that was on both the east and the west sides of the river--both in east St. Louis and in St. Louis itself.

A: That was one of the bigger projects that I got involved in as far as actual interior design of projects. Even though you had a big levee there, it was already there, and they still had a lot of work to take care of the interior flooding.

New *Orleans*

Q: Did New Orleans have problems something similar to that?

A: Oh, New Orleans still has that problem. They never have solved their problem. But one thing--the flood insurance program has put them in a bad [situation]--because a lot of this interior drainage, the interior storm collection and all that stuff, is really the responsibility

of the local people. If they don't do it, why it doesn't get done, and they suffer the consequences.

The Corps will do the main levee for them and some of the major collection facilities or the major items right at the line of the levee. But getting all that water down to the levee and to this major facility is another problem. In New Orleans, the normal water level on the Mississippi River is above the land within the levee. So you've got to pump everything. You can't drain it by gravity. There's no place to drain it, too. So it costs a lot of money to get rid of all that water.

The parishes down there have a tough time convincing FEMA that they're doing something to reduce future damages. Part of being in the flood insurance program is that the community is taking strides to reduce future damages in their area and preventing development in the floodplain.

Well, if the whole area is floodplain, how do you prevent future development in it because people are going to develop and there's no place else to develop. They're actually developing in the floodplain and so FEMA says, "Hey, this is against our policy to let anybody develop in the floodplain." The parish says, "Well, that's all we have. We're all floodplain."

Anyway, they've had some court cases about what they need to do. They have some agreements. We've got some in the office now that we're reviewing where the community or the parish has started working on future facilities to take care of local and interior drainage. But that is probably the worst city in the country as far as maintaining a flood free area.

Q: A city that shouldn't be?

A: Well, a lot of people think so. They talk about the 100-year flood as the basis for the floodplain, you're talking about half the state of Mississippi or Louisiana, you know. If you spread the 100-year flood, most of the state is going to be under water.

Q: Yes, and an awful lot of money is spent down there to keep that river from going where it wants to go.

A: Oh yes. Well, you see there's so many complex problems there. They build levees to protect against hurricanes and the main river flow. Then the doggone levees, the ground

is so soft that the levee settles after you build it up. So it starts going down, down, down and then pretty soon the level of protection isn't what it's supposed to be.

So you have to build it up again. So it's a system or a series of stages of construction. You build it up so high, and then it settles down, and then you build it up again. You keep gaining a little bit on it each time, but it's a very expensive process.

The same way with the capacity of the main river--it fills with sediment. Then they have to go and dredge the whole thing out to maintain navigation and to help the flood carrying capacity of the river. The Corps has diverted a lot of water over into the Atchafalaya Basin by the Old River Control Structure. You've probably heard about all the problems they had with that thing, and it almost failed.

Q: That was '73 that it almost went and had a lot of trouble back in what, 1983?

A: Oh they've had trouble several times there. But '73 was the worst.

They have these facilities, like the Morganza floodway and the Bonnet Carré floodway. Whenever they put those into operation, everybody screams and hollers. They don't go into operation very often, but when they do, then a lot of people get wet.

So then they even have things like the New Madrid floodway, where it's completely developed agricultural land and that land has flowage easements on it by the Corps to use it as a floodway when the Mississippi got too high, so they could relieve the pressure on the levees--let's see where is it? Is it Cairo that is right there?

Q: It's up there north, yes, it's in Missouri.

A: That's right. Cairo, the main levee on Cairo. If they get enough water, if they don't open that New Madrid floodway, the stage is going to get high enough so it will overtop the levee. So with all these people living in the floodway, how are you going to open that thing?

They have to crevasse it with bulldozers and explosives in order to make the thing work because the people wouldn't let them put big pipes or gates. So the only way they can [do it] then [is] to amass a flotilla of equipment to do the job. All those people are going to know about it before you get there. They're going to be there with their machine guns and bayonets to stop you.

Q: Yes, I've heard that--I forget who was talking to me about that. They feared for their lives if they ever went up there to try to open that thing up.

A: Oh, they have tried, they were getting prepared to do it a couple of times; and they never have done it, but they were really thinking they were going to have to. That was always one of the big questions with the Secretary's office--What is your plan for making that thing work and how is it going to work? Will it really work? If it isn't going to work, why don't we do something else? What can we do? Are there any other solutions? They looked at trying to come up with other solutions, but there just really isn't anything that would take the place of the floodway because it will carry so much water.

