ORAL HISTORY INTERVIEWS

HAROLD G. ARTHUR

1994 AND 1995
Denver, Colorado

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STATUS OF INTERVIEWS:
OPEN FOR RESEARCH

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Interviews Conducted by:
Brit Allan Storey
Senior Historian
Bureau of Reclamation

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Oral History Program
Bureau of Reclamation
Original Printing: 2000
Reformatted and Revised by Brit Storey, January 2010

SUGGESTED CITATION:

> **ARTHUR, HAROLD G.** ORAL HISTORY INTERVIEW. Transcript of tape-recorded Bureau of Reclamation Oral History Interviews conducted by Brit Allan Story, senior historian, Bureau of Reclamation, during 1994 and 1995, in Denver, Colorado. Transcription by Barbara Heginbottom Jardee, Jardee Transcription, Tucson, Arizona. Edited by Brit Allan Storey. Repository for the record copy of the interview transcript is the National Archives and Records Administration in College Park, Maryland.

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Harold G. Arthur

INTERVIEWER: Brit Allan Storey
Brit Allan Storey

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Introduction

In 1988 Reclamation hired Brit Allan Storey as the bureau's senior historian to create a history program and work in the cultural resources management program of the agency. While headquartered in Denver, the history program was developed as a bureau-wide program. Since 1994 the senior historian has been on the staff of the commissioner, Bureau of Reclamation, in the Program Analysis Office in Denver.

Over the years, the history program has developed and enlarged, and one component of Reclamation's history program is its oral history activity. The primary objectives of Reclamation's oral history activities are: Preservation of historical data not normally available through Reclamation records (supplementing already available data on the whole range of Reclamation's history); making the preserved data available to researchers inside and outside Reclamation. It is also hoped that the oral history activity may result in at least one publication sometime after 2000.

The senior historian of the Bureau of Reclamation developed and directs the oral history activity, and questions, comments, and suggestions may be addressed to the senior historian.

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Oral History Interview:
Harold G. Arthur

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold G. Arthur, former chief engineer of the Bureau of Reclamation, at his home in Denver, Colorado, at about nine o'clock in the morning on December 21, 1994. This is Tape 1.

Mr. Arthur, I'd like to ask you where you were born and raised and educated, and how you ended up at the Bureau of Reclamation.

Born in Lead, South Dakota

Arthur: Well, I was born in Lead, South Dakota, up in the Black Hills, which is the home of the Homestake Mine, the largest gold producer in North America, as a matter of fact. And August 23, 1914, which makes me just past eighty years old at this time.

I Wanted to Be an Engineer or an Attorney

I was graduated from high school there in 1931. From the time I was probably about in the eighth grade, I decided I wanted to be an engineer or an attorney. The decision was made basically on an economic basis. You could become an engineer in four years, it took longer than that to become a lawyer. So I decided that I would pursue an engineering career.

My Father Worked for the Homestake Mine and I Was Given a Summer Job There Because I Was Planning to Go to College

My father was employed by the Homestake Mine for many years. The Homestake Mine had a policy of offering summer employment to the sons of employees. I'm talking about the darkest days of the Depression, 1931, when I got out of high school, and it was very difficult to find any kind of a job. But the Homestake Mine would employ the sons of employees *who* intended to go to college. They gave preference to those who would attend the South Dakota School of Mines in Rapid City, and they would give *higher* preference to those who were going to study mining engineering. Well, I wasn't interested in mining engineering. I was interested in civil engineering, which was offered by the School of Mines, but I did want to study that, and I was willing to go to the School of Mines, which is only about fifty miles from Lead. So I was given summer employment by the mining company, which enabled me to have a college education, because my father didn't

have the financial resources to do this without my working part-time. So I went to the School of Mines and I was graduated from there with a Bachelor of Science degree in civil engineering in 1935.

I Went on the Road Looking for a Job

As soon as I was graduated–well, in fact, before I was graduated–I was looking for a job, and sending out letters of application. I wouldn't say "résumés" because I didn't have anything to résumé!, but sending out letters of application to every agency that hired civil engineers. I didn't get many responses. Most responses that I got were negative. So I started out to make a little trip, and I left the Black Hills and Lead, South Dakota, and I went south down to Nebraska, where they were building a dam on I think it was the Loup River, by I think it was called the Mid-State Conservancy District, or something like that. Anyway, it was a state-organized agency, and I applied for a job there.

At Casper, Wyoming, I Applied for Work on the Casper-Alcova Project

I went to Cheyenne, Wyoming, and visited the Highway Department there, in the capitol and applied for a job there. And then I went up to Casper, Wyoming, to visit a sister who was living in Casper at that time. And there was a field office of the Bureau of Reclamation on the Casper-Alcova Project, which was just getting underway at that time. The name was later changed to the Kendrick Project, and I applied for a job there. I was told that they were hiring only local people, only Wyoming graduates to take a job there at that time. I said, "Well, I am a Wyoming resident." Well, the question was, Why did I go to the School of Mines in South Dakota, instead of the University of Wyoming? My brash answer was, "Well, I thought it was a better school." (both chuckle) And to establish my residency in Wyoming, I gave my sister's address, and said that I was living with her.

Went to Work for the South Dakota State Highway Commission

I returned back to my home in Lead, and later on in that summer, probably around the first of July, I got an offer of a job from the South Dakota State Highway Commission, one of the agencies I had written to. They offered me a job in Eastern South Dakota, on the Highway Department, and my title was a rodman. A rodman is part of a survey gang, of course. And I took that job and worked there, checking gravel–inspecting, that is–inspecting the application of gravel on some secondary roads, and did some work on traffic surveys where I would stand at an intersection out in the country and stop all the cars, ask them where they came from and where they were going, and this sort of thing. This could get you shot these days!

(chuckles) (**Storey:** Um-hmm.) But anyway, this was trying to establish traffic patterns so the State can determine which roads should be improved and that sort of thing. And I did this until about October. I was told this was a temporary, summer job, and would be terminated as soon as the weather closed down.

Offered Job by Bureau of Reclamation

Along about in October I got a telegram from my sister in Casper, who didn't know–I'd never communicated with her, she didn't know how to get in touch with me by phone–I was living in a boarding house. So she got my address from my mother and sent me a telegram. And what had happened is somebody from the Casper office of the Bureau of Reclamation had knocked on the door up there in Casper, Wyoming, "Is Harold Arthur here?"

"No, not here right now."

"Well, I'm from the Bureau of Reclamation and we have a job for him. He applied for a job, and he can go to work, provided he's here at eight o'clock next Monday morning." This was on a Friday, I think, a Thursday or a Friday. So she sent me this telegram that I was being offered a job. The job I was being offered was chain man at $100 a month. Western Union was not familiar with the word "chain man." They had no concept that that was a title. So the telegram read that I was being offered a job as "Chairman" of the Bureau of Reclamation at $1,200 per annum. Well, as I said later, the pay wasn't very good, but the title was really great, so I accepted the job! (laughter)

I got in touch with my boss there at the Highway Department and I explained that I had this offer, and of course I hated to leave without any notice. And he said, "Well, Harold, you know this is just a temporary job. You're going to be out of work in about a month anyway. I would certainly take that job. It won't be anything to your discredit to leave without notice. I certainly understand why you should do that." So I had a car and I jumped in my car, and Monday morning I reported for work on the Casper-Alcova Project. That's how I got started with the Bureau of Reclamation.

Working for the Homestake Mine Company

Storey: Tell me about your summer job at the Homestake Mine Company. What did you do?

Arthur: Well, I had several jobs: I worked for them for five summers. One summer I worked in the mill where the ore was crushed and the gold was extracted, so forth. And my job was to help, to do anything that was asked of me, but on the special days when they were what they called "cleaning up" or scraping the plates of the amalgam–and I could spend all day telling you about this process.

Storey: Please do! (laughter)

"Cleaning Up" or Scraping the Plates of the Amalgam in the Homestake Gold Mill

Arthur: Well, the ore was dumped into a hopper at the top of the mill, which is way up on the top of the hillside, and it was crushed by stamps which were cast iron cylinders that were moved up and down to crush the rock as it was fed underneath. Then as the rock was crushed, by flushing–it was swept over plates on an incline, inclined plates that were about ten feet wide and twenty feet long. These were copper plates that had been silver-plated, electrolytically, and after being silver-plated, they were coated with mercury. And then as this crushed ore was flushed over these plates, the mercury had a greater affinity for gold than it did for silver, so all the gold that was free gold, that was traversing over the surface, was latched-onto by the mercury, and you got a combination of gold and mercury, coating, on the surface of these plates. Periodically, once every two weeks, these plates would be scraped by hand, to clean off the amalgam. So you'd end up with a mixture of gold and mercury, and it'd be similar to the stuff that they use for fillings in your teeth, only it'd be gold instead of silver. Then that would go to the refinery, and at the refinery, they would heat the mixture and evaporate off the mercury. They would condense it and save the mercury for further use, of course, because it was valuable. But you'd end up with essentially pure gold. Then this gold would be melted and poured into bricks and ingots and then they'd be shipped to the Denver Mint.

So the summer I worked in the mill, I would help on this cleanup. But that only happened once every two weeks, so the rest of the time I would sweep floors and wash windows. I washed more windows than I ever care to see. (laughs) And most of these windows hadn't been washed for maybe fifteen or twenty years–they were really dirty.

Worked in Refining the Gold

Then I also, other summers, I worked in the refinery process that I just described, where I helped in the cleanup and in refining the gold. The gold in the Homestake was "free" gold, it was recovered by the mercury process, and it was also

in a chemical composition that had to be dissolved and was done with a cyanide process. That formed a precipitate, and that was handled separately in a different process than the mercury–about half the gold came each way. Well, I worked on that end of it also. It was a very dirty job. The company furnished us our outer clothing when we were working on the precipitate. They would furnish us with overalls and shirts and stuff like this, and when they got so dirty that they stood up by themselves, they would burn them. And they said each garment, change of clothing, would hold about a thousand dollars' worth of gold dust, so that's why they furnished the clothes, see, so they could burn them and recover the gold.

One Summer Worked Digging Water Ditches

Then one summer I worked digging water ditches, and I got on the gang that they hired all the high school juniors and seniors who were on the football team, and they wanted to condition them for the coming football season. I joined that gang, and we dug water ditches, and most of that was in very rocky ground, very hard work. Well anyway, that's how I worked during my summers. The work was hard enough, and boring enough so that I was *always* glad to go back to school. (laughs)

Father Didn't Want Him to Work Underground

My father had worked underground, and he'd worked in the Coeur d'Alene mining district in Idaho and the Cripple Creek district in Colorado, before going to the Homestake Gold Mine. He had contracted what they called miner's consumption, now called silicosis, which killed him at the age of fifty-six–he was a young man when he died. But he didn't want me to go underground because of the dangers of silicosis and accidents. And also, because I would make too much money. You know, when you're a young fellow and you start making quite a bit of money, it's pretty hard to walk away from it and go back to school. So he didn't want me to make enough money so I'd be tempted not to go to school–and I never was, because I was working as a common laborer, and as I say, the work was such that I was always glad to go back to school. So that's pretty much my career with the Homestake Mining Company.

Storey: What kind of security did they have, to avoid people walking off with gold or ore or anything?

Arthur: Well, they didn't have any security for the ore, because the ore there is low grade, and at that time, it would run around ten dollars' worth of gold in a ton of rock. So they weren't worried. It'd be a long time before you could take ten dollars' worth of

gold out of there.

Storey: Roughly a third of an ounce?

Arthur: A half an ounce. It was $20.56 an ounce, I think it was, in those days. Roosevelt raised the price to $35.00, but this was before his time.

But it was an interesting situation. The town of Lead never suffered a depression, because the price of gold was $20.67 an ounce, and they were making a little bit of money–not much, but they were making *some* money. Say they were making $2.00 an ounce. Roosevelt raised the price to $34.00, so all of a sudden instead of making $2.00 an ounce, they're making *$16.00* an ounce, except the cost of production has gone down because of the Depression–dynamite's getting cheaper, and so on and so forth. So instead of making $2.00 an ounce, you're making $20.00 an ounce. So instead of the stock selling for $38.00 a share, it goes to $640.00 a share. This is in the Depression! The market fell out. When you could buy General Motors for *nothing*, Homestake was selling for that kind of money. (chuckles)

Storey: What about security on the refinery?

Arthur: Well, when you got down to where the gold was concentrated, where valuable amounts were in small amounts, it was under armed guard. It was all under surveillance.

Storey: All the time, and you worked in that situation. Did you work on the process of retorting off the mercury? (**Arthur:** Yes.) What kind of safety precautions did they have? Mercury and cyanide are pretty dangerous substances!

Arthur: You bet they are.

Storey: And the impression I've always had is that silicosis has only recently been recognized. But it seems your dad and I presume others had already recognized it at that point.

Arthur: Well, it was called miner's consumption. I'm not sure that they knew just what was causing it. But I think they had a pretty good idea, because when my father was in the mine, he was a shift boss in the mine. A miner would be fired immediately, be terminated immediately, if he were caught drilling dry. Now let me explain what that term means. (**Storey:** Please.) In the mining process, of course, they drill holes to put the dynamite in, the explosive in, and then to blow up the rock and so

forth. The drill bits are steel–they just used diamond bits for getting cores when they're exploring–but in production, they use hardened steel bits that are sharpened at regular intervals, and these are put in machines like jack hammers that pound and rotate and gradually drill a hole. Well, the drill steel has a hole through the center of it, and water is introduced into the drill so that water goes down through the drill bit to the hole, and you're not drilling dust, but you're getting mud because of the water. You know, you've seen them out running the jackhammer, breaking pavement and stuff. (**Storey:** Sure.) The dust comes up and so forth. Well there, they add the water to keep the dust down. Well, this was not a very comfortable situation, working in the mud, to have this mud coming back, and you're standing in the mud and so on and so forth. So as a matter of convenience, many of the miners preferred to drill dry, drill without the water. But they would be fired for this, and it was known that the dust was injurious to their health.

Storey: What about the mercury and cyanide?

Arthur: Well, in the mercury, I don't know that any real special precautions were taken when they were applying the mercury. I don't remember how they put the mercury on the plates. In the refining end of it, it was retorted in the furnace. The mercury was evaporated and the fumes went off into pipes and it was condensed, so at the other end, it's like distilling–it *was* distilling. At the other end you had mercury dripping into the iron flasks in which it was kept. So there wasn't any exposure to the fumes. But you know, I don't think the dangers of mercury were recognized so much in those days. I remember I had a test tube half full of mercury that I got in the chemistry lab in high school, that I had at home. I used to just kind of play with it and stuff like that, and never thought anything too much about it. And I read in the paper last week there was a little bit of mercury spilled and they closed down the whole doggone school! Did you see that in the paper? (**Storey:** No, I didn't.) They closed down the school and had a team in there to detoxify it. It was really (chuckles) a big deal. How times have changed on that!

Storey: Well, I remember in our chemistry class, for instance, having it out on the counter and touching it and watching it roll around and that kind of stuff. And we thought nothing of it.

Arthur: Right, right. They were careful with the cyanide. It was realized that it was a very corrosive acid, very poisonous.

Storey: Well, after you had done that, you went to work for the Highway Department.

Arthur: Right.

The Roads of South Dakota in 1935-1936

Storey: That would have been '35, or '36. (**Arthur:** 1935.) What were the roads like in South Dakota, that you were doing these surveys on, and so on?

Inspecting Gravel Work on State Roads

Arthur: Well, the main drags, what are now Interstates, were mostly two-lane paved roads. But the roads I was working on were secondary roads, and they were just gravel surfaced. And the secondary roads required so much gravel per mile, to be placed on the road, so each contractor that was hauling the gravel in the trucks, each truck had painted on the side of it, what its capacity would be, or was. And my job was to see that when those trucks came on wherever they were dumping gravel, where the road was being graveled, that the trucks were full. Now the capacity was based on the level, full, but the gravel, of course, was heaped up, and not leveled off. So it was my duty to judge whether the heaped up would be enough to fill the corners, so essentially I was getting a full load of gravel. And of course the drivers would try to haul less than a full load if they could get by with it, because it cost them less to haul it. So they'd be very happy to bring you an empty load if they could get by with it. So I would look at the extent of their load, and if I figured they had a full load, I would give them a ticket, on which I certified that they had brought, [say,][12] 4.2 cubic yards of gravel. And if I thought they were a little shy, I'd said, "Hey, you didn't give me a full load here, I'm going to dock you some," and I'd give them 3½ yards. Or if it's flagrant, I'd give them only half a load, in my judgement. And then the road was staked–every hundred feet there was a stake, so I knew how much gravel was supposed to go between this stake and this stake. So when this truck came up, and he had so many yards of gravel, I'd say, "Start dumping and get away fast," or "Dump and go slow," depending on whether I was trying to get more gravel or less gravel, because I wanted to get a certain *amount* of gravel every hundred feet. A very responsible job for a graduate civil engineer! (laughter)

1. Editorial notes. Use of brackets in the text of this transcript indicates material not on the original tape recording and is intended to clarify the interviewee's meaning for the text. Strikeout of text removes something that is on the original tape recording but that confuses the meaning of the interviewee. Use of parentheses indicates something that is on the original tape recording, e.g., laughter or a brief comment. The general principle used in transcription herein is that false starts, unnecessary nervous interjections like "I said" and "huh" are not included.
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Storey: Well, it sounds like a lot of other jobs I've heard about, during these interviews, though.

Arthur: Oh yeah, and I was working at nights, too, this being the greenest man on the job, you always got the worst shifts, you know, and they were doing this around the clock, so I'd work at night, and I had a gasoline lantern, and I'd get up on the wheel of the truck and hold the lantern up and look into the truck bed to see (laughs) if he had a full load or not.

Storey: What about when you were doing the traffic surveys? Did you find anything interesting then?

Arthur: No, that was pretty boring. I was assigned that job because I had a car, and fortunately I had a radio, because I was out there where maybe it'd be ten minutes between cars. You know, it wasn't heavy traffic. But I'd be out there for twelve hours, so [I'd] get stuff to read and listen to the radio between cars.

Storey: I forgot to ask you about hours. What kind of hours did you work when you were inspecting the gravel trucks?

Arthur: Twelve.

Storey: Twelve-hour days. How many days a week?

Arthur: Five.

Storey: Do you remember what you were paid by the South Dakota Highway Department?

Arthur: Yes, of course, $110.00 a month.

Storey: More than Reclamation offered you!

Arthur: Yes.

Storey: But you knew it was a temporary job.

Arthur: Yeah, that's right.

Storey: How many hours did you work when you were working for Homestake?

Arthur: I worked a forty-hour week.

Storey: Five 8-hour days?

Arthur: Yes.

Working on the Casper-Alcova Project

Storey: Oh, okay. Tell me about what a chain man did at the Casper-Alcova Project.

Arthur: (chuckles) Well, the survey party consists of a man who runs the transit or the level–he's called an instrument man, and there's the fellow that holds the graduated rod so that elevations can be measured through the level. He's the rodman.

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BEGIN SIDE 2, TAPE 1. DECEMBER 21, 1994.

". . .in those days *all* those jobs were filled with graduate engineers. . . ."

Arthur: The rodman holds the . . . . I'm trying to think of a synonym for the word "rod." (chuckles) It's like a long yardstick. (**Storey:** Uh-huh, that's marked.) It's marked in feet and tenths of feet. It's used for measuring difference in elevations. And horizontal distances are measured with a steel tape, which is called a chain. And the guy that holds the front end of that is the head chain man, and the guy that holds the back end of it is the rear chain man. My title was chain man, but actually, you would do the other functions as well, since you'd had surveying in college and knew how to do all of the jobs. Everybody did everything. In those days–these are, of course, subprofessional jobs, so classified now–but in those days *all* those jobs were filled with graduate engineers. Because why would anybody hire a high school fellow when they could have a college graduate engineer for the same price? And there were a lot of them around.

Storey: Was there a foreman with the survey crew? Or how did that work?

Arthur: Usually the instrument man was called the party chief. He knew what the mission was, what they were supposed to be doing, and where "from here to there" was, and that sort of thing. Of course there are all types of surveys: there are topographic surveys, and there are land surveys, and there are surveys where you just run a line of levels, establishing benchmarks and that sort of thing–all require different instruments and different procedures.

Storey: What kind were you doing?

Working on a Survey on the Casper-Alcova Project

Arthur: Well, when I first went to work for the Bureau in Casper, in the first couple of months, I was out on the areas that were going to be irrigated some day, and we were running topographic surveys, mapping the area, and this was so that the canals could be located–they could choose the alignment of the canals and that sort of thing. So we were out just making these topographic surveys. And it was done by what they call a plane table. It was a table on a tripod, and the table was maybe three feet square. You actually drew the map in the field. You had a survey instrument called an alidade, and it would read . . . . You'd point that at a target, and if you had a straight edge, you could draw a line to it, and you would send the rodman out and say, "Go out by that tree out there." He'd go out there with a rod and with this instrument you could read how far away he was. This wasn't as precise as measuring it with a tape, but it was much faster, and you didn't have to get that much accuracy for this kind of work. So the telescope you're looking through has three horizontal cross hairs, and the intercept between the bottom hair and the top hair would relate to the distance. You'd read two feet there, you were 200 feet away, that sort of thing. If you read 1.4 feet, you were 140 feet away from him, that sort of thing. That's called a stadia–the stadia rod, the stadia survey.

I'd only been about two months there, and they awarded the prime contract on the Alcova Dam, which is about thirty-five miles out of Casper, on the North Platte River. And the diversion tunnel had been driven on a previous contract. They'd awarded the prime contract and they needed more inspectors on the construction. So I was transferred out to the dam project.

Transferred to Work on Construction Inspection

Storey: As an inspector?

Government Housing on the Casper-Alcova Project

Arthur: Right. And again, because I was low man on the totem pole, I was required to live on the job, live up there at Alcova. The government had built a couple of buildings–you'd call them shacks today–covered with tar paper and so forth, and one was an office where the resident engineer had his office, and then there were a couple of other rooms where the office engineer would do his computations and stuff, and a place to do a little drafting. And then there was a bunkhouse. This bunkhouse was actually two bedrooms, two units–each one was a big bedroom. And

in the room you had a coal-burning stove, and a bed, and a table, and some chairs. And that's where I lived.

Storey: This was government-provided housing?

". . . they started charging us a dollar-and-a-half a month for rent. . . ."

Arthur: Government-provided housing, but they furnished the coal. You had to go get it, there was a coal shed a little ways away, but they didn't charge for the coal, and you could have all the water you could carry, and they didn't charge for that. Down in the office building, they did have a shower room. They had a bathroom where you could take a shower. But you didn't have running water in your housing. But I lived there for a while, and they didn't charge any rent. Then they decided they had to charge something, so they started charging us a dollar-and-a-half a month for rent. I said it wasn't worth it. (laughter) But you know, we didn't know any better. (chuckles) Yeah, at these retirement luncheons, I still meet one of the guys that used to live next door out there at the Casper-Alcova Project.

Storey: What is his name?

Arthur: Ken McGibbon, —M-C-G-I-B-B-O-N.

Storey: What were you doing as an inspector out there?

Assisted with Office Engineering Responsibilities

Arthur: Just practically everything. Here again, the title was something for the payroll–it establishes your compensation and so forth. And actually, you did whatever had to be done. Since you were all college trained, you could do almost everything that was required along that line. One of my duties was to be assistant office engineer, and every month the survey gang made measurements to determine how much work the contractor had performed, how much excavation had been performed, how much embankment had been placed, how much concrete had been placed, how much steel had been placed, and all these things, because he received monthly payments. The office engineer was responsible for taking all the field notes from the survey party and computing the actual quantities. Well, towards the end of the month when this work started coming in, and of course the contractor didn't want to wait very long for his money, the office engineer needed some help. So I functioned as the assistant office engineer during those times.

Working on Inspection of Work

At other times I was on the inspection–I inspected on the concrete mixers. In those days we didn't have automatic recorders and everything like that, as they do *now* at concrete mixing plants. So I was there to watch the dials and see that the proper proportions were weighed, and see that the proper amount of cement was introduced into the mixer [for] each mix. And I would also periodically take samples of fresh concrete and perform a slump test to measure the consistency of the concrete, whether it was too fluid or too stiff. And I would also take cylinder samples of concrete, which would be cured for twenty-eight days, or seven days some of them, and then others twenty-eight days, and then broken in a compression machine to verify the strength of the concrete. (phone rings, tape turned off and on)

Storey: We were discussing your inspection work at Alcova.

Arthur: Well, I can tell you this, if they had concrete inspectors on the DIA [Denver International Airport] job, doing what I did at Alcova, there would never be any questions about the integrity of the concrete in the runways out there. They would have been properly inspected.

Storey: Did you actually run the lab tests, or was that a different crew?

Arthur: That was a different crew.

Storey: Was this an around-the-clock construction operation?

Arthur: Yes, it was.

Storey: So how many inspectors doing your kind of job would there have been, and how many doing concrete inspection for the lab and so on?

"One reason we had to live out there . . ."

Arthur: Well, we had a total of . . . . One reason we had to live out there–let me digress a moment here. One reason that we had to live out there–and there were five of us that lived out there on the job–was because the construction engineer/project engineer who lived in Casper thought that it would be bad public image to see government cars running around at night. So he didn't want the public seeing Bureau of Reclamation cars on the highway after dark. So the people who worked the night shift had to live on the job. This guy who was that circumspect was Harry W. Bashore, who later became Commissioner of Reclamation. He was the project engineer there at Casper, Wyoming, at the time I was hired.

The rest of the crew–as I say, five of us lived out there–and the rest of the staff . . . . Oh, I forgot the resident engineer! He lived out there too. So there were six of us who lived out there, and the rest of the crew was the size that could be transported in a station wagon. So that would be about eight more, no more than eight more, so there were about thirteen of us.

Storey: So you would be inspecting at the concrete mixing plant (**Arthur:** Part of the time.) and at the dam also?

Arthur: Well, it was at the dam.

Storey: So were you inspecting the placement also?

Arthur: No. I inspected the placement of the earth fill at times, and other embankment construction. And I helped out when they were making all the measurements for monthly payments and stuff–I would work on the survey gang, taking cross sections and that sort of thing. So we just did what had to be done. But they didn't place concrete at night. They didn't have adequate lighting to do that. They would do excavation work and embankment work at night, so when I was working, most of the time, I would be doing that. I worked on the concrete mixers sometimes when I had to fill-in, because people were taking vacations or were off sick or something. Then you'd be taken off night work and put on the other work. We weren't unionized (laughs), you did everything that had to be done.

Storey: So you were working on the embankment placement. Was that a twenty-four-hour activity that the contractor was doing?

Arthur: In the height of probably the third season, it probably was, yeah. Let's see, when we first started, the river had been diverted through a tunnel, as I mentioned. The tunnel had been constructed under a previous contract. Well, the first thing the contractor had to do was excavate for the cut-off trench. So the first year or so, there wasn't any embankment placed–he was digging this hole, and it was a hell of a hole too.

Storey: And were you out there for that?

Arthur: Yes

Storey: What were you doing?

Inspecting Dam Foundation Work

Arthur: Well, observing what the contractor was doing. The rock that he took out of the foundation, there were a lot of big boulders that had to be broken up and placed in a rock fill, so he had to take those and place those in the embankment. The specifications required that the rock fill be placed in three-foot layers, and that all the fine material would be flushed down through the rock by using fire hoses. They had pumps coming out of the river and fire hoses and nozzles out there, and they would wash the fines down through the rock fill. They don't do this anymore. It was found out a long time ago that that was not necessary. But that's what we required at that time, and it required inspection to see that each layer was adequately cleaned up before the next layer came on, or the contractor wouldn't do it. So . . . .

Storey: So they were stockpiling this rock that came out of the cut-off trench for later use in the embankment?

Arthur: Well, it was actually placed in what was going to be the furthermost downstream portion of the embankment. (**Storey:** Oh, okay.) It was downstream of the cut-off trench, and the downstream part of the dam was a big rock fill, and this went into the toe of that rock fill, so it wouldn't have to be rehandled.

Storey: Okay, and then they had to wash the fines out of that?

Arthur: Yes. Yeah, it was placed in three-foot layers, and the fines had to be washed *down*. They were concerned that it would develop impervious layers between the rock, and they wanted it all free draining, so the material had to be flushed down.

Storey: Okay. And that was a twenty-four-hour-a-day job that was going on?

Removing Large Boulders from the Cut-Off Trench

Arthur: There was another thing that was peculiar about this specification. It required that all the rock that goes into the rock fill had to be less than a cubic yard in volume. Now, when the rock was excavated from the cut-off trench, which, as I remember, was about sixty feet deep, and was clear across the valley floor, which was a fairly narrow canyon, but it was full of large boulders. Well, the specifications had a bid item in there for excavation of those boulders. If they were larger than one cubic yard, they'd have to be drilled and shot and reduced to smaller sizes. Well, somebody had made a real bad judgement on how much rock there would be in these boulders, so I remember very clearly the specifications required, specification estimates for rock boulders, was 200 cubic yards.

". . . he bid $7.50 a cubic yard for excavating . . . Now that's the kind of a price

that would be bid today . . ."

So the contractor bid a very high price on that work, because it's only 200 cubic yards. I mean, if he bid $1,000 a yard, he wouldn't amount to much in a million-dollar contract, would it? Well, of course such a bid would be questioned, but anyway, he bid $7.50 a cubic yard for excavating this rock. Now that's the kind of a price that would be bid *today*, but in those days, common labor was getting fifty cents an hour and truck drivers seventy-five cents an hour, and engineers a hundred dollars a month, $7.50 a cubic yard was a hell of a lot of money. (**Storey:** Um-hmm.) Well, instead of 200 cubic yards, it turned out there were over twenty *thousand* cubic yards, so this made a tremendous windfall for the contractor, because he would get the $7.50 for each one of those 20,000 yards. It was a regular gold mine for him (chuckles) is what it was. And of course the resident engineer was very concerned about this, so it was required that before a big boulder would be excavated, and before it could be blown up, the inspector would have to measure the dimensions. So I'd be out there–and I wasn't the only one that would do this–and measure the length of the boulder, the height of the boulder, and the thickness of the boulder and put it down in my book so that in the office it could be computed how much volume there was in this thing. Then the next part of the job was to take a bucket–carried a bucket of red paint–we didn't have spray cans in those days, unfortunately–a bucket of red paint and a paintbrush, and you had to paint big "Xes" on the rock surfaces; the idea being that you would paint the rock so that it could not be broken into pieces larger than one cubic yard that would not contain any paint, because the suspicion was that the contractor would get a rock that had twenty cubic yards, I would measure it, it's twenty cubic yards of rock excavation, he would break that into two pieces, and on the next shift he'd get the other inspector to come down and say, "Hey, I got two tens here." (chuckles) This guy measures two tens, and he'd break these tens down and the *next* inspector would come along on the next shift, he'd say, "Hey, I got 4 five . . . ." (chuckles) You see what I'm talking about?

Storey: Uh-huh. How much reality do you think there was in that concern?

Arthur: Plenty!

Storey: A lot, huh?

Arthur: Plenty, yeah. And you know, (laughs) there was so much concern about this $7.50 a yard price and the windfall to the contractor, that the resident engineer took us up to the laboratory and he got small rocks, fist-sized rocks, or maybe up to the size of a basketball, and he'd have each inspector measure the rock–so many inches, you know, instead of feet, or centimeters. He'd measure the rock, how long it was, and

how thick it was and so on and so forth, and then you'd compute the volume, and then you'd immerse it in water to displace and actually measure just exactly what the volume of the rock was. And this whole exercise was to improve your estimating abilities on how to judge the average length, the average width, and the average size of the rock. (**Storey:** Uh-huh.) See, he wanted his inspectors to have pretty good judgement. And if you could do that on a small rock, you could go out there and do it on a big rock! (laughter)

Storey: That's interesting.

"Batching" out at the Work Site

Arthur: Well, I tell you, my roommate was an engineer from–he was, of course, a Wyoming resident, as I was *supposed* to be. He came from a ranch up there about eighty miles out of Casper. He was a pretty resourceful kind of guy, and he and I decided that we would batch out there. The choice was, you could eat at the contractor's cook shack if you wanted to, but it was pretty expensive. When you were making $100 a month, it was pretty expensive. So this fellow and I, we went down to Montgomery Wards in Casper, Wyoming, and we bought a refrigerator for, I think it was something like ten dollars down and eight dollars a month, and got the refrigerator out there. I had the car so we'd buy groceries and stuff in Casper and take them out there and put them in the refrigerator and we batched out there. So he'd go home once in a while on the weekend and bring chickens from home and that sort of thing from the ranch, and he and I'd go out and shoot cottontails once in a while, skin rabbits, and we'd have fried rabbits and stuff, and we were doing alright. But when I was working nights, measuring these rocks, the foreman for the contractor was a friendly guy, and in the middle of the night, about one or two o'clock in the morning, it'd be dark and cold and stuff like that.

"Why don't we go up to the cook shack and have a piece of pie and a cup of coffee?" They always had the coffee pot on, and there was always some pie sitting around and stuff, so I'd say, "Thank you very much!" I went up there, and it became a sort of a ritual. We'd have a coffee break in the middle of the shift and a piece of pie, "thank you," and a cup of coffee, "thank you."

Well, this guy got talking to me and he said, "Harold, you measure these rocks and stuff like that, you write it down in the book?"

I said "Yeah."

He said, "Well, what happens then?"

And I said, "Well, the office engineer sits down with a Marchant Calculator and he computes the volume of these things, and that goes in and we add them up and multiply by the unit price and that's how you get paid."

He says, "Well, you know, we break up this rock into these fragments, and then we put it out there on the fill. It's an infinitesimal amount compared to the rock that's coming out of this spillway excavation at the same time. There's no way of being able to identify rock that came out of the cut-off trench that was broken up and put in the rock fill–it's all mixed up with ten times as much rock."

I said, "That's true." He said, "Well, you know, if you made a mistake on those dimensions, you made a mistake and made it twice as thick as what you measured, nobody would ever know."

I said, "That's right, absolutely right."

He said, "Suppose somebody came to you (chuckles) and said, 'Look, Harold, there's a lot of money involved in this thing and suppose you make a few mistakes here so that we get paid for twice as much rock as is what is actually there.' Suppose somebody came up and said that to you? What would you do?"

I said, "I know you're just kidding, but actually, I'd report it to the resident engineer, of course." (laughter)

And he said, "Atta boy! I knew that's what you'd say!" (laughter)

So you asked me, do I think those provisions were necessary, painting the "Xes" on the rocks, and I said, without equivocation, "Yes!" Because I think there are people who would do that. Then of course you go back to the shack and then you begin to wonder, "I wonder if all of the other engineers (laughs) are hearing the same story, and what *they're* doing?!" (laughs) (**Storey:** Yeah.) But nobody blossomed out with signs of wealth or anything. (laughs) We were all a pretty idealistic bunch.

"Was that a good job [with the Bureau of Reclamation] for those days?"

Storey: Was that a good job for those days?

Arthur: Was what a good job?

Storey: The job you had–$100 a month?

Arthur: No. No. The common laborers, no education at all, was out there on a muck stick [shovel] or something like that, he's working for twenty dollars a week. Well, that's about $90 a month.

END OF SIDE 2, TAPE 1. DECEMBER 21, 1994.
BEGINNING OF SIDE 1, TAPE 2. DECEMBER 21, 1994.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on December 21, 1994.

You were saying that the truck driver would get sixty-five cents an hour.

Arthur: Sixty-five cents an hour, $125 a month, or something like that–*and* overtime!

Storey: Yeah, and they were getting overtime. (**Arthur:** Yeah.) Were you getting overtime?

Arthur: Not paid.

Storey: Were you working overtime?

Arthur: Oh yes!

Storey: How much, do you think?

Hours Worked on the Casper-Alcova Project

Arthur: Well, at the height of the construction season, we probably worked ten- to twelve-hour days, but we worked seven days a week, because there weren't really enough of us to handle it, to work forty-hour weeks.

Oh, there's another thing–if you were in this lower grade, if you were subprofessional, which these jobs were classified subprofessional, you got no annual leave, you got no sick leave. But the boss–resident engineer–kept track of your Sundays, and you normally worked a ~~six-hour~~ [6]-day week, but he kept track of the number of Sundays that you worked.

Storey: You mean a six-day week.

Arthur: Six-day week, yeah. But he kept track of the Sundays that you worked, and the first vacation that I had was after I'd been there a year. I had a vacation, I took a trip with my mother back East, but it was *all* accumulated Sundays. I think I had twelve Sundays earned.

While I was still there at Alcova, they passed a law that–I don't know what bill they called it or anything–but anyway, they came out with this twenty-six days annual leave, and they applied it to all government employees. I thought I'd really hit the jackpot, because I'd gone from no annual leave, no sick leave, to twenty-six days annual leave. I could hardly believe it! (chuckles)

Storey: Uh-huh, and some sick leave also?

Arthur: And sick leave, yeah, fifteen days sick leave. But as I say, these jobs, in this day and age, would be filled with sub-professionals. But in those days, why hire a subprofessional when you can get a professional for the same money?

"How did reclamation's inspectors interact so that there was continuity . . .?

Storey: Now, when you were out doing this inspection work, if it was going round-the-clock, that would mean that there was an inspector coming on after you, and you were taking over for an inspector before you. How did Reclamation's inspectors interact so that there was continuity there?

Arthur: Well, we'd overlap our time. I'd go out there, half an hour before that guy was supposed to leave, be there early, and we'd talk it over and I'd find out what he was doing, what had been going on, take over his notes and whatever was required. The same would happen with me, the guy'd come out early at the end of *my* shift, so we just overlapped that way.

Storey: So there were notes being taken? You've already mentioned writing down all the rock dimensions. Were there other kinds of notes?

Arthur: Well, you'd take notes if there were anything noteworthy, any instructions that you gave the contractor, that he should dig here and he should move here, or he should dig so deep–anything unusual. I mean, you just wouldn't take a note every hour–if there was something that should be called to the attention of the resident engineer or the guy on the next shift and so forth.

A Problem with the Contractor over Following Specifications

I remember being out there on the night shift on doing this where they were washing the fines down through the rock, and they were excavating the spillway, which is an open-chute spillway. There's a lot of rock coming out of that spillway, and they were taking it right from the cut into the fill. And they were down there with a centrifugal pump, pumping water out at the end of the diversion tunnel, and using fire hoses to wash that down–and the water stopped! (brief interruption) As I was saying, the water stopped. So I went and got the shift superintendent for the contractor and I said, "Hey, you'd better get on with the sluicing, your pump's down."

"Yeah, I know it. I don't know what's wrong with it."

I said, "I don't know what's wrong with it either. It's not my concern what's wrong with it, my concern is that you've got to start water there. You've got to get a mechanic up here, figure out what's wrong with the pump."

"It's three o'clock in the morning!"

"Okay," I said, "I'm telling you, pretty soon you're going to have the whole complete layer covered, the whole layer covered with the fresh layer three foot thick– *none* of it has been sluiced. I'm not going to let you put another layer on top of that, 'til you get it sluiced."

"Aw, come on," he says, "you're kidding me!"

I said, "No, I'm not kidding you, that's what's required, you got to do that." So he didn't do a darn thing, and finally there wasn't anyplace–the layer was complete. None of it had been sluiced for the next layer. So I went over and I said, "Shut her down." The superintendent came storming down there and he says–he was really raising a fuss–he told me how many million dollars' worth of equipment he had, and he had two shovels that were excavating rock, and he had this fleet of trucks, and he had all these truck drivers and he had all this payroll, and all of a sudden I shut the whole damn thing down?! And I said, "Well, I told you to get the damn pump fixed."

And he said, "Well, I've called the mechanic, it's going to take him a while to get here." I said, "Well, I'll tell you what, I'll let you place a half a thickness on the unsluiced layer. I'll bend it that far. You can put on eighteen inches, another layer of rock. By then you got to have the damn pump fixed!"

He says, "Okay." So we started up again, he started putting on this half-layer

of rock. In the meanwhile, I go down where the guy's working on the pump. You know what a centrifugal pump's like?

Storey: Not in detail, no.

Arthur: Well, it's about eight inches thick, and the diameter maybe twenty-four inches, and it's a vertical wheel that spins around and so forth. Well, he took the case up, to open it up, to see the impeller, and it was choked with trout! There was a hole in the suction screen, a hole in the screen on the suction hose, and they'd sucked some trout up there, and it'd jammed the damn pump so it wouldn't pump any water. (**Storey:** Oh my!) It was still turning, see, that's what got them. It was still turning, but the water passages were all plugged up with trout. So they (laughs) cleaned it out, and got the water back on, and everything was okay.

Storey: (aside about closing door).

Arthur: I thought, "Well, what kind of a pickle am *I* in?" Here I am, a hundred-dollar-a-month-man, and I shut down this big job, and so on and so on.

The contractor told me, the superintendent, he says, "Your boss is going to hear about this!" Of course I didn't get up 'til about one o'clock or something like that, after coming off the night shift–I slept 'til about one or two o'clock–then I went down to the resident engineer's office to see Mr. Beemer, and I don't remember whether I had word that I was supposed to see him or not, but anyway, I knew I wanted to see him to report on this. So I went down there, he said, " Harold, I heard you had a little trouble with the contractor last night."

I said, "Yes, Sir."

He says, "They were over to complain about it this morning."

I said, "Yes, Sir. Did they tell you what happened?"

He says, "I think so. Why don't *you* tell me what happened?"

So I related the story, just like I told you, and when I got through, he says, "You know, I think you did just right. You handled it perfectly. We could break a contractor if we tried to enforce every specification to the absolute letter, whether it made any sense or not. You've got to exercise a little judgement. On the other hand, the specifications are there for a purpose, and they just can't be ignored, like the contractor wanted to do. I think your idea of letting him put on a half layer was the

perfect solution, it was great! But I want to tell you something else."

I said, "Yes, Sir?"

"He said, 'if you had made the *wrong* decision, I'd still back you a hundred percent"

He said, "If you had made the *wrong* decision, I'd still back you a hundred percent."

Storey: (laughs) That's the way it's got to work!

Arthur: That was the kind of boss you wanted to have.

Storey: Yeah. Did the inspectors have a lot of those kinds of confrontations?

Arthur: I don't think there were a lot of them, no. But those, of course, are the ones you remember! (laughs)

Storey: Yeah. Mr. Beamer? Is that B-E-A-M-E-R?

Arthur: B-E-E-M-E-R.

Storey: Was the resident engineer?

Arthur: John E. Beemer.

Storey: I've never run across the title "resident engineer" before. Tell me what a resident engineer does as opposed to what a project engineer does.

Arthur: Well, the project engineer in this case was Harry W. Bashore. He was in Casper. And the project consisted of Alcova Dam, and the canal system. So that was the project, and he was in charge of that whole thing. But the man who was responsible *on the dam* was the resident engineer.

Storey: Was there a construction engineer?

Arthur: No. I think probably Bashore was called the construction engineer.

Storey: Did you ever meet him?

Arthur: Oh yes!

Storey: What was he like?

Arthur: Well, to a young fellow like me, he was a pretty intimidating character. I think he was somewhat like Dominy, I think. He was a very positive type of person. Of course we didn't have much to do with each other, I just met him.

Storey: Uh-huh, but a pretty strong personality?

Arthur: Yes. The word I got was that when he gave an order, that was it.

Storey: And what about his management style?

Arthur: Oh, I don't know much about his management style.

Storey: What about Mr. Beemer, what was he like to work for?

Arthur: I gave you a good example of his management style. He said, "Right or wrong, I'd back you up."

Storey: And that was typical?

Arthur: That was typical.

Storey: But say you *had* made an error, he would have backed you up with the contractor and chewed you out in private? How did this work?

Arthur: I don't know.

Storey: You never had that situation? Okay.

Arthur: I don't think he'd have chewed you out, though. I think he would explain to you why you should have done differently, but I don't think he would have done it in that kind of a manner. He was *not* an autocratic person. He was a very approachable type of guy. And of course I thought he was an old man. I don't know how old he was, probably close to forty. But he played a pretty good game of tennis. They did build a tennis court out there, and we played tennis. He fraternized with the guys. I mean, he was "one of the guys." They built a house for him, and he had a family. He had a wife and a young son, and so forth, so he wasn't with us at meals and stuff like that.

Storey: Do you remember the name of the office engineer?

Arthur: Yeah, Huber, H-U-B-E-R, Emrick — Emrick Huber. He was a native of Casper, Wyoming, and a graduate civil engineer from the University of Colorado. He was a couple years older than I was, had been there working for a while when I came.

Storey: I gather from what you were saying earlier, he was the only person in the office, is that right? (**Arthur:** Yeah.) And then when he needed help, as the rush built up at the end of the month, you'd go in and help. (**Arthur:** Yeah.) Were there other folks who'd go in and help?

Arthur: Yes, but I was the first that he called. And then at the last minute there might be several guys helping out.

Another Example of Mr. Beemer's Management Style

Oh, I want to give you another example of Mr. Beemer's (**Storey:** Good!) managerial style. (phone rings) As I say, I lived out there and worked nights. I was actually taking orders from one of the guys that traveled back and forth–he was the field engineer. It was time for me to about go onto my shift, and for some reason or another the shift was canceled. I don't know whether the piece of equipment broke, or something like that. So he came to me and he says, "Harold, you're not going to have to work tonight down on the fill. We got a lot of cross-sections that need to be updated. You can come in the office and do those on your shift." So I'm down there maybe around midnight, all by myself in the office, plotting these cross-sections and stuff like that, and Mr. Beemer walks in the door. He said, "I saw a light on in the office. What are you doing here?!"

And I said, "Well, Mr. Perkins said that since I wasn't needed down on the dam tonight, I could put in my shift up here."

And he says, "Hey, we're not here to put in shifts. We're here to do the job. A lot of the time you're called upon to do extra work, you work extra time that you don't get paid for. When something like this comes up where you could get some time off, you just forget this, you go up to the bunkhouse. I'll speak to Mr. Perkins in the morning." (laughs) So I appreciated that.

Storey: Yeah, that's nice.

Arthur: Of course I had some advancement there. I went as a chain man, my next title was rodman, that was $115 a month. The next title was levelman, that paid $135 a

month. The next title was transitman, that paid $150 a month, $1,800 a year. So I got the three promotions within a period of two years. They don't sound like very big promotions, but percentage-wise, I had a fifty percent increase! In two years, that's pretty good.

Takes Civil Service Exam for Junior Civil Engineer Position

About that time it was announced that there was going to be a Civil Service examination for a junior civil engineer, and in those days, all examinations were assembled, written examinations. And I applied for entrance to the examination and I went into to Casper to take the exam. As I recall, it was a six-hour written examination, and the first morning session was on general engineering, and it was probably three hours long. Then you broke for lunch, and then the afternoon session was on your option: civil, electrical, mechanical, whatever. Mine, of course, was civil. And so I took this examination and this led to my resigning, (chuckles) my first time that I resigned from the Bureau of Reclamation, because I got a job with Civil Service as a junior engineer. I got several offers from the Geological Survey, from the Coast and Geodetic Survey, and from the Forest Service. I turned down the first two because they said they were temporary. The Forest Service said theirs was temporary too, but I decided to take a flier on that. I resigned from the Bureau of Reclamation in September 1937 and went to work for the Forest Service in Missoula, Montana. In that connection, I got something I want to show you . . . .

Leaves Reclamation to Work for the Forest Service

Storey: Did I cover something up?

Arthur: Let's see, I had an envelope.

Storey: Folder?

Arthur: Folder, yeah. What the heck did I do with it? Why don't you turn that off just a minute?

Storey: Okay. (tape turned off and on) A letter or something?

Arthur: No, I want to show you . . . . (chuckles)

Storey: Oh, "Length of Service Award!" (laughs) Ten years the buffalo, "rip, snortin." Twenty years the buffalo on the Seal of the Department of Interior sitting down. Thirty years it's snoring. Forty years it's got its feet straight up in the air, and fifty

years it's a skull. (laughs) That's cute.

Arthur: I was going to show you–I guess I didn't put it in this folder after all–I was going to show you the results of my examination for junior civil engineer. Anyway, back on the record (**Storey:** Yeah.) I scored second in the state of Wyoming. I wrote a letter to the Civil Service Commission and asked them what my standing was, and I was 254th in the United States. There were 10,000 people took that examination, and 254th doesn't sound so high, but it wasn't too bad. (**Storey:** Not bad at all!) So I started getting these job [offers] ~~s~~, and of course Mr. Beemer, when I told him that I had this offer that I was going to accept, he went into Casper.

He said, "Well, we hate to lose you. You've been a good employee and we'd like for you to stay on with the Bureau."

I said, "Well, I'd like to stay on with the Bureau too, but I'm anxious to get a professional rating," and also, of course, it paid $2,000 a year to start.

Reclamation Couldn't Give a Civil Service Rating to Keep Him

So he said, "Well, if they can give you a Civil Service rating, I don't know why *we* can't give you a Civil Service rating. I'll go into Casper and talk to Mr. Bashore." And he reported back to me that the Casper-Alcova Project was funded with PWA funds, Public Works Administration funds, and that because of the fact that it was a Public Works Administration job to help relieve the Depression, the Bureau had got a waiver of going through the time-consuming Civil Service process of hiring employees, so they could hire without all that red tape. Having accepted that waiver, they couldn't turn around (chuckles) and hire you through Civil Service channels–or so they said. So, sorry, but there was a *chance* I would be promoted to junior engineer if I stayed, but I still would not be in Civil Service. Well, I wanted to get on Civil Service because of the retirement and other perceived benefits, so I left the Bureau.

Storey: That would have been in '37?

Arthur: In 1937.

Storey: Field engineer?! I'm getting confused about all these engineers. Let's see, there's a construction engineer, we've already talked about the office engineer and the resident engineer.

Arthur: There's the resident engineer, and then under him is an office engineer and a field

engineer.

Storey: Okay, and the field engineer is the one who does all the inspecting and everything?

Arthur: He's in charge of the inspection, yeah, surveys and that sort of thing.

Storey: Okay. (pause) Well, I'd like to go on and talk about your Forest Service career, but we have used up two hours already. (Arthur chuckles: Yeah.) I appreciate your time.

Arthur: We're hardly out of the blocks!

Storey: Yeah. I'd like to ask you now if you're willing for the tapes and the resulting transcripts from this interview to be used by researchers both inside and outside Reclamation.

Arthur: Yes, I am.

Storey: Good, thank you.

END OF SIDE 1, TAPE 2. DECEMBER 21, 1994.
BEGIN SIDE 1, TAPE 1. DECEMBER 28, 1994.

Storey: This is Tape 1 of an interview by Brit Allan Storey, senior historian of the Bureau of Reclamation, with Harold G. Arthur, former chief engineer of the Bureau of Reclamation, at his home at 52 Cherry Hills III, 2800 South University Boulevard, in Denver on December 28, 1994. It's about nine o'clock in the morning.

[Since] we interviewed last time, I wondered if you'd thought about any stories about that part of your career that you ought to be telling me.

The Conclusion of the Story about Boulders in the Foundation Area

Arthur: Well, one thing I forgot to tell you–you know I told you the story about the contractor's superintendent that took me up for pie and coffee and we'd talk about the boulders and measuring the rock and so forth. (**Storey:** Uh-huh.) And he asked me what I would do if somebody ever made a suggestion to me that I falsify the records. I told him that I would report it, and he said that's great, that's what he expected to hear me say. I forgot to say that I never got invited for pie again, that was the last of the pie! (laughter)

Storey: Oh my! That's interesting!

Expresses Concern about Commissioner Daniel Beard's Comments at ICOLD Meeting in 1994

Arthur: I think I'm about ready to drive on. But you know, I got a Christmas card I wanted to share with you, because it's pretty disturbing to me. You know the Bureau of Reclamation has a world-wide reputation for engineering excellence, especially in building dams, ever since the days of Hoover Dam. As a result, as you know, there've been numerous foreign engineers that have come to the United States and trained with the Bureau of Reclamation to learn about dams. So those in the Bureau are very proud of their image and their reputation. And the Bureau has always been very active in supporting the International Commission on Large Dams, which is called ICOLD. ICOLD had a meeting recently, it was in Durban, South Africa. This is an international meeting. I have here a Christmas card from a engineer and geologist that I was on a consulting board with down in Ecuador for a number of years, a pretty good friend of mine. He lives in Luxembourg. He sent me this Christmas card. He tells me he went to the ICOLD meeting down there in South Africa recently, and I want to read what he says here. "At the ICOLD Congress in Durban, the Bureau's new commissioner volunteered to give a remarkable speech. In essence, he said 'this is an incompetent bunch which has done awful things, and we are going to kick them all out.' He did not get much applause, and the new ICOLD President found it, quote 'not inspiring.'"

Storey: Oh really?! Do you mind sharing his name?

Arthur: My friend? (**Storey:** Yes.) His name is Wynfrith Riemer. That's W-Y-N-F-R-I-T-H R-I-E-M-E-R. I think that's a sad commentary, we have a political animal for the commissioner, would go against everything the Bureau has done, make these kind of comments, *especially* in an international forum. No wonder he wasn't greeted with much enthusiasm.

Okay, that's off my chest!

Move to the Forest Service in 1937

Storey: Well, last time, we had just gotten you to 1937 and your move to the Forest Service.

Does Transportation Planning for the Forest Service in Missoula, Montana

Arthur: Right, I went to the Forest Service in order to get the Civil Service status. And I was

anxious to get on that, and the retirement and so forth. As I explained, the Bureau said they were not in a position to make a similar offer to me. So I accepted this job with the Forest Service in Missoula, Montana, which is a regional office of the Forest Service. And I was engaged in transportation planning, is what it was called, and the Forest Service was making a study to develop a comprehensive, overall road system planning for the National Forests, based on meeting the needs of the public for recreation, including fishing and hunting and picnicking and campgrounds and all that stuff, as well as marketing timber and providing protection against forest fires and all that sort of thing. So this plan was to develop a long-range system of roads, to service these needs. They had, of course, limited budget for construction, so they had five classes of roads: the road that would have the least usage would be more or less a one-lane road with two or three turnouts a mile–could only be one car on the road at a time because it was single lane. If you would meet somebody, one of you would have to back up to the nearest turnout. Obviously that would be a road that could take only very light traffic. And as the study showed the projected future traffic needs, you would select a road of a higher standard, which had more carrying capacity. And this was what I was involved in for two years in Missoula, Montana.

Storey: That was region-wide planning, or a specific forest?

Arthur: Yes, it was region-wide. That was Region I of the Forest Service. That was Western Montana and Northern Idaho and Northern Wyoming, and all the Forests that were involved.

Storey: Did you run into any particularly interesting issues in doing those studies?

Arthur: No, I didn't.

Storey: I take it we're still talking about a fairly poorly developed road system in that area of the country, are we?

Arthur: In some places there weren't any really what you would call roads. They'd be like four-wheel drive stuff to get into the back country. What they were concerned about was the travel time from places where they could recruit fire fighters to get them from the towns out to where the fire might occur. So they took into account not only the physical situation, but also the type of forests that were involved, and how susceptible they were to major burns.

Storey: So then the idea was that you would try and improve the roads, or *plan* to improve the roads out to areas where they thought fires were likely?

Arthur: Not only planned to improve the roads, but developed new roads in areas that were not adequately served–not adequately reached, right.

Storey: Now, did you do all that in the office?

Arthur: Yes.

Storey: So you weren't out in the field for this work.

Arthur: That's correct, not while I was in Montana, that's right.

Storey: Was there anybody out in the field working?

Arthur: Yes, the whole area had been mapped. Of course, it'd been mapped for years, but I mean they had identified the different types of forests and timber that were involved in different places, and had been categorized as high hazard, medium hazard, low hazard, and this sort of thing, and that was all input data that we had in looking at the road system, planning.

Storey: So did you work with foresters a lot? Or did they just provide you maps and say, "This is where we want to improve transportation"?

Arthur: Well, the maps were the basic data that we worked with, yeah. And I was working in the Engineering Division. There were just three of us that were working on this plan–two draftsmen, and I was the engineer.

Storey: If we could back up a little bit, you were in Casper, or near Casper when you were offered this job (**Arthur:** Yes.) to go with the Civil Service System with the Forest Service. Did the Forest Service pay any of your moving expenses?

Arthur: No.

Storey: How did they work out the transfer from Reclamation to Forest Service, do you know?

Arthur: Well, it was really a new hire, just a break in service. I resigned from the Bureau of Reclamation, I was *hired* on the Civil Service rolls. I was just told when to report, and I gave myself a couple of days to travel from Casper to Missoula and took the opportunity to go through Yellowstone Park on the way.

Storey: And see Yellowstone. (**Arthur:** Right.) Tell me about Yellowstone in those days.

Arthur: Well, I haven't seen it since!

Storey: Oh, you haven't. What were the roads like in Yellowstone?

Arthur: The main roads were paved, and they were, of course, two-lane. I guess that's what they are still.

Storey: They sure are! (laughs) Very narrow two-lane, for the most part.

Arthur: I don't think traffic was the problem that it is today, I'm sure.

Storey: Did you stay anywhere in the Park?

Arthur: Uh-huh, I stayed at Old Faithful. They used to have cabins, little one-room cabins that you could rent. Yeah, we stayed overnight there.

Storey: Was it a wooden cabin?

Arthur: Yes.

Storey: All the way up, I mean. It wasn't a tent-cabin?

Arthur: No, it was a wooden cabin.

Storey: You said "we."

Arthur: Yes, my wife.

Storey: When did you get married?

Arthur: I got married about three or four months before I resigned from the Bureau and accepted the Civil Service job. I married a Casper girl.

Storey: Okay, and you met her while you were stationed there, I guess.

Arthur: Yes.

Storey: You mentioned last time that you worked for four years for the Forest Service, so you spent two years on transportation planning for the region. What did you do for

the remainder of the time?

Decides the Forest Service Job in Missoula Isn't Going Anywhere

Arthur: Well, after two years in Missoula, I decided I wasn't going to get anyplace, career-wise. I worked hard for a year and I was given an incentive award, I guess you'd call it, a superior performance award and so on and so forth. And on this occasion my fellow employees, we were all called together, and the boss announced that I'd been given this special award. I was raised from $2,000 a year to $2,100 a year. All this ceremony, I got a five-cent-an-hour raise! (chuckles) Can you believe it?! I was expecting a grade raise and fifty dollars a month, and instead of that I got a five-cents-an-hour raise, so I decided that I wasn't too intrigued with this planning of this road system, it wasn't as technical an engineering challenge as I wanted. I decided to see if I could get back with the Bureau of Reclamation. So we took off from Missoula and I was going to come to Denver and see if I could get on with the Bureau of Reclamation, and then continue on to visit my mother in the Black Hills in Lead, before returning to Montana.

Plans Trip to Denver to See the Bureau of Reclamation but Stops at Regional Forest Service Office in Ogden

So we started out and we decided we'd never seen Salt Lake, so we'd go through Salt Lake, not too far out of the way. And before we got to Salt Lake, we came to Ogden, Utah, which is about fifty miles north of Salt Lake, which is another regional office of the Forest Service–it was Region IV of the Forest Service. So I decided to stop in to say hello and get acquainted, being a Forest Service employee, I'd check in with the Forest Service people there, which I did. And they asked me what I was doing, what my plans were, and what I did in Missoula and so forth. Well, they had the same transportation planning mandate to perform that sort of work down there in that region too, because this was a nationwide, service-wide endeavor. They were being criticized because their planning was lagging, and they needed somebody to work on that planning. Here comes a guy–me–that had two years of this behind me in Missoula and knew all about it and so on and so forth, so they said, "Well, why don't you transfer to our office down here?"

I said, "Well, why should I do that?"

And they said, "Well, we have opportunities for promotion," and so forth. Well, to make a long story short, I got sweet-talked into transferring from Missoula, Montana, to Ogden, Utah. And I spent two years in Ogden.

And here, my transportation planning activities were expanded to the fact that I did quite a bit of field work too, and my field work consisted of taking a pickup–not a four-wheel drive, but a four-speed pickup–and actually driving into the back country and see[ing] what roads were passable and what trails were passable to that sort of a vehicle, and how long it would take to travel from Point "A" to Point "B" and that sort of thing, which was called "logging the road system." So I did that for a month or two in the summer, and then in the wintertime I would be involved in map work. But I became disenchanted with that activity, because it was a little more interesting than what I did in Montana, but it wasn't that much *different*, and still wasn't the kind of engineering that I really wanted to get into.

Takes Course in Soil Mechanics

There's a–it was then a junior college, Weber State Junior College . . . . (phone rings, tape turned off and on) It's now Utah State University.[3] It was then a junior college. But I learned that a professor from Logan, from the State College, was coming down to Ogden and giving a course at night on soil mechanics. Now soil mechanics was at that time a new discipline. Soil mechanics wasn't taught when I was taking my undergraduate work. It hadn't developed yet into a discipline, but it was just emerging as a separate discipline, soil mechanics, and I thought this would give me a good entrée to the Bureau of Reclamation if I knew something about soil mechanics. So I took this course in soil mechanics, and after completing that, and having been there about two years, I decided finally to get back to the Bureau of Reclamation in Denver, the trip that had been aborted two years previously.

Makes a Trip to Denver to Try and Get Back into the Bureau of Reclamation

So I came into Denver and checked in with the Bureau and went to the Personnel Section and told them that I was an ex-Bureau employee and had worked at Alcova Dam for a couple of years and I was currently employed as a junior engineer with the Forest Service in Ogden, Utah, and I was interested in rejoining the Bureau of Reclamation. And because I had worked on the earth dam, Alcova Dam, I was referred down to the Earth Dams Section of the Dams Branch of the Bureau. The boss at that time was an engineer by the name of F. F. Smith, Frank Smith, and I was interviewed, and as a result of that interview I was offered a job. The terms were that I would transfer at grade, I would transfer at my own expense, and I'd go to work in the Earth Dams Section.

Went to Work for the Earth Dams Section

3. Interviewee is apparently confusing Weber State College with Utah State University which is in Logan.

Storey: And what was your grade then?

Arthur: It was P-1 as it was called, junior engineer. But now it would now be a GS-5.

Storey: And did you start as a P-1 with the Forest Service?

Arthur: Yes.

Storey: Did you get a promotion when you went from Missoula to Ogden?

Arthur: No. I got another hundred-dollar raise while I was working in Ogden.

Storey: A hundred dollars a year.

Felt He Wasn't Advanced Properly in Ogden

Arthur: A hundred dollars a year, yeah. Five cents an hour, yeah. And also in Ogden I decided that they had held out promise of a grade raise, which would be from $2,000 to $2,600 was the step in those days from P-1 to P-2, or from GS-5 to GS-7. And that was not forthcoming. And as near as I could determine, it wasn't going to be forthcoming as long as I was a Gentile, because I was working with–I think there was only one other Gentile in the office, all the rest were Mormons. I didn't belong to the right church.

Storey: Did you see that manifested in any way while you were there? Do you have any recollections of that? Or was it just an undercurrent?

Arthur: Well, it was not a direct manifestation, it was just promises were not kept. When I asked why my performance was not adequate for promotion and so forth, it was explained to me, they said, "Well, we only have a limited number of promotions we can make. We have a tight budget and we can only make so many. Each division is allowed to nominate a number of people for promotions. When we"–this is my boss speaking–"when I nominate you, we're sitting around like a board of directors, everybody nominates their person they want to give a promotion to. When I nominate you, the rest of the people just say, 'Well, who is he? Was he at the Christmas party? We don't know him.'"

And I said, "Well . . . ." Of course the parties were at the Mormon Church, the ward house as they called it, which I didn't attend. And I said, "Well, I thought promotions were given on merit, not as a popularity contest."

And he said, "Well, what else can I do? You get out and mix more . . . ."

And I said, "Well, I'm not anti-social, I have a lot of friends. My friends aren't all Mormons, that's all. I know some other people, rather than Mormons. A lot of these people are out here, they don't know anybody except the people they go to church with, that's all they know." So anyway, I got the idea that I wasn't going to go very far in that organization, regardless of my contribution or my talent or anything else.

Storey: Did you ever see the Mormon religion as an issue in the Bureau of Reclamation?

Arthur: No. There were a lot of Mormons *in* the Bureau of Reclamation, I know that, but I never saw it as an issue. You know, it's like everything else in human nature: if you're in the minority, it's one thing, so if you take the Mormons, who are in a minority in the population, there's no discrimination. They're very nice people and so forth. But anytime you get a *majority*, the majority tends to be discriminatory, whether they're Mormons or Catholics or Protestants or whites or blacks, or whatever–that's human nature.

Storey: I was just wondering if you had ever run across any stories about these kinds of issues, at, for instance, Duchesne, or in the Salt Lake City office, or the Provo office, or anything like that.

Arthur: No, never came to my attention.

Goes Back to Work for Reclamation

Storey: Do you remember when in 1941 you started with Reclamation? You *re*-started with Reclamation, maybe.

Arthur: Oh, when I came back to Denver, yes. It was probably July 1941, summer.

Storey: And what did they put you to work doing?

Arthur: I went to work in the Earth Dams Section and I started working on the drafting board on doing design work on earth dams.

Storey: What was your first project, do you happen to remember?

Arthur: No, my first projects were working on preliminary designs for the planning reports and so forth. There were a number of them, I don't remember those.

Storey: What were the working conditions like?

Office Was in the New Customs House in Denver

Arthur: Our office was in the new Custom House. You know where that is?

Storey: Yeah, downtown, across the street from the post office.

Arthur: Right.

Storey: Which floor?

Arthur: I think it was the third floor.

Storey: It was above ground, in any case. It wasn't in the basement or something?

Working Conditions at the Bureau of Reclamation in 1941

Arthur: No, the lab was in the basement. They had a testing machine down in the basement and stuff. And the Drafting Department was in a separate building. I think it was called the Wilma Building. It was a couple of blocks away because of the lack of room in the Custom House. Working conditions were satisfactory, no problem.

Storey: What did the office look like where you worked?

Arthur: Well, the Earth Dams Section was all in one room, and there was a row of drafting tables alongside the outside wall, and another row of drafting tables along the inside wall, and a passageway in between. So just two rows of tables–it was a long narrow room. And at one end, the boss, the section head and assistant section head, had flat-top desks, and all the rest of us had drafting tables.

Storey: So they were just lined up, one next to the other?

Arthur: Yeah.

Storey: And that's where you worked.

Arthur: Right.

Storey: How many folks?

Arthur: About fourteen, I'd say–twelve or fourteen or something like that.

Storey: And who was the section head and the assistant section head?

First Supervisor in Denver Was Frank (F. F.) Smith

Arthur: Frank Smith, F. F. Smith.

Storey: Yeah, you already mentioned him. What was he like to work for?

Arthur: He was a real nice person. He was a graduate of the University of Maine, and he was a Down Easter. I don't know how he ended up clear out in the Wild West, Denver, Colorado. He was a very nice person, nice to work with.

Storey: How about the assistant?

Assistant Branch Chief Assigned Work

Arthur: The assistant was . . . . I'm trying to think. Oh, his name is Woolverton. (phone rings, tape turned off and on) He was a nice enough guy. He was the one that made the assignments, told me what to do, and gave me the work to be done and so on and so forth. I worked very hard at it, and applied myself, and I tried to get the work done as quickly as possible and I finally found out that at times he was having a hard time trying to keep everybody busy. He was not the type who'd say, "Well, here's a job that I want you to do. There's no big rush on it." He would give you the idea that everything was very urgent, had to be done right away. So I'd work real hard trying to get it done, and then I finally found out that he was scurrying around trying to figure out what to have me do next! (laughs) So he was that kind of guy. And he had absolutely no sense of humor. It wasn't any particular problem. (chuckles) I remember I was living up in an apartment at East Tenth and Logan, and I walked to work all the time. Of course it was not very far, maybe a mile down to the Custom House, from Capitol Hill. One morning, it was bitterly cold in the wintertime, and I came into the office . . . .

END OF SIDE 1, TAPE 1. DECEMBER 28, 1994.
BEGINNING OF SIDE 2, TAPE 1. DECEMBER 28, 1994.

Storey: So you had walked down from Capitol Hill in the winter and ran into Woolverton as you were going into the office.

Arthur: Yeah, I said, "It's really cold this morning! Boy, it's cold! I didn't see a

thermometer on my way to work, I wonder how cold it was."

