ORAL HISTORY INTERVIEWS
LARRY D. MORTON
Volume I

BUREAU OF RECLAMATION
ORAL HISTORY PROGRAM

ORAL HISTORY INTERVIEWS

LARRY D. MORTON

Volume I

1996
Phoenix Area Office

♦♦♦♦♦♦

STATUS OF INTERVIEWS:
OPEN FOR RESEARCH

♦♦♦♦♦♦♦

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

♦♦♦♦♦♦♦

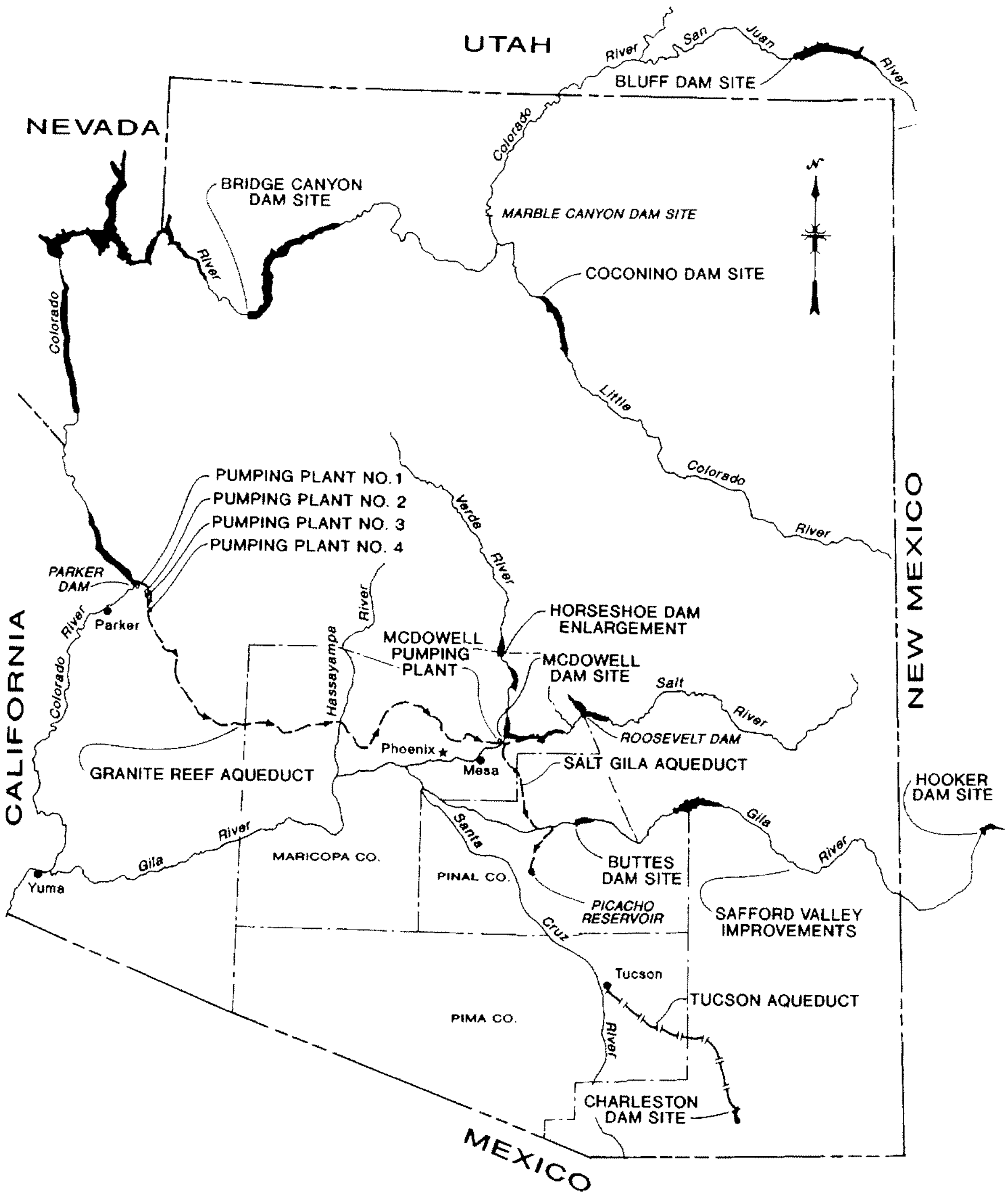
Oral History Program
Bureau of Reclamation

SUGGESTED CITATION:

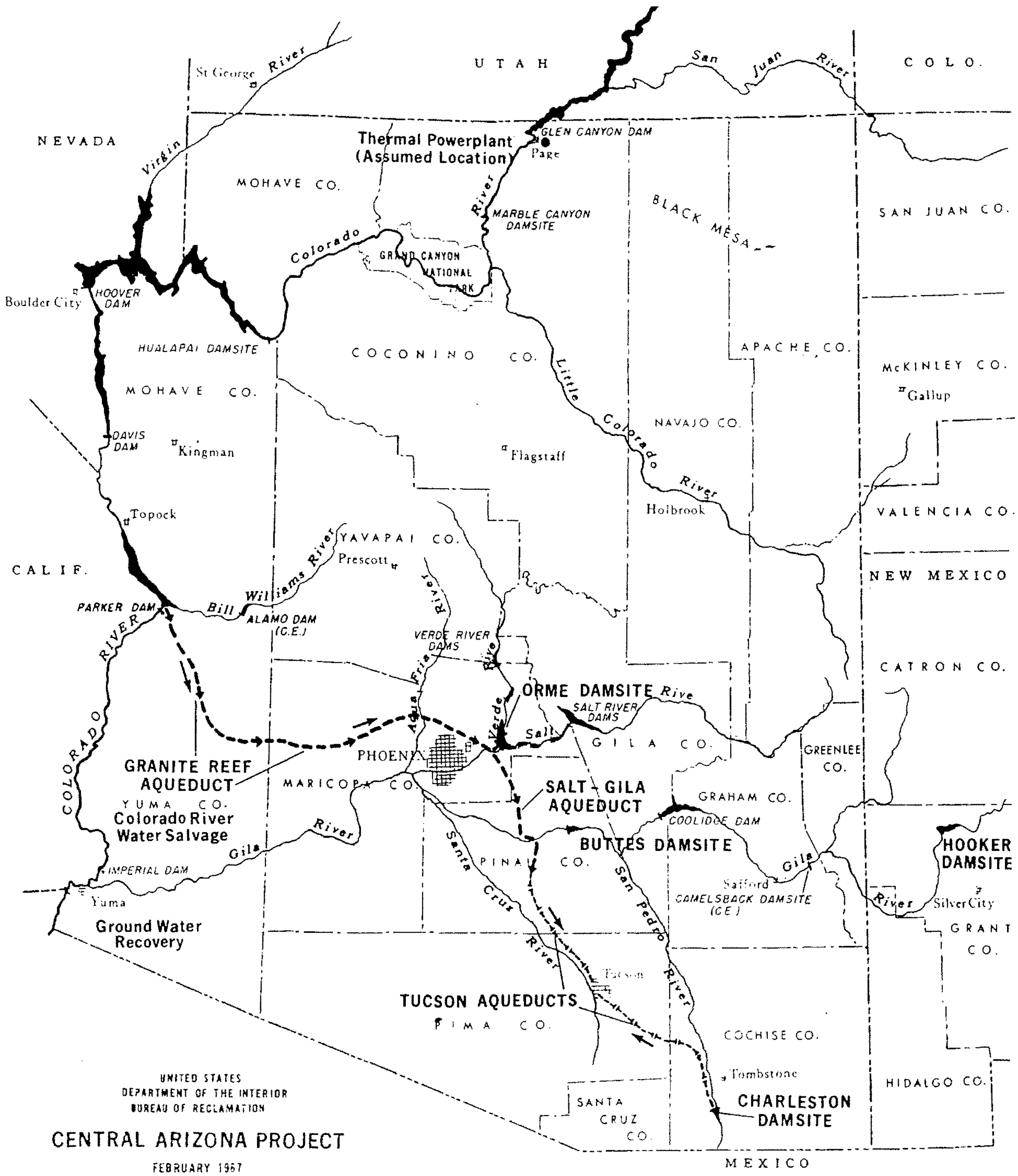
MORTON, LARRY D. ORAL HISTORY INTERVIEW. Transcript of tape-recorded Bureau of Reclamation Oral History Interviews conducted by Brit Allan Story, Senior Historian, Bureau of Reclamation, during 1996 in the Phoenix Area Office. Transcription by TechniType Transcription of Davis, California. Edited by Brit Allan Storey. Repository for the record copy of the interview transcript is the National Archives and Records Administration in College Park, Maryland.

Record copies of this transcript are printed on 20 lb., 100% cotton, archival quality paper. All other copies are printed on normal duplicating paper.

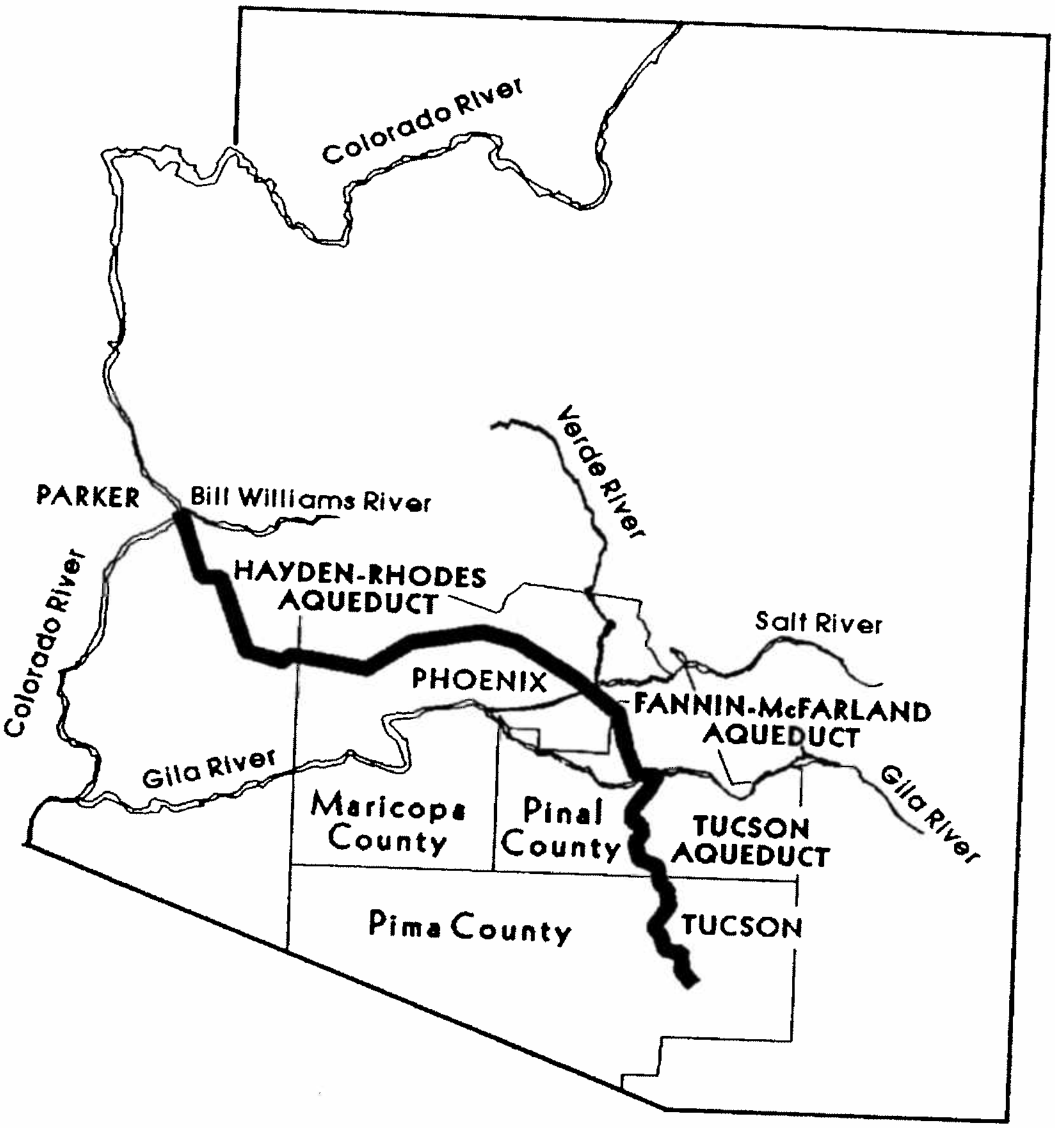
Larry D. Morton



The Central Arizona Project as conceived in 1945.



The Central Arizona Project as conceived in 1967.



The Central Arizona Project aqueducts in 1996.

STATEMENT OF DONATION OF ORAL HISTORY INTERVIEWS OF LARRY D. MORTON

1. In accordance with the provisions of Chapter 21 of Title 44, United States Code, and subject to the terms, conditions, and restrictions set forth in this instrument, I, Larry D. Morton, (hereinafter referred to as "the Donor"), of Phoenix, Arizona, do hereby give, donate, and convey to the National Archives and Records Administration (hereinafter referred to as "the National Archives"), acting for and on behalf of the United States of America, all of my rights and title to, and interest in the information and responses (hereinafter referred to as "the Donated Materials") provided during the interviews conducted during the weeks of April 22, May 20, June 17, July 15, and September 2, 1996, at the Phoenix Area Office, and prepared for deposit with the National Archives and Records Administration in the following format: cassette tapes and transcripts. This donation includes, but is not limited to, all copyright interests I now possess in the Donated Materials.

2. a. It is the intention of the Archivist to make Donated Materials available for display and research as soon as possible, and the Donor places no restrictions upon their use.

   b. The Archivist may, subject only to restrictions placed upon him by law or regulation, provide for the preservation, arrangement, repair, rehabilitation, duplication, reproduction, description, exhibition, display, and servicing of the Donated Materials as may be needful and appropriate.

3. Copies of the Donated Materials may be deposited in or loaned to institutions other than the National Archives, including the Bureau of Reclamation. Copies of Donated Materials may also be provided to researchers. The Bureau of Reclamation may retain copies of tapes, transcripts, and other materials.

4. The Archivist may dispose of Donated Materials at any time after title passes to the National Archives.

Date: 9/3/96

Signed: Larry D. Morton
Larry D. Morton

INTERVIEWER: Brit Allan Storey
Brit Allan Storey

Having determined that the materials donated above by Larry D. Morton are appropriate for preservation as evidence of the United States Government's organization, functions, policies, decisions, procedures, and transactions, and considering it to be in the public interest to accept these materials for deposit with the National Archives and Records Administration, I accept this gift on behalf of the United States of America, subject to the terms, conditions, and restrictions set forth in the above instrument.

Date:____________________

Signed:______________________________
Archivist of the United States

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.

Brit Allan Storey
Senior Historian
Office of Water, Land, and Cultural Resources (D-5300)
Program Analysis Office
Bureau of Reclamation
P. O. Box 25007
Denver, Colorado 80225-0007
(303) 445-2918
FAX: (303) 445-6470
E-mail: bstorey@do.usbr.gov

This page intentionally left blank

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Volume I—CONTENTS

Page

Note: Contents continued in volume II.

ORAL HISTORY INTERVIEWS
LARRY D. MORTON

Storey: This is Brit Storey, senior historian of the Bureau of Reclamation, interviewing Larry D. Morton, the assistant area manager of the Phoenix Area Office, in his offices on April 22, 1996, at about ten o'clock in the morning. This is tape one.

Mr. Morton, I was wondering if you would tell me where you were born and raised and educated and how you ended up at the Bureau of Reclamation, please.

Morton: Sure thing. I was born in Kenosha, Wisconsin, in 1942, and moved with my family to Arizona in 1952, and have been a resident here in Arizona since that time. [Attended] [1] Public schools in Mesa, Arizona. Graduated from high school at Mesa High in 1960, and attended Arizona State University in the School of Engineering from 1960 through 1965. I graduated from Arizona State with a Bachelor of Science degree in Engineering in January of 1965.

Born Kenosha, Wisconsin

Moved to Mesa, Arizona in 1952

Graduated from Arizona State University in 1965

As far as my Reclamation career was concerned, I was first appointed to a position as a student trainee in April of 1962. It was one of those situations where the Bureau of Reclamation and the Department of the Interior were recruiting on campus, and I stopped over, without an appointment, and made some inquiries about the opportunities for summer employment. This was during the early spring semester, probably early February, that I did that. A fellow by the name of Bill Laudenslager, who was the personnel officer at our Parker-Davis office here in Phoenix, suggested that I go take the Civil Service exam and take my scores down to the Arizona Projects Office. Actually, at that time it was called the

Appointed student trainee with Reclamation in 1962

[1] *Unless noted otherwise, material in brackets is provided by the interviewer.*

Phoenix Development Office, and take my scores down there to the Phoenix Development Office, because they were looking for part-time employees both during the school year and the summer.

So I took his advice, and the Civil Service Commission just happened to have an exam that was coming up relatively quickly, and I took the exam. I don't remember what my score was, but they certified me and I went down to interview with the area manager, or actually what we called them at that time, if I remember right, was the area engineer, was the title. At that time, the Reclamation project office here in town was called the Phoenix Development Office, and it was primarily a planning office, and at that time the area engineer was Mr. C.A. Pugh, Cliff Pugh, and he interviewed me for about ten minutes, and he said could I come to work on Monday.

And I said, "Well, you know, if my school schedule fits with your work schedule."

He said, "No problem. We can work around that." So I came to work for Reclamation around the middle of April in 1962 as a student trainee, and generally worked during the school year for about twenty hours a week and during the summertime on a full-time basis. I was real fortunate that in that era there was always a need for technicians to do various computational tasks, and there was always someone looking for help, whether it be a draftsman, or running a planimeter or computing hydrologic data. So I got to see quite a broad spectrum of engineering-type applications in my first couple of years there while I was still in college.

Storey: Good. Did your family happen to live on a farm, either in Kenosha or in Mesa?

Morton: No. My dad was a plumber, my grandfather was a plumber, and they were both primarily in housing construction, but subsequently, as my dad got more skilled, he ended up in heavy construction. He worked for a time at Glen Canyon, worked for the Fluor Corporation at that time, and they sent him to Saudi Arabia for a year and a half, and then he worked for Fluor on some pipeline welding jobs in Texas and Oklahoma, so he ended up in heavy construction. We lived near farms, but never lived on a farm.

Storey: Flor is F-L-O-R?

Morton: F-L-U-O-R, I believe it is.

Why the Morton family moved from Kenosha to Mesa

Storey: Why did you move from Kenosha to Mesa?

Morton: (laughter) At that era, that was a major undertaking to break away from family and move all that distance. At the time, I think it was economics and for medical reasons. My mother had -- she didn't have asthma, but she had severe allergies and sinus problems, and I think that the cold weather in the winter and the wind off Lake Michigan in Kenosha was part of the reason for moving. The other part was--if you don't know Kenosha, Kenosha was the home of the Nash Corporation. They built Nash and, subsequently, Ramblers and, subsequently, Chryslers and Jeeps, but it was a feast-or-famine exercise. One year the cars would sell well and things would go very well, and for two or three years it would be depressed.