But that was one of the problems that the Water Control Management Committee had. That was another committee that we had. The Water Control Management Committee was composed of all the chiefs of the water control branches in the division offices. We met regularly to solve, try to solve, some of these problems like operating the New Madrid floodway, problems with TVA and the operation of Kentucky-Barkley projects--one TVA and one Corps--and connected with a channel between them. We had problems with TVA on that.

Then all the concerns about the Atchafalaya floodway and sediment that was accumulating down there. What's going to happen when so much sediment gets down there that it is filled up? Or when is the Atchafalaya going to take, capture the Mississippi. When is the levee system going to fail? The people at Louisiana State University tell you it's going to happen anytime now. Professors down there ran articles about it all the time. Whose going to win the battle, the Corps or Mother Nature?

Q: Well, there will be some time that Mother Nature is going to win.

A: Well, probably will eventually but...

Q: They'd save a lot of money in New Orleans, won't have to worry about all that levees and pumps and all that stuff.

A: Well, it'll be right back there. They want the navigation in New Orleans. There's nothing down there at the mouth of the Atchafalaya. Morgan City is about all you got down there, there is little navigation. So they don't want all that water down there. Even if it did break through in a spectacular flood, they would go right back to recapturing it.

Q: It would keep them busy for a long time, wouldn't it?

A: Keep them busy, but it may just wipe out one structure. Then the water all goes through that one structure. Miles and miles of the main levee may still be intact so all you have to do is replace that one expensive structure. You don't have to redo the whole reach because once it gets through, it's going to keep coming through that same location. Unfortunately, the structures that are there cost a hell of a lot of money.

Q: From one of my discussions, General Heiberg was on it in that '73 flood. He told me when he was up there, he thought that thing was going.

A: You stand on the control structure? with all that water going under it, and boy you worry. I was on it, too.

Q: He said it was just bouncing up and down.

A: And you see the big boulders that they dumped in there and they just went right on through--trying to fill up the holes. The flood dug a real scour hole underneath that structure. They wondered what the hell was holding it there.

Q: Well, one end was completely undercut.

A: Underneath the structure was an awful big hole. So after the flood went down enough, they started dumping concrete in there as much as they could. Rutting it in and putting it in. But they've got another control structure there now. I think the Auxiliary Control Structure is finished.

Q: So they actually have two of them.

A: Two of the majors, plus the Morganza floodway. Then the Old River floodway upstream from the control structure.

Forecasting and Estimating Flows

Q: When you look at hydrology, you mentioned that you study river basins and systems. In the Corps you have an awful lot of them to study or to analyze. We've talked about the

Missouri a little bit, and we've talked about the Mississippi, are there any of the other systems that you'd particularly like to discuss. The kind of problems that as a hydrologist you've had there or the characteristics of those particular river systems.

A: Well, of course, the Columbia River is another, the Ohio and the Columbia are two other big problems. The North Pacific Division, Dave Rockwood, when he was up there developed what they called the SAAR model, which was a complex runoff forecasting model based on information on rainfall and snow melt over big basins, large basins like the Columbia. The Willamette drains into it as well as a lot of other big rivers.

But they developed the SAAR model for estimating flows and predicting flows. That model was used in a lot of places around the world. In fact Dave and some of the people that worked for him used to go to other countries and explain how the model worked and help other people develop their own models similar to that one.

So it was one of the, I guess, one of the big early forecast models--I guess we've talked about the forecast models before. But that was one of the ones that got a lot of early prominence because of the size of it, the big projects that were involved--all those big hydropower projects on the Columbia River. So that was used in their early water control center that we talked about before.

They got a lot of publicity on their capabilities to do that sort of thing. Turned out that Dave was spending about as much time talking about his model to other people as he was using it in the Columbia River. So he got a lot of publicity out of that.

The Ohio River is another serious problem. We had more navigation problems there than flood control. Even though there are a lot of levee projects along the way, there were an awful lot of navigation problems on the Ohio River. It seemed like every year there were problems with ice jams and barges getting frozen in and blocking the gates, low flows, and water quality.

Sediment and Debris

Let's see, what were some of the others--the Arkansas River, of course. It's a big problem because of the sediment down there. [There was] a lot of sediment going down the Arkansas River and trying to design flood control works and navigation works on the Arkansas River was a big problem because how did you handle all this sediment. So there was a lot of study and research done on how to design projects so that they would take care of the sediment in a manner that you could live with and still make the projects work

WES got involved in a lot of that work in trying to design the right kind of gates and so forth.