He said, "Well, when I stuck mine out this morning it was down to ten below."

I said, "Boy, I bet you pulled it in damn quick!"

And he said, "Oh no, it goes to thirty below." (laughter)

Storey: No sense of humor! (laughter)

Arthur: That's just an example, a couple of other guys–finally gave up. (laughs)

Storey: My, my.

Bought New House in the Spring of 1942

Arthur: I bought a new house in the spring of '42, I think it was. But anyway, I had to put in a lawn. Woolverton had a new house too, he bought a new house, and he had to put in a lawn. I put my lawn in before his, so he came to me and he says–he was going to do the work himself like I did, you know–he says, "Where did you get your fertilizer?" And I told him that I had answered an ad in the paper and ordered this fertilizer. So I gave him the guy's telephone number, and a couple of days later he says, "You know, I called that guy and he can't deliver me any fertilizer because he says he doesn't have any tires for his car, and he can't get any tires." Because of the war situation, you know, tires were being rationed.

I says, "Yeah, I understand the war has just knocked the shit out of the fertilizer business," and he says, "Yeah, you can't get tires anyplace." (laughter)

The Effects of World War II on the Bureau of Reclamation

Storey: What affect *did* the war have on your office?

Arthur: It had a very profound effect. Most of the engineers were ROTC [Reserve Officer Training Corps] and they were beginning to get called up. Now my school did not have military training, so I wasn't a Reserve officer. These guys started peeling out, being called up to the war, and some of them went to Seabees, and some of them were going into the Corps of Engineers and so forth. So I had decided on a course of action. My wife was pregnant when we moved here from Utah. I told her that's one good thing I got out of the Mormons, I got her pregnant–I'd been trying for several

years. (chuckles) But my older son was born November 25, Pearl Harbor was December 7. He was ten days old.

Decides with Wife to Seek Employment in a Job Which Will Be Deferred During the Draft in World War II

So I had this new baby and I told my wife, "I got to make up my mind what to do. Since I have an engineering degree, I can volunteer for the Army, and I will likely be accepted for officer's training, because I have a college degree. That's if I volunteer, that will happen. Or I can wait and take my chances. Eventually, I'm going to be drafted. I won't be drafted high, because we've got a new baby. The baby was born before Pearl Harbor, so I'm not going to be ~~deferred~~ [drafted] for a while because of that. Or, the other alternative is to try to get in someplace, into an activity where I know I will be deferred. I should take one of those two courses of action or one course of *in*action. I've got to make up my mind." So we talked it over and the decision was jointly reached that the best thing to do was to get into an essential industry. So I answered an ad in ***The Denver Post***. There was an aircraft company called Consolidated Vultee Aircraft Corporation. It was later taken over by General Dynamics. But at that time it was Consolidated Vultee Aircraft Corporation, and they were home based in San Diego, but they were starting up a B-24 factory for B-24 airplanes in Fort Worth, Texas. And they were recruiting structural engineers. So I looked into that, and I applied for admittance to their program, which consisted of going to school for thirty days here in Denver, going to school for eight hours a day, in a paid status, and getting instructions on the peculiarities of aircraft structural engineering. Airplanes are different from bridges in many respects.

Sought a War Service Transfer to Work for the Consolidated Vultee Aircraft Corporation

And there was also at that time a–I don't know whether it was a regulation or a law or what it was, but it was provision for what they called a War Service Transfer, and this was designed to *encourage* the movement of civilian Civil Service employees to essential war industries by transferring them with re-employment rights, so after the war was over, you would have your old job back, without any loss of seniority and so on and so forth, called a War Service Transfer. So I was accepted by Consolidated Vultee and I applied for the War Service Transfer, which was opposed by the Bureau. The only thing I can figure out is that nobody had taken advantage yet of this War Service Transfer provision, and I don't think the Bureau–evidently the Bureau didn't want anybody to take advantage of that. And I think because they were losing so many people, so many engineers because of

ROTC, they didn't want to lose the *rest* of them to the War Service Transfer. So they denied the War Service Transfer.

Reclamation Opposed a War Service Transfer

There was established at that time what they called the War Manpower Board, and you have to realize they were operating under a bunch of emergency regulations and proclamations and so on and so forth. I don't know where the War Manpower Board got their authority or so on and so forth, but anyway, they were people of the community here that would referee labor disputes of one kind and another. And in my case, I appealed to this board, the denial of the transfer. And a hearing was held, and I appeared at the hearing. They asked me why I wanted the War Service Transfer and why I thought I should have it, and so on and so forth, and I told them that there wasn't any significant, important work in my opinion, to be done at the Bureau at that time, and I thought I could make a contribution to the war effort in the aircraft industry and so on. So they said they'd asked the Bureau to send a representative over to give the Bureau's side, but the Bureau hadn't done it. The Bureau had written a letter, so they read the letter. And this letter was signed by the chief engineer. I think it was Harper at that time, S. O. Harper, I think. Anyway, the letter talked about the Bureau–food would win the war. The development of some irrigation projects were vital, expanding the irrigation was vital to growing this food. Also, there was a dam down in Oklahoma, the Altus Dam, that was being reconstructed to provide water to a Army Air Force Base, and *all* of this essential work that the Bureau was doing was furthering the war effort, and as far as *I* was concerned, I was a very important cog in the organization, and I was making a significant contribution and so on and so forth, and an *essential* contribution. And they went on at some length. And they finally got to the end of the letter and the members of the board kind of looked around.

"Mr. Arthur," they said, "what's your salary at the Bureau of Reclamation?"

I said, "It's $190 a month." (chuckles) And they all broke down in laughter.

They said, "From the letter, it sounded like you were *running* the outfit!" (laughs) They were just amazed that the Bureau would make all these claims about how essential I was to their effort, and they were paying me so very little. They granted me the War Service Transfer, so I was furloughed from the Bureau and went with Consolidated Vultee Aircraft Corporation. After thirty days of instruction here in Denver, I sold my house and took my wife and my new baby, and we moved to Fort Worth, Texas.

Move to Fort Worth, Texas

Storey: When was this?

Arthur: It was, oh, let's see, I wrote down a few dates. It was October 1942.

Storey: And how long were you there in Fort Worth?

Arthur: I was there three years.

Storey: And what were you doing?

Worked on Development of the XB-36 Intercontinental Bomber

Arthur: I was what they call a stress analyst on the XB-36 airplane. The "X" is "experimental." The B-36 was the first intercontinental bomber that SAC [Strategic Air Command] had after the war. It was the *last* propeller-driven airplane of the bombers. It was a six-engine pusher, a *great* big airplane. It was designed to fly from the West Coast to bomb Tokyo and come back without refueling. To fly from New York to Berlin and back without refueling.

Storey: Really?!

". . . nobody knew but what Europe would fall, and the United States would be fighting Hitler *from* this country. . . ."

Arthur: Yeah, it was a big sucker. And at that time, in '42, at that time it was purported to be the number one priority project in the United States arsenal, because nobody knew but what Europe would fall, and the United States would be fighting Hitler *from* this country. So this long-range bomber was an essential development, and it made the B-29, which was developed during the war, look pretty small. It had much longer range. The first one was flown right after the war ended. But they went into production and I think they produced a couple hundred of them. These were the Strategic Air Command bombers that were–they kept a couple in the air all the time, armed with nuclear bombs to counter the Soviet threat. One of the big bases was up at Rapid City. But I worked on that airplane.

Storey: Can you talk about your design work on that airplane?

Arthur: Sure.

Storey: Tell me about it.

How B-36 Design Occurred

Arthur: Well, as I remember, they had something like 12,000 engineers and drafts people and technicians working on that one design airplane. They were also producing B-24s. If you're familiar with the B-24, it was a medium range bomber, it was the counterpart of the B-17, Boeing Liberator. It was the same class of bomber, and it was being produced, and they were cranking those out, but they had this design office and were developing this new design for this B-36, and it was done in competition with the other aircraft companies. The Air Force put out the parameters of the performance characteristics they wanted in an airplane, and each company said what they could do, and so on and so forth, and they selected this company to develop an airplane, to build *one* to demonstrate that it could be done. They didn't have computer simulation in those days. What they had was mock-ups. I'll get to that in a little bit. But the design organization for the XB-36 design was divided into various groups. There was one group that was run by aeronautical engineers, and these were the guys that could take the wind tunnel data and translate the wind tunnel data into the loads on the airplane, the pressures on the wing, and so on and so forth. And then there were layout groups that worked on different parts of the airplane, on the wing, on the tail, and the fuselage, and so on and so forth. And then there was the structures group. And the structures group and the aeronautical group were the key groups in the organization as far as the technical end of it was concerned. The other groups had a lot of draftsmen, drafts women working in them. But all of the people in the structures group were graduate engineers, some of them had advanced degrees. The people who were designing the airplane would draw up a design of a beam or a bulkhead or a part, whatever was required to perform a certain function, and they would make their best estimate as to what would be required in the way of connections and rivets and what kind of material to use and how heavy a gauge of metal to use and so on and so forth. And when they got that done, then it'd all come through the structures group, and the structures group would take the data they'd gotten from the aeronautical engineers on loading, and they would figure out just what kind of load there was on this column or beam or whatever it was, and make an analysis of the strength of it, and actually do the structural design–change the gauge of the material if necessary, and change the connection, and actually guarantee its structural integrity.

Design Work at the Bureau of Reclamation Was Checked and Rechecked

The thing that was so much different from the work that I did in the Bureau was in the Bureau everything was done and redone–everything was done and

checked. You'd make a computation, somebody else would check it. Here you are down there, designing that airplane, and nobody ever checks whatever you're doing. You do it, that's it. The other big difference between the Bureau engineering work and down there was in the Bureau we all had these Marchant calculators–that was before the days of the electronic calculators, but these were pretty sophisticated mechanical calculators. We were working out earthwork quantities and so forth, with great precision on these Marchant calculators and so forth. Down there we're working on this airplane, very critical stuff, we're all using slide rules, no calculators around, they're too slow, takes too long, we're using slide rules which are good for usually three significant figures.

Design Work on the B-36 Was Turned into Reality on the Mock-up in a Matter of Days

The other big difference was that in the Bureau you design a dam and maybe if every everything goes well, five, six, seven, or eight years later the dam is built. Down there, I would design a part, two days later, it's built and it's on the mock-up. Now, the mock-up is a plane being made out of wood, essentially, and when you release a part from the structures group, it went to the manufacturing place where they started making it out of aluminum. It also went to the carpenter's shop where they made it out of wood, and they were building this wooden airplane at the same time that they were building the other airplane. The purpose of the mock-up was to–of course it would never fly, it was never supposed to fly–but it would solve the spatial problems, interference and so on and so forth. And an airplane is a *tremendously* complicated thing with all the cables and wires and ducts and so on and so forth. It's very hard, in those days, before computers, it was very hard to solve all the spatial problems, without actually building the thing and seeing how it was going to work. But then they were assembling the airplane part-by-part, as you went along, so you had the satisfaction of seeing your work immediately result in something, rather than having a period of five or seven years gestation from the time you designed it to the time it was built. That was the main thing. I found it very interesting, very fascinating.

Storey: Where were they in the project when you arrived?

Arthur: In the design? (**Storey:** Yeah.) They had the overall layout completed, so they knew the outlines of the ship. They knew how long the wing was and what shape it was, and the tail and the fuselage. They had all the external dimensions, and then all we had to do was develop the skeleton.

Storey: "All."

Arthur: Yeah, all the bones and muscles and all that kind of stuff.

Storey: And that took how long?

Arthur: About four years.

Storey: Were you there until the end?

Arthur: I left before it flew, but not long before it flew–it was almost done.

Storey: Did you ever change jobs or anything while you were there?

Promotion into Supervisory Responsibility

Arthur: I got more responsibility as it went along, and I finally, my title was, in addition, I was–stress analyst was my overall occupational title–but I had the title of Lead Man. Lead Man was, we called in the Bureau, Squad Leader, something like that, Group Leader.

Storey: So you were supervising folks?

Arthur: Yes. Yeah.

Storey: How many folks?

Arthur: About six. In fact, one of the guys I was supervising was the teacher that taught me this course here in Denver.

Storey: Really?

Arthur: One thing that he had–he was a very smart guy, but he didn't have too much drive.

Took Courses Through Texas A&M

Oh, and another thing I did while I was down there, is there were evening courses being given through Texas A&M, or I should say late afternoon courses. We were given an opportunity to take those courses tuition free, half on company time, and half on our own time. In other words, we were supposed to get off at four o'clock. Instead of that, we could at three o'clock go down for a two-hour class and got off at five. And I took a course called "Advanced Aircraft Structures." There were about thirty or forty engineers, new hires, that took that course. A bunch of

them were kids that were just out of school. I didn't figure I was a kid anymore, I'd been out of school seven or eight years, so even though I was only twenty when I got out of school, now I'm an old man of twenty-seven, along with a lot of those other kids. And I really applied myself on the course, graduated number one in the class, and that led to me getting the job as supervisor, because I had the technical capability and I had maturity–twenty-seven! (laughs) So when VE-day [Victory in Europe] came, we were tapped on the shoulder and a number of us were called into a conference room, and the big boss was there, the guy that was in charge of the B-36 project.

He said, "A lot of rumors are going around, what's going to happen. Of course the war in Europe is over. Is the contract going to be canceled? Is the B-36 going to stop? Or is it going to be finished? We don't know, we haven't heard yet. Everything's really in a state of confusion. A lot of people are trying to decide what they're going to do. We've called you guys together, we want you to know that you have a job with the company after the war. We want you as our permanent employees, so don't get panicky and don't start looking for another job or something. Stay with us." So that was nice to hear, to be selected as one of those.

Storey: Who was this person, do you remember?

Arthur: Yeah, his name was Kirk, Don Kirk . He was an engineer. He later became Vice President of General Dynamics.

Working Conditions While Designing the B-36

Storey: I'm interested in the working conditions, what the office looked like that you worked in, the hours, all that kind of stuff.

Arthur: It was very much like the Bureau of Reclamation in that we all worked in a big room. It was even a larger room. The room we were in might have been, oh, the size of a football field, all desks and drafting tables and so on and so forth. I'm amazed when I go out to the Bureau now and see all these people with these little compartments and cubbyholes. It was quite different–desks were all lined up row-by-row and so forth. The building was windowless, it had been built by the Federal government as a defense plant. Didn't have any windows, of course it was completely air conditioned, fluorescent lighting and so on. It was a modern building. It had security. You needed to have the proper badge to go into proper places. You had to have the right badge to get into the plant. Even the engineers had to punch time clocks, you would punch in and punch out. Very few people were allowed complete access to all the facilities. So the engineers could not go down–you

couldn't go down and roam around through the factory, that sort of thing. You couldn't go out and wander through this mock-up unless you had business . . . .

END OF SIDE 2, TAPE 1. DECEMBER 28, 1994.
BEGINNING OF SIDE 1, TAPE 2. DECEMBER 28, 1994.

Storey: This is Tape 2 of an interview by Brit Storey with Harold G. Arthur on December 28, 1994.

. . . and you couldn't wander through the factory, the experimental shop, the mock-up.

Arthur: Yeah, you couldn't do that unless you had the proper credentials, unless you had the *need* to go there.

Storey: Yeah. The mock-up, though, it sounds to me as if you did go to the mock-up (**Arthur:** Yes.) to see how things fit and all of that kind of thing. Am I thinking correctly?

Arthur: That's correct.

Storey: So you actually got to see the product.

Arthur: Well, more than that, the last year I was there I was assigned as Structural Liaison, and what this consisted of is . . . . You see, they were building the experimental model . . . .

Storey: The aluminum, the actual airplane?

Design Considerations in Building the B-36

Arthur: The actual airplane, number one airplane, and it was being built by hand. You're designing the parts, if you go into production, molds will be made and castings will be made, and so on and so forth, but when you're only building one of them, that isn't cost effective to do that, or time effective to do that. You give a guy the drawing and a block of aluminum and he machines it. Very labor intensive, but still, if you only need one, that's the way you get it. Well, all the parts were in the same category, they're only making one. So no matter how much labor it took, that's the way you do it, you can't design a machine to do it. Okay? Mistakes are made, they use the wrong material, they use the wrong *gauge* material. Aluminum comes in forty thousandths [40/1000], fifty one-thousandths, sixty thousandths of an inch thick

and so on and so forth. You know, like five sheets of paper, ten sheets of paper, thickness and so on and so forth.

". . . the thrust of the structural engineer is to make it strong enough, but don't make it *too* strong. . ."

And the thrust of the structural engineer is to make it strong enough, but don't make it *too* strong, because if you make it too strong, it means you're putting in unnecessary weight, and they always told us, "Every pound of dead weight on that airplane requires three pounds of fuel to move it, at the design range. So if you can save a pound of weight on the airframe, you're saving four pounds"–four pounds that could be used for transporting bombs, see? (**Storey:** Uh-huh.) They're very weight conscious of the thing. On the other hand, it's got to carry the design load. So when I said nothing was checked, actually if it was a complicated piece of structure, I'd go to the boss sometimes and I'd say, "I don't know how to design this. I can't figure out how to design this thing, how to analyze it. It's redundant. Parts are interrelated to the extent I can't figure out what load is going where and so on and so forth. What can I do?"

Lab Testing the Strength of a Part

He said, "Don't look at me, I don't have any idea! Order a lab test."

Okay. So I'd fill out the necessary forms and about a week later the boss would call me up to the office and he'd say, "Your lab test is ready." We'd go down to the lab and they had a testing machine, and there's the part, it's been made full-size, just the way it's going to be, it's put in the testing machine, and maybe it's a column that's going to be squeezed, you see. The boss would look at me and say–I'd have my computations with me, see–he'd say, "Well, Harold, how much is this thing supposed to carry?"

I said, "Well, the design load, say, 50,000 pounds, supposed to carry 50,000 pounds." Okay, so they started the machine. The load needle starts going up, it gets up to around 30- 35,000 pounds and there's some creaking as the metal adjusts, you know, and the rivets and stuff like that, and there's some creaking and popping and noises and kind of shivers like this, and pretty soon you just hold your breath and hold your breath, and the needle goes up to 50,000 pounds, that's what you designed it for. Now the needle starts going past 50,000, you hope the damned thing'll collapse, like the one-horse shay, because you designed it for 50,000, not 55,000. If it carries 55,000, it's too damned heavy, see. (**Storey:** Uh-huh.) So it goes up, it goes to 50,000 and you hold your breath and maybe it gets to about 52,000 and

(schoom!) it goes to [failure] . . . . "Good job!" (laughter) You were allowed to have what they called a margin of safety of about up to ten percent. They figured that was alright, but if it goes more than ten percent, you got to go back to the drawing board.

Storey: And start over again.

Arthur: Yeah.

Storey: And that's what the experimental lab was?

Arthur: That was the testing lab.

Storey: Didn't you mention an experimental lab earlier?

Arthur: In the experimental building they were building the number one airplane. That was in a separate building. That airplane was very high classified. There was thousands of people working on the B-24 line in the main factory. They didn't have any idea what that thing out there was–it was a separate building.

Storey: Was your office building attached?

Arthur: It was attached to the main factory.

Storey: There in Fort Worth?

Arthur: Yeah. The experimental building was on the same grounds, but it was maybe a quarter of a mile away from the assembly building.

Storey: And those folks on the assembly line couldn't go out there.

Arthur: No, no! (laughs) There were people out there with guns!

Storey: And I suppose there were little signs on the bulletin board, "Loose lips loose the war," and all that kind of stuff.

Arthur: "Loose lips sink ships."

Storey: Yeah, that kind of stuff.

"Avoid Verbal Orders"

Arthur: They had another device that I remember. It was called the AVO. And the AVO is "Avoid Verbal Orders." Now, when I was the structural engineer, and I decided this part had to be changed because it wasn't strong enough, or it had to be changed because it was too damned strong, I'd go back to the draftsperson who had drawn this up, and I'd say, "Make these changes." And I would have to take out a form called "Avoid Verbal Orders," and I'd have to write that down.

Storey: An AVO Form?

Arthur: AVO Form, Avoid Verbal Orders. That was to keep from miscommunicating, so you don't rely on understanding, "Well, I thought you told me to do this," or "I thought you told me to do that." None of that stuff, it was all written down. Well, that took a lot of time. But that's the way it was done.

Storey: Do you think it avoided misunderstandings and confusion?

Arthur: I'm sure it did, yeah. On the other hand, there was probably some of it that wasn't worthwhile–where can you differentiate, you know? (**Storey:** Uh-huh.) You either do it, or you don't.

Storey: What kind of hours did you work?

Arthur: We worked a forty-eight-hour week.

Storey: Basically a six-day week?

Arthur: Um-hmm.

Storey: Every day but Sunday?

Arthur: Um-hmm.

Storey: Were there three shifts?

Arthur: Oh yes. They worked Sundays too in the plant. They worked round-the-clock.

Storey: But were there three shifts designing the XB-36?

Arthur: The engineers only worked one shift.

Storey: That's interesting, I would have thought they would have been concerned about moving it along faster.

Arthur: Well, you would do that with more people, but it requires an intellectual continuity, you know. Suppose I started writing a story and I say, "Well, here's my chapter, now you (**Storey:** You write your chapter.) write your chapter." Well, I've done that too, but maybe that's not a good example. I mean, you're doing a piece of intellectual work, you just can't turn it over to somebody else, without them having to go back and repeat a lot of what *you've* done. You have a problem with continuity. I think what you do is just put on more people.

Storey: Were the hours rigid?

Arthur: Of course. What you're talking about is something that was invented many years later.

Storey: Uh-huh. Run me through a typical day, if you would.

Arthur: Well, all I remember is it was just like a regular day. I don't know whether it was eight to five or seven-thirty to three-thirty or four-thirty. I don't remember the exact hours. That was a long time ago.

Storey: Oh, okay. When you moved to Fort Worth with this big defense plant there, did you have trouble finding housing?

". . . I went out to look at the guaranteed housing, and my wife just threw up her hands—it was Quonsets. . . ."

Arthur: Now, that's a good question! I was guaranteed housing, it was part of the deal. I was guaranteed housing, and when I got down there, I went out to look at the guaranteed housing, and my wife just threw up her hands–it was Quonsets. But one thing they had done, they had built a bunch of new houses in Fort Worth, out in the west part of town, within a couple of miles of where the factory was, and these had been built under war priority, and the contractors were able to get lumber and nails and all kinds of building materials as well as some labor to build these things. But these houses were reserved for people that were coming into the area, for new people. In other words, if you already had a house, you couldn't buy one of these houses, they weren't available to you, they were reserved. If you had lived in Fort Worth, I think it was something like if you had lived there more than a month, as far as they were concerned, you had found housing somewhere else, you couldn't buy one of these houses. If you lived in the county more than six months, you must have

someplace to live, you can't buy one of these houses. If you lived in the state of Texas over a year, you weren't eligible. They had rules like that. So I came in and got into that area, and of course I qualified on all counts. There was a house, it was not brand new, it had been lived in, I don't know what happened to the owner. It had been lived in only a short time. Maybe he got drafted or whatever. But it was for sale. There were two or three houses in that category for sale. So I bought a house.

Storey: Now, you had bought a house in '42, I think, (**Arthur:** Um-hmm.) in Denver, and then you had to move right away. (**Arthur:** Right.) How did you make out in the war market in Denver, the real estate market? Did you lose money, make money, break even? How did that work?

Arthur: We bought the house for $5,000, and I sold it for $6,500 in Denver. I bought the house down there for about $6,000. I sold it for about $7,500. Prices were controlled, but there was a creep in prices. They were *gradually* going up on that sort of thing. But they were controlled, or otherwise it would have skyrocketed, because of the short supply.

Storey: Now, am I to take it this house that you bought in Fort Worth was not right near the plant?

Arthur: Yes, it was. Well, you've got to define terms. It was probably three or four miles from the plant. It was not clear across town, is what I'm trying to say.

Storey: Yeah. So you didn't have a major transportation problem?

Arthur: No, I had a car, and we car pooled.

Storey: Tell me about the kinds of problems, or the kinds of things that came up with rationing of gasoline and tires and food and that kind of thing, and whether because of your status you got advantages as far as that was concerned.

Arthur: Okay. Turn it off for a minute and we'll have a little break here. (tape turned off and on)

Storey: We were talking about rationing and how it affected you.

Arthur: Well, we moved to Fort Worth from Denver at our own expense, so we moved only things that were more or less essential, what we thought were essential. What we didn't move was empty Coke bottles and empty beer bottles and that sort of thing. And we found out when we got down to Texas and into Fort Worth, that it was very

difficult to buy those sort of things. You couldn't buy Coke unless you had a Coke bottle [to turn in]. You couldn't buy a beer unless you had a beer bottle.

Storey: Really?!

Arthur: That's correct.

Storey: That's interesting.

Arthur: Right, because these things weren't being made, you see–they had to be recycled,. We had to recycle.

Storey: Uh-huh. How did you solve that problem?

Arthur: Well, gradually as we became friends with neighbors and so on and so forth, some people would have an extra bottle or two, and gradually we would acquire a small supply. (laughs) But neither could you buy things that were of more significance than that. The house was not air conditioned–Fort Worth gets pretty damned hot. You couldn't buy a fan. The house did not have central heating–this is a new house–and they still probably don't have, a lot of those houses down in Texas don't have central heating. You couldn't buy a stove. You *could* get permission to get a priority to buy a stove, but you couldn't just go out and buy these kind of things. Gas was strictly rationed. I think that if you were a "good ol' boy," good old Texan, and had been trading at the service station for a number of years, that you could probably get a few extra gallons of gas now and then. But if you were a damned Yankee, no favors! (laughs) So you asked if we got special privileges–no (chuckles) there weren't any special privileges. The only special privilege we got was cheap cigarettes. They would once in a while have a big van out at the plant there, and they'd be selling cigarettes for cheap. Cigarettes were hard to get, Kleenex, toilet paper, all those things, very hard to get. So I think we were allowed, I think it was four gallons of gas a week, something like that, and we made do on that. You couldn't get coupons for extra gas to go to work if you lived within a certain radius. If you lived real far, you could get commuting gas, provided you had an essential job, if you met the requirements. Where we lived, you couldn't get extra gas to commute. But because this was a new neighborhood, most everybody *there*–not everybody–but most everybody there worked for the aircraft company, so it was easy to find car pools, and right away I was in a car pool with five guys, and we would take turns driving.

Storey: Total of five, or five other guys?

Arthur: Five other guys.

Storey: So you went six to a car.

Arthur: Yeah.

Storey: Saved a bit of gas.

Arthur: Then my wife was not well while we lived there and she had some health problems and some surgery. A second son was born in 1945 down there in Fort Worth. So she didn't like Texas *at all*. Most of our friends were not Texans, they were all Yankees, although I remember one fellow particularly who was from Minnesota, had married a Texan girl. We became friends with them. A couple of couples where the fellows had married Texas girls. But just the Texans and the Yankees didn't mix too well. So my wife wasn't very excited about this offer to stay with the company. (chuckles) In fact she said as soon as we could go back to Denver, she wanted to go back to Denver. So then came VJ-day [Victory in Japan]. So now it's time to decide what to do. (phone rings) And I made a deal with my wife, I said, "Look, we can't go back to Denver and live on what I was making when I left Denver." So I got a couple of . . . . Do you know what a "Ramspeck" is?

Storey: No.

Arthur: Well, it's a within-grade promotion for length of service. You'd get into grade, and then in a year you get an automatic promotion. Don't they do that anymore?

Storey: Yeah. I don't know what they call it, we call them "nine slash elevens" [9/11s], "eleven slash twelves." It means you start at one grade, and it's presumed that you'll be promoted if your work is satisfactory.

Writes to Reclamation about Returning to Denver

Arthur: Well, the law implementing this was introduced by a congressman called Ramspeck. So these are called Ramspecks. And I earned those because I was on furlough. I wasn't working [for Reclamation] but I would get those anyway. They were just for [satisfactory] length of service. So anyway, I said, "We can't possibly live on what I was making at the Bureau, because prices have gone up." Our standard of living hadn't gone up very much, but maybe a little bit. But anyway, we had a second child, our expenses were going up. And I was making $550 a month down there, which was . . . . On VE-day, they cut back the overtime. We started working five days a week after that, so my salary was cut to $500 a month, and I'm making $500,

and when I'd left to go down [to Fort Worth] I was making about $200. I said, "We can't go back and work for that amount of money." But they had changed, there'd been a pay raise had gone through, they'd raised the salaries of Federal workers, Civil Service workers. I think I *could* have come back at about close to $300 a month. No, that's not right, I could have come back at about $250 a month. That was what I was entitled to on my War Service Transfer. So the deal I made with my wife was that I would write back to the Bureau and tell them the VJ-Day, I could get a release from it, from the War Service Transfer. As far as the aircraft company was concerned, they had to honor my request for release, because the war was over, and I was ready to come back to the Bureau, which I would do *provided* I would be promoted to what was called a P-3 in those days, which would be a GS-9 now, and paid $3,640–I remember this as I go along. I figured this was the minimum we could get by on. The deal was, that if the Bureau said they'd pay me that, we'd come back to Denver. And if the Bureau said "No," then I would stay with the aircraft company. And she agreed to this. And I sent the letter and in due course the letter came back and said, "We'll hire you back at $3,640." It's interesting, I was told later that there was quite a bit of indecision about whether to meet my terms or not, because my letter was judged to be very arrogant in tone. [They] said, "It didn't sound like you gave a damn whether you came back to the Bureau or not." I said, "Well, you read correctly between the lines," because I really didn't *want* to go back. I was doing well down there. I didn't like Texas very well, but we *might* eventually be transferred to California, who knows. In the meantime, I liked the work, and what I was doing, and I liked the pay. Had my wife agreed to it, I was willing to stay there. So they got the sense of this in the letter. Anyway, they agreed to it, and so I, having made a deal with my wife, we came back to Denver.

Storey: When was that?

Moves Back to Denver

Arthur: Well, let's see, it was September 1945. It was shortly after VJ-Day.

Storey: How did you find housing in Denver?

Arthur: It was pretty scarce, but there were houses available. I bought a house over here on South Clayton, not very far from here, as a matter of fact, just about a mile or two over here, just off of Buchtel Boulevard, which was a good location because the office now was down in the Golden Eagle Building. Did you ever hear of the Golden Eagle Building?

Storey: It was a dry goods store, but I don't know exactly where it was.

Arthur: It had gone out of business, and the Bureau had leased the second floor, because the Bureau was expanding. One reason that they hired me back, that I was told, and that I surmised, the feeling was that there was going to be a *great big* depression just as the war was over. We'd been in a big depression, the war pulled us out of it. Now the feeling was with economists that we have three million guys coming back looking for a job, where are the three million jobs? So we got to create some jobs. Can you believe that they really thought that, they were serious about that?

Storey: It's hard to in retrospect think that way.

Reclamation Was Gearing up to Build Projects to Help Employ Military Men

Arthur: Isn't it hard to? Yeah. Well, just remember this when you're reading economic predictions today. (both chuckle) But anyway, one thing that the Bureau had been given the responsibility of getting geared up to do a lot of construction work, and get a backlog of designs ready to go, to go under contract–partly for development, partly for Public Works Project. Well, as I said, most of the engineers were Reserve officers and they were off to the war. The war was over, but they were slow getting out–it takes months for them to get out, because there was occupation in Japan, there was occupation in Europe, and they were being slowly released. On top of that, there were a number of them that didn't want to come back to Denver–they wanted to go out in the field, or they wanted to do something else. Their perspective had been changed, they had been gone for three years, and they looked at life differently after being in the Army, weren't able to come back and draw lines at the drawing board. So the Bureau had this mission/mandate to get this work done, and they didn't have people to do it. And here I was, ready to come, and I'd had two years in the field, and I'd had over a year in Denver and they knew me and I knew the job, and so on and so forth, so I was somebody that could step right in and go into production. So they overlooked my arrogance (laughter) and decided to pay me this big salary, $3,640 a month.

Storey: So what did they assign you to do?

Rapid Promotions in Denver

Arthur: I went back in the Earth Dams Section and did essentially what I was doing previously. But *now* they were expanding and they were trying to hire people. They were getting inexperienced engineers coming in, so I was given supervisory responsibilities. I got a series of rapid promotions. I said I was a P-3, which was like a GS-9. Shortly I went to a P-4 and then I went to a P-5, and I went to a P-6, I think. These are all GS-9, GS-11, GS-12, GS-13. That took place within a

relatively–well, up to the twelve took place . . . .

END OF SIDE 1, TAPE 2. DECEMBER 28, 1994.
BEGINNING OF SIDE 2, TAPE 2. DECEMBER 28, 1994.

Storey: You were saying you were rapidly promoted nine to eleven to twelve, and then eventually to thirteen through the levels that were then P-3, -4, -5, -6.

Arthur: Right. As I had seniority and experience compared to these newcomers that were coming in.

Storey: Uh-huh, and you'd had some supervisory experience.

Arthur: Yes.

Storey: I presume supervision went with this?

Arthur: Oh yes, right.

Storey: What were you all working on?

Works on Boysen Dam

Arthur: Well, the first dam that I was assigned that was my responsibility, was Boysen, up near Thermopolis, Wyoming, it's an earth dam.

Storey: That's B-O-Y-S-E-N, I think.

Arthur: Right. And in those days, the Earth Dams Section actually coordinated all the designs and specifications work for an earth dam. We were specialized and we had the Earth Dams Section that did the earth dam work and the Spillways Section, and we had an Outlet Works Section, and we had a Mechanical and we had Electrical, and all these bunch of specialists. Somebody had to pull this all together and make a whole of the parts, and that was done for earth dams in the Earth Dams Section. We did all the drawings and data, quantities, designs from all these other sections and pulled them together. Well, I was in charge of Boysen Dam. I remember that was the first one. Another one was the South Coulee Dam. The next one was Cachuma Dam–a bunch of dams. In fact, my Distinguished Service Award says over fifty. (chuckles)

Cachuma Dam and Innovations in its Design

But the Cachuma Dam was a very interesting dam. Let me tell you something about it. (**Storey:** Yeah.) It's an earth dam, primarily for the municipal water supply of the city of Santa Barbara, California. It's a dam on the Santa Ynez River. The Santa Ynez River is a valley that's separated from Santa Barbara by a range of mountains. It required tunneling to get the water from the reservoir at Cachuma Dam through the Tecolote Tunnel into the city of Santa Barbara. But this, at that time, was in the planning stage. We were doing feasibility designs, getting ready to go to Congress for appropriations. And the dam was being promoted by the City of Santa Barbara. The City of Santa Barbara also had a consulting engineer by the name of Raymond Hill, who had alternative plans which he thought would be less costly than the Cachuma Dam, so the Board of County Supervisors were kind of in the middle between the Bureau of Reclamation's scheme on one hand, and Raymond Hill's scheme to raise Gibraltar Dam on another. But we prepared a feasibility design for this dam, and an estimate–sent it out to the Planning Office which is located in Santa Barbara, to the County Board of Supervisors.

The feeling was that it was too expensive, cost so much more money than what this consulting engineer's plan was for an alternative type of development. It had certain aspects that made it a better plan for the city, but still they didn't think they could afford it. Well up to that time, the Bureau had built earth dams only in mountains and on small streams and narrow valleys. We hadn't built any out in the Missouri Basin, that was still to come. And Cachuma Dam was no exception, it was a relatively narrow valley. And the way you did it in those days, the way the design was made, you would drill a diversion tunnel, like we did at Alcova, the tunnel would detour the site, then put in the coffer dams, force the river to flow through the tunnel, and that would give you an opportunity to dig down in the foundation of the cut-off trench and backfill it and build the dam in the dry. And of course that's the type of design that was envisioned at Cachuma. Well, they [County Board of Supervisors] came back to the project office, "Can you do anything to cut the costs of this thing?" [And this was relayed to the Denver office.] This was my dam. I went back and I looked at the hydrology, the stream records, and the Santa Ynez River is a very small stream all during the summer, and can be a hell of a big river during the winter rains in California. And the winter rains came from mid-December to like March, something like that, is when you could have the storm fronts moving in from the Pacific and get a lot of rain and so on and so forth. So we had to have a big tunnel to carry these big flood flows, like maybe, I think the tunnel was about twenty, twenty-five feet in diameter, something like that, and would cost a lot of money. And in studying those records, I could see, well, you got a period of time from, say, May through November when you've got very little water to worry about. It's only during the winter you've got these big storms.

So my idea was instead of building this big twenty-five-foot diameter tunnel or something like that, we build a small tunnel, seven foot, which was considered the minimum size for a man to work in and stuff, economically. Seven foot tall. This would have enough capacity that we could divert the river all during the dry season, during the summer. So I said, "Well, we'll build this little tunnel, put up our coffer dams, detour the river through the little tunnel, and we'll dig this hole in this foundation, and we'll fill the hole back up to the river level, and take down the coffer dam and let the big flood go over the foundation. Then the next season, we'll build a coffer dam, *clean up* the stuff, and start building the dam. And we'll get the dam high enough in one construction season, so the next wet construction season, the next wet season, the small tunnel plus the storage capacity behind the dam half-built will control the floods and we won't be overtopped. And the next dry season, we can finish the dam." This sounded like a good idea, "Why don't you figure it out?" So I said, "Okay," so I started the design on this basis, and preparing the estimate and so on and so forth.

Meanwhile, out in Santa Barbara they were very anxious to get this, because the climate is just right politically, that they want to go ahead with this project and so forth, and they just want some answers. What's going to happen when I'm working on this thing, somebody's come up with the idea of moving the office from the Golden Eagle Building to the Federal Center.

"So we're sorry, tomorrow morning at eight o'clock, your desk is going out there, and it's going to be three or four days before you can get back to work. So you're going to have to interrupt your work."

Well, I'm almost through with this design, so I said, "I'll talk to my boss," who was then Oscar Rice and I said, "If I could have three or four guys, and if you can get the overtime authorized, we'll have this job done before the move, we'll get it done tonight."

He said, "How much overtime do you need?"

And I said, "I want it open-ended. I'm going to work to five, midnight, two o'clock in the morning, all night, whatever it takes to get this done. But in the morning, when the movers come in, you'll have that teletype ready to go out with the new cost estimate."

"Okay."

So we did it, got the new estimate. The price was appreciably less. The

teletype got sent out, the project office took the estimate to the County Board of Supervisors, and they were very happy to get this reduction in price. They were so happy with it, they decided that they were going to send a delegation to Washington to call on their congressman and senators from California to get this thing authorized right away so they could get the money to put out the contract documents and award a contract.

But first, they wanted to know a little more about how we had achieved this savings. Was it real? You know, they wanted some verification on it. We had no drawings, they hadn't been prepared, we had nothing. All they had was a lump sum figure on the teletype. So *en route* to Washington, they decided they'd stop over in Denver, get some first-hand information on what had happened, and had changed the design. So when they called, of course, we went in and they called on the chief engineer.

The chief engineer says, "Well, glad to have you, glad to be of service, sure glad this worked out. Now for the details, go to the chief designing engineer."

So they went to the chief designing engineer and he gave them the old glad hand and stuff like that. He says, "Well, you know, that was done by the Dams Branch."

So they go down to the Dams Branch, same procedure. They go in, "It was done in our Earth Dams Section, they're the ones that can really give you the story. So go down there to the Earth Dams Section." So they were ushered into the Earth Dams Section and the section head sits there. He's got a general idea of what happened, but he really doesn't know all the details and stuff, and these guys want to know the details, and they want to see some sketches. The boss hadn't seen any sketches yet, because we had just moved. See, we were still unpacking, as a matter of fact, out there at the Federal Center. So what did they do, they called Harold Arthur. "Get Harold up here, he knows what's going on."

So I went up there and gave them the explanation of what had happened and so forth.

So they went back to talk to the congressional delegation, and it wasn't much later that we got a teletype from the project engineer at Santa Barbara. He said the City of Santa Barbara was going to have a vote on a bond issue, to finance their share of the work. And as part of that procedure, they were going to have a public meeting in the courthouse in Santa Barbara, to which the public would be invited to hear about this scheme, what it was going to cost, what it would do for the city, and

all that kind of stuff, and they wanted Harold Arthur to come out and explain it.

Now, this was *absolutely* unprecedented. The field people, when they wanted help of some kind, were not allowed–I don't know how long this persisted–they were not allowed to request an individual. They could express a need, "We need somebody to advise us on this," but the chief engineer in all his wisdom, *he'd* decide who the person would be to go out there and give them appropriate advice.

Another rule was that you send as few people to the field as possible, for reasons of economy, and you never send a junior person–you'd always have a senior person present. If there's going to be any decisions made at all, it's going to be a senior person–which I was not! I wasn't a section head.

"So that was my first field trip for the Bureau of Reclamation–a rather significant one. . . ."

And I was asked for, by name, by an outside agency. (laughs) So that was my debut. (laughs) I climbed on a DC-4 airplane and flew out to San Francisco and got on a DC-3 airplane and flew down to Santa Barbara and I got there the afternoon before, and they showed me where the meeting was going to be, and there was a blackboard about the size of this wall. We had a number of schemes. One of the things they wanted to do was consider building the dam in one stage with provisions for enlarging it later, and how much would it cost to do that later? They were trying to minimize their capital expenditures. And how much it would cost for this capacity, and how much for this capacity. And so we had a whole bunch of schemes. I spent a couple of hours putting this all on the blackboard, you know. Then I was called upon to explain this to the public. It wasn't such a big public, but the press was there. (laughs) An event, you know, and they took it all in, and stuff like that. And the bond issue passed, and so on and so forth. So that was my first field trip for the Bureau of Reclamation–a rather significant one.

The interesting part of it was, of course this was a planning office in Santa Barbara and we had a Planning Division in the Denver office and they were in close contact. And there was an engineer by the name of Gordon Johnson that worked in the Planning Division and one day he come bustling over to my desk there in the Earth Dams Section, and he says, "Hey, I want to be your office engineer."

I said, "What are you talking about, you 'want to be my office engineer'?!"

He said, "Well, when you get to be the construction engineer on Cachuma

Dam, I want to go out there. I can be a good office engineer, I want to apply for the job."

I said, "What the hell are you talking about?!"

He says, "The City of Santa Barbara has requested *you* to be the project engineer!" (laughs) (**Storey:** Uh-huh.)

I said, "I can't believe it!"

He said, "Yeah, they have requested you to be the project engineer. The Board of County Supervisors carries a hell of a lot of weight."

I said, "Well, I'm way down the ladder. I just don't think it's going to happen." And it didn't.

The project engineer, the construction engineer that went out there was a guy by the name of E. R. Crocker, and he was the head of the Canals Branch. And I heard later that his wife was very ill and Crocker told the chief engineer that the doctor's orders were that he had to get his wife down to ~~the~~ low altitude or she wasn't going to live very long. And so he was asking for some kind of a reassignment, someplace, to a low altitude. Of course he was a big shot, he was a branch chief. So they told the City of Santa Barbara–I *suppose* they told them–"Harold Arthur's alright, but here we got a guy that's much senior to him, you know, and all this experience, and we're going to let you have him." So Crocker went up there, and I didn't become a construction engineer.

Storey: At least then? or ever?

Arthur: Ever. (both chuckle)

Storey: Well, you know, I'd like to continue, but we've reached the end of another two hours. I'd like to ask you again whether or not the material on these tapes and the resulting transcripts can be used for research by people from both inside and from outside Reclamation.

Arthur: Yes, of course.

Storey: Great, thank you.

END OF SIDE 2, TAPE 2. DECEMBER 28, 1994.

BEGIN SIDE 1, TAPE 1. JANUARY 11, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold G. Arthur, former chief engineer of the Bureau of Reclamation, at his home in Denver, Colorado, on January 11, 1995, at about ten o'clock in the morning. This is Tape 1.

Recollections about the Riverton Project

I had asked you about the Riverton Project, and I think you were telling me that you were assistant regional director in Billings at that time.

Arthur: Yes, I was assistant regional director from 1960 to 1963, and I'm listed as attending the meeting, it was in my capacity as probably either assistant or acting regional director.

Storey: But you don't remember that particular meeting in '61?

Arthur: No, I don't remember too much about the Riverton Project, because I didn't have any association prior to that 1960, during the time that I went up there.

Storey: Well, in that case, let's go back to the Cachuma Project.

Arthur: Let me make one suggestion. (**Storey:** Oh, excuse me, yeah.) The engineer who was in charge of Operation and Maintenance of the region was a fellow by the name of K. K. Kober, K-O-B-E-R, Kermit Kober. And I keep seeing him at the retirees' luncheons.

Storey: Here in Denver?

Arthur: Here in Denver. So that would have been in his area of responsibility, and he might have some knowledge of that.

Cachuma Project

Storey: Okay. That's great, that's a good lead! I appreciate that.

Last time, you had just explained your experience out at Cachuma.

Arthur: Yes, and it's very interesting to me the floods that they're having in California at this particular time. If you recall, I explained how there were dry periods and wet

periods in California (**Storey:** Yeah.) and the wet period that I said was from December to March, and that's where we are right now, what they're calling now in the morning paper, the 500-year flood. This also shows the need for storage dams out in California, because as you can recall, a year or two ago, we were having a drought out there. It's feast or famine–floods or drought, and we need storage dams to control the floods, and to retain the water for use in the dry season. As far as the engineering of Cachuma Dam, I think we pretty much concluded the discussion on that.

Storey: Yeah, but you mentioned, after we had turned the tape off, that the model that you established for doing the Cachuma Project was later picked up and used elsewhere, and I'd like to discuss that a little bit if we may.

Arthur: Yes. Well, prior to the Cachuma Experience, the dams constructed by the Bureau of Reclamation had been primarily in narrow canyons, and the only way that the river could be diverted so construction could take place in the canyon was by a tunnel or bypass channel around the dam site.

Creates Staged Construction for Cachuma Dam

We found out in the Cachuma case that we couldn't afford that type of construction, and we needed to do what I would now call "staged construction." Shortly after this, we started building dams under the Pick-Sloan Plan in the Missouri Basin and went into wider valleys. And we adopted this technique of not trying to divert the river during peak flows . . . . (phone rings, tape turned off and on) And in the Missouri Basin Projects, in the wider valleys, we developed, following the Cachuma experience, the technique of caring for only the low flow of the river, through a diversion works, and letting the spring flows, the high floods, flow over the partially completed backfill of the cut-off trench, or moving the river from side-to-side, so that that became more or less the standard procedure for handling the river during construction.

Storey: What kind of advantages did that have for us?

Arthur: Very great economic advantages, the same as Cachuma, because instead of building a temporary diversion works, a large tunnel to handle the peak flows of the river, you could get by with a nominal size diversion works, which made it a lot less expensive.

Storey: One of the things I was sort of interested in, you went back to the Earth Dams Section, I believe it was. There are a lot of us who are not engineers who would be interested to know sort of the basic kinds of differences between earth dams and

concrete dams and where they can be built and where they can't be built and that sort of thing. Could you run through that in language that I could understand?

Design of Small Dams–a Publication

Arthur: Well, let me give you a good reference for that, something that I want to discuss in some detail later on. I was the editor and responsible for the Bureau's publication *Design of Small Dams*, and I wrote the chapter on the selection of type of dams. This will give you in nontechnical language the criterion for selection of type of dam. (**Storey:** Okay, good.) But I can briefly talk about it.

Storey: Yeah, if you would, I'd appreciate it.

Requirements for Different Types of Dams

Arthur: There are significant differences between concrete and earth dams as regards to the site requirements. A concrete dam imposes much greater loads on the foundation than an earth dam, which is spread over a wider area. Therefore, you must have a better geologic site, better geological situation for a concrete dam than for an earth dam. You have to have a foundation that will support this. Also, concrete is, of course, considerably more expensive than earth, though you use a smaller volume of it. But the typical location for a concrete dam is in a narrow canyon, which has good strong rock abutments that will support the thrust from an arch, then they can build an arch dam, which is an economical type of dam. Or in a wider canyon you have to use a gravity type of section which uses considerably more concrete. A concrete dam has some advantages in the fact that you can overflow the concrete dam as a spillway, such as Grand Coulee Dam, where the spill goes over the top of the dam. You can't do that with an earth dam, of course, because it would erode the dam. So you have to have a separate spillway. So primarily it's a matter of economics as to whether a concrete dam or an earth dam should be built.

Auburn Dam Was Originally Proposed as an Earth Dam

Let me talk a minute about Auburn Dam. Auburn Dam was authorized as an earth dam. The preliminary feasibility design was based on an earth dam, and that was in the documents when the Congress appropriated money for the construction of the dam, for final design and construction. I was chief designing engineer at that time, and I had never seen the site–this preliminary work had been done *prior* to my being in that position. Well, I went out to California to review the site situation, and I was particularly interested in where the material would come from to build this dam, because it would take a large volume of earth and sand and gravel to construct

the embankment. And I was particularly interested in where the *impervious* material would come from that would make up maybe fifty percent of the dam and would actually be the water barrier. That type of material was in short supply out there at the dam site, and the exploration had been made over a *wide area* around and in the vicinity of the town of Auburn. And I learned that actually what would happen if the dam were built, the topsoil would be stripped, almost to bare rock, over a *very* wide extensive area in the vicinity of the town of Auburn. Well this was at a time before the environmental movement was very strong, but I could appreciate the environmental damage that was going to be done, and I was well aware *then* of what a bad thing this would be. And of course I could anticipate there would be eventually a public reaction against it too.

Directs Study of Concrete Dam at Auburn Because of Anticipated Environmental Damage of an Earth Dam

So because of that I instituted, when I got back to Denver, I directed a study of building a concrete dam at that site, because it wouldn't require all this tearing up the countryside for construction material. This was practical because the dam site geologically was very good, it was good rock, and not a deep overburden and that sort of thing. The canyon was comparatively wide for an arch dam, but we conceived a design of a thin double curvature arch dam which would have been the longest span in the world for that type of dam, as being practicable for that site. So that was one instance where the type of dam was actually changed from the way it was originally conceived to the way we started to build it. Of course, as you're aware, it never did get built, because of other factors. (**Storey:** Yeah.)

At Anchor Dam Reclamation Designed a Concrete Dam and an Earth Dam and Let Bids on the Two Designs Determine Which Was Built

The other case in point was the Anchor Dam which is on the Wind River Project up in Wyoming, near Thermopolis. That was a site which geologically appeared to be favorable for a concrete dam, or it could be used, of course, for an earth dam also. And there was construction material for an earth dam available, so it was not readily apparent whether it should be a concrete dam or an earth dam. So alternative designs were prepared and estimates were made, and these were still not conclusive. So this was the only time, to my knowledge, in the Bureau of Reclamation, that we let the marketplace decide the type of dam. We designed the concrete dam and put out specifications for bid; and we designed an earth dam and put out specifications for bid; and let the *contractors* decide which would be the most economical structure. And it was on that basis that an arch dam was built.

Storey: Oh. This is in Wyoming, as I recall.

Arthur: Right.

Storey: One of the things I'm sort of interested in: Reclamation sort of has this "image" of Hoover and Grand Coulee and Shasta and so on. *Within* Reclamation, was there any tension or "rivalry" (laughs) or whatever you would want to call it, between the concrete dam designers and the earthen dam designers and the people who were responsible for construction of the two different types?

Competitive Spirit Between Concrete and Earth Dam Designers

Arthur: Well, there was to some extent, the Anchor Dam was a case in point, because the concrete dam design was formulated by one section, and the earth dam was formulated by *another* section. Of course each set of engineers figured that their dam was the one that should be built, so there was a competitive sort of a spirit, in regard to which type of dam would be selected. But in most cases that you cite of these big dams, Hoover Dam, those dams were of a magnitude that earth dam construction was not considered suitable.

Storey: Did that cause some kind of a mind set in Reclamation, that "concrete dams are the thing to do"? Or anything like that?

". . . the majority of dams, by far, of the Bureau of Reclamation, are earth dams . . . because of their economy"

Arthur: I don't think so. The major dams, those that you mentioned *are* concrete because of their scope and size. But the majority of dams, by far, of the Bureau of Reclamation, are earth dams because for the smaller dams, because of their economy. The chief designing engineers who were probably most influential in picking the type of dam when the geologic and topographic conditions permitted either type, came from different backgrounds. Like one chief designing engineer was Louie Puls who had been a concrete dam designer all his life. Well, he understood concrete dams and probably preferred concrete dams. Other chief designing engineers were Oscar Rice who was at one time the head of the Earth Dams Section, and myself, whose background was earth dams. We understood and knew earth dams. But still, I didn't feel, as I explained on the Auburn situation, I didn't feel any great preference for an earth dam over a concrete dam–in fact, quite the reverse, because of the environmental considerations.

Storey: Yeah. Maybe I'm not making my question clear enough. In interviewing some other engineers who were electrical engineers, they have said, "Well, of course nobody was ever made a division chief if they were an *electrical* engineer. You *had* to be a *civil* engineer." In their view–I know this is wrong, because I've interviewed *several* electrical engineers who have risen into the very top of management at Reclamation–but that's the perception they had, and it's sort of a pecking order in their mind. And I'm wondering if there was sort of a pecking order regarding earthen and concrete dams in the Bureau of Reclamation. And what I'm hearing you [say] doesn't seem to evince anything in that direction, to support a conclusion in that direction.

Arthur: No, I don't think you can make such a conclusion. (**Storey:** Okay.) But it's interesting what you said about the electrical engineers, because as you probably well know, L. N. McClellan was an electrical engineer, and he became chief engineer.

Storey: I didn't know that. See, a lot of this perception is that the people don't know the history of the agency, and they don't know the history of the people who are in the agency now, because we have, I think, two or possibly three [electrical] engineers. Mechanical engineers have said a similar sort of thing, "You couldn't rise if you were a mechanical engineer."

"So if I got into an organization, I wanted it to be one that was run by *civil* engineers, not by mechanical or electrical engineers. . . ."

Arthur: Well, primarily the Bureau of Reclamation was a civil engineering organization. This is right. One reason I didn't mention when we were talking about my leaving the Forest Service, I decided I wanted to be in an organization that was run by engineers, not by foresters. So if I got into an organization, I wanted it to be one that was run by *civil* engineers, not by mechanical or electrical engineers. I mean, it just follows that in a civil engineering organization, that the person best qualified for an overall leader is the one that has the civil engineering background, because it's broader in scope.

Storey: Uh-huh. Well, we've wandered way afield (laughs) from your work at the Earth Dams Section and Cachuma. What did you do after Cachuma? You told me about the possibility of going as project engineer at Cachuma and how that didn't occur and all of that.

Assigned to Coordinate Between Reclamation and the International Boundary and Water Commission on Design and Construction of Falcon Dam on the Rio Grande

Arthur: Well, my first big opportunity with the Bureau of Reclamation came with the decision of the Bureau to assist the International Boundary Water Commission in the design and construction of Falcon Dam, F-A-L-C-O-N Dam, on the Rio Grande, seventy-five miles south of Laredo, Texas.

In 1945 the United States and Mexico entered into a treaty which among other things allocated the flow of the Rio Grande along the international boundary, which is maybe four or five hundred miles long, stretching from El Paso, Texas, to the Gulf of Mexico. And they divided the flow of the river, as I say, based upon the drainage areas in each country that contributed to the flow of the river, saying that about sixty percent of the water belonged to the United States, and forty percent of the water belonged to Mexico, roughly. This treaty, among other things, provided for the construction of some dams along the river, for the purpose of flood control, and for irrigation, and the development of hydroelectric power, and empowered the International Boundary Water Commission to get this work done. Well, the International Boundary Water Commission is made up of two sections: the United States Section and the Mexican Section, each headed by a commissioner, and they had equal authority in the Commission. They decided that neither one of those organizations were dam-building organizations, nor did they have a large staff of engineers available, so they decided that they wanted to get some assistance in the design of the first dam that was selected to be built, which is the Falcon Dam I've already mentioned. They approached the Bureau of Reclamation with the proposition that the Bureau of Reclamation perform the design work for this dam. I think this was partially influenced by the fact that the United States commissioner, whose name was "Larry" Lawrence Lawson, had been an employee of the Bureau of Reclamation in his early days, so he was well acquainted with the Bureau.

So the Boundary Commission and the Bureau of Reclamation officials got together and it was decided that the Bureau of Reclamation would perform the design work for the Falcon Dam. The United States Section of the Commission was aware of the structure of the Bureau of Reclamation, how it was organized, and they said in effect, "We want a liaison engineer assigned on the chief engineer's staff, an engineer to whom we can turn to for information, for assistance, during this design process. We don't want to try to have to deal with the Electrical Section, the Mechanical Section, the Dams Section–all these myriad sub-organizational units. We want *one* person that we can go to that can get us our answers, that can get us information, and so on and so forth, more or less be our representative." So the Bureau agreed to do this.

The person that was selected was called a Project Coordinator, and of course that was me–I was selected for the job–the reason being, as you may recall I explained before that the Earth Dams Section more or less coordinated *within* the chief engineer's office the preparation of the specifications for pulling together the electrical parts, the mechanical parts, and the spillways and outlets and so forth, and pulled those together into a unit and so on and so forth. So it was logical that such a sponsor would come from the Earth Dams Section, since the Falcon Dam was going to be an earth dam. Then to select an individual, they had to select somebody who had a high enough status in the organization so he'd have *some* recognition. On the other hand, he couldn't be in a *key* position, because it was going to take most of his time to carry out this assignment. So anyway, I got selected for the job, and I was instructed that I was to spend as much of my time as necessary to carry out this coordination function. And also, of course, I was the principal designer on the dam itself, which was an earth dam.

Storey: When was this?

Several Things about the Falcon Dam Project Were Unprecedented for Reclamation

Arthur: It was 1948 that I was appointed Coordinator. This was unprecedented in the Denver office, to have an individual like myself, because I pretty much started to cut across the lines of organization, and coordinating and *pulling* this thing together, and working with the Boundary Commission, I was working directly with the people who were involved in designing the varied aspects of the job. And I didn't always go up, all the way up, through *my* line authority, cross over to the top of somebody else's and then go down the ladder to get to the guy–*I went direct* and got these things done.

Also very unusual was the fact that I attended *all* the meetings, and there were a lot of meetings between the United States and the Mexican sections to coordinate and to follow what was being done on the design of this project. The Mexican Section had its consultants, the Hydraulic Resources Agency in Mexico City, who were overseeing what was being done, and I think initially there was perhaps a little suspicion on the part of the Mexican Section about having me as a United States engineer, design this joint project, as to whether or not there would be favoritism shown on the design or whatever.

Anyway, what I'm saying is that the Mexicans wanted to monitor it very closely. So they were concerned with details of design that normally didn't come under anybody's scrutiny, because they were done in Denver by the chief engineer for the Bureau of Reclamation projects. Nobody said, "Why do you have two

penstocks instead of three penstocks?" or "Why do you have this size unit instead of that size unit?" or "Why do you use this kind of a gate instead of that kind of a gate?" The Mexicans wanted to know all this. They wanted everything justified, all the decisions justified. This took a large number of meetings between the United States and the Mexican Section, and I was the guy, the messenger, who answered their questions and funneled the information from Denver to the Boundary Commission, and took their questions from the Boundary Commission back to the Bureau and got answers to them and that sort of thing, and coordinated the Project.

And sure enough, it was practically a full-time job. In fact, before I got through, I had to have an assistant to help me out, because I was initiating all the correspondence, pulling it all together and so forth. It was a big difference in the way the Bureau usually operated. As an example, in a Bureau project, there would be correspondence between the chief engineer's office and the field, but the correspondence would be initiated in the various branches and divisions, might be signed by the chief engineer, but there'd be a letter from the Mechanical Division, there'd be questions from the Electrical Division, the dams would have something, the geology would have something –all these separate letters going out. Well, this isn't the way you deal with a client like the Boundary Commission–this was coordinated, so instead of three or four separate letters going out, addressing these separate fields, there would be one letter go out addressing the whole thing. I became the author of those letters, pulled all this thing together, and that sort of thing. So I became very involved in this thing.

". . . I got out of my narrow area of specialization, and the Bureau at that time was *very* specialized . . ."

Another big change, the way it affected *me* is that I got out of my narrow area of specialization, and the Bureau at that time was *very* specialized with mechanical engineers, electrical engineers, and so on and so forth, and they had a hard time talking to each other because of their different disciplines and so forth. But since I was responsible for coordinating this whole thing and for supplying the information to the Boundary Commission, and especially to the Mexican Section, and getting the information that they wanted, the answers to their questions and so forth, I became very much involved in the intimate details of the hydraulic machinery, the mechanical . . . .

END OF SIDE 1, TAPE 1. JANUARY 11, 1995.
BEGINNING OF SIDE 2, TAPE 1. JANUARY 11, 1995.

Storey: You were saying you became very involved in all of these different disciplines, and it gave you a whole different . . . .

Arthur: It really broadened my experiences, right. I don't know any other engineer in the chief engineer's office that had this sort of an opportunity. So because of this, I got a lot of attention, and a lot of people that would never have known of me became aware of my activities and what I was doing, and it worked very well too.

When this effort was first initiated, the Mexican commissioner said that at an appropriate time, they were going to station a Mexican engineer in the chief engineer's office who would keep up-to-date on what was going on in the status of the designs and how these decisions were being made that would affect the Project layout, and the details of the Project and of the powerplant and the outlet works and the penstocks and everything that was involved. But they didn't think it was necessary to do it at the very early stages, until we started making some recommendations. Well, we started making these recommendations, and they were being discussed and adopted and so forth, and I became concerned because I thought if a Mexican engineer were going to be here in Denver to oversee what we were doing, and to be fully aware of what we were doing, that the sooner he got here, the better it would be. Because I could envision somebody coming along later and saying, "Hey, I don't like this decision you did two weeks ago," or "I don't think what you decided last month is the way we want to go."

Storey: Or *five* months ago.

Arthur: Yes, that sort of thing. So at these joint meetings at the Boundary Commission . . . . I should explain that these meetings, the United States Section's office was in El Paso, Texas, and the Mexican Section's office was in Juarez, Mexico, right across the river. And we would meet one day on the U.S. side, and then we would meet the next day on the Mexican side, and so on and so forth, like that. Of course in my discussions with the U.S. commissioner, I kept saying, "Hey, if the Mexicans are going to send a liaison engineer, we need to have that done *now*, because of all the problems that might develop later."

So he said, "Okay, we'll take this up in the meeting over in Juarez tomorrow." So he did, and in these formal meetings, a lot of these people were bilingual, but in these formal meetings, the U.S. would speak English and the Mexicans would speak in Spanish and then it would be translated back and forth, so it was pretty slow going, exchanging ideas. But anyway, the U.S. commissioner put forth the statement that the Bureau of Reclamation was desirous of having this Mexican engineer assigned as soon as possible so there'd be less opportunity for

false motion and that sort of thing. And this was translated into Spanish, and the Mexican commissioner did not speak English, so anyway, he would have replied in Spanish, which he did. And it was a long discussion, but anyway, then it was translated. And what he said was this, in essence: That they had become very well acquainted with the way that engineer Arthur operated, and they had learned that when engineer Arthur knew the answer to a question, he was forthright in giving them the answer. When he didn't know the answer, he was equally forthright in saying he didn't know, but he'd get it. In other words, he was saying that I wasn't trying to B.S. them and they appreciated that. Furthermore he said that from the discussions that had taken place, and engineer Arthur's explanations of why this was done and why this was done, they'd come to the conclusion that engineer Arthur wasn't conscious of where the international boundary was. He didn't care whether this portion of the works was in the territory of Mexico or the territory of the United States, he was just interested in it from an engineering point of view, and was purely objective about it. So they had come to the decision that because of their heavy domestic program that required all their engineering talent in Mexico and so on and so forth, that it was not necessary to station this Mexican engineer in Denver to protect their interests. I thought that was a great compliment.

Storey: Yeah, that's very interesting.

Offered Job with International Boundary and Water Commission

Arthur: And I guess the U.S. commissioner did too, because eventually, after the dam was designed, he offered me a position with the International Boundary and Water Commission, while this was being constructed. The Bureau, wisely, I think, took the position that they could not be responsible for this dam, even though they designed it, unless they were also responsible for its construction, to be sure it had been constructed in accordance with the design. Well, this was not acceptable to the Boundary Commission, U.S. Section. It was *their* dam, and they were going to build the dam. So as part of the original negotiations, it was provided that Bureau of Reclamation engineers would transfer from the Bureau of Reclamation to the International Boundary Water Commission, for the purpose of overseeing the construction of this dam. That was done.

The construction engineer of the United States was Dick Ward, and he had been a construction engineer on some of the Colorado-Big Thompson Projects. And he took his field engineer–I don't recall his name now–but the field engineer that had worked with Dick Ward up on the Colorado-Big Thompson went with him down there. And a fellow by the name of Lloyd Hamilton who worked in the Earth Laboratory here in Denver went along, transferred to the Boundary Commission to

do the quality control of the earth work. So that's how it was constructed, under the supervision of those people. But of course it was still the constant flow of information and construction data and so forth from Denver down to the dam site, and review of the quality control records and the performance back in Denver.

". . . the project had to be divided so that Mexico's work could be done by the Mexican contractor, and the United States' work could be done by the United States' contractor, and the dollar value of the work done by United States had to be sixty percent, and the dollar value of the Mexican work had to be forty percent"

It was interesting: the project had to be divided so that Mexico's work could be done by the Mexican contractor, and the United States' work could be done by the United States' contractor, and the dollar value of the work done by United States had to be sixty percent, and the dollar value of the Mexican work had to be forty percent, because the benefits were divided sixty-forty because the water ownership was sixty-forty. So we had to provide two specifications: one for the United States contractors to bid on, and one for the Mexican contractors to bid on. And the nature of the thing is that you couldn't divide it geographically and say, "Well, the international boundary is in the center of the river, and we build up to the center of the river, and the other guy builds up to the center of the river." You can't do that. So we had to divide the work, make the whole area sort of an international area while the construction was going on, in other words.

So it was a very interesting job. I came out of this with a Superior Performance Award from the commissioner.

Storey: Who was?

Arthur: I'm trying to think of what his name was.

Storey: When was it?

Arthur: In 1952.

Storey: In 1952, the commissioner should have been Mike Strauss.

Arthur: Yeah, Mike Strauss. Right, that's who it was. (chuckles)

Oh, incidentally, I got invited to the dedication. The dam was designed with a wide [crest] area over what had been the center of the river, which was the international boundary, and a monument erected, "This side is United States, this

side is Mexico." And the dedication was attended by President Eisenhower, and President Cardenas of Mexico. And so I got to shake hands with two Presidents in one afternoon. That was a big occasion.

Storey: This sixty-forty split on the construction fascinates me. If I'm understanding you, this means the American contractor was over in Mexico some of the time, and vice versa, the Mexican was operating in the United States. What kinds of problems came up? Or do you remember anything?

Arthur: Well, as I say, during construction it was pretty much an international zone, and the International Boundary and Water Commission had broad responsibilities in this area, so as far as I know, there were no problems. Now, the work was divided this way because of the topographical and geological conditions. The logical location for the spillway was in the United States. Now this was one of those items that took a lot of convincing to the Mexicans, because it's a very important structure, and it could be operated or *mis*operated by whoever's in charge of it, and if it's in the United States after the dam is built, Mexico isn't going to be able to operate it. So they want to know why is it over there, why ~~is~~ it [isn't] over here, and so on and so forth. But anyway, it was a very big structure, a very costly structure. It was a concrete spillway. I think the capacity was about something like 457,000 cubic feet per second, if my memory serves me. So the United States contractor did that work, and for the forty percent work, Mexico built all the earth embankment, even in the United States, all the way across, extending several miles into the United States. It's a long dam. The Falcon Dam is three, four miles long. It's a broad valley. But I don't think that caused any problem.

Storey: I think I'm speaking in terms of planning problems. Was it hard to figure out the sixty-forty split, or did it become fairly obvious to you all as you were working on the design?

Arthur: Well, it became pretty much logical because the construction of this big concrete structure was the swing point. And it was logical for one country to do *that* because otherwise you'd have to duplicate all of the concrete mixing facilities and all that sort of thing–it would be uneconomical. So we had one contractor do all the concrete work. And when that was assigned to the United States because it was *in* the United States, then the earth embankment became the large item of work for the Mexicans to do. And then there was some outlet works and other things that could be used to sort of balance it out. And of course the sixty-forty split was based on the Bureau of Reclamation engineers' estimates of what the bids would *be*.