So I think my dad felt like that economic depression was something that he didn't want to continue to live with. He wanted to have a relatively assured income, so he decided to come

West. He was a union man, and it was just the luck of the draw that we ended up where we did. I remember we spent about five days or six days on the road, driving. We put all of our personal belongings in a trailer, put it on behind the car, and headed West. He stopped in St. Louis and checked the union hiring hall there, and there was no work, and went on to Oklahoma City, and Amarillo, Texas, and Albuquerque, New Mexico, and every stop along the way, there really wasn't much in the way of work.

We got to Phoenix, and he went down to the hiring hall, and they said, "We can put you to work first thing this morning." And we stayed in Phoenix and lived in Mesa and settled down, bought a house, and stayed here. I think that was just--we'd have gone all the way to L.A. looking for work if it hadn't been that we found a job here in Phoenix.

Storey: So you were then in Mesa High School. (Morton: Right.) How did you become interested in engineering? Why did you become interested in engineering?

How he became interested in engineering

Morton: I think it was just that I had an aptitude for math and sciences. The math teacher, probably, or my physics teacher probably put me on to engineering. I liked chemistry, but when I enrolled there at Arizona State University, they had a special chemistry program for chemical engineers and chemistry majors, and it was just a little bit beyond me.

Started out in chemical engineering

So in my sophomore year, after I'd had a full dose of chemistry and decided that it was going to be too much of a burden for me, I backed off into civil engineering. I had the opportunity to take a land surveying class in the fall semester of

Switched to civil engineering

my sophomore year, and I liked that, so I changed my major from chemical engineering to civil engineering, and stuck with it.

Storey: When did you first become aware of the Bureau of Reclamation?

Morton: When I read the announcement on the bulletin board at ASU, the announcement of the recruitment. They said Department of Interior, Bureau of Reclamation, and I said to myself, "I think my dad worked at one time on a Bureau of Reclamation job," and I talked to him and he said, "Oh, yeah, I worked on that Glen Canyon Dam up in northern Arizona in 1960." By that time I'd been out of the house. I'd been living on campus, so I wasn't sure if he really worked on that job or not, and he assured me that he had and what they did. I said, "Hey, that sounds like a good outfit to go to work for. They build dams." It was probably, you know, the advertisement for recruitment and my dad's statements about the fact that they built dams that attracted me to Reclamation in the first place.

Storey: Were you aware of how he transitioned from residential plumbing into heavy construction plumbing?

Morton: Well, I think it was just the fact that Phoenix was a boomtown in the late fifties and early sixties, but from time to time there would be economic upheaval, shall we say. I remember in '56 there was a major strike by the concrete suppliers, Teamsters, and concrete finishers, and we went over to California to find work for about six months while that strike resolved itself.

I think in about 1958, about two years later, there was another upheaval like that, and so he decided that--well, plumbing was his original choice in terms of career. He decided that he needed to learn some skills, pipe fitting skills, pipe welding skills, and he did that. He took some classes and upgraded his capability, and then he got involved in heavy construction and, like I said, worked on the dam and some pipelines in Texas and Oklahoma, worked on a number of schools and hospitals on the Navajo Indian Reservation in northern Arizona. So the latter part of his career was primarily in industrial-type buildings and so on.

Storey: And he traveled to do that?

Morton: Yeah.

Storey: Did the family travel with him?

Morton: Just on that one occasion that I mentioned. We did move to the Anaheim area in Southern California. At that time I think it was '56. I think Disneyland had just opened, the Orange County area was booming. There was a lot of housing construction going on, and we settled there for about six months. Kept the house in Mesa, rented it out, and after the job market stabilized here in Phoenix, we moved back to Phoenix.

Family moves to Anaheim, California, area briefly

Storey: Did the fact that you were working as a student trainee with Reclamation affect the courses you took in your engineering program?

Morton: Probably not. By the time I came to work with Reclamation, I had almost two years under my belt, so to speak. I'd already made the decision to switch from a chemical engineer to a civil engineer. Your civil engineering program was pretty stylized. There weren't a lot of options available to you. The electives were -- oh, I don't know, half a dozen classes for the types of electives you could take. So the options--there weren't a lot of options available to you at that time.

So in college I tended to gravitate towards structural programming, structural design, rather than hydraulics, or waterways, or streets and roads, or any of the other civil specialties, but as it worked out, I never did use any of that structural design background that I acquired in college.

Storey: Were there any professors that were particularly influential in your training?

Morton: I really don't think so. I think that they were just professors. They didn't take a personal interest, and since I was working with Reclamation for about twenty hours a week and taking fifteen to eighteen hours of classwork, I really didn't have a lot of opportunity to interface with any of the professors on a personal basis; strictly classroom kind of activities.

Storey: Must have kept you very busy.

Morton: I thought I was pretty busy, yeah. I had plenty of time for other pursuits, watching sports and things like that. I still enjoy that.

Storey: Tell me more about what you did as a student trainee, where you were assigned, how you got your assignments, the kinds of things you did, all that sort of thing.

Morton: Okay. When I was initially appointed, as I said earlier, the office was a planning office, and there were a number of planning programs associated with potential water resources in Arizona. The Central Arizona Project (CAP), the principal program, was still on hold. Congress, in 1952, had said they weren't going to look at CAP anymore for authorization until Arizona had established its right to Colorado River water, and there was litigation ongoing in the lawsuit *Arizona v. California*. A special master in 1962 was just about ready to hand down his report to the Supreme Court. At that time, CAP was not to be studied.

Storey: It was a gleam in some politicians' eyes.

Morton: It was a gleam in a politician's eyes. The state of Arizona was talking about funding Reclamation to do an update. Reclamation had done a report in 1944; actually, 1947 was the date of the report. They started that study in 1944 to determine if there was a feasible way to bring Colorado River water into central Arizona. By 1962, the state was talking to Reclamation about funding an update of that report.

Storey: This was the '44 one where the legislature allocated $200,000. But wasn't that matching money with Federal money?

Morton: In '44, it was, yes.

Storey: So it was a joint report.

In 1962 it was necessary to update the 1947 report on the Central Arizona Project (CAP)

Morton: Joint report. It was a joint study that culminated in a report in 1947, a report to Congress on the feasibility of the Central Arizona Project, but a lot of things had changed from 1947 to 1962.

Arizona had another million people living in the central part of the state, so the whole concept of delivering Colorado River water changed because the ultimate consumer had changed. The concept of land development had changed. During the war years, a lot of land had been put into production using groundwater. Between 1944 and 1952, over 600,000 acres of new land had been put into production.

So that the concept of what was in the '47 report and what things looked like in Arizona by 1962 had dramatically changed, and while there was a prohibition on any Federal participation in a restudy of the Central Arizona Project, there was a desire on the part of the state to reinstitute planning activities and at least obtain an appraisal of how things had changed. That was the reason behind hiring a number of people in the Phoenix Development Office at that time, was to bring people on board who would be available in anticipation that CAP would eventually, the restudy of CAP and the search for the authorization, would eventually get started in the near term.

Storey: Because of the settlement of *Arizona versus California*.

Morton: Right. The special master's report was scheduled, I believe, in the summer of '62, was scheduled to be released to the Supreme Court. As it worked out, it was in 1964 that the decree was actually handed down, but by that time Reclamation had worked out a reimbursement arrangement with the state of Arizona for funding these studies.

Technician work in support of CAP restudy

So generally, the kind of work I did was technician work in support of these studies, these studies that would indicate what changes had occurred in Arizona, what other alternatives were available for the use of CAP or Colorado River water that could be conveyed by CAP.

When I initially started work, they asked me to work in the hydrology organization. I worked on several ancillary programs that were potentially part of CAP, but at that time they were programs that could stand on their own, they didn't necessarily have to have CAP as the economic or financial support for their justification. They could be justified as single-purpose programs.

Orme (McDowell) Dam

The first program I worked on was Orme Dam. At that time we called it the McDowell Dam site. It had opportunities for conserving the surplus waters, or the unappropriated waters, of the Salt and Verde Rivers, because it was located at the confluence of those two rivers. It also had the opportunity to provide flood control through the city of Phoenix. On that basis alone, it was a program that did not require any association with the Central Arizona Project. It could function by itself as a single-purpose dam, or as a multi-purpose dam, without any Central Arizona Project involvement. The waters that would be conserved, or could have been conserved, could be delivered through the existing facilities of the Salt River Project. They could serve agricultural lands on the Salt River Indian Reservation, as well as agricultural lands east and west of Phoenix. Domestic water supply could be furnished to the city[ies] of Phoenix, Scottsdale, Mesa, Tempe, Glendale, through the existing conveyance facilities of the Salt River Project.

So there was a lot of attributes to Orme Dam as a single facility structure, and that was the first one I worked on. The first supervisor I worked for was a fellow by the name of Bruce Blanchard. Bruce had just graduated, I think about 1959. He'd graduated from Harvard and was a graduate student in their Water Resources Program. He was granted shortly after I started working for him, I think in the fall of '62, he was granted a year's sabbatical by Reclamation, he went back and completed his master's work on the optimization of the Orme Dam site. So a lot of our work with Bruce and with Darrell Webber, who at that time was a young engineer in the Denver office, an advocate of computers, part of their effort was to model, using dynamic programming, model the Orme Dam, the hydrology of Orme Dam.

Computer modeling of Orme Dam hydrology and manual checking of model

So a lot of my first work was working on a calculator, an old manual rotary-type calculator, to calculate the inflows and outflows and changes in storage and potential operation of a theoretical dam situated at the Orme Dam site to determine its yield capabilities and to validate, if you will, the results that they were getting out of the computer. While I personally didn't have anything to do with the computer model or the development of the program for that model, I did, by manual procedures, I think there were about five of us, who manually calculated on a month-by-month basis over a forty-six-year time cycle, the operation of the reservoir in an attempt to demonstrate that the results that were coming out of the computer were, in fact, the same results that you would get if you used traditional manual methods. So that was one of the first jobs that I had to work on, was to validate a computer operation. (laughter)

Storey: Let's see. You say forty-six years of operation. Is that because that's how long we had water records for?

Morton: Right. I think there were certain gauges that we had for a longer period of time than that, but this was the most reliable period that we had at that time, was a forty-six-year period of record.

Storey: And there were five of you doing these calculations manually?

Morton: Right.

Storey: Do you remember about how long that took?

Morton: We probably worked on that, maybe not full time, but on and off for about four or five months, just filling out spreadsheets, if you will, filling out the cells, by hand on a spreadsheet that was probably--well, forty-six years by twelve months by about twenty variables--evaporation, changes in storage, inflows, outflows, delivery assumptions, etc.

Storey: So let's see. That would be forty-six times twelve times twenty is 11,040 calculations.

Morton: And we probably did, I'm going to say, half a dozen different capacity, storage capacities, and/or variations in operational regime.

Storey: Times another six is 66,240.

Morton: Yeah. A PC today probably can generate that table in several seconds. (laughter) It took, oh, five--I would guess something on the order of fifteen or twenty staff months to do that.

Storey: Did you have any insight into whether or not the computer program was working properly? Do you remember anything about that?

Morton: Of course, the computer was programmed in a language foreign to all of us. I'm sure that Darrell Webber and Bruce knew what they were doing, but oftentimes we found that as--we would go through each step, have a flow chart, and each step would have to comport with the program itself, so if the program said, "Add A to B," we actually manually added A to B. There were no shortcuts. We were not allowed to do any shortcuts. So for each operation you had to manually proceed through it.

On more than one occasion we found that the code that had been written for the computer was in error, whether it was because the programmer used the wrong symbol or--I mean, this was before even FORTRAN. I'm not even sure what language they were programming in, but it was a machine-type language that really did not translate well like a FORTRAN or a BASIC or one of the later translatable languages that at least looked like English. But this was a machine code and we had to follow each step in the code to validate that not only were we getting the right answer, but the procedure was correctly being entered into the machine to actually do the calculation.

Storey: Let's see, then. If I'm understanding where you found the problems was where the coding in the machine was not correct for performing the function that they wanted.

Morton: Correct. Right. For example, the instructions said that you were to subtract the calculated evaporation from the previous months end of month content, and the coding may have indicated it was to be added, in which case instead of reducing the volume by the monthly evaporation, in fact you were increasing the end-of-month storage by that evaporation. So we occasionally found those types of coding errors.

Storey: Were you then the ones who were comparing the results from the machine with mechanically-arrived-at results?

Computerization at Reclamation in 1962-3

Morton: The printouts that were created by the machines were brought down to Phoenix, and we would go through and verify each calculation to ensure that our results, our manual results, were equivalent to what was coming out of the machine.

Storey: Where were they brought down to Phoenix from?

Morton: They were actually run on a computer in the Denver office, and this was before the age of electronic transmission, so they'd run a study and it would take all night to run a study, and the postal service would bring it down. We'd get it about three days after it had been run, and there would be a mammoth computer printout that we'd spend the next week looking over, verifying.

Storey: Do you know where the data input was taking place?

Morton: The data was actually being inputted in Denver. It was using the--

END SIDE ONE, TAPE ONE. APRIL 22, 1996.
BEGINNING SIDE TWO, TAPE ONE. APRIL 22, 1996.

Storey: You were saying that this was before the era when we had electronic communications, is that right?

Morton: That's correct. We used to get about one run out of the computer a week that we were asked to verify, and normally I think the computer was probably dedicated to various administrative applications at the time during the day, and so they were doing personnel actions and things like that, payroll, what have you, and so the only time to run these studies was at night.

They would run a study on a Tuesday night, and we might get the printout by Friday morning, in the mail, and then we'd have a week to evaluate what had come out of the computer, to verify whether or not the computer was giving the correct answers, or at least the answers that we were deriving through manual methods.

Storey: Now, let's see if I understand this. The Phoenix Area Office was interested in developing a program, so it was providing the raw data, and the raw data was going to Denver and being input.

Morton: Right.

Storey: Somebody was programming, developing the computer program.

Morton: Correct.

Storey: Was that in Denver or was that here in Phoenix?

Morton: The computer code was actually being written by our former Assistant Commissioner, Darrell Webber. At that time, he was in--

Storey: He was in Denver.

Morton: He was in Denver. He was a young engineer who felt like there was a future in the engineering profession for computers, and so he was writing the code.

The flow charts and the data were being done in Phoenix by Bruce Blanchard. He would develop the flow charts. He would develop the details on the manual operation. He'd test it with the men. He had five people working for him, doing the manual testing. He would deliver the flow charts to Darrell. Darrell, in turn, would actually code the machine language and--

Storey: Based on what Bruce Blanchard had said?

Morton: What Bruce had inputted. Then the data and the code was manually punched on the old IBM punchcards and fed into the computer. When we finally got the operation going, we used to get one computer run and one manual verification a week out of the system, and we did that for several months to verify that we had done the program correctly.

Storey: Do you know whether they used this program further once they had developed it?

Orme Dam hydrology model became basis of CAP Simulation Model

Morton: It formed the cornerstone for what eventually became what we still use today. It's called the CAPSIM--the CAP Simulation Model, that we presently use. It's gone through about five generations on five different computers, but we still use it as an evaluative tool for financial analysis and for water supply purposes on CAP.

The Orme operation, as a result of the decision to not build Orme back in 1977, has been discarded, but the operation associated with New Waddell Dam, which is part of the Central Arizona Project and is now a reality, is essentially patterned after the same manual operation and subsequent automated operation associated with Orme Dam in 1962 and early '63.

Storey: Is that because there's something unique to CAP, or is that because that's the way you do it?

Morton: I think it's more the latter. It's a stylistic approach to water resource operations, and it's just been integrated into CAP, but that was the first manifestation of using the computer associated with Central Arizona Project.

Storey: Do you know whether that program has been taken to other areas and adapted and used, by chance?

Morton: Well, over time, the concept certainly has been. We've had a Colorado River model for a number of years that had various names. That's a similar situation. While the Orme model was primarily a reservoir model and the Colorado River model has multiple attributes, over time I think that the concept of that model and the involvement of people like Darrell Webber and other people in the Denver office associated with the computer activity has resulted in adaptations to the old Orme model, that go back to the early sixties.

Storey: Am I thinking correctly that Bruce Blanchard ultimately ended up in Washington?

Morton: Yes.

Storey: An environmental officer, maybe, or something?

Morton: He was the Department's [of the Interior] environmental officer and was, or still may be, an assistant director of the Fish and Wildlife Service.

Storey: Well, what was your second assignment as a student trainee?

Morton: (laughter) Oh, let me see.

Storey: Or is there more we should talk about Orme and the modeling? Because the computer thing has radically changed the way Reclamation did business, the introduction of computers.

Morton: I think computers will come up again, because that was another thing later in my career that I worked with some folks on.

Generally, I worked with several other people. Like I said, this was not a full-time job for me. I was only working about twenty hours a week, and I would generally come in about 12:30 and work 'til 4:30 every afternoon if I didn't have a lab [class]. My supervisors were very good about scheduling my time so that it fit with my classroom schedule.

Storey: Where was the office then?

Morton: The office at that time was located at First Street and Roosevelt. The building still stands there. It was a relatively new building then; it's thirty-five years old now, but it still stands there. I think we had about sixty people working in that building at that time.

Office location in 1962

Storey: This was for an office, if I'm understanding it correctly, that was not a very active office.

Morton: Like I said, it was primarily a planning office. Most of the funding came from what we know today as our General Investigation Program.

Phoenix Development Office in 1962 primarily a planning office

Storey: G.I. Program.

Morton: G.I. Program. There was no construction money. We had a rehabilitation and betterment loan that was oversighted from the office at that time.

Rehabilitation and betterment loan for rehab of Steward Mountain Dam

Storey: For?

Morton: For the Salt River Project. They were rehabbing Stewart Mountain Dam on the Salt River at that time, and they had a Canal Rehabilitation Program, a lining program, ongoing. We had one engineer, one supervisor who had other duties in addition to construction oversight, and two inspectors that worked on that program, so out of the [staff] roughly three and a half staff persons associated with construction, everybody else was devoted to development type of activities, planning-type activities.

At that time we had the Orme program, which at that time was called McDowell Dam for various reasons, I'm not sure what.

Storey: But you were able to study that not because it was part of CAP, but because it had a capability of an independent life, right?

Morton: Right. Correct. We had programs in southern Arizona. We were studying water resource needs of the San Pedro River Basin, the Santa Cruz River Basin, so we had two studies, a San Pedro Study, a Santa Cruz Study. We had programs in northern Arizona--Flagstaff, Williams, Kingman, St. John's, Winslow, Holbrook.

San Pedro River Basin Study

Santa Cruz River Basin Study

We were characterizing the water resources of Arizona and trying to determine needs and trying to develop programs to satisfy those needs, whether the needs were agricultural, whether the needs were domestic water supply,

Reclamation was characterizing the water resources and water resources needs of Arizona

industrial water supply, or irrigation. We were evaluating just a number of different areas.

I would have to say from a political perspective, I think that Carl Hayden was very instrumental at that time. He was the senior member in the [U.S.] Senate. There was a lot that wasn't known about water resources in Arizona, and I think that there were a lot of appropriations made to further the knowledge base associated with Arizona's water needs, and he was very instrumental in ensuring that funds were available to staff and study in Arizona through the Phoenix Development Office.