Q: Would experience working on that river, the Corps' experience working on that river, have alerted you a long time ago to these problems? I mean, if the work was done on the Arkansas River and the whole system out there, would they have known from the 19th century, the early investigations and surveys that were done, that this was a problem or was that something that just came about recently?

A: Oh no, they knew about the sediment problem. They've known about it, but what to do about it--that is, if you could do anything about it. How to design the projects, how much extra storage do you need in these projects if you're going to make them functional for a long period of time. How much of that sediment is going to stay in the reservoirs and how much of it is going to move on through. Trying to design for that sort of thing is a tough thing to do because the people didn't know enough about it. So they come up with a lot of new technology.

Q: Was that sediment problem repeated in any other major river basins?

A: Well, the Missouri River has a lot of sediment problems. Oh, what's the name of the community there. They had to relocate a whole community. Oh, Niobrara [Nebraska], that whole community practically had to be relocated because of the sediment accumulation in the headwaters of the reservoir. I forget which reservoir it was, it was one of the mainstream reservoirs [Gavins Point].

As the water flows into the flat pool, it spreads out and slows down, and the faster the water is flowing the more sediment it can carry. When it slows down, it drops the sediment. It was dropping it right there at the headwaters of the reservoir. So as it built up, it just starts getting built up higher and higher, and so it couldn't pass flow there without getting pretty high. When the flow did come in, then it would flood out the communities up in that area. The sediment was actually restricting the flow in the Niobrara River.

So they ended up relocating that whole community as a mitigation measure for the project. But they hadn't planned on it, originally they didn't have that in mind. But as it become more and more prominent, why they saw they were going to have to do something about it, and they finally did [relocation completed in 1977].

Q: What happens when you have to do something like this on these structures. Do you design for that extra storage? How much more are you talking about beyond an average dam, an average one that doesn't have a lot of sedimentation problems?

A: Well, some of them don't have too much sediment problems. Others, the life of the project is diminished in a lot of cases. Now what the Corps tried to do was design a project to take care of a certain size flood. We talked about design floods for safety. The design floods for flood control are a different design flood, much smaller than the design floods for safety. Now design floods for flood control, what you're trying to do is retain the water temporarily so that you're passing non-damaging flow downstream.

You may design the reservoir so that you can take care of a 50-year flood without causing damage downstream. But if you get a 100-year flood, you have to pass some of the flow over the spillway or open the gates wide in the outlet works. But you still are having less damages than you would have had if you didn't have any reservoir there. It's just that you can't completely control the 100-year flood.

So after you exceed the design flood capacity then your level of protection is no longer a hundred percent, you start getting damage. Not only that, channel capacity changes as time goes on. If you build a big dam and you don't make major releases, the channel downstream tends to fill in and farmers keep moving closer and closer to the river. They use their bulldozers to push more material out into the channel, make the channel smaller, and it naturally gets smaller, anyway, with more vegetation.

It doesn't have those big flows to clean the channel out occasionally. So if the channel capacity gets smaller, you have to change your water control management plans so that you don't let so much water out at one time. You have to try to let it out for longer periods or do something to offset your loss of channel capacity because the larger your channel capacity, the less you have to store in the reservoir. As your channel capacity goes down, the more you have to store.

As far as sediment is concerned, we tried to estimate enough storage to take care of a hundred years of sediment. Then on top of that, we'd have the storage for the flood control. There are other purposes and other storage, so that presumably the project would be still performing it's design function at the end of a hundred years.

But in many cases, that was a poor estimate, and that reservoir either started having more sediment inflow than it had in the past or it got some unusual floods right at the beginning of the project life and so it started filling up quickly. Then you had to re-analyze your project and decide whether you still had the same kind of capabilities you started off with.

Q: What happens when these things fill up, what do we do then?

A: That's been a subject of a lot of debate. People have talked about, "Well, hey, why not empty them. As they fill up why not go in there and remove all the material. " Well, that's fine when you're talking about debris dams out in California, the purpose of those debris dams is to capture all this debris and let the flood waters go on downstream.

They don't really store the flood waters, they just capture the big rocks and trees and all that kind of debris to keep it from going down into the nice concrete-lined channels that we built through Los Angeles. If those big boulders go bouncing down there, they raise hell with the concrete channel.

So after you have a major flood of some sort, the debris dam is all filled up and what do you do with it? Well, the local people have to get rid of it so it will be ready for the next flood that comes along. Otherwise, it's not going to serve any purpose. All the boulders will go right over the top of it.