Storey: Were you in meetings and watching them discuss the issue of the spillway being under the control of the United States?

Arthur: Yes.

Storey: How did they work it out finally? What was the basis on which Mexico finally came to feel comfortable with it?

Arthur: Well, it was the obvious engineering solution. I think that was it. There was another way to overcome that situation, and that was to build a big concrete overflow section like a concrete dam in the middle of the river, and earth extensions on either side into the United States and into Mexico, and have this big concrete section in the river, half of it into Mexico and half of it into the United States, and let the river overflow this concrete dam during times of flood.

Storey: Something like Folsom is?

Arthur: Yes. And this was estimated. This was one of the schemes. We evaluated probably a dozen different layouts. It wasn't just, you know, the Bureau decided "do this." No, there were very detailed studies made and so forth, and this was one of them that would put half the spillway in Mexico and half of it in the United States. But it was considerably more costly. The Mexican engineers finally agreed to go with the chute spillway in the United States. But it's very interesting that some years later, a second dam was built, and this was built upstream from Laredo, and it *is* that type, the concrete is in the center of the river, as I described. That was designed by the Corps of Engineers, and I don't know what the economics of that . . . . I don't know anything about the details of how they arrived at that layout, but it is interesting that in their situation that's what they ended up with.

Storey: Did you ever find yourself in a situation where something couldn't be worked out and caused design or engineering problems on this project?

Arthur: (long pause) No, there were some questions raised by the Mexican engineers about details of the design and so forth. I think one thing that was interesting, the Mexican powerplant . . . . Well, let me back up a little bit and say–the most economical way to build a project was to have one powerplant. And we made studies of that, and when we put the powerplant at the toe of the dam, half of it in the United States, and half of it in Mexico, this was not acceptable to the Mexicans. It may not have been acceptable to the United States, I don't know. I remember it wasn't acceptable to the Mexican engineers. They wanted their powerplant *in* Mexico, entirely separate from the United States powerplant, so two powerplants were built, one on the Mexican

side of the river and the other one on the United States side of the river. Well, the United States' powerplant's penstocks, the water could be supplied to the power units on the United States side through separate penstocks, and using a concrete forebay structure which adjoined this spillway that I mentioned before, it was all one big structure, you just built a little concrete section beyond the spillway gate structure and have the pipes penstocks go down in the United States side. Of course this situation didn't exist on the Mexican side because the topography wasn't there in the first place, and they didn't have the spillway section in the second place, so the engineering solution there was to supply the water through a conduit, a big pipe in other words. For economy, it would be a single pipe going from the upstream part of the dam down to the powerplant, and then at the powerplant branching into smaller pipes, one for each of the units. There was quite a bit of discussion about how this conduit should be designed, because it was unprecedented in size and scope. As I recall, it was twenty-two feet internal diameter. And it was to be a pressure pipe, it would be under pressure, going through the dam, so its safety had to be guaranteed, it would be structurally sound, no question. We ended up in quite a discussion in the chief engineer's office how this should be designed. The Mechanical Division thought it ought to be just a steel pipe, whatever thickness was required, steel pipe, and coated so it would be corrosion-proof and so forth. The Spillway and Outlets Branch thought it ought to be a concrete pipe, and they would line it with a steel liner so that it would be water-tight, wouldn't be any possibility of any leaks. And each division produced their own estimates of what this would cost. I remember this alternative design decision was made by the chief designing engineer who was Nalder, N-A-L-D-E-R, Bill Nalder. But the head of the Mechanical Section, whose name was Jim Richardson, and the head of the Spillway and Outlets Section whose name was D.C. McConaughy, went up to the chief designing engineer's office to get a decision on which design would be recommended. And of course I was there, because I was the sponsor, the coordinator, and so I was there too. These two gentlemen were very well acquainted, but they had opposite positions on this matter, and it got into a very strained situation. I can still remember they got formal with one another, got to be "*Mister* Richardson, I don't agree with that." "Well, *Mister* McConaughy . . . ." (chuckles) And before that it had been "Jim" and "Mac," you see. (**Storey:** Uh-huh.) And Nalder, who was not a heavyweight in this area of engineering, became quite frustrated because he had these two guys, both of them very positive, both of them very stubborn, and they were just like two bulldogs, sniffing each other. And I can still see Bill Nalder sitting at his desk and he actually snapped a pencil in two, he was so frustrated (chuckles) trying to referee an argument that there didn't seem to be any answer to.

Well, anyway, the concrete pipe solution with the steel lining was selected.

Storey: And which person was espousing that?

Arthur: That was McConaughy. I suppose it was economics, must have been economics. But then they were in a big argument about how thick should the liner be? You know, it's pretty much an arbitrary solution. You're putting it in for water tightness. So McConaughy says it ought to be a quarter of an inch thick, and that was *plenty* thick to guarantee that the water would[n't] leak through it. And Mr. Richardson thought it ought to be like an inch thick or something like that. But anyway, McConaughy prevailed and it was a quarter of an inch thick.

Well, you think a quarter-inch of steel as being pretty substantial, but you make it into a twenty-two-foot pipe, and it's very flimsy, it can't support it's own weight and so forth. But it was used by the contractor as the inside form for constructing the pipe. They got the quarter-inch liner all in place, and then supported it from the inside with "bulkhead spiders," they call them, and then they poured the concrete around it. The concrete was very heavily reinforced, because it has to sustain this load of about 150 feet of saturated fill above it. It was very heavily reinforced, and as I remember, the barrel thickness was about six feet, so it was a massive thing and so forth.

Storey: Was the power split sixty-forty also?

Arthur: Yes.

Storey: So the Mexican power . . . .

Arthur: Wait a minute, before you get into this, let me tell you a little bit more about this pipe. Because all this long explanation is being responsive to the question you asked me about the Mexicans always agreeing with everything. Okay, so the pipe was built that way. There was no attachment of the steel liner to the concrete–you understand? There was no attachment, there was just a pipe and you embedded it.

Storey: Concrete around it, yeah.

Arthur: Well, we got progress photos from the job site as the job was being built. This was, of course, work was being done in Mexico. The pipe was furnished and installed by Mexico. And when they got pictures of this liner being erected prior to the placement of the concrete, here it was studded with hooks, with anchor hooks. I would guess they were rods about a quarter-inch in diameter and maybe six inches long and bent over and extended another six inches. And this was to provide a mechanical attachment of the steel to the concrete. And this was not in the design,

that had been added by Mexico, and they had done that on their own. They just figured that there ought to be some mechanical attachment. Now Mr. McConaughy was very unhappy (chuckles) with those hooks being placed on the steel pipe–I'm not sure why. But later after the reservoir was full, they closed the upstream gate to make an inspection on the inside of this conduit, and they found that there were big blisters of this pipe, draped down, hanging down, away from the concrete, because of the water pressure that had gotten through the concrete, which is not impervious, came through the concrete, and when it hit the steel, and then it buckled the steel. And if the Mexicans hadn't put those damned hooks on there, the whole thing would have collapsed. That was a very, very wise thing they did.

Storey: Really?! (**Arthur:** Yeah.) Good.

Arthur: Okay, so sometimes they exercised their own judgement. But that's the only case I can remember. The other things we came to an agreement on. I think on this one they just decided it wasn't worth arguing with the United States about it, so they just did it. (chuckles)

Storey: I was asking about the sixty-forty split on the power.

Arthur: The powerplants were identical in capacity, but it would be the sixty-forty split on the water that could be used for generation of power.

Storey: I see.

Arthur: And this was primarily a flood control and irrigation project, and these were fairly small powerplants and they would produce secondary power. They would produce power when water was available, in other words.

Storey: And when they happened to need to release it.

Arthur: Yes. When they needed to release it, yeah. The United States was entitled to sixty percent of the water, and when they wanted their water downstream, they'd run it through *their* turbines. When Mexico wanted their forty percent of the water, they'd run it through *their* turbines.

Storey: But there were no canals or direct links to delivery systems out of this dam?

Arthur: No, the canals, there were some diversions downstream.

Storey: Did Reclamation have anything to do with the U.S.-side delivery of water downstream?

Arthur: There was an early Reclamation Project in existence down there that this water went to that was already in existence (**Storey:** Okay.) in the southern tip of Texas.

END OF SIDE 2, TAPE 1. JANUARY 11, 1995.
BEGINNING OF SIDE 2, TAPE 1. JANUARY 11, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on January 11, 1995.

I had asked if Reclamation had ever operated the dam.

Arthur: No, the Boundary Commission operates the dam.

Cutting Across Lines of Authority in Reclamation During the Falcon Dam Project

Storey: I'd like to go back and discuss the unique situation you found yourself in where you were sort of cutting across lines. Reclamation has an "image," I guess you would say, of being very structured, and very hierarchical, and if you want to do something, you go up through the chain and back down through the chain, and all of that. I imagine this position you found yourself in caused a lot of eyebrows to be raised.

Arthur: Yes, it did. I remember one incident very well. It involved Mr. Samuel Judd, and he was the head of the Structural and Architectural [S&A] Branch, was responsible for the design of the powerplant. He was an autocratic type of manager, nothing was done in his section without his direct supervision and so forth. One time I was trying to get out one of these comprehensive letters that I mentioned before, where I'd pulled all these matters together, and there were some things in there that involved the powerplant design. I incorporated this into the letter, and of course to get the letter *out*, I would get clearance, I would get surnames from everybody who was involved, be sure that their interests were expressed correctly. I went up to S&A to get Mr. Judd's surname on this letter, to be sure that I was expressing S&A's position on whatever it was, on a Friday afternoon. This was a letter that the Boundary Commission was waiting for, a very important letter. In those days we didn't have FAXes to get things back and forth quickly. So it was very important that I get the letter out that afternoon, so it would be there Monday morning. Well, Mr. Judd was gone for the afternoon. Of course he had an assistant who was acting for him, so I said, "Here, you surname the letter."

He said, "Oh, this is something that Sam is . . . . I can't do that, Sam would have to surname this letter."

I said, "Well, he isn't here."

Storey: Sam being?

Arthur: Sam Judd.

Storey: Oh, I see.

Arthur: I said, "He isn't here, and this letter's got to go out. Here, surname the letter. If you don't agree with what is stated, say so. If you have any objections, say so. If you don't have any objections, well, surname the letter so the chief engineer, who's going to sign the letter, will know that this expresses your position."

"No," he said, "Sam left orders that nothing on the Falcon should go out without his personal attention."

I said, "Well, if he wants to be a full-time manager, he's got to be here full-time. This has got to go out." Well, anyway, it did go out. I don't know whether he surnamed it or how I got it out, but it went out. I learned later, of course, that Judd was furious about this. And word was given to me in a staff meeting he had expressed to the chief designing engineer that ~~that~~ Harold Arthur was exceeding his authority, and he really complained about the way I was cutting across lines–this sort of thing. So this was to Mr. Nalder, who I already mentioned. So I waited to be called up on the carpet to explain my actions, but I wasn't, and then I had a meeting involving Mr. Nalder, and I waited for him to say something, and he didn't. A couple of times he had an opportunity to say something to me, and he didn't. Finally I couldn't *stand* it any longer (chuckles) and I said, "Mr. Nalder, I understand that Sam Judd has some complaints about how I've been operating on the Falcon Project." The chief design engineer looked at me and he said, "Oh, you know old Sam!"

Storey: (laughs) And that was it! (laughs)

Arthur: That was it! (laughs) It was very often that I would be called up to the chief engineer's office, usually on a late Friday afternoon, and he'd have some mail to sign off, he was signing the mail, and he'd have some letters that I had *not* initiated, I didn't initiate *all* of the letters. I initiated the letters that involved more than one

organization, but there were a number of letters that, say, just deal with Geology, that would go, but I wouldn't author.

Storey: But did you get copies?

Arthur: The chief engineer would call me up–his secretary would call me up–she said, "Mr. McClellan would like to see you." So I'd go up there and I'd go in there. He'd have this letter ready to sign, and he said, "Did you see this letter?"

I said, "No."

He said, "I don't know when these people are going to get it through their heads that there's nothing on this Project, there's no correspondence on this Project goes out of this office without your surname on it!" And a couple of times, then I would surname the blue copy, final copy, and he'd sign the letter. But there were a couple of times when I'd say, "Mr. McClellan, this isn't right," or "this has been decided," or "this idea was vetoed two months ago," or something like that. So he realized it was important that I see this thing, because I was the only one that had the whole picture of this thing. But the support that I got from management was just terrific.

Storey: But you didn't actually sign correspondence, then? (**Arthur:** No.) You *initiated* the correspondence.

Arthur: I authored it.

Storey: And authored it. And was it usually the Chief ~~of~~ Engineer~~s~~ who signed it?

Arthur: ~~I was~~ *Always*.

Storey: Okay.

Arthur: This was an outside agency, you see, so signatory authority was not given to anybody else.

Storey: So you had to go through this surnaming process, section to branch to division, probably to chief engineer?

Arthur: Yeah, right. You can see why I needed an assistant. Because I wouldn't wait for this to be done through the normal channels, because it takes days.

Storey: You didn't drop it in the mail and let it wander around.

Arthur: [No special] messengers and so on, so I *carried* it around. And when I was given this appointment to be the project coordinator, the chief engineer instructed that I was to have full cooperation. So I could wave this under their nose too. And I know there was quite a bit of–I'm *sure* there was quite a bit of resentment about the way I did things, but I tried to smooth his feathers down just as much as I could. I tried to be as diplomatic as possible, but I was also quite insistent on getting things done.

Storey: The chief of engineers: now you said a few moments ago that the secretary would call up and say, "Mr. McClellan would like to see you." Is that really what she said, or did she say whatever his first name was, "would like to see you"?

Arthur: No, it was "Mr. McClellan."

Storey: And did you address him as Mr. McClellan, face-to-face?

Arthur: Oh yeah! Yeah, I wouldn't call him "Mac"! (chuckles)

Storey: Well, I'm just trying to figure out how this worked.

Arthur: I was just a young fellah.

Storey: That's a much more formal sort of an approach than we would take today, I think, with a lot of these folks.

Arthur: Well, considering my position and his position, maybe it's different now, I don't know. But it would have been very presumptuous on my part to try to use a first name. Of course in those days, there was a lot of prestige in titles and addresses and so forth. Shop people didn't call you by your first name, the barber didn't call you by your first name, the dentist and the doctor and so forth.

Storey: It was just the standard way of doing things.

Arthur: Yeah, probably more formal.

Storey: I take it Mr. Strauss was probably at the dedication of Falcon also?

Arthur: No, he was not.

Storey: Were you Reclamation's representative?

Arthur: No, the chief engineer was there too.

Storey: But that would have been after you were off the Project for a period of time.

Arthur: The dedication? (**Storey:** Yes.) No. No, it was just brand new completed. In fact, it probably wasn't quite completed.

Storey: So then you were involved in the construction.

Arthur: I was liaison during construction! Oh yes!

Storey: Oh, you continued in that same position.

Arthur: Oh yes, indeed.

Storey: So the design and the construction took from, what was it, '48? to when?

Arthur: To '52 or '3, yeah. (Unintelligible remark overvoiced by Storey's following comment.).

Storey: So it was a four- or five-year assignment.

Arthur: Yes.

Storey: Pretty much full-time all the time?

Arthur: During construction, no. After construction was underway, it was probably only about half-time.

Storey: And did you still attend the meetings?

Arthur: Oh yes.

Storey: How did the meetings differ in terms of issues during the construction period?

Arthur: Well, during the design period, decisions were being made all the time, and the choices were being made, and during construction the only reason for the meetings is when it was found necessary to make some changes or amend the way we were doing things, or to review certain aspects of the situation. So there were not as many meetings.

Storey: And most of it was just the review of progress?

Arthur: Yes.

Storey: Now, you were stationed here in Denver. (**Arthur:** Right.) And you had to go down to these meetings. How did you travel?

Arthur: DC-3, Continental Airlines.

Storey: Okay. Didn't use trains, didn't drive?

Arthur: No.

Storey: Interesting.

Arthur: No, DC-3s. It's about a six-hour trip.

Storey: (chuckles) A little different than nowadays! Did your grade change any, as a result of your being Project Coordinator?

Arthur: I think I was already a ~~thirteen~~ GS-13, and no, it didn't change. I'd have to be a section head to be a ~~fourteen~~ GS-14.

Storey: What did you do after you came off this Project?

Kept in Earth Dams Section in Spite of Not Really Working There While Doing Liaison on Falcon Dam

Arthur: Well, while I was on this project, I still had my position as leader of the Design Unit in Earth Dams, and I became aware of the fact that, as I said, I was to spend all my time, as much time as necessary, and it became a full-time job, taking care of Falcon Dam, so I didn't have much time to do the other work. And I became aware of the fact that Fred Walker, who was then the head of the Earth Dams Section, had gone up to the chief engineer or the chief design engineer–somebody–and asked that I be reassigned. He wanted me out of his organization, and the reason he wanted me out of his organization is because I was spending all my time on this one job. And he wanted to replace me with somebody that would be more helpful on the other jobs. And he was told they sympathized with his position and understood, but on the other hand, that this was something that wasn't going to last forever, and when this Project was done, I'd be available, and this was my niche, and they weren't going to move

me out of it. So I just stayed in as head of the Design Unit, even though my full-time was on this one job.

Storey: But during the construction period, you were devoting about half-time to (**Arthur:** To other jobs, right.) your job then. (**Arthur:** Right, right.) did you pick up any other interesting jobs at that time?

Falcon Dam "Was a *Very* Successful Operation"

Arthur: They were pretty much one job after another. I wanted to tell you one thing about this design coordination. This was a *very* successful operation, the client, the Boundary Commission, the United States and Mexico, were very pleased. They were pleased with everything but the costs–we did have a cost overrun on engineering, due primarily to all these myriad of alternative studies we had to make. I mean, that wasn't envisioned by the people who were estimating how much (laughs) this was going to cost to engineer the job. But in the end result, they were very happy with the whole thing. And the Bureau management was happy with it–so much so that they decided, "Well, hey, this worked so good on this job, we'll do it on our own jobs."

Because of Success on Falcon Dam, Reclamation Decides to Use Design Sponsors on All Its Projects

So I heard they were going to set these design sponsors up for each of the Bureau jobs. And when I first heard about this, I thought, "Boy oh boy! I'm going to be a manager now for sure, because there's going to have to be a head of this organization." But that wasn't to be. I didn't have that much stature, so they selected a guy by the name of Cook, and he was to be the "father" of the sponsors, coordinators, and so forth. And he called me up to ask me to come up and talk to him, because I had all this experience and he wanted to have the benefit of my ideas and so forth. And he told me what the Bureau was going to do on this sponsorship, what they intended to do, and I told him flat out that it had *absolutely no prospect of being successful*, it would not work. And he said, "Well, why won't it work? It worked on Falcon." I said, "Because simply, you cannot make *every job* top priority. That's what made Falcon go. It got the green light, it was the top priority, got the first attention. You can't give first attention to every job, so it's not going to work. Furthermore, your people who are in your line positions, line authority, I know they resented the way *I* operated, and if you got twenty or thirty people doing that, it's not going to work." And it didn't. So they fooled around with it for about a year, and then gave up on it.

Another reason it didn't work is because the people in the field were used to calling the people in the Denver office directly, they would call somebody in the Mechanical Branch or the Electrical Branch or so on and so forth. In the Boundary Commission, they always called *me*–they didn't know the people in these other branches, they called me so I could coordinate it. Now, they made me Project Sponsor on another job, too, and it didn't work at all because the people out there in the field, they didn't call *me* and say, "Hey, we've got this problem, we've got that problem," they called the people direct. So people are out there and I had no idea what the hell's going on. So I knew it wasn't going to work, and it didn't work.

Storey: That was something before they decided to set up this branch or section or whatever it was? Your experience with this Reclamation project?

Arthur: This Falcon Project?

Storey: No, the other one that you had been set up as a coordinator with.

Arthur: Yes. What was your question again?

Storey: Well, you had this period of time when you were half-time. Were you a Project Coordinator on this other Reclamation project then?

Arthur: Right.

Storey: So that by the time they decided to set Mr. Cook up and try this, you'd already had this experience?

Arthur: Yes.

Storey: Yeah. That's interesting. You *try* to learn from your experiences, and sometimes they aren't as applicable as you think they are.

Arthur: Yeah, that's right.

Storey: What did you do after you were done with Falcon, then?

Arthur: Well, I worked on various dams.

Storey: In the Earth Dams Section still?

Returns to Earth Dams Section Work after Falcon Dam

Arthur: In the Earth Dams Section. Then one day another big opportunity in my career came when as a result of a book called ***Low Dams*** . . . . During the early days of the Roosevelt administration, there was a committee formed of various government organizations, representatives, and they produced a volume called ***Low Dams***, and it was about primarily designing earth dams. And it was a book, an ordinary sized book about 200, 300 pages, something like that. It evidently was the first book on the subject that'd ever been written, and it was very, very popular. I think it was published in '33, '34, something like that. It was a best seller by GPO [Government Printing Office], and then there finally came the time when they wanted to reprint it, it was out of print, and they were still getting a lot of requests for it and so on and so forth. So GPO wrote to the Secretary of the Interior and said, "We are contemplating reprinting this book. Are there any changes that should be made?" The Secretary of the Interior sent that to the Commissioner of Reclamation. The Commissioner of Reclamation sent it to the chief engineer. Well, the letter ended up on my desk, to make a long story short. "Here, answer this letter."

Recommends Replacement of Reclamation's Publication *Low Dams*

Well, I was very familiar with the *Low Dams* book, because it was . . . . You know, I mentioned that I took an evening course in soil mechanics from Utah State University at Weber College in Utah? (**Storey:** Uh-huh.) We used this as a text, because it was one of the few books that dealt with this sort of subject. And it had a chapter in there on Swedish slip circle analysis, which was a method of computing slope stability. And we used this book, as I say, as a text. So I was very familiar with it. So I wrote the letter, and what I said was, "No, the book couldn't be revised, it had to be replaced. The whole discipline of soil mechanics had come into *being* since that book had been written, soil mechanics was now being taught in the universities and so on and so forth, and we knew so much more about the subject than those people knew, that the book should be replaced." So the letter went back and went up through all the channels–came down, "Okay, you replace it." (laughter) So I was called up to the chief engineer's office, and you know, and said, "Hey, we've been directed"–I initiated this correspondence, you know–said, "We've been directed by the commissioner to produce a book to replace *Low Dams*."

So Mr. McClellan said, "We'll put you in charge of it."

"Fine."

Placed in Charge of Book During Spare Time

So he said, "During your spare time, you work on this book."

"Aye, aye, Sir."

Storey: And saluting, huh? (chuckles)

Arthur: So I think a couple of months passed, and I got a call from the assistant there [Mrs. Aday], "Mr. McClellan would like to see you," and I said "Okay," and so on.

[So I] Go up there and he says, "How you coming on that book to ~~do~~ [replace] *Low Dams*?" and I said . . . . (phone rings, tape turned off and on)

Storey: "How's the book coming?"

Arthur: I said, " Well, I haven't gotten anything done on it except I've given some thought to it. I've outlined the scope. I've got a list of chapters that I think we ought to cover to give the scope of the book."

And he said, "Well, why haven't you gotten anything done on it?"

Assigned Full Time to Produce Book

I said, "Well, you told me to work on it in my spare time, and I have a full-time job down there! I haven't *had* any spare time. Since I completed work on this Falcon Project, I'm working full-time on designs."

"Well," he says, "Commissioner Dominy wants a book. He wants to have it handed out at a meeting of the International Congress on Large Dams, some kind of a meeting in Spain in six months from now. So I want you to turn your attention to producing this book."

"Yes, Sir. Mr. McClellan," I said, "I can't write this book. There's no engineer in the Bureau of Reclamation that can write this book. There's no one person that can cover all these areas of hydrology and the derivation of in-flow design floods, and soil mechanics, and concrete, and everything that's involved with it. A number of people have to contribute to this book."

And he said, "Well, what do you suggest?"

I said, "Well, can I think about this and check with you tomorrow on this?, at which time I'll have a definite proposal."

And he said, "Yeah, okay." So I did. I met with him later. I said, "This is what I need. I need for you to tell my boss that I'm going to work full-time on producing this book, writing this book, and not to be given any other work assignments during this time. I need physically to be moved from sitting in the bull pen, right next to my boss where he takes things from his desk and puts it on my desk and says, 'Here, you take care of this.' I need to be in a separate office someplace. I can write a large portion of this book myself. I can write several chapters, including the one on design of the earth dam, which I think will be the major chapter. But the other major chapters have to be on the design of spillways and the design of outlet works. That's such a major work that we need somebody assigned to that full-time. I would like to have Carl Hoffman assigned to that." The reason I picked Carl Hoffman is because he was a *hell* of an engineer, and because of an organizational change, I knew he wasn't being utilized, he was unhappy with what he was doing, and so I selected him for two reasons. And I said, "The other assistant I need is somebody to write on earth materials. That would be Jack Hilf, I need him on that. They should be assigned full-time to work with me in this office until they complete their portion of the work. They won't need to be there for the whole time, but 'til they complete their portion of the work. I've drafted a memorandum which I suggest you sign. This tells the organization that we are about to embark on this project of writing this book, and that everybody is supposed to contribute to it. I'm the editor, and they're supposed to cooperate with me and furnish me with the information that I need to put this book together." So that's the way it happened. He accepted all my ideas. Carl Hoffman and Jack Hilf and I were all put in a little office by ourselves, and we went to work. I went and called on all the other divisions, said, "Hey, I want a write-up on how you derive in-flow design floods," and I went to Concrete Dams and I said, "You're going to give me a chapter. You're responsible for the Concrete Dams chapter." And so forth.

Storey: And what kind of a time frame are we talking here?

Arthur: Six months.

Storey: Well, it had to be *published* in six months.

Arthur: Yeah.

Storey: How much time did you have for writing . . . .

END OF SIDE 1, TAPE 2. JANUARY 11, 1995.
BEGINNING OF SIDE 2, TAPE 2. JANUARY 11, 1995.

Storey: . . . Three months in which you could do the writing.

Arthur: Three months before it was to go to the printer.

Storey: So that was writing and editing (**Arthur:** Right.) and putting it all together and getting all the connectors in place, and the introductions and all that.

Arthur: Right. So (chuckles) I told my wife . . . . Oh, and we started working overtime. Started working Saturdays and working ten-hour days. I told my wife, "You know, this is going to be something . . . . The Bureau has to be proud of this; I can't be associated with anything the Bureau isn't going to be proud of. And it's got to be something that the Bureau's proud of, and I'm going to *make* it that way. There's no way I can do it in three months, just no way. It's just going to take longer. This is the first time I've ever, in my Bureau career, consciously decided not to follow orders. I'm going up to talk to the chief design engineer," who was then a guy by the name of Puls who I mentioned before, the concrete dam designer. I went up to see the chief design engineer, and I explained to him, "you know, this isn't possible. What I have in mind is to do something that's credible to the Bureau, and treats the subject thoroughly like we're supposed to do. It just can't be done in that amount of time."

Book Couldn't Be Completed in the Time Frame Wanted

And he said, "Well, do the best you can, and get the manuscript as far along as you can in that time. We'll send it in to Washington and we'll just say, 'This is it, this is the best we could do, we need more time to do an adequate job.'"

So I went home again, I talked to my wife, and I said, "You know, I can't do this, because engineers are notoriously reluctant to write things anyway, as you know. Beating on these guys to try to get them to furnish this material and so forth, and if I do that and accept their material in three months, send it into Washington and get the answer back, 'Well, now do it over, do a good job this time.' I'll have absolutely no cooperation the second time around. The only way to do it is to do it right in the first place, and that's what I'm going to do."

There Were Some "unhappy people in Washington . . . *until* they saw what they were getting. . . ." in *Design of Small Dams*

Well, it took seven months, I think it was, to write it. It took eight months to get it printed. The deadline was never met, and there was some unhappy people in Washington–some unhappy people–*until* they saw what they were getting. Then all

of a sudden, the amount of time it took and so on and so forth was *all forgotten*, everybody was smiles. There was an insertion in the *Congressional Record* about what a *fine* contribution the Bureau of Reclamation had made in producing this book.

Are you familiar with the book?

Storey: I don't know which book you're talking about, for sure. *Design of Small Dams*?

Arthur: I'm talking about this. This replaced that slim volume that I was telling you about.

Storey: I see you've got three different editions on the shelf there.

Arthur: Yeah, it's been *reprinted* twice, editions, right. (tape turned off and on)

Storey: *Design of Small Dams* then was published in 1960, first edition.

Arthur: That's correct. I had a lot of interesting experiences with that. The first edition was one of them. The people in Washington that reviewed the manuscript, "Why do you want to call it first edition?"

I said, "To identify it from the subsequent editions."

They said," well what do you mean?"

And I said, "Well, the scope of this book is such, and the treatment is such, it's going to be a demand to keep it updated in the future. So there's going to be a second edition and a third edition and so forth. This is the first edition, put it down there." So I won that argument. There's a second edition, and there's the third edition up there now.

"I had a big argument with Washington about . . . putting the names of the individuals on their various chapters"

The other thing that I had a big argument with Washington about is putting the names of the individuals on their various chapters. You don't find *that* very often in government publications. That was one of my means of motivating (chuckles) these engineers to contribute. One of them was this Hoffman that I mentioned before. "Carl," I said, "you'll be dead and gone and forgotten, but what you write will still be there, and your name will still be there, 'C.J. Hoffman, Spillways and Outlet Works.' You're going to be immortal!" (laughter)

Storey: And it made a big splash when it came out?

Arthur: It really did.

Storey: Even though a few months late for Commissioner Dominy's purposes.

Arthur: It really did. It's in four languages now. One of them was a Spanish version that was translated and produced in Mexico City as a commercial venture. So they thought it was a very significant contribution to the science of dam construction.

Storey: How did you select the people to contribute in that sort of thing? And what kinds of stories came out of that process?

Arthur: Well, the main people I selected were Hoffman and Hilf. There had been two Spillway and Outlet Works Sections at one time in the Dams Branch–number one and number two. McConaughy was the head of number one, Taber was the head of number two. Taber had an assistant by the name of Whinnerah. McConaughy had an assistant by the name of Hoffman. And Taber died, McConaughy retired, they combined the two sections, and put them under Whinnerah. He became a section head, and Hoffman was assigned to that. But these guys had been in sort of competitive positions before, and for some reason or another Whinnerah did not utilize Hoffman as an assistant section head. One thing he *did* use him for is to work with foreign trainees, of which we had a steady procession of foreign trainees throughout the Bureau. And Carl would work with those. Otherwise, he just seemed to be kind of at odd jobs. As I mentioned, I knew he wasn't very happy. I also knew from working with him that he was an *excellent* engineer, so I knew I could get him, because Whinnerah wasn't using him, and I knew he would come because he wasn't being used, too. So I knew he would be willing to participate in this. So that's how I selected him.

Storey: And actually, you did it in longer than eight months, because of all the overtime you worked, (**Arthur:** Yeah.) in a sense, in terms of working days.

Arthur: Yeah. I took a few days off–leave during this period, for one reason or another, and when I came back, Hoffman and Hilf had had a sign made up, above my desk–gone up to the drafting room and had this sign made up–big cardboard thing like this, and in great big letters about three inches high, it says, "Be reasonable . . . " And down below in small letters it says, " . . . do it *my* way." (laughter)

Storey: A two-by-three-foot sign, huh?

Arthur: That's the kind of editor I was, "Be reasonable, do it my way." (laughter)

Storey: Whinnerah? How do you spell his name?

Arthur: W-H-I-N-N-E-R-A-H.

Storey: And is it Hill, or Hilf that I'm hearing you say?

Arthur: H-I-L-F.

Storey: Hilf, okay. Anything come out of this in terms of recognition, other than the fact that you know you had sort of *the* premier book in the field?

Arthur: Yes, there was a Superior Performance Award, and it was shared-in by everybody whose name is in the book. It was allocated, I don't know what system they used for allocation, with a number of pages or what, the contribution. I got the largest amount, and I think it was on the order of a $600-$700 award, something like that.

Storey: Which in those days was a big award?

Arthur: Yes, it was, because it was about a month's salary.

Storey: That's good. There were other people besides the three of you who participated in authoring the book, am I correct in thinking that?

Arthur: There's probably about thirty. Their names are in the chapters.

Storey: How did you guys go out and select *them*? Did you do it very formally through the hierarchy, or did you pick the people that you thought ought to be doing the work?

Arthur: No, I went to their section heads, and I said, "Well, you got this memo from the chief engineer. What we're supposed to do and stuff like that. So who are you going to put on this job?" No, I didn't pick anybody. The only people I picked were Hoffman and Hilf.

Storey: And then the managers, the supervisors were allowed to select the others.

Arthur: Yeah. Well, and of course in the case of Hoffman and Hilf, the supervisors had to agree with it. But Hilf's supervisor was the same as *my* supervisor. I was the head of the Design Unit, and he was the head of the Performance Unit in Earth Dams [Section].

Storey: What does Performance Unit mean?

Arthur: Well, he was the head of the instrumentation, and studied the performance of dams, and also he was in charge of the construction materials. That's what I had him write about in the book, was construction materials.

Storey: Anybody who's ever edited anything knows that it's like finding chicken's teeth, and extracting them to get the things all in, all together, all edited. What kind of experience did you have?

Arthur: Well, I think this "Be reasonable, do it my way," (chuckles) kind of reflects how I got this done. But I have to tell you this, that Hoffman was willing to do this, but he said, "You know, I'm not a writer."

I said, "None of us are, you know."

"How do you do this?"

"Well, you select your design and how do you proceed and so on and so forth, and just put it down. First, let's go over an outline of your material, and let's go over it together so I can agree on the scope of your discussion and so on and so forth." And you know, he didn't follow this suggestion at all. He took a pad of paper and started writing. So he wrote, and he wrote, and he wrote, and (unintelligible). And then the typists' pool drafted it up, they gave it to me to edit. Well, I started editing it, I got scissors and scotch tape and I'd clip out a paragraph here, and I'd clip out a paragraph here, and I'd move this here and move that here. Didn't have word processors in those days.

I'd do this and I'd do that, and finally he says, "Well, what are you *doing*?!"

And I says, "Well, I'm trying to organize your material. You didn't have an outline. Now you discuss this subject here, and in three or four pages you come back to it and you discuss it again. Your material isn't organized, so I'm trying to organize it and get it into shape. Carl, let me tell you what I heard one day. I went to a western movie when I was a little kid and they said the cowboy came out of the saloon and jumped into the saddle and rode off in all directions. That's how you wrote!" (uproarious laughter) Anyway, if you interview Carl, you can find out about how I was as an editor on this (book). (laughter)

Storey: But that's very true of people who aren't used to doing that. (**Arthur:** Right.) They tend to do that.

Arthur: But using his material, and what he had, we could develop an outline. And after we got the outline developed, then he started writing the stuff that could be edited.

Storey: He wrote it again?

Arthur: Well, pretty much so, yeah, because he didn't like what I was doing to his work, so I don't know if he completely rewrote it or not, but he reworked it, yeah.

Storey: Some more problems with the other writers, the other authors?

Arthur: No, Hilf was very good. Hilf would edit *my* stuff, because nobody writes as clearly as they think they do. I would edit his stuff, and he would edit my stuff, and we didn't have any big arguments about it. I had some arguments with Carl. It's funny, but a person who admits that he doesn't know how to write resented me changing anything that he wrote! (laughs)

Storey: I know. Historians are notorious. If you touch their stuff, it's like you have taken the baby and split it in half and thrown it out.

Arthur: Even though he said to begin with that he didn't know how to write.

Storey: Yeah. What about among the other twenty-seven or thirty folks?

Arthur: I didn't have too much trouble with them. The criterion that I had was that I had to understand what they were saying. It had to be perfectly clear to me, and I went back and I'd say, "Hey, I don't understand this."

And they'd say, "Well, it's perfectly obvious."

And I said, "Well, it isn't to me. You're going to have to change it. I don't know how to change it. I'm the editor, but I don't know the subject well enough that I can make it correct. *You've* got to make it correct, but you've got to make it so I can understand it. You know, I didn't have too much trouble with that.

Storey: People were pretty much on time and everything, once they'd been assigned the task?

Arthur: Yeah, their contributions were usually so much smaller than mine, they could get their work done in a month or two, while I was working on months.

Storey: You didn't have a section that was left out because "Joe" just simply never produced?

Arthur: No.

Storey: Nothing like that?

Arthur: No, but we had one section that wasn't developed the way I thought it ought to be. Well, there were a couple of sections, chapters that were not as complete as I thought they ought to be. And it was after the book was published like this, and the people in Concrete Dams see Earth Dams has got about this much text, and Concrete Dams has got about this much text.

Storey: Maybe three-quarters of an inch as opposed to an eighth of an inch.

Arthur: They said, "Why didn't you tell us?!" I said, "Well, I told you what we were trying to do here. I tried to get you to be more detailed or more information and so forth. Over and over I went back to you and said, 'Hey, can you give me more information in this?' This is what you wanted to do, and this is what you got." But they felt that their end of the work didn't get the recognition that it should have had.

Storey: Was that changed in subsequent editions maybe?

New Chapters Were Added to *Design of Small Dams* in Subsequent Editions

Arthur: No. The subsequent editions, they added some chapters. They added a chapter on environmental concerns, which was not in the original book. But they didn't really expand. They expanded the discussion on earth dams with some of the newer techniques, like slurry walls and stuff like this, that were not in existence in 1960. They added that, and so forth. But they didn't do an overhaul of the whole thing, no. (**Storey:** Okay.) But what they did do, and this I didn't like at all, but I didn't have anything to say about that–third edition, the names are gone from the chapters. The authors are recognized in the preface, but they're not identified with the chapters anymore.

Storey: Well, you know, that's something I'm fighting in the history program. You know, I insist everybody be recognized for the work they've done, and that's caused a lot of eyebrows to go up. And my response has just simply been, this is a professional standard in history. (chuckles) You don't do it just anonymously.

Any other interesting anecdotes or stories about the book that you think you'd like to share with me?

Arthur: I think that just about does it, Brit. As far as I was concerned, it was really a labor of love, I enjoyed doing it. Speaking about eyebrows being raised, I was one of the few GS-13s that had a typewriter on his desk.

Storey: Oh, tell me about that.

Used a Typewriter to Draft Correspondence

Arthur: Well, I learned to typewrite when I was in high school–I typed all my life. So, when I got into Falcon and started initiating a lot of correspondence, I requisitioned a typewriter. This raised a few eyebrows. "What's a professional engineer doing, sitting there writing on a typewriter?!"

I said, "because it's a hell of a lot faster than writing longhand like you're doing!"

Storey: Plus, the secretary can *read* it! (chuckles)

Arthur: Exactly right!

Storey: Yeah, I had a friend in the Soil Conservation Service, eight years ago maybe, ten years ago, whose performance review was pushed down because he had used a typewriter and that was secretarial work and they weren't supposed to be doing that. It's an interesting prejudice that has held on in the Federal government.

Arthur: When I got promoted and got into higher positions in the Bureau, of course, I could no longer have a typewriter, it would be unseemly. But I got a secretary! That's fine, had somebody I could dictate to, and I learned to dictate, so it was alright. But to this day, I hate to write longhand.

Storey: Back in those days, though, it was really–it was seen as secretarial work, I suppose.

Arthur: I guess so, yeah.

Storey: Well, I appreciate it, and once again, we've used up two hours. I'd like to ask you again if you're willing for the tapes and transcripts from this interview to be used by researchers both inside and outside Reclamation.

Arthur: Yes, I am.

Storey: Good, thank you.

END SIDE 2, TAPE 2. JANUARY 11, 1995.
BEGIN TAPE 1, JANUARY 19, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold G. Arthur, former chief engineer of the Bureau of Reclamation, at his home in Denver, Colorado, on January 19, 1995, at about nine o'clock in the morning. This is Tape 1.

Working with Ellis Armstrong in the Earth Dams Section

Mr. Arthur, I was wondering: After we quit last time, you mentioned that Ellis Armstrong was in the Earth Dams Section when you were working on *Design of Small Dams*. Could you tell me about him?

An Incident with Jack Savage and Frank Smith over Boca Dam

Arthur: Yeah, but before I get into that, I'd like to regress a little bit if I could, and tell you kind of a funny incident. (**Storey:** Good!) This happened early-on when I came into the Denver office–in fact, it was in 1943.

I had an opportunity at that time to meet with Jack Savage, who was the chief designing engineer at that time. He was a very well-known engineer. I think he achieved his reputation through the design of Hoover Dam, I think, although I'm not sure. But anyway, I was working in the Earth Dams Section, for Frank Smith, as I mentioned before. And in those days, the design of earth dams was more of an art than it was a science. Anything that was a bit unusual would have to get the direct approval of the chief designing engineer, Mr. Savage.

We were looking at the design of a dam proposed as part of the Colorado-Big Thompson Project, and it would be unprecedented in height at that time. It would have been 450 feet high. There were alternative designs for the dam for that location, called a thick core dam and a thin core dam, and I was directed to prepare sketches of those alternative designs to take up for the chief designing engineer's approval. So I made this sketch, and when that was completed, Frank Smith took me along and we went up to Savage's office. Of course this was the first time I'd met anybody of the stature of the chief designing engineer. And we got into a discussion up there, and I wasn't part of the discussion, I was just listening to these two discuss

this design. And Mr. Smith kept talking about what we did at "Boker" Dam, and "we did *this* at 'Boker' Dam, and we did *this* at 'Boker' Dam," and Mr. Savage looked at him kind of with a puzzled look on his face and finally his countenance cleared up and he says, "Oh, you mean *Boca* Dam. It's B-O-C-A, Boca Dam in Nevada."

And Smith said, "Yeah, that's what I said, 'Boker' Dam."

"Smith," he said, "It's Boca. Damn it, can't you say Boca?" (laughter)

As I mentioned before, Smith was a graduate of Maine University. (mimicking a Down Easter's accent) You get the "idear"? (laughter) There's the sketch that I provided. That's my original drafting back in 1943.

Storey: This is for Rattlesnake Dam.

Arthur: Yeah, this was never built.

Storey: Yeah, I was going to say, I don't think I'd heard of it.

Arthur: You know, it was a study of alternative schemes or something. I don't even know just exactly where it was located or what replaced it or anything. But anyway, I can still hear Savage saying, "Smith, can't you say (emphasizing each syllable) Bo-ca?!" (laughter) "That's what I said! 'Boker'!" (laughs)

Impressions of Jack Savage

Storey: Did you have any other impressions of Savage from that meeting?

Arthur: I was surprised he had a high-pitched voice, which didn't seem to be in keeping with his stature. He was, as I remember, a pretty good-sized guy, and fairly heavy frame, and he had this high-pitched voice.

He went over to China to advise the Chinese on the design of the Yangtze River Dam before World War II. And after World War II, some Chinese engineers came over into the Denver office in the Concrete Dams Section to get advice on building this dam, and I understand this dam is finally going to be built.

Storey: Three Gorges, it must be.

Arthur: Three Gorges, yeah. And of course about a year ago, the Bureau said, "We're no longer in a position to provide assistance to the engineers on this," and interrupted a fifty-year tradition. But anyway . . . .

I later heard that Savage was affected by Alzheimer's Disease, which is too bad, he was a very brilliant man.

Ellis Armstrong

But to get on to your question about Ellis Armstrong: When we moved out to the Federal Center, the Earth Dams Section was in a satellite building called Building Number 10, that was apart from the main office building, which was 52. We hadn't been there very long–we moved there in 1946, I believe–when Ellis Armstrong came into the Earth Dams Section. And I understood that he had been employed by the Bureau in Utah someplace, on a dam, prior to that. Ellis and I were in comparable positions, both responsible for the design of several dams, and we had adjoining drafting tables, and I got pretty well acquainted with Ellis. Well my impressions of him were very favorable. He was obviously a very competent engineer, he was industrious, he obviously was pretty ambitious–wasn't any question about that. As I say, we got pretty well acquainted.

"We joked about the day when he would become commissioner and I would be chief engineer . . ."

We joked about the day when he would become commissioner and I would be chief engineer, believe it or not. So his ambition was that, to be commissioner, and mine, I didn't want to be Commissioner, but I wanted to be the chief engineer. We worked together as colleagues there for maybe a year or so, and then he was selected as construction engineer for Trenton Dam out in Kansas.

"I was very pleased to see him [Ellis Armstrong] go, because I recognized that he was pretty stiff competition."

I was very pleased to see him go, because I recognized that he was pretty stiff competition. (both chuckle) As construction engineer, Ellis had occasion to visit Denver and the Design office from time-to-time, and so I saw him periodically while he was out there as construction engineer.

Then he became commissioner of the Bureau of Public Roads. So we kind of lost track of each other until the day when he became the Commissioner of Reclamation. He told me at that time–I last saw him when he was commissioner of

Public Roads–and I said, "How come you became commissioner of Public Roads, Ellis?, being a strong supporter of the Bureau of Reclamation."

Armstrong Accepts the Position of Commissioner of the Bureau of Public Roads Thinking it Was the Position of Commissioner of the Bureau of Reclamation

He said, "Well, I'll tell you, I got a telephone call. The fellah said, 'Ellis, how would you like to be commissioner?'

He said, "Yeah, I sure would." I found out later it was Public Roads instead of Bureau of Reclamation!" (**Storey:** Oh, really?!) (laughter) But Ellis obviously was well connected someplace, and I think it was through the Utah congressional delegation where he had friends in high places.

Storey: So he only worked with you then for a year before he became commissioner?

Arthur: Yes, that's right.

Storey: Trenton was an earthen embankment dam?

Arthur: Yes, it was, uh-huh, and he worked on the design of that dam, and then after it was designed, he was selected as construction engineer to construct the dam.

Storey: Okay. What kind of a personality in the office did he have at that time?

Arthur: Well, he was a friendly, outgoing person. I think everybody liked Ellis, I know I liked him.

Storey: Good. Well, what did you do after your whirlwind development of *Design of Small Dams*?

Arthur: Well, I want to tell you about something that happened just before that. (**Storey:** Okay.) You know, when we were talking the other day, I thought that this incident that I'm going to relate happened after *Design of Small Dams*, but when I looked into my files to get a little information on it, I find out it happened before *Design of Small Dams*. In fact, it happened in November of 1955, and I started *Small Dams* in about 1958, as I remember.

Reviews Disputed Plans Regarding the Nebraska Mid-State Reclamation District

This, in 1955, was in connection with the Nebraska Mid-State Reclamation District. And what happened is, there was a reclamation district headquartered in Grand Island, Nebraska, that was asking the Bureau for assistance in planning the additional irrigation works in Central Nebraska. The Bureau had a plan that would divert water from the Platte River with a diversion dam. I don't recall, I think there was an off-stream storage dam, but I'm not sure of that, and a system of canals to irrigate the land.

Well, this reclamation district also got involved with a consulting engineer by the name of Adolph Meyer, M-E-Y-E-R, and he was a consulting engineer out of Minneapolis. [He] had a very small firm, in fact I had the impression that he and his son-in-law, a fellow by the name of Barr, B-A-R-R, were the principals of the firm, and I don't think they had too much support behind that. But anyway, Meyer came up with an alternative scheme for irrigation that would cost a lot less than the Bureau's scheme. Something like on the order of $45 million, where the Bureau's scheme was at least double that in cost. And it was a different concept, and it was a concept that was unusual, unique, and the Bureau engineers did not embrace the idea of it, for technical reasons.

But anyway, the Bureau was asked to look at this scheme. As I say, they didn't like it too much, but they said it might work, but the costs were way low. The consulting engineer took offense to this. He said that the Bureau of Reclamation didn't want the competition of having somebody else design irrigation projects, so they were sabotaging his scheme. He too evidently had political connections, because Reclamation got instructions from the Secretary of the Interior to make a formal review of Mr. Meyer's proposal. And also, to have a *review* of the Bureau's review made by a well-known consulting engineering firm of Black and Veach out of Kansas City.

So of course the commissioner appointed the chief engineer, gave the chief engineer the responsibility for making this review. The chief engineer official memorandum dated November 17, 1955, on the subject of the review of the adequacy of the design and estimates of costs of this project. And he says that the secretary of interior is requesting the Bureau to make a study of this, and arrangements are being made to have Black and Veach of Kansas City serve as consultants to the Bureau. This actually was to keep the Bureau, quote, "honest," quote, or impartial and so forth, and to satisfy the consulting engineer who was charging that the Bureau was not being forthright in their analysis and so forth. So he said, "A due date of January 10, 1956 has been set for the reports. The Bureau's reports should be completed by December 23, 1955 in order to afford time for Black and Veach to review it and prepare their report to meet the due date of January 10.

The following team is designated to review the district's plan and data and to prepare a report on the adequacy of the design and estimates of cost of the proposed works: Harold Arthur, Chairman, somebody to be designated from the region, Region 7." Their representative turned out to be Herb Prater, regional engineer at that time. And the other two members of the team from the Denver office were a fellow named Harold Brickey, B-R-I-C-K-E-Y, and Cecil Hoisington. Now Brickey was assistant chief of the Canals Branch. Hoisington was the chief of the Estimates and Analysis Branch, and the regional representative was the regional engineer.

". . . I realize now that I was getting picked off for special assignments quite often. . . ."

All of these guys were higher-graded than me, all of these guys were *older* than me, and out of the blue I'm appointed Chairman! And when I look back on my career in the Bureau, I realize–I didn't realize it so much at the time–but I realize now that I was getting picked off for special assignments quite often. (chuckles) But imagine what we had to do here was to . . . . Oh, and he ends up saying, "The commissioner has pointed out that an early meeting of the District Consultant and the Bureau representatives is a necessity. Black and Veach has suggested a meeting in Grand Island, Nebraska, on November 22." So we had an organizational meeting on November 22. We had to have our work done by December 23. I have a month between Thanksgiving and Christmas to do this report. This was a very ambitious schedule.

I accompanied the chief engineer, McClellan, to Grand Island and we met with this consulting engineer, Adolph Meyer, and the representatives of the District. It was not a very pleasant meeting, in my estimation, because Meyer sat there and accused us of bad faith and trying to prevent his scheme, which was very economical, in his opinion, from being adopted, and all this sort of thing. Mr. McClellan, a perfect gentleman, he never took offense with any of this. Of course I was the junior person, so I bit my tongue, because I wanted to respond to a lot of this tirade. But anyway, we agreed to go forward on this thing, and Meyer agreed to furnish us with his plans, which were mostly sketches, and his cost estimates, which were very sketchy also.

Merle Modig's Luggage Didn't Make it to a Meeting in Kansas City

I got back to Denver, then I found out that I was supposed to go to Kansas City and negotiate a professional services contract with Black and Veach, and I was to be accompanied by a fellow by the name of Merle Modig, —O-D-I-G, from the solicitor's office, for the legal advice. So Modig and I went to Kansas City, spent a

day with Black and Veach, and then returned to Denver and got to work on this project. Modig was a young attorney. I met him at the airport to get on the plane to go to Kansas City, I was quite surprised, because here I was decked out in a white shirt and a tie and a suit and so on and so forth, and Modig was there in very casual clothes: he had a loud sport shirt on and so on and so forth, and I guess he thought an explanation was in order and he said, "I'm dressed comfortable like this . . . . You know, I'm from Kansas, and after the meeting, I'm going to take a couple days leave and spend it with my folks. I just thought I'd dress casual on the trip, and I'm taking these casual clothes for when I'm on leave." So I said, "That's fine." So we got to Kansas City, everybody arrived alright, except Mr. Modig's suitcase. His suitcase was lost. So he was quite upset about this, because all he had on was these very casual clothes, and we're going to go to negotiate a contract with a high-powered engineering firm.

He said, "Well, Harold, if you could loan me a tie . . . . Have you got an extra shirt? I can kind of dress up a little bit, even though I don't have a suit jacket."

I said, "Well, Merle, I'm real sorry, but we're only going to be there a day, so I told my wife, 'Boy, this is one time I'm just going to travel carry-on, going to travel light. I don't even have an extra tie. I wore my tie, I wore my suit. I have a clean shirt and a change of underwear and my shaving kit, and that's all I've got." We were going to be picked up at eight o'clock in the morning, so there wasn't time for him to get anything, and we got there at ten o'clock at night. So Modig was trapped. And why I related this is because it was so funny, because they picked us up in the morning and they whisked us to their headquarters office in Kansas City, which was a pretty imposing edifice, and in to see their big brass, and here's the engineer, me, I'm in a white shirt and a tie and a dark suit and all spiffed up, and the attorney's dressed very casual. Of course they mistook our roles. They figured *he* must be the engineer, and I must be the attorney!, (laughs) because of our dress.

But anyway, this was a very demanding assignment. We completed the work on time. Black and Veach, as I remember, got an extension for their time to review it, and when they reviewed it, they thought our estimates were a *little* high, but not nearly–they didn't agree with the consulting engineer at all. They were much closer to us than they were to the consulting engineer. So that was an unusual experience, and I don't know what ever happened to that project. I don't think it was ever built. I *know* the Meyer scheme was not built, but I don't think the Bureau's was either, as far as I know.

The strange part of this was, Brit, that all these people were senior to me, and they were all older than me. And I was given this assignment. (phone rings, tape turned off and on) I was the junior person and *I suppose* the reason I got this assignment–I'm speculating–but I suppose the reason I was given this assignment is because of the coordination work that I had done on the Falcon Dam, that had given me the opportunity to cross lines into the various organizations and work directly with the people. And this was a very short fuse on this project, this was a lot of work to accomplish in a month, especially during the holiday season when a lot of people were trying to take leave and so forth. I suppose that's why I was selected, although nobody ever told me this.

Storey: Now, when you did this study, were you studying whether his cost estimates were low, whether the project was feasible, or what?

Arthur: Both. We were critiquing the design, and where we thought that the structures were inadequate, we would modify the design and then we would review the costs.

Storey: Do you remember how his concept varied from Reclamation's concept, by chance?

How Reclamation's Proposals for the Nebraska Mid-State Reclamation District Project Differed from Those of the Consulting Engineer

Arthur: Yes, the basic concept of the irrigation project for the Bureau is, you start out with a big canal, and the canal traverses the area to be irrigated, and you take laterals off of it from time-to-time, like branches off of a tree. And of course that diminishes the amount of water flowing in the canal, so the capacity of the canal gradually decreases as it extends in length. His idea was to just not start with a big canal, but to just have a small canal and pump water into that canal. And when that water was used up, put in another pump and pump water and start another canal. And he had a series of pumping stations, so it was an entirely different concept–instead of a gravity system, it was a series of pumping stations, you might say.

Storey: So it was taking water directly out of the river?

Arthur: Yeah, and ground water.

Storey: Oh, okay.

Arthur: I don't remember too much about the details of the project. Another thing was strange about this: there weren't any earth dams involved. It was primarily a canal

system. That's why they had this Harold Brickey who was assistant head of the Canals Branch.

Storey: Yet they came over and selected you.

Arthur: And I was selected as the coordinator, really, facilitator, whatever. But we got the job done. And it was after that, that I got into *Design of Small Dams*, and the *Design of Small Dams* was essentially finished in '59, and it was first published, I think it says April of 1960.

Storey: Uh-huh, so what did you do after you went off that?

Working in the Earth Dams Section after Completion of the *Design of Small Dams*

Arthur: I went back to doing my normal work, which was designing dams and being the supervisor of the Design Unit in the Earth Dams Section. Then on September 28, 1959, at which time I was reviewing the galley proofs of *Design of Small Dams*– which just took part of my time, the rest of my time I was doing my normal function in the Earth Dams Section–the commissioner forwarded a request to the chief engineer from an agency called ICA, International Cooperation Administration, which was an agency of the State Department, for a dam specialist to consult in Chile, South America, on the design of a major earth dam. And they wanted this dam specialist to come as soon as possible and to plan on spending about six weeks in Chile. (phone rings, tape turned off and on) I was asked whether I would be interested in taking this assignment. I accepted the assignment, provided that I wouldn't initiate travel until after the first of the year–that's January 1, 1960.

Assigned to Assist in Design of Diguillin Dam in Chile

And I left Denver on February 2, 1960, and I stayed in Chile until March 16, 1960, and then returned to Denver, with a stopover in Washington. It was a very interesting trip, of course, very interesting assignment. One thing that was pretty important, I think, as far as my career was concerned, is that I was debriefed for two days in Washington, and I met with Commissioner Dominy and his staff, and gave a detailed account of my six weeks' experience in Chile, and the work that I had done in Chile. And this is the first time that I had met Commissioner Dominy, the first time that . . . .

END OF SIDE 1, TAPE 1. JANUARY 19, 1995.
BEGINNING OF SIDE 2, TAPE 1. JANUARY 19, 1995.

First Meeting with Floyd E. Dominy

Storey: So this was the first time you'd met him.

Arthur: Yes, he knew of me because he knew that I was the guy that was the engineer that was responsible for the *S*
nesign of Small Dams coming together like it did. And this was the first time that we became acquainted. And it was that summer that I was selected as assistant regional director, transferred to Billings, Montana, through the direct intervention of Dominy.

Storey: What kind of an impression did he make on you?

Arthur: So I guess I made a good impression on *him*. (laughs)

Storey: Yeah, you sure did, I guess.

Arthur: Dominy was a very dynamic personality. He's very energetic, very outgoing, very sharp.

This assignment in Chile worked out very well. My boss, the chief engineer, got a letter from the embassy in Chile–actually, it was the United States of America Operations Mission to Chile. It said thank you for my services. It said, "In addition to Mr. Arthur's professional competency, which impressed the Chilean engineers, he showed the kind of personality and understanding which is invaluable in working with people foreign to the United States customs, in effect, they liked him and his operation. I want you to know we appreciate greatly your foresight in sending us a man of Harold's ability. We are certain that his contribution to the water resources program of the government of Chile will be long remembered." I thought that was very nice.

Storey: Uh-huh. Now, who was that?

Arthur: This letter was written by the fellow that was in the State Department. He was the Director of this Mission down there in Santiago, Chile. While I was there in Chile, I met with and briefed the ambassador and his staff on what was going on. I gave lectures to the Chilean engineers on various aspects of dam design. I drafted my report while I was there so I could go over it with them in the rough draft to be sure that there was complete understanding of what I was saying and what I was recommending and so forth. And then when I got back to Denver I prepared the formal final report.

Storey: And what was that on?

Arthur: "Preliminary designs of Diguillin Dam." That's spelled D-I-G-U-I-L-L-I-N, Dam, in Chile. And it was a proposed dam for irrigation. It was a *major* structure, it would have been about 300 feet high.

Storey: And it would have been an earth-filled dam?

Arthur: An earth-filled dam, right.

Storey: Was it ever built?

Arthur: I don't know. In 1962, while I was in Billings, Montana, I got a letter from the engineer who'd been in charge of the design of this for the Minister of Public Works in Chile, and they were running a test program of grouting the foundation–it was a difficult problem, and I had recommended that they make a test section before they tried to go into large-scale operations. They were having some problems with it. And he wanted to know if I could return to Chile and give them further advice on this. I wrote them a very long letter giving a lot of information, but I said what they were doing was primarily a construction operation, I was a design engineer, I could tell them how to proceed, but to actually do it in the field and improvise to meet the local conditions and so forth, they needed a construction person, and I recommended three retirees from the Bureau of Reclamation that were qualified in that work, experienced in that kind of work, and suggested that they get in contact with *those* engineers. And I said that if that didn't work out and they still wanted me to come down, that I might be able to arrange it. I was no longer in the design function, but I still might be able to arrange it. Well, I don't know what happened after that.

Floyd Dominy Suggests Application for Position of Assistant Regional Director in Billings

Storey: By that time you were in Billings. (**Arthur:** Right.) Did you have any finger in going to Billings? (**Arthur:** Yes.) I mean, other than the fact that you said, "Yes, I'll go." Did you apply for this job?

Arthur: Yes. In those days–I don't know how they still do it in the Bureau–but in those days vacancies were advertised. Those who were interested, thought they were qualified, could apply for the job. Well, I was sitting at home, having returned from Chile, I was sitting at home one evening, we had company and were having dinner out on our patio, and the phone rang. My wife went and answered the phone and she came to get me. She said, "Honey, you're wanted on the phone."

I said, "Who is it?"

She said, "It's Mr. Dominy."

So I then answered the phone and he said, "This is Floyd Dominy. I'm down here at the Albany Hotel." (**Storey:** Uh-huh, I remember the Albany.) And he said, "I want to see you. I want to see you tonight, or I want to see you in the morning, whichever is convenient for you."

And I said, "Well, commissioner, we have dinner guests here tonight. It would be much more convenient for me to come down in the morning, if that is satisfactory with you."

And he said, "Well, it is. Meet me at eight o'clock, come down for breakfast." So I went down and had breakfast with the commissioner in his room at the Albany Hotel. And he told me that he was familiar with my background, the work I'd been doing and so forth, and he thought it was time that I moved on to other things, to broaden my experience. He said, "There's an assistant regional director's position open in Billings, Montana, and I suggest that you apply for it. It's a grade raise for you. You're a thirteen, and that job's a fourteen. I think you'd like it. I think you ought to apply for it."

I said, "Well, thank you, commissioner, I will do that." So I made a formal application for the job, and a couple of weeks later I got a call from the chief engineer's office and they said, "The regional director from Region 6, Mr. Bruce Johnson, is up here and he'd like to meet you."

I said, "Okay," so I paddled up to the front office and I was introduced to a fellow by the name of Bruce Johnson. We talked for about ten or fifteen minutes, and the next thing I heard, a week or two later, that I was selected as assistant regional director to Mr. Johnson.

Storey: That would have been in '62?

Regional Director Bruce Johnson Interviews for Assistant Regional Director Position

Arthur: No, this was '60. (**Storey:** Sixty?) This is still '60. (**Storey:** Okay.) So I moved up there Labor Day weekend, 1960. This Bruce Johnson told me quite frankly, "You're not my first choice, because I don't know you." I'd never been in his office, I'd never been in Billings. "I don't know you, but I understand you're well qualified and so forth. I've been *advised* that you would make me a good assistant. If I had

my choice, I would have selected somebody that I'd worked with." He had been a project engineer in Bismarck, North Dakota, and he said, "I would have selected my assistant from there."

I said, "I understand. I'll try to do a good job." I found out either then from the commissioner, or maybe later, that Bruce Johnson was not *his* choice for the regional director. The regional director vacancy occurred because the regional director at Billings was transferred, I think to Salt Lake City, is where he went. There was a vacancy in Billings for the job, and I don't know who Dominy wanted to put into that job, but he was pressured by Senator [Quentin Northrop] Burdick from North Dakota, who was a personal friend of Bruce Johnson and lived in Bismarck, to select Bruce Johnson for that job. Now I don't know whether Dominy figured that somebody else was better qualified, or what his reason was, but Dominy was not . . . . (phone rings, tape turned off and on) Dominy was not the type of person that wanted somebody else selecting his staff for him–he wanted to hire all his assistant coaches himself, you might say. And he resented Bruce Johnson because of this, and he was always, in my dealings with Dominy after that, he was always putting Johnson down, and I was always standing up for him, because he was doing a tremendous job as regional director in my opinion. But Dominy didn't want to hear any good things about him. He resented him. And I think that Dominy by selecting me–he was the one that selected me for the job, there wasn't any question about that–and he knew I knew it. He expected to have somebody loyal to him in the Billings office, which I was, but I was loyal to the regional director also.

Bruce Johnson as Regional Director in Billings

Bruce Johnson was a very unusual guy. He was very sharp, had a very nice manner, very friendly. I reported in his office in Billings, Montana, the first time I'd ever been in the office, on a Monday morning as his new assistant, and he said, "Harold, I know you haven't been here on the staff, haven't met the staff before, except for the regional engineer, you met him down at the Boysen Dam, I understand. You don't know the rest of these people. I'd like to introduce you to them so they know who you are. Which would you prefer, to have a general meeting or would you like to have one-on-one with the various division chiefs?"

And I said, "Well, it'll take more time, but it'd be more effective if we have a one-on-one, so we can discuss each individual's area of responsibility and what is expected of them, what's expected of me, and so forth."

And he says, "Okay." So he told his secretary to set up a series of meetings. I think he allocated forty or forty-five minutes per division chief, so I met them one

at a time and found out what they were doing, what their responsibilities were. Bruce Johnson told each of the division chiefs the same story, that I was the new assistant. He said they were not to view the office as an assistant regional director *and* the regional director, but to view the office as the regional director's office, and that we were a team, his assistant and he were a team, and they should feel free to come to me, they didn't have to see him on everything, that I could speak for him on everything, use my own judgement on that, and they could get decisions from me, and offered a lot of support to me. Then after those interviews were done, he really surprised me. He said, "You know, I haven't had an assistant for a couple of months since Les Barstch went to the World Bank. Without an assistant, I've been pretty much tied-down to the office here. I haven't been out to the Projects, I haven't been to visit the power center in watertown, South Dakota, or the project planning office in Huron or Bismarck, haven't visited the Riverton Project. It's long overdue that I go show my face and meet with these project engineers and so forth. We'll have lunch together. After that, I'm leaving, I'll be back in two weeks, you're in charge."

Storey: (chuckles) Didn't know what you would do or anything, huh?

Arthur: You know, I realized later what a gutsy decision this was on his part, because at the time I didn't think quite that much of him, because I felt I can do this alright, but he didn't know me, he had just been with me for three or four hours, and he's turning over *his* region to me.

Storey: After he had told you that you weren't his first choice. (chuckles)

Arthur: Uh-huh. And he said, "One word of advice. You're going to be called upon to make a lot of decisions. Just use your best judgement. If you see anything that's *obviously* very old and has got a lot of whiskers on it, somebody's probably trying to slip something past they don't think they can get past me. I would suggest if it's real old, you just table it until I get back. Anything other than that, don't hold it for me, just go ahead, you're in charge."

And this was a great strategy, because the staff had been working without an assistant regional director for quite some time. They were used to going to the boss for decisions on everything, and if I were interposed as an intermediate level, they would end-run me as much as possible, but all of a sudden the boss had gone. Now here's this new guy they *have* to deal with, because he is the acting boss, so they *have* to deal with me. And in two weeks, I had developed a working relationship with all those guys. So when the boss *did* come back, they still were coming to me, and then I would screen out the things that I thought the boss didn't

need to bother with, or I could brief him on later and stuff, and free up the boss for a lot of other activities. So it worked great.

Storey: And you were the only assistant regional director then?

Arthur: Yes.

Storey: So you didn't have a specific area of responsibility like construction or administration or anything like that?

Arthur: No, the whole thing.

Storey: Who were the division chiefs, do you remember any of them?

Arthur: Yes, I mentioned this Kermit Kober, I said lives here in Denver. Might know something about the irrigation district at Riverton. He was the chief of operation and maintenance, and he hadn't been there more than a couple of years. He had come out of Denver. He'd been up there for a couple of years. And the regional engineer was a fellow by the name of Anderson, that I had met during the construction of Boysen Dam when I was involved with design and construction of Boysen. I had met him. Then the people in charge of operations, administration, finance, and the fellow in charge of power–I'd never met any of those fellows before, and don't remember their names now.

Storey: How long had he been there as regional director when you came?

Arthur: Probably less than a year.

Storey: So you were both fairly new.

Arthur: Yeah. He didn't have an assistant for a long time. The reason why he didn't have an assistant is because that was the second time that the assistant regional director had been passed over, when the regional director's position opened up. The assistant regional director, who had come from Denver maybe in the early 50s and been there quite a while, a fellow by the name of Les Barstch–B-A-R-S-T-C-H--was passed over for the second time when Bruce Johnson was appointed regional director. So he decided that that was the end of the line for him, and he started looking for another job, and he got an appointment to the World Bank in Washington, D.C. So a couple of months after Johnson arrived on the job, Barstch left, Johnson was by himself. But of course Johnson had worked in Bismarck, which was part of the region, and because of being a project engineer there, he was

familiar with the regional office and the regional office personnel, so he wasn't a stranger as much as *I* was–he had been part of the region.

Storey: Did they try and bring you any projects "with whiskers"?

Arthur: Not that I identified! (laughter)

Storey: What were the major issues up there then?