I think that following my exercises with Orme, I did do several hydrologic or meteorologic data-collection activities. During the early fifties, as part of the Supreme Court lawsuit--

Storey: The early sixties?

Morton: Well, early fifties, actually. The suit was filed in 1952.

Storey: That isn't when you were doing the work, though.

Morton: No. I just wanted to say that as Reclamation represented the Secretary of the Interior, who was a participant in the suit, I mean, he had intervened, the Secretary had intervened, and in the early fifties, a compendium of water resources in Arizona and California was done. It was a book called the "White Book," it's about six inches thick, and it contains a number of hydrologic and meteorologic records that was used to demonstrate the department's position with regard to the uses of water, both in Arizona and along the Lower Colorado River. That was the bible of data, so to speak, that was used by the special master in his analyses.

But the cutoff date for the data was 1952, so one of the things that I worked on early on in my appointment, in addition to the Orme Reservoir Operation Study, was an update of the "White Book," the update of the waters of the Colorado River, to extend the data from 1952 to 1958, which was the next checkpoint, next milestone, if you will, in our reliance on various stream flow data, various cropping census data, various water use data.

So one of my jobs was to pore through records that had been published by the Department of Agriculture, the state of Arizona, the USGS, the Geological Survey, various water resource and water management agencies in Arizona, in the Lower Basin, actually. It included lands in southwestern Utah, in southern Nevada, in eastern California, and western New Mexico, as well as the state of Arizona, to determine just a broad range of information to update the record and abstracted data from the Weather Service, for example, on rainfall, abstracted diversion data from various sources of crop census reports to determine what crops had been grown. Generally to derive an understanding of how water flowed into Arizona, how it was used in the state for agriculture or domestic purposes, what the net consumptive use was from tributary streams in the Lower Basin.

So I compiled from a number of sources. That was another job I had early in my career, was to compile from a number of sources this hydrologic and meteorologic and agricultural kinds of data. That was kind of fill-in work. That was kind of boring to sit there and copy down rainfall records for fifty-two recording stations in Arizona, monthly rainfall records, for example.

But we would take that data and apply a formula known as the Blaney-Criddle Formula, to various crops that agricultural census data indicated were grown to determine exactly how much water was being consumptively used for agriculture.

At that time, there was no central collection point in Arizona for groundwater pumping information, but from crop census data generating this consumptive use information and the limited amount of rainfall that occurred, we could develop reasonable estimates on how much groundwater was being pumped in various parts of the state of Arizona, since we did not have a real good data-collection point for actual pumpage.

I don't know that any wells at that time in the early sixties had meters on them. People just did not meter their wells. The number of wells that were available [was not known], there was no census of wells, whereas today the state has a very active program of maintaining records of wells, both where they are, the type of well that is being produced, and the volume of water that's being produced. But we didn't have that kind of data, so you needed to use secondary data to derive a feel for what the nature of the water resource [was] and how it was being used. So that was another early-on technician-type job that I did as a student trainee.

Storey: But why did we care?

Morton: Well, we cared for a number of reasons, but I think principally it was to validate the fact -- well, it started out initially in the '50s as a demonstration of the tributary inflow to the Lower Colorado River Basin for the lawsuit [*Arizona v. California*]. There was an assertion being made in the lawsuit between Arizona and California that tributary flows in Arizona should not be counted against Arizona's apportioned right to Colorado River water.

Of course, California maintained that the Basin, as a whole, in historic times, there were contributions being made from the Gila and the Bill Williams and the other major tributary streams, and, in fact, that was a part of the total water resources that was considered in the Colorado River Compact and should be part of Arizona's entitlement.

California argued that water in tributaries in Arizona should be part of Arizona's allocation in the Colorado River Compact

Of course, Arizona maintained that the tributary streams that arose within Arizona should be used entirely within Arizona, and the compact that titled Arizona to another 2.8 million acre-foot of consumptive use from the river, from the Colorado.

Arizona argued that tributary stream water was not part of the Colorado River Compact allocation

Storey: From the water that passed Lee's Ferry annually.

Morton: Right. Right. And so that was a major argument within the state of Arizona, and the Secretary at that time, Secretary of the Interior, had a number of Federal projects, the Salt River Project, the San Carlos Indian Irrigation Project, the Yuma Project, the Gila Project.

Secretary of the Interior water projects caused concerns in Arizona

There were a number of either Reclamation or Indian, BIA [Bureau of Indian Affairs], projects within Arizona that the Secretary had responsibility for. So he had to have his own independent view of those entitlements, and I think that in all likelihood, the Department [of the Interior] came down on the side of Arizona in its demonstrations to the Supreme Court and to the special master, because the Secretary had to ensure that these projects that he was responsible for, in fact, were justified and would repay their costs, and if the total water supply for those projects came out of Arizona's total entitlement in the Lower Colorado River, he was going to be at a loss in the future for new projects in Arizona.

But as the Supreme Court ruled, Arizona was entitled to the 2.8 million out of the Lower Colorado River and the tributary streams did not count against that entitlement, as it turned out.

Groundwater mining was an important element in planning for Arizona's water needs

That was the original justification for this kind of study, but then as we came about and said, "What is Arizona's need? How can we satisfy that need?" there was an existing economy that had been built on groundwater mining, if you will. The groundwater was literally being pumped out from under cities and towns and farms and being used to grow crops in central Arizona, and there was no return being made. There was no recharge. It was totally a mining and overdrafting operation, and there was no real data on how much water was being used, what purposes it was being used for, what economic activity did it produce, and those were the kinds of things, by developing this secondary data, those were the kinds of questions we were attempting to answer.

"The Status of Groundwater in Arizona" a publication of USGS and Reclamation

And ultimately Reclamation and the [U.S.] Geological Survey cooperated on a technical paper on "The Status of Groundwater in Central Arizona," and I think that was published about '68 and revised again in '73. But we worked on that in the early sixties and used secondary data to derive information concerning groundwater pumping and its impacts, both economic impacts and physical impacts, on Arizona.

Subsidence as it related to groundwater in Arizona

Some of the things that came out of those studies were the issues around subsidence. We were observing, through anecdotal data, that the ground was subsiding, it was falling away from where it originally had been situated, and nobody knew for sure how much or how good was our survey, our land survey control. Could we be assured that those points that we were setting weren't also subsiding? Was it all a relative subsidence? Was it a regional subsidence?

When the railroad started moving, physically the rails would physically separate or would physically bow, when cracks would appear across major highways, it became obvious that there were some economic impacts produced because of this subsidence, and that was all directly attributable to groundwater mining.

Then the questions were, well, at what point does subsidence become a problem? How does it relate to the amount of water that's pumped out? Is it a relationship between the volume of aquifer that is dewatered or is it a question of the depth to which it is dewatered, or is it a combination of factors that results in subsidence occurring? Those were all research kinds of questions that the geologists and groundwater hydrologists could debate, but we were the ones sitting in the back room, so to speak, with our little green eyeshades on, that were actually going through secondary information to develop the data that they needed to try to answer these questions. That was kind of a secondary job I had in my first year that I worked for Reclamation.

Storey: What was your office like?

Morton: Compared to today, it seems small and cramped and dark. (laughter) The thing I remember as a part-time person, I think there were about six of us that would show up every afternoon, and we kind of had to walk around the building and say, "Are you using your table today? Can I borrow your desk?" We didn't have enough room for all the people that were there. The permanent employees

Office conditions in 1962

had staked out every square inch, so the part-time, or "when actually employed"--that was the title they gave us, WAE. I remember that. My title was Student Trainee, WAE, which meant "when actually employed."

So we'd come in about 12:00 or 12:30 and they were just breaking up lunch, and perhaps they were still playing cards at the lunch table, and we'd ask if we could use that table. "Did you need that throw table today?" or what have you, to do our computations on, or shared a corner of a desk with a full-time employee. Everybody had a little desk lamp. The reason I say it was dark is you needed a desk lamp to actually see, so everybody had to have a desk lamp. Overhead lighting was not adequate to do any close work, working on a calculator or filling out a spreadsheet.

Air-conditioning, I don't recall that it had central air-conditioning. My recollection is that they still had what we call evaporative coolers to cool the place in the summer. It would get kind of warm and stuffy in the summer. Wintertime, it tended to be on the cold side. I don't know if that was because there was a lack of heat or just poor circulation in the building, but my recollection is it was kind of cold in the winter, hot in the summer, kind of on the dark side, and never enough room to actually spread out and do work in an efficient manner.

By 1963, as a result of the special master's report being filed and the Supreme Court proposing or putting forth its proposed decision, it appeared much more favorable that CAP was going to start up again, and the office started to hire additional staff. [Unclear due to extraneous noise] until '64, it seems to me, but in '63 the state had come through, had funded two studies, an appraisal report and a supplemental report, so we'd hired some additional staff people.

We had an amalgamation of folks in the office, but as is the case with Reclamation, many people follow their mentors or their former supervisors, and we had two people in the office that were the assistant and the chief of the planning organization, both of whom were from California, out of the Sacramento office, and so we had the Sacramento influx in 1963 and early '64, so a number of planning engineers from California joined our staff at that time.

Storey: Let's see. Am I thinking Bob Johnson might have been one of those?

Morton: No, neither of the Bob Johnsons were of that age. (Storey: OK.) The folks that came at that time were Dave Creighton, Oliver Lillard, Jack Jorgensen. They were all from what [at] that time was Region Two [Sacramento/Mid-Pacific Region].

Rotation engineers hired from the graduating class of 1962

We also, as part of our program at that time, the graduating class of 1962 was one of the first -- may have been the first -- time that Phoenix hired rotation engineers, and of <u>that class</u> there were three people, if I remember right, came on board, one of whom still works in Denver, a fellow by the name of Yogi. You know Yogi?

Storey: Yogi Shaeffer.

Morton: Yes. Richard R. Shaeffer. Richard Ralph Shaeffer from the University of Wisconsin. He was a good friend, one of my early mentors. He came to work right out of the University of Wisconsin in 1962.

Another fellow that was a rotation engineer on our staff at that time was a fellow by the name of Cliff Gatlin. Cliff still works closely on the Central Arizona Project. He's an employee of the Central Arizona Water Conservation District [CAWCD}. Cliff was an early Reclamation employee that came to the Phoenix Development Office.

I think that probably the summer of '63, while I had worked in the office the summer of '62 and from April of '62 to May of '63 in the office doing a number of repetitive kinds of tasks, including this Orme hydrologic water operations study and the "White Book" recomputation study, the summer of '63 was my first opportunity --

END SIDE 2, TAPE 1. APRIL 22, 1996.
BEGINNING SIDE 1, TAPE 2. APRIL 22, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry D. Morton on April 22, 1996.

The summer of '63, they assigned you to the field surveys operation?

Assigned to field operations in summer of 1963

Morton: Yes. This was my first exposure to the real world, if you will, or the real program of Reclamation, i.e., the construction activities. I spent one month out at Parker, Arizona, along the Lower Colorado River, where the daytime temperature runs an average of about 120, I think, and we did a lot of vertical control surveys for what eventually became the Buckskin Mountain Tunnel.

Vertical control surveys for the Buckskin Mountain Tunnel

At that time there was no maps of the Buckskin Mountain region north or just due north of Parker, and it had been concluded some years earlier that if CAP was going to become a reality, if the Central Arizona Project was going to become a reality, we needed to bring the water through the Havasu pumping plant, which would be situated adjacent to Lake Havasu, and immediately north of the Buckskin Mountains, and that necessitated a tunnel through those mountains in order to get the water to the correct location to convey it on into Phoenix.

There was little or no maps of the top of the Buckskin Mountains, so I worked with a crew. I think we had four crews out there at the time, four-person parties, or three-person, three or four depending on what the crew did.

So there were ten to twelve people out at Parker at any one time, and my first assignment for a month was out there. Of course, I'd been not too active, kind of sedentary, going to school and working in the office, and so the first day they handed me a theodolite and said, "We're going to go do vertical control, and what we need to do is to establish a number of monuments along a grid on the top of these mountains, and we need to check the elevations. There's two ways of doing elevations. You can run levels, a series of level lines to get to those points, but you can also triangulate the points and compute their elevation using trigonometry. So we want to do both, because we want to double-check our elevations."

I thought to myself, "Well, why do we really care how high these mountains are?"

They said, "Well, when you drill a tunnel, you don't want it to daylight in the middle of its alignment. So we want to make sure that there's sufficient cover over the alignment of the tunnel to ensure that we don't have any cave-ins while we're excavating the tunnel or to ensure that the rock is competent. So we need to know what the relative surface elevation is along the alignment of the tunnel, but we don't know exactly where the tunnel is going to be located yet. So we need to map a relatively large area along where we think the alignment's going to be."

So this ended up being a grid on about half-mile centers of points, a grid of points on about half-mile centers, and it was about six miles in east/west direction and about ten miles in the north/south direction. They said, "We're going to start here on the south end of this grid, and your crew is assigned to work the B line," which would have been the second line ~~to~~ [from] the west, the A line being right along the river, the B line being the second line to the east of this grid.

Storey: And would go sort of north and south?

Morton: We would walk a line north and south, and we'd carry the theodolite and we would turn vertical angles from point to point, to ensure exactly what the vertical angle was to the next point. So we'll start here and we'll set up on this point, and the next point is up there on the top of that next hill up there about a half a mile.

Storey: So the first point would be in the valley?

Morton: First point would be in the valley, next point would be on the hill, next point would be down in the subsequent valley. The party chief said, "You go work with John." John Harrison was a fellow that had been doing this. He'd graduated in 1960 [from North Phoenix High School] with me, had come to work for Reclamation in '61 as a surveyor. He was still a surveyor. I think by that time I'd worked for Reclamation for about a year, so I was probably a GS-4 and he was probably still a GS-3 surveyor, but he'd been an <u>experienced</u> surveyor. He'd worked in the <u>field</u> for two years, and he was lean and strong and muscular, and knew what he was doing, and I was, you know, I was white and he was tanned and ran around in shorts and a pair of field boots, and I had the normal clothes, Levis, western shirt, etc. I promptly got sunburned, and John nearly ran me into the ground. I do remember that.

But the survey party chief, he'd say, "You ought to get to the power line road, which crosses B alignment, by noon. I'll be up there with the lunches and the water. Take a canteen," and we'd get started about six in the morning and we'd turn vertical angles. I'd sit on the point there in the valley, and John would go up to the top of the first peak, find the point that had already been established up there, and he'd set up his instrument over that point, and then we'd reciprocate angles, turn angles, to determine both in terms of vertical deflection, what the angle was to the preceding point, or the succeeding point, in my case, and then I'd pick up my instrument, which with the tripod and everything else probably weighed about forty pounds, and leapfrog past John to the next point. And we'd redo that operation.

So for about five hours of walking and shooting vertical angles back and forth, we eventually get to the power line road and have lunch, then do the rest of the thing, the rest of the line. There were no roads, a Jeep couldn't traverse that country, so it was all done on foot, and I was never so glad to get out of Parker after that one exercise. I think we were working four-tens, four days. I'm sorry. Ten days and then we'd get four days off. So every two-week pay period, we would work ten consecutive days and we would work ten-hour days.

Living in Parker, Arizona, at The Corral on per diem

I thought that was great. I mean, the government was paying me to live in Parker. The per diem, I think, was thirteen dollars a day, including the room. I mean, that was meals and incidentals and room rent, and I was making five bucks a day just on the per diem, and I was working overtime. So that was the good side. I was putting money away for college the following fall.

Storey: And that was in the days when they just gave you a blanket fee for your room and your board.

Morton: Right.

Storey: And you didn't separate it out and everything.

Morton: No. As a matter of fact, I remember everybody liked to stay at a place called The Corral, and that's exactly what it was. The buildings were built of adobe and they used to be a corral, and they had come in and cleaned it out and put whitewash on the abode walls and put wood planking down on the floor, and I don't remember what the room rate was, like three dollars a night or something like that.

Storey: Where were the bathroom facilities?

Morton: They had an outhouse in back and then they had running water. They had a sink in the corner of the room that they had plumbed in through the wall. But everybody liked to stay there because you could make more money, you could save more money by staying there, so all of the rodmen and instrument men would try to stay at The Corral. The party chiefs, they would stay down at the Triple A Motel down by the river. Of course, they were paying five dollars a day and we were paying three, I think.

I got totally sunburned the first day and was sunburned the rest of the period that I was out there. I learned a little humility. I obviously didn't know it all and didn't have the physical capabilities of doing it all. I think that the first day that I worked with John Harrison, he said, "I'll show you how to do it once and then you're on your own." Fortunately, we developed a much better relationship over time and became real good buddies, even in the late sixties, bowled on a bowling team together. At that time I think John was thinking, "You're a four and I'm a three, and you're making 22 cents an hour more than I am. I'm going to show you I can do this job better than you can," and undoubtedly he could. I mean, I was not real good at that job. But it was a real learning experience and showed me some of the practical applications of what actually goes on in the field of Reclamation.

Assigned to survey party at the Salt-Gila Pumping Plant site

Shortly after my stay at Parker, I came back to Phoenix and they reassigned me to another party, and we mapped, did the topographic mapping for what's now the Salt-Gila Pumping Plant site, because this is a pumping plant in the Central Arizona Project that's located just upstream from Granite Reef Diversion Dam on the south side of the Salt River. It's one of the key pumping plant sites for conveying water south to Tucson.

Storey: This is out southeast of Phoenix, I believe.

Morton: Yes, southeast of Phoenix in what is now east Mesa, but at that time was rural, <u>well</u> out into the rural part of Arizona.

Using a plane table to develop a topographic map

Once again, that was quite a learning experience, had the opportunity to do plane table topography for the first time. Today you use photogrammetric means to develop topographic maps. At that time you took a stadia rod and a plane table and actually triangulated on the table the actual points, and read the rod to determine the elevation difference and the distance, and made that entry on a sheet of mylar plastic, and then from that mylar, drew contour lines on the map, physically on the table itself. That gave me the opportunity, I worked as an instrument man, and kind of learned the craft of field surveying from both the control aspect at Parker and the plane table aspect at the Salt-Gila pumping plant.

Storey: What was the issue at the Salt-Gila pumping plant?

Morton: Well, we just didn't have maps at that time. Today the U.S. Geological Survey produces reasonably good scale maps that allow you to site things. At that time we had no idea of the elevation, the terrain. We needed to determine, for siteing purposes, where alternate sites would be, what the relative cost of excavation would be, the volume of excavation that you would need to site these plants and construct them. So this was primarily a mapping exercise to site physical features.

Storey: But for more than one location? For a series of alternatives? An area or--

Morton: In both the Buckskin Mountain Tunnel area and the Salt-Gila Pumping Plant area, we knew because of the prevailing regional topography that those were key sites. In other words, the Buckskin Mountains, because of its proximity to Lake Havasu and the point of diversion for the Central Arizona Project, we knew we had to come through the Buckskin Mountains, and it was well understood, because of their topographic influence within the area, we would have to come through

Surveys done in the area of the proposed features because detailed siteing was not complete

in a tunnel, and so we needed to have some reasonably good topographic maps of the top of the mesa, the Buckskin Mesa, to know where the tunnel could be safely situated.