So for years the city and the Los Angeles Flood Control District had people they could give that debris to. People wanted it for fill in highways and places like that. New developments where they wanted to smooth out a bunch of valleys or something, they'd use that debris and fill in with other material, highways, and all kinds of places. But even before I retired, they were having problems, starting to find [it] very difficult to find a place to get rid of it.

So what did they do with it? If you can't find any place to get rid of it, it gets more and more expensive all the time. At first it was a giveaway. Then pretty soon people started charging you for storing it. So, anyway, that's one of the other ticklish problems you have in California. Trying to estimate how much debris is going to come with one of those storms is a tough problem because in most of those watersheds, there is vegetation in there that gets drier than hell in the summertime.

Then some camper will go up there and throws a match, and the whole thing will go up in a fire. Immediately after those fires, the capability for debris load coming down the watershed--it'll be maybe 10,000 times greater than it was the day before. So for some time until the vegetation grows back, the potential for debris coming down there is just tremendous. You can't possibly build a debris dam big enough to hold all that stuff or design it for right after a fire, you have to design it for some period after a fire, like 10-15 years, and estimate the debris from that. Design it for that because there is no way you could do it otherwise.

Q: Well, what about some of these dams on the Missouri. What happens if they fill up? What are you going to do with those?

A: You're not going to worry about those filling up.

Q: You don't worry about that?

A: Those major ones on the Missouri River, those are big suckers.

Q: You've got a couple thousand years of storage there, then?

A: Yes, you've got lots of storage on those. Those will be some of the last ones to fill up, even though there is a lot of sediment. But you see, there are a whole lot of them, a lot of reservoirs there. The ones farthest upstream, they get a lot of the sediment. The ones downstream then are the ones that get the sediment flowing in from the tributaries. But they all don't get the main sediment from the Missouri River.

Garrison Dam and Fort Peck both have a lot of storage, an awful lot of storage in them. They collect a lot of the sediment.

Q: What about a river like the Delaware, which has really got terrible problems with pollution? Do you get involved in that kind of thing?

A: The Corps doesn't really get involved except in whatever they're doing to help EPA. At one time water quality was a project purpose. You could estimate, well you kind of assumed, that whatever you spent for storage for water quality you could recapture in benefits. You didn't have a good way of estimating the benefits that derived from it, but it was kind of like water supply. You figured that if anybody wanted it and was willing to pay for it, why it was worth the money it cost.

But for a while there we were able to add water quality to projects and give some gross estimate of what the benefits would be by diluting the downstream water. People would be dumping effluent into the stream, and by putting better water in it from the reservoir, then you would reduce the contamination of the river downstream.

Some rivers may not have any oxygen in them, for example, or very little oxygen. If you put in water from a reservoir that has a lot of oxygen in it, then the fish can survive and

things like--and so you save fish lives and that sort of thing. But then after a while they decided that dilution was not a solution.

Q: Yes, we talked about that one before.

A: So we really didn't do a lot of work in water quality outside of the reservoirs. What do you do to control these people that are dumping a pollutant into the river? That's really primarily an EPA responsibility.

The Chesapeake Bay

Q: We were talking yesterday about wetlands. What about the Chesapeake, did you ever get involved with the Chesapeake, those issues?

A: Well, we had a Chesapeake Bay Model, hydraulic model, that was built. I don't know, you might have been familiar with that. Maybe you haven't been over there. Were you ever over to that?

Q: I never was, but I certainly know about it.

A: Well, that was a big expense. They did try to redo nature in a small building, in a relatively small building, and put the Chesapeake Bay in a little building and try to determine what happened when pollutants went in one area and how would they impact other parts of the bay. They got a lot of good information, but still it was at a scale where you couldn't do the kind of things you really needed to do in order to do experiments because you couldn't actually reproduce nature in that small of a scale. So it's hard to really know for sure what is happening.

They had a hard time maintaining the gauge controls, sediment and things like that, a little bit means a lot if the gauge isn't perfectly the same all the time, why then the data isn't worth much. They had some problems like that with it. But there were quite a few experiments done there, and they finally gave up on it.

But, well, the Baltimore District has been involved in activities in the Chesapeake Bay for a long time, working with the states and other Federal agencies trying to do things that would help preserve the bay and to keep water pollution out of there. But it's kind of a losing battle, I guess.

Q: Because you've got so many points of entry on the bay?

A: Can't police it all. Well, it's not just the coming in the bay but with all the boating and so forth you get a lot of pollution in from that.