They Were Getting Ready to Build Yellowtail Dam

Arthur: Well, we were getting ready to build the Yellowtail Dam, a major dam on the Yellowstone River. The construction engineer on a dam is appointed by the chief engineer, but the regional director in those days was responsible for all the administration of the project, for staffing the job, and providing housing and support, and everything that went with it. Chief engineer appointed his representative who was the boss, and the regional director did all the rest. So that was a big part of the region's load.

And then there were a number of minor construction contracts that were delegated to the regions for construction of access roads and fences and camps, housing, that sort of thing.

Power Operations Were the Biggest Activity in Billings

But the biggest activity in the region there in Billings was the power operations, because we were marketing the power that was generated on the mainstem dams of the Missouri River–the Corps of Engineers dams, Owyhee, Fort Randall, Fort Peck, and Garrison–we were marketing all that. And we would build all the transmission lines, so we were very actively engaged in that scope of the work, that phase of the work.

Storey: That must have been a whole new world for you, (**Arthur:** Well, of course, it was.) the hydro and the transmission and everything.

". . . I had to leave my typewriter behind and learn how to dictate!"

Arthur: Not only that, I had to leave my typewriter behind and learn how to dictate! (laughs)

Storey: Uh-huh, wouldn't let you have a typewriter, huh?

Arthur: It was unseemly to have a typewriter and be up in the executive offices. Besides, I had a secretary. What would my secretary do if I sat there and used my own typewriter? (chuckles) Besides, it was much more convenient. I much prefer to have a secretary to having a typewriter.

Storey: Yeah, you learned how to dictate, though.

Arthur: Yes.

Storey: What kinds of issues came up about the hydro, for instance, and the transmission lines?

Right-of-Way Was a Major Issue

Arthur: The main problem with the transmission lines was procurement of right-of-way. There was always a lot of opposition. Oh, I shouldn't say "always," but there was a lot of opposition from landowners to granting right-of-way, or to selling right-of-way for transmission lines across their property. They didn't want these big towers out in the middle of a wheat field or a hay field, where they'd have to mow around it and so on and so forth. I remember in one case we had a dentist who owned a ranch out of town, and he was very vociferous. "Don't put the transmission line on *my* property, go over here on Harry's property, or go over here on Bill's property, but not on my property." He had a theory that the electromagnetic waves from the high voltage transmission towers would interfere with the sex life of his breeding bulls, and he thought that was going to interfere with his lifestyle, breeding operation. There's been some evidence in recent years that maybe there's some truth to that too, but back in those days, we didn't give much credence to that.

And the region was responsible for getting the right-of-way, and a lot of the right-of-way had to be secured by condemnation proceedings. Of course this was handled by the solicitor's office there in Billings and so forth. There was a *tremendous* amount of correspondence regarding that activity.

Planning for the Helena Valley Project and the Anchor Dam Project

And then we were planning various projects, irrigation projects. There was the Helena Valley Project and Anchor Dam Project, Riverton Project was in operation and maintenance phases, and there were dams in North Dakota and South Dakota that were under our jurisdiction for operation and maintenance. So it was a pretty good operation.

Storey: What about power marketing? Did you become involved in that?

Arthur: Yes, the power was marketed to preference customers. This is the REAs, the cooperatives, the Rural Electrification Administration cooperatives. They had first call on government-produced power, because they got preferential rates. So we dealt with them.

How Responsibility Was Assigned in Billings

Storey: What kinds of issues would be elevated to the assistant regional director and the regional director as opposed to being just handled routinely down in the divisions?

Arthur: Well, the division chiefs did not have signatory authority for correspondence to outside agencies or outside individuals. In other words, if you were a landowner and got a letter from the Bureau of Reclamation, it would be signed by the regional director, not somebody in a lower position. And this did not always involve policy, but it added to the amount of paperwork. I *routinely* took a briefcase home at night of letters to be signed, and would work after dinner, get out on the table and read these letters and sign a whole bunch of letters. Then there'd be some letters on which I'd have questions, that would be raised about statements that were being made and so forth, and I'd tag those so I could take it up with the staff when I got back in the office the next day, and that sort of thing. But that's the only way you could keep up with the volume of correspondence that was being issued.

Storey: The regional director had to do the same thing?

Arthur: He'd have to do it if he didn't have an assistant. But I took care of all the routine stuff, and relieved him of this particular chore. And if I signed . . . .

END OF SIDE 2, TAPE 1. JANUARY 19, 1995.
BEGINNING OF SIDE 1, TAPE 2. JANUARY 19, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold G. Arthur on January 19, 1995.

This correspondence that you signed would be stamped "Acting regional director," even if he was in the office.

Arthur: Outside correspondence, yes.

Storey: What about correspondence within Reclamation, say? How would that be handled?

Arthur: Pretty much the same way. It would depend on the nature of the correspondence. But there was a daily reading file, and I would read all the outgoing letters, no matter who signed them, so that I would be kept abreast of what was going on and so forth. So if there was any policy decisions involved, the branch chiefs would send the letters up to the regional director's office. If it was strictly routine, directions, say, of the regional engineer telling the drill crew to take come cores someplace or something like that, the regional engineer would sign it–not me. It would be routine.

Storey: That would be a division chief.

Arthur: Yeah, a division chief.

Storey: Did signature authority go lower than division chief?

Arthur: No.

Storey: It was still that way when *I* came here in '88, pretty much.

Arthur: Yeah. Still should be. (chuckles) Isn't that way anymore, I guess.

Storey: No. How long were you assistant regional director?

Arthur: I came back to Denver on the Fourth of July weekend, 1963.

Storey: So you were there about three years.

Assistant Secretary Kenneth Holum Proposes a Move to Sacramento as Assistant Regional Director

Arthur: You know, Region 6 had its own airplane pilot, because we covered a rather large geographic area. I was sent to Eastern South Dakota, I think it was to our office in Huron, to pick up Assistant Secretary of the Interior Kenneth Holum, and Kenneth Holum was coming out to Billings to attend and address a meeting of the power supervisors of the region–they were having a conference, an annual get-together. I think I was the only–well, I don't know if there were any other people on the plane or not–but anyway, we went over there to get him, and I was his escort. So I

visited with Mr. Holum on the way to Billings, as best you can in a Beechcraft airplane.

Storey: Yeah, they're rather noisy.

Arthur: He attended the meeting, and of course I attended the meeting too. We had a dinner that night after the meeting in Billings, and after the dinner, Mr. Holum says, "Harold, I want to meet you in the lounge of the hotel here after the dinner, you and Mrs. Arthur."

I said, "Okay." I wondered "what's this all about?"

So I met him in the Golden Belle of the Great Northern Hotel in Billings, Montana, and we ordered an after-dinner drink, and he said, "Harold, we have an opening in Sacramento, the assistant regional director out in Sacramento. I want you to transfer out there and take that job. You know, California is our top region, the most important region, the most active region. It's a great promotion for you. You're a fourteen here in Billings, you'll be a fifteen out there. I want you to take that job."

And I said, "Well, I'm very flattered, Mr. Holum, thank you very much. What does the commissioner want me to do?"

And he said, "Well, I don't know what he wants you to do, *I* want you to go out there."

I was aware that the commissioner and the assistant secretary–he was assistant secretary for water and power–and I was aware that they didn't get along, because Holum thought he ran the Bureau of Reclamation, and Dominy knew that *Dominy* ran the Bureau of Reclamation, and I knew there was a power struggle between these two guys, and I sensed that I was in the middle of it. I said, "Well, I don't wish any disrespect, Mr. Secretary, but as long as I'm working for the Bureau of Reclamation, I have to take orders from the Commissioner of Reclamation, he's my boss. I have to take orders from him. You know him well enough to know that I couldn't exist in the Bureau of Reclamation if I end played him. If Commissioner Dominy wants me to transfer, I'll do it. I'm not anxious to take the job, because I'm settled here in Billings, I have a son here in high school, I have a son at the University of Montana. Six months ago I moved into the new house I built. I figured on being here permanent, I'm not anxious to make the transfer. But, I said, I will under those circumstances, if the commissioner requests

it." So we parted company and the next morning I'm having breakfast about eight o'clock in the morning, the phone rang. My wife answered the phone.

Floyd Dominy Calls about Kenneth Holum's Offer of the Position of Assistant Regional Director in Sacramento

She said, "Alice wants to speak to you, the commissioner's secretary."

So I got on the phone and she says, "Commissioner wants to talk to you."

"Okay." So he came on the phone.

He said, "I hear that you told Ken Holum who's running the Bureau of Reclamation last night."

I said, "You did?!"

He says, "Yeah. Good for you! I'm proud of you. You know, you may be finished in the Bureau of Reclamation, he's a very powerful man. You made yourself a powerful enemy."

I said, "Well, if I've got to chose between Holum and Dominy, I'd rather have Holum for an enemy than Dominy!" He laughed! He laughs uproariously.

Storey: Yes, I know.

Arthur: How he got the information–I have no idea how he got that information–unless Holum contacted him, I don't know. He didn't say, and I didn't ask.

Storey: Would this happen to be about the time that Bob Pafford was appointed regional director in Sacramento?

Asked Whether He Would Accept a Job as the Head of Research in Denver

Arthur: Yeah, it was about that time. Then about a few months after that, I got a call from Grant Bloodgood, the chief engineer, and he says, "I'm down here in Amarillo, Texas, with Floyd. Walt Price has just retired as the head of the Division of Research. Dominy thinks you'd be interested in that job. You're not interested in that job, are you?!" (chuckles)

And I said, "Yes, I am."

"Why would you be interested in that job?"

And I said, "Well, it's a grade raise for me, it's back in Denver."

"Yeah," he says, "but you've never been in research, you've always been in design."

And I says, "Well, as you know, there's always been friction between the Design and the Research Divisions regarding their overlapping functions on design and selection of materials for dams and so forth. I think it's time that somebody from Design was in Research, or somebody from Research was in Design that can bring these organizations together. Yeah, I'd take it."

"Okay," he says, "if that's the way you feel." (chuckles)

This is going to be my new boss, see. (**Storey:** Uh-huh.) So actually, [I] came down to Denver. I had a business trip down to Denver, and I brought my wife, and we started looking for an apartment to rent here in Denver, if we were going to be transferred back to Denver. I put a deposit down on an apartment out in Applewood, because I understood this transfer was going to be imminent, because he said they were going to send it up.

Kenneth Holum Refused to Approve Transfer Papers to the Research Labs

Well, I got a call from somebody–I don't know whether it was Dominy, I don't remember–but anyway, what they said was that they had sent my reassignment papers up to the Department for approval, and they got to Ken Holum's desk, and Ken Holum said, "If that so-and-so doesn't want to go to Sacramento, he doesn't have to go to anyplace, he can just stay there in Billings for the rest of his life."

"Sorry." It must have been Floyd. He said he didn't have enough [influence], he couldn't get by Holum on this. So I was out of luck as far as the job was concerned.

Storey: That would have been about '65 or '66?

Barney Bellport Interviews Him about Becoming Assistant Chief Designing Engineer in Denver

Arthur: No, this was ‘62. That was probably mid-‘62, then a few months went by, and I got a call from the *new* chief engineer, now Barney Bellport. And he wanted me to stop in his office, or to come to Denver and visit his office, which I did. And he told me that he was making some reassignments in the staff and that the assistant chief designing engineer’s job was going to be open, and he thought that I would be a great candidate for that job with my design background. And he said, “You’ve been out ~~of~~ in the region now for three years, you’ve learned how the other half lives, and you can help build bridges between the Denver office and the region and so forth. But you’re primarily a designer, and I think it’s time for you to come back.”

“I realized at that time that I’d been out on a training mission.”

I realized at that time that I’d been out on a training mission. I didn’t know that when I built a new house in Billings, Montana, and settled down my roots, figured I was going to stay there a long time. They were just broadening the scope of my experience. But I said, “Well, do you think they can get this through the Department? You know, a few months ago I couldn’t get cleared to be the head of Research.”

He said, “Well, Dominy thinks that he can get this approved. Before, you hadn’t been in Research. That was one thing that the people who were against it could point out, but they can’t say that about [this assignment]–you *are* a designer. You’ve got all this experience in design. Well, what about it? Do you want to come back?”

And I said, “What’s the grade?”

“Well, it’s a fifteen.” And I said, “Yeah, I’ll take it. One thing”–this was in the spring of ‘63–“I don’t want the transfer to be effective until after school is out. My younger son is graduating from Billings Senior High School in June, and my older son is graduating from the University of Montana in June. If I come down here in May or June, I’ll be going back up there for their graduations and stuff. I’d rather wait until after that is over with.”

So he said, “Okay, we’ll make it the first of July.”

“Okay.”

He said, “in the meantime,” he says, “we’ll rotate a bunch of people through the job as acting [assistant] chief designing engineer. It’s time that some

of those division chiefs find out what goes on here in these offices, and see what we have to do, and so forth."

They started doing that. They had a guy up there for a couple of weeks, one branch chief, and then they'd have another branch chief up there, and so on and so forth.

He said, "One stipulation: There's to be no word leak out that you're going to come to Denver until I announce it. I'm not going to announce it until just before you come."

I said, "Okay, I'll keep my mouth shut."

Well, that led to quite a bit of embarrassment in one incident. I came down here–I might say, the regional director used me all the time for liaison between the region and Denver, because I was a Denver product–and I came down on one trip, I had business with the chief designing engineer and with the assistant chief designing engineer–*acting*–was F.C. Walker, who was the section head of the Earth Dams Section. And he was acting in that position and really enjoying it. I was visiting with him, and there'd been a number of individuals that'd been up there for a period of time, he'd been there for two weeks, and his assignment was renewed for another two weeks, it was going to be the last two weeks before I came down. But of course he didn't know this.

Storey: And he was thinking, "Hey, maybe I have a chance here."

Arthur: He thought he was going to be selected. So he started telling me all the things he was going to do: he was going to change this, and he was going to get this done, and this done, and this done, as soon as he became the assistant chief designing engineer. And I couldn't even say, "Don't get your hopes too high." I couldn't say a damned thing, because if the instructions I had from Bellport. So I just played it cool. Then when that was announced when I came down, our relationships were very cool. He resented the fact that I hadn't told him that I was going to get the job. And I don't blame him.

Storey: Who was the chief design engineer, was it still Jack Savage?

Arthur: No, no, Savage had come and gone. There'd been a number [since then]. The one then was Oscar Rice. Before that, it'd been Keener and before that it'd been Nalder. Nalder was the chief designing engineer during the Falcon days. And I

don't know who it was before then. But there was somebody between Savage and Nalder.

How the Nature of the Work Changed in the Various Positions Held

Storey: Well, you've raised an interesting question. When Barney Bellport, who *had* been the regional director in Mid-Pacific, or Sacramento, I don't know the region number–(**Arthur:** Region 2.) Region 2–said to you, "I want to give these guys a taste of 'what *we* do up here,'" could you characterize the kind of work you did at the Earth Dams Section, and how that evolved when you were assistant regional director, and how that evolved when you were assistant chief designing engineer? How did the work change? What are the different kinds of *concerns* that you have at the different levels of the organization?

Dam Design Is Strictly a Technical Job

Arthur: As an earth dam designer, you were actually involved in the design of dams, the computation of quantities, making quantity estimates, cost estimates, preparing drawings, drafting specifications, and directing exploration, reviewing of instrumentation results, performance of dams, and it was strictly a technical job. The regional director's job was purely an administrative job. It was a management job, didn't require . . . . I was going to say it didn't require any technical background–a technical background was helpful, of course. But it was a nontechnical job, it was an administrative job.

The chief designing engineer's job, and the assistant chief designing engineer's job was a combination: it was administration, management, *and* it had some technical aspects. Most of the technical aspects were done by the specialists at a lower level, by the branch chiefs and the sections. But the chief designing engineer's office brought the things together.

It Was Unusual to See the Entire Process of Dam Design

As I explained when I became the coordinator/sponsor on Falcon Dam, the Bureau is very highly structured and specialized, so the earth dam people and electrical engineers and dam engineers and so forth, they didn't have much interfacing and so forth, and it was *unusual* that I got the breadth of experience of finding out what the electricals did and why, and what the structural and architectural people did and why, and the various studies that were made on valves and gates and the *whole* thing. Of course the chief designing engineer brings this all together in a coherent design. But the *people* who were the branch chiefs just

see the pieces–each guy sees his own piece. And it's up there where they *really* come together.

The chief engineer thought that if some of those branch chiefs could *see* how these things had to come together, and interrelated one to another, it'd be helpful in understanding the whole work process.

Storey: Did you have to work with political types, when you were in Billings, for instance?

In Billings Became Liaison with the Press

Arthur: Another one of my functions, when I went to Billings was that I became the liaison with the press, the media. This was a very important job there, because I think the Bureau of Reclamation was the largest Federal agency in town, and we were one of the biggest operations in town, very important to the economy of Billings, and we were starting this major dam, Yellowtail Dam of which I spoke, and people in that area were very interested in that. So there was a *lot* of interest on the part of the press and *The Billings Gazette* as to what the Bureau was doing and why. And there was a lot of interest with the Rotarians and the Kiwanis and all the service clubs who have to have a luncheon speaker every week, or every month, on what was going on, and the Bureau's activities, and Yellowtail Dam, and so on and so forth. And the regional director made me the point man for that. The first time the reporter that was assigned to government affairs showed up after I was there, Bruce called me into his office and introduced me to this guy and said, "This is my new assistant regional director. From now on, he's the guy you work with. You want to know something about the Bureau, ask him. He's got all the answers," and so on and so forth. So I became very active on the lunch circuit at the service clubs, and in the paper. I've got a whole scrapbook of articles that I cut out of the paper that I've saved. I made some friends that were *not* with the Bureau of Reclamation there, and every time I'd see them, they'd say, "Well, we see what Harold Arthur says today!" (laughter) Because I was quoted two or three times a week in the publication.

Storey: Then you went back to Denver, and that kind of thing sort of disappeared, did it? You were no longer so active, publicly, like that?

Back in Denver the Activities Were with Professional Organizations

Arthur: That's right. Now the activities were in professional organizations, in the United States Commission on Large Dams, and the Commission on Irrigation and Drainage, and writing professional papers and that sort of thing.

Storey: What kinds of pressures operated on the chief designing engineer's office? Were there internal pressures, were there external pressures? I get a look that tells me maybe there weren't a lot of pressures coming down to that office.

Pressures on the Chief Designing Engineer's Office Have to Do with Design Cost and Completion of Designs on Schedule

Arthur: Well, the pressures were of two kinds. The pressures on what the designs cost, and on when the design schedules were met. There was an annual program conference held by the commissioner, all his regional directors, and the key personnel from the Denver office–would meet annually and spend the week together and evolve the Bureau's program for the next fiscal year. And at that time, it would be decided what was going to be done, and the timing, and the money, the appropriation requests that would be made, and that sort of thing. And the chief designing engineer participated in that, because he made the commitment as to what he could do, what his staff could do, and the estimates of cost, how long is it going to take to do it.

Storey: Um-hmm, and you participated in those also?

Arthur: Oh yes.

Storey: So was the chief designing engineer in charge of these design branches and sections under him?

Arthur: All of them.

Storey: Were there divisions?

Arthur: When I became chief design engineer, I had 600 people in the Division of Design.

Storey: How long were you assistant chief designing engineer?

Arthur: Two years.

Storey: And then you became chief designing engineer?

Arthur: That's correct.

Storey: Well, I'd like to continue, but I think you need to leave today.

Arthur: Oh yeah, that's right!

Storey: So, I'd better ask you if it's alright for researchers inside and outside Reclamation to use the tape recordings and the transcripts from this interview.

Arthur: [If you] think it makes sense between my hoarseness and the coughing, that's alright.

Storey: I think they'll do fine. But you're saying "yes," right?

Arthur: Right.

Storey: Okay, thank you.

END OF SIDE 1, TAPE 2.
BEGIN SIDE 1, TAPE 1. FEBRUARY 1, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold Arthur at his home in Denver, Colorado, on February 1, 1995. This is Tape 1.

Mr. Arthur, I was wondering if you had anything *you* wanted to put on tape before we start going forward again.

Special Assignments While Working in the Earth Dams Section

Arthur: Well, you know, our detailed discussions about what I did in the Bureau and so forth, has stimulated my thinking, and I've thought of a couple of things since our last interview that I thought would be interesting to have in the record. You were asking me questions about just what I did, and when I was in the Earth Dams Section–this is a period of 1945 to 1960, a fifteen-year period–and I explained that I seemed to get a lot of special assignments, such as the Falcon Dam coordination job, and the Mid-State Project, and writing *Design of Small Dams*, and so forth. On the side I did my regular job.

Participates in Review of Maintenance and Safety of Reclamation Dams

Well, I've thought since of a couple of other special jobs that I had that I would like to mention. One was, I was involved in the review of maintenance and safety of existing Bureau of Reclamation dams. This was a program that was started in about the late 40s or early 50s. The Bureau decided that they should

monitor the old dams that'd been built by the Bureau and had been turned over to the water users to operate and maintain. The Bureau decided that they should review the condition of these dams to be sure they were being properly taken care of and so forth. And this was done by a team of two engineers: a civil engineer and a mechanical engineer. The mechanical engineer would look at the gates, and the valves, and all of that, and the civil engineer would look at all the other aspects of the dam. And I went out on a number of those assignments with various mechanical engineers during that period

Met Gil Stamm During Safety of Dam Reviews

I met Gil Stamm when Gil Stamm was in charge of the operation and maintenance of Region 1 Projects out of Boise, Idaho. I met him on one of those review of maintenance trips and got acquainted with him at that time.

Small Reclamation Projects Act Reviews

Another activity I was involved in was the Small Reclamation Projects. The Congress passed a law that would allow irrigation districts to secure Federal financing at very favorable terms for development of small irrigation projects. There were irrigation districts that wanted to build small projects and didn't want the Bureau to do it because the Bureau was primarily constructing large jobs, which meant the Bureau had higher overhead and that sort of thing, and they thought they could to it more efficiently themselves. So some of these irrigation districts got this Small Reclamation Projects Act passed, and it provided for government funding, but it also stipulated that projects had to be approved by the Secretary of the Interior for the economics and for the engineering and so forth. And of course the Secretary of the Interior turned that over to the Bureau of Reclamation. There was a fellow by the name of Rex Reed who was appointed as a loan engineer out at the Federal Center, the Bureau, and his full-time job was handling these applications and processing these applications for Small Reclamation Projects. Whenever an earth dam was involved, which was quite often, I was assigned to handle that part for him, and I not only made a lot of reviews of plans and specifications, but I went out into the field on several occasions, met with the private engineers who were designing the dams and reviewed the plans and specifications *with them* in order to get the dams up to what we considered were suitable standards for design and construction. So there were a couple of other minor jobs that I had then.

Storey: Did you ever run into any problems with those small projects?

Arthur: No, we were in the position of being the banker. When the bankers says, "Well, now look, you got to do this in order to get the loan . . . ." Those problems were easily resolved.

Storey: Uh-huh, but did you have situations where they'd overlooked something that would appear obvious to Reclamation?

Arthur: Yes. I remember situations where the details of the structures would not be what we considered to be satisfactory standards, and we would ask them to be modified. I would discuss this with the other engineers and we usually got these revisions made without any problems. And likewise, the same with specifications: If we thought that specifications weren't stringent enough, or were too stringent or whatever, well, we would suggest they be modified. Most of this activity was before *Design of Small Dams* was published, so that the guidelines that were later used by private engineers to design small dams were not available. But the knowledge was in the Bureau, of course, and that's what I was bringing to the discussions.

Storey: Do you remember any of those situations in particular?

Virginia Ranch Dam, California

Arthur: Well, I remember one dam in particular was Virginia Ranch Dam in California, and it was designed by Woodward-Clyde. Woodward-Clyde at that time was just a fledgling organization. They've since become a very prominent engineering organization, as you probably know. (**Storey:** Yeah.) At that time they were just starting. I remember that it had something to do with the arrangement of the gates of the outlet works or something, but I don't remember the exact details.

Safety of Dams Reviews

Storey: What about the Safety of Dam Reviews? Did you find any dams that needed modifications, or that were considered a problem?

Need to Exercise Equipment in Dams

Arthur: Only in details where we would find that emergency gates had not been exercised and were inoperable. If an emergency came up, the gates wouldn't have worked, and that sort of thing. So we got out there and exercised all the equipment to be sure it would work and so forth. A lot of these dams in remote areas required electrical power to operate the machinery, the gates and so forth. And there would

be just a low service transmission line coming into the project. The original designers had been concerned about the reliability of that power source in case of a storm that might cause a flood or something like that. So a lot of these projects were equipped with gas-electric generator sets–Model "T" Ford engine hooked onto a generator, and you'd crank the engine, crank up the Ford and start it and spin the generator, and get your electricity that way. And some of those hadn't been operated for a long time. So we made sure that everything was brought up to date and so forth. And then in lots of cases we monitored the seepage to see if that was operating okay.

No, I don't think we discovered any dams that were unsafe, but we uncovered a lot of procedures that were not being followed, where the monitoring was not what it should have been, and conceivably problems could have developed later without these procedures being modified.

Storey: Now when you say "we" did it, does that mean you actually went to the dams and watched them operate the equipment? Or how did that work?

Arthur: No I mean we went to the dams and *we* operated the equipment. Yeah, we would swing out on a trip, it would be about a two-week trip, and we would go to a certain region of the country, and we would maybe look at ten or twelve, fifteen dams, and spend probably a day or most of a day, or sometimes more than a day, at each project, going over, examining the dam facilities. And then of course we wrote a report and would give that to the water users *and* the region. And the region would monitor to see that our recommendations were carried out.

Storey: Tell me about Gil Stamm in those days up in Boise.

Impressions of Gil Stamm

Arthur: Well, I was impressed with what a nice guy he was. We were always accompanied by regional personnel to these jobs wherever we were. As I say, he was the Operation and Maintenance, in charge of that division, and worked for Region 1 out of Boise. And we were up on the Yakima Project, in Oregon and Washington, some dams in Idaho, and he was accompanying the two of us out of Denver on that trip. I was impressed, as I say, with his manner and his relationships with the water users. Obviously, he was well acquainted with all the heads of the irrigation districts who would accompany us on these inspections. He was well acquainted with them, on good terms with them, and that's about all I can say. I didn't really get to know him *real* well.

But I found out later that he was impressed with us. On this particular trip, the mechanical engineer was a guy by the name of Walt Fowler, and he was particularly impressed with Fowler's hands-on approach to this mechanical equipment. I think Stamm had had acquaintance with a lot of mechanical engineers that had good academic training, but didn't really know the nuts and bolts of how do you make a motor operate, or how do you make a gate operate? And this Fowler was very good at that, so he was very impressed with Fowler. Also, I heard later that he was pleased with the way *we* reacted and interacted with the officials from the irrigation district. We were not the "high and mighty know-it-alls" from Denver, but we met them on common ground and discussed the problems that way and got along real well.

Storey: What kind of problems did you normally run into, besides the fact that the equipment hadn't been exercised.

Issues Identified During Safety of Dams Reviews

Arthur: Well, there would be trees growing on the back of the dams, and there would be guardrails that had gone into disrepair where roadways crossed the dams. There would be concrete that was beginning to spall off and disintegrate and needed to be replaced or repaired and that sort of thing. There would be drains that appeared to be plugged and had to be opened up, and that sort of thing.

Storey: Do you remember what time period you were involved in the Safety of Dams Project?

Arthur: Well, this was over a period of years, like maybe, I would say the early-50s to mid-50s.

Storey: And then what about the Small Reclamation Act things?

Arthur: It was over a period of several years too.

Storey: In the 50s again?

Arthur: Yes. It might have started in the late-40s, I'm not sure.

Impressions of Grant Bloodgood

Storey: You mentioned last time, Grant Bloodgood. What can you tell me about Grant Bloodgood?

Bloodgood's Nickname Was "Beno"

Arthur: Well, Grant was known as "Beno."

Storey: B-E-A-N-O?

Arthur: B-E-N-O, "There will *be no* coffee breaks." (laughter)

Storey: "Be no coffee breaks," huh?

Arthur: That's where we got that name Beno. Quite a few engineers developed a habit of going to the cafeteria midmorning and mid-afternoon for a coffee break, and he issued an edict that we were not supposed to do that. So he said, "There will be no coffee breaks." (chuckles) So we called him Beno.

Grant appeared to be pretty autocratic in his method of administering the work–pretty brusque. From some of those who knew him real well and worked with him out in the field, years ago, I understood he really had a heart of gold, but it was a little hard to find in those days if you didn't know him real well. He was kind of a formidable type of guy. (chuckles)

Storey: Where was the chief engineer's office?

"Mahogany Row" in Building 52

Arthur: Well, it was in Building 52. There was wing on that building where Remington Arms people had their offices when that was a factory building, and that was known as "Mahogany Row," though the partitions were all steel partitions with painted wood grain on them and so forth. But that was called "Mahogany Row." And that's where the chief engineer and the chief designing engineer and their immediate assistants were headquartered. And that was the extreme north end of Building 52.

Storey: Did you go there often?

Arthur: I went there very often when I was working on the Falcon Dam. I was being summoned up there. I made a lot of trips up there when I was working on ***Design of Small Dams*** too. So I went up there a lot more than most people in the rank and file of the organization.

Storey: How would you describe, I guess your feelings, about being called to Mahogany Row at that time?

Arthur: (pause) I'm not sure just what you mean.

Storey: Well, there are some people who have said the only reason you were ever called to Mahogany Row was to be chewed out.

Arthur: (chuckles) Well, that wasn't so in my case. I was working, as I explained before, on a very special assignment, like on Falcon Dam, where the chief engineer said, "When are the staff going to learn no letter goes out of here without your surname on it?!," that sort of thing. And I was called in on all of the important meetings with the chief designing engineer, where design decisions were being made, where recommendations were being made, and the decisions followed and so forth. Although I didn't participate in the decisions, I was present so I would be fully informed as to what was going on and so forth. So no, I didn't have any feelings of trepidation or anything like that.

Storey: But it wasn't an area you'd just walk through casually or anything?

Arthur: No, there wouldn't be any point to that.

Grant Bloodgood

Storey: Do you remember any more about Bloodgood?

Arthur: He came to see me once in the Denver office, long after he retired. I was then the deputy director of design and construction when he stopped over to see me and visited with me. We had our picture taken together. He was retired out in California, raising avocados, as I remember.

Storey: Do you know if he's still alive?

Arthur: No, he's not alive. My wife and I were invited to a party at his house one time, but I don't remember what the occasion was.

Barney Bellport

Storey: What about Barney Bellport as a chief engineer?

Arthur: Well, I knew Barney very well, of course. I was his Deputy. Barney was of the old school. He was kind of a rough character. When I think back on the chief engineers, they were all characters. (chuckles) Maybe that's what it took to be the chief engineer, except L. N. McClellan–I mean, of those I knew, L. N. McClellan was a real gentleman. All the rest of these chief engineers that I knew were of a construction engineer's background and a little more rough-and-ready type thing.

Walker Young

Storey: Now, did you know Walker Young? He was just there '44 to '48.

Arthur: Yes, very well.

Storey: What was he like?

Arthur: Walker Young was the chief engineer when I was appointed the Coordinator on Falcon Dam. But shortly after the design of the Falcon Dam started, Walker Young retired, and he became the President of Thompson Pipe and Steel here in Denver. He also became a consultant to the United States Section of the International Boundary Water Commission on the Falcon Dam. So he attended all the meetings that I attended–probably meetings besides that–but I mean he was always there when I was there, and we traveled back and forth from Denver down to El Paso and back. He was a nice guy when you got to know him on a one-to-one basis. He seemed to be sort of a formidable character when he was chief engineer, as far as I was concerned in the ranks. They were all pretty autocratic. He'd been construction engineer on Hoover Dam, and these guys were used to being in control. They were very much that way.

Storey: He ever tell you any stories about working on Hoover that you remember?

Arthur: No. I remember one incident with him. When we were at a meeting down at El Paso, working on Falcon Dam. I remember a couple of things. We used to take a coffee break from the Boundary Commission, and we'd leave their office, which was in downtown El Paso, and go about a half-a-block to a coffee shop and so on and so forth, and he had been one of these guys before Bloodgood who was against coffee breaks and so on and so forth, but here we were trapezing [sic.] out to these coffee breaks. And of course I was kind of a brash young fellow at that time, so I kind of chided him about it. "You know," I says, " we didn't do this in the Bureau of Reclamation," you know, where he'd been chief engineer.

"Well, yeah, this is a lot different. The Bureau's a big organization and you don't know what the people are doing and how long they'll goof off. We're just a small group and we go together and come back together." (chuckles)

Another time, we had the meeting with the United States Section and the Mexican Section, and we finished up our business late one day. And so the next day I padded down to the office there, and he said, "When are you going back to Denver?"

And I says, "Well, I've got a reservation, I think it leaves at eleven, eleven-thirty, something like that."

He says, "It'll take all day, by the time you get home it'll be quitting time, the office'll be closed."

I said, "Yeah, that's right." The DC-3 took a long time to get to Denver, with a couple of intermediate stops and stuff.

I said, "Well, that's true."

He said, "Well, can't you find something to do here?"

I said, "Well, I could. I got to write a report, I could start writing my report here."

He says, "Well, why don't you do that and give the government a full day. (Storey laughs) And go back with me on the plane tonight at seven o'clock."

Storey: Oh, get in after midnight or something?

Arthur: So I said, "Yes, Sir." Maybe it was six o'clock, I don't know. But anyway, we went out to the airport in El Paso. We got out there, there was equipment problems. The flight was canceled, or delayed, I should say. They had to bring in another plane, we had to wait for another plane. And finally another plane showed up. Now this was a DC-3 that had been used, I think, for carrying troops, and it had tin seats, as I remember. I don't think they were upholstered seats. It wasn't *really* a passenger plane. And the heater didn't work very good, and this was in the wintertime. And we finally got into Denver about three-thirty or four o'clock in the morning. As we got off that plane, I said, "Well, Mr. Young, we gave the government a full day!" (laughter)

Storey: Yeah, it sure sounds like it!

Arthur: It's a wonder I didn't get into trouble with my sense of humor!

Speech at Western Canada Reclamation Association While Assistant Regional Director in Billings

Well, then I thought of a couple of interesting things that I did in Billings, I hadn't mentioned. (**Storey:** Good!) You asked me about what my functions were there, and I told you one thing I did was act as the P.R. man, or the press relations man anyway, and so forth. In my memorabilia, I came across this paper here which is a publication by the Western Canada Reclamation Association. They had me as a keynote speaker up in Canada. That was when I was assistant regional director. I gave them a rundown of the history of the Bureau of Reclamation, its formation, its mission, how it operated, and so on and so forth.

Storey: "A Convention Extra of the Western Canada Reclamation," which is a publication in November of 1962.

Arthur: Here's a note my boss wrote. That's what he thought of my effort.

Storey: "Regarding the paper presented June 22, 1962, at Lethbridge, Alberta. An altogether magnificent compilation. After reviews are complete, we should mimeo and distribute to our employees." And who was B.J.?

Arthur: Bruce Johnson, regional director, my boss.

Storey: Good! That's neat. It's always nice to find those kinds of things in your files, isn't it?

Makes Arrangements for Dedication Ceremony for Oahe Dam and Reservoir by President John F. Kennedy

Arthur: And another thing I did, I told you I was a luncheon speaker and dinner speaker at the service clubs and so on and so forth. Well, I also was sent on special missions to meet with water user organizations for certain purposes. And one such meeting was with Oahe, O-A-H-E, Irrigation District (**Storey:** Let me just shut the door.) to make arrangements for President Kennedy to speak at Oahe Dam in South Dakota. Now we required a speakers' stand to be constructed, and arrangements to be made to take care of the President's visit. And of course Reclamation didn't have funds for this sort of thing. We didn't have any money to go out and build

review stands, spectator stands and so on and so forth–but the irrigation districts did. So I was sent as an envoy over there to the irrigation district to get their cooperation in getting this done. So that was very interesting. As a result, I got invited to hear President Kennedy speak. Here's a picture I took.

Storey: A slide.

Arthur: Look at the light.

Storey: You were near President Kennedy then, when his car came up.

Arthur: That's with his bodyguard on either side.

END OF SIDE 1, TAPE 1. FEBRUARY 1, 1995.
BEGINNING OF SIDE 2, TAPE 1. FEBRUARY 1, 1995.

Arthur: I didn't remember until I got this slide out yesterday, that my boss, Bruce Johnson, is in that picture. He's the guy in the center of the picture up on the stand in the light grey suit with the white hair. That's Bruce Johnson. And this was taken on August 17, 1962.

Storey: Did you actually get to meet Kennedy?

Arthur: Yes, got to shake his hand.

Storey: He was moving down the line, I suppose, so you didn't get to talk to him or anything.

Arthur: Oh, no.

Storey: Kennedy went from Pierre, South Dakota, which is where Oahe Dam is. Oahe Dam was built by the Corps of Engineers, by the way. And here the Bureau of Reclamation (chuckles) is sponsoring this ceremony. Kennedy was making a swing around the West to build up more support, because he wasn't as well known in the West as he wanted to be. And after leaving Pierre, he spoke at Pueblo down here. And then he went out to California and dedicated Whiskeytown Dam.

Storey: Which is another Reclamation Dam.

Arthur: Yes. So that's just a little more insight into what I did when I was assistant regional director.

Storey: Did you have any trouble getting the irrigation districts to cough up the money for the review stand and stuff?

Arthur: No, not at all.

Storey: Do you remember how much it cost, by chance?

Arthur: No, I don't. I don't think I ever knew.

Storey: Did they just go build it?

Arthur: As far as I know, yeah.

Barney Bellport

Storey: Of course you came back to Denver in '63 as assistant chief design engineer. That was the same year Barney Bellport became chief engineer. (**Arthur:** Uh-huh.) Do you remember any more about Bellport? You would have worked with him fairly closely, I would imagine.

Arthur: Yes. Bellport is the one that, of course, offered me the job as assistant chief designing engineer. But I was sure that Dominy was behind it, because as I told you previously, Dominy was trying to show his appreciation for what happened with my relationship with Holum, and had offered me the job, or I had been offered the job as chief of the laboratories–been vetoed by Holum. So then this position came along, and Bellport offered it to me, but Bellport didn't know me, so I know (chuckles) where the initiative was for this job. But as I already told you, my deal with Bellport was that I wouldn't report right away, because my sons were in school up there in Montana. (**Storey:** Yeah.) And then I came down and went to work as assistant chief designing engineer under Oscar Rice. I had worked for Oscar Rice when he was head of the Earth Dams Section, so we knew each other from way back.

Development of a Double Curvature Arch Dam for the Curecanti Project

But during the early 60s, probably about 1960, the Bureau of Reclamation was designing the Curecanti Project over on the Gunnison River, and one of the dam sites was suitable for an arch dam. The Bureau decided that it was a good site for a double-curvature arch dam. You know what a double-curvature arch dam is?

Storey: Please tell me.

Arthur: Well, it's a dam that in plan is an arch.

Storey: Arched upstream?

Arthur: Arched upstream. In elevation, it is also a curved dam that curves toward the upstream, and then lays back as you get up towards the top, kind of like the edge or profile of an egg, and it swells out at the bottom and then tips back. The dam design makes the optimum use of concrete in that all of the concrete in the dam is in compression, in which concrete is very strong, and not in tension, [in] which concrete is weak. And since all the concrete is in compression, where it's strength can be mobilized, it uses a minimum amount of concrete. So it's called a thin double-curved arch dam–curves in plan, curves in elevation.

Publication of *Modern European Practice in the Design of Double-curvature Arched Dams*

The Bureau had never designed one of these dams, and they decided this would probably be a good place to learn how to do it. But it'd been a type of design that had been developed in Europe and used for some years, so the Bureau decided the best way to embark on this project was to find out as much as they could about how the Europeans did it. So they put together a team, Merlin Copen, C-O-P-E-N, was a concrete dam designer, and George Wallace was a concrete technologist in the laboratory, and George Rouse, R-O-U-S-E, was a specialist in instrumentation, which would be different instruments to measure the performance of dams and so forth–put together this team and decided they should go to Europe and visit the sites of these various dams, talk to the engineers, and see what information they could get that would be helpful to the Bureau. So they contacted a number of European countries, including France, and Italy, and Switzerland, and Spain, about an official visit, come over and find out how this was to be done. And they were welcomed by all the countries, as I understand it, except Spain. And what I understood was that Spain had had a dam failure the previous year, and they were not welcoming any foreign engineers coming in prowling around Spain. So these guys visited France and Switzerland and Italy, and they wrote a book. The book was called *Modern European Practice in the Design Of Double-Curvature Arched Dams*,[4] or something like that. The book was published and made available to the engineering community, and was well received. It was a nice study, a nice

4. See Merlin D. Copen, *Study of Concrete Dams in the Europe* 1962 (Denver: Bureau of Reclamation, February 1962), 318 pp. See also Merlin D. Copen, G. C. Rouse, and G. B. Wallace, *European Practices in Design and Construction of Concrete Dams* (Denver: Bureau of Reclamation, March 1963), Vol. 1–239pp.; Vol. 2–157pp., Vol. 3–66pp.

compilation of how you design it, how you mix the concrete for it, how you instrument the dam to ensure its performance and monitor it and so on and so forth. But it became, should I say, a "best seller" of its kind.

Trip to Spain with Floyd Dominy

The Spaniards had their feelings hurt about this, because here the modern European practice didn't include anything in Spain, because our engineers (**Storey:** Were not invited.) were not invited. So the fellow who was the head of the Spanish National Committee of the International Committee on Large Dams was a private engineer by the name of Toran, T-O-R-A-N, who must have been very well connected in the Spanish government, and through the ICOLD Congress meeting, evidently had gotten acquainted with Dominy. So out of this came an invitation for Dominy to visit Spain and review water resources developments in Spain. This was 1964. Dominy called up Bellport and said he was going to go to Spain, he was going to review all their dams and their projects and so on and so forth. He had to take somebody along, an engineer who could talk with the Spanish engineers, and also somebody who could write the report, and he wanted Harold Arthur, because he knew I'd done *Design of Small Dams*, so he figured I could write. (chuckles)

So Bellport called me over and said, "Dominy wants you to go to Spain with him."

"Hey, great!" (laughter) I'd gotten well acquainted with Mexico and the Mexican engineers during Falcon Dam, and I felt an affinity toward the Spanish people. I thought, "Gee, that's great, if there's anyplace in the world I wanted to go, it's Spain. Great!"

So I thought I'd go down to the library and see what information I could get on Spanish dams, which I did, and I learned that most of the dams in Spain were concrete. Of course that's what the Spanish were touting anyway, was their ability to design and build double-curvature arch dams. So my literature search showed that that in fact was what they had. So I went into Bellport and I said,

"Hey, I want to take this trip, and I don't want to cut myself out on it, but you know, these are concrete dams that they're going to be talking about. I'm not a concrete dam designer, I'm an earth dam designer and I can talk with the foreign engineers on their earth dams, and they do have a few in Spain, which we may or may not visit, but I can't talk with them in detail on the concrete dams. We need somebody else on the team."

Well, he called out, "See if you can get Floyd on the phone." So the secretary called and got Dominy on the phone. Bellport explained to him that Harold Arthur thought they ought to have a concrete dam man also–not in lieu of, but also.

And Dominy says, "Okay! Okay, pick out somebody and send me his name and something about him."

So Bellport says, "Well, pick out somebody to go with you, somebody in the Concrete Dams Section."

So I thought of the engineers in the Concrete Dam Section and I knew them, but I had never worked with them–I wasn't a concrete dam man. I knew them as "those guys who worked across the hall," you know. I knew Merlin Copen was considered one of their top men. He'd been on this European trip. And another fellow by the name of Max Ford had been in Australia working on the Snowy Mountain Project. The Australian engineers had come to the Bureau for training in the system. And I knew another guy that was in there by the name of Dutch Lewis. I thought, "Well, old Dutch has never been anyplace. This is a plum, this trip to Spain, a real plum." So I called Dutch up to my office–asked him to come up. I explained the situation to him and I said, "You know, this is not all fun and games, there's going to be a lot of work involved in this thing. You'll be responsible for most of the report. I'll help you, and we'll collaborate on it, but we're going to have to write a good report, and you're going to have to do most of it, because I'm too damned busy as assistant chief design engineer. But aside from that, would you like to go?"

I can still see Dutch, he said, "Well, Harold, I've always done what the Bureau wanted me to do. If the Bureau wants me to go to Spain, I'll go to Spain."

And I said, "Dutch, don't give me that crap. I'm asking if *you* want to go. If you don't want to go, I know a dozen guys that would *die* to go to Spain."

"Oh!" he said, "I'll go! I'll go!" (laughter)

I said, "Well, you want to check with your wife and see if it's convenient? It's going to be about two weeks that we'll be gone." "Oh, no! I'll go! I'll go!" (laughter)

Visits National Engineering Laboratories in Lisbon Where the Morrow Point Dam Is Subject of a Model Study

So we went to Spain. Dominy met us in Madrid. I don't know whether Dominy had been somewhere else in Europe, but anyway, he ended up in Madrid and we met him there. On the way there, we visited the National Engineering Laboratories in Lisbon, Portugal, where they were making a model study of the Morrow Point Dam, it was then a new design by the Bureau of Reclamation. This laboratory in Portugal had an international reputation for designing dams by models. The Bureau's design procedures were all analytical, but their procedures were to build a plaster model of the dam, and instrument it and stuff, and then load it and determine what the stresses were and all that sort of thing. So the Bureau thought the way to do it with this important dam, and our first one, is to have a model study, *plus* the analytical study. And I think Dominy was well acquainted with the head of that laboratory, his name was Rocha, R-O-C-H-A. So they were going to do this study for us, so this was an opportunity for us to see first-hand the laboratories facilities, we stopped over and saw it. Then we met Dominy in Madrid.

Storey: So they did the model study of Morrow Point. (**Arthur:** Uh-huh.) And Morrow Point was the thin double-curvature arch dam that we were designing.

Arthur: Curecanti unit, right. And the Bureau did the analytical study. The Bureau also made a structural model

Treated like Royalty on the Trip to Spain

We started out on a tour of Spain, and it was really something. We traveled by DC-3, private plane, and in some cases a little twin-engine plane, a little six-passenger plane, and by private car. We were all over Spain and visited a whole–number of dams and some very imposing projects, very important projects. The thing that impressed me the most was the way we were treated, which was like royalty. Never treated like that in my life before or since, or ever expect to be! (chuckles)

These dams were under different what they call confederations, and I think they were quasi-government corporations, something like TVA [Tennessee Valley Authority], but there were a number of them in different parts of Spain. And we were hosted at each of these stops by these organizations. They'd usually have a dinner for us and lunch, and we were treated extremely well. I think the news got out how we were treated by Company "A," and Company "B" said, "Hell, we can do better than that!" (laughter) Each one was trying to outdo the others. Just to give you an idea, I remember once I think it was at Balazar Dam, beautiful dam,

they had a beautiful guest house up on the hill quite a ways above the dam, overlooking the dam and the powerhouse and the lake and so on and so forth. And a *nice* veranda, and it was lunchtime when we were there. It was the first time I'd ever been served shrimp as they came from the sea, with their eyes looking at you, all the shells and stuff like that. I didn't know shrimp looked like that. The table was loaded with shrimp and all kinds of hors d'oeuvres and finger food and so on and so forth, and there was lots of libation, anything you wanted, and wines and liquor and so forth. We had a real nice time there visiting with our hosts and so forth–had all this shrimp and the drinks and all these goodies. After about an hour of that, they opened up a bunch of sliding doors, here was our luncheon inside! And like all the Spanish luncheons, you sat down at your plate, and here's a row of glasses. You had the champagne glass, you had the white wine glass, you have the red wine glass, you have the brandy glass. You have all of those, *all* the silverware. This is just a little lunch, you understand. And then they pass around a box of Cuban cigars, of course not obtainable in the United States, because they came from Cuba, but they were available in Spain. I tell you!

A number of times we stayed in–I forget the Spanish name for them, but they were hotels remodeled out of old castles, and refurbished and modernized and stuff like that, but they were still–the walls were three feet thick and made out of hand-cut stone and that sort of thing, you know. That's where we spent our stay overnight and stuff like that. It was really something!

I remember Dominy really enjoyed this too. Of course he was the leader. His son had graduated from West Point a year or two before that, and he was a military attaché someplace–I don't know whether it was Germany or France or someplace–but anyway, Dominy got *him* to join the party, so there were four of us: Dominy, his son, Dutch Lewis, and myself, plus the Spanish contingent that went around.

Cigars for Floyd Dominy

I remember Dominy says to me, "Well, Harold, I notice when they pass around those cigars you don't take any cigars."

I said, "No, commissioner, I don't. I quit smoking about four or five years ago. I don't smoke."

He said (emphatically), "Well god damn it, *I* do!"

I said, "Yes, Sir!" (laughter) So after that, when they passed the cigars, I always took my cigar.(laughter)

Dominy Commits to Publish the Report on the Trip to Spain as a Senate Document

Dominy did all the talking, gave all the speeches, and we were interviewed by the press wherever we went and so forth. Dutch and I were strictly in the background, except for technical discussions and so forth. I mention this because of something I'm going to tell you later, so you understand that I never get to talk to anybody, so that's alright. So Dominy is a very–well, you've met Dominy–he's a very outgoing personality, and can be very charming. The Spaniards really delighted in him. He got carried away by the moment several times. One time he said, "Well, you know, my idea was to come over here and review the Spanish accomplishments in the development of water resources and your dams and so forth. It was my intention to write a report, Commissioner of Reclamation's Report on the Spanish accomplishments. I had no idea the extent and the quality of your accomplishments. I don't think a report by the Commissioner of Reclamation would give the Spanish accomplishments the recognition they deserve. It's my intention to have the report issued as a document of the United States Senate." (chuckles)

Storey: Yes?!

Arthur: Can you believe that?!

Storey: Well, that's interesting, certainly.

Arthur: Well, he wasn't just talking. He wasn't just woofing, because the report was issued as a United States Senate document. (tape turned off and on) Well, I only saw Dominy really flustered once, and that was on this interconnections on our journey around Spain, one of his suitcases got misplaced. And of course the Spaniards were handling our luggage and so on and so forth. This really, really annoyed Floyd that he was missing his suitcase. And of course he couldn't say anything to the hosts about it, so he took it out on me, and he really, really gave me hell for not seeing that his suitcase got loaded on the plane. He noted that I had *my* suitcase and Dutch had *his* suitcase, how come Dominy didn't have *his* suitcase?! He didn't have time to look out after his luggage, et cetera, et cetera, et cetera. So he really chewed me out on that.

As I say, Dominy got the report published as a Senate document. The Spaniards were really impressed with the idea that this would be a Senate

document, to the extent that they sent an engineer over from Spain and spent two weeks in my office in Denver, and his function, as I could best determine, was to be sure that we got all the names and titles of the Spanish people correct. So he did review our report as well, but most of the technical parts of our report were just taken verbatim from Spanish reports to begin with. So there wasn't too much editing that he had to do in that respect. But the report was duly published, and you know Senate documents are not very imposing dealies. It went back to Spain and was promptly translated into Spanish! So most of the text of the report was Spanish reports that had been put into English, put into our report, sent back to Spain, put back into Spanish (chuckles) and so on and so forth. But then they thought it would be nice to have some of the reports dolled-up a little bit, so they put them in a hard cover. This is my copy of *Water Resources Development in Spain*, by Floyd E. Dominy, Commissioner, Bureau of Reclamation, U.S. Department of the Interior, that Dutch and I wrote. And what it says in here, "Senate Resolution 119. In the Senate of the United States, agreed to July 7, 1965, resolved, that there shall be printed with illustrations as a Senate Document, a report entitled, quote, 'Water Resources Development in Spain,' close quote, prepared by Floyd E. Dominy, Commissioner, Bureau of Reclamation, U.S. Department of the Interior. Section Two: That there shall be printed 1,000 additional copies of such document for use in the Senate Committee on Interior and Insular Affairs." Attest. (chuckles) And this is an autographed copy, and it says, "August 23, 1965, for Harold Arthur, a great Reclamationist and a fair luggage man as well. Sincerely, Floyd E. Dominy." (laughter)

Storey: That's nice.

END SIDE 2, TAPE 1. FEBRUARY 1, 1995.
BEGINNING SIDE 1, TAPE 2. FEBRUARY 1, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on February 1, 1995.

From the map in this report, you did a complete circuit (**Arthur:** Yes, we did.) of the country. And you were saying they gave you a little souvenir, a cigarette case?

Arthur: Yes, I have a silver cigarette case, inside of which is engraved a map showing our route through Spain, the places we visited. Also, I have a knife , a Toledo, Spain, engraved knife.

Storey: Oh yeah. Isn't that elegant, and fancy.

Arthur: Yes, it is.

Storey: Sort of a switchblade, is it?

Arthur: Yes.

Storey: I'll have to let you work the catch.

How did you get to Lisbon and then to Madrid?

Arthur: That was about a year or two before they started flying jets across the Atlantic, so we went by DC-6, flying out of, I believe, New York, Kennedy.

Storey: To Lisbon?

Arthur: Uh-huh. Then we came back after the trip was concluded in Spain, Dutch and I took some leave and we came back, we visited Paris for a couple of days and London for a couple of days, the World's Fair in New York City for a couple of days, and then ended up in Washington for a couple of days, talking to Dominy, and came back to Denver.

Storey: Did you get to do any sightseeing while you were in Spain?

Arthur: Yes, we got to see a lot of the country and some of the sights. As I mentioned, we stayed overnight in a lot of these restored castles and so forth. We flew down the *Costa del Sol*, of the Mediterranean Coast, in a helicopter. They wanted us to see the Alhambra, and the only time available was after dark. We saw the Alhambra by flashlight. I don't think we could really appreciate its magnificence by what we could see, illuminated by flashlight.

Storey: But they got you in after hours, then, I guess.

Arthur: Yes. Mr. Toran was very well acquainted, very well connected. He later became International President of the International Congress Committee on Large Dams. But he was a very flamboyant Spaniard.

Storey: Well, another question I'd like to ask you, since you were in such close proximity to Dominy for two weeks, he has quite a reputation as a womanizer, and of course Marc Reisner in *Cadillac Desert: [The American West and Its Disappearing Water]* has written about this. Was there anything that you saw while you were in Spain that you're willing to talk about?

Arthur: No, there were times in the evening when Dominy and the hosts went off by themselves without Dutch and me, that's all I know. I can only speculate on what happened. (both chuckle)

Preparing the Report on the Trip to Spain

Storey: How long did it take you to do the report then?

Arthur: Let's see, it didn't take too long. See, at each of these dams where we visited, they had brochures, which would show sections of the dam drawings and description of the dam and so on and so forth, so we could incorporate that. I don't remember who translated it, but we could incorporate that into our report, more or less verbatim. We had to fill in, of course, with the itinerary, and the people who accompanied us, the meetings, and we had to make editorial comments on what we thought about the project, and our observations and stuff, but the technical data were all available. It takes a long time for a DC-6 to fly from London to New York, so by the time that Dutch and I arrived in New York, we had an outline of what we were going to do. We had made up our mind on the format and how we were going to approach. We got a lot of work done on the report, and it just became a matter of getting it done.

So we went over there in September of 1964, and the report was published in . . . . The Spanish engineer visited us just before Christmas, the report was done then, as far as we were concerned. He came over and reviewed it, and I remember that because I took him to the American Society of Civil Engineers Christmas dinner-dance as my guest. So it was just before Christmas, we were done with it. Of course it wasn't published until July 1965.

Storey: Okay, so how did Dominy arrange this, or do you know?

Arthur: No, I don't know, but I imagine he had to cash a lot of his chips to get it done. But Dominy, of course, was very close to Senator Hayden.

Storey: Carl Hayden of Arizona?

Arthur: Yeah. Hayden was Chairman of the Interior Committee or something, had a lot of influence. I imagine it took a lot of doing to get this done, and I understand that someplace it was said that this should not establish a precedent. In other words, don't do it anymore. We'll do it once, you promise that we're not going to do it anymore. It was quite an accomplishment.

Storey: Yeah. So this was while you were the assistant chief designing engineer.

Arthur: Right.

Responsibilities as Assistant Chief Designing Engineer

Storey: What were your responsibilities as assistant chief designing engineer?–the routine responsibilities.

Arthur: Well, I reviewed the work being done by the civil and architectural branches of the Bureau, which would be the dams and canals, powerplants, pumping plants, visitors centers–everything except the mechanical and electrical. The chief designing engineer had two assistants, one was the assistant on the civil side, and one was on the electrical/mechanical side.

Storey: Who was that, the other assistant?

Arthur: Max Kight.

Storey: Oh really?! What was Max Kight like?

Arthur: He was a very . . . . He's sort of a quiet guy, and mild mannered. Very good technically.

Storey: How did that office work, with the chief designing engineer and these two assistants? As I recall, you were seeing the whole picture instead of the little pieces of it the way you would have in the Earth Dams Section.

Arthur: Yeah. Well, the drawings and designs and specifications and correspondence that originated in the civil engineering divisions would come through me on its way to the chief designing engineer, and then to the chief engineer if necessary. And I would assist in the scheduling of the work and monitoring of the work and reviewing the work, and bringing to the chief designing engineer those matters that needed his attention and that sort of thing.

How Design Work Was Reviewed in the Office of the Chief Designing Engineer

Storey: When you say you reviewed the civil engineering work, does that mean detailed review, does that mean you were doing sort of a *pro forma* review after the sections and divisions were done, or how did that work?

". . . review in the chief designing engineer's office was primarily policy . . ."

Arthur: Yeah, the detail design was carried out in the sections and in the divisions. The review in the chief designing engineer's office was primarily policy and that sort of thing. In other words, if . . . . The selection of the type of dam could not be made below the level of the chief designing engineer. He was the one that would decide if it was an earth dam or concrete dam. Of course he'd have the input from the various branches, but they were competitors in some cases. He was the one that would make the decision.

Storey: And so you would see that as a sort of a policy decision about (**Arthur:** Yeah, uh-huh.) the design process. And so you would be providing input on those kinds of decisions?

Arthur: . . . the chief design engineer's office would review, the manuals and instructions, and . . ., that sort of thing, that set forth procedures. But the detailed work was done in the sections and branches.

Storey: Did you then have to sign off on the detail work?

Arthur: Some of it, though we would sign off on the drawings, we would sign all the standard drawings that were repetitively used in specification after specification, on how to make a joint or a particular structural member or something like that. But most of the construction drawings, they would not come through the chief design engineer's office. You see, when you design a dam like Falcon Dam, for example, the specifications probably contain something on the order of 150 drawings. The purpose of those drawings was to show the scope of work and generally give the contractor a conception of what he had to do so that he could evaluate the cost of doing it and enter his bid prices. But those drawings were not detailed enough for construction, and they were probably followed, in the case of a project like that, by probably a couple thousand detail drawings, during the period of construction. And those would not come through the chief design engineer's office, because those were the details of accomplishing what the general plan and section called for.

Storey: But those would go to the contractor eventually.

Arthur: Yes, they'd go to the contractor.

Storey: Would they go through the chief engineer's office?

Arthur: Well, the whole office was the chief engineer's office. They'd go through the Contract Construction Division, and there was a Drawing Transmittal Section and so forth. It didn't go up to the upper ranks.

Storey: To be signed off on or anything like that.

Arthur: Right. They were signed off at the branch level.

Storey: Okay. Now how long were you the assistant there?

Arthur: Two years. Then I became the chief designing engineer upon the retirement of Oscar Rice. And let's see, that was in May of 1965.

Storey: What grade levels are we talking about here? For the assistant and the chief, do you remember?

Trip to South Africa, Angola, and Mozambique

Arthur: Assistant fifteen, and the chief sixteen. While I'm chief designing engineer comes the next foreign excursion with Dominy. The *Water Resources Development in Spain* got pretty wide circulation and gave the Spanish some bragging rights, "Hey, look what great work we do." This is what I think (chuckles) they were saying. And it came to the attention of the Portuguese. At this time the Portuguese were being criticized by some for exploiting the African colonies of Angola and Mozambique, which had been Portuguese possessions for many years. So somebody, a Portuguese engineer–I'm trying to think of his name– came up with the idea that if the Portuguese could get some publicity showing how they were not exploiting the African colonies, they were *developing* the African colonies, that maybe the world sentiment would change, and be looked at differently. So lo and behold, "Why don't we get the Commissioner of Reclamation to visit Angola and Mozambique and report on the developmental work, agricultural work, dams and canals, being built by the Portuguese for the benefit of the African population?"

So Dominy was invited to do this, make this trip. So he called up Barney Bellport and explained his mission in going to Africa, and he said "I want Harold Arthur to go with me and write the report. (laughter) This was 1967. Dominy was attending an International Congress on Large Dams meeting in Istanbul, Turkey, and his trip to Africa was tied-into being over there in Turkey. So I met him in Johannesburg, South Africa. I should explain that when the news got out that the Bureau of Reclamation commissioner was going to visit Africa and see what great

work the Portuguese were doing, the South Africans said, "Me too!" they wanted to get in on it.

So they invited the commissioner to stop over in South Africa, as long as he's in the neighborhood.

Storey: (chuckles) In the neighborhood of Africa, huh! (laughter)

Arthur: So I met the commissioner in Johannesburg. I flew from Denver to New York to London and down to Johannesburg, and he came in from Istanbul. Our flights were just about an hour apart. Our hosts, of course we were met by a delegation.

They said, "I hope you don't mind, commissioner, but we've arranged this evening that you will give a talk to the South African Society of Civil Engineers, and the faculty of the University of South Africa."

"Oh no, we'd be glad to do it." We were taken from Johannesburg to Pretoria, where the university was. And as we're going down the highway, we go past the golf course, a beautiful golf course.

Dominy says, "Oh, you play golf here!"

"Yeah, sure."

"Do you suppose I could get in a round of golf?"

"Oh yes, of course, commissioner, we'll get it in," and so forth and so on. So they take us to the hotel, and Dominy gets on his golfing togs and he says,

"Well, I'll see you later," and he goes off to golf. Well, I wait for him and wait for him, to go to dinner. I think we're supposed to be picked up at like seven o'clock or seven-thirty to go to the University. I wait for him and wait for him for dinner, and finally I decided that I'll go to dinner by myself, because he isn't around. I go and have dinner, and at the last moment here he comes in, all disheveled and things like that–he's been out, he's played eighteen holes of golf since I saw him last. But his host assured him–of course I've got a white shirt and tie and suit and so forth, and he's in his knickers or slacks and a golf shirt–"That's alright, this is just a bunch of engineers, they'll understand."

Dominy Unexpectedly Hands off a Speech Before Engineers at the University in Pretoria to Harold Arthur

So we're off to the university. And they take us to a lecture hall. It's one of those amphitheaters where the students are in seats and rise above the stage and go way up high. We're down, I felt like we were in the Roman Coliseum, we're down in the pit, with these people up there. And there's Dominy and me and the Chairman. He gets up and the Chairman gets up and calls the meeting to order and explains how honored they are to have Commissioner Dominy and his associate come there to speak to them, and Mr. Dominy's busy schedule, "Mr. Dominy wanted me to tell you he just came off the golf course and he apologizes for not having had time to change and so forth. So I give you the Commissioner of Reclamation." So Dominy gets up and walks across the stage to the podium and the microphone and he says, "I haven't been in South Africa for very long," or words to this effect, "but I'm very impressed with the country and what I've seen, and I'm looking forward to visiting the Orange River Project and traveling down to Capetown in the next couple of days, and I know what we're going to do. I'm very impressed with what I've seen so far. I've brought along my chief designing engineer . . . ."

I'm sitting there dumb, fat, and happy, relaxed, because I never got to open my mouth in Spain, as I told you before–he did all the talking. He said, "I brought along my chief designing engineer. He's going to describe for you some of the recent developments in the Bureau of Reclamation."

Storey: (laughs) Caught you a little off guard!

Arthur: He had *never* indicated in any way that he was going to call on me. So it's quite a ways from the chair up to the microphone and we passed midway as he's coming back to his chair and I'm going up to the microphone. And he says, "God damn it, Arthur, I'm tired!" (laughter)

Discusses Auburn Dam and the Third Powerhouse at Grand Coulee with Engineers

Well, as chief designing engineer, making these policy decisions and so on and so forth, as I explained before, I had studied Auburn Dam, had decided why Auburn Dam should be a concrete dam instead of an earth dam, because of the lack of suitable construction materials for an earth dam without ruining the whole countryside. We were in the early stages of designing this concrete dam that they told me they could do, because it would be an unprecedented dam for a double-curvature dam, in it's length, and the ratio of its length to its height and so forth.

The other project that I was working on was the third powerplant at Grand Coulee, because we had just completed our studies of 300 versus 600 megawatt units, 500 megawatt units, and all this kind of stuff, and selected 600 megawatt units, and how we were going to do this. And to put in this powerplant, we had to cut off one end of Grand Coulee Dam and do this against the full reservoir, without emptying the reservoir. We're going to cut off an end of the dam and build another dam that would run perpendicular to the main dam so that we would have a forebay that would supply water to the new powerplant. The new powerplant would be built sideways, up and down the river, instead of across the river.

Well, I had both of these projects *well in mind* because I'd been working on them. I had all the facts and figures and dimensions in my head, and on the stage was a big blackboard and stuff like that. So I got up and I showed them how we were going to cut off the end of Grand Coulee Dam and how we were going to build this, and described the powerplant and so on and so forth. And I told them all about Auburn. And I talked for over an hour, and when I got through, they opened it to questions, and I was bombarded with questions, *technical questions*, from these engineers, wondering how I do this and how I do that, you know. I'm answering all these questions and so forth, and finally they kind of had to shut it off, because the hour is getting late and stuff like that, and it looked like it was going on forever. So they cut it off, and the Chairman asked Mr. Dominy if he had some final remarks that he wanted to make. So we passed again, between the podium and the chairs, and as we went by, Dominy says, "God damn it, Arthur, I didn't know you could talk!" (laughter)

Storey: That's great!

Arthur: But you know, it was probably the best talk I ever gave in my life, because it was completely extemporaneous, which is always a lot better than reading from a prepared paper, as you know, as far as the audience is concerned. And I so thoroughly knew my subject, there was no gainsaying that, so it went over *very* well. I think Dominy was impressed.

Then we saw some big dam they were building in South Africa, then we went down to Capetown. We went to Angola next, and there we were met by our Portuguese friend who had arranged this whole thing. I still haven't thought of his name. But we were taken on a tour, mostly by small plane, of Angola, and saw some irrigation projects and dams–no monumental works, they were all rather small-scale developments. Considering the country, some of them were fairly ambitious.

And from there, we went by commercial plane from Angola, which is on the West Coast, the Atlantic Coast, of Africa. We went to Mozambique, which borders on the Indian Ocean, the southeastern part of Africa. And in Mozambique, we visited the Caborra Bassa Dam site on the Zambezi River. This was going to be an important dam, a major dam, but it was just in the design stage at that time. But we visited the site and went into the exploratory tunnels that had been driven into the abutments. We went across the Zambezi River on a cableway, a suspension bridge, man bridge, and into these tunnels. We spent a night in a game park, got to see all the animals in the wild–saw lions, elephants, giraffes, this whole bit. We visited a dam on the Elephant River, an earth dam. So we had quite a tour of Mozambique. Only made one mistake on this trip, as far as . . . .

END SIDE 1, TAPE 2. FEBRUARY 1, 1995.
BEGINNING SIDE 2, TAPE 2. FEBRUARY 1, 1995.

Plays Cribbage with Floyd Dominy

Storey: You were saying you only made one mistake on this trip in your relations with Dominy.

Arthur: Yes, we were in a hotel in Mozambique shortly after we arrived there in the evening. We were down there in the lobby and Dominy says to me out of the blue, "Arthur, you know how to play cribbage?"

"Commissioner," I said, "I'm a hell of a good cribbage player."

"You are?!"

"Yeah."

"Good! I've got a cribbage board up in my luggage." (laughter) I never dreamed that he was carrying a cribbage board and a deck of cards in his luggage. He said, "Well, you wait here, I'll go up in my room and get them." So he goes up to his room and gets his cribbage board. So the next several nights that we're in Mozambique in this foreign country, we'd go out in the evening and see the sights? No sir! We're in the damned lobby, playing cribbage! Fifteen-two, fifteen-four, and a pair is six. Run of threes is nine. You ever play cribbage?

Storey: Yes, I play at it too.