Similarly, the Salt-Gila Pumping Plant, at that time it was assumed that there would be an Orme Dam and that it would be a cornerstone for the Central Arizona Project, and because of its unique location, the Salt-Gila pumping plant had to be in proximity to Orme Dam just because of elevation requirements and proximity requirements. So we knew within a mile upstream and downstream from what is still the Granite Reef Diversion Dam, that the Salt-Gila Pumping Plant had to be situated within a mile of that location, but we had no maps. We didn't know what the absolute topography looked like and we didn't know what the relative elevations were.

Survey of the Salt-Gila Aqueduct for location in summer 1963

There was another crew that worked with us late that summer in August, and to situate the rest of the southern part of the Central Arizona Project, the canal system south from Phoenix, they started at an elevation where we thought the Salt-Gila Pumping Plant discharge line would be located, and they ran a level line, a "fly line", south all the way to what's now Picacho Reservoir, to try and determine roughly where the Salt-Gila Aqueduct should be located. Up until that point, all of our locations were purely on paper and the kind of maps that we had were 1:250,000 scale Army Map Service type maps, so the variations in those maps as compared to what actually was on the ground is substantially different, substantially different.

Storey: When you say that you became an instrument man at the Salt-Gila Pumping Plant, I thought I heard you using instruments on the Buckskin Mountain survey also.

Morton: Well, that's true. Different kinds of instruments, I guess. At Buckskin Mountains, I think that we were using theodolites to precisely measure horizontal and vertical distances, ~~our~~ [or rather] horizontal and vertical angles. At the Salt-Gila Pumping Plant site, I got to work with levels and plane table and--I can't even think of the name of the instrument anymore. It's gone out of business.

Storey: Are we talking about an alidade?

Morton: Alidade. Yeah. Exactly. (laughter) That's what it's called, an alidade.

Storey: (laughter) It's the only other surveying term I know.

Morton: Yeah, archeologists use alidades and plane tables.

Storey: Um hmm, they do, sometimes.

Morton: Today you use global positioning and GIS and photogrammetry, but at that time, nobody had any idea of those kinds of instruments, I guess.

Anyhow, I spent the summer of '63, between what would have been my sophomore and junior year at Arizona State, I spent in the field working with the survey parties.

Storey: The first part of the summer at Buckskin Mountain, the second part of the summer at Salt-Gila, right?

Morton: Salt-Gila Pumping Plant, yeah.

Storey: And then during the winter? I use the term advisedly for the Phoenix area. You were back in the office?

Morton: Came back to the office. That would be September of '63. If I remember right, we were still on the old fiscal years at that time, so I think that by that time there had been an appropriation made for what would have been fiscal year '63-'64, fiscal year 1964, but it started--

Storey: July the first.

Morton: --in July. Right. So I think by the time I got back into the office, there had been a Federal appropriation made to the Central Arizona Project in anticipation of seeking authorization for the construction of the Central Arizona Project, and so our work became significantly more focused on CAP when I came back to the office after that summer in the field.

Stewart Udall's Southwest Water Plan which included the CAP and dams at Marble Canyon and Bridge Canyon on the Colorado River

I think at that time the Secretary of the Interior was Stewart Udall. I know at that time the Secretary of the Interior was Stewart Udall. At that time, he had a regional water development concept in mind. He called it the Pacific Southwest Water Plan, and the Pacific Southwest Water Plan had a number of units, and I think this was somewhat patterned after the Colorado River Storage Project (CRSP), which was passed in the mid-fifties, and the participating projects that were associated with CRSP.

The Udall concept was one of a regional water plan to integrate all water resources in the Southwestern United States with units that involved both the main stem of the Colorado River, facilities in California to bring water from

Northern California into Central and Southern California, and the Central Arizona Project. As part of the Pacific Southwest Water Plan, our office primarily focused on the Central Arizona Project and the two proposed dam sites on the Colorado River between Glen Canyon and Hoover Dam.

Storey: In other words, Marble and Bridge Canyons.

Morton: Marble and Bridge Canyon. And while I didn't do a lot of work on Marble and Bridge Canyon, [during] that '63 time period I did spend a lot of time developing data for CAP and for some of the other programs along the Lower Colorado River, including what at that time was called the Lower Colorado River Water Salvage Program, which was a proposal to eradicate phreatophytes along the Lower Colorado River.

Lower Colorado River Water Salvage Program

Storey: Plants that drink a lot of water.

Morton: Plants that drink a lot of water that were either considered to be not very good for economic species, wildlife species, like ducks, the concept being--we were still, in the fish and wildlife arena, we were still dealing at that time with economic return from fish and wildlife, and you got economic return from hunting and fishing.

Studies lower Colorado to improve hunting and fishing

The types of vegetation that were prevalent along the Lower Colorado River tended to inhibit hunting and fishing, they did not provide good habitat for ducks, which could be hunted, nor did they provide the -- they tended to be overgrown and have a lot of snags and water was not efficiently conveyed from Hoover Dam down to the point of diversion at Imperial, because the river was choked, the channels were choked, and

Fish and wildlife considerations in early 1960s were limited to economic value for hunting and fishing

there was very limited fishing. It was just not a real good stream for fishing.

So the concept being if we could improve and make the river more like a manmade channel, we could improve the flow regime, we could improve economic types of fish and wildlife, and we could improve recreation along the Lower Colorado River.

When I came back from my field experience in the summer of '63, one of the first jobs I was assigned was to, what we would call today, do remote sensing. They had photographed a number of reaches, a number of river reaches along the Lower Colorado River, they had done transects of the type of vegetations that were in those reaches, the transect center lines were placed on the maps, and then somebody had to sit there and actually, with a planimeter, compute the types and, based on the transect notes, the densities, the types of trees and vegetation that were growing there, how much water they used. Some of the plants were submerged, what the normal depth of that submergence would be; how much would be necessary, because of the type of plant, how much cut would actually have to be made to get to the roots of these plants and eliminate the plants; how much water could be saved based on the consumptive use of this type of plant species; how much water could be saved if these plants were eradicated or removed in some fashion.

So I spent probably the next six months of my Reclamation career every afternoon after attending classes bent over a planimeter, planimetering from the various notes that the field parties had assembled, going through a calculation to determine consumptive use of these various plants and the amount of total water that could be saved as a result, knowing the area and extent that these plants grew along the Lower Colorado River.

Storey: I presume some of the species would be cottonwood, willow?

Morton: Cottonwood tended to be one--what they were primarily attempting to eradicate and what we were tabulating, we would tabulate the extent of all species, and cottonwood and willow would be some, but, in fact, the cottonwood and willow are a small percentage of the total along the river. Mesquite, mesquite bosques, ~~arrow wood~~, arrowweed, tules, some of the submergent species, those were the ones that "yielded the best."

Storey: So-called salt cedar or tamarisk?

Morton: Salt cedar, that's one, too. Salt cedar were horrible. There were tremendous volumes or area of salt cedar along the river.

So the intent was to eliminate salt cedar, mesquite, arrow weed, tules, and over time the concept became, well, some species needs to replace these. Of course, cottonwood and willow were the favored species. Although cottonwood was considered to be a high-water-using type of vegetation, it, nonetheless, provided some economic value. It was considered to be a "good" species for wildlife at that time.

New office location for the Phoenix Development Office

So once again I was back [in the Phoenix Development Office]. By that time we'd moved to a new office. We'd moved from First and Roosevelt, we'd moved a block south and a block east to Second and Garfield. We had a much larger building, had a much larger staff.

Storey: Because of the settlement or because of the decision, I mean?

Morton: Well, the decision had been handed down and Congress had appropriated funds for CAP [Central Arizona Project] finally, to begin reinstituting the planning process for CAP, and we were involved in this Pacific Southwest Water Plan development, the proposal of the Secretary [of the Interior].

Study of CAP and other projects was underway

So there were more programs. There was at least some assurance that CAP would be going forward, and, of course, the state had put in several hundred thousand dollars to update the evaluation, so there were a lot of activities going on, primarily, once again, still in the data collection and planning arena. But as a result of a favorable decision for Arizona in the Supreme Court, some of the engineering work was involving now, conceptual design activity was now looking at how much is it going to cost. We had an estimate of $500 million back in the 1947 time frame, but now the canal could be bigger. How big should we make the canal? What's our--

END SIDE 1, TAPE 2. APRIL 22, 1996.
BEGINNING SIDE 2, TAPE 2. APRIL 22, 1996.

Storey: You were talking about some of the issues the Pacific Southwest Water Plan caused to come up.

Morton: Right.

Storey: Sizing of canals.

Morton: Sizing of the canals; the service area to be served; the amount of water to be imported from the Colorado River; how to operate the system to deliver that water. These were all questions that had been researched in the forties and presumably answered in the forties, in the 1947 report, but now we had another 600,000 acres of agricultural land in production, now we had another million people having a need for domestic service, municipal and industrial service, we had projections that showed Arizona in the next fifty years by 2020 would grow by 2 million people in addition to the million people that were already there.

Changes in conceptualization of CAP that had to be considered

There were a number of new constraints being placed on our programs. We needed to evaluate things in terms of its financial capability, we needed to evaluate in terms of its economic justification, and the data from 1944-1945 time frame was no longer really valid, so we needed to re-establish that data based on what we thought the circumstances were in the early and mid-sixties.

Storey: The '47 plan [for the Central Arizona Project], did it assume that Arizona got to use <u>all</u> of the Arizona tributary water <u>plus</u> the 2.8 million acre-feet, or did it assume a total of 2.8 million?

Morton: To be honest with you, the '47 plan just assumed that there would be a 1.2 million acre-feet imported into central Arizona and would be used on existing agricultural lands and about 80,000 acre-feet would be used for domestic purposes in the Phoenix area. The concept did <u>not</u> convey Colorado River water to Tucson. There was no delivery made to Tucson within the CAP at that

Water for Tucson added to CAP conceptualization

time. The agricultural service area extended to the Gila River, and that was it.

The water supply for Tucson, there was 12,000 acre-feet identified in the '47 report for delivery to Tucson, but it wasn't Colorado River water, it came from the San Pedro River and the construction of Charleston Dam. So in terms of the project, the CAP at that time, there was like 90,000 acre-feet of domestic supply.

When we reassessed it in the--I believe it was the supplemental, CAP supplemental report in June of '94, we identified 312,000 acre-feet of domestic and municipal and industrial water deliveries, so that increased about threefold, almost fourfold, from what was in the '47 report. The agricultural service area was over a million acres, as opposed to roughly 500,000. The canal that diverted water from the Colorado River in the '47 report was 1,800 cubic feet per second. By '64, we had recommended 2,500 cubic--

Storey: CFS.

Morton: CFS. That's what I'm trying to say. By the time it was actually authorized in '68, the size of the canal was fixed at 3,000 cubic feet per second. So there had been a rather substantial increase in the diversion and the capacity of the diversion canal from the Colorado River.

Reasons the canal capacity of 3,000 cfs was authorized for CAP in 1968

Storey: What was happening in there to cause that? What was changing?

Morton: Well, there were probably two major reasons for that. One was that there was a realization that at least in the later years--let me go back. In the early sixties, the concept was [that] instead of using a firm delivery of 1.2 million acre-feet, let's divert our remaining entitlement.

The assumption, by the mid-sixties, of course, based on the Supreme Court decree, was that Arizona was entitled to 2.8 million acre-feet, and the conclusion was that the river itself, the area adjacent to the river from Lake Havasu City, from the northern reaches in Mojave County down to Yuma, Arizona, in the southern part of the state, southwestern part of the state, those water users along the river would only be able to use roughly 1.2 million or 1.3 million[2] of Arizona's 2.8 million. So then the cry became one of, "Well, let's divert and use in central Arizona, Arizona's remaining entitlement," nominally a million and a half acre-feet, rather than the 1.2[3] million. So that was the rationale behind the first increase from 1,800 cubic feet per second to 2,500 cubic feet per second.

In the later years of the congressional debate in 1967 and '68, in that debate, there were concessions made by the state of Arizona where during times of shortage along the river, California would remain whole while Arizona, the Central Arizona Project, would become the junior water right, and, in fact, Arizona would take the initial shortages whenever the Colorado River supply was not 15 million acre-feet or 7.5 million acre-feet available for consumptive use in the Lower Basin.

So then the concept became, "Well, let's not only take our remaining entitlement, our full remaining entitlement into the Central Arizona, but let's make sure that when there are surpluses, we have the ability to take those surpluses, which through good water management, can be offset when the shortages occur, those surpluses can be used to offset the shortages and, in fact, we will have some stable water supply on a long-term

[2] This was actually said as "a million two or a million three."
[3] Said as "million two."

average over time." And in order to take the surpluses which occur infrequently, but do occur, you needed a bigger diversion facility. So that's how we went from the 2,500 to the 3,000. So I think those were the key points to move from 1,800 to 3,000 cubic feet per second.

Storey: Largely motivated by California and its involvement?

Morton: Well, I think in reaction to California's involvement, to legislate the Central Arizona Project or, as it became known, at authorization, the Lower Colorado River Basin Project. Irrespective of what the Supreme Court has said, you still had fifty votes sitting in California, and at that time two in the Senate and two in the House in Arizona, so Arizona did not necessarily--it may have had law behind them, but in order to get a Federal project in place, they still needed the votes from California.

Political implications of the Colorado River Basin Project Act of 1968

So the Colorado River Basin Project Act was a political accommodation to actually put into place, and from a practical sense, nearly every state in the Southwestern United States got some benefit from that legislation. California got some assurance of water supply for delivery to Los Angeles and to the Imperial Valley of Southern California. Utah got a reauthorization for the Dixie Project. Colorado got five participating projects reauthorized. Political implications of the Colorado River Basin Project Act of 1968.

Storey: Dallas Creek and various other things.

Morton: Animas-LaPlata, Dallas, Dolores, West Divide.

Storey: What was the fifth one? Divide or something.

Morton: And New Mexico got a guarantee that the Secretary [of the Interior] would offer to contract for 18,000 acre-feet of CAP in western New Mexico, so New Mexico got the potential to build the Hooker Dam or suitable alternative, but also got a commitment that the Secretary would offer up to 18,000 acre-feet for use in New Mexico.

Storey: If you cast your mind back to the days when you were working on the Pacific Southwest Water Plan, what was the talk around the office about what was really going on?

Pacific Southwest Water Plan proposed transfer of water from northern to southern California

Morton: Well, I think that at that time the California water plan had not really been put in place yet. The Department of Water Resources in California was in its infancy. There was no California aqueduct. There was no transferal of water from Northern California to Southern California.

Many of the people in my office had come from Sacramento or Fresno or Bakersfield or Tracy, and their concept was [that] this was an effort on the part of the Secretary of the Interior to move Northern California water in a Federal project to Southern California, and create even more dams on the American River and on the Upper Sacramento, get Auburn Dam built, and a few of those types of activities. Their view was that it was entirely to benefit California, not Arizona.

Storey: But Stewart Udall is an Arizonan.

Morton: Steward Udall was an Arizonan, and I don't know what the concept there was. Like I said, many of the people who worked for Reclamation in our office had come from California and they viewed this as his effort to ensure a Federal involvement in the California efforts.

It was also at that time of many of the grand plans [for instance] the Parson Plan to import water from Alaska.

Storey: The United Western Investigation, whatever it was.

Morton: United Western Plan. Right. And many of the people from Sacramento had worked on United Western or had been affiliated with United Western. The assistant area manager at that time, he had a bound set of the United Western books lining his bookshelf. Many of the concepts that were in that were embodied in various units of the Pacific Southwest Water Plan.

The Arizona people were primarily focused on Bridge Canyon Dam as the cash register for CAP and importation of Colorado River water through the CAP. That was the Arizona connection, so to speak. There were other programs being proposed. Like I said, this phreatophyte removal, Colorado River Water Salvage Program. There was a lot of energy expended to come up with a plan that was economically feasible, that demonstrated a water savings that would have some economic justification, but I don't think there was a lot of interest or any belief that it would ever fly.

Southern Nevada Water Supply Project

Some of the other programs at that time, there was no facility for diverting water from the Colorado River to Las Vegas, so the Southern Nevada Water Supply Project was part of the PSWP [pronounced PASSWAP], Pacific Southwest Water Plan. The Dixie Project in Utah was also a unit of that plan. So there were just a number of water resource programs that had been studied over ten- or twenty-year period of time that was now being wrapped into one grandiose scheme for water resource development in the Southwestern United States.

I think there was as much talk in the office about what was going on in California as there was about what was going on in Arizona, because, like I said, many of the folks, many of the engineers who were working on CAP, in fact, had come from a California background at that time.

Storey: Well, I'd like to continue, but our time is up. I'd like to ask you whether or not you're willing for the information in these tapes and the resulting transcripts to be used by researchers.

Morton: It would please me no end to allow researchers to use this information, for whatever purpose they care to.

Storey: Good. Thank you very much.

END SIDE 2, TAPE 2. APRIL 22, 1996.
BEGINNING SIDE 1, TAPE 1. APRIL 24, 1996.

Storey: This is Brit Allan Storey, Senior Historian of the Bureau of Reclamation, interviewing Larry D. Morton, Assistant Area Manager of the Phoenix Area Office, in his office in Phoenix, Arizona, on April 24, 1996, at about 1:30 in the afternoon. This is tape one.

Yesterday, day before yesterday, we had gotten to the point of about 1963 or '64. You were still a student trainee, I gather.

Morton: Right.

Storey: And we had talked about Pacific Southwest Water Plan and some of the other things. What else were you doing in that time period when you were a student trainee?

Morton: Well, while we were writing the PSWP Report, the Pacific Southwest Water Plan Report, we were also gearing up for hearings. Back in the early fifties, when congressional committees charged Arizona with ascertaining its water rights, they said they would not consider any additional bills until such time as that occurred.

I believe it was in the session that began in '63, Senator Hayden was a senior senator, both from Arizona and in terms of the entire Senate. He was probably number two or three at that time in terms of seniority in the Senate,. He wanted to push a bill that would consider CAP, but he knew he didn't have any support in the House until the Supreme Court decree was handed down. But he did, out of his own volition, prepare a bill to authorize the Central Arizona Project, and I believe it was 1963 that it was introduced, and we had field hearings out here in Arizona.

Senator Carl Hayden conducts field hearings on draft CAP legislation in 1963

So one of the things I got involved with that year was developing testimony, working with the engineers and [reclamation] administration on developing testimony and actually running around more than preparing the testimony, but carrying it around from -- we didn't have faxograms and computers and that type of stuff at that era, and so one of my roles, I think I was probably a GS-4 student trainee, was to make copies of that material and carry it from the Interstate Stream Commission to the state water engineer, to the governor's office. So I got to be involved in data transmission in the most basic sense.

Storey: 1963 stuff.

Morton: 1963 kinds of stuff. They had a field hearing at Coolidge, and Cliff Pugh, the area manager at that time, was the Bureau's designated person to testify, and I, for one reason or another, had the opportunity to drive Cliff down to that congressional hearing, and that was the first exposure I had to anything that had to do with Congress. I sat there on the sidelines as a chauffeur, if you will, and listened to a lot of the testimony that was offered.