But it's, I don't know, it's been a big effort. It has been for a long time to do all they can and try to figure out ways to enhance the bay and keep it pristine, or they'd like to keep it pristine, but there is no way they can do it.

Q: But as a hydrologist, is the bay a major concern to the Corps of Engineers hydrologists or has it mostly been the area's pollution problems?

A: It's primarily a pollution area, water quality type.

Q: Because it's big enough to take anything that comes in there, I guess.

A: Oh yes. Flood control wise it's not a. . .

Q: No problem?

A: No problems there, no.

More About People: Hans Einstein

Q: I want to go back and ask you about a few more people and see if you can give me some comments on them. Did you have anything to do with Hans Einstein at all?

A: No, I didn't have much to do with him. Some of the hydraulics people. . .

Q: He was more in hydraulics then?

A: He was more in hydraulics, but I never had any personal dealings with him.

Jerry Ackerman

Q: How about Jerry Ackerman?

A: Jerry Ackerman, yes I knew him. I had a few committees that I worked on with him. Now, are you talking about the Ackerman that was in MRD or are you talking about the Ackerman that worked for the Illinois State Water?

Q: No, this was the one that was in MRD, and I guess he was in OCE at one time, too.

A: He was Chief of Engineering in MRD. But I don't think he was ever, to my knowledge, he was never in OCE. But he followed Wendell Johnson, I think, or closely after Wendell Johnson was Chief of Engineering at MRD. He was a good man too.

Joe Caldwell

Q: How about Joe Caldwell?

A: He was a prince of a man. He was a kind of guy who really worried about taking care of his employees--he got to be Chief of Engineering for a while there. He really didn't have the right background for that job. He had the personality for it, but his background was primarily coastal. He designed coastal structures and that sort of thing.

He really hadn't been much involved in major darns and levees and things like that, so that he was missing a lot of the background he probably should have had as Chief of Engineering. But he really knew how to deal with people, and he could pick up on things real quickly. It didn't take him long to learn once he had a chance. But, it's tough when you go into a top position like that, it's not a very good place to be learning.

Q: Yes, it's a little late, isn't it?

A: It's kind of tough to have to be getting the basics on a lot of the things. But he was really a great man as far as I was concerned. He knew a lot of the important people in Congress because of his background down in Mississippi, Jamie Whitten mouse of Representatives, Chairman of the Appropriations Committee] and people like that, why he patted them on the back. They'd have a hearing or something over there, and he'd walk in the room and, some of the prominent Senators and Congressman, say, "Hey, Joe how ya doing?" It would make the generals feel a little inadequate.

But he got around a lot, and he knew a lot of people and everybody liked him. I don't know anybody that didn't like him. If you worked for him and he knew who you were, if you went to a retirement party or something like that, you didn't see him standing there next to the general all night. Like a lot of the top civilian people would spend most of their evening talking with the Director of Civil Works or the Deputy Chief of Engineers or something. But not Joe. He'd talk to them, but he'd spend as much time going around visiting with all of his staff and other people as he did with the most prominent people.

Q: So he came out of LMVD, then?

A: He worked at the Coastal [Engineering] Research Center for a long time. He was in charge, when it was here in Washington.

Q: Down at Fort Belvoir?

A: No, before that. Up at. . .

Q: Oh, up at Dalecarlia?

A: Dalecarlia. That was when he was in charge of it up there. I don't know--I think it moved after he left there. I'm trying to remember, I'm not sure, but I think it did.

Q: It moved to Vicksburg, Mississippi, in '83.

A: '83, is that when it moved.

Q: Well, it moved from Fort Belvoir in '83.

A: Oh, from Fort Belvoir.

Q: I think it moved down from there in like 1970 or something. Because the Kingman Building was built in 1970, and that was CERC's building.

A: Okay, 1970. Okay, well, he was Chief of Engineering a couple of years after that or a year or so after that. So he couldn't of been Chief when it was down there, I don't think. They had a tough time finding somebody that would come in at that time. They couldn't get some of the division--people who were Chiefs of Engineering in division offices didn't want to come into Washington.

At that time they weren't putting as much pressure on them to do what the Chief wanted them to do. Since then they've been a little more forceful in getting people from field offices to do what they want them to do. They tell them, "Well, you're going to move into Washington." It wasn't a question of whether you wanted to or not necessarily.

Q: That's all part of professional development or engineering career program, isn't it?