Arthur: Okay. Well, you know, the kind of cribbage I play, if your opponent doesn't count all his points, you get to get them.

Storey: You play cutthroat, yeah.

Arthur: You get to peg them. That's the way we were playing, and we'd go along and Dominy missed some of his count.

"Are you through, commissioner? You all through?"

"I'm pegged," he says, "I'm through."

I said, "Well, you missed this."(laughter)

Storey: You'd peg it up, huh?

Arthur: I'd peg it up. So at the end of our session there he says, "Arthur, you've proved to me one theory that I've had for a long time."

I said, "What's that, commissioner?"

He says, "Horse shit luck will beat brains any time." (laughter) So you know who won.

Storey: You did, I take it! (laughter)

Arthur: Since the brains were being beat, you know who won. But we were playing for modest stakes, so much a hole, and so much for skunk, if you don't turn the corner, and so forth. I'd win a couple of games, and Dominy would keep increasing the stakes a little bit, see, so I could win three games and he'd win one and we'd be even. (chuckles) That sort of thing.

When we got back to the States . . . . Oh, when we got through in Mozambique, we ended up in Lisbon, and we met with some foreign ministers and high officials of the Portuguese government, had an exit interview with them, and Dominy told them what a good job they were doing, and so forth. And he told me to write some articles, both on South Africa and Mozambique. There wasn't much to write about in Angola, but Mozambique had more going. So I wrote the articles and sent them into Washington. Ottis Peterson was handling them in Washington. He was the assistant commissioner in charge of that sort of function. He couldn't get them published. He tried to get them published in *Civil Engineering* magazine or

Engineering News Record or I don't know what other magazines he tried to get to accept the manuscript. I guess they felt it wasn't wide enough interest, or whatever. I don't know why they didn't choose to publish them, but they were never published. Anyway, it was a great trip.

Storey: Sounds like an interesting trip.

Arthur: Yes, it was.

Storey: How long was the trip?

Arthur: I think probably from the time I met him in South Africa, 'til we got back to Lisbon it was probably about ten days, something like that.

Storey: Sounds interesting.

Arthur: Yeah, it was interesting. Probably one of the most interesting things I did as chief designing engineer.

Storey: How long were you chief designing engineer?

Arthur: Three years.

Storey: So that would have been '65 to '68?

Arthur: Yeah, right, 'til June '68.

Explains Third Powerhouse Project at Grand Coulee

Storey: Tell me more, if you would, about Grand Coulee, since you were up on it. I'm sort of fascinated with how you keep a reservoir full. I can understand how you could build the dogleg on Coulee, but then how do you take out the old dam? (laughs)

Arthur: Well, so were the South Africans! (laughter) Well, what we did is, towards the right abutment of the dam where we were going to build the dogleg, we built a temporary dam by using steel piles driven into cells filled with sand and gravel. And we built a temporary dam that would cut the corner off from the dam over to the rock so we could take off the end of the dam behind the protection of the temporary dam. Then we built the dogleg.

Storey: Was that the whole height of Grand Coulee?

Arthur: Well, of course it's over on the abutment, so it's only about half as high as it is in the center of the river.

Storey: So the water access to the third powerhouse is not the full reservoir–maybe half the reservoir or so?

Arthur: In height, yeah, right. But that doesn't affect the power, it's the head that affects the power. All the channel has to be, the dogleg channel has to be deep enough so that you don't have too much head loss of the water flowing from the reservoir down to where it can go into the turbines, into the penstocks.

Storey: Do you remember a meeting where the regional director from Mid-Pacific got together with the chief engineer, and I guess you as the chief designing engineer, to decide whether Auburn would be an earthen dam or a concrete dam? Mike Catino was the regional director at that time, I believe.

Arthur: No, I think he was assistant.

Storey: Was he?

Arthur: Pafford? No, it was before Pafford.

Storey: Well, let's see, I may have a list of that region's directors.

Arthur: Well, let me say, I don't remember such a meeting.

Storey: Okay. Well, Pafford was '63 to '73. Pat Dugan was '60 to '63, in the regional director's chair there.

Arthur: Well, it would have to be Pafford, because I didn't come back, I wasn't chief design engineer until '65.

Storey: Now, were you there when the earthquake problem came up with Auburn? Or was that later when you were chief engineer?

Arthur: That was later.

Storey: Okay, I'd like to talk about that later. Actually, we're at the end of our time, or virtually at the end of our time.

Arthur: Right.

Storey: I'd like to ask you again whether or not the tapes and transcripts from this interview can be used by researchers both inside and outside Reclamation.

Arthur: Yes, indeed.

Storey: Good. Thank you very much.

END SIDE 2, TAPE 2. FEBRUARY 1, 1995.
BEGIN SIDE 1, TAPE 1. FEBRUARY 14, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold G. Arthur, former chief engineer of the Bureau of Reclamation, at his home in Denver, Colorado, on February 14, 1995, at about eight-thirty in the morning. This is Tape 1.

Last time after we had quit, you mentioned that you were involved in selection of the architects for Building 67, I believe. Could you tell me about that?

Selecting Architects for Building 67 in the Denver Federal Center

Arthur: Yes, you mentioned in our last session, I believe, about talking to Floyd Dominy about how he secured authorization for Building 67 at the Federal Center. And of course when the news got out in the Denver office that we were going to have a new building, it was greeted with a great deal of enthusiasm. We understood that it had been done by Commissioner Dominy ~~in~~ overcoming objections of the GSA [General Services Administration], who were not supportive of Reclamation having a new building.

So Dominy managed to get the appropriations through the Reclamation committees in the Congress. One thing we understood was that part of the argument between GSA and Dominy involved the cost of the building. The GSA said it would cost a certain amount, like on the order of $10 million to $12 million. Dominy said that was an inflated figure and he could get it done for less. As I recall, the budget was about 7 million dollars.

The decision was made somewhere in the Bureau that the Bureau would get a competent private architectural firm to design the building. Saying while the Bureau was very competent and skillful in designing powerplants and dams and so on and so forth, we didn't know that much about office buildings, and therefore we needed to

get somebody that was experienced in this field. The request for proposals was sent out by the Bureau, outlining the various parameters that would have to be made in meeting the requirements for the office building, and the committee was appointed to select the engineer and architect to design the building. At that time I was assistant chief designing engineer and I was a member of that committee. This was the first time the I ever served on a committee to secure professional services from an engineer and architect–not the last time, by any means. This was a very interesting experience for me.

We reviewed the various backgrounds of the companies that responded to our request for proposals, and to see what their experience was, and examine the photographs of the various structures that they had designed and so forth. And I don't recall just how much information they had to furnish at that time, with what their solution for our office building was, but after reviewing a number of proposals, we selected Hellmuth, Obata, and Kassabaum in Kansas City as the engineer/architect for the work. It's interesting to me that this is the same organization that is designing Coors Field at the present time.

Storey: Did Mr. Dominy participate in that committee?

Arthur: No, he didn't. I don't remember who was on the committee, but it was all from the chief engineer's office here in Denver.

Storey: Did he apply any pressure to the committee?

Arthur: No.

Storey: That's interesting. The reason I ask is because his version is that he selected them! (laughs)

Arthur: That he selected?

Storey: Yeah, that he selected the firm in Kansas City and had quite a bit of trouble getting them actually selected to do the work. But you don't have any recollection of that, I gather.

Arthur: No, I don't have any recollection of that at all, although I wasn't key–I don't recall who was the Chairman of the committee. He might have had some (**Storey:** Some conversations, huh?) communications with him, I don't know. He [Dominy] might have brought some influence to bear. From *my* perspective, it was selected on the basis of experience and their proposal of what they could do. The Bureau had set

forth how many square feet of office space ~~they~~ [we] needed, and it was agreed that the budget was very tight, because of the commitment that Dominy had made for the building. It wasn't going to be easy to get what we wanted and what we needed, for the funds that were available. But the architect selected the configuration of the building, decided what its footprint would be and how many stories it would be, how many elevators it would have and so on and so forth, and explained to us their consideration of vertical transportation between floors up and down, *and* horizontal transportation from the elevators to the various offices and so forth, and try to get an optimum configuration of length, breadth, and height, and so forth. Their thinking on it was pretty impressive to me, as to how these architects went about deciding how big our house was going to be, or what shape our house was going to be and so forth.

I have here a clipping I took out of the paper dated November 18, 1964. It says, "Office building work to begin. Commissioner Dominy will turn the first shovel of earth Wednesday, marking start of the work on the fourteen-story Reclamation engineering office building." I'm just hitting the highlights. "Dominy will fly to Denver especially for the groundbreaking, scheduled for 4:20 p.m. When completed in two years, the new structure will dominate the 700-acre cluster of Federal structures at the Center. It will be 210 feet high, 230 feet wide, and 110 feet deep. It will be built of light-weight, prestressed and post-stressed concrete, and will have moveable interior partitions. The $6,273,029 building will house the Design, Engineering, Executive, and Administrative staff of chief engineer B.B. Bellport. MSI Corporation, Maryland, submitted the lowest of seventeen bids, and was awarded the contract [for construction of the building]."

Storey: Could you tell me from your perspective why Reclamation needed Building 67, a new office building, on the Federal Center?

Working Conditions That Required Construction of Building 67

Arthur: Well, I'm sure you've heard reports of how unsatisfactory the working conditions were in what had been the factory buildings at the Denver Federal Center. The ventilation was by opening the transom windows high in the top of the building, and the birds would fly in and out. There was no air conditioning. We had a big thermometer in our section there, and it was very common that the temperatures get over ninety degrees in the office. We were trying to work on vellum drawings, and your arm would stick to the vellum because of the perspiration and so on and so forth. It was a very, very poor environment for an office. Dominy took a position that it was a fine engineering organization and it deserved suitable facilities in which to operate. In that assessment, he certainly had agreement (chuckles) of all the

engineers that were working for the Bureau. We understood that the proposal by the GSA–well, they first said that it wasn't in their budget cycle, they didn't have the money to spend for Reclamation improvements at the Federal Center at that time. It would be several years before it could be budgeted. And they didn't favor a new building, they favored remodeling of the existing buildings and so on and so forth. Dominy took the position that the buildings were really not that suitable for remodeling, that the costs of remodeling would be–here they got into the different cost estimates–that he could build a new building for what they thought the remodeling would cost sometime in the future. So that's how the whole thing got started.

Storey: Were there any interesting incidents during the construction?

Arthur: No, we were instructed by the chief engineer to stay away from the construction site. He didn't want everybody trapezing (sic.) up there at noon and standing around, getting in the way, and so on and so forth, so the construction site was pretty much off limits for Reclamation ~~project~~ personnel while the construction project was underway. There was an engineer by the name of Henry Fitz, F-I-T-Z, who was the liaison engineer between the chief engineer and the contractor, so he was the go-between for contract administration purposes and so forth. But the rest of us, we pretty much stayed away until the building was completed.

Storey: So the chief engineer was administering the contract for the building? Is that correct?

Arthur: Yes. The chief engineer administered all the contracts for *all* reclamation work, except the very minor stuff: roadways, fences, and camps and stuff–work that was done by the region. All major work was under the contracting authority of the chief engineer.

Storey: And who did that work for the chief engineer? Was there a special branch or section or division, that supervised the construction work?

Major Divisions in the Office of the Chief Engineer

Arthur: Of Reclamation projects in general? Yes, there was a Construction Division, was one of the main divisions. There was a Design Division, a Construction Division, an Administrative Division, the Laboratories–were the main elements of the organization. The Construction Division was headed by the chief construction engineer and his assistants, and there were a number of liaison engineers in the Construction Division that spent most of their time visiting the projects under

construction and reporting back to the chief engineer as to the progress of construction and modifications that would have to be made in the design and so on and so forth. All during this time, the construction engineers on all these jobs were the chief engineer's contracting officers' representatives. The construction was carried out, as you've heard, by the construction engineer and his staff. The construction engineer was appointed *by* the chief engineer, and was the chief engineer's representative.

Regional Director Role in Construction When the Chief Engineer Was the Contracting Officer

The regional director had some input into selection of key personnel, but the key personnel were *really* selected by the chief engineer. The regional director's office furnished administrative support for the construction engineer, and would furnish the personnel for . . . the inspectors and the administrative personnel, and it would arrange for housing and all that sort of thing. But the chief construction engineer reported directly to the chief engineer on all technical matters.

Storey: Okay. And the chief construction engineer would be the person in the field at the project.

Arthur: That's correct.

Storey: And then where would the regions take over? At the end of construction, or . . . .

Arthur: No, let's say a job was ready to go into construction. A construction engineer would be appointed, primarily through the chief engineer. The construction engineer would have two primary assistants, the field engineer and an office engineer. These key positions were also pretty much selected by the chief engineer. And *all of the rest* of the organization was staffed through the region.

Storey: Okay, so all of the construction inspectors and those sorts of people.

Arthur: Right. They were all hired through the region and the region gave all the administrative support, finance, and records, and all that sort of thing.

Storey: And then how long was the chief ~~of~~ engineer~~s~~ in charge of a project?

Arthur: The chief construction engineer, you mean?

Storey: No, the chief ~~of~~ engineer~~s~~–he was in charge of the construction, right?

Arthur: I'm having trouble with that title. There was no chief of engineers.

Storey: The chief engineer, excuse me.

Arthur: The chief engineer in Denver.

Storey: Right, was responsible for the construction?

Arthur: Right.

Storey: At what stage, if ever, was the responsibility passed on to the regional office then?

Arthur: Well, when the construction was completed, and the contract was finaled out, the project would be turned over to the region for operation and maintenance.

Storey: For O&M, but never for construction at that time.

Arthur: Never construction, no! No.

Storey: Okay. Good. I guess to me as a person not experienced with the design process, you sit down and you design something and you give it to the construction people and you say, "Go build this." Is that really the way it works? Or do you give them, first of all, some sort of a preliminary design and then the design evolves as the project proceeds through construction?

Preparing Design Specifications for Bidding Purposes

Arthur: Well, to begin with, the Bureau would prepare design specifications, for bidding purposes. This would consist of, the specifications would describe the quality of the work that was to result. It wouldn't describe how the contractor would do the work, that was up to the contractor, the method and means of doing the work. It would describe the finished product specifications, what parameters it had to meet. And this would be supplemented with a volume of drawings that would show the work in detail. On a job like Falcon Dam, we talked about at length earlier before, the specification was a volume about an inch-and-a-half, two inches thick, describing the work, and there were probably a hundred and some drawings showing the work, the layout and what the structures were to be like and the shape of them and that sort of thing. Then the contractors would bid on doing the work in accordance with these specifications and these plans.

"After the specifications. . ., the designers were continuing to work on *more* detailed construction drawings . . ."

After the specifications were issued, in fact, the designers were continuing to work on *more* detailed construction drawings, showing exactly the details of the work, the reinforcement and that sort of thing. And as soon as the contract was awarded, then these very detailed drawings would be forwarded through the construction engineer to the contractor, and the contractor would use these in performing the work.

Storey: And did those change during the process of construction?

Arthur: Well, you would go from 100 drawings to maybe 1,000 drawings, because the 100 drawings that he bid on showed the scope of the work, but it didn't show the *details* of the work to the extent where all the equipment and all the dimensions of the members and that sort of thing. You can kind of compare it to building plans for a house. You can show a drawing of a house, perspective drawing, and it shows how big it is, how long it is, and how wide it is and how high it is, and the specifications say what kind of shingles you have and what kind of siding you have and so on and so forth. But later, when you go to build the house, you need all the drawings that show the detail of the plumbing, where all the pipes run, how many fixtures there are, and that sort of thing. You need drawings that show all the wiring, where each light switch is supposed to be, and where each outlet is and all that sort of thing. And you need drawings showing how the roof rafters are put together and it's that way with a dam also. So you would go from 100 drawings showing the scope, to 1,000 drawings necessary to build the work in detail.

Storey: But how could a contractor bid when he didn't know the detail?

Why Reclamation Sought Construction Bids Based January 5, 2010on Unit Prices

Arthur: Because he was bidding on the basis of unit price. He had a general idea from these 100 drawings of what the work was like. He knew ~~whether~~, in general, the size of the concrete members, and so on and so forth. And he bid unit prices, so much a cubic yard, so much for each pound of steel, so much for each electrical fixture, so much for each cubic yard of excavation, and so on and so forth. And he would be given a quantity to bid on. But that could be varied somewhat, and he would be compensated for what he actually did.

Storey: So he would be bidding on the materials and the labor that was involved in each unit, and the units could change, and that wouldn't affect him, because he had already figured out how much it was going to cost him.

Why There Were Limits on Variations in Quantities Contracts

Arthur: Yeah, except there were times when there were limits on how much you could vary the quantities. This evolved over a period of time, but it came to the point when I was chief engineer, that the specifications would stipulate that the quantities could not be changed more than fifteen percent without adjustment in unit prices. Theoretically, the prices could be adjusted in favor of the contractor or in favor of the government. This was on the theory that if you have a *whole* lot of work to do of a like kind, you can reduce the unit price, because of the effect of scale, because you can get more effective, you can get larger equipment, you know. For example, if you bid on–that you have to excavate 1,000 cubic yards of rock or other material, the equipment that you would use would be vastly different than if you were faced with the problem doing 100,000 cubic yards in the same period of time. So if you bid on 100,000 cubic yards and brought all this massive equipment on the job and then there was only 1,000 yards to do, you say, "Hey! I was misled here, and misrepresented. I've got all these fixed costs on this equipment, and just this little bit of work to do to recover my costs. So I should have an adjustment in price." The reverse would be true. If the bid quantity bid for 1,000 cubic yards and then he's faced with doing *100*,000 cubic yards, he'd say, "Well, hey, I didn't come equipped to do this kind of work. The specifications said I'd have 1,000 cubic yards, and I brought this little equipment here and these few trucks, I've got to go out and get all this new equipment, I've got to do this and I've got to do that, and it's going to cost me a lot more money," see? So it's that sort of thing. (chuckles)

Storey: Okay. Did you ever, in your experience as assistant chief design engineer, or as chief design engineer, run into any situations where that kind of thing came up, that you happen to recall?

Alcova Dam Construction as an Example of a Quantities Bid That Got out of Hand

Arthur: Yes. You remember, way back in one of our initial meetings, I told you about my experience at Alcova Dam where we were painting the rocks?

Storey: Yes, I do remember that.

Arthur: Well, that was an outstanding example of what happens when you have a big overrun–specification quantity was for like 200 yards, and came out it was 20,000

cubic yards. The contractor had bid a big price because it was just a small amount, and so that reflected a big windfall for him when the price went up. In those days, there wasn't this provision for renegotiating the prices. See, the specifications were refined as the years went by. As those kind of situations came up then the next specifications would make changes to reflect that those things might happen.

Storey: Well, in the Design Division–is that the correct title? (**Arthur:** Yes.) In the Design Division, did you have people doing the specs?

Arthur: Oh yes! The specifications were written in the Design Division.

Storey: Okay. And when there were changes, were those negotiated in the Design Division also?

Arthur: When there were changes, the Design Division had input as to the suitability of the change from the technical point of view. The contract negotiations themselves were carried out by the construction engineer and the chief engineer, the contracting officer. The designer sat at the table and participated in it.

Storey: Do you ever remember any of those situations when you were there, as assistant or as chief design engineer?

Arthur: Yes.

Storey: Any that sort of stand out?

Arthur: No, not really.

Storey: Was it then pretty routine business, to be renegotiating like that?

How Competition Affected the Way Construction Bids Were Made on Reclamation Projects

Arthur: It was routine to have changes, yeah. And in later years, of course, I became more aware as my responsibilities were increased, but there seemed to be more changes–there seemed to be more claims. The contracting business got very competitive and in order to be the low bidder, it was necessary for the contractor to use a very sharp pencil. And the contractors became optimistic when preparing their bid, and they were optimistic: this would be this way, and this would work this way, and this would work *this* way–because if they were pessimistic they would always be out of the money, they would never be low bidder. So the biggest optimist was often the

successful contractor. But if his optimism did not turn out to be well-founded, the contractor would begin to look for reasons why he was not at fault, and he would claim various changed conditions, or ambiguity of the specifications, or all sorts of things, trying to get an increase in this unit price, or increase the quantity, or some adjustment in the contracts. So the increase is relative. This became a very common procedure, and it happened on almost *every* job when I was the director of design and construction, and when I was in the deputy position, involved in the contract administration. I became aware that this was a very . . .

END OF SIDE 1, TAPE 1. FEBRUARY 14, 1995.
BEGINNING OF SIDE 2, TAPE 1. FEBRUARY 14, 1995.

Storey: When you say that it was a common procedure, does that mean that you spent *a lot of time* participating in claims, adjudication, and that sort of thing?

"The contract administration part of the responsibilities of the chief engineer were his primary function. . . ."

Arthur: The contract administration part of the responsibilities of the chief engineer were his primary function. I would say that he spent most of his time dealing with contract administration, claims being an important part of that.

Storey: And at that time, let's see, we're talking sort of the mid- to late 60s here, as I recall. Were there a lot of projects out there under construction?

Arthur: Oh yes! Yes, there certainly were.

Storey: So it was a full-time kind of activity for the Denver office.

How Contractor Claims Were Processed

Arthur: It took a lot of time. You see, when the contractor had a claim, or thought he had a claim, he would take it up with the construction engineer in the field.

". . . construction engineer was the authorized representative . . .of the contracting officer,. . . he had a limited authority to settle claims. The authority . . . varied from project to project, depending upon the confidence that the contracting officer had. . . If it was somebody who had a lot of experience and knew his job real well, he would have a higher threshold at which he could settle the claims, whereas if it were a construction engineer who was relatively new on the job, his authority would be more limited."

The construction engineer was the authorized representative of the chief engineer, authorized representative of the contracting officer, he was called. He had a limited authority to settle claims. The authority was limited on the dollar amount. The amount varied from project to project, depending upon the confidence that the contracting officer had in the contracting officer's representative. If it was somebody who had a lot of experience and knew his job real well, he would have a higher threshold at which he could settle the claims, whereas if it were a construction engineer who was relatively new on the job, his authority would be more limited.

Well, if the contractor could not reach satisfactory arrangements with the construction engineer, he would ask to meet with the contracting officer. So the contractor and his engineers, and usually then his attorneys, they would come to Denver, and they would meet with the chief engineer and his representatives. His representatives would include the chief construction engineer and contract administration people who had been working on the details of the claim, and if it involved certain design aspects, the appropriate designers would be present too. They would meet in a conference room and the contractor would make a presentation of his claim, and the designers and the other people who had knowledge of the subject, they would give their side of the question. Obviously, agreement hadn't been reached, or they wouldn't have all this tribe coming in.

Regardless of the size of the claim, if the construction engineer did not have the authority to settle it, he could still endorse it and recommend it for settlement, in which case these conferences would not be necessary. The chief engineer would send people out from Contract Administration, they would go over the situation in the field, maybe look at the contractor's records and review the contractor's claim in detail, and if they thought it had merit and could reach agreement, they couldn't make a payment to the contractor, but they could recommend to the chief engineer that this claim be allowed. And if the chief engineer received this recommendation with the backup material, which showed an adequate justification for the claim and so forth, *and* if the chief engineer could get the endorsement of the solicitor's office, that it met all the legal requirements and so forth, then the chief engineer could pay this claim without negotiation. So any time that the conference was held, it was because there was disagreement between the government and the contractor as to the merits of the claim.

Storey: Another thing I'd like to explore about claims, is what claims did to Reclamation's budgeting process. Presumably we had "X" number of dollars allocated to "Y" project, and so the contractor comes in with a claim which is approved–what happens in the budgeting process?

Contingency Is Provided for in Budgeting

Arthur: Well, in the first place, there's a contingency carried in the budget process. The budget for a project may include a number of contracts, so if you're overrunning on one contract, it doesn't necessarily break the budget, because you might be under-running on another contract, or it might be within the contingency figure. But there can be cases, and there were cases, where the claim was such that it was not within the budget, and money could not be transferred from other project functions to cover it, that you would have to go back to the Congress for supplemental appropriations. And the contractors, this was in the contract documents so the contractor was well aware that certain funds were available, and that if his earnings exceeded that, then his payment would be delayed.

Storey: How accurate were the estimates that Reclamation did for projects generally? Were they on the money, short, long, all over the board? (chuckles)

Generally There Were Cost Overruns on Projects

Arthur: *In general*, I would say that the actual cost was an overrun. Being in analysis when I was chief designing engineer, trying to decide on whether to build Auburn Dam as a concrete dam or an earth dam, as I mentioned before, I had these estimates that were essentially very close to each other, essentially the same. So I had to think about the reliability of these estimates. So I had a study conducted of the original estimates for a whole bunch of earth dams and their final costs, and the same for concrete dams–the original estimates and their final costs. As I remember, the earth dams overran about fifteen percent, and the concrete dams overran about twenty-five percent, something like that. Well, between various projects, there'd be a wide variance. Some projects there might be an underrun, and another project the overrun might be fifty percent or so.

Storey: Did you ever think about why Reclamation's estimates would be off?

"The *main* reason that the estimates were not more accurate is because of the fact that we were dealing with unknown geological conditions. . . ."

Arthur: The *main* reason that the estimates were not more accurate is because of the fact that we were dealing with unknown geological conditions. No matter how much exploration you do, you're still going to find conditions in foundations of the dams, canals, and other structures that are different from what were anticipated. And these conditions usually cause changes that increase the cost of the project. If you'd known some of these conditions beforehand, it may not have increased the cost of

the project, but when these changes are discovered during the course of construction, when you're under contract and have to amend the contract or pay extra, the prices that you get from the contractor to do this work are negotiated prices, they're not competitive bid prices. And the contractor is not going to give you as good a price on a negotiated change that has to be made as he would if he knew about that in the first place and was in a competitive position of bidding on the work. That'd be one factor that would enter into it. You understand what I mean?

Storey: Yeah, I think I do. So you have unknown conditions, you have the negotiation factor involved. What about things like just plain screwing up, as it were, on Reclamation's part? The guy put in fifteen dollars a cubic yard instead of twenty-eight a cubic yard, or whatever.

Estimates Would Have Been Better If Designers Had Been Able to Visit Job Sites

Arthur: Well to go back to my old Alcova example, I think that if the designers who had estimated that quantity of rock excavation had been able to go out to the job site beforehand and look it all over, they would have realized that there would be a lot more rock excavation than what they put in the specifications. They figured, well, there's going to be some in that foundation. There's going to be some boulders that have to be broken up, so we'll put in a figure so we have a bid price. I imagine that was how they arrived at it. But if they'd have been able to go out there and *see* that, they would have realized that there were some boulders in there that were the size of boxcars and things like that, that were on the surface. It was just a lack of appreciation of local conditions, really.

Storey: Was it typical for designers to go out to the site and see the project they were working on?

Arthur: No, it was not.

Storey: That seems very strange to me. Why wasn't it considered strange to Reclamation?

Congressional Limitations on Travel Severely Restricted Ability to Visit the Job Sites

Arthur: We were victims of the congressional limitations on travel. That's the *main* reason. When I was in a position of authority, that was the sole reason, because I recognized the need for the designers–being one–I recognized the need for designers to visit the job before construction and during construction. But there was a mentality in Washington that there was a lot of government money being spent on unnecessary travel. And nobody knew it better than the members of Congress, because they were

junketing all over the world–they still do–study trips to Europe, and study trips here, study trips there. So they assumed that anybody else who was traveling was also on a junket. So limitations were placed on travel for the Executive Branch of the government. That was apportioned out to the various Departments, [including the] the Department of Interior. The secretary of interior made a travel allowance to each Agency: the Bureau of Reclamation, the Bureau of Mines, and the Park Service, and so on and so forth. It came to the Bureau of Reclamation, and the travel allowance was all divided among the various offices and so forth, and there just plain wasn't enough funds. And you could have all kinds of money in your budget, but the travel allowance was a specific ceiling item, that you had to live within that.

Storey: So that was very limiting.

Arthur: Yes.

Storey: Did it also result in the fact that only high-level folks traveled and went out to the projects and saw them? (tape turned off and on) What I was trying to ask you was if the limitations on travel meant that only the highest-ranking members of the Denver office went out and actually saw the projects and so on.

Arthur: Yes, that would be the result of that. Usually when a design person had to go out to a job during construction, it would be at the request of the construction engineer. The chief engineer would have to send somebody who had enough experience that they could respond to the needs of the project and so forth, so it would have to be somebody who was fairly senior. The limitations on travel would prevent sending more than one man, usually. So unfortunately, the younger engineer, who in many cases was not very familiar with the field work, could not get this exposure and this training. Things look a lot different on the ground than they do on a piece of paper, lots of times, but he would not have this opportunity to do this. So it was unfortunate because of that. I mentioned in one of our earlier sessions about how unusual it was that I went out to Santa Barbara, to talk about Cachuma Dam. (**Storey:** Yeah.) I would *never* have gone out there without the direct request of the Board of Supervisors for Santa Barbara County–it would have been somebody senior to me who would not have had the background that I had in this particular case, because this was not to solve a field problem, this was to explain the design concept. But ordinarily, I would not have the opportunity to go.

Travel for the Work at Falcon Dam Was an Unusual Opportunity

Storey: And of course Falcon Dam was an unusual circumstance that allowed you to travel.

Arthur: Yes, that was entirely different too, yes, because I was the Project Coordinator, right.

Storey: Were there any other sort of issues like travel limitations that affected the design process that you recall?

Political Considerations and the Design Process — Third Powerhouse at Grand Coulee

Arthur: Yeah, I should actually call them political considerations, I guess. (**Storey:** Okay, good.) I can give you an outstanding example. (**Storey:** Good.) The third powerplant at Grand Coulee Dam. The need for additional hydroelectric power in the Northwest was recognized by the Bonneville Power Administration, that was selling government power in the Northwest. And they wanted the Bureau of Reclamation designers to increase the hydroelectric capacity at the Grand Coulee Dam. The dam was there, the head was there, the water was there, it wasn't being used. The two million kilowatt installation was only using a portion of the water, so they wanted additional capacity installed at Grand Coulee Dam by a certain date. They wanted this power available. So they went through the appropriation process, to get the appropriations from the Congress, and it ended up, I don't know why, but for some reason or other, the appropriations were made a year later than what they thought they would be available. So the construction of the third powerplant was delayed one year. We were told that the end date could not be extended, the end date would have to be held.

Storey: The date when the powerplant actually went into operation?

Critical Path Method Schedule Prepared for Third Powerhouse at Grand Coulee Because of Tight Construction Time

Arthur: Yeah. Of course it was *not*, it was a couple of years *late*, as a matter of fact. But anyway, at that time, they said, "No, you cannot change the power-on-line date, it has to be held." I was chief designing engineer at this time, and I was convinced that it was impossible to design and build the Third Coulee Powerplant and meet that power-on-line date, impossible to do it. And in fact, I was so concerned about it, that when we prepared the specifications, which gave the time that the contractor had to build the project, that I had the engineers in the Design Division prepare a critical path method schedule, showing how the project could be built. I said, "I don't think it can be done in that time. I want to see *how* it can be done." So they prepared a schedule. Are you familiar with critical path?

Storey: I know the basic outline of how CPM works–I think that's what they call it.

Arthur: You know you make a lot of assumptions, of course, on how long it takes to do this, and how long it takes to do that, what's critical, and the sequence of events that have to follow in order to get things done in the least amount of time, and so on and so forth. And they finally came up with a schedule which showed that the job could be built within the contract time. And I was instrumental in getting that schedule incorporated in the specifications. This is something that had never been done before. And I said, "We have devised this critical path analysis that showed how the job could be done in this time, we spent a couple hundred thousand dollars doing this, making this study, and there wouldn't be time during the bidding process for a contractor to make a like schedule, it would just take too much time for him to do it." So I wanted to give him that schedule we had prepared, say, "Look, if you follow this schedule and do the work in this sequence and do these items in the amount of time that we have scheduled here, you'll come out alright. You can use that as part of the specifications." So it was done that way.

"It [Coulee Third Powerhouse] was the largest dollar contract ever awarded by the Bureau of Reclamation up to that time. . . ."

The job went into construction. It was the largest dollar contract ever awarded by the Bureau of Reclamation up to that time.

Storey: Including the construction of Grand Coulee and Hoover and Shasta and all those?

Arthur: Oh yes.

Storey: Okay.

Arthur: Of course prices increased a little bit. (**Storey:** Right.) Inflation had reared its ugly head already. As I remember contract value was about $110 million, and the job was bid by a consortium of four ~~design~~ construction contractors: there was Vinnell Corporation in California, Dravo Corporation in Pittsburgh, Mannix Corporation of Canada, and Lockheed Construction Corporation, also of California, an offshoot of Lockheed Aircraft. They were a consortium and bid this job.

Well, they started in construction. They didn't follow our CPM plan at all, they started to build it the way they wanted to build it. According to my people they were . . . . Oh, I should say, by the time that this went under construction, I was the deputy director of design and construction. I later became the contracting officer on this work where I had started as the chief designing engineer. I became the contracting officer before it was over. According to my staff, the contractor was doing work out of sequence, as far as our idea of how the job should be built, in

order to maximize his early earnings. See, in order to get money to get good cash flow for operating expenses, the contractor has a tendency to do the work that is easiest to do and pays the best.

Storey: Up front.

Arthur: Yeah. Whether it's the logical thing to do or not, he's going to take the cream first, because he gets the cash to operate on. So the work progressed, and it was obvious that they were losing time. The work was behind schedule, and of course we were trying to get the contractor to expedite and get back on schedule and that sort of thing. A small example of building the airport out here! (chuckles) Denver International Airport. Finally, I was invited, as the director of design and construction, I was invited to the annual meetings of the Beavers' Association. The Beavers is the social organization of all the heavy construction contractors, primarily of the western contractors. Every year they give awards to ~~people in~~ their contractors for contract supervision and their attainment in their construction activities. They also give an award for engineering achievement, and that award has been given to the top man and top technical person in the Bureau of Reclamation several times. This is what it looks like, a golden beaver.

Storey: Uh-huh, a beaver in front of what looks like a dam to me, maybe.

Contractors on Third Powerhouse Run into Financial Problems

Arthur: Yes, that's right. They're primarily dam-building organizations. This says, "The Beavers' Engineering Award presented to Harold G. Arthur, for outstanding achievement in heavy engineering construction, 1976." But before this award was made, I was also a guest out there at their annual meetings, held out there in Los Angeles. And shortly after the Third Powerplant went under construction, I can't remember just what year it was, but I was out to a meeting of the Beavers in California, and the President of the Vinnell Construction Company contacted me and said he would like to have a meeting with me.

Storey: Vinnell was one of the four in the consortium, was it?

Arthur: Yes, Vinnell was the sponsor organization. In other words, they were the ones who were really running the job. The others were financial participants and so forth, but Vinnell was the one that was running the job.

Storey: And is that B-A-N-E-L-L.

Arthur: V-I-N-N-E-L-L. Two "Ns" I think, if I remember. So I met with him, and he told me that things were not going well at Grand Coulee third powerplant, and they were losing a lot of money, and he said the job was impossible to construct in the amount of time available.

END OF SIDE 2, TAPE 1. FEBRUARY 14, 1995.
BEGINNING OF SIDE 1, TAPE 2. FEBRUARY 14, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on February 14, 1995.

. . . was telling you that what they had contracted to do was impossible for them to do.

Arthur: It was impossible to construct this job and do this work in the amount of time that we had given them to do it. And he felt, of course, that we were responsible in large part for their problems because he, in good faith, had bid this job on the basis that the Bureau had said, "You have 1,400 days to do it," they could do it in 1,400 days, it was possible to do. Now it wasn't possible to do it in 1,400 days, it was going to take much more time than that. And in the construction business, time is money. And if it's going to take twice as long, it's going to take a lot more money, because they've got all their overhead and their equipment and everything tied up for a longer period of time. So he said that they were faced with bankruptcy unless the Bureau would renegotiate the contract, could see that it was impossible to construct this job in the way that had been contracted for, and that they would need a renegotiated contract.

Well, I asked him, how serious his problems were?

He said well, they had an immediate need for $7 million. He said that if they didn't get that additional payment, they were going to have to walk off the job, turn it over to the surety group, they were through, ruined, bankrupt, kaput. So I told him that I would take this up with my staff and other people and see what our position would be on it.

So I came back\ to Denver and called in the field people. One of the key persons in this was Donald Duck, whom you will interview at a later date.

Storey: I hope, yes.

Arthur: And get the input of the construction engineer, Roscoe Granger and Duck was the field engineer. They confirmed what we already knew, ~~was~~ that the contractor was in deep trouble, way behind schedule, and you could see his costs were greatly outrunning his revenue at that time, and so on and so forth.

Reclamation Had Several Alternatives to Deal with the Contractor for the Third Powerhouse

So we were faced with a dilemma, what to do. We had several courses of action. One, we could tell the contractor, "Hey, you got a contract and if you're not going to perform, you've got a performance bond and we're going to your bonding company and saying, 'Hey, it's yours, you got to take over the job.'" That's one alternative. Another one is to say, "If you walk off the job we're going to terminate your right to proceed, we're going to impound all your equipment, we're going to readvertise the contract, get some new bidders to complete the work, and we'll charge to your account any increase in costs that result to the government because of your failure to perform." A third alternative is to say, "Well, hey, you're right. You're right, the job is impossible to construct. We'll make a contract adjustment, pay you this additional money, you stay on the job, finish the job." So we analyzed those three alternatives as to what is the best for the government? The best thing for the government was to pay the claim.

Storey: Of $7 million.

"Renegotiate the contract. That's the best deal for the government . . ."

Arthur: Renegotiate the contract. That's the best deal for the government–provided the contractor could stay on the job and perform. Because the other alternatives are going to cost the government *much* more money. The first alternative that we looked at, turning it over to the bonding company, we're going to be probably in a legal position, we're going to have certainly a big delay in construction.

"This power that we're going to produce is worth like a million dollars a day if we ever get it on line."

This power that we're going to produce is worth like a million dollars a day if we ever get it on line. We're going to have all that lost revenue, delay of construction, and the bonding company, we're going to have problems with the bonding company. We'll probably undoubtedly have to go to the second alternative, is rebidding the job.

Well, if we rebid the job, all the construction organizations know the problems that they're having there, they know the job is overrun in cost and time, their new bids are going to reflect this, we're not going to get any favorable bids, compared to the original bid, when they were in the optimistic mode, looking at this job. Now they're in the harsh days of harsh realities, and they're going to visualize this job a lot differently, and it's going to cost us more money.

Solicitor Had to Approve Renegotiation of the Contract for Coulee Third Powerhouse

So the best thing to do for the government appears to be to renegotiate the contract. And of course to do this, we have to have the 's agreement. The doesn't work for the Bureau of Reclamation, the solicitor works for the Secretary of the Interior. This is a good organizational setup, because the regional solicitor isn't under my jurisdiction at all, I can't fire him or give him a raise or anything else. See, he's truly independent. But he also has the interest of the government at heart, and they agree that this is to the interest of the government, to renegotiate the contract, and that legal justification can be made for supporting the contractor's position, if we want to do it. On the other hand, we can argue against it, but if we want to argue for it, we can do it, there's grounds for it, because we knew in the beginning that this was an unrealistic schedule. Okay? We could say we knew it.

Further Approvals for Renegotiating the Contract for the Coulee Third Powerhouse

So when it comes to me to make the decision on whether to renegotiate this contract or not, I take it up with the Commissioner of Reclamation, who at that time is Gilbert Stamm. And he says, "Well, you guys are the technical experts and you're the Contract Administrator. I have to rely on your judgement of what should be done. Whatever you want to do, I will approve it." I should add anything of this magnitude would have to go to Washington for approval, but this was always more or less a rubber stamp operation. But he said, "I'll approve it."

And I said, "Well, I think this is the way to go, but I'm not willing to do this on my own responsibility. I *think* we ought to take this up with the secretary of interior. It's that big, as far as I'm concerned. I don't want somebody coming later and say, 'Harold Arthur gave them $7 million. What the hell did Harold Arthur get out of it?' I don't want anything like that to ever happen. I'm not going to do it on my own authority."

So he said, "Well, I can appreciate that." So it ended up, we got an appointment with the secretary of interior to explain the need to renegotiate the contract for the third powerplant. The secretary of interior was a guy by the name of

Morton (**Storey:** Rogers C.B. Morton.) who at that time was having cancer surgery out in California at . . . Stanford. He was recuperating from cancer surgery, but we got an appointment with his assistant, a guy by the name of Horton. Horton was Morton's Assistant.

So we gathered up our material and stuff and I had some charts made up, and it's kind of like a flow chart, and I could show here was the situation at the top there, where the contractor wanted this much money, and then I had these alternatives. You could go down here, if you decide to do this, then this would happen, and this would happen, and this would happen, and this would be the cost to the government, estimated. If you did this, you go down this way and this would happen, and this would happen, and this would happen, and this would be the estimated cost if the contract were readvertised and so forth. This other way, you pay the contractor and this would happen, this would happen, this would happen, and this would be the cost to the government. It showed in graphic form, the basis for our analysis. So we went to Washington, I headed the delegation, of course, as the contracting officer. Donald Duck was with me–he was by then my deputy–but he had been the field engineer on the job, so he was very well informed. The regional solicitor, Palmer King, and there may have been somebody else, I can't remember.

Storey: The commissioner didn't go though?

Arthur: Well, I'm talking about the group from Denver.

Storey: Oh, okay.

Arthur: So we got to Washington. I got to tell you this. You've been into Dulles, of course. (**Storey:** Yes.) You get on the bus and you ride into the terminal, get your luggage and so on and so forth. Oh, I know who else was along, it was the chief construction engineer. I think his name was Ralph Gullet, I'm not sure. But anyway, we get to the terminal and get in there and get our luggage and get our suitcases off the carousel and so on and so forth, and I look around at these guys and I said, "Who's got our drawings?" Each guy looked at the other guy and each guy looked at the other guy. The drawings had been left on the airplane. These were our charts that I was going to show to the Secretary of the Interior. They were so valuable we wouldn't check them (chuckles) we carried them on, and everybody walked off the airplane and nobody had the charts. We had to go up there to the gate and get a special dispensation to ride out to the airplane to retrieve our charts. (chuckles)

But anyway, the next day, accompanied by the commissioner, we had the meeting with the assistant secretary of interior, and we started off with a slide show,

to show what the Third Powerplant was, what it was like, what it was going to be like, and the status of construction at that time. So we gave him a good briefing on what we were talking about. The assistant secretary was accompanied by a couple of his staff assistants. I don't know who they were, but they were rather young fellows in blue suits and white shirts, I remember. After we gave them a briefing of what the problem was, then we put up these charts, and this big chart to show the alternatives.

And one of these young fellows says, "Well, great, we got a decision tree." That's the first time I'd ever heard that term. Have you ever heard that term?

Storey: Yeah, but it's a more recent term, I think.

Arthur: I'd never heard that term. And I found out that these guys were both from Harvard Business School. (chuckles) So they were convinced right off the bat, because here we had a decision tree, something that they *really* thought was a great thing, you know. (**Storey:** Uh-huh.) So let's recess.

Storey: Okay. (tape turned off and on) We were talking about the meeting in Washington. So I take it Horton agreed with the decision?

Arthur: Yes, he did.

Storey: Did you want it in writing, or did you just want the meeting? How did that work in your mind, in order to . . . .

Arthur: I just wanted the meeting. No, I didn't need it in writing, as long as I had the meeting and others were present.

Storey: Did Commissioner Stamm also attend that meeting?

Arthur: Yes, he did.

Storey: Any other people from the Washington office?

Arthur: Not that I recall. May have been, but I'm not . . . .

Storey: So then what was the process you had to go through with the contract?

Vinnell Learned the Results of the Meeting with the Assistant Secretary of the Interior Very Quickly

Arthur: Let me tell you something [else] interesting about this. (**Storey:** Go ahead.) I was being called by Vinnell people during the time this process was taking place, for progress reports.

"What are you going to do? When are we going to know what you're going to do?" and so on and so forth. So I had advised them that I was going to meet with the secretary's office, and I also promised that I would get to them immediately–as soon as I had a decision–I would let them know immediately. So the meeting was over, and Horton agreed that this was the way we ought to go, it was clearly in the best interest of the government. I gathered up my stuff, I could just make the late afternoon plane back to Denver, but I took time to make a telephone call to California to the Vinnell Corporation. The guy I wanted to speak to was not there, he was out and would be back in a little bit. So I went out, I got on the bus at the terminal building there, rode out to Dulles, and I had a few minutes before boarding the plane, so I got on the phone again and I called Alhambra, California, headquarters of Vinnell Corporation, and the guy was at his office and he answered the phone, and I said, "This is Harold Arthur."

"Harold," he says, "I hear you got it done."

I said, "Yeah, you're right. We're going to renegotiate the contract."

He said, "Well, we certainly appreciate it." It was interesting to me, in the time it took me to get from the secretary's office to Dulles, that he'd already found out about it.

Storey: Uh-huh! Was this the President that you were talking to, who had approached you originally?

Arthur: No, the President who talked to me originally–and I'm trying to remember his name–it wasn't Vinnell, Vinnell had passed away–he was an elderly guy in very poor health, and the fellow that I dealt with subsequent to that I guess was called their CEO [chief executive officer]. He was an attorney by profession. So anyway, all this is an example of what can happen sometimes.

Storey: Yeah, it's a good example, I think.

Arthur: I should say that when this job was ended, when we finaled-out the contract, we paid a total of–I think it included the $7 million–we paid a total of $29 million, extra, on this $110 million contract.

Storey: That's a pretty sizeable percentage, isn't it?

Arthur: Yeah.

Storey: Did you ever discuss with them why they hadn't followed your critical path and whether or not that might have saved them some troubles and things?

Arthur: No, in our first discussions I talked to them about that, because when he first approached me, I didn't say, "I agree with your position, we ought to renegotiate."

He said, "Well, I think the government's responsible."

And I brought up the reasons why I thought Vinnell was responsible. That was part of it. We never really got into debating it or analyzing it.

Oh, there was another interesting point on this. Vinnell had taken the position that it was impossible to do this job within the time available. So I said, "You're also in a position to make this a self-fulfilling prophecy." So as part of the renegotiation, I insisted that they change sponsorship, and that Vinnell no longer be in control of the actual construction, that one of the *other* partners take over. I didn't care whether it was Mannix or Dravo or Lockheed, "But," I said, "I'm not willing for Vinnell to continue running the Project. Somebody else has got to take over."

One other stipulation. They had a contractors' superintendent for the joint venture on the job, the contractors' top man. According to what I knew of him, and according to Duck's evaluation, was a *top-notch* construction superintendent. He *really* knew his job. The things that he had been doing wrong, what we considered to be wrong, working out of sequence and so forth, was the result of the directions he was getting from the home office of Vinnell. So we didn't hold *him* responsible for it, and he had a lot of background and had been there over a year working on the job. So we specified *he* be retained, but the sponsoring company be replaced. So the President of Dravo Corporation from Pittsburgh came out to Denver, and we renegotiated the contract with him. And the Dravo Corporation took over the management of the job.

Storey: How do you spell that?

Arthur: D-R-A-V-O.

Storey: Okay, and Mannix I presume is M-A-N-N-I-X. (**Arthur:** Yes.) And the other company, Lockheed. I think that we can get that.

Arthur: They were known as VDLM, that was the contractor.

Storey: It's nice that they had the L-M on there! (chuckles) How long did it take from the time that you were approached at the Beavers meeting until the decision had been made? How long did that take, do you happen to remember?

Arthur: I expect a couple of months. I'm not sure, I don't remember.

Storey: So they were on pins and needles for a little period of time there.

Arthur: Yeah, I expect as much.

Storey: What was the logic of saying it had to be one of the other companies running it? I'm not quite following why you insisted on that.

Arthur: Because Vinnell had built their whole case that what they were being required to do by the contract was impossible to accomplish. So I was damn sure they weren't going to accomplish it. They could prove to me it couldn't be done, because they wouldn't do it. So I wanted to put somebody else in there that I would think would be more motivated to try to get the job done. And in my opinion, Vinnell hadn't shown the necessary leadership on the job at that point in time, so I thought somebody else could do a better job.

Storey: While we're talking about all this multitude of things that you were involved in as assistant chief designing engineer and chief designing engineer, I'd like to talk about what were the stages of project development. Is this a logical place, or is it more logical when you were chief engineer?

Arthur: I don't know yet (chuckles) until you ask me the question.

Storey: What were the stages that Reclamation went through to design a project from beginning to end? From the very first time somebody came in and said, "You know, we ought to study 'X' project." What happened in Reclamation in order to study a project, and then to design it and construct it?

Arthur: Well, with the exception of the short time I was in the region, all of my experience was in the design and construction end of it. The project development and planning was carried out by a separate division in the chief engineer's office, prior to the establishment of the regions. After the regions were established, it became the primary responsibility of the regions, the project development. The regions were

established right after the end of World War II, when it was envisioned that Reclamation was going to, and *did*, expand greatly.

Storey: Actually established in '44, I believe.

Arthur: Yeah, well, it was with the end in sight.

Storey: In preparation for the end of the war.

How Reclamation Studied Projects for Potential Construction

Arthur: Yeah, that's why, they were getting ready for a big program and so forth. So they wanted more administration, decentralized administration, and more contact with the local people. And just how it was done prior to the establishment of the regions, I'm not sure. I'm not sure how it was done. In the regions, well, early-on in the Reclamation movement, the Reclamation Act of June 17, 1902, provided for the government assistance development of the irrigation projects, reclamation of the West. And provided that the government could contract with irrigation districts. The government couldn't contract with individuals, but could contract with organizations that would have been set up under various state laws and so forth for this purpose, these irrigation districts. So when people in an area wanted to take advantage of this funding through the Reclamation Act, they formed districts so that they could interface with the Bureau of Reclamation. And these districts would . . . . I guess these districts would ask for an evaluation of their . . . .

END OF SIDE 1, TAPE 2. FEBRUARY 14, 1995.
BEGINNING OF SIDE 2, TAPE 2. FEBRUARY 14, 1995.

Storey: So the districts would ask for consideration of a project.

Arthur: And local offices would be set up in the area to investigate the project and evaluate it and so forth. These offices would be established, and then when their work was completed, they would be discontinued. That was prior to the establishment of the regions. Then when the regions were established, the districts would work with the regions, and these projects would be evaluated. the project would be formulated, be planned, and they would come into the chief engineer's office for preparation of the plans and estimates. In the Earth Dams Section where I worked, we would have preliminary designs. We'd prepare preliminary designs of dams and various projects, based on preliminary data or reconnaissance data, or a little exploration and so on and so forth, to get a cost estimate for the project features, to determine what the project would cost. And if this were attractive to the irrigation districts, further

study would be made to advance the plans where they could go to the Congress for authorization for appropriations. And at that stage, feasibility estimates were prepared, and these were supposed to be higher-grade, more reliable cost estimates that could be used as a basis for getting appropriations from the Congress.

Now the irrigation districts would take the lead in working with the Congress. It was their project, the Bureau was just a service organization providing engineering services, providing financing, and so forth. But it was still local people, working through their congressional delegation, that would get appropriations for the project.

Now the Bureau got appropriations for making these general investigations. These first-stage investigations were made, *I guess*, without cost to the district. Later on, these costs would be charged against the project, when we got to the feasibility stage, was my understanding. My participation, as I explained, was in preparation of those preliminary designs and estimates, feasibility designs and estimates.

Storey: Who decided whether it was logical to build a project?

"The local people who wanted the project, were promoting the project . . ."

Arthur: Well, there would be, of course, the local people who wanted the project, were promoting the project, and there would be an economic analysis made of the costs and benefits to determine whether the project was economically viable. If the Bureau's estimates showed that the project would cost more than the benefits, well, irrigation districts didn't have much chance of getting appropriations through the Congress. And the higher the benefits in relation to the costs, the more attractive the projects would be. And of course these projects were kind of parceled out around the seventeen western states, because these projects were brought into being because of local interest and their representatives in the Congress. So one year Colorado would get a project, the next year Idaho would get a project, and so forth. Projects were distributed around the area, around the territory.

Storey: One of the criticisms of Reclamation in the past has been that our cost-benefit ratios were not very accurate. How would you respond to that criticism, or that point, if you wish. I think the implication is that Reclamation had more of an interest in it [promoting the project] than what you've been describing to me.

Arthur: We've already touched on the fact that when you're making estimates and you don't know too much about the geological conditions at the site and the foundations and so

forth, that your estimates are usually on the optimistic side. So cost overruns were common, that's true.

"Now as far as the benefits were concerned, these benefits were arrived at by economists, not by engineers. . . ."

Now as far as the benefits were concerned, these benefits were arrived at by economists, not by engineers. I don't know how they were arrived at. Well, they were arrived at, I know in general, they figured here you had land that under dry farming would produce hay, that's worth so much, and if you irrigate it, you could produce sugar beets and that would increase the crop value that much, and that was the general approach–how much additional revenue would be generated by the increase in production from the farmland. Plus, there were, of course, the multi-purpose projects, there were other benefits to be considered such as flood control, and fish and wildlife, recreation, all those sorts of things.

"A Lot of those values are intangible to a large extent. . . .This is all very subjective."

A lot of those values are intangible to a large extent. Like, how much is it worth to you to be able to go out and fish in a lake? How much would you pay a day, or something? How much is a visitor's day worth at a reservoir? This is all very subjective. And of course, can be criticized by people who are opposed to a project, and also by people who favor the project saying, "Hey, you're understating the benefits!" So I don't know, it's a matter of opinion.

There's a lot of intangible benefits that flow from the projects also: increased tax bases, is one of them. The influx of construction labor in the economy and that sort of thing. You ever been up in the Columbia Basin up in Washington where you've got these nice towns and businesses thriving, and the communities? None of those would be there without the irrigation. How does that factor into the benefits? I don't think those were really considered as much as they should have been.

Storey: Is there anything else we should talk about, about design and development in a general sort of way?

Arthur: Well, of course, after the project was authorized, and money appropriated for construction, that's when actually the preparation of the design started, final designs and specifications and so forth.

Storey: But we had money for preliminary kinds of work. Did we have to have authorization to look at "X" project, or was that pretty much at Reclamation's discretion, so far as you know?

Arthur: I think that was pretty much at Reclamation's discretion. I'm sure Reclamation planners were looking for opportunities. It wasn't always that the farmer had to form an organization that would come in. I'm sure there were cases where planners said, "Hey, there could be a good project here if you guys would get together and organize and work on the development, I think we could bring something in." I'm sure that happened.

Like I mentioned when we were talking about Cachuma Dam, the Board of Supervisors, when they got this reduced estimate that made the project look economically viable, they came to Denver and went right into Washington to see their congressional delegation, got the project authorized and stuff. So it's really the local people that were the driving force, I would think, and the planners were more of a service organization.

Program Sessions Within Reclamation Determine the Proposed Work for the Coming Years

Storey: One of the things I'd like to discuss is the way Reclamation internally planned its work, the so-called "skull sessions,"[5] I think it was. When did you first become involved in that, and what was your involvement at first, and what were they like?

Arthur: I think I first became involved when I was assistant chief designing engineer, and I became more and more involved as time went on, as I went higher in the organization. And what it was, skull practice was the allocation of resources. The Denver office was a finite resource: with so many designers and so many engineers, and had such-and-such capability. We could accomplish so much in a given period of time. And it was matching the resources to the programs that the regions wanted to be carried out, was the basis for the skull session. We scheduled the work *and* allocated the funds that would be required–not only to perform the work, but to finance the construction of the projects. Obviously, we couldn't build all the projects at once. In a nutshell, that's what it was.

5. Note that the interviewer used an incorrect term which carried through this section of the interview with Mr. Arthur. "Skull Sessions" were when the commissioner met with his top managers to prepare for hearings before Congress, especially budget hearings. "Program Sessions" were internal Reclamation planning sessions where top managers determined what work Reclamation would request funding for and support–generally within overall budget limitations established by The Administration.

Storey: Who attended?

Arthur: all the regional directors, all their planning people, the assistant regional directors, their program coordination people–that pretty much covered the regional representatives, and then the chief engineer and the chief designing engineer, assistant chief designing engineer, chief of planning, chief of research I think. That's all the top brass.

Storey: That's the Denver office.

Arthur: Of the Denver office, and all the top brass of the commissioner's office.

Storey: Including the commissioner.

Arthur: Oh yes, the commissioner and assistant commissioners and all the staff people that had programs and coordination, finance and planning and all that jazz.

Storey: Say Grand Coulee, third powerhouse, for instance. How would that have played out at the skull session? Did it start out small and grow as the years went by? I still don't understand quite the interaction that was going on.

Arthur: Well, when the . . . . (long pause) I'm trying to think where the schedule for design . . . . I don't think we had any advance planning on that project to speak of. In other words, this is different from an irrigation district getting a project and so forth. This was the Bureau, because of the efforts to meet the Bonneville Power Administration's request for additional power. This was a Bureau-sponsored project, not an irrigation district. And the Bureau went in for authorization, I think, for planning, to begin with. I don't recall. But we had to make enough study someplace, we had to have money to make a study to determine the overall costs of the project and the benefits of the project before we could go in for construction appropriations. I don't recall how that was handled. I would have been chief designing engineer at that time, and that wasn't my responsibility.

Storey: Well, maybe I misled you in using third powerplant as an example–a *typical* project that would come in and be discussed at the skull session. Was there a lot of give and take between the regions? Or how did all this work? What was the interaction that was going on?

Arthur: Oh, yes, right. Well, it was kind of a round robin conference, and the regions would meet with the Washington staff and with the chief engineer's staff, one at a time, and it was the Washington office that was pretty much coordinating the activities as to

what would go what in which region, and the chief engineer would schedule how long it would take to do his work and what he could do within the time and so forth. But the chief engineer didn't referee whether we're going to build "X" dam in Wyoming or "Y" dam in Texas. That was the commissioner's office that was doing that.

Storey: That was the commissioner's responsibility, because that was policy.

Arthur: Yeah, right. It's the commissioner's office that's working with the congressional delegations. It's the commissioner who's working with the senator from Wyoming and the senator from Texas. He's got to tell one, "Well, we can support your project this year." He tells the other guy, "Well, maybe two years from now we can fund your project, or we can try to go for your project." They're the ones who were scheduling the thing, overall schedule.

Storey: Uh-huh. The input, though, that was coming in from the chief engineer's office then was, "We have enough to do Wyoming this year and maybe Texas next year"? Or how did that work?

Arthur: Well, it would be a joint deal, yeah. The commissioner would say, "We have these projects and so forth, and we'd like to do this and we'd like to do that." And of course a number of projects could be worked on concurrently, because they're all in different stages. Some are in the planning stage, and some are in the construction stage, and so forth. Of course the priority has to go to ongoing construction. I mean, you can't shut down a contract because you didn't have time to do the engineering work. So that gets first call.

Storey: But this was sort of the heyday of Reclamation's construction, back in the 60s, I think.

Arthur: Yes, the 50s and 60s.

Storey: There were a lot of projects going on then, a lot of coordination going on at these skull sessions? (**Arthur:** Yes.) How long did a skull session last, normally?

Arthur: Usually most of a week.

Storey: And where were they held?

Arthur: Well, one was held in Albuquerque that I went to. One was held in Spokane. One was held in Grand Junction. I think one was held in Amarillo. They usually tried to

schedule the conference away from a regional office. They didn't want the distractions of the regional director being at the conference and being in his home city where he would be available to the call of his own office.

Storey: Uh-huh. What other considerations went into location choice?

Arthur: Well, I imagine the consideration of facilities, of transportation and housing and restaurants and that sort of thing. It couldn't be in a very small town. I remember the one in Grand Junction–that's not a very big town–we were in a Ramada Inn over there. They had the meeting rooms, had to set up these various meeting rooms and sleeping rooms and so forth.

Let's take a break.

Storey: Okay. (tape turned off and on) We were talking about skull sessions, I believe. I think you mentioned to me off tape the other day that Floyd Dominy didn't like to go to resort areas and things.

Arthur: Yeah, that's right. We understood that he didn't want to go to places where it could be criticized that this was just an excuse for a social gathering.

Storey: Was that a concern of other commissioners also?

Arthur: I don't know. I wasn't involved in skull sessions before Dominy.

Storey: What about Ellis Armstrong and Gil Stamm afterwards?

Arthur: Yeah, it was carried on the same way.

Storey: Okay. Well, I'd like to continue, but once again, we've consumed two hours in our discussion. So I'd like to ask you now whether or not you're willing for the tapes and resulting transcripts from this interview to be used both by researchers from inside and outside Reclamation.

Arthur: Yes, I am.

Storey: Good, thank you.

END OF SIDE 2, TAPE 2. FEBRUARY 14, 1995.
BEGIN SIDE 1, TAPE 1. MARCH 15, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold Arthur, former chief engineer of the Bureau of Reclamation, on March 15, 1995, at his home in Denver, Colorado, at about nine o'clock in the morning. This is Tape 1.

Skull Sessions

One of the things I wanted to ask you about, Mr. Arthur, was the skull sessions that were carried on, when you began to participate in those, where they were held, what their character was, that sort of thing.

Arthur: Well, I first began to participate in the skull sessions when I was assistant regional director in Billings, Montana. I would accompany the regional director and our chief of program coordination to these various meetings. As I mentioned before, they were held in different places that the commissioner identified as not being resort areas, so there wouldn't be any interpretation by people that these were just a chance to get together and have a social event, that these were working sessions. And each year they were held in a different geographical area and different regions. And each region would have to host the skull session. Usually the skull session was not held in the city where the regional office was headquartered, because they wanted to get that regional director away from the everyday happenings of his office–distractions that would come about that way.

I don't recall all of the places that we met, but I remember a few: one was Spokane, Washington, one year. One was Grand Junction, Colorado. And one was Albuquerque, New Mexico. Those are three that come to mind at the moment.

Storey: What was the purpose of the skull sessions? Have we already discussed this?

Arthur: Yeah, we have.

Storey: Okay. Was there another *annual* meeting that pulled together a similar group of people for planning purposes or something, that you remember?

Arthur: Not that I remember on a regular basis.

Engineers Doing Independent Consulting While Employed by Reclamation

Storey: Okay. One of the other things I wanted to discuss briefly with you was independent consulting. I found out through conversations with Carl Hoffman that Jack Savage, for instance, had a fairly active consulting business *while* he was the chief design

engineer. (**Arthur:** Yeah.) And you mentioned something about that, after one of the previous interviews, and I was wondering if you could elaborate on that.

Arthur: Yes, Savage was a consultant on the Three Gorges Dam in China, I mentioned that, before World War II. And what other assignments he was on or had, I'm not aware of. I'm just aware of that work that he did there.

Problem at Ross Dam in Washington State Results in Prohibition on Outside Consulting by Reclamation Engineers

Storey: Ross Dam, I believe, in Washington State was one of the things he was involved with.

Arthur: Yes. I don't know really how much he was involved in Ross Dam, but since we mentioned Ross Dam at the last meeting, I've recalled that the person who seemed to have been involved in the consulting in Ross Dam had brought some criticism back to the Bureau, and resulted in doing away with the ability to do consulting work. It was a guy by the name of Ireal Winter, I-R-E-A-L Winter, and he was the head of the Hydraulic Machinery Branch in the Denver office. This was the organization that was responsible for selecting the characteristics and type of turbines to be used in hydroelectric power production–pumps and that sort of thing. And somehow he was involved in consulting, and as I understood, got crosswise with other consultants with different ideas of how things should be done, and as a result, the whole idea of the Bureau's engineers being involved in this private work came into question. Instructions were given out that this was not permitted in the future for Bureau engineers to take on private work. Though I mentioned before this happened that I had done a couple of small jobs in the Denver area involving earth dams that were being designed by local engineering concerns, asked my advice.

Consulting Jobs Arthur Completed Before the Ban on Outside Consulting Work

Storey: Oh really? Where were those?

Arthur: One was out in Eastern Colorado, and one was down in Colorado Springs. The one in Colorado Springs was an existing dam and they were concerned about the safety of the dam because of some seepage that was occurring. I was asked to consult on that. The dam out east was a small dam of the type that used to be built by the CCCs [Civilian Conservation Corps], and I was asked to advise them on the design of that, and particularly of the determination of an appropriate in-flow design flood. It was about that time that I had just finished editing *Design of Small Dams* so I used the procedures there, given in the chapter on flood studies.

Storey: Do you remember the names of either of these?

Arthur: No, I don't.

Storey: Well, chronologically, we had gotten to your being chief designing engineer from '65 to '68 and your trip to Angola–I believe that was with Dominy?

Arthur: Yes, that's correct: Angola, South Africa, and Mozambique in Africa.

Storey: What position did you have after you became chief designing engineer?

Arthur: Well, I *was* the chief designing engineer.

Storey: Uh-huh, we had talked about that, I believe. Where did you move to for your next position?

Becomes Associate Chief Engineer, Later Known as Deputy Director of Design and Construction

Arthur: Oh, excuse me, I didn't quite understand the question. My next position, the title name was associate chief engineer. And that was the number two job in the Denver office at that time. The title later was changed to deputy director of design and construction, during the time that Armstrong was commissioner. And I was in that position for four years, I believe it was.

Storey: About 1972 then.

Arthur: Right.

Storey: What did you do as the associate chief engineer?

What the Job of Associate Chief Engineer Entailed

Did Much of the Arrangements for the United States Committee on Large Dams (USCOLD)

Arthur: Well, the associate chief engineer was the right-hand man of the chief engineer. It was essentially a staff position, as opposed to a line position. In other words, I didn't have the responsibility for supervising any of the organization directly, but I assisted the chief engineer who had the overall responsibility. And I would sort of carry out the various functions that needed to be done that the chief engineer delegated to me,

with regard to staffing and budgeting and that sort of thing. Also during that time, the chief engineer, who was Barney Bellport, became the chairman of the United States Committee on Large Dams. And there was quite a bit of correspondence involved with that, and handling the activities of the organization, arranging for meetings, and that sort of thing. And he pretty much delegated all of that type of activity to me. And at the same time, I was appointed chairman of the technical activities committee for that organization. In that capacity I was responsible for soliciting papers for the international congresses, and selecting the papers that were to be published in proceedings, which included the editing of those papers and getting comments on them from other members of the organization, that sort of thing. That took up a lot of time. The United States would be allocated, as I remember, sixteen papers to be presented at the congress, and ordinarily four of those were assigned to the Bureau of Reclamation, four to the Corps of Engineers, and eight to the private sector. And these would be apportioned out and each congress would deal with four questions, and each paper would have to be pertinent to one of those questions for discussion. So that kind of activity took up most of my time.

Storey: Now, we're talking about the international ICOLD, right?

Arthur: Yes.

Storey: And Mr. Bellport was the President of ICOLD, or the U.S. Committee on Large Dams?

Arthur: U.S. Committee.

Storey: And how does that relate to ICOLD then?

How USCOLD and the International Committee on Large Dams (ICOLD) Interact

Arthur: Well, ICOLD is composed of national committees of seventy-some foreign countries throughout the world. Of course the United States Committee was one of the most influential because of the resources of the United States and the number of engineers who belonged and that sort of thing. But as I mentioned earlier in our discussion, the Dominy trip to Spain was really triggered by a fellow who was President of the Spanish National Committee. So each of the Chairmen of the National Committees in each country were leaders in the dam-building business.

Storey: How often did the International Committee meet?

ICOLD Congress Met Every Four Years

ICOLD Had Executive Meetings Every Two Years

USCOLD Met Every Year

Arthur: Well, the congress–this was the *big* overall meeting–was every four years. In between, at two-year intervals, were executive meetings in which the working committees of the international organization would have like a mini-congress. And there there would be the reports from the various committees that were working on various tasks that had been assigned, and discussion of other activities that should be carried out, and that sort of thing. Then every year, at least in the United States, the U.S. Committee had a meeting in which all the members of the U.S. Committee, of which there were a couple hundred, were invited to attend. And there there would be preliminary papers. This is one way that papers were screened to go to the international congress later on. There would be preliminary presentations of some of these papers, that sort of thing. So it was sort of a busy thing.

Storey: Uh-huh, and I suspect there was a lot of jockeying in order to be able to give papers.

Arthur: Yes.

Storey: And so there were pressures on you about this, (**Arthur:** Yes.) especially, I suspect, from Reclamation people maybe?