There were two senators in attendance from the Senate Committee on Interior and Insular Affairs that heard testimony, and predominantly the testimony was from farmers and irrigation personnel, staff personnel from irrigation districts, on the state of groundwater in Pinal County here in central Arizona.

Mr. Pugh tended to summarize what was going on since 1947 when the '47 report was originally issued, based on the appraisal report that we had completed for the state of Arizona and based on what was then known as the CAP Supplemental Report to the Pacific Southwest Water Plan. So he had both of those reports to use for supporting documentation, and he testified as to the nature of agriculture, how it had changed over time, over the preceding twenty years, how the population had grown, what they expected the future for the population base in Arizona was going to be, and talked a little bit about orders of magnitude of costs to bring Colorado River water into central Arizona.

So while I was a very junior person on the staff, just by the nature of the kinds of manual work that was involved -- chauffeur, courier, etc. -- I did have the opportunity to observe a lot of stuff that many senior people didn't have the opportunity to do.

The decree in *Arizona v. California* was handed down in 1964, and there was an additional hearing held in the Senate in 1964. The field hearing was out here in Arizona, and then on that same bill, the same bill that Carl Hayden had introduced, there was a subsequent hearing held in the Senate in 1964. '63 was in the field, '64 was in Washington.

By that time, I had been promoted to a GS-5. I worked in an office that was right across the hall from Cliff Pugh's office, and his Secretary was always looking for somebody to act as her courier, so I did get a lot of little manual assignments like that during that era, and had the opportunity to understand the legislative process on a first-hand basis. It certainly was of interest to me.

Storey: Do you remember the two senators that came to Coolidge?

Morton: I sure don't.

Storey: One of them wasn't Hayden, then?

Morton: No, Senator Hayden was not one of them. If I remember correctly, he was chairman of the appropriation committee, and he did not sit on that committee, but I believe it was the one from--Senator [Clinton Presba] Anderson from New Mexico. I think maybe it was Senator Anderson, and I don't remember the minority Republican at that time. I don't remember who it was, but there was one Democrat and one Republican that came out and heard the testimony.

Storey: Do you recall any impressions of the meeting and what it was about?

Morton: It was held in a high school at Coolidge, Arizona, and my impression was, it was hot, and I was in short-sleeve shirt, everybody else was in ties and they still wore hats. Many people, the Eastern contingent, wore--what do you call them-- fedora-type hats, you know, felt hats. The Arizona farmers, they all had Western straw hats on, and those of us from the West that were more urbanized, shall we say, we were all there in our short-sleeve shirts, but they all wore these heavy coats and ties.

The impression I guess I got was that Arizona was in dire straits. I mean, the sum total of the testimony focused on the fact that during the war years and during the subsequent fifteen-year period after the war, Arizona agriculture had boomed, and if the Central Arizona Project didn't come into being soon, it was going to be a boom-or-bust type of economy; that the cost of pumping groundwater and the increasing depths to groundwater were making it prohibitive to sustain agriculture in central Arizona, and there was a million acres of agriculture that provided food and fiber to the United States, and the Federal government needed to sustain that with the importation of Colorado River water. Almost to a person, that was the basis of the testimony.

The other thing probably in today's era was the fact that with the possible exception of one person, everyone was male. I think there might have been only one female in the audience, in that whole -- I mean, the auditorium at the high school was full, and it was predominately a male society and everyone that got up to testify was male.

Storey: What about the media?

Morton: I think it was predominantly local media. I don't know that there was any real national media there. The press, the following day, the newspapers had articles about it, but my sense was that it wasn't a real big deal in the entire scheme of things in the

Phoenix newspapers, for example. Not having seen the Casa Grande or Coolidge or Florence newspapers, I suspect it was real important to them.

But, in later years where a predominant aspect of the CAP became domestic and M&I, municipal and industrial water supply, there tended to be a lot more press and a lot more involvement. I guess that's another impression I had was that nearly everybody that testified before the committee was allied in one manner or another with agriculture, whether they were actually farmers or worked for an irrigation district or on the board of an irrigation district, sold farm products in town.

Other than the governor and perhaps a legislator, I don't recall anybody from the city of Phoenix or the city of Mesa or Scottsdale or Tucson offering testimony in support of bringing Colorado River water into the state of Arizona for domestic purposes. To the best of my recollection, at that time, that did not happen. Certainly later in the sequence of things, through the authorization ~~problem~~ [process], the cities became a very strong force in the lobbying effort for M&I water supply, but to the best of my recollection, in the field hearings in '63, there was no representation specifically associated with the urban community.

Storey: This was while you were still a student over at Tempe.

Morton: Right.

Storey: Tell me your recollections of what Tempe and Mesa and Phoenix were like in those days.

Phoenix and Tempe in the early 1960s

Morton: (Laughter) I lived in Mesa and had a motor scooter, and I would drive the motor scooter to ASU about five miles away in Tempe. The first mile was through town, and the subsequent three and a half miles were through farmland, and then you got into Tempe and it was about half a mile from the urban fringe of Tempe to the campus. So roughly three miles or a little more than three miles of my drive every day to school was through farm land.

Storey: And they were cultivating what?

Morton: They were cultivating--my route generally took me through areas that at that time were dairy farms, and so the cultivation was generally alfalfa hay. Depending on the season of the year, there was cotton, was another crop that was cultivated, and during the spring, either barley or, wheat wasn't a big crop, but rye, I think, was a crop then. So it was barley or rye, alfalfa for dairy feed, and occasionally some cotton.

This was all on the Salt River Project. Mesa, Tempe were all on the old Salt River Project. Water was relatively inexpensive at that time on the Salt River Project. I think that the assessment rate was probably in the [range of] $10-an-acre per year, and you got three acre-feet of water, so your price of water was something less than $3 an acre-foot at that time. The pump districts that grew predominantly cash crops like cotton, water was available for, oh, $12, $15, $18 an acre-foot, probably, in that era.

Storey: What's the difference between a cash crop and another kind of crop?

Morton: Well, a cash crop would bring a cash payment on the front end, whereas a non-cash crop might be to improve the soil or to provide feed for a secondary crop.

Storey: Like alfalfa?

Morton: The cash return would be from milk or from the sale of beef or something like that, rather than from the sale of the crop itself. The crop would go to a secondary use, so it tends to be referred to as a non-cash crop.

Storey: What about oranges?

Morton: Oranges would have been a cash crop, but at that time the orange groves in central Arizona, in the Phoenix area, were predominantly to the south of Tempe and to the south of Phoenix. They were located along the northern exposure of the south mountains because of the good air drainage. When it got cold in the center part of the valley, there was still air drainage coming down off the mountains, and you didn't have freeze problems with your citrus crops. So your oranges and your grapefruits were primarily in the southern part of the Salt River Valley, south of the Salt River.

Storey: I had you on your motor scooter. Did you ever go from Tempe on into Phoenix?

Morton: Oh, all the time. Every day. Well, occasionally I'd have a lab that would run from one to four, and that wouldn't work that day, but generally speaking, if I didn't have a lab, I was working for Reclamation.

It just so happens that between Tempe and Phoenix at that time it was--it still is--it was highland and wasn't irrigable land, so you went through the Papago Park, the Papago Buttes area, and down Van Buren, and between the Tempe Bridge and 48th Street, there was no agriculture. There at about 52nd Street to 48th Street was the stockyards, so you'd motorcycle through. And all along 48th Street, between Van Buren and what's now University Drive, was all stockyards. There was Cudahy and Torrea and Hughes and Ganz. So there was a major stock-feeding, cattle-feeding operation.

Storey: It must have been an interesting drive in the summer.

Morton: It smelled to high heaven. On one side of 48th Street, you had cattle-feeding operations, and then on the east side you had two tallow plants, so it really--I'm sorry, on the west side was tallow plants, on the east side was stockyards. So it was a very olfactory operation, driving through that area. (laughter)

By the time you got to 48th Street, you got into an urbanized part of town. It's about five miles from 48th Street down to the downtown area where the office was, and traffic was about half, a third, a quarter of what it is today. There was no traffic problems, stoplights every mile. Now they're every quarter-mile. You still had things like drive-in theaters. Had a couple of drive-in theaters along Van Buren there. We don't have drive-in theaters anymore. Used to stop and have a hamburger or something as I was driving in, and I'd usually get to the office between 12:00 and 12:30, and usually worked 'til about 4:30 on the days I went into the office. No traffic jams going home in the evening, no problems like that at all.

Cliff Pugh and his responsibilities as head of the Phoenix Development Office

Storey: What was Cliff Pugh like in those days?

Morton: Cliff was a little, short, bald-headed gentleman. (laughter) I always thought of him as kind of like a grandfather figure. On occasion you'd run into him in the break room, and he liked to reminisce over a cup of coffee about his early career with Reclamation.

He seemed to spend an extraordinary amount of time outside the office. He would be down at the legislature; he'd be out at SRP, Salt River Project; he'd be down at the Interstate Stream Commission or the state water engineer. As the senior Reclamation person in Arizona, he generally dealt with political issues, I think, rather than the technical issues. He was always interested to hear the results of technical activities, but he didn't like to get into the day-to-day nitty gritty of technical stuff. He was more interested in just summaries and synopses of what the answers were to his questions.

Storey: When you say he spent an extraordinary amount of time out of the office, was that your perception <u>then</u>?

Morton: That was my perception, yeah. Understanding now the kinds of things, activities that he was engaged in, it probably wasn't extraordinary, but you'd come into the office and you'd look for -- there was one government vehicle that was designated for him and it had a separate parking place, a designated parking place. I'd come into the office, and probably three days out of four, the car was gone, so you knew that Cliff wasn't in the office that day. I guess maybe my impression is he spent a lot of time outside the office.

In my later career, having been tasked with similar kinds of assignments, that's just part of doing business and I understand that now, but at that time I thought he probably spent a lot of time out of the office and, in fact, relied on Jack Jorgenson, his assistant, and subsequently Ollie Lillard, his assistant, for the day-to-day operation of the office.

Storey: I think it's very typical that people who don't yet have a vision of what Reclamation does think "these regional directors, these project managers, they're never in the office." (laughter) And they just don't understand what goes on.

Morton: Certainly at twenty-two, twenty-three years of age, a junior or senior in college, that certainly was my impression.

Storey: What kind of management style did he use?

Morton: I guess I'd have to say that he was a delegator. He liked to send problems to the technical staff to deal with and would question the results, but only in probably a superficial manner. He did not question the technical adequacy as much as how will this influence the political aspects of what we're doing, how will this play back through the public, etc. If he needed a cost estimate or he needed a technical evaluation of a resource, he relied on the technical person to provide that. He seldom, if ever, questioned the accuracy or adequacy of what was being furnished, and he tended to view things more, like I say, in a political or social arena than from a technical sense.

He was a good boss. I worked for Cliff for a long time. This is a future vignette here, but in about 1972 or so, we had just executed a master repayment contract with the Central Arizona Water Conservation District, and one of the first issues was "who's going to get the water." In '69, when Secretary Udall stepped down from office, he and Floyd Dominy came out and told the people of Arizona and told the governor and the state legislature that they expected Arizona to determine where the water would be put to use. This was after authorization.

After the repayment contract was entered into, the issue became, "well, who does get the water?" At that time, the Arizona Interstate Stream Commission, subsequently the Department of Water Resources, had a fellow by the name of Wes Steiner as its leader, executive director of the Interstate Stream Commission. Wes had been told that the best way to do it would be on an economic basis and that he should hire a consultant that would do a linear programming model to evaluate all of the economic factors that would go into water deliveries in central Arizona.

And, Wes came to the Bureau and said, "Well, this is half your problem, and we'd like to cost-share this technical study." And Cliff agreed to do that! I think at that time, consultants came a lot cheaper than they do today. The total cost of the study was estimated at $50,000, so Reclamation put up its 25,000 and the state put up its 25,000.

The consultant was supposed to produce some results in about six months, and Cliff took myself and Tom Burbey to a meeting at the time that the model was supposed to be presented and the results were supposed to be presented, and the consultant got up there and told them what the model said, and Steiner said, "This looks like a good model." Both Tom Burbey and I had had some working knowledge of what was going on, and we objected, and Steiner got somewhat loud and we got equally loud with him.

After the meeting, Cliff pulled us aside in his office, Tom and myself, and said, "You hollered at Wes Steiner. Nobody hollers at Wes Steiner. I don't want you at any more meetings that Wes Steiner's at." So, for a period of about two years, Tom Burbey and I were banned from any subsequent meetings that Mr. Steiner participated in. (laughter)

But, I think that over time, we were proven correct and, in fact, the results of the model and the $50,000 effort to find an equitable allocation of CAP water was discarded, and we went on from that point and developed different kinds of models and different kinds of strategies for allocating that limited resource.

Storey: We'll get to how that evolved later, I take it.

Morton: Yeah.

Stewart Udall and Floyd Dominy tell the state of Arizona it must determine how to allocate CAP water

Storey: Did I hear you saying that Secretary Udall and Dominy came out and, in effect, said, "We're going to build the project, but the state's going to allocate the water"?

Morton: Correct. Correct. The administration changed in--the project was authorized in September of 1968, and I guess in November of '68, the election occurred and the Democrats were out and Republicans were in. I guess [Richard M.] Nixon was elected in '68.

Storey: Yeah, Nixon was elected.

Morton: So he came into office the second week of January of '69, and I believe it was like January 6th, within a week of Nixon taking over the Office of

President, the Commissioner of Reclamation and the then Secretary of Interior came to Arizona and conducted several meetings, and at those meetings their statements directed the state of Arizona to determine how that CAP water should be allocated amongst the uses.

While it's still the Secretary's responsibility to contract for that water and to ultimately allocate the water and then subsequently contract for it, he was relying on the state of Arizona to make its recommendations, and we've adhered to that policy over the past twenty-five years. We've continued that. The only deviation--and it really wasn't a deviation--that those uses that were solely the Secretary's responsibility, i.e., uses on Indian reservations, uses for Federal properties like refuges or parks, uses for endangered species, for example, that would be solely within the purview of the Secretary, he reserved the allocation of water for those uses to himself, but the remainder of the uses, the domestic, the municipal, the industrial, the agricultural uses for these non-federal sectors, he indicated that he wanted the state of Arizona to make those recommendations, and that has been our mode of operation since early 1969.

The Secretary of the Interior did have some water allocation responsibilities for CAP with precedence over Arizona's allocations

Storey: And had they set up a--

END SIDE 1, TAPE 1. APRIL 24, 1996.
BEGINNING SIDE 2, TAPE 1. APRIL 24, 1996.

Storey: I had just asked you if they had in their own minds set up shares of Federal and nonfederal water.

Morton: No, they had not. As a matter of fact, there was no infrastructure in place within Arizona to do that, in the first place, and in the second place, the

Federal versus nonfederal relationship in allocation of CAP water identified in the later 1970s

Federal versus nonfederal relationship was not identified until much later, probably '78 or '79 before the first true proposals were put forward with regard to allocation of water.

It always seemed, for that nine- or ten-year period of time, between '69 and '78, it tended to be, who's going to go first? Who's going to make the first finding? Finally, it came down that the state prevailed and said, "Mr. Secretary, you need to decide how much water you're going to reserve for Federal uses and then we'll know how to allocate the remainder," and that's generally the concept that's been followed, is that the Federal government has gone first.

1978 allocation to Indians of CAP water

As in the case of the 1978 Indian allocation, we said, "We're going to reserve, I believe at that time it was, 257,000 acre-feet for Indian use," and the state made an allocation, and subsequently we increased it and the state made another allocation. So there's been some give and take over time to increase the Federal and reduce the nonfederal part of CAP, but it was kind of "Who's going to be first in this allocation process?" It was finally concluded over a period of eight or nine years, that, well, the United States probably needed to be first, because the state was looking for an economic type of a solution, generally speaking. Of course, that changed over time, as well, but initially they were looking to maximize the economic return from the water.

Finally decided the Federal government would go first in allocating CAP water

And, the Federal allocation was based on other parameters such as Indian water rights, or providing economic return to Indian communities, or preserving endangered species, or providing secondary benefits associated with recreation and parks, or protecting other wildlife attributes in refuges, and things like that. So the objectives of the state and the objectives of the Federal government were never consistent over the use of

CAP water, so they couldn't be modeled in the same sense, so there did need to be a distinct difference in the allocation strategy.

Storey: What else was going on in '64 that you recall, besides the hearings?

Morton: Let me think. Summer of '64, I think I was back working in hydrology. We were now looking at how much water could we bring from the Colorado River; what size and capacity of the canal would convey that water; how did that water affect the flow regimes in the river; how did it affect power generation at Hoover, for example; how did it affect flows downstream of Parker Dam in the lower river; how does this delivery of water result in revenues for repayment; what are the costs of the project.

Summer of 1964 spent on hydrology studies determining size and capacity of conveyance facilities and predicting economic issues

I didn't get in specifically on the costs, but more leading from the hydrology of the Colorado River, the operation of CAP, the delivery of water, the receipts that would come from the delivery of water, and how that played back in repayment of the project. So I did a lot of intensive labor, hand labor, on computing monthly and in annual operations for the delivery of CAP water, once again going back to my analogy of 1962, using an electric calculator, a rotary-type calculator, writing down each number.

Storey: Were you doing ranges, or were you doing average, or . . .?

Morton: We would start with averages, but when it got down to discrete operation to determine cash flow, you generally had to either do an annual operation or a monthly operation, and we got down, in some instances, to monthly operations so that we knew

Determining cash flow for the project CAP exactly how much energy we needed, what we were paying for energy, what the relative cash debits and receipts were--to ensure that there was enough money to pay our O&M, and pay our electric bill.

Determining the source of electricity for the CAP

There was always a question about, in that era, what the source of the power to pump CAP water was going to be. At that time it was Bridge Canyon Dam or Marble Canyon Dam, or a combination of Bridge and Marble. In turn, the project energy that would come from them generally peaked because of the way these were run-of-the-river, generally run-of-the-river powerplants, specifically at Marble, but at the Bridge Canyon site there was a lot of storage at Bridge Canyon.

Integration of river operations with CAP

But nonetheless, you had to integrate the river operation with how you took the water, because the situation you have today with integrated power systems wasn't envisioned at that time. It was envisioned that there was going to be a certain amount of power generated at these dams, and that power, the first use of that power would be to provide pumping energy for CAP. Today, of course, with integrated power systems and interrelated working arrangements with various Federal and nonfederal contractors, you can get power from the Northwest or you can get power from Texas, you can get power from Southern California, when your source of power, for whatever reason, is unavailable to you. At that time we were only looking at one single power source, either being a hydroelectric dam, one of two hydroelectric dams.

So it was important to try and match the dam's operations with the demand for power. The demand for power was much larger in the summer because of the demand for water being much larger in the summer and much lower in the winter, and you didn't have that much variation in the output of the plants. You tried to fit your output with the river operations. So there was a lot of operation studies in the hydrology division of the Phoenix office at that time.

Storey: Are you saying that there would have been a direct tie? Say, Marble Canyon. We would have built a transmission line to the pumping plants?