A: Well, some of them, they just pretty well twisted their arm and said, "Hey, either you come in here or you're in trouble as far as working for the Corps of Engineers is concerned."

Q: Then go work for somebody else.

A: I don't know that they actually told them that they'd fire them, but they intimated that they might as well forget about their careers in the Corps of Engineers.

Homer Willis

Q: Well, that's a relatively strong statement. How about Homer Willis?

A: Well, Homer Willis--he was Wendell Johnson's assistant. Homer was in the project development branch when he was in Washington. He had some hydrology experience when he was in the field, but he didn't really have much real technical engineering background. He was more of the project management type thing than processing reports and that kind of stuff before he got to be Assistant Chief of Engineering for Wendell.

Wendell didn't use him as an Assistant Chief. When he was gone, Homer didn't get to make decisions. There weren't any decisions made when Wendell was gone. Wendell would make them when he got back. So Homer passed the paper, but he didn't make the major technical engineering decisions at that time.

But, when Wendell retired, he tried to be a Chief of Engineering and he got in trouble with, I don't know, General Groves [Brigadier General, later Lieutenant General, Richard H. Groves, Deputy Director of Civil Works, January 1969-July 1971, I guess it was. He really worked him over the coals because Homer tried to do some things that needed to be done in Engineering, and General Groves was all over him. So he didn't get much accomplished when he was acting, and then he went down to LMVD and became Chief of Engineering down there. And boy he served under some tough generals down there, and so he just kind of lost it as far as having a lot of brass, you know, to get things done. He just didn't have the force to get things done that he had or that he tried to have to begin with.

He lost a lot of his strength, I think, when he was down there, his inner, you know, [due to] his action with General Groves. He just figured, I guess, that it didn't pay to fight generals. So I don't think he was anywhere near the kind of a Chief of Engineering that the people before him and after him had been. While he tried hard, he didn't have the right kind of a personality, and he didn't have the reputation and all that kind of stuff that he needed to do the job. So it was tough on him.

He was in there and had a bad time, too, when the dam safety program was on. There was a lot of controversy about it. People didn't look at him like they did Wendell Johnson or Slichter or any of the others. They just didn't have the same kind of respect for his judgment on professional engineering decisions.

Q: So for the time you spent in the headquarters, you seemed to be leaning toward Wendell Johnson as the top Chief of Engineering Division.

A: Well, I had an awful lot of respect for Lloyd Duscha. I worked a lot closer with Lloyd Duscha than I did with Wendell. When Wendell was in there, Al Cochran did most of the close meetings and so forth with Wendell. I didn't work as closely with him. But he had that kind of a charisma about him--Lloyd didn't quite have that kind of charisma.

But Lloyd had the technical capability, and he knew a lot about hydrology and hydraulics, even though he had never worked in Hydrology and Hydraulics. He could understand when I'd explain problems to him. But a lot of the other Chiefs of Engineering weren't all that hip on it. He was a hell of a good man all the way around. It's just that he didn't have that magnetism that some of the people have about them. He was adequate but as far as socializing and all that stuff; he just didn't stand out, I don't think, like some of the others did. Like Joe Tofani, like we were talking about.

Joe Tofani

Q: Well, there are very few people like Joe Tofani around.

A: I mean he'd walk into a room, and Joe is the center of attraction no matter where you go.

Q: Or he'll make himself the center of attraction.

A: Well, Lloyd wasn't like that. He was kind of quiet, and he could be in a room and nobody would even notice him. But Wendell Johnson was in a room or Joe or somebody like that, by God, you knew they were there. If you didn't, why there was something wrong with you.

Q: I think we're about at the end of my questions. Is there anything else that you'd like to discuss that we haven't touched on? We've touched on pretty many things.

A: Well, I can't think of anything really off hand. Somehow that theme of keeping H&H healthy and independent as much as possible is something I'd like to see continued forever, as long as they have a need for it. In our lifetime, why there's going to be a need for hydrology and hydraulics for sure. And forever.

Q: Oh yes, I wouldn't doubt that--as long as we have water and rain.

A: As long as you're trying to do anything with the water. But I have been happy with my choice of a profession. When I first started to work out of college, I had a choice of working in different areas. I decided that hydrology had the most to offer in terms of interesting work and everything wasn't cut and dried, you had room for vision, new ideas, and concepts.

Whereas, some of the other areas of engineering are more tied down, and it's more of a textbook type approach. The standards are already there, and they use certain size loadings and certain size, how much strength. Whereas in different types of materials, you didn't have to try to come up with your own concepts or anything like that, it had already been done for you as long as you knew what the rules were.