How Papers Were Presented at ICOLD

Arthur: Well, from across the board, because this was a very prestigious sort of thing, and there were a lot of authors who were very anxious to enhance their reputation by preparing technical papers, having them accepted for publication. And whereas in many organizations papers are delivered at the various international meetings, in the case of the ICOLD, they were prepublished, and the purpose of the congress was to discuss the papers, dissect them, ask questions, and supplement and this sort of thing–it wasn't just deliver the paper. So they were much more productive in disseminating the information and in sharing the technology involved with the design and construction and operation of dams.

Storey: It's an interesting approach, too. (**Arthur:** Yeah.) Do you remember any incidents where people were putting pressure on to be one of the presenters?

Arthur: No, I don't. The call would go out for papers, members who were interested in preparing papers were asked to prepare abstracts, the abstracts would be reviewed by my committee, the technical activities committee, which had representatives from various private organizations, as well as the Corps of Engineers and TVA. On the basis of the abstracts, the authors would be selected, who could prepare the papers, who could give the papers.

On each of these questions, that were dealt with in each congress–as I mentioned, there would be four questions, four areas–these had been selected two years before the congress at one of these executive meetings I spoke about. There would be an international committee set up for selection of questions, and the questions would be selected on the basis of the need to make certain information available to the profession and to get information on problem areas and that sort of thing.

Then at the actual congress, there would be a general reporter for *each* of these questions, and the general reporter had the task of preparing a summary of all the papers that dealt with his question. And there might be like thirty or forty papers, and he had to pick out the gems of information out of these papers and summarize the whole thing. And he would deliver his summary, and then there would be discussions from the audience. The general reporter would be accompanied by a panel that would be selected from the general membership of ICOLD–there'd be a panel for each of these questions–they would be recognized experts in that particular field, and then there would be discussions between the members of the audience and this panel. The procedure called for the questions to be submitted in writing prior to the meeting and then after those were handled there were extemporaneous questions that were handled. I was the general reporter on one of the questions at an international meeting in Madrid one time. And I also was Vice Chairman of the United States Committee, in addition to serving on the Technical Activities Committee. So I was pretty involved in that.

Participation in International Commission on Irrigation, Drainage, and Flood Control (ICID)

I was also involved in the International Commission on [Irrigation,] Drainage and Flood Control. I was on the Executive Committee of that. This was organized very similar to, it was called ICID.

Storey: Were papers presented in one language?

Languages Used at ICOLD

Arthur: No, all the meetings were conducted in three languages: English, French, and the host country. So if it was in Turkey, everything was in English, French, and Turkish. China: Chinese, English and French.

Storey: And were all the papers translated into those languages?

Arthur: The papers were published in English and French only. One requirement of membership was that the members had to speak one of these languages, either English or French. I should say that the ICOLD was an outgrowth of the–I think it was called the World Power Conference that was held in the . . . maybe right after the war.

Storey: And I presume when you say World Power Conference, you're referring to hydroelectric power?

Arthur: No, I'm referring to an early form of the United Nations.

Storey: Okay, which was probably then *pre*-World War II.

Arthur: This was before the United Nations. Yes, might have been [pre-World War II].

Storey: Let's see, I'm not sure, I think the United Nations was created in '44 or '45, I may be wrong.

Arthur: It was created after the war, yeah, or just at the tail-end of the war, right.

Arthur's Attendance at ICOLD

Storey: Okay. So then how often did you attend these? And when did you start attending international congresses?

Arthur: When I was chief designing engineer, I started attending. Then I attended most of them after that. When I was assistant chief designing engineer, I didn't attend. As I mentioned earlier in our discussion, when I met Dominy in Africa, he had been attending an international congress meeting in Istanbul, but I didn't attend that. So really, I guess I was associate before I really attended many of the meetings and had this office in the U.S. Committee.

Storey: Uh-huh. So when they got together to discuss the papers, did they do it one paper at a time? How was this done? At the international congress, I believe you said the idea was that the papers were pre-published.

Arthur: There would be a session on each *question*, and there would have been prepublication of the papers, by questions. They'd be segregated by questions. Then all the papers pertaining to a single question were summarized and commented on by the general reporter, and then the discussion was held with the general reporter and the panel. The papers were not presented.

Storey: Right, but they were discussed. (**Arthur:** Yes.) But they were discussed as a whole? (**Arthur:** Yes.) So you would have maybe thirty people on this panel?

Arthur: No, it would be maybe four or five. Of course when the questions came up, some questions would be pointed at a particular paper, like some engineer would say, "In paper number such-and-such the author said that he had obtained these sort of results on an experimental test, or something. My experience has been quite different, and this is what happened to me. I would like to show a slide of my findings." That sort of thing. These sessions would last a half a day on each question.

Storey: So were the people who actually wrote the papers present?

Arthur: Usually. It depended on . . . . They were all *eligible* to attend. In the Bureau, of course, the attendance that the government would pay for was severely limited. They wouldn't send anybody just because they wrote a paper. They had to have some important part to play in the organization. Like when I was Chairman of the Technical Activities Committee, or general reporter, I had an important role. Then the ICOLD established committees to study various aspects of the technology: dam design, construction, and operation. And these would be international committees, and the United States usually had a member on the committees, and other countries would have members on the committees. And these committees did their work throughout the year by chiefly correspondence. But when a congress was held, the committee members came in a couple of days ~~early~~ [prior] to the congress and they had their committee meetings. So they had their coordination meetings every two years, at the executive meetings, and at the congresses. (phone rings, tape turned off and on)

Storey: You were talking about the committees.

Arthur: I have the membership directory of 1993, membership directory of the USCOLD here. I've looked at it briefly, and I see there are eighty-two countries that are listed

as members — that have ICOLD national committees. And there are eighteen U.S. members who are members on ICOLD international committees. Those people would usually attend both the executive meeting and the congresses. (**Storey:** How many folks from Reclamation would have attended back when you started attending?)

Arthur: The ICOLD congresses were usually limited to Bureau people to two or three. This took a special dispensation from the Secretary of the Interior for permission for foreign travel. So the limitations were pretty strict.

Storey: How about the U.S. Committee on Large Dams?

Arthur: Attending the U.S. committee meetings? (**Storey:** Yeah.) Well, that was much more generous. There'd be a number of Bureau people that would attend that. Those kind of meetings, of course a lot of them would have their expenses paid and some would come on their own. Anybody who had an official capacity on the committee or preparing papers and so on and so forth, they would have their way paid by the Bureau. I would say that at most of those meetings would probably be eight to ten Bureau employees.

How Arthur Became Associate Chief Engineer

Storey: Good. You didn't tell me about how you were selected to become the associate chief engineer.

Arthur: (chuckles) That's a long story!

Storey: Good! (laughter)

Selects Bill Wolff as Assistant Chief Designing Engineer

Arthur: When I became chief designing engineer, of course my promotion to chief designing engineer created a vacancy as assistant chief designing engineer. So we advertised the position, went through the procedures and a number of people applied. I was looking for an assistant in the civil area, because I had an assistant mechanical engineer. There were two assistant chief designing engineers. I had the electrical and mechanical, so I was looking for the civil structural. And one of the applicants in the Denver office, I knew him, but not real well. But I knew of him and had met him, and his name was Bill Wolff, W-O-L-F-F. And he was a structural engineer and worked in the Structural and Architectural Branch, reinforced concrete design specialist and so forth. He was well qualified and I interviewed him, and finally I

selected him as my assistant. He worked out very well. He was about my age, he was very bright, he worked well with people, and was a good engineer. He had been my assistant for about . . . .

END SIDE 1, TAPE 1. MARCH 15, 1995.
BEGIN SIDE 2, TAPE 1. MARCH 15, 1995.

Storey: You were saying that Bill Wolff had worked out very well and had been your assistant for about eight months.

Arthur: Yes, when the vacancy occurred for the associate chief engineer. Mr. Bellport came over to my office and said, "Harold, I'm going to take Bill Wolff as my new associate," which of course would jump Bill over me, he'd become chief associate engineer, and I'm chief designing engineer. He said, "I like the way Bill operates and I think he's a very good man. I think he'd make me a good associate."

Bill Wolff Becomes Associate Chief Engineer

I said, "Well, I agree with you. Barney, he's *my* assistant. I selected him, you didn't even know who he was. I selected him, and he's been working for me. Just recently he's become acquainted with the job. It took a while to find out everything he has to do here, and he's my right-hand man. You're really doing me a disservice."

"Well," he says, "I can't help it. I appreciate all that, but [you] can't stand in the way, I got to have Bill. You can have anybody you want for your new assistant that the Civil Service Commission will qualify for the position, but I'm going to take Bill Wolff." So Bill Wolff became the new associate chief engineer. He was in that position maybe for a year when he had a sudden fatal heart attack and passed away.

Barney Bellport Approaches Arthur about Becoming Associate Chief Engineer

So Barney came over and he said, "Harold, I want *you* to be my associate chief engineer. You think it over and tell me in the morning. I'll let you think about it."

I said, "Okay." So he came in the next morning and I hadn't thought about it. I should say at this time that these promotions were all paper promotions, everybody got the same salary, because the chief design engineer was a GS-16, the associate chief engineer's job was a sixteen, they paid the same. Actually, I think I was getting the same money as the chief engineer, because we all had bumped up against

the ceiling that'd been placed by the Congress, because we couldn't earn more money than some congressman or some [such] dealie. You know, it's all this sort of thing. But it's the prestige that counts.

So Barney came in and he says, "Well, are you ready to come over and be my associate?"

Arthur Informs Bellport He Wants to Remain on as Chief Designing Engineer

And I said, "Barney, I appreciate your confidence in me, but you know, all my life in the Bureau of Reclamation I've had one ambition, that was to be chief designing engineer. I *am* the chief designing engineer, I love the job, I'm *very* happy in what I'm doing. I would rather stay in this position which is a line position than be in a staff position. Thank you very much, but I think you'd better select somebody else for your associate chief engineer."

He said, "Now wait a minute. One of my responsibilities is to develop somebody who can take my place when I retire. *As you know,* the most important function in my job is contract administration, dealing with the contractors and claims. You've got a lot of experience with the Bureau, but you don't have any of this experience. You can *never* be the chief engineer unless you have some background in contract administration. You'd better come over as an understudy if you want to be chief engineer. You think about it, and I'll talk to you tomorrow."

". . . this is a technical job, and this is what I really want to do . . ."

So the next day he came in and I said, "I don't know as I want to be a (laughs) chief engineer, Barney. I know you spend a lot of time interfacing with the commissioner and a lot of things that are not technical, but they're management. It's a manager's job, a very important job, I agree with that, but it's essentially a manager's job. And this is a technical job, and this is what I really want to do, this is what I really want. I don't aspire to your position."

Bellport Orders Arthur into Position of Associate Chief Engineer

He says, "God damn it, Harold, I want you to come over and start in tomorrow." (chuckles) *That's* how I became associate chief engineer! (laughter)

Storey: Oh-kay. It sounds to me as if in addition to your work with the Council on Large Dams, both International and U.S., you had some other things that you were doing as associate chief engineer then, in contract work maybe?

Other Responsibilities Besides ICOLD

Dealing with Contractors' Claims in the Chief Engineer's Office (Chief Contracting Officer)

Arthur: Yes, when he had these meetings with the contractors, to go back a little further, see, when a contractor has a claim for extra work or changes or something that he thinks he's entitled to more money than he would get in the normal course of events, he puts in a claim to the construction engineer in the field.

The construction engineer had authority to pass on these claims to a limited amount, depending on–his authority was given by the chief engineer, and the extent of his authority was limited depending upon his seniority, his experience and background, and capabilities, and the size of the job. He might say, "Well, [the] chief engineer from whom I have delegated authority and he can settle any claim up to $10,000 or up to $50,000," but rarely, that would be the most.

Any other claim would have to be submitted to the chief engineer with the construction engineer's recommendations and findings. Of course the construction engineer would evaluate the claims, say "I agree with it," or "I don't agree with it," and "the reasons are this or that. My recommendations are this or that.".

Then these claims would be evaluated by the Contract Administration Section. It was headed up by a chief construction engineer at that time, in the Denver office. And he had a staff of people. They would go out to the field, talk with the construction engineer, make any in-field investigations that were necessary, talk to the contractor, go over the contractor's books if necessary, review all his documents, and make a finding.

Well, if they agreed with the claim, then it would be submitted to the contracting officer, the chief engineer, for approval. And he would review the record and the recommendations of his staff and so on and so forth, and usually approve it. Or if he had some questions, he would ask for additional information. But in the end, usually if everybody was on board that ought to be–that the claim was justified and the contractor ought to be paid extra, well, he would approve it. Then the recommendation would be sent to Washington. It required administrative approval in Washington. This was always just a matter of form. But once in a while they would raise some questions just to let you know they were there, reading the thing.

However, if the construction engineer in the field, or the construction administration people in Denver did not agree with the contractor's claim, or agreed

partially but the contractor would not accept their recommendations–in other words, if they came to an impasse, then the contractor would request a meeting with the contracting officer, the chief engineer. And they would come into Denver, meetings would be arranged, and they would come into Denver, the contractor would always bring his attorney and his key members of his staff, his superintendent, and the documents. Really, the documents had been submitted in advance so that they had been evaluated by the chief engineer's staff. But he'd bring in various things.

The chief engineer, contracting officer, would sit there and I was present too. Then there would be the chief construction engineer and the contract administration people that made the analysis, and there would be certain design people there, depending upon the nature of the claim and so forth. And the contractor would make an oral presentation of his claim, and he'd describe how the "big bad Bureau" mistreated him and how he'd lost money and how the specifications were ambiguous, and how conditions in the field were different than what he was led to believe from the geological exploration, and *all* these things that were the basis of his claim. Then the Contract Administration people would all comment on, "Well, hey, the specifications say this, you should have known. We had this drill hole here that showed this rock at this elevation. You can't say now that you were anticipating that the rock was down there twenty feet deep, when the drill hole showed it was only ten feet to rock," and this sort of thing. Refute his claim, in other words. And then if there were questions about the specifications, we'd ask the designers, "What was your intent when this language went in there about this work should be done, what was the intent there?" There would be just a give-and-take discussion. And depending on the nature of the claim, some of these sessions lasted several days, depending on what was involved and so forth.

And then the procedure was usually the two groups would divide and go into separate rooms, and the contracting officer would say to his people, "Well, you heard what the contractor said. What do you think about it?" The validity of his claim and so on and so forth. There would be a frank discussion of where they were.

Oh, the solicitor's office was always represented too. And we'd have the legal input of where we stood on this thing, and then there would be an evaluation of, well, okay, so the contractor had some problems, and maybe he's entitled to some extra, but is it reasonable, what he's asking? Is that a reasonable amount? Usually it wasn't. Contractors usually ask for more than they expected to get–typical negotiation.

In the other part of the building, the contractor's people were having similar discussions about, "Well, what do you think about the Bureau said this and the Bureau said that, and so forth. What do you think we ought to do? and so forth."

Then finally we'd convene again. Usually, there was some merit to the claim. They didn't come in with just no facts on their side at all, because they knew we weren't running a charitable organization. So there was usually some merit to their claim, but usually it was overstated, in the cost and effect. So we would discuss the impact of various events on the contractor and his costs and so forth, but eventually it ended up that the Bureau made an offer. The contracting officer made an offer. "Well," he'd say to the contractor, "you've asked for 'X' number of dollars. We've analyzed this thing. In our opinion, true, there's some merit to your claim, but we can't agree with the costs that you have here, the costs are excessive, and for these reasons, and so on and so forth. But what we will do in order to settle this claim, we'll give you 'X' number of dollars."

The contractor [comes back with], "I can't possibly accept that." He'd [argue] why he should get more money and so on and so forth. Then the groups would split up again, then they'd get together again, and the contractor usually had a counter-offer– just bargaining, negotiating, just negotiating. And in seventy percent of the cases, a meeting of the minds was reached, and it was once said that it was a successful negotiation, because the chief engineer thought he ~~gained~~ [paid] too much and the contractor didn't think he had [received] enough. Neither side was satisfied with what they got, so it was a compromise. And seventy percent of the time, that agreement was reached.

Well this took quite a bit of skill, this negotiation process. It was always led by the chief engineer, he was the contracting officer, so he's the one that's got to take the lead and he calls upon his subordinates for opinions and stuff, but he has to pull it all together and say, "This is my opinion. This is what it is and what it's going to be." And this is what I was in training for as ~~deputy. Chief engineer~~ deputy of design and construction, to see how this process went, and learn how to do it.

Storey: Did Mr. Bellport ever just say, "You're in charge of this one."

Arthur: No.

Storey: So your training was watching?

Arthur: I would be in charge of some of the preliminary negotiations in his absence. But if he were there, the contractor felt he was entitled to talk to the contracting officer.

Bellport was the one that signed the contract, so he wanted to talk to *him*, and it was his right to do so. So I don't think Bellport felt like he could delegate it, except under unusual circumstances. For example, he broke a leg doing some work around his yard. He fell off a ladder and broke a leg and he was off work for six weeks or something like that. And of course life went on. I ran the office in his stead, that sort of thing. And he was absent quite a bit. I mean, there were these meetings in Washington that we talked about. (phone rings, tape turned off and on)

Storey: So he would be away sometimes.

Chief Engineer's Need to Visit Construction Sites

Arthur: Yeah, he'd be away. And also, the chief engineer felt it necessary, and it was necessary, that he visit all these jobs that were under construction, because the construction engineer was his representative on the job. He had to establish and maintain a relationship with these people. He had to be able to evaluate these people because he was in technical charge of these people, the construction engineer. And also he had to have familiarity with the job itself or he wasn't going to be able to handle these claims. You know, he had to know what the layout was like and so on and so forth. So the chief engineer had to maintain a familiarity with the jobs that were going on. We had a hundred and some construction contracts going on all the time. *This* took quite a bit of time. That explains why you see a picture on my wall of me in a hard hart and stuff–I was up there becoming familiar with the Third Coulee.

Storey: At Grand Coulee, Third Powerplant.

Arthur: Yeah. The other picture you noticed the other day, I was out at Auburn. Well, those weren't just junkets, those were so I would be familiar with the project and the people, so that I could carry out my responsibilities as the director of design and construction.

Storey: That was the chief designing engineer?

Arthur: No, that was chief engineer.

Storey: Okay, different titles, okay. Tell me about Bellport. You've already given a little hint of his character and his way of doing business in the way you became the associate chief engineer. What was he like?

Barney Bellport

Arthur: Well, Barney came up in the Bureau in construction. He had been a construction engineer on the Tracy Powerplant in California, but then he became regional director in Region 2 for a time.

Storey: Region 2 is Mid-Pacific now?

Arthur: Sacramento.

Storey: Sacramento, yeah.

Arthur: And then he was promoted to . . . I'm trying to remember whether he came in as the associate, or whether he came in as the chief engineer. I think he came in as associate, I'm not quite sure. But he was a construction type. He related very well with the contractors. They were all the same type of people, and what I mean by that is they were not diplomats, they were the other end of the scale, they were the doers. They weren't the talkers, they were the doers and so forth. His management style, he was pretty autocratic. Well, one of the things he said . . . . He was sometimes hard to deal with, he was pretty gruff, and he was aware of it. I think he cultivated it, as a matter of fact. One of his sayings has stuck in mind: something happened, he said, "I don't have heart attacks, I *give* heart attacks." (Storey chuckles) He said that once. After Bill Wolff died, I never heard him say that again. But you know, it was just one of his sayings, he didn't really mean anything by it. But he was short on praise and long on criticism. But I got along with him pretty well.

Storey: Did he socialize with staff?

Arthur: Yes. Yes, he did.

Storey: In what way?

Arthur: Well, he attended all the Bureau functions, and he had an annual Christmas party to which he'd invite all his top staff to, and their wives, at his home. That sort of thing.

Storey: Do you happen to know if he's still alive?

Arthur: No, he's not.

Storey: So you did that for four years, taking care of USCOLD and ICOLD activities and things for him? And sitting in on these negotiation sessions. What else did you do?

Technical Input to Contract Negotiations

Arthur: Of course I could participate in these sessions too, because of my design background. I just wasn't inactive. I was learning negotiation–I didn't *do* the negotiation, but I had a lot of technical input, because I'd been chief designing engineer and had a background in all this stuff, especially in soil mechanics and earth dams, and that's where a lot of claims would arise, would be in foundations and investigations of foundations, construction materials and that sort of thing.

Storey: Do you remember any particular incidents, any particular negotiations that stand out for you that were interesting?

Arthur: When I was the . . . .

Storey: Associate chief engineer?

Arthur: No, I don't. There were hundreds of them, literally.

Storey: Would your sense be that claims were fairly routine on any major project?

"In fact, the construction business was so competitive that the feeling was . . . that they bid the job at no profit, or maybe at a small loss, and hope to make it up on their extras."

Arthur: *Extremely so,* yeah. In fact, the construction business was so competitive that the feeling was that that's where the contractors intended to make their profit–that they bid the job at no profit, or maybe at a small loss, and hope to make it up on their extras.

Storey: On claims.

Arthur: Uh-huh.

Storey: That was the feeling in Reclamation?

"In order to be low bidder, you had to be an optimist. And. . . things weren't always going to work out the way you hoped. . . ."

Arthur: Yeah, because if they took a pessimistic view–see, they had the specifications and all the foundation excavations and the geological work and so on and so forth–if they took a pessimistic view of how much it was going to cost to do this, and how

difficult it was to do this, and how difficult it was to do this, they would never be low bidder. In order to be low bidder, you had to be an optimist. And if you were an optimist, things weren't always going to work out the way you hoped. In fact, *rarely* would they work out the way you had hoped. There'd always be some surprise, or something where your judgement wasn't validated by the facts as disclosed during construction.

Meetings of Reclamation with a Committee of the Associated General Contractors to Discuss Issues on Both Sides of Reclamation Contracting

Now during this period–and I suppose they were doing it up 'til recently, I don't know–there was a committee formed, the AGC, Associated General Contractors of America Committee, and the Bureau of Reclamation Committee, and we would have annual meetings that would last two or three days, to discuss an agenda which had been prepared thirty to sixty days ahead of the meeting, to discuss topics of mutual concern in the design and construction of Reclamation projects.

And what we were trying to do, the contractors would tell us what was wrong with the way we were operating, what was wrong with our plans, what was wrong with our specifications, and how we should improve our operations from the viewpoint of the contractor. And we would tell the contractor's association, Associated General Contractors, what our problems were with specific contractors–I mean, specific problems, not that we would name the contractors, but we would talk about contractors who had done things *we thought* were not quite ethical or were not above suspicion, that sort of thing.

We discussed our problems with the industry, they discussed their problems with us. We'd have a darned good, frank exchange of ideas. And the AGC Committee would be represented by the top people in the contractor's organizations, various organizations. And of course the chief engineer and the associate chief engineer and top members of the staff would participate in the Bureau's side of the discussions.

Storey: Do you remember any of the specific issues that were discussed?

"Over the. . . years, there was a steady improvement and evolution in our specifications"

". . . improvement in the specifications were to reduce the contractor's *risk* as much as possible, without passing the risk on to the government"

Arthur: Over the period of years, there was a steady improvement and evolution in our specifications that I think were the result of these meetings. And the improvement in the specifications were to reduce the contractor's *risk* as much as possible, without passing the risk on to the government.

How Changes in the Amount of Work Might Adversely Affect a Contractor

The inherent risk was the contractor's. For example, I think we mentioned before the contractors would base a claim . . . . Well, the contractor would bid on doing a certain amount of concrete. He'd bid so much a cubic yard for the concrete. And that price that he bid for the concrete would include him furnishing all the aggregates, usually he got paid extra for the cement, but he would furnish the sand and the gravel and the water. He would mix it, he would transport it from the mixer to the point of construction. He would construct the forms that were necessary for the construction. He would place the concrete, he would compact the concrete, he would strip the forms, he would cure the concrete by using water or curing compound. All this work would be included in the price bid per cubic yard. Well, if the quantity were changed a great deal, then his calculations were no longer valid because the . . . . Suppose the quantity of concrete were reduced significantly. He had planned on and had purchased concrete batching plants . . . .

END SIDE 1, TAPE 2. MARCH 15, 1995.
BEGIN SIDE 1, TAPE 2. MARCH 15, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on March 15, 1995.

. . . the contractor would have bought a batching plant maybe.

Arthur: . . .an excessive plant. He would have spent money, cost him more than if he bought a smaller plant. Or suppose a wall thickness were reduced from, say we were planning on a wall, the plans showed it was eighteen inches thick, and we decided to make it twelve inches thick when the construction drawings came out. Well, the concrete volume was reduced substantially, but the form work was not. They still had all the forms, and that's very labor intensive. He had all the form work to do and all that sort of thing, and the only way he could recapture that cost was on the basis of the cubic yards of concrete. So we're going to pay him for less concrete, but he's still got the form work to do. So an underrun of quantities would harm him that way. So would an overrun.

Supposing he bought this batching plant we talked of before, of a certain capacity to do a certain amount of work, and we increased that work substantially.

Here he is with an inadequate plant. He doesn't have time to go get another plant, or if he does, during that period, he cannot operate at peak efficiency, because he lacks the necessary equipment. So he's got the carpenters out there to build the forms and stuff, but he doesn't have the concrete to put in the forms. So he's kind of got standby costs. So he has claim, and he's injured either way.

So what we did in our specifications, we specified that the quantities could not vary more than fifteen percent without a renegotiation of the unit price. And supposedly the price could be negotiated up or down, ~~as~~ [since when] something ~~that~~ would save the contractor a bunch of money, the government should recover costs. Usually it went the other way, and because of the factor I just described, how it worked, the contractor's costs were increased whether the quantity went down or the quantity went *up*, because if he's a good contractor, he had figured on doing that amount. So that was one thing.

Contracting for Grouting Services

And another thing was the grouting. In the early specifications, we had the provisions for grouting the rock foundation, which consists of drilling a hole in the rock and getting the grout machine and mixing cement and water and pumping that into the hole, and we would pay, in the early specification we paid so much a cubic foot for the grout mixture that was pumped into the hole. But for that cubic foot price, the contractor had to drill a hole, clean it out, and hook up the pump, and mix up the grout, and pump it in, and when he was through, clean up his equipment and all that sort of thing. Now, the inequity in this was that if it turned out that the rock was better than what was expected, then the grout quantity was overstated. Say we thought this hole would take 1,000 cubic feet, he was going to get paid so much a cubic foot for doing this work. Well, suppose it only took a tenth of that or a small portion of that, well he'd only get paid a small amount, but it costs him still the same amount of money to drill that hole, clean it out and hook up the pump and do all these operations. The other way, if we figured it was going to take 1,000 cubic feet of grout, and it took *10*,000 cubic feet of grout, he had a gold mine, because he had figured on recovering all his costs and making a profit on the small quantity, and now all of a sudden all he's got to do is keep pumping it into the ground, you know, the hole's paid for, the equipment's paid for, and everything's sitting there, all he's got to do is run it. The bill keeps going up and going up, the government says, "Hey, wait a minute! We ought to get a cheaper price, because you would have bid cheaper if you'd known the quantity was going to be greater."

So to protect against this, the specifications were changed so that the contractor got one payment for drilling the hole, you got one payment for hooking up

to the hole, he got one payment per cubic foot of grout pumped. So it was broken down that way so that his costs would be more readily ascertainable. So that sort of thing, just for a couple of examples that come to mind.

Storey: So really, one of the things we're talking about is learning by past experience for Reclamation.

Arthur: Exactly. But the experience, what was valuable about this was the experience was going both ways and we weren't relying just on our view of the thing, but we saw the contractor having his input to the thing too, because he would be the one–we're not so quick to realize that the contractor is being harmed. We can understand it if the government's getting cheated–not cheated, but if the way it's working out is to the disadvantage of the government, we're quite aware of that, but if it's to the disadvantage of the contractor, we're not quite so sensitive to that, but the contractor is, so he points out, "Hey, look, you guys are doing this to me and this to me."

So it was over a period of years, and of course as a result, our specifications went from a document maybe, and I think maybe when I first started at Alcova Dam, I think the specifications were maybe sixty or seventy or eighty pages and they went to *hundreds* of pages, from a quarter-inch thick volume to one that's an inch, inch-and-a-half thick, because of more details that were presented in the specifications. And this affected the drawings also.

Contracting for Steel Work

Another practice that was changed was with reinforcement steel. In the early days the contractor was paid so much a pound for furnishing and installing the reinforcing steel. In later days we broke that down into sizes. He was paid by sizes, because if you're getting paid by the pound, it takes a *lot* less labor to put in a few big bars than it does to put in twice as many smaller bars, tie them up and so forth.

Storey: So you had a graduated scale for that. That's very interesting. Were there any other major things?

". . . this is the reason that you travel all over the world, and. . . you'll find a reference set of Bureau of Reclamation specifications, because they are recognized as being really the state of the art authoritative best type of specifications . . ."

Arthur: So I might say that this is the reason that [when] you travel all over the world, and you travel into consulting offices everywhere, you'll find a reference set of Bureau of Reclamation specifications, because they are recognized as being really the state

of the art authoritative best type of specifications that you can get, as evidenced by my request this morning that you help [me] get some specifications for my friend in Greece. It all ties together.

Storey: Sure. So writing specs is one of the ways that the Bureau of Reclamation has influenced dam construction around the world.

Arthur: Yes, indeed. (tape turned off and on)

Storey: . . . getting ready to ask you what other kinds of things went on while you were associate chief engineer.

Chief Engineer's Office Had a Great Deal of Correspondence and Many Meetings

Arthur: (long pause) There was a mass of correspondence between the chief engineer's office and the various regions and Washington and so on and so forth. There was a delegation of signatory authority that was throughout the Denver office, but matters affecting policy all came through the front office and it came first to the associate chief engineer. And most of it then would go to the chief engineer for signature, not (**Storey:** Uh-huh.) all of it. And there would be representing the Bureau at different meetings and so on and so forth, that sort of thing.

Storey: What kind of meetings?

Arthur: Well, interagency meetings. We had coordination meetings with the Corps of Engineers and TVA, and those were annual meetings in which we would coordinate our research activities so that not everybody's trying to plow the same furrow, so we're getting the most out of the research money that was available in the various agencies that had to do with problems on dams, hydraulics, and that sort of thing. These meetings were held in various [locations]. . . . I remember one meeting in Chattanooga with the TVA that I went to, and that sort of thing.

Storey: How did the Lab figure into all of this?

Organizational Location of the Denver Laboratories Changed under Ellis Armstrong

Arthur: Well, prior to Armstrong being commissioner and reorganizing the Bureau in this respect, the Lab was under the chief engineer. In fact, *everything* in Denver was under the chief engineer. It's when they changed the title from chief engineer to director of design and construction is when the Labs reported to the commissioner's office in Washington, and also the administrative functions such as personnel and

finance and so forth reported to the assistant commissioner in Washington. So the chief engineer's activities were [primarily] design and construction and the technical activities of the drafting and the preparation of manuals and books and that sort of thing. But they no longer dealt with the Laboratories, no longer had *supervision* over the Laboratories. Of course there was a lot of interaction between the Design and the Laboratories, both before and after–it didn't really change the relationships between those organizations. What it *did* do, it made it more difficult to allocate resources–I mean, people and money–because they were separate. The laboratory, the head of the Division of Research, wasn't under the chief engineer. He would get his allocation of resources from Washington. The further away your point of coordination is, the loosier-goosier it gets. So that, from my point of view, was a very bad move in the reorganization.

Storey: You mentioned that you were involved in the International Council on Drainage and Flood Control.

Arthur: Yeah, International Commission on ~~Drainage~~ Irrigation and (**Storey:** Commission.) Flood Control.

Storey: Were you involved at this time?

On the U.S. Executive Committee of the International Commission on Irrigation, Drainage, and Flood Control

Arthur: Yes, I was on the Executive Committee, the U.S. Executive Committee.

Storey: When did you start participating in that group?

Arthur: I think it was when I was a deputy, or associate chief engineer.

Storey: And what were their purposes? Are they actually described by their title?

Arthur: Yes, their function is to irrigation systems and drainage systems, primarily–similar to what ICOLD is for dams. One's on dams, the other's on irrigation. They're more concerned with canals and drip irrigation and salinity and crop practices and everything that has to do with the farming part of it.

Storey: Uh-huh. Did they run themselves in a way that was similar to ICOLD?

"Both of these organizations [USCOLD; USCID] were originally pretty much managed and run by the Bureau of Reclamation"

"Larry Stephens retired from the Bureau of Reclamation And he is now the executive secretary for both of these organizations"

Arthur: Very similar, yeah, very similar. It's an international organization, it's constituted very much the same way, and both of these organizations, the U.S. committees on both of these organizations were originally pretty much managed and run by the Bureau of Reclamation under Steve Poe, P-O-E. He was the . . . . (sigh) I can't come up with his title right now. But he had to deal with foreign activities. And one of the members of his staff, a young fellow by the name of Larry Stephens, became involved in this also. As these organizations grew, the job of managing them on the United States end of it became pretty complicated. And finally, as a result, Larry Stephens retired from the Bureau of Reclamation and he is now the executive secretary for both of these organizations, and he has an office in downtown Denver, and he really is the one that coordinates the U.S. committees in both of these organizations, gets out the directory and meeting notices, and manages the organizations.

Storey: You said Larry Stephens?

Arthur: Yeah, S-T-E-P-H-E-N-S.

Storey: The other thing I wanted to talk about before we moved on is you mentioned earlier, when you were talking about your conversation with Barney bellport, about moving from chief designing engineer to associate chief engineer, that you were very *happy* in the position you had. (**Arthur:** Yeah.) Could you talk about that a little bit for me? Explain why you liked the job so much, a little more than what you've already said.

". . . chief designing engineer is a combination of being a manager and being strongly technically oriented. And I liked the engineering part of it very much."

Arthur: Well, chief designing engineer is a combination of being a manager and being strongly technically oriented. And I liked the engineering part of it very much. I had decided on being an engineer when I was very young, like in the eighth grade or something like that. I went to work for the Bureau and always viewed the chief designing engineer as the guy who really created these projects and was responsible for their creation or their conception. And as I mentioned before, I looked at the chief engineer as being more of an administrator. Not that I didn't like being boss too–I liked that facet of the job as well. But it was pretty well balanced. I liked the

(pause) recognition that was given to the chief designing engineer by other engineers. I mean, it was recognized as a very important job. And I just enjoyed it.

Storey: Good. Do you think we have pretty much covered your position as associate chief engineer and the major activities you were involved in and so on?

Arthur: Yeah, I think so. I later became the deputy director of design and construction in that same position, just a change of title.

Storey: Okay, this would have been during a reorganization?

Ellis Armstrong Organizes Some Power and Authority Away from the Chief Engineer

Tensions Within the Washington Office about the Powers of the Chief Engineer

Arthur: Yeah, Armstrong became commissioner. You've interviewed Armstrong. The Washington office, in my opinion, a lot of people in the Washington office were always a little bit jealous of the prerogatives and authority of the chief engineer. The chief engineer, *as* the contracting officer, was considered by their contractors who built all these projects, *as* the Bureau of Reclamation. The commissioner was some politician who was out there in Washington, D.C., that testified before the committees of the Congress and that sort of thing. But the guy that was really doing the job, was making Reclamation go, was planning the projects, building the projects, and operating the projects, was the chief engineer. And I think that as I said, there was a little feeling on the part of a lot of the people in the Washington office that they weren't getting the due respect [and] recognition that they deserved–especially, perhaps, in the commissioner's office, immediate office.

Well, there wasn't a whole lot that . . . . It was a very well-running organization, it [chief engineer's office] was operating very well, and I think a lot of the commissioners didn't want to disturb it too much. And besides, they were not engineers themselves, and the feeling was that the chief engineer should be an engineer, which is right. No other discipline would set him up [as] well to run the Denver office as engineering. So we had several commissioners, like Strauss, he was a newspaperman as I remember his background, a politician. Dexheimer was in there just for a little while. I think he tried to get rid of Dominy and Dominy got rid of *him*. Dominy became commissioner–he wasn't an engineer, he was a farm agent out of Wyoming. I don't think he wanted to mess with it, though there's no bigger ego than Dominy. *Stamm* became commissioner. He was an O&M man out of Boise.

Then came Armstrong. Now here's a guy who's an engineer. He'd worked in Denver, he'd worked as the chief construction engineer on Trenton Dam, and *he* wanted to be, in my opinion, he wanted to be the big cheese. And he didn't like this star out there in Denver, the chief engineer. He wanted more of that for himself. But he realized, of course, he couldn't run the design and construction operations from Washington–logistically impossible. But what he *could* do, and what he *did* do was reorganize the Bureau, and he took away the Research Division, the Operation and Maintenance–had those reporting directly to Washington. Oh, and one I didn't mention before, the very important function, is the planning. It was given autonomy under an assistant commissioner. So reduce the authority of the chief engineer considerably, but not his activities.

The job didn't change at all, with the exception that the chief engineer was not the person responsible for selecting the key positions in the Laboratory–somebody else did that–or in personnel–somebody else did that, and so forth. Nor was he responsible for allocating the travel budget between design and construction and research and so forth. Those allocations were made by other people and that sort of thing. I was on the reorganization committee, by the way. Another fellow on the committee is a fellow that you're going to be talking to, is [Clayton Wilson]. A fellow I said lives in Colorado Springs.

Extraneous material deleted here as

During the Ellis Armstrong Reorganization "I didn't like what we were doing. Within the guidelines I was trying to do the best that we could to maintain the organization"

Arthur: He was the personnel man. He was on the reorganization, and *I* was on the reorganization. I didn't like what we were doing. Within the guidelines I was trying to do the best that we could to maintain the organization. Of course. Wilson, Clayton Wilson was his name. We were on that committee together.

Storey: What were the major issues you discussed?

Arthur Creates Title: Director of Design and Construction

Arthur: We were under instructions to reorganize the Denver office, along the lines where chief engineer became . . . . Well, the director of design and construction and the deputy director, these were job titles that I was responsible for–I mean, I made up these terms. Couldn't call him the chief engineer anymore because he wasn't over all these various segments, so I came up with this to best describe his responsibilities. You see, before, the earlier part of the history of the Bureau of

Reclamation, in fact, when Bloodgood was the chief engineer, his title was chief engineer *and* assistant commissioner. That appeared on all the correspondence, "chief engineer *and* assistant commissioner." So there was trying to be a linkage all the time of, "Hey, look, this guy maybe is the chief engineer, but hey, there's a commissioner someplace, and he's an assistant commissioner."

Ellis Armstrong

I knew Ellis, as I described before, I knew Ellis very well back in the days when we were both on the board. He changed a lot.

Storey: "On the board," you mean on the drawing boards?

Arthur: Drafting board, yeah. He changed a lot as he got into a position of authority. His ego developed substantially.

Let me tell you about something that happened when I was Deputy director of design and construction. One Sunday morning the telephone rang and my wife answered the phone. She says, "It's Ellis Armstrong calling you from Washington." This was on a Sunday morning. Of course she knew Ellis, met him on various occasions.

Ellis Armstrong Approaches Arthur about Becoming Deputy Commissioner in Washington, D.C.

So I got on the phone and Armstrong said, "You know, Harold, I'm pretty much tied down here in Washington, got all these meetings with congressional committees and various members of the Congress and so on and so forth. All these policy decisions that have to be made. I'm pretty much tied down to my desk a lot more than what I want to be. I want to get out and visit the jobs and stuff." Bored with being the big cheese. That's parenthetical–he didn't say that. I'm saying that. But anyway, he said, "I want to go down and visit the jobs and so forth. I'm thinking of establishing a job as the deputy commissioner, new position. Deputy commissioner, back here in Washington, GS-17. You're one of the candidates that I'm considering. How would you like to come back here? I haven't made up my mind yet," or words to that effect, "but I'm just wondering, would you be interested in being the deputy commissioner?"

I said, "Ellis, our friendship goes back many years. We worked together down there at adjacent drafting tables in the Earth Dams Section. I have a lot of respect for you. I'd . . . ."

END SIDE 1, TAPE 2. MARCH 15, 1995.
BEGIN SIDE 2, TAPE 2. MARCH 15, 1995.

Arthur: I said, "Because of our long association and friendship, I'd be very reluctant not to do anything that you wanted me to do, in regard to the Bureau, but I'm delighted that I'm only one of the candidates and that you have other candidates, because I don't want the job, you give it to somebody else."

And he says, "Yeah, but Harold, I want *you*."

And I said, "Now, wait a minute, you didn't say you wanted me, you just said you were considering me as one of several candidates and I just said 'just take my name off the list, I just don't want to be considered.'"

And he said, "You're at the top of my list."

"Well, I'm sorry Ellis, but as far as I'm concerned, anything east of the Mississippi is foreign country."

And I said, "Well, I'm sorry Ellis, but as far as I'm concerned, anything east of the Mississippi is foreign country. I just don't care to come to Washington."

He said, "Well, you may not have any choice."

And I said, "Well, yeah, I've got a choice, Ellis, I'm eligible for retirement. I'd retire before I came to Washington."

He kind of choked on that. He said, "Well, you know, Barney's going to retire one of these days."

And I said, "Yes, I know that."

And he said, "Well, if you're sticking around Denver thinking you're going to get his job, I can't promise it to you. You know, there's a lot of pressure, that's a top job in the Bureau. There's a lot of political pressure to put various people in that job. I can't give you any assurance at all that you'll be Barney Bellport's successor."

And I said, "I'm not *asking* for any assurance, Ellis. All I'm saying is that I want to remain here as the Deputy. When I no longer want to be Deputy, I'm no

longer satisfied, I'm approaching retirement age, I'll be ready to retire." So that was the end of that conversation. (chuckles)

Well, one of the reasons for the reorganization, you know, was given as Ellis didn't like Barney, and he hoped to hasten Barney's retirement by the reorganization. I think that he was of the opinion that if Barney's title were changed and so forth, that Barney would probably retire, but Barney did not, and he remained on the job for a couple more years, I guess it was.

I misspoke about Stamm being commissioner. He was commissioner *after* Armstrong. (**Storey:** Yes.) I've got that out of order. He became commissioner *after* Armstrong. But anyway, Barney did retire, and I was appointed director of design and construction, while Ellis was still commissioner.

Barney Bellport Retires

Storey: What did Mr. Bellport do after he left Reclamation?

Arthur: He retired, retired, retired. He moved to a suburb of San Francisco. Barney had one son that lived in San Francisco, and Barney and his wife moved out there, into a condominium. I did hear from him again, but I never saw him again.

Storey: He didn't become a consultant or anything?

Arthur: I think he did a little consulting work. He didn't make a big deal of it, and I never saw any notices that he was available as a consultant and so forth, but I did run across a couple of jobs where he had been a consultant during the period of time that I was active as a consultant.

Storey: Tell me about how it came about that you became the director of design and construction.

Arthur: Well, that was just it. Barney retired, I was promoted.

Becomes Director of Design and Construction and Contracting Officer

Storey: Okay. How did you responsibilities change then?

Work at Grand Coulee Third Powerplant

Arthur: I became *the* contracting officer, and I became, of course, the contracting officer on not only all the *new* contracts, but I became the successor contracting officer on all the old contracts, including the Third Powerplant at Grand Coulee that we've talked about before, being such a momentous claim and all that sort of thing. I told you about going into the secretary's office and all that, and getting approval for keeping the joint venture alive, building that project. That was when I was director of design and construction.

Storey: So Third Powerplant was already under contract when you came?

Arthur: Yes.

Storey: And the size of the turbines had already been determined by that point?

Arthur: Yes, the size of the units was determined really when I was chief designing engineer. So I had more to do with that than what the chief engineer did.

Storey: Do you remember any of the other major projects? Would this have been about the time CAP [Central Arizona Project] and CUP [Central Utah Project] would have been starting up?

Work at Auburn Dam

Arthur: Oh yes. Also we were doing a lot of preliminary work on Auburn. That was a very big deal back in those days, Auburn Dam. We spent, what, $60-, $80 million out there on the foundation for the concrete dam, and it was never built.

Storey: Tell me about that. I know you had a *long* association with Auburn.

Arthur: Yeah, well I told you earlier about when I was chief designing engineer the decision was made that it would be a concrete dam instead of an earth dam, and I played a key role in making that decision. That was approved, and appropriations were obtained, and we started construction work out at Auburn Dam, and this was . . . . Well, first we built a diversion tunnel to divert the American River around the dam site, de-water the dam site with a coffer dam.

Auburn "was going to be an unusual thin-arch concrete dam. It would be the longest span in relation to its height, of any such dam attempted–be a very unique structure."

Then they started working on the foundation for the concrete dam. This was going to be an unusual thin-arch concrete dam. It would be the longest span in relation to its height, of any such dam attempted–be a very unique structure. Well, while we were in the stage of the foundation construction, which is when they built that office building out there at Auburn Dam that you visited and so forth, there was a moderate earthquake that occurred in the vicinity of Oroville Dam. And that's a *major* earth dam constructed by the State of California about, oh, I forget . . . . It's on the Sacramento River. It's north and west of Auburn, maybe 150 miles, something like that. It's an earth dam, it's a *major* dam like 600 feet high, something like that. It got a pretty good shaking, no damage. But it was in an area where no seismic activity had been previously recorded. The environmental groups who were anti-Auburn Dam, anti-dam construction, *and* I think the California Geological Society, raised the question about, "Hey, if there could have been faults up there near Oroville that we didn't know about, what about at the Auburn site, where the Bureau was planning this big dam on the American Forks River, right above Sacramento, the failure of which would wipe out the city of Sacramento. How about its safety?" Well, we'd done a lot of investigation, looking for seismic problems and so forth and hadn't found anything of consequence. And of course we planned on building the dam so that it would withstand heavy shaking, because it was in California. But our appraisal of this was not accepted by these organizations.

Woodward-Clyde Hired to Study the Safety of Auburn Dam

So I was approached by a representative of Woodward Clyde Organization, which is a very well-known geotechnical consulting firm, has offices nationwide, that they proposed to make a seismic survey. Not a seismic survey–a seismic evaluation of the Auburn region, and help us put to rest these concerns about the seismic activity. So we negotiated a professional services type contract for a rather modest amount, I forget what it was. Let's say it was on the order of a half-million dollars or something like that. And they would go out in the field and try to find evidences of faults and that sort of thing. So they started their investigations and their investigations were just like topsy, and they grew and they grew. "Well, we found this out, we need to do this study, we need to do this study, and we need to do this study." So it grew from something like a half-million-dollar project to three-and-a-half million or something like that. These are very rough figures, I'm thinking back a long time ago.

But anyway, I was concerned about the way this contract had grown. But there didn't seem to be much of an alternative, because we had to quiet the concerns of the community out there. Well, they came up with nonconclusive findings, which I guess I might have expected. (chuckle) These things are not cut and dried, but

they found, oh, maybe some possibilities and so on and so forth. Anyway, it didn't serve the purpose of quieting the criticism. Neither did it fuel it. I mean, it wasn't of that inflammatory nature. But it didn't help the situation. And eventually, as you know, the construction was halted, appropriations were canceled, and the project was not built.

Storey: But it keeps springing to the surface, springing up again.

Arthur: Yeah, it does. The *need* for the dam is still there. In fact, yesterday I spent with my niece's husband. They live in Stockton, California. They're here visiting my sister. Stockton is not very far from Sacramento. And he's aware of the flooding situation that's occurring out there this week, and he said, "Boy, if they'd had Auburn Dam it would sure have cut down a whole lot on the flooding situation, because Auburn could have stored a lot of that water, instead of turning it loose and letting it run down the river, to *add* to the Sacramento River, to add to the whole miseries of Northern California." And so it's still needed for flood control, and it still could be used for irrigation, because water is still a precious commodity in California, especially good-quality water. So the various groups, and the State has showed some interest in it. They've talked to the Corps about it for a flood control job, and the Corps would build a dam that would be lower, and according to the popular thinking, be much more substantial than the arch dam because it would be a big, thick, heavy, massive structure, which would not be any safer, in the opinion of people who build arch dams. And this world-wide experience has shown dams that have been subjected to earthquake, these arch dams are very good. Anyway, that's what happened to Auburn.

Storey: Yeah. Well, I'd like to continue, but we've used two hours again.

Arthur: Hey, so we have! Hard to believe.

Storey: I'd like to ask you again whether or not you're willing for these interviews to be used by researchers inside and outside Reclamation.

Arthur: Yes.

Storey: Thank you.

END SIDE 2, TAPE 2. MARCH 15, 1995.
BEGIN SIDE 1, TAPE 1. APRIL 6, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold Arthur, former chief engineer of the Bureau of Reclamation, at his home in Denver, Colorado, on April 6, 1995, at about nine o'clock in the morning. This is Tape 1.

Enjoyed Being Chief Designing Engineer

I see that the last time we talked, I have a note down that says, "As chief designing engineer you said you were happy," and I wonder if you could expand on that a little more, please.

Arthur: Well, that was what I was telling Mr. Bellport when he wanted me to become his deputy, or assistant chief engineer. I viewed that as more of a staff job than a line job, and I told him my ambition had always been to be the chief designing engineer, which I viewed as being the top technical job in the Bureau of Reclamation, and that's what I had always aspired to be. I had attained that position and I was very *pleased* with the job, I was *happy* in the job. It was a combination of management and technical responsibilities and I enjoyed what I was doing. So for that reason, I was not anxious to move into a staff position. I think I mentioned that he told me that the staff position as his assistant would give me the necessary training so some day I could be his successor. But I didn't even find that persuading, until he finally more less reassigned me, whether I wanted to go or not. And of course I could see some attraction to it too, because it *clearly* would lead to becoming the chief engineer, if things went alright.

Storey: And you went to be the associate chief engineer in '68? Is that what my notes tell me?

Titles in the Chief Engineer's Office

Arthur: In June of '68 I became the associate chief engineer. I keep using these titles indiscriminately a little bit. The head of the office was chief engineer, later changed to director of design and construction. The chief engineer's first assistant was called the assistant chief engineer, later called the deputy director of design and construction. The position was the same with either one of those titles, and I keep using one and then the other. I hope that isn't too much confusing. But anyway, I became the associate, *then* called the assistant chief engineer in June of '68. Later that title was changed to deputy chief engineer.

Storey: Uh-huh, while you were in the position it was changed?

Becomes Director of Design and Construction

Arthur: Right. Then I became the director of design and construction in July of 1972. There was several months after Bellport had retired, I was in the acting position for several months, and then my appointment came through in July.

Storey: As I recall, we had talked about Ellis Armstrong calling you and wanting you to take a position.

Arthur: He wanted me to be deputy commissioner in Washington, but I wasn't interested in the assignment.

Storey: And we had talked about the fact that this position gave you some experience with negotiating contract issues.

Arthur: That was really Bellport that stressed that.

Storey: Do you remember any particular negotiation sessions that you participated in?

Arthur: Oh, there were many of them–I don't recall any one specifically.

Duties as Assistant Chief Engineer

Storey: How about running the Denver office? Presumably the chief engineer also did that, (**Arthur:** yes, that's correct.) and would use his deputy for that also. (**Arthur:** That's right.) What kinds of things did you do there?

Arthur: Well, this was a staff position, the duties were as assigned by the chief engineer, of course. But it had to do with the staffing and allocation of resources, such as the allocation of travel funds–a subject we mentioned once before, where the ceiling amount was established for the Denver office, and that had to be parceled among the various divisions and that sort of thing. Also, we had a limit on the number of employees we could have, so that had to be decided, apportioned among the various divisions, as to who needed additional personnel and that sort of thing. And then there were special studies that were always being conducted, such as whether or not the Bureau wanted to get into value engineering concepts. And other activities would be developing standards to be used for design and construction, standard paragraphs for specifications would have to be reviewed, and that sort of thing. But in that position, you had only the authorities delegated to you by the chief engineer.

Served as Acting Chief Engineer

And of course another big part of that job was acting in his absence, because the chief engineer was gone quite a bit on his trips to Washington and trips out to the field and so on. And in his absence, you'd take over the front desk, take care of it.

Storey: How did you go about allocating resources? There must have been a lot of competing interests and offices in Denver.

Arthur: Well, there was, but it would be related to the program, essentially. I mean, our main consideration was the production of designs and specifications and construction of the jobs. We also had various assignments given to us in research and so forth. So there were certain things that had to get top priority, but on the other hand, those organizations had to be kept rather lean or you wouldn't have the resources for the other parts of the organization. So it was, of course, a matter of judgement, discussion with the division chiefs as to their various activities and work loads and programmed-out estimation of man-years. And then consideration would be given to the nature of the staff, how many were nearing retirement, the need to bring in new rotation engineers and other people to learn how to do the work before all the experienced people had gotten retired and that sort of thing, and develop continuity of the staff.

Storey: You remember any particular situations that arose out of that process?

Arthur: No, we would from time-to-time, if we had a specific assignment, establish a team or a committee, if you want to call it that, that would perform a certain investigation or function or study or whatever was required, that would consist of people from the various divisions or branches, and not be all involved with the organizational lines. (tape turned off and on)

Participation in Professional Groups

Storey: I think as chief designing engineer, for instance, you had started participating in ICOLD maybe (**Arthur:** Yes.) and other professional groups like that. Did that continue while you were in the Deputy position?

Arthur: Yes, I mentioned that it was while I was in the Deputy position that I was the chairman of the Technical Activity Committee (**Storey:** That's right, you did.) for ICOLD, and I was Vice Chairman. So Mr. Bellport was the Chairman of the U.S. Committee. A lot of that correspondence and work of the Chairman he delegated to me to take care of. Yeah, that took up quite a portion of my time.

Storey: I don't remember that we discussed how you became . . . . Let's see, what was it, assistant commissioner for construction? I've lost the title I'm afraid.

Arthur: Well, it was chief designing engineer, and then I became assistant chief engineer. The title changed to deputy director, design and construction.

Storey: And then you became the *director* of design and construction.

Arthur: I became the director of design and construction, right.

Becomes Director of Design and Construction

Storey: And I don't think we discussed how that transition from deputy to director took place.

Arthur: Well, as I mentioned, as the deputy, I was often the acting director of design and construction, and when Bellport retired, of course I was acting full-time. I was probably in an acting position for, oh, I'd say about three months, and my papers came through that I was appointed as the director of design and construction.

Problems at Fontanelle Dam

Storey: That would have been by Ellis Armstrong, right? (**Arthur:** Right.) Were you the Deputy when Fontenelle Dam had the problems?

Arthur: I think I was chief designing engineer when Fontenelle Dam had the problem.

Storey: Okay, how were you involved in that, if at all?

Arthur: I'm trying to remember just how we got word that there was a problem at Fontenelle. My memory is that–well, I just don't know–but I do know that we were alerted that there was a problem and Bellport was the chief engineer. He called Pat Dugan who was the regional director in Denver and told him that we needed to borrow his airplane. And Bellport put together a team to go to Fontenelle and I went as chief designing engineer. I think somebody went from the Earth Dams Section–I don't remember who–and a geologist. It seems like there was somebody else. But anyway, we flew to Rock Springs where we were met by the project personnel and driven by car out to Fontenelle.

Storey: And what happened then?

Arthur: Well, we could see where there was a concentrated *leak* through the abutment close to the dam on the right abutment that was in the nature of a pipe or a tunnel that the water was coming through. The contractor was still building the dam, it was still under construction, but it was pretty well along. As I recall, he was at that time building the closure section in the middle of the river. In other words, the way the dam had been built, as I recall, was to build the spillway and the outlet works while the river was allowed to flow through the middle of the dam site, and then when those features were done, then the gap in the dam was being filled. Mr. Bellport ordered the contractor to get a bulldozer out there and make a cut. I don't remember if it was through the embankment, or a lower part of the abutment–but anyway a channel was made so we could lower the reservoir rapidly. And that was done. And that prevented any major flood downstream of the dam.

Storey: What was this leak like? I don't visualize this very well. Do you remember?

Arthur: Well, it was like there was a hole poked into the abutment near the contact of the embankment with the abutment. It was like there was a hole there and the water was issuing from this hole.

Storey: Like in a spout?

Arthur: Yeah, it was under pressure, uh-huh.

Storey: Was it big, do you know?

Arthur: Yeah, it was pretty good-sized, and it was enlarging. That was the thing, it was eroding and the hole was becoming larger. It started as just a small opening, a small pipe, and the leak came through and it started getting larger and larger. It appeared like eventually it would result in carrying away the right abutment.

Storey: Well, if you were chief designing engineer, how does all of this work in terms of who does what and who yells and who gets yelled at, and all that kind of stuff when we have a major problem like this?

Arthur: Well, of course the chief engineer was the captain of the team, and we didn't know what the problem was. He knew there was a problem, but he didn't know the cause of it, or the details of it and so forth, so he put together an emergency team to go out there representing the design people and the geologists and I think a construction–yeah, that was the other man, was a construction man–to try to review the situation and if possible, determine what the cause was and what action should be taken. Then after the period of emergency was over, then the question was to

investigate and find out what the problem was and how to fix it. So the people that would be involved in this would be dependent upon the nature of the problem. Now as I recall at Fontenelle, it was *believed* that the reason for the problem was the fact that there were some soluble salts in the foundation. There was a trona mine not too far from Fontenelle Dam, and trona, I think, is a sort of a soda ash that was being mined commercially. And there are certain minerals that will dissolve in the presence of water. And the finding was that there were lenses of this kind of material in the shale beds in the abutment that had not been detected or adequately identified during the . . . (phone rings)

Storey: During investigations?

Arthur: During the investigation of the Project, and after the reservoir started filling and the water got in to saturate these beds, they began to dissolve and form these openings through which the reservoir water could penetrate and start eroding the material.

Storey: Now when would Fontenelle have been designed, if it was under construction then?

Arthur: Construction of Fontenelle Dam began in June of 1961, the dam was completed in 1964, a period of eight years was needed to complete the dam and powerplant and all the associated works. The construction started in 1961. Of course at that time I was assistant regional director in Billings. I'd gone to Billings in 1960, so I was not too familiar with the design of the dam nor knew nothing about the investigations, but I happened to be on the scene when the trouble . . . .

Storey: Uh-huh. What kind of a time lag would there have been, probably between the time that the design was done and construction was begun in '61, in those days?

Arthur: Well, usually the construction money was what was used for the preparation of the designs and specifications. I mean, investigations were carried out previously, and to get the project authorized, and then a definite plan report was made in order to get construction money. But the preparation and design specifications would not be started until the money had actually been appropriated for construction. When money was appropriated for construction, it was high priority to get this done as soon as possible, because these projects had been planned for a long period of time, they had the supporters that were working with the congressional delegations to get the money appropriated. After the money was appropriated, our supporters wanted action, they wanted to get something done as quickly as possible. So the timeline between getting money for the preparation of the final designs and specifications for starting construction was very tight. Usually it would take, since we'd have a number of designs going on at the same time, it might take six months to a year to

prepare the contract documents. That would depend somewhat on how much additional exploration had to be made in order to form the final designs. If the project had been investigated very thoroughly, the specifications could be done more promptly. Otherwise, it might take a little bit longer. And as soon as the specifications were completed, they were put out for bids, depending upon the complexity and size of the project, the contractors would be given 60 days to 90 or 120 days to make their bid. And the contract would be awarded, after that, in probably thirty days, and construction would start soon thereafter. So it was a pretty short leash for these kind of projects.

How the Growing Environmental Movement Affected Reclamation

Storey: Now as you were assistant chief designing engineer and chief designing engineer, then the deputy and then the director of design and construction, this is the period when we have a whole complex of environmental laws beginning to be passed and beginning to take effect: the Wilderness Act, the National Historic Preservation Act, National Environmental Policy Act, and you know the list goes on and on and on. What were you seeing happen to Reclamation projects as this was happening?

Arthur: They were under *attack*, of course. There was a well-organized and vocal opposition to most any project. Outstanding, was, of course, Bridge Canyon, which I'm sure you've heard about from Commissioner Dominy. And that was the first big job that environmentalists were able to halt in its tracks. That was primarily through the Sierra Club. Bowers I think his name was, the head of the Sierra Club.

Storey: Yeah, Brower, I think.

Arthur: Brower, that's right, Brower.

Storey: What was happening in terms of planning for projects?

Arthur: Well, not a great deal. I mean, the planning was still going on. Though as I mentioned in the case of Auburn, where we changed from an earth dam to a concrete dam, *primarily* because of environmental considerations of obtaining the soil from that area in order to build the dam. So we were becoming more aware of environmental considerations. We still hadn't decided not to build any dams.

Storey: Did all of this lengthen the planning process, that you saw, I mean, while you were there?

Arthur: No, the preparation of these environmental impact statements was still down the road somewhere. We weren't into that yet. So it really didn't have a great impact on the planning process during that period of time.

Storey: And what period of time are we talking about now? Just to make sure we're on the same wave length.

Arthur: In the 1960 to later 60s.

Storey: Okay, yeah. What's the first major thing, major issue, major project, that you remember as the director of design and construction?

Central Arizona Project Had Started

Arthur: Well, I became the successor contracting officer on about a hundred contracts, and at that time we had about $300 million worth of work under contract, which would be a billion and a half in today's money. So there were a lot of jobs being built, and the Central Arizona Project was started. The Buckskin Mountain Tunnel on the Colorado River, and then off the Colorado River had been built. The big siphons were being placed on the aqueduct, so that Project was well underway.

Storey: On the aqueduct, Central Arizona Project?

Third Powerhouse at Grand Coulee

Arthur: Central Arizona, yeah. The biggest Project that was underway at that time was the third powerplant at Grand Coulee. It was under construction, and there were a number of smaller dams throughout the country.

Storey: In what way were you involved with the Third Powerplant?

Arthur: Well, I was chief designing engineer when the third powerplant was proposed.

Making the Third Powerhouse Look Good

Storey: I had been told that some pains were taken to make the architecture of the building nice. Do you remember anything about that?

Arthur: Oh yeah sure. Brauer and Associates in New York City, the architects. This was a spinoff of Ladybird Johnson. President Johnson was the Great Society, and he was

leading us into the Great Society, and Ladybird Johnson was leading us into a good looking Great Society. So she was very active in that sort of thing. We were responsive to the criticism that a lot of government works were not aesthetically pleasing and so on and so forth, so the decision was made to make the Third Powerplant, which would be a monumental structure, give special consideration to its artistic values. That probably came from Ted Mermel (laughing), I don't know. But this was the sort of thing that he was involved in. It wasn't the chief engineer's idea.

One thing that was of concern was that such architectural treatments usually cost money, and on projects that were being directly financed in part by water users and so forth . . .

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BEGIN SIDE 2, TAPE 1. APRIL 6, 1995.

Storey: You were saying this wouldn't have been terribly popular because it had to be reimbursed. (**Arthur:** Yeah, right.) But with the Third Powerplant . . . .

Arthur: That was a little different, because it was not directly reimbursed by water users, it would be reimbursed through power revenues, which was more like a general *tax*, you might say. And of course it was different in the fact that it was a monumental structure as well.

Storey: It's a *huge* structure.

Arthur: But you know the concrete dams, especially arch dams in themselves, are very attractive structures. You think back about Hoover Dam, you've been to the Hoover Dam, you've seen the dam and the towers, and the intake towers and so on and so forth. We didn't have any consulting architects in those days, the Bureau didn't. But still, they're inherently very handsome structures. Don't you agree?

Storey: Yeah. Worked out that way.

Arthur: Well, that's one place where form follows function.

Discussions over the Size of the Generation Units in the Third Powerhouse

Storey: Were you involved at all in the discussions that went on over the size of the generators at the Third Powerplant? (**Arthur:** Oh yes.) Ted Mermel's version of the story is that Barney Bellport opposed having anything larger than a 300 megawatt

generator for a *long* time. Were you involved in any of those discussions? Can you comment on any of that?

Arthur: Yeah, let me tell you, Barney Bellport started a campaign in the Denver office one time, against "grandpa-ism." He said he was tired of everybody doing things the way grandpa used to do. We had to be progressive and look forward and do things in a new fashion. But yet, on the other hand, he was very conservative himself. Now at the time the Third Powerplant was being discussed, the need to use large generating units was apparent because of the physical limitations of the site. We didn't have enough room to have a hundred small units. We needed a more compact installation, which would come with larger units. Well, the Soviets had 300 megawatt units at Krasnoyarsk, I think it was, someplace in the Soviet Union, and I think maybe Ted Mermel had visited there at one time. But these were the largest hydroelectric units in existence, and there had been some problems with them that we knew about, but we didn't know too much about them, but we knew they'd had some problems. So there was reluctance on the part of *many* people, not only Bellport, but in the minds of many people, about trying to go beyond this state of the art, you might say, in building much larger units. Mermel was a proponent of larger units, there's no question about that. And the way this was resolved is we made studies of the layouts with 300 megawatt units, 500 megawatt units, and 600 megawatt units to see what configuration would be required to house those units. At the same time, the Bureau contacted the leading manufacturers of turbines and generators in the United States and elsewhere and asked them for their comments on the feasibility, possibility, and practicability of building these larger units. And the responses were encouraging, as I remember–well, I know they were, or we would have never gone forward. But we were assured that if we put out specifications, solicitations for 600 megawatt units, that we would have competition in the industry, and more than one bidder to supply those units. So finally the decision was made to go this way.

Storey: Hm, okay.

Arthur: Does that tie-in with Ted's comments pretty well?

Storey: Well, Mr. Mermel seems to think he pushed a little bit on Mr. Bellport. (laughs)

Arthur: He did.

Storey: Sort of forced him up higher. I think he tells a story about Stewart Udall telling a newspaper reporter or some such thing, that, "Well, if the Americans can't build it, the Russians are, and we can put in Russian units." Caused a little bit of a furor.

Arthur: I don't recall that. But Ted was a pusher, not only for the larger units, but in other efforts too. Ted had little cards–I still have them around here someplace–it says, "You can't be a leader unless you're out in front." This was his philosophy. He was a great supporter and booster of the Bureau of Reclamation, he thought we were the smartest, we were the most competent, and we ought to be breaking new ground all the time. He was always encouraging the Bureau to be progressive and lead the way, as it were.

Storey: Was he in a good position for doing that?

Arthur: Yes, he was, because he had the ear of the commissioner, and the commissioners like Dominy, Dominy was not an engineer, but he was very ambitious, as you know. He had a very active personality. He would be receptive to hearing this kind of advice. He would rather listen to somebody saying, "We can do this," rather than somebody saying, "Oh, I don't think we ought to try this sort of thing." You know, that's *his* personality too. Yeah, I think Ted deserves quite a bit of credit for putting in those larger units.

Storey: Good. What do you remember about CAP at this time? Were we having any particular technical problems, any issues that would come to the director of design and construction?

Arthur: No, we put in a big pumping plant there on the Mojave[6] Reservoir on the Colorado River. The river mountains tunnel.[7] It didn't pose any particular problems. We used a new technique of precast tunnel liners. That was the Shea Construction Company that did that. But no particular problems. The most challenging thing about the design was the inverted siphons on the aqueduct. The Central Arizona Aqueduct is mostly a canal, as you know. But when it crosses the river valleys, [that] come down from the mountains, when it goes across those, you have your choice of how you're going to carry the canal across those valleys, and one way is to build a flume and carry the canal across on a bridge, in other words, and bridge the valley. The other one is to put it in a pipe and bury and it go down underneath. The solution chosen was the use of the inverted siphons, and they were of a very large size, twenty-two feet in diameter, as I recall. And they were a challenge to manufacture and install. They would have to be manufactured on-site, because they were so large and so heavy they could not be moved very far, they couldn't be moved on public highways, that sort of thing. They required the designing and

6. This was Lake Havasu behind Parker Dam.
7. Officially, the tunnel was the Buckskin Mountain Tunnel.

construction of special handling equipment to put them into place and that sort of thing. So it was a major undertaking.

Storey: And done by this contractor?

Arthur: The pipes were under contract to the Ameron Corporation, they're the ones that built the pipes. There were a number of construction contracts along the canal. I mentioned J. F. Shea company. They were the contractor for the River Mountain Tunnel itself, but there were dozens of contractors involved, as the work progressed, because it was done in reaches.

Storey: Now were they contractors directly with us, or were they subcontractors to a major contractor?

Arthur: No, they were all separate contracts with us.

Storey: So the director of design and construction's office was administering all of these different contracts.

Arthur: Yeah, we had a *big* office in Phoenix, the project construction engineer's office there. And it was managed *there*, but the chief engineer was the contracting officer on all these contracts.