Morton: Yes. We [ultimately] did build a transmission line to the pumping plants [it was (ed.)] just [that]~~as~~ it came from the Navajo generating station, a coal-fired steam-generating plant, as opposed to a hydroelectric dam.

Storey: This was still in the days when we built our own transmission.

Morton: This was still in the days. At that time, most of the operation and maintenance for transmission lines was done by what is now the Western Area Power Administration, but at that time was part of the Bureau of Reclamation.

Here in this region, we had what was known as the Parker-Davis Project, and they built and operated and maintained the power transmission grid, as well as dispatched power, for the whole Southwestern area here -- New Mexico, Utah, Nevada, eastern California, etc.

Storey: Why was Reclamation interested in the effects on the Colorado River?

Morton: Primarily for economic reasons. If we put a demand in, for example, for a given quantity of water and it didn't match the generating cycle at

Hoover and Davis and Parker, you were going to adversely affect somebody else's power contract.

So we were putting somewhere on the order of a million and a half acre-foot of additional release requirement through the generators at Hoover, Davis, and Parker. In addition, we were also running the run of the river, the 8 or 9 or 10 million acre-feet per year that was released at Glen Canyon, we were running that through either Bridge or Marble Canyon, and the generation there was being used initially. The first increment was used for project power and any surplus over and above that. Project pumping power, any surplus over that was used as a commercial sale.

So you had to balance your need for pumping energy with the demand for commercial power so that you got your best mix of income. You wanted to make sure you never curtailed--water deliveries always were number one in priority. Power was supposed to be secondary. But power also offset the irrigation repayment, so you needed to also maximize within the limits of having enough power to deliver your water, then maximize the sale of whatever was left. So that was always the balancing act you needed to accomplish, while at the same time not jeopardizing any of the power contracts that were already in place for Hoover, Davis, or Parker power sales.

It wasn't as easy as it is today, you know. You could do one study in maybe two days with different parameters, and you could vary your parameters today on a normal desktop PC computer system, you could do one every fifteen minutes, and you could create fifty studies in the time that you could do one ~~annually~~ [then].

So we weren't able to ever test the full range. We had to evaluate, on a sensitivity basis, and determine the direction that we were headed, based on the limited number of operations. We just didn't have the capability to do a full suite of operations that you could do today.

Storey: So the effects on the river were not environmental effects that we're talking about.

Morton: No.

Storey: What we're talking about is issues of managing the river to make it most efficient--

Morton: From an economic perspective, yes. In that same era, even fish and wildlife enhancement, which was a multipurpose function of many Reclamation projects in the forties, fifties, and sixties, was measured in economic terms. You would say, "Well, this project is authorized for fish and wildlife enhancement." Well, what does that mean? Well, it [then] ~~means~~ [meant] more hunter days or more fisherman days. It produces more economic activity for the good of the region or the good of the nation, not that it produces more fish, or it produces more wildlife, or produces a greater diversity of wildlife, or provides more habitat for various wildlife species, or protects endangered species, as began in the seventies with the Endangered Species Act.

The purpose of the studies was to make the river run most efficiently from an economic perspective

Endangered Species Act changes Reclamation's approach to wildlife issues

In the mid-sixties and before, there was very limited valuation associated with the aspects of the environment that were subsequently considered in the seventies and later years, so we were beginning that transition, but it hadn't occurred yet. So when we would do an evaluation, it would be solely on economic terms.

Changes in approach to environmental issues because of laws passed in the later 1960s and early 1970s

It wasn't until principles and standards and principles and guidelines as a result of the Water

Water Resources Development Act's effects on environmental issues

Resources Planning Act in '73 or '74 that we got into non-monetary terms, other types of quantitative terms like habitat units, or acres of habitat, or types of diversity of species, what have you.

Storey: What kind of repayment issues were you looking at?

Morton: There were two aspects to repayment. One was the end effect, if you will, on the ultimate water consumer: how much, what was the consumer's ability to pay? So we did a number of farm budgets. While I didn't personally do farm budgets, I did work on the fringes. The hydrology organization and the economics organizations were co-located in one large office, and so I was able to get an understanding of the basics of the farm budget and determine what the repayment or payment capability of a farm was, how much they could afford to pay for water.

Repayment issues that were considered in studying CAP

And then the other side of the coin was, what was going to be the total investment that had to be recovered; over what time period did it need to be recovered; were there other sources of revenue like commercial power sales that would assist? Irrigation assistance, for example. Within Reclamation, interest was not charged to irrigation [components of the projects]. Within Reclamation, the receipts were limited by the farmer or the water user's ability to pay, and if the water user didn't have the ability to pay, if there were other sources of revenue, like commercial power, to offset that, that was allowable.

So we were looking, on one hand, on how much could the water user afford to pay for water, and on the other hand, what can we reasonably expect in terms of return from commercial sales. It was generally conceived that municipal and industrial water sales would pay for themselves, whatever costs were allocated to M&I, the M&I rates would be established such that there would be full recovery. So you needed to offset your shortfall in the irrigation sector with revenues from some other source.

Generally speaking, we found that that was easily attainable with hydropower, so that's what made Bridge and/or Marble Canyon fiscally, financially a good operation, is that they would cover the commercial sales of energy from Bridge or/and Marble, would produce more than enough revenue to offset the shortfall from the ability of agriculture to pay, and would still provide some surplus, some profit, if you will, for the entire project.

Later on, as we evolved and moved away from the dams in the Grand Canyon, Bridge and Marble, and looked for other power sources, the cost of those power sources and the fact that you needed to produce some energy component for coal or fuel oil or whatever, resulted in not that beneficial a rate, and, in fact, in terms of our repayment contract with CAWCD [Central Arizona Water Conservation District], we had to ensure that they have another source of revenue, and in this case a property tax source, to actually recover the full cost of CAP. We found that the generated revenues from the project were insufficient to repay to the treasury the cost of the project when we moved from hydroelectric energy as a cash register and as a project pumping source.

Storey: So this is after Bridge and Marble were canceled that you're talking about.

Morton: Right. Right. But at that time, in the '64, '65 time period, we were still looking at one or two dams on the Colorado River, and we were showing a profit. In other words, the project was repaid over a fifty-year repayment period. We didn't charge any more than the farmer's ability to pay for irrigation water. We charged what was reasonably allocated to M&I for M&I water. We recovered what the market sales price of energy was at that time, and it paid for everything, and there was still a profit, using the power dams.

That was the presentation that was made to Congress, to the House of Representatives in 1965, when the first authorization legislation was introduced in the House of Representatives. By the time we got to '65, we had done a number of these preparatory hydrologic and economic studies. We could describe in financial terms and economic terms what the CAP would do or receive from these economic inputs so that we could go to Congress and tell Congress that it was going to cost $650 million to build CAP, it was going to cost another $350 million[4] to build Bridge Canyon. We could reasonably expect to return, over a fifty-year time period, for those Federal investments and there would be a profit to the treasury of "X" dollars associated with those.

We had done a whole suite of studies, all in traditional methods, on a big spreadsheet piece of paper, with pencil entries made--

Storey: And alternatives?

Morton: And alternatives. We would trade off different sizes of canal systems and different costs for the different sizes of canal systems. Those would produce different yields from the river, different amounts of water. We would use different variations in height of the dam versus variations in installed capacity for the generators in the two dams we were looking at, so we had a number of

[4] *These figures were stated as: "six hundred and fifty million dollars" and "three hundred and fifty million dollars" by Mr. Morton.*

alternatives that mixed and matched, and that was the data that we were charged with putting together for our testimony before Congress with regard to authorizing construction of CAP.

That was our charge in '64 leading up to the bill that was introduced in '65, new session of Congress, new Congress, and the first session of a new Congress. The House agreed to introduce a bill, and Senator Hayden was waiting for [it], because he felt he had the votes in the Senate, he was just waiting for something to get out of the House, because politically he knew he could get it passed in the Senate in a relatively short period of time. So it was now the burden of the House and, at that time in Arizona, the burden was placed on John Rhodes, Congressman Rhodes, to facilitate that for the state of Arizona.

Senator Carl Hayden, in 1965, was waiting for passage of a CAP bill by the House where Congressman John Rhodes was the prime mover

Storey: Allocation of repayment costs is open to interpretation. What gets assigned where? Were you in a situation where you were discussing those kinds of issues, or had you already been told how the costs were going to be allocated?

Allocation of repayment costs

Morton: No, I think that a history had been built up within reclamation law on what was a reasonable--or how to address various functions, and we knew this was going to be a multi-function project. Various laws were on the books. The Flood Control Act of '44 identified how flood control was allocated, the fact that that was a nonreimbursable function, it was a requirement placed on the Federal government, and the Federal government assumed 100 percent of those allocated costs.

The Fish and Wildlife Coordination Act was passed, I think in '56, and subsequently amended, and then the Water Resources Federal Water Recreation Act was passed in '67, but there

"Document 97 Blue Book"

was a document at that time that we generally followed, a water resources planning document called "Document ~~67~~ 97 Blue Book" that the Senate put out. That characterized all the laws that were within reclamation law and how to address those, and that document got updated and was eventually discarded through the Water Resources Planning Act, but that came later.

But we generally knew how to deal with costs in terms of the cost allocation, and how those costs, in turn, were subject to reimbursement. The sources of revenue for repaying those costs was up in the air. There was no guidance at all on that. Do we charge the water user more and make him go bankrupt? Do we define some add-on tax? Do we find other revenues? And we've done that now. I mean, subsequent legislation has indicated, for example, that a surcharge will be applied to all power sales from Hoover powerplant that, in turn, will be available to help repay the cost of the Central Arizona Project. But that came later.

There was no guidance in 1965 on sources of revenue for repayment of costs allocated to repayment

In 1965 time frame, our project involved the traditional approach of a hydroelectric powerplant, and the revenues from that hydroelectric powerplant more than offset the shortfall for repayment that came out of the irrigation sector, more than subsidized that irrigation, provided repayment assistance to agriculture.

Storey: But I can imagine, for instance, well, if we allocate more to recreation, nonreimbursable, that makes the project more viable.

Morton: Well, there were always those kinds of questions, but, in fact, in order to allocate more to recreation, you needed to technically demonstrate what the benefits were. The benefits or the cost, the single-purpose cost of developing recreation, for example, was the measure for the cost allocation, so you need to have a technical basis to say that.

It would be nice, of course, from a repayment entity's perspective, if the project was 100 percent recreation and you got some incidental benefits from water delivery, but the first increment, obviously, of any Reclamation project is the delivery of water, and you have to build from that. And you add increments of cost and increments of benefits from the base, and the base is the delivery of water.

Theoretically, if you do a hypothetical scenario, you continue to add water. So long as the demands are there, you continue to add cost to produce water until those costs are equal to the [repetitive material removed] last increment of benefits. So when you reach an incremental benefit/cost ratio of 1 to 1, you've maximized. If the next increment of benefits is less than the cost, the cost ~~of~~ [is] more than the benefits, then you don't have that increment.

So theoretically, you could design your canal or your conveyance system or your storage reservoir and increment it up each time and test whether or not that next increment of cost is less than the next increment of benefits that results from that added conveyance capacity or that added storage capacity.

In the case of CAP, we got to the point that we ran out of water. In other words, we had a limit on the Colorado River of 2.8 million acre-feet, so had there been an <u>unlimited water supply</u> on the Colorado River, the system would have looked significantly different than it does today, because we would have continued to expand the capacity. We were probably at, for every dollar of investment, we were probably still getting a dollar and a half of benefit from the delivery of that water. But we ran out of water, so we had to stop, in terms of the formulation.

The other side of the coin, that's an economic measure, the formulation based on benefits and cost. The other side of the test is can somebody afford to pay for those costs, and that's the other aspect, the financial aspect that we're now testing. Do we have enough revenues from either the sale of water or the sale of power or the sale of recreation to pay for the capital cost and the operation and maintenance cost over a mandated period of time, forty or fifty years, depending on the authority within the project? In the case of CAP, it happens to be fifty years.

Storey: Did I hear you say that we were sizing the project in doing these calculations, or am I reading something in here?

Designing CAP carrying capacity based on hydrologic projections and economic considerations

Morton: No, as we discussed yesterday or day before, the original concept was that we would bring 1.2 million acre-feet of Colorado River water from the river to central Arizona. This is the 1947 concept. And to do that, you needed a carriage capacity, a canal capacity, of about 1,800 cubic feet per second.

What we concluded was that there was more water in the river than 1.2 million acre-feet. On an average basis, there was 1.5 million acre-feet, and on a probability of about 20 percent, one year out of five, which, in fact, was not one year out of five, it was really five years out of twenty-five. When we get spills on the Colorado River, they come back to back to back, so what you're faced with is a sequence. Over a twenty-five-year period, you may have five years in a row where you have more than 1.5 million acre-feet. Then you back off to the 1.5 million acre-feet.

So our studies, our hydrologic studies that we performed in--

END SIDE 2, TAPE 1. APRIL 24, 1996.
BEGINNING SIDE 1, TAPE 2. APRIL 24, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry D. Morton, on April 24, 1996.

. . . . showed that there was sometimes more than 1.5 [maf: million acre-feet], and you dropped back.

Morton: Right. We would have availability of a million and a half acre-feet for CAP twenty years in a row, and then for five years you would have maybe 2 million acre-feet or 2.5 million acre-feet available for CAP. Well, to convey that water during those short periods of time, you had to have a demand for the water, which, in Arizona, because you were still mining with groundwater, you could just shut off the pumps and deliver it.

You also had to have a much larger conveyance canal capacity, conveyance capacity, pumping plant capacity, to move that water into central Arizona during these relatively short periods of time that it was available. So we tried to address those in economic terms to decide, to determine, how big we should make the canal. Did we have the ability to sell the water? And if we did have the ability to sell the water, did those additional costs merit that expansion of the diversion capability?

What we found was, if I remember right -- we did studies. We didn't have high-speed computers to do these studies for us. We needed to do them manually, and what we found was that as we incremented up the canal, the yield <u>over a long period of time</u> became incrementally smaller, but offset the additional cost, so we were able to economically justify a 3,800 cubic foot per second diversion from the Colorado River, but that 3,800 cubic foot per second, according to our hydrologic studies, would only be used perhaps ten years out of the fifty-year repayment period, because the rest of the time the water was unavailable.

What we found was that we had to be reasonable. The difference between an 1,800 cubic foot per second canal and pumping plant system versus a 3,800 was about double. In gross dollar amounts, we were talking about a half-a-billion project versus a billion-dollar project. And I think that had a lot to do with the final decision to go with a 3,000 cubic foot per second canal.

The studies that we presented to Congress went from that full range, from 1,800 cubic foot per second to 3,800 cubic feet per second, but when you got out there in the higher discharge rates, 3,000, 3,500, 3,800, the costs started becoming prohibitive, or the costs politically were prohibitive, and I think there was a legislated solution that says, well, we're not going to formulate CAP to do the maximum. We're willing to take less than the maximum, because there's this degree of risk, this degree of probability out there, that may say we never use it or we don't use it for a long period of time, and those additional costs, in terms of capital investment, may be recoverable, but why should we make that kind of an investment?

So the theory behind water resources formulation and the practical aspects of the Federal legislation, the practical limitations of dealing with it on a real-time basis, result in less than what theoretically could be planned.

Storey: If you had built the 3,800 cfs, how many acre-feet could that have diverted?

Possible economic and ultimate delivery capacity of CAP

Morton: Oh, that could probably deliver in excess of two and a half million acre-feet a year. We were authorized to build 3,000 cubic feet per second, and that will deliver right about two million acre-feet a year.

Storey: Which is eight-tenths of a million acre-feet higher than the 1.2 original conception. That's surplus water? Is that the correct term?

Morton: Well, no. Part of it's surplus water. When Arizona was able to sustain its case before the Supreme Court at 2.8 million acre-feet, there was, and still is, an expectation that about 1.3 million acre-feet of that 2.8 will be used along the Colorado River Valley, in the state of Arizona but along the Colorado River, direct pump out of the river, service to municipal and agricultural lands along the river.

How Arizona's 2.8 million acre feet of water from the Colorado River affected planning CAP

Storey: That's the six-tenths of a million acre-feet?

Morton: Well, then a million and a half is available for bringing into Arizona. So when we started at 1.2 million in '47, 300,000 of the 800,000 increase would be attributable just to the fact that Arizona got a better water right through the Supreme Court than what we envisioned at the time we did the planning in '44, between '44 and '47.

We [Reclamation] just said, at that time, "Let's plan a baseload plant. It'll run 1,800 cubic feet per second eleven months a year. We'll shut it down for a month to do maintenance and clean out the canal. How much water can we move if we do that kind of operation?" The answer was 1.2 million.

So there would have been, within Arizona's entitlement, there would have been a unallocated or an undistributed share of about 300,000 in that scenario. In other words, CAP would take 1.2 million, the river use would be 1.3 million. That's 2.5. Arizona's entitlement was 2.8,[5] so there would be 300,000 that would be available for future allocation.

By 1965, we had already concluded that during a normal year we could very easily justify, both financially and economically, a 2,500 cubic foot per second canal, which would deliver 1.5 million acre-feet. So that would be the system that would take Arizona's remaining entitlement and put it to beneficial use, the whole 2.8 million, 1.3 in the river, 1.5 to central Arizona, 2.8 million.

Arizona's share of Colorado River waters declared surplus by the Secretary of the Interior

But, during times of surplus, which was your question, during times of surplus, Arizona's entitlement is 44 percent, roughly 44 percent of what -- that's not the right number. It's 2.8 over 7.5 [37.33 percent], whatever that is expressed in percentage terms, of what's out there on the river.

So if the Secretary [of the Interior] says, "This year we have a surplus in excess of 7.5 million acre-feet. Anybody with the capability to divert that supply, come ahead and divert it," that is surplus water. If you don't divert it, it will flow down the river and across the boundary into the Gulf of California. It will be an over-delivery to Mexico or it will flow into the sea.

Storey: A little over 37 percent.

Sizing CAP to have the ability to capture surpluses of Colorado River water

Morton: So 37 percent of whatever that surplus is, is part of Arizona's entitlement. So the people in Arizona were advocating that at lower surpluses, maybe the Secretary declares half a million acre-foot surplus or three-quarters of a million acre-foot surplus, we think we should build the capacity, a sufficient capacity in the diversion works to allow us to divert some of that water.

[5] *For this series of figures the interviewee said: "a million two," "a million three," "two five," and "two eight."*

I think a good example would be the Metropolitan Water District of Southern California. Within California's 4.4 million acre-foot Supreme Court entitlement, Metropolitan Water District has a contract of 550,000 acre-feet within the 4.4 that the Supreme Court has upheld that California is entitled to.

California historic use of Colorado River Water and plans for surpluses

They also have a contract with the Secretary for another 550,000 acre-foot of the surplus water, so, in fact, their canal, the Colorado River Aqueduct, that takes water from the Colorado River to the Los Angeles Basin, it has double capacity in anticipation that they can use this surplus water contract as a vehicle.