The Fort Worth District and Water Losses

But, anyway, it's been interesting, I think. I've never really been bored in any of the time I've been working in it. Even today we run into new problems and trying to figure out how to do things. We've got a tough one right now we're working on with the Fort Worth District, trying to do the right kind of hydrology for a river basin down there which has some apparent large losses, which the district is having a hard time recognizing. We're having a hard time trying to decide what they should be because we don't know enough about the local area except we do know there are major problems with trying to get a good frequency analysis down there.

Q: What do you mean by major apparent large losses? Is it water?

A: It's the water. There are some streams where there are underground canyons, like almost where a lot of the water will disappear from the river and then reappear later on downstream. So there is an underground channel there someplace, flowing underground, and these can be large quantities of water in some places. But this one we don't know enough about to know what it is. Nobody has really got into it to check it out in great detail or anything.

But we see by looking at the historical flow at the gauge upstream and then we look downstream and there hasn't been enough *rain to cause an increase in flow. Yet the flow downstream from this station is much greater than this one. Where is the water coming from? Well, there was a lot of flow up here. It seemed to disappear when it got here and then reappear down here. Trying to figure out just how much it's going to be under different circumstances and that sort of thing when you don't have much to work with, you're doing a lot of guesswork. You're trying to develop a model that will show this stream up here with a lot of water and then less water here and then more water back down here, and it doesn't follow your normal run-off procedures, where so much rain falls on the land and you estimate the losses and then you make a hydrograph out of it. You have procedures for doing all that. But you don't really have good procedures when the water disappears and comes back in.

Q: Now what river is this?

A: This is the Ciblo River down in Texas. But it's an interesting study, and Fort Worth District wants to approach it one way and we think that maybe they ought to try another way. We're trying to get them to do a little more than they want to do. It costs money

to do it. It takes a lot of time and effort, and FEMA isn't giving them enough money to do all of the stuff that we'd like to see them do. So I don't know how it's going to come up.

Q: That's the kind of thing you were talking about though--it keeps you interested.

A: Oh yes, it's a challenge to figure out how we're going to solve this problem, how are we going to get together on this thing. How can you come up with convincing arguments for doing things and give them enough information, enough evidence, to say, "Hey, this ought to be studied and that type of thing." So it keeps you really on your toes, even after you've been fooling around with the stuff as long as I have, you're still running into new things that you haven't had a chance to study or look at before.

Part of it is just having data to work with. In this particular project, why we didn't have hardly any data to work with except a few stream flows. But since the Fort Worth District has been working on it, they've submitted the material to us with reams of basic data that we could work with and puzzle over and try to decide what way to use it. It may be different from the way they use it.

But in this particular basin, they have three or four counties that all have different ideas about what they want for a floodplain. Some of the communities want to be real restrictive and have a high, a big 100-year flood. Others don't want to be restrictive, and they are not going to have the flood large. One county down there passed a law and said this is going to be the 100-year flood, even though they didn't really know how they got it. But, I think, they were quite a bit bigger than some of the other people. They said this is it in our county. So you can't build anything below this level.

What we're trying to do now is, or what FEMA is trying to do, is resolve these differences so that you don't have one flow when it's going through this county as the 100-year flood and then when you leave the county boundary; it jumps way up. So those are the kind of problems you run into.

Well, they had some pretty prominent people make suggestions on how to solve the problem. Who knows which one is right, or if any of them are right, on how to do it because none of them had spent a great deal of time. They come up with statistical procedures that are different than the other guy's statistical procedure and say, "Well, this will do a better job of representing the data than the first one." How could you prove that it does?

What we're trying to do is study the problem from more than one angle and then come up with a composite answer that's reached by adjusting and modifying both approaches until they merge together into the same answer.

Q: And then you get them to accept it?

A: And then get somebody to accept it, get everybody to accept it, you know, that what you did was the best way to do it.

Q: Which is the greatest challenge you're going to have?

A: Well, of course, FEMA really has the ultimate authority here in saying, "Well, this is what we're going to use." Then if anybody doesn't like it, they'll have to take them to court and prove they're wrong and that's hard to do. But still, they'd like to have as good an answer as they can get without spending a fortune.

Q: So it comes down to dollars?

A: Oh yes. There is not unlimited resources in any of these agencies or projects.

Final Thoughts

Q: Anything else you want to talk about. As I said, you're going to have another opportunity at this, so this isn't the end of it.