Storey: Who was the chief construction engineer, do you remember?

Arthur: There was more than one over a period of time. Andy Dolyniuk was one of them. I can bring up in my mind the pictures of a couple, but I can't tell you their names.

Storey: Presumably you were their direct supervisor (**Arthur:** Yes.) and you selected them.

Arthur: Yes, although most of those had been selected by Bellport. That Project was underway . . . Again, this is one that I took over. It was a *long*-term construction period, ten years or so.

Storey: Yeah. When you selecting a chief construction engineer like that, what were you looking for?

Arthur: A good construction engineer! (laughter)

Storey: And what did that consist of?

Arthur: Well, it consisted of a person that has had experience, when he goes on a big job like this, that he's had experience and has performed well on smaller jobs, as an engineer who has savvy, knows construction and construction procedures, and one who has demonstrated a capability of working *with* a contractor, and a person who has demonstrated an ability to lead a staff. He's a manager as well, because he may have . . . . Well, I suppose on the Third Powerplant he had about a hundred people on board, or something like that. It was a combination of personality and technical knowledge and experience.

Storey: Okay. I'm interested in how politics affects Reclamation–how we respond, how we don't respond, that kind of thing. And in your job as designing engineer and then as director of design and construction, did you see political pressures being brought, and how were they brought, and how did we respond to them as an agency?

Politics and Reclamation

Arthur: We were aware that there was a lot of political pressure on the commissioner, because he was the interface between the Bureau and the Congress. There was some political pressure brought on the regional directors, because they were the interface between the Bureau and the public. I was not aware of any political pressure on the Denver office. There was all these appointments that I know about that were made to these top jobs. They were not politically inspired or affected. And certainly *mine* wasn't because I didn't have any political clout at all.

Storey: Yeah. How about pressure being brought to speed up jobs, slow jobs down, that sort of thing. Were you ever aware of any of that?

Arthur: Well, yes, we were aware during these programming conferences that we'd have periodically, annually. There was more than one annually, which projects the commissioner placed the highest priority on, which projects were considered should go forward as quickly as possible and that sort of thing. And that had to be, in part, motivated by political pressure.

Storey: So that's the way it would take the form though, like in the programming and so on?

Arthur: Yeah. (**Storey:** Okay.) It didn't affect our staffing. It may have, in selecting regional directors, I don't know. I know that my regional director up in Billings, Bruce Johnson, I know he got the job as regional director in spite of Dominy wanting somebody else, because he was personally acquainted with Senator [Quentin Northrop] Burdick of North Dakota. So I guess you could say that was a political appointment. But he was *highly* qualified. I mean, it wasn't a question of somebody

getting a job just because they knew the senator. I mean, he got the job because he was *highly* qualified *and* he knew the senator.

Storey: Did you ever see any situations where benefit/costs ratios were worked on so that they came out supporting the project?

Arthur: No.

Storey: Okay. I'm fascinated with the way this all works.

Arthur: In all the work I did, I was never involved in evaluating the benefits.

Storey: Well, that's true, but it would have been done in your office there, right?

Arthur: Well, before the Armstrong reorganization, yeah, it was under the chief engineer, that's right. But if there was pressure to do that, it didn't come through the chief engineer–it must have come through some other avenue. But I did want to say that one pressure to reduce the costs to help the benefit cost ratio was on Cachuma. It was one of my early jobs that I described how I redesigned the job to cut the costs. (**Storey:** Uh-huh.) But that was legitimate. I mean, I actually cut the costs, and something that should have been done in the first place. (**Storey:** That's right.) I mean, it wasn't rigged.

". . . when you became the director of design and construction, did your status change in any of these national and international organizations?"

Storey: Well, when you became the director of design and construction, did your status change in any of these national and international organizations?

Arthur: Well, the director of design and construction and the chief engineer was a prestigious position. It was recognized throughout the profession. So it would change in that respect, but I didn't get any additional offices or responsibilities.

Storey: With ICOLD or any of those?

Arthur: I would still go to ICOLD, I would be the top representative instead of the second, so you get a little more attention.

Storey: What else was important about that position as director of design and construction?

Involvement with the Soviet Union

Arthur: Well, one of the highlights of that job was my involvement with the Soviet Union. Nixon went over to the Soviet Union in 1972, and it was the beginning of the thawing of the Cold War. While he was over there, it was decided that the United States and the Soviet Union should cooperate on various technical matters. I don't know if you've heard about this before or not–I expect you have. But there were a number of committees that were formed, and there were a number of subcommittees that were formed of the committees, to work with the Soviet Union on various aspects of research and development, as regards–well, lots of things. What we were involved in was reclamation, irrigation, and so on and so forth: dams, hydroelectric plants and equipment, and everything else was supposed to be an exchange of technology and working together on research. Well, one of the subcommittees was a committee on the use of plastic materials in irrigation works. And I was appointed as U.S. Chairman of that committee. I would rather have been working on dams or something like that, but I didn't get to. In fact, I didn't know anything about this until I got word that I was now the Chairman of this subcommittee. And I was expecting a delegation from the Soviet Union to visit the United States as the beginning of a joint effort to research the use of plastic materials in the irrigation works. This delegation consisted of I think about eight engineers from the Soviet Union, and a woman interpreter. None of the engineers could speak English, but Svetlana was very fluent in English and Russian both, of course. This team was welcomed into Washington by the commissioner, and then they were turned over to me. Now I formed a committee for the United States side that was not just the Bureau of Reclamation. I had Gunner Thorsky who was from the Canals Branch of the Bureau of Reclamation, and I had an engineer from a plastic plant in Chicago–they made plastic film used in lining irrigation canals and that sort of thing–and I had a representative of the Corps of Engineers, and I had a representative from some company that made plastic pipe. I think I had a team of about six of us or something like that. I met the Soviet Union delegation in Chicago, and we toured a big plant in Chicago that made plastic film, and showed them how it was manufactured here in the United States.

Then we went on a junket. Our first stop was Spokane, Washington. We stopped there because there was a World's Fair going on in Spokane, and some of these Soviet engineers knew the people that were staffing the Soviet exhibit, so we stopped in Spokane and visited them briefly, and then we went on and inspected the Third Powerplant, which was under construction. And from there we went to Olympia, Washington, a plant where they made large-diameter plastic pipe. This is plastic pipe two or three feet in diameter, that sort of thing. Then we went on to Riverside, California, and visited the Ameron Corporation, who also made plastic pipe. And then we visited the Salt River Project in Phoenix so they could see work

that was being done there, and review the [Salt River] ~~Sierra~~ Canals and works in that area. Then we came to Denver (phone rings) and they visited the . . . . (tape turned off and on)

Storey: . . . talking about Riverside and Ameron, I think.

Arthur: Then we went to Phoenix and the Salt River Project and visited that Project, and then we ended up in Denver, and they visited our labs and spent some time. Then they went on to Washington and an exit interview, then ~~their~~ [they] return[ed] to the Soviet Union. About six months later it was *our* turn, the U.S. delegation, to go visit the Soviet Union, see what they were doing and what their capabilities were. So I gathered together my team and I called Washington and said, "I need an interpreter."

And they said, "Well, they'll furnish an interpreter. We don't have any interpreters around, they'll furnish an interpreter. They had lots of people over there that could speak English instead of Russian".

I said, "Hey, wait a minute, I don't want to go over there and talk to them without my *own* interpreter, because I want my interpretation to be done accurately. I don't want somebody editing the thing and me not knowing it."

"No, it costs a lot of money to send . . . ."

Trip to USSR

Oh, the financial arrangement was that each country would pay its own expenses, so funds were of concern, and I said, "Well, if that's the main thing, the funds, I'm not going if I don't have my own interpreter. I'm just not going, you'll save a *lot* of money."

Well, they got me an interpreter, and it was a wise move, if I say so myself. He was a young fellow who was a hundred percent–I think he was Ukrainian–and his folks had fled the Ukraine just before World War II started, to come to the United States, and he was a native-born American. They spoke Russian in the home–his Russian, I guess, was perfect. His English, of course, was very good too, so he was a *valuable* member of the team as it turned out.

So we flew from the United States over to Moscow, and we met the brass–irrigation people over there in Moscow. Then they took us down to Kiev. (phone rings, tape turned off and on) We saw a number of the canal linings that the

Russians had done on their canal system down south of Kiev, which is a big agricultural . . . .

END SIDE 2, TAPE 1. APRIL 6, 1995.
BEGIN SIDE 1, TAPE 2. APRIL 6, 1995.

Storey: This is Tape 2 of an interview by Brit Story with Harold Arthur on April 6, 1995.

They had lined canals.

Arthur: Yeah, they lined canals with concrete. One of the things we were talking about is putting down plastic material as an impervious barrier, and then covering it with concrete to protect it, and they wanted to show us some work that they had done down there, the kind of work they had done. Well, I wanted to take some pictures of what they were doing. I got out my camera to take a picture,

"Nyet, nyet, nyet! No pictures!"

So I said to the Russian delegation, "Well, look, you guys came to the United States, you went into a manufacturing plant in Chicago and you took all these pictures. You went to Olympia, Washington and took all those pictures. Never once did I say, 'You can't take a picture,' and so on and so forth. I don't understand this. I want a picture to show this work." So there was a lot of Russian interchange between the Russian delegation and the local people. And the guy "Nyet!" wouldn't change his mind–local man–he wouldn't change his mind. So I turned to my interpreter and I said, "I want you to interpret my remarks just exactly as I say them. I don't you want to sugar-coat them or anything else. I want you to give interpretation just as I say it."

"Yeah, sure," he said, "whatever you say." I said, "You tell them I can quite understand his reluctance for me to take a picture. If we did work of such a poor quality, I would be ashamed for anybody to have a picture of it also." (chuckles) I didn't know whether I was going to get in a fight or not, but I think he interpreted my remarks, and I got the picture! (laughter) Oh well, they weren't ashamed of it, go ahead and take a picture! (laughter) The concrete was not well finished, it was rough, you know, irregular and stuff, but it was perfectly functional–it's just the appearance. (laughs)

But, then they took us to what is now Saint Petersburg, was then Leningrad. And of course we get the sightseeing too. They did a lot of sightseeing in the United States, and we were doing some sightseeing also. They took us to the Hermitage,

which is the famous museum where this month they're disclosing they have a lot of the German art.

Storey: Yeah, a lot of the impressionists.

Arthur: That they had taken from Germany, taken it from France! (chuckles) And they took us out to Peter's summer palace, which was completely destroyed during the war, during the siege of Leningrad. Completely destroyed by the Nazis, and completely restored by the Soviets. It was just beautiful. And this guy Peter had a gifted hydraulic engineer, or maybe he was a hydraulic engineer himself, I don't know which, but anyway, they had the darnedest array of fountains that you ever saw in your life out there. They were scattered all over the grounds. There's some beautiful fountains, and they're all run by gravity. I don't know where — how they get the head, I never could find out, and the delegation didn't know that much either. They have fountains where you'd go up and you'd walk around, there wouldn't be any water flowing, and you step on a certain rock, and man, you got a shower! (laughter) Trick fountains and stuff.

Then we went to Latvia, went to Riga, visited a laboratory. And the reason we went there is because the leader of the Soviet delegation was from Latvia. So we had to see his diggings and so forth. Then we went back to Moscow, and we sat down after they had visited the United States and we had visited the Soviet Union, we sat down now to discuss "What do we want to do?" What are the Soviets going to do? And what will the U.S. do in carrying out these various research studies and projects and so forth? Of course, this was not too long before I retired. The work was taken over by Lloyd Timblin who retired recently from the Bureau of Reclamation. They were very active in this. This turned out to be quite an effort, and quite a bit of cooperation between the U.S. and the Soviet Union engineers. They put out a number of reports that are listed in the publications for sale, I noticed the other day. They put out three or four reports on the use of various materials and techniques. That was a very interesting interlude.

Storey: Did you have joint meetings of any kind? Or was it just the intent to visit and see the other people's work?

Arthur: Well, they met here, and then the next meeting was over there. Whether there were any subsequent meetings or not, I don't know. I think there probably were, but I don't know.

Storey: I was just wondering if there were any other tensions. I presume there was a Soviet Chairman also.

Arthur: Yes, he was the Latvian.

Storey: Your counterpart.

Arthur: Yes.

Storey: I was just wondering if there were any tensions over how this was going to run or anything like that. That was sort of in the days of the Cold War. (chuckles)

Arthur: Well, as a matter of fact, we wrote up a protocol–it was called a protocol. And this was a memorandum of how we were going to proceed and who was going to do what, time frames and so on and so forth. And we had a lot of discussion about that. There were a lot of sticking points on that. But trying to get language that was acceptable to both parties, you know, where everybody was conscious of the fact that after all, there was still a Cold War going on.

Storey: Do you remember any details of the things that had to be discussed?

Arthur: No, mostly picky stuff. I remember on one occasion we were there in Moscow on our final meeting, trying to come together with this protocol, and we were stuck on something, some language which was unacceptable to me, I don't remember why, and I wanted it changed, and they didn't want to change it. So we argued back and forth and discussed it back and forth. And of course this takes quite a bit of time because everything has to be translated. I'd speak in English, and then my interpreter would speak in Russian. They'd speak in Russian and I'd get the feedback back in English. And this went on and on. Finally I got exasperated, or pretended to be exasperated and put down my pencil and I said, "I'd like to talk to the U.S. Embassy."

"Of course, of course." So they led me out of the room to a phone. I didn't know whether it was tapped or not.

So I called the U.S. Embassy, and they answered the phone. I identified myself. Of course we had visited the U.S. Embassy, they knew we were there, of course. And I said, "Say, in our initial meeting I told you guys we were expecting some mail. I'm just checking to see if any of it had come, because we're about to depart the Soviet Union in a day or two. I was wondering if we'd gotten any mail." He said, "I'll go check." He came back and I think he said he had a letter or two. So I thanked him and I went back to the conference table and sat down and I said, "Well, upon reflection, can we come to an agreement on this point?"

"Yeah." (chuckles) I don't know if this had any effect or not.

Storey: That's interesting. Now, did you go over there just for the planning meeting? Or was this part of your tour?

Arthur: This was an organization meeting, to set up the two committees. They came to visit the United States to learn *our* technology, what we were doing, what we could do, what we planned to do in that field of plastics in irrigation works and so forth. So we returned the visit to meet their people, find out what they had done, what their experience was, what their capabilities were, what their interest was, and then we could agree on a joint program. And when I left there, we had agreed on a joint program.

Storey: Oh, so this was putting together this joint program (**Arthur:** Yes.) *after* the two tours. (**Arthur:** Yes.) I see. So it was to be a continuing effort then.

Arthur: Oh yes. Yes, this was just *starting* the thing. This was just setting it up. And it continued for a period of . . . . It may still be continuing, I don't know. It continued for a period of years.

Storey: Yeah. Well, it sounds interesting. Did we learn anything of use?

Arthur: Yes, Timblin said we got some good ideas and so forth. I never bothered with it after I retired, because it's not my field of interest, really.

Storey: Yeah. When did you retire?

Decides to Retire from Reclamation

Arthur: I retired June 8, 1977.

Storey: Hm. Why did you retire? Let's see, you started in '33 with the government, didn't you? Or am I thinking of somebody else?

Arthur: In '35.

Storey: Forty-two years.

Arthur: Uh-huh. Is that what this certificate says?

Storey: I don't know. Which one? (pause) Forty-one years. There may have been a year in there that I miscounted.

Arthur: I only got half credit for the time I was on War Service Transfer Furlough to Consolidated Vultee.

Storey: Oh, down to Fort Worth.

Arthur: Yeah. You've got a good memory.

Storey: (chuckles) Well, I try, but I'll tell you, I get *really* confused with all the people I talk to!

Arthur: I expect so! It surprises me how well you remember these things.

Storey: Oh, I had asked why you decided to retire.

Arthur: Well, there was a little project called Teton Dam, I know you want to discuss.

Storey: Yes, I would like to discuss that one.

". . . had it not been for Teton Dam, I would have retired earlier than what I did. . . ."

Arthur: Let me say, had it not been for Teton Dam, I would have retired earlier than what I did.

Storey: Oh really?!

Arthur: Actually, I retired *when* I did because I was told that I was ~~*non persona grata*~~ [*persona non grata*] to the secretary of interior who was a guy by the name of Cecil Andrus. (tape turned off and on)

Storey: You were saying that Secretary Andrus had become displeased.

Arthur: Yeah, let me explain a little bit about my retirement. I had decided a long time before I reached the point of retiring that I would retire at age sixty-two. I decided that was time to hang it up. I would be sixty-two in '76, in August of '76. It was in June of '76 that Teton Dam failed. That kept me from retiring, for two reasons: one was . . . . Well, the Bureau was under fire, under a lot of pressure, because of the failure of Teton Dam, was being attacked from every quarter and roundly criticized

and so forth. There were two reasons why I wouldn't retire at that time: one was that I didn't want to quit under fire; and the second one was I didn't think that there was anybody else there in the Denver office that could defend the Bureau as well as I could. And I say this because my Deputy was Donald Duck, who had not been in Denver very long–he'd been there, of course, while I was director of design and construction. But he had not been there in the days when Teton was being designed. He wasn't an earth dam designer, like myself, nor was he a long-term Bureau employee, like myself. He had quite a bit of service, but he didn't have the whiskers I had. And he didn't know the people like I did. So I thought I was in the best position to defend the organization, and I knew it needed all the support it could get. So I stayed on. Now how long I would have stayed on if permitted to do so, I don't know. I hadn't quite made up my mind on that. But in '77, I got a call. I was up in Helena, Montana, looking over a project up there that we were having a little trouble with on a dam. I was up there looking at that and I got a call from [Commissioner] Keith Higginson, and he said, "I wanted to tell you the secretary is making a speech today at the Washington Press Club, and he's going to announce that anybody with the Bureau at the time of the Teton failure is being gotten rid of, and that includes you."

And I said, "Well, that's going to take a little doing, Keith. He may be the Secretary of the Interior, but I've got about forty years of Civil Service experience. I hold the highest recognition given by the secretary of interior — not him, but by the secretary of interior beforehand– for valuable service to the government — the distinguished service medal. And the investigation of the failure of the dam has shown that I was not involved in the design. It's going to be a little hard to get rid of me, isn't it?"

"Well," he says, "yeah, that's true, but you know we can create another position for you someplace in a telephone booth and set you up in that, and you can stay there as long as you like."

I said, "Yeah, I know you can do that. I'll tell you what. I'm ready to retire, but I'm not going to do it gracefully."

He said, "What do you mean?"

I said, "What I mean is, I'm going to bitch about it, because I think Andrus doesn't know what he's doing, he's out of line, and I'm going to tell people that."

"Well, whatever," he said.

So that's why I retired. And sure enough, I didn't do it gracefully. The last day that I was director of design and construction I sent out a little memorandum announcing my retirement and the reasons therefore, went to all the engineering organizations, American Society of Civil Engineers, all the engineers I knew, all the professional organizations, and so on and so forth. I later found out that the Washington office was *not pleased* with the fact that I didn't go quietly. (chuckles)

Keith Higginson

Storey: Let's see, in '77 Higginson would have been there about two years maybe? A year? Year-and-a-half? Let's see, (checking notes) not at all! He *got* there in '77. (**Arthur:** Yeah.) What was he like as a commissioner, your little bit of experience *before* your phone call?

Arthur: He was certainly unqualified.

Storey: *Un*qualified?

Arthur: Yeah, he didn't have any qualification. He'd been the State Water Engineer for the State of Idaho. He wasn't qualified to be Commissioner of Reclamation. He didn't know that much about Reclamation.

Gil Stamm

Storey: What about his predecessor?, Gil Stamm, I believe.

Arthur: Yeah, Gil.

Storey: Yeah, Gilbert G. Stamm. How was he as a commissioner?

Arthur: He was great as commissioner, I thought.

Storey: What was his training?

Arthur: Well, when I first met Gil, I think I mentioned a long time ago, I was on one of these review and maintenance of dams, back when I was in the Earth Dams Section, back in the 50s. Gil Stamm was the head of operation and maintenance in the Boise office, in charge of operation and maintenance of all the Bureau projects, and overseeing those that were being operated by the irrigation districts. Before that, I don't know what his background and training was, but he was in that position, which was an important position, before he went to Washington. And then he worked his

way up in the chain of command in Washington. He was an assistant commissioner under Dominy, I think, still in charge of operation and maintenance. But this is a very important area in the Bureau, of course, and also brought him in contact with all the irrigation districts and through them the congressional delegations and so forth. So he seemed to have a very good working relationship with Reclamation supporters and the congressional people. And he did not try to run the Denver office, he figured he was not the chief engineer, and he left the engineering up to Denver, which of course I thought was proper! Well, so did Dominy. Of course Dominy wanted things done: he wanted this done, he wanted that done, but he left the doing it up to Denver. Denver had a great deal of autonomy under Dominy, and continued to have that under Stamm. As I described, less under Armstrong.

Storey: What other characteristics made him a good commissioner?

Arthur: Well, he was intelligent. He was experienced, he was intelligent, and he had a good personality.

Storey: And he knew Reclamation really well.

Arthur: Oh yes! Yeah, he'd been in it clear back in the 30s.

Storey: Did he leave because of Teton?

Arthur: I don't know. He left before I did. But he was with me at the congressional hearings on Teton. He didn't leave immediately, but he may have been pressured by . . . . I don't know just when he left, whether he left before Andrus came in or not.

Storey: Well, I believe my list shows that he was there until '77.

Arthur: Well, when did Andrus come in, I wonder, in '77?

Storey: Probably sometime in '77. Now, how coincidental it was, I don't know.

Arthur: Was there an election in '76?

Storey: Seventy-six was the election that put Jimmy Carter in the White House in '77.

Arthur: Okay, so we changed Secretaries, and the commissioner serves at the pleasure of the President, and is appointed by the President, so *pro forma* submits his resignation as soon as he demands. All the presidential appointees tender their resignations, and his was accepted, I expect.

Congressional Hearing on the Failure of Teton Dam

Storey: Uh-huh. Tell me about the congressional hearings on Teton, if you will.

Arthur: That was an experience.

Storey: Yeah (chuckles) I figured so. I didn't know whether you wanted to talk about it.

Congressman Leo J. Ryan

Arthur: Oh, I'm perfectly willing to talk about it. That was an experience. I have to say that there were two hearings. The day after the Teton failure there was a hearing in Idaho that was presided over by a congressman named Leo J. Ryan, and he was a congressman from South San Francisco. And he was a chairman of some public works subcommittee or some irrigation subcommittee or something in the House of Representatives, and he held a public hearing on Teton out at Idaho Falls, the day after the dam failed. And of course nothing was accomplished, because nobody knew anything, but he had witnesses telling about what they saw, and he had a professor from Montana University giving his theory why the dam failed, professor of geology, talked about why the dam failed. And nothing was accomplished, as I've said before. But I was pretty favorably impressed with this guy, Ryan. I thought he was a very sincere person, and he was very concerned about the failure of the dam, the damage and loss of life, and that . . . . (phone rings, tape turned off and on) . . . your formal hearing held in Washington, D.C. I don't remember when this was held, but it was a couple of months later, I would say. I think it was sooner than that. I could look it up, I've got the proceedings somewhere.

Storey: That can be looked up by somebody who's interested.

Arthur: I think maybe it was in July. It was quite soon. The Chairman of the committee was Leo J. Ryan. The Vice Chairman was a guy from Missouri, the congressman from Missouri, I don't remember his name. And there were maybe three or four other congressmen. They all set up there on the dais, and Stamm and I were called to testify. I was given the opportunity to make a statement, I had a written statement, which I read, discussing the situation, the design of the dam, the investigation, design, and construction of the dam, and what we knew about the failure of the dam, which was not much at that time, but the fact that there were two ongoing committees that were boards of engineers who were investigating the dam. And then they started asking me questions, and they were very unfriendly questions. And, I soon got to the point where I didn't like Leo J. Ryan at all. I formed the opinion in my mind that here was a typical politician that was trying to garner for himself some

favorable publicity and so forth. We were surrounded with television cameras and stuff. It was a big deal at that time. This was being televised live, and these questions were unfair. The comments of the committee were, to me, they were unfair. I was trying to be very objective and very straightforward, tell them just what I knew and what I didn't know. I explained that the reason for the failure of the dam had not yet been determined, and we really didn't have any clue as to what had caused it. We had the two boards of engineers that were investigating this, and maybe when the investigation was complete we would have an idea of what caused it and how we could prevent anything like this occurring in the future, which was what the avowed purpose of this hearing was all about. So I implied that this hearing was premature in that respect, we hadn't made an investigation yet, so how could we have a hearing on what caused the dam to fail?! But I did point out this: that we had built dams on basalt foundations before; we had built earth dams *higher* than this before . . . .

END OF SIDE 1, TAPE 2. APRIL 6, 1995.
BEGINNING OF SIDE 2, TAPE 2. APRIL 6, 1995.

Arthur: We had constructed the dam according to the same specifications, and the same inspection procedures. This other dam had been in existence for several years and was performing very well. Teton failed. I didn't know why.

One of the congressmen said to me, "Excuse me, Sir, Mr. Arthur, I believe I read in the paper the dam did fail, didn't it?"

I said, "Yes, Sir."

He said, "But you tell me there's no reason why it should fail."

I said "Well, I'm telling you that I don't *know* of any reason why it should fail, but it failed."

But anyway, they got all through with it, and they had a bunch of other witnesses, including this geologist from Montana University. He testified at length that the great weight of this water caused the settlement of the earth's crust, and this had opened up joints in the rock and the water had gotten into the joints, and this and this and this led to the failure of the dam. So I was asked to comment on his testimony.

I said, "I don't agree." (phone rings, tape turned off and on)

Storey: You had said you didn't agree with this Montana geologist's view.

Arthur: I said we built Hoover Dam, which is twice as high as Teton Dam, the water was twice as deep, and it hadn't failed, and so on and so forth, and I didn't agree with his theory.

So all of a sudden, "*Mister* Arthur, you don't agree with *Doctor* So-and-So?"

And I said, "No."

"You understand he has a doctor's degree in geology?"

And I says, "Yes, I do. I haven't heard how many dams he's designed and constructed." (chuckles) Well, they didn't like me worth a damn, I wasn't a very cooperative witness.

So the hearing lasted all day and finally wound up late in the afternoon. Leo J. Ryan got up to close the meeting, and he said that the purpose of this was to investigate this horrible disaster, to see that such a thing could never happen again, to find out who caused this, who was at fault for this thing happening and so on and so forth. He went on quite some length of time, a very pompous type guy anyway, in my opinion. Of course I'm not very objective at this point, I've been badgered. And then he noticed I was still sitting in the witness chair. And he said, "That will conclude the meeting, unless, Mr. Arthur, you have something else you'd like to add."

Final Comments on the Failure of Teton Dam Before the Congressional Committee

And I said, "Well, thank you, Mr. Chairman, I would like to make a final comment. My comment is this. I think this meeting is premature. The reason for the dam failure and the way to keep this from happening again has not yet been discovered. It's not going to come out of a congressional hearing. It's got to be determined by physical examination of what happened, and an investigation by engineers and geologists to determine what happened and so forth. After *that* has transpired, we can logically assess why the dam failed, and who, if anybody, was responsible. Until then, I think such a meeting as this is premature."

He glowered at me and he said, "Thank you."

Do you know none of my closing speech, closing comments are in the record?! I didn't know that these guys edited the *Congressional Record*. I thought it was taken down verbatim what was said. Did you know this?

Storey: I didn't know they'd leave things out like that.

Arthur: Yes.

Storey: Huh. Well, I'd like to continue, but we've been at this two hours.

Arthur: I'm just going to run on for just a few more minutes.

Storey: Okay, great, that's fine. I just don't want to run over my welcome, is all.

Arthur: Well, while I'm on this subject . . . . This was in ~~1966~~ [1976], that this congressional hearing took place.

Storey: You mean '76, I believe.

Arthur: Excuse me, 1976. In 1978, there was a religious cult in Guyana, South America, run by Jimmy Jones. You remember hearing anything about that?

Storey: Yeah, I remember this.

Arthur: Do you remember where a couple hundred people committed suicide by drinking poisoned Kool-Aid?

Storey: Yeah. I remember there was a congressman murdered there before they did that too.

Arthur: Do you know who he was?

Storey: Was that Ryan?

Arthur: Not only the congressman, but the TV crew and the newspaper people, maybe two TV crews. Do you think he was down there just to help these people to find out what was going on, to try to rescue these people? If so, why did he take the TV crew? Why do you need that? Why do you need all the press coverage? Why do you need that? The way I heard about this, Don Duck called me up on the phone, and he said, "Did you hear about the Jimmy Jones disaster down in Guyana?"

And I said, "Yeah, I heard something about it." He said, "Well, Leo J. Ryan was killed down there. He was shot."

(Extraneous material removed from transcript.)

:**Storey:** Before we finish up, where were you, and when was it that you heard about Teton?

Arthur: It was on a Sunday morning, I was home.

Storey: Did you receive a call?

Arthur: I received a call from the construction engineer, Robison, that the dam was leaking. I don't know, I think I heard on the radio that it had failed, because he never got back to me. He said it was leaking and they told me what they were doing, what steps they were taking to try to stem the leak, and I never heard from him again.

Storey: How did Reclamation respond?

Arthur: I was there the next morning, with a team of people.

Storey: Oh, you were *up* there the next morning. (**Arthur:** Yeah.) But at that point there was nothing to be done, I presume (**Arthur:** No, there wasn't.) in terms of, I mean, just dealing with the disaster that followed. (**Arthur:** That's right.) How did people in Reclamation respond to the dam failure at Teton?

". . . I told them that the Bureau of Reclamation would never be the same, this would have a lasting impact"

Arthur: Well, I think mostly with disbelief that anything like that could happen. We were having a conference of construction engineers at that time, and a whole bunch of them were in Denver for some reason or other, I don't remember just what the purpose of it was. When I came back from Idaho, I went in and talked to them, our construction engineers, and told them what I knew and what I'd seen, what I knew about it, which wasn't very much. But I told them that the Bureau of Reclamation would never be the same, this would have a lasting impact.

Storey: Why?

Arthur: Because of the fact that we had the failure.

Storey: You mean because it was such a blow to Reclamation from an ego point of view, from a technology point of view. . .?

Arthur: Well, because of not only that, but concern of the public. A lot of our dams were built above cities. It had an impact on Auburn Dam. What would an Auburn failure do to Sacramento? It led to all these flood studies and what would happen if dams failed. It led to a nationwide survey of dams, an assessment of damage, the classification of dams in the high hazard/low hazard areas and that sort of thing. It just changed a lot of things.

Storey: Yeah, it was the catalyst for all that. Did we really need . . . . I don't think I'm putting this correctly. Did we need, in any case, the SEED/SOD Program, the Safety of Existing Dams/Safety of Dams Program? I've forgotten what "SEED" means.[8] Safety . . . . Well, anyway, did we need . . . .

Arthur: Well, starting in the 50s, we had the review of maintenance and operation of these projects, as I've described, where we sent out teams of people to review these. But that was a review of the physical condition of the dams. We did not consider whether there had been changes in the flood forecasting or hydrology or that sort of thing. We were just looking at the structure. Well, is the structure as good as when it was built? Not, did it need to be raised for a bigger flood or that sort of thing. I think these things need to be reevaluated, yeah.

Storey: Okay. Well, I appreciate your spending time with me today. I'd like to ask whether or not you're willing for the tapes and transcripts from this interview to be used by researchers.

END OF SIDE 2, TAPE 2. APRIL 6, 1995.
BEGIN SIDE 1, TAPE 1, APRIL 20, 1998

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold Arthur, at his home in Denver on April 20, 1995, at about nine o'clock in the morning. This is Tape 1.

Continues to Discuss Teton Dam Failure

Last time after we quit talking you mentioned you wanted to talk about Teton from a different direction–we sort of backed into it.

8. Safety Evaluation of Existing Dams.

Arthur: Yeah. Yeah, we talked about the end of the investigation and so on and so forth. I thought maybe we ought to discuss how the thing happened, how it came about. (**Storey:** Uh-huh.) We knew that the Teton site was . . . . (**Storey:** Okay, we're live now.) Is what I just said on the tape? (**Storey:** No.) Well, the last time we talked about the Teton Dam and the investigations and more or less how it ended up with my appearing before a Congressional Committee and so forth. And I thought you might be interested in some of the events at the beginning of the Teton Project. So upon further reflection, I realized that probably there's a lot of historical data that are available–probably would be a waste of time for me to repeat all that.

Storey: No, I want to hear your perspective on all of it.

Arthur: (chuckles) Well, as I mentioned before, I was home one Sunday morning in June of 1976, when I got a call from the project construction engineer, whose name was Robison, and from Teton Dam. And he said there were some leaks that were developing downstream from the dam some distance, and some springs that were showing up, and these were being monitored. He saw, at that time, no particular cause for concern. He wanted to advise me of the situation. He said that he would keep me advised as anything progressed. Of course that's the last I heard from him, because things developed pretty quickly after that. It was shortly, say, about three hours after that, that the dam failed. He was very busy in the interim period. The contractor marshaled some equipment and tried to dump rock into a crater that was forming on the back of the dam, and tried to take measures to save the dam, but it was unsuccessful. Obviously showed a lot of initiative in alerting the proper authorities that the dam was in danger, and there were signs of possible failure. It took a lot of initiative on his part, because certainly it was a hard thing to do, and he didn't really know what was going to happen. But his forthright action saved a lot of lives, I'm sure of that.

I heard on the radio that the dam had failed. As I mentioned before, I called up the regional director for the Denver region[9] and made arrangements to borrow the regional airplane so I could visit the site and see first-hand what had happened–which I did the next day, the next morning.

Do you have any particular questions you want to ask?

Storey: I thought you wanted to talk about maybe the events leading–in the construction.

9. The regional office in Denver was the Lower Missouri Region, Region 7.

Arthur: Well, we knew that this was a difficult site from a geologic point of view, because of the nature of the foundation. It consisted of basaltic flows, and successive layers of basalt had been deposited, and between each of these layers was an interflow zone–sort of broken and full of cracks and so forth. We were not sure that this could be successfully treated, so for the first time ever, we did a trial grouting section, before we committed ourselves to building the dam. We had a contractor go out there and see if the foundation could be grouted. The results of that program were positive. It appeared that the foundation at depth could be satisfactorily sealed by cement grouting, and that the near surface layers that could not be grouted successfully because of the inability to exert much pressure on the ground without lifting the rock could be treated by excavating a deep cutoff trench through the surface layers of rock, and this trench would be backfilled with impervious material. So we thought that we had a feasible site and we could build a dam there.

Storey: After the dam failed, what happened in the Denver office?

Boards Established to Study Teton Dam Failure

Arthur: Well, after the dam failed, I got a call from the commissioner's office in Washington, and I was informed that the Secretary of the Interior wanted to establish a board to investigate the failure of the dam, and I was asked to nominate private engineers who could serve on that board. I suggested a number of names. I suggested that Wallace Chadwick be selected as the leader of the team, Chairman of the Board. I knew Mr. Chadwick and he was the Past President of the American Society of Civil Engineers. And although I didn't think he was an expert on earth dam design and construction, he was an engineer with stature and impeccable reputation, and I thought he would be a very good Chairman of the Board. There were a number of engineers appointed to the Board who were experts in the design and construction of earth dams, who could furnish all the technical expertise. I figured that Mr. Chadwick could manage the whole operation. (**Storey:** Uh-huh.) As it turned out, he had more technical knowledge than I thought he had. In addition, the Secretary of the Interior appointed a government board to investigate the failure of the dam, and this consisted of representatives from different agencies in the government, including the Corps of Engineers and the Soil Conservation Service–and I was a member of that board also.

The problem with both of these investigations is that they were given very short time limits in which to reach a finding. I don't recall exactly, it seems to me that they asked the Board to come up with conclusions within thirty days. This was a very short time frame for such an investigation. You know, when an

airplane crashes, they convene a board to investigate the accident, and they usually don't report on the cause of the accident for at least a year, sometimes two years. In the case of Teton Dam, really, in order to make a thorough investigation of what caused the failure of the dam, they needed to do a lot of exploration, and in itself would take months to accomplish. And of course time was not available for this, so that the cause of the failure had to be determined by an examination of the visual evidence that was available at that time; plus the testimony of the Bureau of Engineers as to how the dam was designed and constructed, how the site was investigated and so forth.

So both boards reported their findings, and they were similar findings, that pointed to the failure of the dam being due to lack of proper attention to design details, [proper] filters in the dam. There were some other theories about hydraulic fracturing and as the professor from Montana, whom I mentioned before, testified, that the weight of the water in the reservoir had caused the foundation to open up, and this sort of thing. All of those things were looked at.

I directed that a investigation be made in the remaining portion of the dam, as far as an archaeological dig, you might say, in the left portion of the dam that was still remaining, to examine the contact between that portion of the dam and the foundation, to see if we could get any clues as to what had happened on the right side when the failure had taken place, because the bedrock in both cases was very similar, and the design of the dam, of course, was the same. So I hoped that we could get information from the dig, which would give us some insight as to what caused the failure of the dam in the first place. This investigation was started immediately, but it took some time to be completed, of course, because it was[n't] a simple undertaking. And some new information was disclosed that led to the development of some additional theories to why the dam failed.

Storey: In addition to the ones in the reports?

Arthur: Yes. So the Independent Board was reconvened to look at this new material and to evaluate it, which they did. And after deliberation, the consensus of the Board was that their original findings were still valid: there was a design deficiency. Although there were some data that indicated that there was a construction problem. They found a zone in the dam that was of low-density, wet material, that shouldn't have been there if the dam had been constructed properly, that led some engineers to thinking that that may have been the defect that had triggered the collapse of the dam. In fact, one of the members of the Board who was very prominent in the field of soil mechanics, Dr. Arthur Casagrande of Harvard University, sort of had a "minority report." With this new information, he thought

there was indication that there was a problem with the construction of the dam. This led to an investigation or evaluation of all the information that was available by Dr. Jack Hilf, a retiree from the Bureau of Reclamation, and he published a paper called "The Wet Seam and the Teton Dam Failure," in which he postulates that the failure of the dam was due to a construction-related deficiency, and not to design. Jack gave a report on this at a meeting of the ICOLD [International Congress on Large Dams] organization, Congress, in New Delhi, India, in 1979. Later, he prepared a paper that was given at the proceedings of the International Workshop on Dam Failures that was held at Purdue University in August of 1985. His paper was subsequently printed in the magazine *Engineering Geology*.

Of course I was a member of the initial Government Board that examined the dam failure, and I carefully reviewed all the information that was obtained later during the investigation–and particularly the analysis made by Dr. Hilf. And I'm inclined to believe that it was more a construction deficiency than a design problem. As I testified in front of the Congressional Committee, there really wasn't anything unique about the design of the Teton Dam. There was nothing unique about the materials, the type of material that was used, the specifications that were followed in the construction of the dam, the filters. The only unique thing about it was the ~~problem~~ [condition] of the foundation, whether or not it would be able to be treated by grouting. And as I explained, we had made an investigation before we decided to build the dam, to see that that could be successful or not. There wasn't any doubt in our mind but what that could be accomplished. So there wasn't any reason that could really convince me that it was a design deficiency.

On the other hand, I couldn't conceive of it as being a construction deficiency because the dam was built under close supervision of experienced inspectors from the Bureau of Reclamation. I was confident in their ability to see that the specifications were followed. The problem, which was called a wet seam, seems to be associated with the fact that there was frost action in the embankment during the winter shut-down when the dam was . . . . It was constructed over a period of several seasons. Of course during the real cold weather, the earth embankment activity was stopped. But the indications were that the material that was placed in the dam just before the close of the construction season one winter, that during the winter this material froze. And when the ~~spring~~ construction was started up the next spring, that it wasn't recognized that this material had been frozen to the depth that it had been, and that the frost action had loosened the soil, to the extent that it was no longer impervious, and that the loose seam of earth material could be penetrated by the reservoir water. Then the dam was built, completed, on top of that. As the reservoir came up, the water penetrated into this

— the theory is — the water penetrated into this relatively loose material, saturated it, and this actually contributed to the formation of the leak that led to the failure of the dam.

Storey: So this would be a compacted earth embankment?

Arthur: Oh yes.

Storey: And they had done something to compact it, and the compaction, according to this theory, had been destroyed by the frost action?

Arthur: Yes, exactly.

Storey: Okay. Is Jack Hilf still around?

Arthur: No, he passed away a few years ago. (**Storey:** Oh.) But you know, it's interesting that this wet seam theory has never been widely accepted as a cause of failure. As I say, it was recognized by Dr. Casagrande that this could have happened. And as Hilf ends his paper up, he says, "it is interesting to note that U.S. Bureau of Reclamation specifications following the failure of Teton Dam were revised to provide for identification and treatment of frost action in winter shut-down surfaces, and for all impervious core of dams located where frost action is significant, that they've added provisions, including the use of frost tubes. Also, they provide, before the next spring construction season starts, a considerable amount of material be removed from the previous compacted fill and recompacted." So that's sort of the tacit acknowledgment that there's a lot of concern on a lot of people's part that that actually contributed to the failure of the dam.

Storey: Yeah.

Arthur: In one way, Teton Dam was unique in that it was built in a very, very rigorous climate where they get very cold weather in winter, have deep freezing and frost penetration, whereas this would not have occurred in a dam built in California or Kansas or some of these other places.

Storey: Do you know anything about Robby Robison and where he went?

Arthur: No, I don't.

Storey: Marc Reisner in *Cadillac Desert tries* to make, or *seems* to make a big deal about the fact that you gave permission for the reservoir to be raised in two-foot levels a day, instead of one-foot level a day. Do you have any thoughts on that?

Arthur: Well, the main comment on that is that raising the reservoir was pretty much involuntary, the fact that the inflow from the melting snowpack was a lot greater, it was much larger than the capacity of the outlet works would have been, if they had been available, which they were not. So this was not the first case where that had happened. The Falcon Dam (**Storey:** down in Texas.) down in Texas had just been completed when they had a really Texas-size, gully-washer flood. And the lake came up very rapidly–about four or five feet a day sometimes, in spite of the fact that they'd been trying to control the level. The inflow was much greater than the outflow capacity. The situation in Teton has led to the development of much larger capacity outlet works being provided at dams, so that it would be physically possible to control the ~~greater~~ [rate of] reservoir filling. But it couldn't have been controlled at Teton with the limited capacity of the outlet works.

Storey: When did you first talk to Gil Stamm, the commissioner, about Teton? Do you remember? You don't remember anything about the conversation?

Arthur: No.

Storey: Okay. How did he react, generally? Do you remember that?

Arthur: Well, he was very supportive. We went together to the Congressional Hearing. Of course he testified too. He kept his cool.

Storey: What kind of pressures were exerted on you and the Denver office as a result of the failure?

Media and the Failure of Teton Dam

Arthur: Well, as I mentioned in our last meeting, this was not too long after the Watergate incident, so I think all the press around the country, they were all looking how they could break a big story and win a Pulitzer Prize, so the media was very energetic in covering this disaster. And it [media] seemed to be digging very hard to try to find some evidences of wrongdoing on either the part of the government or the contractor, rather than being just more factual, more interested in the facts of the situation. That's the way it seemed to me, at least. I was visited and interviewed by reporters from the *St. Louis Dispatch*, they came to my office. And the *Los Angeles Times*. Seems like I was contacted by the *Chicago Tribune, Washington*

Post, as I recall. Probably a lot of other newspapers, as well as the engineering magazines and so forth. So I appreciate the fact that when anything like this happens, like happened yesterday in Oklahoma City, that the officials who were responsible for investigating the incident and trying to find out what happened, and to do what they can to minimize the damages, are severely hampered by the media, which demand attention and interfere with what you're trying to do. You can't be sitting around having conversations with various reporters and all that sort of thing, and be doing what needs to be done on the other side. So I sympathize with the problems that they have.

Storey: Referring to Oklahoma City, you're referring to the bombing of the Federal Building yesterday in Oklahoma City.

Arthur: Right.

Storey: Evidently a *huge* bomb.

Who was the contractor, and how did they react?

Arthur: Morrison Knudsen was the contractor.

Storey: That's a Boise firm, isn't it?

Arthur: Yes.

END OF SIDE 1, TAPE 1. APRIL 20, 1995.
BEGINNING OF SIDE 2, TAPE 1. APRIL 20, 1995.

Morrison Knudsen Was the Contractor on Teton Dam

Storey: You were saying Morrison Knudsen was also one of the companies that built Hoover Dam as part of the Six Companies consortium.

Arthur: And they had worked on a number of Bureau projects, and of course they were from Idaho. As far as they were concerned, Idaho was part of their territory, so there were very few projects built in Idaho that Morrison Knudsen wasn't the low bidder. They're a very competent outfit. Their attitude was that they built the dam in accordance with the specifications and under the direction of the Bureau of Reclamation. The Bureau of Reclamation had done the inspection for quality control.

Storey: And had accepted the work, I presume.

". . . we had . . . inspectors . . . actually supervising construction of the dam. So as far as I could see, Morrison Knudsen had not . . . been derelict in anything"

Arthur: Right. And with this attitude I agreed. It was before the days of the contractors' quality control. We'd actually–we had, of course, inspectors up there under Robison, actually supervising construction of the dam. So as far as I could see, Morrison Knudsen had not done anything, not been derelict in anything that they'd done in their responsibility. They were concerned, of course, because of the failure and the fact that they'd been the contractor on the job. I think initially they were very concerned that the accusations may be made against *them*. I wouldn't do that. But the press started asking the kind of questions about the contractor, I gave them good marks, just like I'm doing now, because of their background and experience and know-how, and the fact the work was done under our direction.

Storey: Did you have political pressure or any kind of pressure to change anything in the Denver office as a result of Teton? Politicians, it seems to me, tend to want scapegoats.

Arthur: Well, of course that's what Andrus was looking for when, through Higginson, he asked for my retirement. Everybody else closely associated with the job had already retired. As you know, these kind of projects take a long time from the planning stage until they're finally constructed. Many people who had been involved during the design and so on had reached retirement age and retired before this had happened.

Storey: So they didn't retire *afterward*.

Arthur: No.

Storey: Oh, okay. So nobody sort of said, "Well, it's time to hang [it] up and go away."

Arthur: Well, I don't think so. I knew it would be the easiest thing to do, but I didn't feel it was the thing I *wanted* to do. I didn't want to retire or get fired. I didn't want to dump the problems on Donald Duck who was my Deputy, hadn't been involved in the Project at all.

Storey: Do you have any feeling for how long Design took on Teton? You know, the whole thing: investigations, design, and so on?

Arthur: Well, let's say . . . probably about ten years.

Storey: Okay. What else should we be talking about, about Teton? I'm sure it had an affect on the Denver office–psychologically, in terms of some of the programs.

Arthur: Of course it led to, when I retired, I was replaced by . . . . Let's see, Rod Vissia came in there.

Storey: I believe Keith Higginson hired somebody from the outside at first.

Arthur: Yes, he hired a guy from California Water Resources for it. I'm trying to recall his name.[10] I know him real well, too.

Storey: I don't remember it right now.

Arthur: But this led to bringing in people from the outside — to the establishment of independent boards to review the Bureau's work and so forth, which we had done very little of that previously. And it led to the passing over of Donald Duck, who had been groomed to take over my position. He was passed over. The guy's name out in California started with a "J." Was it Jennings? Something.

Storey: I don't remember.

Arthur: Well, anyway . . . . Then they brought in Rod Vissia, who had been a regional director in Boise, and he didn't have the kind of background, he'd never been in construction or design, either one. He was an administrator. So they changed the complexion of the job.

Of course Carter was defeated and Andrus was out. I suppose that led to Stamm's retirement, since the new President came in.

Storey: Well, of course he retired when Carter came in. Or he left when Carter came in, because that's when Keith Higginson came in.

Arthur: Yeah, right.

Reclamation's Safety of Dam Programs

10. Robert B. Jansen.

Storey: What about Safety of Dams Programs? Did we have them? Did it affect them? How did it affect them?

Arthur: Yes. They were expanded. We had them from the review of maintenance that I described when I participated in, clear back in the 1950s, where we would go out and review the physical condition of the dams and their appurtenant works, to see that they were satisfactory. As I mentioned before, we didn't reevaluate the hydrology, those sort of things, to see whether a spillway capacity was adequate for that sort of thing, which was needed, which was subsequently done.

Storey: One of the things Carl Hoffman mentioned to me in his interviews was the evolution of the science of — I think it's hydrology — where you predict floods. Is that the correct term? (**Arthur:** Yes.) And that as Reclamation's sophistication about predicting floods improved, we began to expand and expand our outlet works and our spillway capacities and that sort of thing. And that becomes part of the Safety of Dams issues.

Arthur: That's right. This is one problem we were having, cost overruns. When a preliminary design was made, when a spillway capacity was based on an inflow design flood of a certain size, and by the time we got to the final design, the hydrology had progressed to the point where it always seemed like the flood was larger, so it cost more to build the spillway. And this provoked chief engineer Bellport, and he once said, "Anytime that somebody pissed on the watershed, they doubled the inflow design flood." (laughter)

Storey: Uh-huh! But it was very real in terms of costs?

Arthur: Yes, of course, it was.

Storey: So spillways are a major expense, I take it, then.

Arthur: Well, they are on certain streams, yeah. (chuckles) Barney was an old-time construction engineer, his language is kind of salty. (laughs) (**Storey:** Yeah.) But you understood what he's talking about. (chuckles)

Storey: Well, as the assistant commissioner, though, for instance, did Safety of Dams issues come up involving hydrology, for instance, or other issues that you then had to make recommendations for dealing with? Or how did that work?

Arthur: Well, at that point in time, there wasn't a lot of investigation of the conditions regarding *existing* dams. Hydrological studies were being made in connection with proposed projects.

Storey: With new construction work, uh-huh. Now, while you were assistant commissioner, were there any new authorizations, as opposed to appropriations?

Arthur: I wasn't the assistant commissioner. I never had that title. I was director of design and construction, deputy director, deputy of design, director of design and construction. Before that I was associate chief engineer.

Storey: Oh, I thought you were the assistant commissioner for design and construction.

Arthur: No, I never had that title.

Storey: I'm confusing this with something else, I guess.

Arthur: well, bloodgood had that title, assistant commissioner *and* chief engineer. He at that time . . . .

Storey: Maybe that's where I picked that up from.

Arthur: Yeah, titles came and went over a period of time. The title that really seemed to stick up until Armstrong became commissioner, *was* chief engineer. There was always chief engineer in the title. (**Storey:** Yeah. But . . . .)

Your question, were there new authorizations: yes, I'm sure there were.

Storey: You don't remember any specifically?

Arthur: No, I don't. I'm sure there were new authorizations, but I don't remember anything specific.

Storey: You mentioned last time that you decided not to leave really quietly. (**Arthur:** Right.) And that you wrote a letter. Did that letter go into the files officially?

Arthur: I don't know. I found a copy in my files the other day.

Storey: Was this a letter to Keith Higginson, to the commissioner?

Arthur: I sent this to somebody. Copy on the front says, "Attached is a copy of a form letter regarding my retirement, which I am sending to over 100 organizations and individuals, including professional organizations, professional magazines, newspapers, contractors, associates, and friends. I expect there will be a small fuss as a result of the secretary's actions." Yes, this certainly went to everybody I could think of. I'm sure it's in the files. This copy that I have here is not dated. As you know, the letters are stamp dated as they are mailed, so this copy I have was one that was not mailed, isn't dated.

So there was some comment in *Civil Engineering*. There was a letter of protest, as I recall, from the Colorado Section of the American Society of Civil Engineers to the secretary and anyone else.

Storey: Is there anything else you'd like to talk about, about your career at Reclamation, before we move on into your second career? Or should we say about your fourth career?

Arthur: (chuckles) Well, I think we've just about covered it all. It was a very interesting career. That was the only — Teton was the only bad spot.

Storey: You know, now that you mention Teton, do you know John Keys?

Arthur: Yes.

Storey: He's the regional director in Boise now. He told me during an interview a few weeks ago, that there were *some* of the Denver office people who were *convinced* that the problem was an earthquake, and that when they actually uncovered the powerplant in order to recover some of the equipment or something, that people came up from Denver to check the seismic recorder there, which had been destroyed by the water and the mud and so on. (**Arthur:** Is that right?!) I was just wondering if you knew anything about this theory in the Denver office.

Arthur: No. It's not an active seismic region, though they've had earthquakes up in Yellowstone Park, of course, not too far from there.

Storey: Yeah, and up at McCall, Idaho, I think they had one a few years ago here. McKay, Idaho? I've forgotten, someplace up [there].

Arthur: What I wanted to say on the Teton, when the Teton Dam was designed, and that period of time, I was in staff position. I had nothing to do with the design, never even reviewed the design. My name isn't on any of the drawings or anything else.

The only involvement I had was with this trial section. I was involved in doing that, because I realized in reading the trial reports and this and that, [that there were] potential problems in that area, and we'd better investigate to see whether it's feasible to build a dam. But that's what annoyed me with regard to the secretary's actions, is that I really hadn't been involved with the design of the dam. By his action, he was trying to make me the scapegoat.

Storey: Yeah. Do you have any thoughts on the idea that Reclamation became too conservative about its design work as a result of Teton? That it tended to overbuild, it tended to become more expensive — all of those kind of issues?

Reclamation and Others Tended to Overbuild after the Failure of Teton Dam

Arthur: Not only Reclamation, but the entire [dam engineering] profession, yes.

Storey: You think that's true?

Arthur: Yes. As I mentioned, we started building these large-capacity outlet works, so the reservoir water could be controlled. That cost a lot of money, doing that sort of thing. And there were other conservative measures taken in the design details and stuff that added to the cost. And not only in Reclamation, but as I found out in my consulting practice, that it was being done by all the engineering organizations, which after all, pretty much pattern the specifications and methods of design after the Bureau of Reclamation practices.

Storey: Uh-huh. Well, now as I recall, you retired in the summer of '77?

Arthur: Yes, I did.

Retirement Plans

Storey: And this came somewhat unexpectedly, but did you have a plan for what you were going to do, or did you just go retire, or how did that work for you?

Arthur: Well, as I said before, I decided to stay on because of the Teton thing. I didn't know just when I was going to quit, but Higginson called me up and said that the Secretary [of the Interior] was going to announce at the Press Club that everybody connected with Teton Dam was going to be let go and that he wanted my retirement. He figured that was a good time to do it. So I agreed that I would retire. I didn't retire the *next day*, I retired maybe a couple months later, something like that. So in the interim period, I decided . . . . Before this happened — let me

revise this a little bit — before the secretary talked about this, or before my retirement had been announced — I don't know which in time — I got a call from the commissioner's office. They said they had a request from the Philippine government to furnish a Bureau of Reclamation engineer who was experienced in the design of earth dams, to serve as a member of a consulting board on the building of a major earth dam project in the Philippines. This came about because in 1972 there was a team of Bureau engineers who went over to the Philippines to assist the Philippine government in the planning of their projects to evaluate some of their plans. This team was headed up by Art Mitchell, who's also passed away, but anyway, this team came out with a finding that a certain project with the best potential for development in the Philippines. That was in '72, so along in '77, after that report, the Philippine government had an initial evaluation study made, preliminary designs, by a group of engineering organizations. The lead organization was a Denver organization, ECI Engineering Consultants, Incorporated. This study showed that this project was economically feasible. And the Philippine government went to the World Bank for financing. The World Bank agreed to finance it, but they had a stipulation that they wanted an international consulting board to advise the Philippine government agency in the design and construction of this job, and to oversee the designers, because the Philippine agency didn't have any in-house expertise. The World Bank wanted a "guarantee on their loan," you might say.

Serves on Engineering Board in the Philippines

So anyway — sort of a long preface here — the head of the National Irrigation Administration of the Philippines who was going to build this project was a guy by the name of Junio. And he was, of course, aware of the fact that the Bureau of Reclamation had an important part in its planning. So he was told that he should convene a consulting board. And he asked Reclamation to furnish a member of the consulting board — it was going to be an earth dam. So I got this request — back to that — I got this request from Washington to nominate three engineers who were either about to retire or had retired that would be qualified to do this work. So I sent in three names, including my own. And I got a call from Washington.

They were amazed that I'd put my name on this. They said, "You realize this isn't just a one-shot trip or something: this is a consulting board that's going to be involved over the project for a long period of time," and so on and so forth. "Are you sure you have time to be a member of that consulting board?"

And I said, "Yeah, I'm going to have a lot of time, because I'm going to retire." That's when they first knew in Washington that I was going to retire. I said, "I'm certainly qualified for that job." So I was selected by the Philippine government. There were the three of us on the board: another engineer [who] worked for . . . . [Alexander] Gibbs in London was a British engineer; and a geologist was a guy by the name of Campbell from Vancouver, British Columbia, a Canadian; and myself. So we were truly an international board.

And the first meeting that we had of the consulting board was in March of '77.

Storey: Uh-huh, before you're even retired.

Arthur: Before I retired, yeah. I went over . . . . Of course I couldn't collect a fee over my expenses being reimbursed to the Bureau, but that was the organizing committee. And then after I retired, I then became a consultant for the Philippines. And from March '77, my last visit there was in October 1982 for the dedication of the project, I made thirteen trips to the Philippines in connection with that assignment. So that's how I got started on my consulting. I had a consulting board assignment before I retired.

Consulting Engineering Board in Greece

Well, this letter went out that I mentioned, saying that I was retiring, that I sent to all the engineering organizations and so forth: I got a call from a professor at Purdue University, a geologist who had once worked for the Bureau of Reclamation, and he said he was on a consulting board to the government of Greece, and that ~~that board,~~ one of the board members was a guy by the name of Wendell Johnson. Wendell Johnson was retired from the Corps of Engineers, and had a job, he was in charge of civil works for the Corps of Engineers at the time he retired. And he had been on this consulting board in Greece for several years, and he was going to retire from that board for health reasons. And ~~he~~ [the caller] said, "They want to replace ~~him~~ [Johnson] on that board, and" he said, "they want the same expertise in somebody that ~~*he*~~ [Johnson] had." And he said, "You and ~~he~~ [Johnson] had almost identical jobs — you in the Bureau and he in the Corps. Would you be interested in being a member of the consulting board in Greece? If so, write a letter to the guy to contact." So I wrote a letter to Greece and told them that I'd be interested in consulting and sent them a copy of my résumé, and I was retained on that. The first trip I made there was on July 5, 1977, and the last trip I made on that job was in August 1985. In that seven years I made twenty trips to Greece. I worked on a *whole bunch* of jobs over there. So as you see, just within a

month after my retirement, I was on two international consulting boards, and I was very busy.

I became involved on another international consulting board the following year. So that was in Ecuador. I made my first trip to Ecuador in October '78, and my last trip there was in September of 1991. I had twenty-seven trips on that project.

END OF SIDE 2, TAPE 1. APRIL 20, 1995.
BEGINNING OF SIDE 1, TAPE 2. APRIL 20, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on April 20, 1995.

Consulting Engineering Board in Ecuador

You were saying that you were also placed on a board for Ecuador, an international consulting board.

Arthur: Right.

Storey: And your last trip there was in '91, was it?

Arthur: Yes. I started going there in '78, and the job was completed in ~~'81~~ '91. At the time I went there, they had just completed the feasibility designs for this big project. And Ecuador secured financing from the Inter-American Bank. The Inter-American Bank wanted a consulting board to advise the Ecuadorian government, because they didn't feel the government had the in-house expertise to evaluate the work that was done by their consultants. So that assignment lasted throughout the additional investigations and the preparation of the final designs and specifications, and then we periodically visited the job, monitored the construction, reviewed the quality control and all that stuff. So that wasn't completed until '91.

A couple of years ago, for purposes of testimony as an expert witness, I counted up, I had, I think, seventy or eighty international trips as a consultant. A lot of time on that.

Storey: In the Philippines, what projects were you working on?

Magat Project, Philippines

Arthur: It was one project, it was called the Magat Project, M-A-G-A-T.

Storey: And what was it?

Arthur: It was a big major earth dam. It was on a rather small river about the size of the South Platte that flows through Denver. But because of the hurricanes — the typhoons, they call them over there — the typhoons that they have in the Philippines, the spillway capacity was larger than Grand Coulee Dam. The spillway was a significant structure.

Storey: And what did you do as an international consultant on the Magat Project? And what was the name of the river, do you remember?

Arthur: It's the C-A-Y-A-G-A-N, Cayagan. Well, I reviewed the design of the dam, the exploration investigation of the dam for the foundations, and the design of the dam, construction materials. I reviewed all the aspects with regard to the earth dam. [The] Gibbs [representative] was a hydraulic engineer and structural engineer. He was concerned with the design of this big spillway and the forebay for the concrete dam section. The third member of the team was a geologist, and of course he was involved in both foundations and so forth. We reviewed the work that the consultants did and the designs, specifications in detail. We reviewed the construction [progress], quality control, procedures that were being used, and that sort of thing. Every time we went over there, we would convene in Manila. Of course we all came from different parts of the world and different times [time zones]. We all convened in Manila, and we were immediately taken out to the dam site, which was about 150 miles north of Manila — by government plane. We would stay out there doing field work that was necessary for several days, and then we would come back into ~~the Philippines, in~~ Manila. We would make a verbal report to the administrator and then prepare a written report of our findings that would be furnished to the World Bank.

Storey: While you were still there? (**Arthur:** Yeah.) What were the accommodations like out at the reservoir site?

Arthur: Well, when we first started going out there, they were very rough. But by the time we got through out there, they were very nice (chuckles) because one of the earliest things they started building was the government camp, government village out there. They built some nice guest houses and a recreation center for their people. We used to have a big party out there every time when we came out — dance and dinner and that sort of thing. Very hospitable people.

When we *first* went out there, conditions were pretty primitive. They had some temporary-type housing — they weren't tents, but they were shacks, and we did have running water and we had a shower. We were out in the bush pretty much.

Storey: Let's see, how old would you have been in '77?

Arthur: [I was] sixty-two, *sixty-three*.

Storey: I can tell from the look on your face, you enjoyed this.

Arthur: Oh yeah, it was great! It was great. They built this recreation center, and of course they had a big staff out there, it was a big project. And they used the occasion of the consulting board coming out to have a party, as I mentioned before. And they'd have a big dinner, and they had a Philippine orchestra, made up of employees out there. They'd have a dance. The three of us would draw straws to see who would have to stay, because those Filipinos, they got to going, and they were there for hours and hours. They weren't going to close up until the wee hours of the morning. We were all a bunch of old duffers. (laughter) We'd all go to the dinner, but one-by-one we'd made our excuses, but we always had one guy that would stay on for quite a while. But it was a lot of fun. The construction engineer was a Filipino, and he was very anxious that the consultants have a good time, you know. So we'd kind of stand around while these Filipinos were out there dancing. He'd make these poor little, shy little secretaries, these little Filipinas, come ask us for a dance. (laugh) And these little gals come up and ask you to dance. Of course we didn't dance the same kind of style, quite. (laughs) They were rock-and-rollers, and that sort of thing.

Storey: What kind of food would they serve you at these banquets?

Arthur: If they were going to have a banquet, they would usually take a steer and barbecue the steer on the spit–I mean the whole animal. They'd serve the beef, and they'd serve fish — served all kinds of things, some of it was edible! (laughter)

Storey: What were your accommodations like then, when they had become more civilized?

Arthur: Well, they were brick houses, permanent-type housing, and tile bathrooms and bedrooms and good beds and that sort of thing. Not luxurious, by any means, but you know, pretty modern. (**Storey:** But comfortable anyway.) Yeah. Of course the accommodations in Manila were *super*. They were *great*.

Storey: Tell me about those. Where did they put you up?

Arthur: Well, we stayed in different hotels. Marcos had wanted to have a real conference for some kind of an organization there, several years before that, and there was a complaint that there wasn't sufficient accommodations for the delegates. So the Filipinos embarked on a big hotel-building program there. They had some nice hotels. And they had a Hyatt Hotel we stayed at sometimes. We stayed at the Manila Hotel: this is the hotel where General MacArthur had his headquarters at one time. This was kind of like staying at the Broadmoor, very luxurious. They were really first class.

Storey: Did that project run into any problems that the consulting board helped them straighten out or anything?

Arthur: Just at the very beginning. At our initial meeting, when we went out there and looked at the site, they had just been doing some additional exploration, and they had uncovered a trace of a fault that would cross the chute section of the spillway. As I say, the spillway was bigger than Grand Coulee in capacity. And our geologist, who was *very* concerned about this, because it was a recent fault–when I say "recent," I mean it occurred in the last 10,000 years, through the recent tertiary materials. It wasn't an old ancient fault. So based upon his recommendation and a strong feeling of mine, we as a consulting board recommended that they put the spillway on the other side of the canyon–other side of the valley, it wasn't a canyon. At the other side of the valley–we changed the whole physical layout of the project. Of course this put the consultants on the defensive–they set out to justify their original layout. We reached an impasse, where they wouldn't agree with us, and we wouldn't agree with them. So when we got back to Manila, they had a reception for us. There was a roof garden at the top of the National Irrigation Administration Building in Quezon City, and the administrator, Mr. Juinio, got us to one side, because he'd had the briefing during the daytime. So he said he didn't know what to do. Here he had the consulting board on one side saying one thing, and he had this other organization, American engineers, saying something else. He didn't know what to do. We told him that we didn't have any confidence in the layout that they'd been proposing in the preliminary designs because of this recent disclosure of the fault. We didn't blame the consultants, because at the time they'd made the design, this exploration had not been completed. So we weren't holding them *responsible*, we thought now was the time to face facts, that they had this additional information, it would be prudent to change the location, and that more or less, we didn't care to be associated with the project unless the change was made. So the change *was* made, but over the protests of the consultants who were designing the project.

Storey: That's the ECI?

Arthur: ECI. One of their strong arguments was that it was going to increase the cost considerably, because of our changing the location [of the spillway] it would make it a less favorable situation, from a topographic point of view. It would greatly increase the cost. We didn't think so, but it was agreed that they would make some alternative design studies. And there were two or three ways that the project could be changed: all put the spillway on the other side. There were several ways that this could be done. So the ECI was asked to make these comparative studies. We ended up having a meeting in Vancouver. I don't remember why we held it there–we held it in the offices of the geologist. I guess it was more convenient than trying to meet back in the Philippines at that time. (**Storey:** Uh-huh.) Anyway, Bach — the fellow who came over from London, his name was Bach–and a couple of Filipinos came over to Vancouver, and ECI was up there, and we reviewed all these designs and found out that we estimated the increase in cost was on the order of ten percent, which we said, as a board, was not significant, because the estimates were within that degree of accuracy . . . We picked the one that we thought was the most favorable, and that was selected for final design. No problems [turned up during the] construction period of any magnitude.

Storey: What was the purpose of the dam and reservoir?

Arthur: Primarily irrigation. You see, this river, as I mentioned, is about the size of the South Platte sometimes, it was bigger than the Columbia at other times. I guess it was because the rain came, and these typhoons. It's in the tropics, they only have enough water in the river that they can irrigate and get one crop of rice a year. And if they had an adequate supply of water, they could get *three* crops a year, because they have a twelve-month growing season. (**Storey:** Right.) And the only way they could do that, is have storage to store portions of these large floods to augment the low flow of the river during the dry season. They had six months of dry season, six months of rainy season.

Storey: And that project took how many years? Six was it? Seven?

Arthur: Well, let's see, I wrote it down here. We went '77 to '82, five years. Five years that *we* were involved on it, but it had already been planned, and feasibility and designs prepared before we got over there, so it had been planned in '72, so it was ten years.

Storey: Let's see, there was also a powerplant, was there?

Arthur: Yes. We weren't involved with the construction of the powerplant. It was designed and built by another agency. We were consultants to the Irrigation Administration, and the powerplant was not financed by the World Bank, so we weren't involved in that. At the last meeting, we had the dedication of the project, and we had the opportunity to meet with the President and First Lady of the Philippines.

Storey: Uh-huh. Did she change shoes while you were — never mind. . . . (laughter)

One of the things I'm interested in is what happens to former Reclamation employees who go on and go out to do consulting work. I'm particularly interested– I keep getting a glimmer–that their income goes up, because they were basically underpaid in the Federal government. And I'm wondering if you would comment about what happened to your income, how this consulting stuff works, and that kind of thing — in terms of the economic side of it.