From the time that the Colorado River Aqueduct was put in service to deliver water to California in the late thirties, until CAP came on-line, there was always a surplus, because Arizona wasn't using its entitlement, so the state of California -- traditionally the state of Arizona has alleged that the state of California has been stealing their water to the tune of 550,000 acre-feet, and delivering it to Los Angeles just because the state of Arizona didn't have a diversion mechanism to use the water.

Storey: Is this year one of the big years for water?

Morton: No, this year's still a normal year.

Storey: But when I am driving around Phoenix and I cross these canals, they all look like if you put more water in them, they'd be about ready to overflow.

Why the aqueduct appears to be full all of the time

Morton: The problem with that is that we operate a canal that's a checked canal, and so the water surface is checked up [artificially] with ~~artificial~~ gates in the canal, and so what you're seeing, it looks like it's full, but the velocity of the water is significantly less than it needs to be, or that it could be, I guess I should say. The velocity is only what it takes to deliver the supply to the turnouts.

Storey: So why do we need to check it, put checks in?

Morton: Because it's a much more effective operation than without the checks. The water level would draw down, the pressure, the hydrostatic pressure that occurs in the soil behind the lining, would force the lining, and it would bulge it out or cause it to fail, so you keep the canal full so you can keep your lining in place. (laughter)

Storey: Okay.

Morton: So, in fact, if we weren't even delivering any water, if there was no water, the velocity would be zero, but the depth of the water in the canal would still be 16.5 feet deep. So when you drove across the canal and looked down at it, you'd say, "Boy, that's a full canal," and it would be a full canal, but it wouldn't be moving, so the delivery would be zero. (laughter) Just because the check gates would be totally in a depressed position, there would be no velocity under the check gate, so there would be no flow in the canal.

Storey: I think I misasked that last question. We did fine, we got lots of interesting information, and you answered the question in the process. If I'm understanding you, they were starting with the assumption that 1.3 million acre-feet needed to stay in the river, of Arizona's allocation, in order to meet Arizona's needs down the river.

Morton: Right.

Storey: So you weren't working on deriving that figure when you were doing these studies.

Morton: Right.

Storey: Do you know how they had arrived at that figure?

How it was determined how much of Arizona's allotment of 2.8 million acre feet would be used along the lower Colorado and how much in Central Arizona

Morton: It came about through three sources of information, one of which was how much do we have under contract along the river at that point in time, 1965. The Secretary had contracts with a number of water users, the Yuma Valley Water Users, the water users in Wellton-Mohawk, the water users with the Gila Project, etcetera, in the Yuma area. The Secretary had contracts with the Colorado River Indian tribes at Parker. The Secretary had contracts with the Fort Mojave Indian Tribe at Lake Havasu City. The Secretary had contracts with Kingman, and with Bullhead City, and Lake Havasu City, and Parker, and Ehrenburg, and the city of Yuma, all up and down the river. So the Secretary knew that block of water, and I think it probably was on the order of 900,000 acre-feet in that era.

The Secretary also had some uses that were without contract, but they were legal entitlements that were present perfected rights that predated the Boulder Canyon Project Act, and while he hadn't gotten around -- the Bureau of Reclamation, as his representative, had not gotten around to sign up these people, it was clear that these water rights holders who were diverting water from the river without benefit of contract, nonetheless, had legitimate rights to that water. So I think that was like 900,000 acre-feet of contracted rights, probably 250 or 300,000 acre-feet of present perfected rights that were acknowledged to be legitimate rights.

Then in anticipation that there was going to be some growth, that Yuma was going to get bigger, that Lake Havasu City was going to grow phenomenally, that Bullhead City was going to triple over the next couple of years, that there were some properties along the river, mining properties, other future uses of water.

Wildlife refuges, another aspect. At that time there was only one wildlife refuge. I think today there's five wildlife refuges along the river, all of which grow forage crops for wildlife, geese, and ducks, and so on. So there is some consumptive use made of Colorado River water within wildlife refuges.

So that all was amalgamated into an estimate, those three components, and we derived a model of 1.3 million acre-feet, so we didn't have to worry about the 1.3 million. That was going to stay over there on the river. Hindsight, foresight, whichever it is, it worked out that way, because, in fact, today they're still right at about 1.28, 1.27, and some additional growth anticipated, and there will probably be some conversions. There will be some agricultural contracts that will go out of business as the area around Cibola, for example, either urbanizes or becomes a third home/recreation/retirement community, what have you. It'll convert from an Ag to an M&I supply.

Some of the farmers in Wellton-Mohawk and Yuma-Mesa, for various reasons, have either gone out of production or there's been floods on the Gila, and they've reduced their contract value, but the city of Yuma has increased its contract values in anticipation of urbanization in the Yuma area.

So the 1.3 million acre-feet for uses along the river in Arizona has proven to be a pretty good number. The variation in what you build for CAP comes about because of--do you just operate for a normal condition or do you try to get some of these surplus flows that are going to occur from time to time, and the justification clearly demonstrated up to at least 3,800 cubic foot per second because that's all the larger we tested. Even though they became less and less frequent, the use of that capacity became less and less frequent, the benefits associated with that water more than offset the incremental costs associated with building that system.

So then it became, as I said earlier, it became a political decision on how much total capital cost should we invest in, how far should we go on the risk. These are all projections and estimates. We've got to deal with this over fifty years. Do we really want to go to the maximum position or do we want to reduce that somewhat? And the solution in 1968 was a 3,000 cubic foot per second canal as opposed to an 1,800 or a 2,500 or 3,800.

Storey: So this was part of the authorization?

Morton: Yes.

Storey: The Colorado River Basin Project Act, was it?

Morton: Right.

Storey: So at some point, Reclamation, as the representative of the Secretary of Interior, had determined 1.3 was appropriate, or the state had determined that, or a combination, or what?

Morton: It tended to be--yeah, the Secretary has a responsibility under law to consult with the states, and we did do that. It was a given-and-take proposition. We put our cards on the table and said, "This is the data we have. We're not certain that this is all the data, but we think it's pretty good for what we know." They, in turn, say, "Well, we think you ought to add a little bit. We don't think the present perfected rights are too high. We think that you need to add a little bit more for future growth along the river."

You know, we had differences in our relative scenarios, but there was a consultive process that was undertaken, and, in fact, there was general agreement. At that time the representative of the state was the Arizona Interstate Stream Commission, in the early seventies, '74 or so. They, under state law, were combined and made into the Arizona Department of Water Resources. So the agency that now represents the state of Arizona on all matters pertaining to the Colorado River is the Department of Water Resources, but at that time they were known as the Arizona Interstate Stream Commission. It's just a predecessor organization.

Storey: When you say "we" did this, do you mean you actually participated, or do you mean Reclamation?

Morton: I mean Reclamation did that, yeah.

Storey: It was before you came, is that right?

Morton: I was still -- no, no, this was as a result of the reports and the studies that the state charged Reclamation with doing in the time period '63, '64, leading up to true legislative inquiry in '65.

Storey: And what we're talking about is the allocation of 1.3 million acre-feet to the river and 1.5 to CAP.

Morton: Right. And our position, of course, at that time was in order to deliver -- Reclamation's position was in order to deliver 1.5 million acre-feet, you need to build a canal, a diversion canal, of a 2,500 cubic foot per second capacity.

In turn, that was what we presented, the costs, the economic evaluation, and the financial evaluation, that was what was presented to Congress, to the House, in 1965, in the set of hearings, the initial House hearings, the first time they'd occurred since 1951. Even though there had been Senate hearings on the problems and needs of Arizona with regard to water resources in '63 and '64, this was the first time that the House had taken up a bill to consider authorization of the Central Arizona Project since back in the early fifties.

Storey: You mentioned that the Secretary was responsible for the river. I think I'm correct in thinking that he was the watermaster for the Colorado.

Morton: Still is, yes.

Storey: Why?

Morton: By virtue of the Boulder Canyon Project Act.

Secretary of the Interior is watermaster of the Lower Colorado River

Storey: That specified that he would be the water master?

Morton: The river is a multi-state river. I mean, it flows through seven states. It's been divided by two compacts, Upper and Lower Basin compacts. There are a number of interstate compacts between each of the states in the basin. There are Supreme Court decrees, and the control of the river, the actual physical control, whether you release or store, is in the Bureau of Reclamation, which is an Interior agency. So it just made sense that the Secretary would be the watermaster for the river and he would delegate that to the Bureau of Reclamation.

Storey: You have also sort of peripherally touched on another question. The Supreme Court issued its decision for *Arizona versus California* in 1963. Then in 1964, it issued its decree.

Arizona v. California

Morton: Correct.

Storey: What's the difference? What's all that about? (laughter)

Morton: Well, I think--and in fact, the direction of both the decision and the decree was probably preordained, if you will, by the report of the special master in 1962, so all of those three things kind of followed one another in some logical sequence, and at each of those points, the states were able to intervene. They were able to address the court and point out deficiencies or concerns that they may have had in what the court was doing.

So the special master report became, as I said, a public document, I believe in '62. The states looked at that. All the states were involved, the whole seven basin states, Wyoming, Colorado, Utah, New Mexico, Arizona, Nevada, and California. They had all intervened in one sense or another because not only was it a case of Arizona proving up its water rights against the state of California, but to a certain extent was setting precedents for the rest of the states.

If Arizona had gotten a substantial increase in what they thought they were entitled to and California stayed the same, it had to come out of somebody else's share, so everybody else was at the table as well. I suspect that if Mexico had any standing before the Supreme Court, the nation of Mexico would have been there, too, but they, of course, couldn't participate in that, but I suspect that the State Department followed it pretty closely as well, because there were Mexican interests that desired to know how the waters of the Colorado River were going to be apportioned.

But the special master's report set down the technical details and made some recommendations to the Supreme Court. The Supreme Court debated those recommendations. They heard objections, they heard briefs from the seven basin states on the adequacy, the technical merit of what the special master had written, and, in turn, they deliberated and produced the decision.

I think that the difference between the special master report and the decision was primarily a technical rebuttal, and then the difference between the decision and the decree was primarily a legal challenge that the states were given the opportunity to introduce legal precedence or case law precedence to indicate to the court that there were legal challenges, if you will, to what the court was proposing in its decision.

I think that was the main difference between those three milestones, was between the first milestone and the second milestone, they were presenting rebuttal information from a technical basis and between the decision and the decree, between those two milestones, the litigants were presenting legal challenges, precedents, legal precedents rather than technical issues about water supply or consumptive use or prior historical uses or the technical stuff that the special master spent --actually, there were two special masters. The first one died halfway through it, and Simon

Simon Rifkin serves as special master for the Supreme Court in Arizona v. California

Rifkin picked it up in '57 or '58, and he had to deal with it, assimilate everything that had already been assimilated to that point in time, and thendeal with it for the next four or five years. He had to sort through a lot of technical data.

Storey: Did it change?

Morton: I suspicion that there were some minor changes. Certainly if you compare word for word, the decree versus the decision, there are changes. To the best of my recollection, I have not looked at the two documents comparatively for thirty years, but to the best of my recollection, the changes were predominantly in entitlements to Indian reservations that, in fact, *Winters* Doctrine[6] kinds of questions were raised with regard to practically irrigable acres and so during this period of time between the decision and the decree, the Federal government and the Indian attorneys, the attorneys who represented the various Indian tribes, brought additional legal evidence and precedence with regard to Indian water rights and Federal reservation doctrines that caused the Supreme Court to vary some of the numbers in the final decree, as opposed to the decision.

I don't think--to the best of my knowledge or recollection, there were no significantly major differences on a state-by-state basis. It was primarily in the arena of a Federal reservation doctrine that the changes came about.

Storey: So the decree would take precedence over the decision.

Morton: Oh, yes. The decree is the final document, the final finding of the Supreme Court.

[6] *This refers to a 1908 case before the Supreme Court, Winters v. United States.*

END SIDE 1, TAPE 2. APRIL 24, 1996.
BEGINNING SIDE 2, TAPE 2. APRIL 24, 1996.

Linear programming modelling in preparation for the CAP

Storey: Another thing that you mentioned today was linear programming model. Could you explain to me what that is, why it is?

Morton: (laughter) It's been thirty-five years since I took that math class, but just in conceptual terms, it's an attempt to constrain an economic system in terms of linear equations, a series of linear equations. So if you have five unknowns and five equations, they're linear equations, you should be able to solve for the unknowns, because you have an equal number of equations to unknowns.

In the case of the Central Arizona Project and in the case of trying to optimize, on economic terms, optimize the delivery of [the] Central Arizona Project, in terms of maximizing the amount of economic return that you get for the state, you're dealing with literally hundreds of variables, hundreds of unknowns, and, in turn, you're trying to relate those unknowns in a linear fashion. Well, many of them don't have a linear relationship. In other words, the first increment may be $1 for $1, the second increment may be $2 for $1 of investment, the third increment of return may be $5. Well, obviously that's a curvilinear function, not a straight line, a linear function.

So in order to have an effective and competent, valid, linear model, you need to relate all the functions in some linear fashion. Well, a lot of times it's very difficult to do that just because relationships are not always on a linear basis. But it's a good optimizing technique. Today I think they tend to use stochastic and dynamic programming models, but you have the ability to use high-speed computers to evaluate those models, whereas in the sixties, if you had a rudimentary computer, you generally still had to deal with it on a linear basis, because the amount of time it took to compute all these variables was prohibitive.

Today you can do many millions more calculations over a given period of time than you could then, and some of these stochastic and dynamic programming models are certainly more effective and tend to represent the situation at least on a theoretical basis. But at that time, this was a methodology of relating economic trends and economic investments and returns to arrive at a solution that basically said we should give agriculture in Pinal County "X" acre-feet, give agriculture in Maricopa County "Y" acre-feet, and deliver "Z" acre-feet to the city of Phoenix, and other variable quantities of water to other various sectors within the state of Arizona.

Storey: During ~~1974~~ [1964], when you were working in hydrology again, you mentioned a whole list of things, and we've only discussed two of them--river regimes and the repayment issues. What were some of the other issues?

Morton: It was '64.

Storey: Yeah. Did I say--

Morton: You said '74.

Storey: Yes, '64.

Morton: There were a lot of other activities going on in the office that I really was not personally party to, but the kinds of things that we were trying to ready ourselves for was anticipation of an authorization bill in 1965, and the kinds of things we were

Urbanization in Phoenix requires relocation in the 1960s of CAP features proposed in the 1947 report

trying to develop in addition to payment capacity and financial repayment and water supply and how big you make the canal was how much does it cost to build a canal of that size, where should we be locating it, are there alternative siteing studies we need to perform to ensure that we're minimizing our cost for this kind of a system? I mean, the optimization parameter says you maximize your yield and you minimize your cost. If you get those two set[s] of parameters maximized and minimized, you'll have your best economic project.

For example, one of the things that we did in '64-'65 was determine that the city of Phoenix was expanding at a phenomenal rate to the north and where we had anticipated locating the canal in 1944 or '45, when we wrote the '47 report, was now in the middle of a bunch of houses. Went out there on the ground and determined that, well, this is where we thought the canal ought to be, and lo and behold, we're in the middle of a subdivision.

So the conclusion was, because we felt like the cost of acquiring all those houses and the urban infrastructure that goes with those, streets, roads, sewers, water lines, etc., would make the cost of at least <u>that</u> piece of the canal, <u>that</u> reach of the canal, very prohibitive. But in order to move the canal two or three or four miles beyond the infrastructure and the developed properties meant that you had to go uphill twenty or thirty or forty feet, which means you need to put an additional pumping capability twenty of thirty or forty feet into your pumping plant.

So the engineering staff, the field engineering staff at that time within our office was reevaluating the location of the canal, the size and configuration, how big is it from bank to bank, what do we need in the way of O&M roads. A sixteen-foot road is not wide enough today. What you had for maintenance vehicles, cranes, bulldozers, what have you, in 1944 didn't look anything like what you had in 1965. I mean, the cranes were bigger, the width of maintenance equipment was different, so they were doing a number of sizing and cost studies associated with where the canal should be, how many pumping plants did we need, what should be the head on the pumping plants, how far should we pump the water. We don't want to pump the water uphill too far. We want to make sure that it delivers water to the entire service area.

In instances like north Phoenix, we don't want to go through heavily urbanized lands. We don't want to spend the extra money associated with acquiring those lands and rights or relocating that infrastructure. So those were the kinds of studies that were ongoing on our engineering side of the organization in '64 and '65, so that, in anticipation of legislation, we could go to Congress and tell Congress with some degree of assurance that the Secretary of the Interior believed that the Central Arizona Project could be built for a given capital investment.

Land classification of irrigable lands under CAP

Other things that were going on during that era, I mentioned the need for determining, through farm budgets, to determine the payment capacity of farm operations so that we knew how much money they could pay for water and, in turn, knew what kind of irrigation assistance needed to be provided by power [revenues]. So we had soil scientists. We had a team of soil scientists, about ten at that time, I think, out there examining the existing agriculture to determine whether or not the soil was capable of sustaining irrigated agriculture over the next fifty years.

With the application of CAP water, was some of the soil going to lose its fertility? Were we going to waterlog the soil in the root zone so that they couldn't grow crops? We knew that it worked fine, the soil worked fine and produced ample and abundant crops with groundwater, but we were bringing in a different quality, different kinds of constituents were in the Colorado River water as compared to the local groundwaters. What was going to happen when that water was introduced, when the Colorado River water was introduced? Was it going to seal the soil? Was it going to adversely affect production? Was it going to be beneficial production?

So we had a whole division of people, both laboratory scientists and field scientists, that were out there evaluating on each -- perhaps not each -- yes, we actually classified about 1.2 million ~~acre-feet~~ [acres] here in Arizona.

Storey: Two million acres, right?

Morton: 1.2 million. They went out and determined that out of that 1.2 million acre-feet -- acres. I'm sorry, you're right. Get in these acres and acre-feet. 1.2 million acres of land that we looked at, there was about 900, about a million, 996,000, I think it is, that were what we call "arable," were capable of sustaining irrigation over a long period of time.

Some of the lands that people were growing crops on were what we called "Class 6, non-economic." The reason it was non-economic for that landowner was probably because the supply of water was relatively inexpensive. He could afford to make a crop because he wasn't paying a whole lot for his water. He may have had very early water rights. He may have had relatively shallow groundwater available to him, but if you applied CAP water to his property, to his farm, he would have gone bankrupt, so we would have had to classify that land as "uneconomic," or "Class 6."

So that was another process that we had under way there in the mid-sixties, was to determine the viability of who we thought our consumers were to actually use the water, were we going to adversely affect their farming enterprise.

Storey: Was there any controversy about the figures Reclamation was arriving at?

Morton: There was always controversy. (laughter) You'd go and tell a farmer, "Well, I've classified your land. This 160 acres you've got here that's grown three-bale-an-acre cotton for the last twenty years, with CAP water it's not going to grow any cotton at all," he's going to find that offensive. He's going to take exception to that, especially if he's been an advocate of bringing Colorado River water into central Arizona for a number of years and he's served on local lobbying committees or what have you, and many of them did.

Many of them were tried-and-true Arizonans who had backed projects in the '40s and had been fighting the battle over many years to get CAP water in, and now the government finally came out and looked at his property and said, "Sorry, only two-thirds of your farm is going to be eligible to receive CAP water." He would take exception to that, and they did. So we had to be prepared on technical terms to demonstrate what the data showed and why our conclusions were being reached.