A: Well, I'll get a chance to review it, and hope I didn't say anything too derogatory about anybody.

Q: I don't think so, it doesn't sound like it.

A: I mean the people that work for the Corps, by and large, most of the ones that I've run into were all very competent people. If they made mistakes, they were honest mistakes in most cases. Oh, once in a while you'll find somebody that did things deliberately to serve a purpose. But sooner or later they usually get found out, and they fall by the wayside.

This business of government employees being lazy and not competent and all that stuff, I've never run into that in the professional side. Most everybody that I run into were pretty conscientious and intelligent and really wanted to do their job right.

Q: Well, there are enough organizational levels and layers in the Corps that the good people will naturally percolate up, I think. This whole professional development program that they have for engineers with the levels of responsibility and the movement of people around is a very good program. I think that's a very good idea.

A: It worked out before somewhat like that, even kind of on an ad hoc basis people would get their own training by moving around because they couldn't get a promotion here. They'd say, "Well, how do you get promotions." The way to get promotions is to move to another office because the office you're in, they think you're going to stay there forever.

You can threaten to leave and that doesn't make any difference. Then after you tell them you have a job someplace else, "Oh, you shouldn't have left, we would have given you a promotion here." But that's the way it works, so that there are a lot of people that have to move around to different jobs just because they were trying to advance their career.

But the people that were so intent on staying in one location, they didn't usually advance very far. They had to really be outstanding to advance and stay in the same place because there was so many people willing to move to another location.

Q: Who had a variety of experience?

A: Oh, I was really fortunate when I was in Garrison District before Icame into Washington because when I got in that Hydrology and Hydraulics Branch, I worked in the hydrology section for awhile doing all different types of hydrology studies. Then I moved over into the report section, which was really a planning job, and I worked there for a while.

Then I moved in the hydraulic design section and worked there for some time before I finally went into Washington. So I got really a good variety in a relatively short time, which most people don't get. Usually, you get stuck in one area and you have to stay there for quite a while before you get any new experience.

Q: Yes, that's a valuable thing to have, that breadth of experience early in a career.

A: Well, I think that's one of the reasons that Al hired me without even talking to me, because I had had enough experience in various types of hydrology and planning and that sort of thing before I ever came into Washington. So I could review projects and know enough about them that I could make the intelligent choices.

Well, I hope you get enough information here--I've always thought it was kind of a shame that people with all this knowledge, like Al Cochran and some of them, really didn't get their ideas and thoughts and so forth on tape or paper some place so that other people wouldn't have to make all the mistakes they had to or that they had to go through.

Q: Well, this is a new effort. Though they were working on civilworks people before, they had not made an effort to really work on the people in hydrology and hydraulic engineering at all, especially hydrology. So there are many more that we're probably going to be talking to. I have the names that you gave me.

A: Well, there are a lot of them around yet--maybe not working in the business anymore, but they still have their memories. Maybe a lot of them have collections of material that would be useful.

Q: No, we're going to go after them. I want to thank you for your cooperation.

A: Well, I've enjoyed talking about it. I know Jake [Douma] before he retired [said], "You know it's too bad that the Corps doesn't have some plan where they can take guys like me and let them have an office, some space, in the office. Don't pay me any money but let me come to the office and work on things that I'd enjoy working on and do things I want to do. I would contribute to answering questions and things like that and all they'd have to do is provide me some space," he says. "I could come and go when I felt like it. I think that would be a good thing for the Corps and carry over information and concepts from one generation to the next."

Q: I think these interviews will do that because they will be useful. A lot of them will be printed and published, and they'll be used for study, too.

A: Well, the job I have now is kind of like this thing that Jake was talking about. Dewberry & Davis pays me for sitting at a desk and working on special projects and having the young engineers, when they don't know how to do something come and talk to me and

find out how to do it. I give them my ideas on how to do it, and then they go ahead and work until they're stuck again and then they come and ask more questions.

Personally I find that it's better training for them than to give them a formal course on various aspects of hydrology that they may not be using for a long time. So what I try to do is give them good information on a particular problem that they're working on so they can learn that particular problem.

Then when it comes time for the next problem, why we'll teach them about that one. Because you can teach them a lot of stuff they never will use and spend a lot of time doing it. By the time they come around to using it, they may have forgotten everything you told them in the first place.

Q: Yes, the practical things they will learn and will remember rather than the book learning.

A: And they have to do it and do a little book learning on where the technology is published.

Q: Thank you very much.