". . . he retired from the Bureau of Reclamation and went to his financial reward. . . ."

Arthur: Well, let me quote Grant Bloodgood–he was the chief engineer years ago. (**Storey:** Uh-huh.) Grant Bloodgood retired from the Bureau of Reclamation and became the chief engineer for a consulting company, International Engineering, out in San Francisco. And I heard him say once that he retired from the Bureau of Reclamation and went to his financial reward.

Storey: (laughs) So presumably it does go up.

Arthur: That was well put. I retired in June of '77, and just launching my career as a consultant . . . . As I recall — I thought I had it written down here, but I don't — as I recall, in that six months, my income from consulting was more than my *annual* income with the Bureau of Reclamation. And in subsequent years it became, I would say, more than double.

Storey: Uh-huh. And you weren't working full-time, is that correct?

Arthur: That's right. I was making — let's see, to Greece I made two trips a year; Philippines I made one trip a year; and Ecuador I made two trips a year — so that was five international trips, I was making a trip almost every other month. And, that coupled with the other work that I was doing, [at that time]. I would say that I was pretty busy–not more than half-time.

Storey: How long would trips generally be?

Arthur: The trip usually took about two weeks from the time I left Denver til I got back.

Traveling to the Philippines

Storey: And how would you go–to the Philippines, say.

Arthur: I tried every which way (chuckles) you can think of. I went through Hong Kong. The flight would go from here to the West Coast, and then to Hong Kong and stay overnight, and then go to Manila the next morning. I'd go to the West Coast and then to Tokyo and stay overnight, and go to Manila the next morning. On several occasions, I took a sleeper plane out of San Francisco and went through Hawaii and then on nonstop to Manila and got there the next morning.

Storey: What's a sleeper plane?

Arthur: This was a 747 with the upper deck. Have you ever been on the upper deck of a 747?

Storey: No.

Arthur: You know they have the bulge, the circular staircase that goes upstairs? (**Storey:** Uh-huh.) Well, they put in a number of bunks up there. And if you have a first class ticket–first you had to be flying first class–then for a surcharge on top of that–you could have a bed. Usually I'd get on the plane–the plane usually left about late afternoon in San Francisco, and I'd sit in the first class section until we had dinner and so forth, for a couple of hours and then I'd go up and go to bed, and stay in bed until I got up for breakfast the next morning–we'd be in Manila. But that took quite a bit more time, because Hawaii's a couple thousand miles out of the way. The quickest way to Manila is to go up from San Francisco up over Alaska, the Aleutian Islands, around there, and down through Tokyo and down to Manila. But, there weren't any planes that went clear through from Denver, changed planes, layover, couldn't make connection. That's why I stayed over in Tokyo or Hong Kong. Except the sleeper plane, it stopped in Hawaii and refueled and then went on nonstop to Manila. But these other planes, Tokyo and Hong Kong are both about thirteen hours from the West Coast. I think going through Hawaii, meant about seventeen hours from San Francisco to Manila.

Storey: As a consulting engineer working for the Philippine government, I take it? (**Arthur:** Yeah.) Did you just do a flat fee with them, or did you do a fee plus expenses, or how was that worked?

Arthur: On all my consulting I had a per diem fee, plus expenses. Expenses included first-class transportation, and the *fee* included travel time, so I'd get paid portal to portal– from the time I got home 'til I got back.

Storey: So it was a daily fee or something?

Arthur: Yes, a daily fee. No retainer, it was just a daily fee.

Storey: Okay. Now what did you work on in Greece?

Work in Greece on Hydroelectric Projects

Arthur: In Greece I worked on a number of hydroelectric projects. Greece has very little fossil fuel, they have no oil. There's a little oil in the Aegean Sea, but they quarrel with Turkey about who owns that. They have some low-grade coal up in the northern part of Greece, lignite. It's not very good. So most of their power is supplied by hydroelectric. They're almost like Switzerland: Switzerland's entirely hydroelectric. Greece is, I'd say, ninety percent hydroelectric. So they were building a number of hydroelectric projects to meet the increasing demand for electrical energy over the years. They started out by hiring the consulting engineering firms. This ECI firm that I mentioned before, they built a big project in Greece back in the '60s; I think it was, and they had another project which was designed by the Swiss; and another project was designed by the British. But as their demand for electricity increased and more and more projects had to be built, they decided that it would be much more economical and more satisfactory for them to develop in-house capability. Their engineers were all — had adequate technical training, some of them graduated from American universities, some from English universities, some from French, some from German. They were all adequately trained, but they didn't have any practical experience. So they decided that in addition to assembling a staff of technically-trained engineers, they should have a consulting board that would oversee the work and advise them on all aspects of their development of hydroelectric power. And they convened this board back in the early '70s, and it continued up until '82 when they had a change in the socialistic government: Papandreou got in there, and he canceled the board. That ended my association there in Greece at that time. But the board was involved in all aspects of the development, including the site selection, going out in the field and examining the sites, reviewing the geological studies, and directing the geological studies for the drilling and that sort of thing, exploring the foundation, exploring for construction materials, aggregates and so on and so forth. We would advise on the *type* of dam — most of them were concrete dams because of the situation in Greece, the geologic and topographic ~~material~~ _____

~~situation~~ [conditions]. And we would advise them the type of dam, and the size of the project, and the scope of the project. That would be, actually, the content, the whole ball of wax. And we would review and advise on the preparation of the specifications, preparation of the contract documents, and reviewed all that. Then we would visit the sites of these jobs during the construction period, to see how they were being constructed, and monitor that.

END OF SIDE 1, TAPE 2. APRIL 20, 1995.
BEGINNING OF SIDE 2, TAPE 2. APRIL 20, 1995.

Arthur: We were advising, consulting with this agency, under the Public Power Corporation of Greece, which is a government agency. We were advising this group, you might say "from the cradle to the grave," on these hydroelectric projects. And invariably, when we went over to Greece, we would be consulted on a number of projects — maybe three, four, sometimes up to five or six projects, that were in various stages: Some, they were just beginning to look at, in a reconnaissance mode. And some of them were in final design. Some were under construction. So we would be involved in all these various phases. And we would write a report, write a chapter on each one of these projects, advising what we felt they ought to do and what they were doing. And these were being financed by the government of Greece–there wasn't any World Bank or any organization like that involved, so we were working for the owner, not because the owner *had* to have a board, but because the owner *wanted* a board. I think one of our functions was to have been involved in case anything goes wrong.

They could say, "Well, look, we had a board of international specialists that came over here and advised us."

Fortunately, nothing ever went wrong. We did some major projects in transmountain diversions and all sorts of things–very, very interesting job. I thought I'd be working there as long as I was able to get out of the rocking chair, but they had a political situation change there.

Storey: Uh-huh, a lot of projects.

Arthur: Yeah, a lot of projects.

Storey: My sense of Greece is very arid. Where do they have rivers?! I mean, what rivers were they working on, and what were some of the projects?

Arthur: The northern part of Greece is the tail end of the Alps. In fact, one of the projects that we were looking at was located near a ski area. So the elevation was up around 6,000 feet, and was about the highest point in Greece. It's very mountainous. The plains are down toward the sea. The northern part of Greece and the central part of Greece is very mountainous. And there are a lot of streams. They get quite a bit of snow. These streams all swell. The canyons are narrow, the gradients are steep. To develop a great deal of power, it's going to take a lot of projects. There aren't any Grand Coulee sites. ~~There aren't any Gopp Project sites.~~ They were all narrow canyons, that type of thing. More like Three Forks up here, you know. (**Storey:** Uh-huh.) More like Auburn.

Storey: Auburn's pretty large, isn't it?

Arthur: Yeah, but it's not a Columbia River.

Storey: No, it sure isn't. That's the American, isn't it?

Arthur: Yeah. And nothing like Shasta.

Storey: But none of them particularly stand out? It was a lot of medium and small-sized projects?

Arthur: Well, some of these projects were pretty ambitious. I mean, they weren't low dams. They were short dams, because of the narrow canyons, but they were building dams, 250- 300 feet high. They were high dams. And in fact, they had one high-head plant where the reservoir was built up in the mountains, and water was carried through penstocks way down in the valley where the farmland was. So they could develop a high head.

Storey: Any particular problems with that one that you recall? Is that high-head technology fairly well developed?

Arthur: Oh yes! (phone rings, tape turned off and on)

Storey: Did Reclamation have anything to do with the development of that technology? Or is that something outside our expertise?

"No, reclamation didn't develop this technology. . . . The reason being is that a high-head plant is of value only for power production — the Bureau of Reclamation . . . was irrigation, with the power as a corollary use. . . ."

Arthur: No, Reclamation didn't develop this technology. Reclamation doesn't have any high-head plants. (**Storey:** Okay.) The reason being is that a high-head plant is of value only for power production — the Bureau of Reclamation is not a power-producing organization, it was irrigation, with the power as a corollary use. But a high-head plant is a single-purpose power producer. But the technology was very well developed in Switzerland. They've got a few mountains in Switzerland, they've got a lot of snow with the small streams, high head. It's a similar situation in Greece. They developed the technology there.

Storey: Okay. I don't remember whether you told me about how many dams you worked on over there, how many projects. (**Arthur:** In Greece?) Yeah.

Arthur: Probably around twenty. But of the twenty, the only . . . . Let's see, I can think of one, two, three, four . . . . Only about four were completed during this period of time–the rest were all in various stages.

But another thing that was interesting in Greece was their . . . . Almost invariably they did underground powerplants. You know, I can just recall two surface plants–the rest of them were all underground. And this was primarily because of security. The Greeks and the Turks are not very good friends. The Greeks are paranoid towards the Turks.

Storey: Uh-huh. And underground powerplants are more secure?

Arthur: Less likely to be bombed — aerial bombing around there. It's like Cheyenne Mountain.

Storey: I would think it's more expensive, though.

Arthur: Not always, because in some of these narrow canyons, it would be very difficult to find enough room outside for the plant anyway. So it's the same reason we built, in many of the cases there, it was the same situation the Bureau was faced with at Morrow Point: There we put our first and only underground powerplant, because it's in a narrow canyon with very steep walls and so forth. It would be difficult to develop enough area outside for a surface plant without *long* penstocks running from the dam to the plant, which increased the costs in that situation. So it'd be more economical to put the plant underground.

Storey: Did you get to do any sightseeing while you were on these foreign jobs?

Arthur: Not as much as I'd like. To go back to the Philippines: I took my wife over there a couple of times, and some of the other guys had their wives from time-to-time. They'd take them on plane trips, they'd go to resort areas in the Philippines and to the rice terrace areas. She saw a *lot* more of the Philippines than I did–I just saw between Manila and the dam site and back! In Greece, when I was still with the Bureau, I went over to Greece for an ICOLD meeting, and I took a study tour and saw more of Greece in that study tour, as far as sightseeing is concerned, than I saw during all the time I worked there. This was the time I went to the Acropolis and I did all the touristy things. But we did see some unusual things in connection with our travels throughout Greece, and we went all over Greece to these various sites. We traveled mostly by car, but on occasion by Greek [Air] Force airplanes, and occasionally by helicopter. Sometimes in four-wheel drive we went places where tourists don't go to these very interesting spots.

Storey: Well, I'd like to continue on with Ecuador and other things, but our time is up for today.

Arthur: Good, I've got a lunch date anyway!

Storey: Good. I'd like to ask you again if you're willing for the material on these tapes and the resulting transcripts to be used by researchers.

Arthur: Yes, indeed.

Storey: Thank you.

END OF SIDE 2, TAPE 2. APRIL 20, 1995.
BEGIN SIDE 1, TAPE 1, MAY 4, 1995.

Storey: This is Brit Allan Storey, senior historian of the Bureau of Reclamation, interviewing Harold Arthur, on May 4, 1995, at his home in Denver at about eight-thirty in the morning. This is Tape 1.

Consulting Work in Ecuador

Mr. Arthur, last time you were talking about consulting after you retired from Reclamation. We had talked about the Philippines and Greece, and had not yet gotten to your consulting work in Ecuador. I was wondering if you would tell me about that please.

Daule Peripa Dam Project

Arthur: Yes, I was on the consulting board down in Ecuador from the period of 1978 to the completion of the project in 1991, was my last trip there. I made twenty-eight trips in all to Ecuador. This was in connection with the design of the Daule Peripa Dam Project. I'll spell that. Daule is D-A-U-L-E. Peripa is P-E-R-I-P-A. This site is located on the Guayas River, G-U-[A]-Y-A-S, about 120 miles north of Guayaquil, the largest city in Ecuador. It's not in the mountains, not in the Andes (**Storey:** Coastal isn't it?) but more in the coastal range, coastal plain, right. It is a multi-purpose project: irrigation, flood control, and hydroelectric power development. In this case the project was financed by the Inter-American Bank. The bank required that the agency of the Ecuadorian government that was in charge of this project have an advisory consulting board of international people to oversee/oversight of what the consulting engineers were doing, and review their work. The preliminary planning, the final design, and the supervision of construction was all furnished by a New York consulting firm called TAMS, T-A-M-S, which is the acronym for Tibbett, Abbott, McCarthy, and Stratton, a prestigious firm. This involved a major embankment dam. It was about 100 meters high, and on the left abutment, extended for about twenty-eight miles of a low dike type, because they wanted to built a dam higher than what the topography on the left abutment was really suitable for, whereas the right abutment continued to a higher elevation and [the dam] could terminate there. It was a very interesting project in that the embankment was constructed out of, instead of the clay material for impervious material, was of a crushed sandstone. The rock in the area of the dam was a very weakly cemented sandstone, weaker than the Navajo, which is down at Glen Canyon, and quite friable, was easily crushed, and could be used as an embankment material, which it was. This was my first and only experience building a dam in a jungle environment, as it was a very tropical area, and was literally, the abutment was covered with tropical vegetation and very dense foliage and that sort of thing.

The building of the dam required the resettlement of a large number of natives who lived in the reservoir area, and quite primitive environment. The river was used as a means of commerce. They were using dugout canoes powered with outboard motors and that sort of thing. In addition to building the project, they had to build about twenty-five miles of access road to get into the dam. The contractor was a firm called Agroman, A-G-R-O-M-A-N. Agroman was a Spanish construction company. The actual design of the dam, the supervision of the construction, was carried out primarily by Ecuadorian engineers under the direction of a key group of people furnished by TAMS.

My first involvement with the project involved an evaluation of the preliminary design, and that was followed by membership on the board. The board reviewed the investigations that were being made and suggested additional investigations that were required in the board's opinion, for final design. The board provided oversight of the final design of the dam, reviewed the contract documents. After the dam construction was initiated, the board visited the site at least twice a year for the purpose of reviewing the quality control and quality assurance programs, and assisting on solving problems that came up during construction, due to different geologic conditions or foundation conditions that had been envisioned from the exploratory program. (long pause) Do you have any questions?

Storey: Yeah, are you done? (**Arthur:** Yeah.) Okay. Let me ask about this friable sandstone concept. You know, basically it sounds to me like you'd crush it and you'd end up with something similar to sand. (**Arthur:** Yes.) And it doesn't sound like it would hold water very well. How does that work?!

Arthur: Well, the sandstone contained quite a bit of the fine materials, silt material, and very little clay, but some clay material, clay sizes. So it was well graded so that after it was crushed up and then compacted into fill, it *was* impervious.

Storey: So it was compacted by sheepsfoot rollers or something?

Arthur: Yes. And before this design was adopted, a trial section was made in the field using heavy equipment rollers and bulldozers and so forth, to verify that this was a practical procedure and would give the desired results. So we were quite sure that this would result in a satisfactory dam. There was other material available, a very highly plastic clay. This material would be unstable, and use in a high dam like that would require extremely flat slopes. And the topography was such that it would make the configuration of the dam unsuitable. In other words, the river had a turn in it that gave us a good opportunity for a diversion tunnel location and penstock for the powerplant, and that would be completely covered up if the slopes were made real flat. So it was judged that this sandstone material would be a superior construction material, to the clay–although the clay was used in the dikes. It was used in the dikes because it was close at hand. As I said, the dikes extended for twenty-eight miles, so it was like a long roadfill, varying in height from–well, it went across a couple of small ravines–but the maximum height would be about fifty feet, and eventually it tailed out, died out at the end of the dam. But because the material was right there, it was more economical to use it, and use the flatter slopes, because of the lower height of the embankments.

Storey: Let's see if I've picked up enough to be able to ask an intelligent question. The section of the high dam did not include an impervious core then? It was a homogenous material?

Arthur: The bulk of this material, the outer slopes were constructed of a more free-draining material, which was actually a coarser sand and some real fine gravel that was dredged out of the river, downstream from the dam. So it *was* a zoned dam, rather than a homogenous dam. But the core, you might say, was a very "thick" core.

Storey: And it was made out of this crushed friable sandstone. (**Arthur:** Right.) Okay.

One of the things I'm interested in, you've mentioned, I believe in the Philippines, maybe, that the World Bank supported that work, and required a consulting board. (**Arthur:** Yes.) And here we are in Ecuador with the Inter-American Bank requiring a consulting board. How did the banks participate, or did they? Did they, for instance, have a member on the board, or anything like that? Did they receive the reports? How did that work?

Arthur: Our reports, which contained our review of the project and our conclusions and recommendations, were all submitted to the bank by the owner, so it was reviewed. And in both the Philippines and Ecuador, I would say that bank representatives were present about maybe once a year, maybe twice a year — very infrequent, but enough so that they were aware of what the local situation was, you might say.

Storey: Were you ever aware of a situation where the bank put on pressure, because of your reports?

Arthur: No, I think I mentioned in the Philippines that we had a disagreement with the consulting engineers on the layout of the dam, (**Storey:** Yes.) but our recommendations were adopted by the owner. They were submitted to the bank, and the owner concurred and so forth, so there wasn't any problem there. And there was no similar problem in Ecuador. There was a consensus reached between the board and TAMS on all the main points.

The final design of the dam was carried out in Guayaquil. I mentioned it was done primarily with the Ecuadorian engineers' support. There were two or three TAMS engineers that were stationed in Guayaquil during that period. The fellow who was in charge of the [design of the] project was a retired Corps of Engineers civil engineer, dam engineer. So we didn't have the problems of considering international practice versus U.S. practice and so forth. In other words, we're all on the same wave length.

Storey: Do you remember his name? The Corps of Engineers man, I mean.

Arthur: (pause) Hm. (pause) Not at the moment.

Storey: Well, it isn't that important anyway. You were working on the Daule Peripa–is that the way you pronounce it? (**Arthur:** Yeah.)–Dam, if I'm figuring correctly, for thirteen years.

Arthur: Thirteen years, '77 to '85. Wait a minute, '77 to '82.

Storey: I wrote down '78 to '91.

Arthur: I'm looking at the wrong thing here. Let's see, yeah, '78 to '91 (chuckles), that's right. Let me say this: '78 was my initial trip and that was for me to look over the project, and for the Ecuadorian owners to look *me* over, and *then* I was invited to be on the board, after that initial trip. Then during the early days, we made trips about three times a year during the design stage and so forth. Then the dam was completed in the mid-80s, I would say. We were called back a couple of times to review the maintenance and to advise on some maintenance problems that occurred. So my last trip was in '91, but I probably hadn't been there for several years, several years between trips.

Storey: Okay. What I'm interested in is how you got there. Transportation in '78 and transportation in '91–do you remember?

Traveling to Ecuador

Arthur: It was all the same, just different airlines. The best way to get there was Denver to Miami nonstop, Miami to Guayaquil nonstop. Of course Ecuador is on the west coast of South American, that's due south of Miami, the same time zone. We used different airlines out of Miami, including the Ecuadorian National Airline and Braniff in the early years was flying that route. Braniff was taken over by Eastern, and I think Eastern was still flying at that time. I remember one trip I made by Pan-American. It was always the same route.

Storey: But the same basic route, the same basic kinds of airplanes. Okay. I asked Ken Vernon this question last week, How did he get from Billings to anywhere? (chuckles) There was a change between '47 when he became regional director and '53 when he left, because the airline routes started up in Billings then.

Let's see, did you have any other foreign consulting jobs? Is there anything more we ought to cover about Ecuador?

Arthur: No, I think that pretty well covers it.

Storey: What about your accommodations when you were down there? Where did you stay, where were you headquartered and so on?

Arthur: Well, normally, we arrived in Guayaquil . . . . One member of the board was the European geologist, and the trouble with my computer is — my mind — is the access, and I have a lot of information in my mind, and eventually it comes out. The man who was in charge for TAMS down there in Guayaquil was Herb Witte, W-I-T-T-E.

Storey: Your mind works the way mine does. (chuckles)

Arthur: I think everybody's does like that. (**Storey:** Yeah.) What was your question?

Storey: I was asking about accommodations while you were down there, and how they treated you and what they provided and all that.

Arthur: We would meet in Guayaquil, and of course there were two stages, and one was while the dam was being designed, and the other one was while the dam was being constructed. While the dam was being designed, we would meet in Guayaquil, spend maybe a day in reviewing progress that had been made since our last previous visit, and orientation and so forth, and then we would travel by car up to the dam site, which was, as I say, about 120 miles north of Guayaquil.

Storey: And how long would it take you?

Arthur: In the first stages there, we would have a highway — I call it a highway, it was a two-lane road, often full of potholes and chuckholes — but we'd travel along at a reasonable rate until we got to the turnoff to the dam site. And from there it was a pioneer road and had been bulldozed out, and required four-wheel drive. And a couple of times in wet weather, it required a winch on the front end to tie onto trees to get through some of the mudholes and so forth. So it would take you most of the day to get out there. After the exploration was going at full blast, they had a sort of a bunkhouse, and we would stay there one night and then go back to Guayaquil. Guayaquil was the largest city in Ecuador, fairly cosmopolitan.

Storey: So they would put you up at a hotel there?

Arthur: Yes. And we'd work in their offices during the daytime.

Storey: About how long would you be there on each trip, and did it change over time?

Arthur: We were usually there six to ten days, depending on the scope of the activities. And like the other boards, we drafted our report before we left.

Storey: Uh-huh, so then they took care of the final drafting and stuff?

Arthur: Yes. But we would review it with the owner, our report, go over it point-by-point so there'd be a complete understanding in the discussion, we would have a recommendation to do this or that, then we would have a discussion of what our thinking was and our reasons for it, answer questions and that sort of thing, so there would be complete understanding.

Storey: Do you happen to remember the name of the river the Daule Peripa Dam is on?

Arthur: G-U-A-Y-A-S, Guayas.

Storey: The Guayas. Oh, I think maybe you mentioned that. What was its purpose?

Arthur: It was multi-purpose: flood control, irrigation, and hydro.

Storey: Okay, and the flood would have been Guayaquil maybe?

Arthur: Yes. I would say the prime purpose of it was irrigation. The water was to be released from the Daule Peripa Dam in periods of low flow, and they were going to build a pumping station to lift the water out of the river up onto the plains, and this pumping station would be located maybe about forty miles north of Guayaquil, and then by a system of canals and tunnels, water would be conveyed to the irrigable land along the coast ~~low-lying land~~ [of Ecuador].

Storey: Let's see, were there any other international consulting jobs that you did?

Assignments in the Dominican Republic

Arthur: I had a couple of short-term assignments down in the Dominican Republic, one was in connection with resolving a contractor's dispute that had arisen, and I don't remember the details. This was a short-term assignment, I was there maybe three, four days. We got that resolved. And the second time I was down there was for the same agency. It was an agency of the Dominican Republic government. And

that was to advise them on award of a contract for a dam. They were concerned because the low bidder was *very* low.

Advised Dominican Republic Regarding a Very Low Bid on a Dam Construction Project

The low bidder, as I recall, had bid only forty percent of the engineer's estimate, and his bid was about half of the second low bid. And they felt like they were on the horns of a dilemma. They couldn't afford to ignore his bid because it was so cheap, but they were afraid that they weren't going to get a satisfactory performance if they awarded the contract to this firm. So they asked me to evaluate the bids and advise them of what they ought to do. Well, it turned out this low bidder was a contractor who I later was to find in Ecuador, Agroman. This trip took place before I was on the Ecuadorian board, or it was before the contract was awarded. I was on the board, but before the contract was awarded. So this was my first knowledge of Agroman. I found out one reason their bid was so low was because they had some work underway in the Dominican Republic, and all the other bidders were offshore and would have the costs of moving men and equipment and so forth from overseas locations to the Dominican Republic, while he was already there. So he was taking advantage of that and so forth. But I advised them that our practice in the Bureau, when a contractor gave us a low bid, was to tell the bidder that his bid was much lower than the others, and we particularly wondered if he had made a mistake in his bid or whether he had correctly evaluated the problems and so forth. We would ask him to review his bid and confirm it, or claim an error. Of course if he claimed an error, he was disqualified, he couldn't just ratchet his bid up, take advantage of the space between him and the next bidder. He would just be released from the contract. Or *if* he confirmed his bid and said, "Yeah, I know I'm low, but I know what I'm doing and so on and so forth and I feel comfortable with my bid," and so forth, *and* if he furnished a performance bond that was required, and the bond was issued by some surety we knew of and so forth, we went over the contract. I said, "You should do the same. You should tell Agroman that he's very low, you're concerned about his bid being so low, and ask him if he made an error in his bid, telling him, if you do, we'll release you from your bid bond. But if you confirm that you can do the work at that lower price, we'll award you the contract." They did, and they awarded the contract, and so far as I know, it was performed satisfactorily, though I never received word to the contrary.

Storey: You never followed up on it, huh?

Arthur: No.

Storey: So this was a man. It's A-G-R-O . . . .

Arthur: It's A-G-R-O-M-A-N, Agroman, was the name of the organization.

Storey: But it's . . . .

END OF SIDE 1, TAPE 1. MAY 4, 1995.
BEGINNING OF SIDE 2, TAPE 1. MAY 4, 1995.

Storey: We were saying that Agroman, A-G-R-O-M-A-N, is the name of the company rather than a person's name. (**Arthur:** That's right.) When you went down to settle a payment dispute–is that what it was?

Arthur: It was a dispute over the requirements of the contract document, the specifications.

Storey: Do you remember what it was about and how it came out?

Arthur: The contractor and the owner were in a dispute about what the specifications required. The contractor had an American engineer–I don't remember who he was– represented his position. And this fellow and I sat down and discussed the matter and we resolved the problem to the satisfaction of both parties. I don't remember what it was. Somewhere in my files, I have a report, but I didn't dig it out.

Storey: Did you have any other foreign consulting jobs?

Consulting Jobs in the United States

Arthur: No, I think all the rest of my jobs were in the United States.

Storey: And that's what I wanted to move to next anyway, so could you tell me about that, please?

Most U.S. Consulting Jobs Had to Do with Contractors' Claims

Arthur: Well, I had a number of jobs over the years in the United States. They were of a varying nature. Some were advice on technical matters. Most of them were involved with claims. . . . and disputes between the contractor and the engineer or between the contractor and the owner. Sometimes I represented the contractors, sometimes I represented the engineers, sometimes I represented the owners. In a

number of occasions, the disputes were resolved by negotiation, and in several cases they went to litigation, and I became an expert witness.

"Didn't make any difference to me who I represented, whether it was contractor or owner, as long as I was on the right side. . . ."

Again, I was an expert witness for various parties. Didn't make any difference to me who I represented, whether it was contractor or owner, as long as I was on the right side. I would review the dispute, and advise the potential client whether I thought I could help him or not. If I thought the client didn't have a very good case, well I wasn't interested in representing him. I would tell him why I thought his position was not tenable and so forth.

Amount of Time Spent on Consulting after Retirement

So over a period of years–well, I started in with a number of these assignments right off the bat. I was thinking, you asked me during our last session about how much of my time was taken up by my consulting practice after I left the Bureau, and I said about half the time. As I started reviewing these various cases, and thinking about it, I realized that I was a lot busier than that, because I was having trouble even scheduling my overseas trips with my domestic work that was going on. So I would say maybe in the first five years I was working maybe close to full-time. In the later years, I did less, as these overseas boards were finished. I made a short compilation here. I had, from '77 to '94, I had a total of twenty-six clients I was involved with. Four of them were engineering firms I was advising or consulting with. Twelve of them were contractors that I was advising on construction disputes. Nine of them were government agencies or cities, and one was a private client. So I had a *wide* variety. With a few exceptions, these were all related to dams.

Worked for Clark County, Nevada, Regarding a Wastewater Treatment Plant

One notable exception was an advanced wastewater treatment plant for the city of Las Vegas, Nevada. The owner was Clark County, of which Las Vegas is the county seat. And my client was Morrison Knudsen [MK] Company. And they had been the construction manager on the job. And they were being sued by the contractor–they and the county–were both being sued by the contractor who allegedly lost a pile of money on constructing the job. Well, when I was contacted by Morrison Knudsen representatives to ask about my interest and availability to consult with them on this job and to serve as an expert witness, I told them I didn't know anything about wastewater treatment plants, I'd never worked on wastewater

treatment plants. They said, "Well, we're aware of that, but we know what your experience has been on contract administration, and that's what we're interested in, that's the aspect of it." So I represented them on that. This was a $40 million claim that was made. The contractor was Frank Briscoe Company of New Jersey.

Storey: Briscoe, without an "L" on the end?

Arthur: Yeah, B-R-I-S-C-O-E. It was an *extremely* interesting case. Off the bat I couldn't understand why Morrison Knudsen was being sued, because I reviewed their agreement with the County, and they had a "hold harmless" clause in their contract with the County, which said, in effect, that if there was a suit brought by the contractor or any vendor and so on and so forth, that the County would be the respondent party and Morrison Knudsen would not be held liable. So I said, "I don't see why these guys are suing you." The answer was that they'd been sued–anybody can sue anybody at any time–they had responded to the court, pointing out this "hold harmless" clause–the judge had taken it under advisement. So they had made a motion for dismissal of the suit against Morrison Knudsen then, based on this "hold harmless" clause. The judge indicated it would be some time before he could rule on the motion. So this made it necessary for them to get in a protective mode. They had to protect themselves, so they had started to get ready to defend themselves in court. So he didn't rule on the motion until the trial started. The first thing he did was rule on the motions, and he ruled that Morrison Knudsen was not responsible under the contract, that the contractor could sue only Clark County. So that ended my assignment. I spent a lot of work.

Next I was contacted by the attorneys for the County. They said, "We want *you* to be our expert." Of course I'd done all this work for Morrison Knudsen. Everything I had done to prove that Morrison Knudsen had done a proper job, of course, meant that the County was not responsible either. "So would you be willing to be an expert witness for Clark County?"

And I said, "I would."

They said, "Well, we'll see if we can get a release from Morrison Knudsen."

I said, "What do you mean, get a release? I'm through with Morrison Knudsen, I'm an individual, I don't work for Morrison Knudsen, I was just a consultant."

They said, "Well . . . ." Found out that it wasn't that simple. I mean, they had to get Morrison Knudsen's okay to use me, because of confidential information I was privy to during my consulting with Morrison Knudsen. I found out later that they got the entire work product of the Morrison Knudsen attorneys, everything they had done, and they got me, and everything that I had done–my reports and everything, for $2 million. So I was an expert witness for Clark County.

Storey: But you didn't get the $2 million, that's what Morrison Knudsen got, huh?

Arthur: I got my daily fee, and so on and so forth. I testified at the trial in Clark County in Las Vegas. I expect I was on the stand about six hours or something like that, and I defended the actions of Clark County's agent, Morrison Knudsen, and explained how the contractor had lost money because of the contractor's problems: ineptness and lack of supervision and everything else that was wrong that the contractor was doing. Well, wastewater treatment plants are very complicated–a manufacturing facility is what it is. It takes in sewage and turns out drinking water. It was a little difficult to explain this all to the jury. The jury consisted of housewives and retired people and so forth that were available, and I spent a lot of time (chuckles) with the jury work and so forth. The outcome of the thing was that the jury split it about down the middle. They gave the contractor about half of what he was asking for.

Storey: Twenty million?

Arthur: Uh-huh. Something like that.

Storey: It's still better than *no* million! (laughs)

Arthur: Yes, and it was a lot more than what the contractor was entitled to. This was a *very* poor performance on the part of the contractor. Of course I was working with one team of lawyers when I was working for MK, and this firm was in Las Vegas. It was a national firm, but I mean they had an office in Las Vegas, and the attorneys I was working with were in Las Vegas. The attorneys for the County were in Washington, D.C., I believe, or Baltimore, or someplace *back East*. They were quite different in their approach, and in my opinion, not as good. I read in the paper this morning, some guy says the purpose of the jury in a trial is to decide which side has the best lawyer. (chuckles) Most attorneys I've found *very* willing to accept advice. This was not quite the way this firm was–these lawyers were. And I felt that some of the advice that I gave them that was ignored, was very important. Of course that's a subjective (laughs) analysis. But I did a very thorough review of all the data that were available and the depositions that had

been made by the other side and so forth, and I found glaring inconsistency in what the contractor's superintendent said in an earlier deposition, given a year or two before, about his background and qualifications, and what he said at trial–he'd already testified at trial. And I called this to the attention of the attorneys, and I said, "Look, this fellow at trial said, his testimony was that he was very well qualified and he had all this experience in this kind of work and so on and so forth. That's not true." I gave them these deposition excerpts where it was disclosed that he had had very little supervisory experience. And the main reason that he was selected–and this was in the deposition–the main reason that he was selected for that job out in Las Vegas is because none of the senior people at Frank Briscoe Company in New Jersey wanted to go into the Wild West, go out there to Las Vegas–it wasn't civilized! Their main jobs had been on the East Coast and Florida. They had done–had a big contract at Dulles, on one of the airport terminals or something. And they had done work all up and down the East Coast, they hadn't done *any* work west of the Mississippi, and it was foreign land to them. So the only person they could get was a fellow that had very limited experience. Not only limited experience in construction, but limited experience in supervision. He was an engineer, and he had supervised an engineering group of four or five people in his past, and now he's out there trying to run an organization of about 800 people and all that equipment and all that kind of stuff. He was *way* over his head. So I said, "Well, we ought to bring this to the attention of the jury, because this is the seat of their problems, is their supervision."

And the lead attorney said to me, "Well, you know, he's a pretty young fellow."

"Yeah," I said, "that's one of his problems." I wasn't there when he testified, I was just reading the transcript.

He said, "He made a very good appearance to me, very good impression on the jury. They liked him. Now for *you* to come in there, you're a senior person and so forth, you come in there and beat up on him, the jury's not going to like that."

Storey: Trial psychology, huh?

Arthur: Yeah. So he said, "We're not going to attack and try to discredit him. You can talk about his lack of expertise, but we're not going to bring out that he didn't have the background and he lied about it and so forth. We don't want to do that." So when I left there, after giving my testimony, this fellow says . . . . Well, the case was going to the jury in the next day or two. I was along the tail end of the witness

list. And he said, "When we get a verdict, I'll let you know." I never heard, I never heard. I waited maybe, oh, a month, six weeks or something like that. Finally I called his East Coast office, he was out, I left my name, and he never called me back. So I called two or three times. The last time I called, I said to the secretary, "Say, I'm sorry to keeping missing . . . " whatever his name was, "but do you happen to know how that case came out, that Briscoe case out in Las Vegas, the wastewater treatment plant?" And she told me.

Storey: (chuckles) Did they do any preparation with you for going in to testify?

Arthur: Oh, you bet they did!

Storey: Tell me about it.

Arthur: These attorneys in Morrison Knudsen were the ones that prepared me for it. Well, in the first place, we had a number of conferences, of course, on my evaluation. They wanted to know what I thought about it, and so on and so forth. But then before I was to give my testimony, they set up a TV camera and they videotaped me with one of their attorneys posing as the cross-examiner, and he knew where the tough spots were in the case, so he was asking me what he thought would be the most difficult questions for me to handle, and then I would give my testimony, and then they played it back for me to see how I looked, and my gestures and so on and so forth. We had a dress rehearsal.

Storey: How long did it take?

Arthur: I think we spent most of a day doing this.

Storey: What form does this take? Do they just say, "Well, you can say this a different way"? What kind of "coaching," as it were, did they give you?

Arthur: Well, most of it was to be sure that I was prepared for these questions, that I wasn't going to be sandbagged, that I had not overlooked something, and so forth. There were suggestions about being more definite or less definite on certain points, where you have to admit that Morrison Knudsen could have done a better job. You don't say, "Well, Morrison Knudsen was derelict in this respect," you just say, well, you admit that they were a little remiss, but you wouldn't highlight it, and that sort of thing. But they really didn't try to influence me to any great extent. It was just a matter of emphasis, you might say. And of course I'm quite aware of what the

purpose of this whole thing is, too, you know. Of course an expert is supposed to be totally unbiased. He still is on the side of his client, or he wouldn't be testifying.

Storey: Do you remember any other specific examples of consulting work you did in the United States?

Arthur: Oh, I remember *lots* of them. (both chuckle)

Storey: Want to talk about some?

Represents Dravo Corporation Regarding a Hydroelectric Plant Built for the Ohio Power Company

Arthur: Well, the first big one that I got was I got a call from an engineer that worked for Dravo Corporation, D-R-A-V-O Corporation , of Pittsburgh. They had been the firm that I had made the lead firm at Grand Coulee third powerplant, when I renegotiated the contract so to speak, and I said they had to change sponsoring companies. Dravo became the sponsoring company. I met this guy during our negotiating sessions, met him a number of times, and he called me up and said, "We've got a problem. We're suing the Ohio Power Company over a construction of a hydroelectric powerplant in Ohio–on the Ohio River. We lost a lot of money and we think it was the responsibility of the owner, the engineer, and we'd like for you to come to Pittsburgh and review the situation and see if you think you can help us, if you're willing to do that."

So I went back to Pittsburgh, met with their engineers, *and* the attorneys that they had hired to represent them on this case. This was very interesting to me because it involved a dam on the Ohio River that had been built by the Corps of Engineers, and several years before this took place, the Congress had passed a law that permitted private agencies to build powerplants, retrofit powerplants, at existing public dams. So this dam had been built for navigation on the Ohio by the Corps. The Ohio Power Company saw this as an opportunity to develop some hydroelectric power with the head that was available at this dam. It's a low-head plant, you know, like twenty feet of head, thirty feet of head, something like that. So they got an engineering firm from New York to design this powerplant, and they put it out for bids and Dravo was the low bidder at about $10 million was their bid, to build this powerplant, and it cost them almost $20 million to build it. It took them twice as long as what was given in the contract. They had a large number of changes, extra work orders, and so on and so forth, and they were concerned that the job hadn't been properly engineered. So they told me the

history of how this developed, and so forth, and I said, "Well, the problem is, with this job, this was a fast-track job. You bid a fast-track job without *knowing* it was a fast-track job." That was the whole problem.

And the lawyer looked at me and he said, "What's a fast-track job?"

I said, "Well, it's mostly done in building construction. An owner finds a site in a city to build a new office building. He spends a lot of money for this site, and he starts to build the building. He's not going to get any money back until he finishes the building and has some tenants. So he doesn't want to spend two or three years of the site sitting there, while the engineers and architects are designing the building. So he says to the architect, 'We're going to have a building, it's going to be so many square feet, has to fit on this lot. I want the plans for the basement next week, and we'll give that to the contractor. And while the contractor is digging the basement and putting in the foundation, you guys can be designing the rest of the building, the floors and the air conditioning and the electrical stuff, and all that while the thing's being built. And that way the job gets completed a lot faster than if you wait for a couple of years for this design to be *all* done, and give it to a contractor, and then he starts digging the basement." So the advantage is, it saves a lot of time.

The *dis*advantage is, that the contractor cannot be asked to bid a firm bid on how much the building is going to cost, because he doesn't know what the building is going to be. Maybe he knows it's going to be steel, or maybe he knows it's going to be concrete, but he doesn't know whether the architect's going to put in granite floors, or marble in the building, or what sort of embellishments he's going to have, or what the air conditioning system is going to be like. He doesn't know all these things that enter into his costs. So the only fair contract for him is to say to the contractor, "Start building the building, and we'll pay all your expenses plus a fixed fee. We'll give you so much for your profit." Or another form of contract is, "We'll pay you a percentage." This isn't usually a favored way of doing it, because the contractor has incentive to run up costs instead of trying to *save* money, if he gets a percentage of what it costs. But a fixed fee, or some other means of compensation.

I said, "What they did to you, is they gave you a set of plans that were not designed, they were pictures. They looked like a designed building, a powerplant, and they said, 'How much is it going to cost to build this powerplant?' And you figured it out, how much concrete, how much steel, and all this stuff like that, and you told them $10 million." And I said "Then what happened? You go to work

and they said, 'Oh yeah, hey, we're going to change this. We want this over here, we want this over here. We don't want . . . .'"

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BEGINNING OF SIDE 1, TAPE 2. MAY 4, 1995.

Storey: This is Tape 2 of an interview by Brit Storey with Harold Arthur on May 4, 1995.

Things started changing under their very feet.

Arthur: Right. To the extent that they would have to maybe . . . . It's like the Denver Airport, DIA: they'd have stuff built, and they'd have to tear it out and make the changes. This was fast-track, because they started building the Denver Airport before they had the tenant, United Airlines, on board. United came in, they wanted to make all these changes. Denver's paying a lot extra for this. But in this case, the owner took the position that "You bid on this building, on this powerplant, for $10 million, and by golly, that's all I'm going to pay you." Well, maybe a few dollars here and there, but they wouldn't recognize that it was a different job than what the contractor bid on, because the outside dimensions were not changed, the shell stayed the same. The walls were different thicknesses, and the steel was different reinforcement, the partitions were different places, everything had been changed, and these changes took a lot of extra time, put in through another winter, and Ohio winters aren't too great to work in. Had to work through another winter, and keep all of his men and equipment on the job and so on and so forth, and they wouldn't recognize this. So I said, "That's what's happened to you guys."

They said, "Well . . . ."

And I said, "Yeah, I can help you." I ended up testifying in District Court, I think three or four days, explaining this to a jury. And my testimony was interrupted–I remember this–by a ten-day trip to Ecuador. (chuckles) I remember some of the scheduling problems that I had. And then I came back for cross-examination. It [the trip] was between my direct and cross. Finally this went to the jury and when I came out of this job, I told my wife, "This is the most stressful thing I was ever in. Who needs this?! I don't ever want to do this again." Because being under cross-examination, these attorney's if you've watched any of this O. J. Simpson case, where they're bringing cross-examination against some of the witnesses, you realize how sarcastic and unfair these attorneys can be.

It wasn't very long, the lawyer called me up and he said, "Good news, they'll honor the $10 million we asked for, we got $10 million."

Storey: And did you say, "And where's my bonus?"? (laughter)

Arthur: He said, "It was mostly due to your testimony. You were great."

So then that changed my mind. After that, "Hey, this is kind of fun!" (laughter)

Storey: That's an interesting one, alright. But tell me, Dravo, I believe they're still a major firm around.

Arthur: Oh, they still are. They're not in the dam-building business anymore, they gave that up.

Storey: But a company of, I think, international standing–at least national standing. (**Arthur:** Yeah.) Why wouldn't they have recognized this problem before it became so bad? That's what I don't understand.

Arthur: Well, they recognized that they were having problems right off the beginning. They recognized it, and they were protesting. They were on the record saying that this was extra work and this was unforseen changes and so on and so on, so yeah, they're savvy about that. (**Storey:** Oh, okay.) But the owner just wasn't–they had to go to court to get the money. (**Storey:** Oh, okay.) The owner wouldn't negotiate. So they felt like they would like to have–their case would be stronger if they had an outsider come in and say how the contractor was screwed by the owner, rather than just the contractor saying it, see.

Storey: Uh-huh. Do you have any other examples you'd like to talk about?

Arthur: I remember some of the cross-examination. You know they say, the lawyers had told me this, they said one rule a lawyer has is Never ask a question unless you know what the answer's going to be. Have you heard that? (**Storey:** Uh-huh.) "Mr. Arthur," he said this on cross-examination, "Mr. Arthur, you have testified that there were an inordinate amount of change orders. I think you said something like 256 change orders that were issued on this job."

I said, "Yes, that's right, that's how many were issued."

"Well, Mr. Arthur, of these 256 change orders, how many of these change orders did you personally review?"

And I said, "Out of the 256, two hundred and fifty-six!" (Storey laughs) And I had! I'd read every damned one of them! One of the main things they had done is, they had changed the number of reinforcing bars. Instead of a few large-sized bars, they would give the same area of steel to twice the number of smaller bars.

Storey: So that means automatically labor costs rise, I suppose.

Arthur: Yeah, but they don't recognize that. They just said, "a pound's a pound. We didn't change the pounds of steel. You ~~had~~ [bid on] so many tons of steel, you put in so many tons of steel." And the fact that it came in two or three times as many pieces, they didn't want to recognize that. It was that sort of thing. (chuckles)

Storey: Huh. Were there other consulting–let's see, you wouldn't call them "cases"–jobs? (**Arthur:** Yes, or assignments.) that you had that you remember?

Worked for Contractor Being Sued by Kansas Power and Light Company

Arthur: Yeah. (tape turned off and on) I had a variety of jobs. I advised one contractor on airfield construction, runways. These were geotechnical problems. I advised the same contractor who had a dispute on the foundation for a school building, and that sort of thing.

But the major job involved a dam in Kansas. The owner was the Kansas Power and Light. The dam was designed by Black and Veatch of Kansas City.

Storey: V-E-A-C-H?

Arthur: V-E-A-T-C-H, an international firm. The dam was constructed by a contractor called Green Construction Company, whose headquarters are out here at the DTC [Denver Technical Center]. The dam was in connection with a large-sized thermal steam powerplant located north of Topeka, Kansas. The dam was to provide a storage for their cooling water, so that the water coming from the steam turbines could be stored in this lake until it was cooled, and then reused. The dam was not on a river, it was on an off-site dry channel. (phone rings, tape turned off and on) This dam was not a major structure, it was about 110 feet high. It was a homogeneous earth embankment, contained a little less than 2 million cubic yards of embankment.

Shortly after the dam was completed, it began to settle, and the upstream slope began to bulge and move outward, and there were longitudinal cracks

running along the crest of the dam, and it appeared that the dam was distressed, and it likely might fail, there was a possibility of failure. So the reservoir was emptied. As I mentioned, this was fed by pumping from a river, so the pipeline was reversed and the reservoir was emptied. And the owner convened a consulting board to tell him what was wrong with the dam. The consulting board consisted of a professor, Dr. William Lambe, L-A-M-B-E, who retired from MIT, as a professor in geotechnical engineering, and a Professor George Sowers, S-O-W-E-R-S, who, I guess at that time, he was professor emeritus at Georgia Tech. And the third member of the team was a fellow, an engineer in Denver. His name was Thorfinnson. He had retired from a local engineering firm, it's also a national firm, Woodward-Clyde. These three gentlemen went out and made a survey of the situation to evaluate why the dam had failed, and they said the problem was that the material had been placed too wet, and in the compaction process, had developed destabilizing pore pressures, and that had resulted in instability of the fill and had caused it to slump and move and so forth. So the owner said, "Well, the dam is too wet, the material is too wet." The owner said this: the solution arrived at with the board and Black and Veatch and the owner was to tear the dam down, excavate the dam, spread the material out over the landscape, let it dry to the extent that the moisture content was reduced to acceptable levels, and then rebuild the dam with the same material. And this is what they did. They hired a contractor on a cost-plus basis, fast-track job. They hired him to come out there and do that. So he tore the dam down, dried the material, put the dam back together again. Then they sent the bill to Green, the original contractor. They sent the bill to Green for $10 million. This is what it cost to rebuild the dam. This dam had cost about $6 million in the first place, but it cost $10 million to restore it. So they sent the bill to Green Construction Company. Green Construction Company said, "Well, we don't think we're entirely at fault on this. We didn't design the dam. We built the dam like the specifications required, the contract documents required. We built it out of the material that came from the areas you specified, and we did a workmanlike job. But we agree, it wasn't a satisfactory product. We'll pay half. We'll go half with you, we'll pay $5 million of the $10 million claim."

The attorneys for the owner, according to the attorneys for Green, said, "In all my years of practice, this is the most open and shut case I've ever seen. We will not settle for less than 100 cents on the dollar. So you pay us $10 million, or we sue." So they went to a lawsuit, because Green wouldn't pay the $10 million. The attorneys for Green, they were quite concerned. They had this prestigious board, MIT, Georgia Tech, and Woodward-Clyde, [that] said that the dam failed because the material was too wet. They felt *they* needed a board to counteract this board. So this law firm that was representing Green was based in Seattle, but one of the attorneys knew an attorney in Denver that had worked for the Department of

Interior. And he called this attorney and he explained the problem to him. He said, "We need a board of specialists on earth dams. You worked for the Department of Interior, maybe you know some of the people in the Bureau of Reclamation. We think they probably know as much about dams as anybody. Maybe we can get a board of the Bureau of Reclamation retirees that could help us."

And this attorney says, "Well, as a matter of fact, I do know three engineers. You want three men? I know three engineers. They're Harold Arthur and Jack Hilf and Wesley Holtz. They're all experienced in this line." So the three of us were contacted one at a time by the attorneys to see if we might be interested in helping them out on this problem. I agreed, yes, I was interested. (phone rings, tape turned off and on)

Storey: Talking about Hilf and Holtz. And how do you spell Holtz?

Arthur: H-O-L-T-Z.

Storey: Hilf is H-I-L-F, I believe.

Arthur: Right. It turned out Hilf was interested in it. Holtz had some ties with Woodward-Clyde, and Woodward-Clyde had been retained on the repair of this job, so it was deemed a possible conflict of interest, so Holtz was not a member of the team. So the three-man team became Hilf and Arthur. So we took this assignment. We said we were interested. Time passed. In fact, a *lot* of time passed, like a year. A year later I called up this attorney. I'd kept his name and telephone number in Seattle, and I said, "Hey, you asked me if I was interested in working on this dam out there in Kansas. What the hell happened? I haven't heard anything from you guys, what happened? I'm just curious."

He said, "Well, you know, Green Construction Company has been bought out by a consortium based in Australia. The Australians are very youth oriented. I don't know whether you know that or not–they're that way. I submitted your c.v., curriculum [vitae], and Hilf's, to them because they're the ones that are going to have to pay the bill, and they came back and said, 'These are old men! We want you to find some younger people who can represent us.' I was just about to call you, because this thing's been going on for a long time, as you know. We're getting to the point where we need somebody real bad. I called up these guys and I talked to them. 'We've been looking around and we've been trying to find some experts in earth dams. We can't find any forty-year-old men with fifty years' experience!'" (laughter) So he said, "I just recently got the okay to hire you guys.

I'd like to come to Denver and meet with you and give you the background on the job and so forth." Fine, so we started out on that relationship.

The first thing I did was review the contract documents: the specifications and the drawings. And I reviewed the consulting board's report, the report that was made by Lambe, Sowers, and Thorfinnson. And I said, "Well, they're absolutely right. The reason the dam failed is because the material was placed too wet. I agree with their report completely. The other part of it is, that the specifications permitted that, required that, in fact. I can tell you this, categorically, based on my experience of designing over fifty dams and authoring the book on ***Design of Small Dams***, all my experience and background, that a dam of this height, 110 feet, built with this material, which is plastic clay, of high plasticity and medium plasticity, a homogenous dam, with these slopes, three-to-one upstream, and two-to-one downstream, with this moisture content, which was I think plus two percent of Proctor optimum, *will fail*, it's doomed to failure. It can't *help* but fail. That's the whole nut. Now I don't know what the contractor's performance was, that's something yet to be determined. But I'm saying this, that if the contractor built the dam a hundred percent in accordance with the specifications, this was foreordained this was going to happen." I got to say that speech a couple of times in front of the jury, because that's what it was.

In the interim, that one year, the consultants for the Kansas Power and Light and Black and Veatch, had done a lot of exploration and testing of samples of the fill and so forth, before they tore it down, to prove that the embankment had not been placed in accordance with specifications. And Dames and Moore, who had been hired by Green Construction Company to do geotechnical work, felt that they had to do everything that the other side was doing, so they would be prepared to refute the findings, if in fact they didn't agree with them, and so forth. And each side had spent a couple million dollars on this investigation. So I gave the client the good news, that if we'd been hired a year earlier, we could have saved them at least a million dollars on that exploration, because a lot of it was just *plain not necessary*. They could have monitored what Black and Veatch was doing, they didn't have to replicate it. And they'd done a *lot* of unnecessary work. But anyway, we did a lot of work on this thing. Now we were retained, let's see, I wrote down here, in September of 1988, and the trial was completed in December of 1990. So we worked on this a whole lot in a period of over two years, with countless meetings and review of data, trips to San Francisco where Dames and Moore did the laboratory work, meetings with attorneys in Kansas City, attending depositions being given by all these experts, by Lambe and Thorfinnson and Sowers, by giving our own depositions and so forth. A lot of time.

Storey: Are there any others that stand out in your memory?

Arthur: Well, I wanted to tell you about how job came out.

Storey: Oh, yeah!

Arthur: At the time of trial, ~~In addition to this trial,~~ Hilf could not testify, because he was ill, and in fact, he's since passed away. He gave his deposition in Denver here–to Denver to get his deposition. And I worked closely with him so that I was able to testify on his behalf at the trial. Our strategy which we developed was that the main point was that this dam was defectively designed, as I said, with this material, so on and so forth, it's impossible. The second line of defense was that we could prove that ~~he~~ [the contractor] met the specifications, by all the tests that had been done and so on and so forth. And the *third* line of defense was that if the dam had to be fixed, it could have been fixed for about $2 million, you didn't have to tear it down, it could have been reinforced. So we were trying to lower the exposure and so forth. So we gave those three points of view to the jury. Of the $10 million that the Kansas Power and Light was seeking, the jury gave them nothing, absolutely nothing. And it was the only job that I worked on where I got letters of appreciation from both the attorneys and from the owner, thanking me for my services and my testimony. No bonus!

Storey: Well, when you say the owner, you mean Green Company?

Arthur: Yeah.

Storey: *Not* the Kansas Power and Light. (laughter) Yeah, that's interesting.

Consults on a Dam in Colorado Springs, Colorado

Arthur: Shortly after that, I was hired on a job that had to do with a dam that was constructed for the City of Colorado Springs. It was just south of the Air Force Academy. And they'd had problems there. Now, the dam was constructed, but there was a big cost overrun, because of the requirements that the engineer had placed on the contractor, that he thought was beyond the scope of the contract.

Storey: The contractor thought?

Arthur: Yeah, the contractor thought that. So I was asked to review the situation, and I agreed. The irony of the whole thing was, this dam had been designed by the same fellow at Black and Veatch, that had designed the Kansas Dam. I met with the

contractor and the attorneys after I'd reviewed the data, and I said, "You got stiff-armed on this. They didn't have a right to do this."

"Well," he said, "I don't know. I met this engineer for Black and Veatch, and he's very persuasive, a very nice-appearing guy, very knowledgeable and very persuasive. He pretty much convinced me that we're in the wrong on this."

I said, "I happen to know that engineer *real* well. (laughter) Don't believe what he's saying. Black and Veatch has an *international* reputation for design of thermal powerplants and water treatment plants and that sort of thing, and had designed all the thermal plants for Kansas City, that's why they were in on this dam. But when it comes to building dams, they don't know *anything*, they're not competent. Don't believe anything this guy told you." And I told him how the problem could be resolved. Well, they met with Black and Veatch and the City of Colorado Springs subsequent to that. I was not invited to attend the meeting, but they asked if it was okay to tell them that I had been retained.

END OF SIDE 1, TAPE 2. MAY 4, 1995.
BEGINNING OF SIDE 2, TAPE 2. MAY 4, 1995.

Storey: So they told them that you'd been retained and then they got a settlement, huh? (chuckles)

Arthur: They got a settlement.

Storey: This was after the Kansas . . . .

Arthur: Yes, it was *shortly* after. Let's see, the trial was completed in December of '90, this was the summer of '91, about six months later, that I was called in on this job.

Storey: That's interesting.

[Now] "there's not near as much litigation of construction claims, due to the development of the partnering concept and the different methods of alternative dispute resolution that have been developed. . . ."

Arthur: Yeah. Oh, those are just some of the jobs I worked on. I was very busy for a long time. The demands for my services have diminished over the years, I think for two reasons. One reason is because I'm getting old, I suppose. And the other reason is there's not near as much litigation of construction claims, due to the development of the partnering concept and the different methods of alternative dispute

resolution that have been developed. Because both sides have come to the realization that this litigation costs a *hell* of a lot of money, takes a lot of time. In fact, I was told that it cost my client $6 million to defend his $10 million claim. I was also told that he recovered this from his insurance company, and not all companies can do that. And of course this is one reason, even in the past, that they agreed to settle for the $5 million in the first place, because they knew it would be costly to defend themselves. But the push has been on to find alternative means of resolving these disputes. So all of the consultants I know have experienced the same thing–there just isn't as much litigation as there was, nor is there as much dam building. So the whole thing has been declining.

Storey: This was sort of a specialization that Barney Bellport shoved you into!

Arthur: (chuckles) Yeah, right. That's right.

Storey: When you were back at Reclamation, did you ever testify on behalf of Reclamation in court cases?

Arthur: No, I gave a deposition once, but I didn't actually appear in court. Nor did I appear before the Contract Board of Appeals. Most of our disputes that weren't negotiated, went to the Contract Board of Appeals, instead of the Court of Claims. Contractor had a choice.

Storey: So we tended to avoid going to court.

Arthur: The contractor would usually choose the Contract Board of Appeals.

Storey: And did the Contract Board of Appeals have a tendency to go for one side or the other when Reclamation was involved?

[Reclamation's] "position was upheld about seventy percent of the time" by the Contract Board of Appeals

Arthur: Yeah, during my time there, and Bellport's, our position was upheld about seventy percent of the time. Of course we were pretty sure of our position. If we had reason to negotiate, we would. If we could see merit to the contractor's claim and get a reasonable settlement, well then, we wanted to settle. We didn't want to go to the Court of Claims either, because it doesn't cost us money out of our pocket, but it takes a hell of a lot of our resources. Takes our engineers . . . .[out of production].

Storey: Were you offered any consulting jobs while you were still with Reclamation? I think you told me a story once about being called, for instance.

Arthur: Yeah, in the early days I had a couple of small jobs when I was in the Earth Dams Section. That was before the regulations came out that said we shouldn't do any outside work.

Storey: Yeah, but I'm talking about maybe offers that you didn't accept. For instance, on Brazil, was it?

Arthur: Well, that wasn't a consulting job, that was permanent employment.

Storey: I don't know how to ask[11] the question properly: Were you ever offered other employment?

Arthur: Oh yes, yes, several times.

Storey: Would you tell me about some of those?

Arthur: Well, what did I tell you about Brazil? Did I tell you about it?

Storey: I believe you did, but I believe it was off tape. I don't believe it was on tape.

Permanent Job Offer in Brazil While Chief Engineer at Reclamation

Arthur: Oh, okay. Well, the world's largest powerplant was being built in Southern Brazil near the Argentine border. It was designed by, I don't know, a consortium. But one of the firms that was involved was International Engineering of San Francisco. And I was called by their chief engineer–this is while I was director of design and construction, I was called by him–and he offered me a position in which I would be responsible for the contract administration of that job. I would be headquartered in Sao Paulo or Rio de Janeiro, and would do the same work there that I was doing for the Bureau, you might say. I said, "Why don't *you* take that job?"

He was the chief engineer for International at that time, and he said, "Well, I'll tell you frankly, I don't want to go down there. I don't want to go down to Brazil. If you don't take it, I've got to!" (laughter) And he did!

11. Interviewer incorrectly said "answer" instead of "ask" at this point.

Storey: What was the name of that dam?

Arthur: I'll put that in the computer bank . . . .

Storey: It'll come back out. Did they talk salary or anything to you?

Arthur: Here's a picture of it. I visited the thing on one of these study tours with ICOLD. Itaipu, I-T-A-I-P-U, [pronounced Eye-tah-poo], is the name of the dam, as I recall. (**Storey:** Okay.) This circuit was a little shorter than the other! (chuckles)

Storey: Did they talk money with you?

Arthur: No.

Storey: It didn't go that far. Any other job offers like that?

Offered Permanent Job While Working in the Earth Dams Section

Arthur: Yeah, when I was in the Earth Dams Section, I had an inquiry from, again, International Engineering from San Francisco. They were looking for an earth dam designer at an intermediate level, which I was at that time, and they wanted me to come out to San Francisco at their expense for an interview. And I told them I wasn't interested. And they said, "Well, we haven't talked money yet. You know, we can offer you considerably more than what you're making there at the Bureau of Reclamation."

And I said, "Well, the reason I'm not interested in it, in Federal service, after twenty-five years you're vested in retirement. And I've got about twenty-one years of service. I'm not going to look at anything until I get my twenty-five years. If you can offer me a lot more money, I don't care to hear about it, because my mind's made up. I'm just not interested.

Offered Job with International Boundary and Water Commission

So then, I don't know whether I mentioned it or not, I was offered a job with the International Boundary Water Commission. I think I told you about that.

Storey: I don't remember it, you may have.

Arthur: Well, I was the Coordinator in Denver.

Storey: Uh-huh, for Falcon Dam.

Arthur: When it went under construction, they wanted me to come down there and be a coordinator on that end.

Storey: Oh, I didn't know that.

Arthur: They offered me a grade raise, and I said, "Well . . . ." I didn't dismiss it out of hand, because I didn't want to insult them [by saying], "Oh, I wouldn't join your organization." I said, "Let me think it over, and I'll let you know in a week or so." I told them [later] I wasn't interested, though I did go up and talk to Mr. McClellan, the chief engineer. I said, "I want you to know I've been offered a job by the International Boundary Water Commission." Because I didn't want any word to get around that I was going around the corner.

He said, "Yes, I know, they asked me if they could talk to you." So I scored by being frank with him, see. (**Storey:** Uh-huh.) And he said, "We'd hate to lose you, but I realize it's an opportunity for you. We're not in a position at this time to give you a raise to a fourteen, we don't have a slot open. They've offered you fourteen, you're free to take it if you want it." I didn't want it that much. In all fairness, I did make a counterproposal to the commissioner. I knew that the principal engineer, the fellow that I worked with and admired, an older fellow, I said I wanted to be assured that I would get his position when he retired. And the commissioner said he wasn't in a position to make any guarantees. He said I'd be a candidate, "I'm sure you'd be a *leading* candidate."

I said, "Well, I want a thorough understanding, because I have opportunities where I am."

Storey: Today you have said several times, "major dams" "major structures" I think are the phrases. What's a major structure, and why?

Definition of a "Major Dam"

Arthur: Well, ICOLD defines a major dam as being one over fifty feet high. *Design of Small Dams* uses the same definition, though I also said that if it contains a very large volume embankment it should be considered as a major dam, and it would be warranted to have a detailed design and investigation of design procedures. The smaller dams, you can't give the same treatment as you do a major structure, because the cost of investigation and design would exceed the cost of building it. So the philosophy was in *Design of Small Dams* that it was cheaper to be

conservative, rather than try to design it precisely and save material, that the cost of engineering would be more than the cost of construction. So that's roughly the difference between large and small, or major or minor.

Storey: Does it make any difference whether it's an earthen or a rock or a concrete dam? Or it's all the same, fifty feet and above is considered a major work?

Arthur: Yeah, is a large dam. Well, some people would use different definitions for "major." They would say Grand Coulee's a major project, and Hoover's a major project, and so on and so forth. But from an engineering point of view, the structure height of a dam makes whether it's major or not, because the problems of engineering are related to the head[12] of the reservoir.

Storey: So the issue is that at fifty feet you begin to get into new and more complex engineering problems?

Arthur: Well, the cost of the structure is such that more precise methods are economically justified. I would say it's just the cost effectiveness of investigation of design.

Storey: Okay. And so the rule of thumb is that at fifty feet, these things start changing.

Arthur: Yeah, but just start. Of course you would do a lot more for Hoover Dam than you would for . . . .

Storey: For a fifty-five-foot dam! (laughs)

Arthur: Yeah, absolutely.

Storey: Okay. Well, gee, what else should I be asking you? You've been real good about filling in where I don't know how to ask the questions.

Arthur: Well, I don't know. That about winds it up, I think.

Storey: Well, I have certainly appreciated you spending all of this time with me. It's been, I think, twenty-two hours now.

Arthur: Is that right?!

12. This refers to the height of the reservoir and the resulting "head of water."

Storey: Uh-huh. I'd like to ask you again whether you're willing for the information and the material on these tapes and resulting transcripts to be used for research purposes.

Arthur: Yes. I hope that it'll be of some value to somebody, someday, somewhere.

Storey: Oh, I know it will be.

Arthur: I want to say that I've enjoyed this too, obviously. (**Storey:** Good.) I've thought about a lot of things I haven't thought about for years. A lot of memories have come back and so forth. It's been a two-way street.

Storey: Good. Well, I've really enjoyed it. Thank you very much.

END OF SIDE 2, TAPE 2. May 4, 1995.

Appendix 1: Memorandum–Formation of the Denver Reclamation Employees Association

Denver, Colorado

November 8, 1946

Memorandum for K. B. Keener
(H. G. Arthur)

Subject: Reclamation Employees Association.

1. I attended a conference Novem[illegible]7, 1946 as the Dams Division representative, to consider ways and means of holding elections to choose delegates from the various divisions. These delegates will form a steering and nominating committee to draft by-laws and provide for the election of officers for the Reclamation Employees Association.

2. All Bureau of Reclamation employees in Denver, except Region 7, will be eligible for membership in the Association. The Association, which has been approved by Management, will be controlled by the employees themselves. The purpose of the Association will be to further social, economic, and recreation interests of the employees, and to provide entertainment and act as a welfare agency. It has been suggested that the Association sponsor Community Chest and Red Cross drives, provide a Credit Union, whose benefits would be available to all Bureau employees without required membership in this or any other organization, promote cooperative buying when such becomes possible, maintain a disaster fund to help any Bureau employee in time of emergency, secure reduced rates for entertainment when possible, provide legal services at nominal rates, and eliminate the necessity for "passing the hat" for flower funds or other purposes.

3. The Association will probably be financed by nominal membership dues, the establishment of various concessions at the Denver Federal Center, and a portion of the profits from the operation of the cafeteria at the Denver Federal Center, as well as profits from various recreational activities.

4. The Association will publish an informal news letter to be called the "Bulletin Board". The issue of November 14, 1946 will announce the tentative formation of the Association, its aims and purposes. The letter will also announce the election to be held November 19, 1946 for the selection of delegates.

5. My function is to act as Election Director for the Dams Division, to provide a ballot box, maintain a roster of voters, and tabulate election returns. All candidates will be "written in" on the ballots provided.

6. Mr. K. W. DeMarcus has stated that permission has been obtained to hold the election during working hours.

H. G. Arthur

Appendix 2: Resignation Memorandum to Employees, May 18, 1977

OPTIONAL FORM NO. 10
JULY 1973 EDITION
GSA FPMR (41 CFR) 101-11.6

UNITED STATES GOVERNMENT

Memorandum

Memorandum

TO : All Employees of the E&R Center

Denver, Colorado
DATE: May 18, 1977

FROM : H. G. Arthur, Director of Design and Construction

SUBJECT: Retirement From Bureau of Reclamation

The Secretary of the Interior's dramatic announcement in a speech to the National Press Club on May 10, 1977, that "If the persons directly responsible for the safety of this project (Teton Dam) are still employed by the Bureau of Reclamation, I plan to see that they resign or are fired" has led to a situation which makes it untenable for me to continue in a high level position in the Bureau of Reclamation. Although, according to the Associated Press, he declined to name me as one of those who might be asked to leave, he has asked through administrative channels for my retirement. This action places me in a position where I think it is in the best interests of the Bureau of Reclamation for me to retire. Accordingly, I plan to retire not later than July 1, 1977.

I do not feel that Commissioner Higginson was responsible for my retirement and I ask that you all give him full support in carrying out the Bureau's mission.

Following my retirement, I will offer my services as a consulting engineer. I will bring to my clients 40 years of experience in design, construction, and administration of water resource developments with a speciality in earth dam design and construction. In my consulting practice I will follow the principles of candor and integrity with which I faced the aftermath of the Teton Dam failure.

H. G. Arthur

5010-110

Buy U.S. Savings Bonds Regularly on the Payroll Savings Plan