Determination is made that CAP water will be delivered only to lands with a "history of irrigation"

Like I said, we looked at -- another aspect of the project at that time had already been kind of predetermined. The initial concept of CAP was to deliver water not only to existing farms, but to new farms. By the time we started reevaluating, like I said, over a million, ~~200-300,000~~ [1,200,000 to 1,300,000] acres of land, had been developed in central Arizona, and that far exceeded a reasonable supply. I mean, we could only bring a supplemental supply to that acreage, so it was concluded -- and I really can't say who made that decision, but at least early on in that process, in that evaluative process, it was concluded that CAP water would not be delivered to new land, land that did not have a history of irrigation. And that was subsequently written in the legislation, and CAP water can only be delivered to land with a history of irrigation, and then it took Secretary Udall to determine what the definition of the history of irrigation was.

The "history of irrigation" terminology that's in law is undefined, but it prohibits the Secretary from delivering water for agricultural purposes to land that does not have a history of irrigation. The repayment contract defines the history of irrigation as any land that was irrigated between 1958 and 1968, ten years prior to the date of authorization.

Groundwater and subsidence studies in preparation for CAP

But, like I said, we had field engineers, we had surveyors, we had geologists. That's another aspect of the program that was just beginning. We talked a little bit earlier about the lack of knowledge with regard to what was happening in the groundwater, how fast it was declining, what it was producing in the way of subsidence and fissuring and so on. It was in the '64-'65 time period that we staffed up with a cadre of drillers and a cadre of groundwater and hard-rock geologists.

The geologists who dealt with construction types of activities were interested to determine, for cost purposes, things like bearing strength of the foundation materials; how big of a pumping plant could we site on this type of foundation; would it take any special remedial measures; would we have to over-excavate and replace the natural foundation with concrete or piles or what have you for cost-estimating purposes. They were beginning that type of analysis on a feasibility level, very rudimentary level, not sufficient actually for construction work, but at least to give some measure of comfort or assurance that our cost estimates were reasonably good.

The groundwater geologists, they and their drilling counterparts would drill piezometer wells to determine the depth of the groundwater, to measure on a regular interval the rate of decline in the groundwater, to give us information, to give us raw data to evaluate what future costs would be for production of that groundwater. That, in turn, would go into the equation, into the payment capacity equation. If CAP was 50 percent of the water supply and groundwater was the other 50 percent, and groundwater was going to decline at the rate of twenty feet per year, obviously the cost of production of that increment was going to be more over time, and the amount that was available to buy your CAP water with was going to become less over time, and, in turn, we needed to evaluate whether there was enough revenue from the sale of CAP water to pay for the project.

So there are just a number of studies on a number of fronts, and engineers and hydrologists and geologists, and economists, and soil scientists all working in a small office of about 125 people, I think, by 1965.

Storey: Small office of--

Morton: About 125 people, I think. We had moved from the location that I had originally come to work at, at First Street and Roosevelt, to new GSA-leased space at the corner of Garfield and Second Street. I think we had on the order of 125 people in that office at that time.

Storey: Was your office space better than the first office?

Morton: I think we were more crowded, but the one thing I do remember was that the walls were white and the lighting was much better. (laughter)

Storey: Well, I'd like to keep going, but our time is up, so I'll ask you again whether or not you're willing for the information in these cassettes and the resulting transcripts to be used by researchers.

Morton: Yes, I'd be more than happy to provide that.

Storey: Good. Thank you.

END SIDE 2, TAPE 2. APRIL 24, 1996.
BEGINNING SIDE 1, TAPE 1. APRIL 25, 1996.

How Reclamation dealt with issues of urbanization in the Phoenix area during construction of CAP

Storey: This is Brit Allan Storey, Senior Historian of the Bureau of Reclamation, interviewing Larry D. Morton, at about ten o'clock in the morning on April 25, 1996, in the Phoenix Area Office. This is tape one.

Mr. Morton, yesterday we were talking, toward the end of the day, about how in '64-'65 we had to, in effect, go back in and relook at the project, and one of the causes was urbanization in the Phoenix area. It occurs to me that water wasn't delivered until about '85. That was then known as the Granite Reef Aqueduct. Did urbanization cause us problems later on, too?

Morton: We always had to be cognizant of urbanization, but, in fact, we planned for it early on. It's just is it happened a lot sooner than we anticipated, I think, but fortunately we did some protective right-of-way acquisitions in the early seventies that saved us from additional costs that would have been the case. We got around to constructing some pieces of the aqueduct system in mid- to late seventies and early eighties, but by having acquired the land early, in the early seventies, we eliminated some of the problems with urbanization that could have occurred.

Storey: Were there any other issues like that that were being looked at as they were doing the studies in '64-'65?

Water deliveries to Phoenix and Tucson were reconsidered in the 1960s in revising the conclusions of the 1947 report on CAP

Morton: Well, probably the other big issue that surrounded the urbanization question was how much water should be made available to the metropolitan areas of Phoenix and Tucson. The '47 report was based on formulation data that was assembled during the '44 to '46 time period, [and that data] anticipated only a minimal amount of water coming to the Phoenix urban area, and no water deliveries from the Colorado River for Tucson.

I don't know the rationale behind those early decisions, but certainly by 1964, Phoenix had grown substantially. I think the population of Phoenix in the 1940 census was about 60,000 people. By 1960, in the metropolitan area we were approaching a million, it seems to me.

Storey: You meant the 1944 census.

Morton: Well, the decade census, the 1940 census that was used for the '47 report was about 60,000. I think Tucson had about 25,000 during that time period, and they were probably pushing 200,000 by the mid-sixties. So obviously there was a substantially larger population to have to deal with. They were also not concentrated in a centralized area.

There was a growth pattern that was similar to Los Angeles. It was--what do I want to say? You'd settle one area and then the next development would be a half a mile away, so there was a substantial amount of open land between respective developments, so that you didn't have a centralized core city. You had a dispersed development process that was ongoing. Because of that, a number of different water purveyors were delivering water to these. There was no centralized water wholesaler that was delivering water to the urbanized areas.

Each development would have its own water company, or frequently had its own water company, and was not associated necessarily with the city of Phoenix or the city of Mesa or the city of Glendale. There were just a number of private water companies that grew up pumping groundwater to serve those developments that were in proximity to that water company, so there was just a lot of dispersed urbanization that was ongoing from after the war years through 1965 or so, that caused us a lot of concern with regard to who will be taking CAP water, how many people will be here that we need to plan for, what will be the rate of growth that will occur, both in Phoenix and Tucson? How will that displace agriculture? Will it displace agriculture?

In the mid-1960s studies of urbanization and groundwater use resulted in changes of conceptualization for CAP

We found much of the urbanization was occurring on prime agricultural land, for example, and if we made plans to deliver CAP water for agricultural purposes, were there opportunities to convert those uses from Ag to M&I, or did we have to plan separate systems to deliver those waters? So there was a lot of that evaluation that was ongoing in the mid-sixties to try and update the whole perspective on infrastructure in Arizona, agriculture, urbanization, groundwater versus surface water, institutional relationships on where you can use groundwater, where you can use surface water, legal requirements. There was a lot of that type of evaluation also ongoing in that era.

Storey: But at that time there was no groundwater regulation in Arizona?

Morton: No. Generally speaking, there was little, if any, groundwater regulation. You put down a well and you pumped it. You didn't report that to anybody.

Why Reclamation needed to classify all the lands that might receive CAP water

Storey: Yesterday you mentioned that we went in and looked at all of the lands that were going to receive Reclamation water or that potentially would receive Reclamation water. You also mentioned that it was a supplemental supply. I have -- well, it's at least a two-part question. It may grow as I go. (laughter) Why were we interested in what kinds of lands were involved? And did we have any trouble getting access to the lands, which would have all been private, I gather?

Morton: Yeah, they were all private. Well, I think as I explained yesterday, much of the concern for the quality of the land and the interrelationship between the Colorado River water and the Central Arizona soil body was a technical question of crop production. It was a technical question of how will this change of water quality affect the soil? Will it adversely affect the soil? Will it sustain its current productivity? Will it produce drainage problems? Will it result in salt formations? These were all technical questions that soil scientists had to consider in their analysis.

As far as access to the land were concerned, generally I would have to say that the farmers in Central Arizona -- [Telephone interruption. Tape recorder turned off.]

Southern California with a nuclear plant and the energy from that nuclear plant being available for CAP pumping purposes. So it was a combination study on desalting of seawater and using the output from the nuclear plant to not only desalt seawater, but also to pump CAP water. That came out in January or February of '68.

So just about every year we got a little change in direction either through the Department or through Congress, where they redirected us to examine some other issues, some new issues, one being the concern for dams in the Colorado River and the other being the utilization of nuclear power. Nuclear power was just in its infancy. It had a lot of enthusiasm and interest behind it, but as we know today, it didn't grow to the extent that was envisioned there in the mid- to late sixties.

"So just about every year we got a little change in direction either through the Department or through Congress"

Storey: And were you working on those reports?

Morton: Yeah.

Storey: All of them?

Morton: I not only worked on those reports, but from time to time I would be drawn into some of the investigation reports for local water supplies here in Arizona, and I worked on the Flagstaff-Williams, on a report that proposed supplying water to the cities of Flagstaff and Williams in northern Arizona. I worked on reports to provide water to Sierra Vista and Fort Huachuca and on the San Pedro Basin in Arizona, and another report on the water supply for the city of Prescott here in Arizona.

So I got involved in a lot of -- at that era, I got involved in a lot of different plan formulation investigations and report preparation activities.

In addition to CAP reports Morton worked on local water supply investigations and reports

Storey: Did you sort of become a specialist in something? Was there something you were assigned as opposed to other people being assigned it?

Morton: Just the opposite. I think I was the resident generalist. I didn't probably know a lot about anything, but I knew a little bit about a lot of things. I worked on a part-time basis during the heavier periods of the budget cycle with the budget officer. I knew how to formulate budgets, I knew how to present budgets. I learned how to do that, I should say.

Became a generalist rather than a specialist

I knew Arizona. I traveled the whole state of Arizona in my youth, and I knew physical locations and sites and rivers and watersheds, and so I knew a little bit about the hydrology. I managed to pick up a little bit about economics. So I guess I was more of a generalist, because I did have a diverse background. If you sat me down and asked me to do something fairly detailed, it would be a chore for me to do that, because I didn't have the depth in any given area. I just had a very broad exposure to a number of areas.

Storey: How did you like being in the reports section?

Morton: It was generally where things were going to culminate, so it was a good job, I felt. If you would work in a very technical area, the product of your labor might be one number. I mean, you could have ten three-inch binders, but when you boiled it all down, what people were looking for was one number.

Things were going on in the Reports Section

Storey: For instance?

Morton: For instance, we had a cost estimator, a fellow by the name of Tom Schlichting. He was a GS-12 engineer. He had a lot of practical field experience. If you wanted to know how much a canal would cost from Point A to Point B, of such and such a capacity, he'd ask you how long he had to derive the answer, and he would give you an answer in your time period, but the level of effort he put into it would be commensurate with the time period.

Probably his estimate would be no better if you gave him five minutes or you gave him five days to do the estimate, but he just had the uncanny ability to match the level of detail to the time period you gave him. So if you gave him five minutes, "I need this answer in five minutes, Tom," he'd do that. If you'd tell him, "You've got five weeks to do it," he'd go through very detailed computations, you know, scale things off a map or actually go out in the field if he had enough time, and take some cross-sections. He would build a notebook to justify that cost estimate.

Tom, at that time, in '64-'65 time period, was charged with coming up with a cost estimate for the Central Arizona Project. Well, all we needed to know was that it was going to cost half a billion dollars or $600 million or $750 million, but Tom had a whole bookshelf of loose-leaf binders with computation sheets in it, where he had gone through and meticulously computed all this information.

So from that perspective, what was really wanted by both Congress and by the state of Arizona and by me, the report writer, I just need to plug a number in here. I've got all these words that describe what the plan is and where the canal is going to go and the way the water is going to be delivered, but what we really need to know is the fact that it costs "X" dollars.

So for me, that was a culminating product, is this report that basically says the CAP costs "X" dollars and the benefits to be derived from building this are "Y" dollars, and "Y" exceeds "X" by a ratio of 1 to 1.5 or something like that. I mean, that was the level of detail and the facts that were being presented, and that was my deliverable, was that report, with three or four numbers in it.

Tom, on the other hand, had a million numbers and a ton of backup data, and he knew lengths and distances and everything else, but he never got the big picture. So for him, his deliverable was a whole compendium of numbers, and for me the deliverable was just that one number, or at least on the cost side, and from the benefits side it was another number.

Storey: I think I heard you saying you preferred it that way.

Morton: I preferred it that way, yeah, because what Tom produced, even though it was supporting data and to the extent it supported the legislative process, nobody knew that. The data I was putting together with his number was being used to justify the project and to get it authorized for construction, to get it built. So I felt like my product -- I got a lot of satisfaction out of my product, even though I didn't go into the depths and detail that our cost estimators or the folks that did benefit analyses may have gone into.

Storey: In order to do a cost estimate like that, there had to be design data, right?

Morton: Correct.

Storey: Similar kind of issue in terms of where you were sitting?

Morton: Yeah, it came to be how much time do we have, how much reliability do we have to have with this data, and we'll produce what we can produce in the time frame that we're given.

Responding to Congressional concerns regarding CAP

I think it's fair to say that the hearing process normally would culminate in the summer. Usually Congress would recess like in August, so they'd have hearings up until the end of June or middle of July, and then the Department would sit down and decide, "Well, what can we do? There's not going to be any more hearings. The bill's going to languish here for the remainder of this session. What can we do to make a better presentation next year?"

Or Congress, in turn, would say, "Don't send us back a bill that talks about dams in the Grand Canyon. We don't want dams in the Grand Canyon. Come up with something else."

So you had until the next session of Congress or the next term to build a new justification or new story or new plan, and you needed to present it to Congress early in the session. So by the time they convened in mid-January and got organized and so on, the hearings would start like in March, so you had to have your job done by March.

Then you tended to be just responsive to questions during the hearing process. But if you're going to do a major reformulation, which we did do on two occasions, you had about from the first of August through the end of February to do that, of the subsequent year to do that. That's what we did in 1966 and in 1967, was we reformulated CAP with different power arrangements and different sizes of canals and whatever would sell in the next session of Congress or what was thought to be a reasonable compromise.

Storey: How long did you do reports?

Worked in reports preparation from late 1965 to late 1968

Morton: I got my own project as a Planning Coordinator, Planning Officer, in 1968, so generally from late '65 when I completed my rotation training assignment until it was probably right about the time that the Central Arizona Project was signed into law, so about September of '68, my principal role was reports in one fashion or another.

I may have been working with the Budget Officer to write budget narrative justifications or working with the economists to help them write an economics of farm budget analysis, to help them write it down, put it on paper. They'd hand you the data and have a bunch of tables on all the inputs that would go in to produce a crop on the farm, but somebody had to put it in a written format so that it would constitute a report. So I didn't just solely work on the formal reports that were part of CAP, but all kinds of different reports I had the opportunity to work on. So there was probably three full years, from about October of '65 through September of '68, that I did that.

Storey: If I were reading this transcript, I might take what you've said about the way we looked at the reports, the way you saw the reports process, and say, "There goes Reclamation again. All they were doing was trying to build another project and to <u>sell</u> the project they <u>wanted</u>." How would you respond to that?

Morton: Well, there's a certain degree of truth in that, but, in fact, we don't sell things ourselves. I mean, there's a constituency and there's a legislative process. The problem is that the Department of Interior and the Bureau of Reclamation has to work between those two extremes and be the communication medium, I guess I would have to say.

Reclamation/Interior was the technical advisor in a constituency-advocacy and legislative process

The constituency would go to Congress and say, "Just give us the money. We want to do 'X.' Give us 'Y' dollars to do 'X.'" And there would be no assurance that, in fact, what was being proposed was economically viable, engineeringly viable, would be efficient, would be effective, would not damage the environment, etc.

And, so we became the mechanism to assess what a local sponsor or an advocacy group would be putting forward, and we wouldn't do this in a vacuum. I mean, you would have the Fish and Wildlife Service looking at the fish and wildlife benefits. You'd have, at that time, the Bureau of Outdoor Recreation was responsible for looking at recreational aspects that you were proposing. The Corps of Engineers would have to examine the flood control aspects. So there was a lot of dialogue amongst the various Federal agencies that were responsible, and I think we tended to be a point of verification on what was being proposed to the Congress.

If the Congress supported it, we had to be honest in our appraisal. We had to be honest in our justification numbers. And if the Congress supported it, well, then it got built. If Congress didn't support it, as was the case in '47, it ended up in the trash heap for fifteen years. I mean, that was CAP. We were an advocate, but we were an advocate for viable programs. We were not there trying to advocate things that we knew in our own mind had no justification for them.

END SIDE 1, TAPE 1. APRIL 26, 1996.
BEGINNING SIDE 2, TAPE 1. APRIL 26, 1996.

Storey: You were saying that we weren't advocating projects that we thought weren't viable. I think what I'm also hearing you say is that there is a lot of interaction between constituents who are pushing a project, the Congress who's receiving the push and sort of providing guidance, Reclamation as the agency, as the bureau -- excuse me -- and probably the Department of Interior as the agency, and there's a lot of give and take going on here. How would you characterize that give and take? What kinds of things were going on?

CAP as an abbreviated example of how many different constituencies and Congress affected a Reclamation project

Morton: Well, that's kind of hard to draw a specific example. Let me try on a couple of fronts. The pieces of the puzzle for the people in Arizona were a canal to bring water from the Colorado River to Phoenix and Tucson and to the major agricultural area that lies between Phoenix and Tucson. That was basically what the Arizona interests wanted, the Arizona water interests wanted.

There was a major power-using/consuming consortium, and what they wanted was big power dams or a cheap federally subsidized source of power, preference power, and they equated that, of course, with the Bureau of Reclamation's authorities, equated that to a hydroelectric power dam, because that was the only authority Reclamation had.

There were local interests that wanted specific flood control. For example, the city of Phoenix and the Airport Authority and other constituencies that lay along the Salt River through the city of Phoenix would dearly love to have that river controlled and to ensure that the flows that come down the highly variable Salt River were fully controlled and, in fact, there could be urban encroachment on the flood channel or on the flood plain, that development could take place on the flood plain, with some degree of assurance that they wouldn't get flooded out. There were property owners that saw flood control would bring them a windfall in terms of the value of their property.

There were entities like the San Carlos Indian Irrigation Project that saw that while Coolidge Dam had been built in the mid-thirties for the benefit of the Indian Irrigation Project, they saw a second dam at the Buttes Dam site downstream would be much better. It would tend to control the unregulated runoff from the San Pedro River, which was located between Coolidge Dam and the Buttes Dam site. It would help them with their maintenance activities, because they have a lot of maintenance costs associated with sediment removal. You put a dam just upstream of their diversion point, it would minimize their sediment removal problems at their diversion point. So there was an advocacy group for Buttes Dam.

There was local sponsorship in the San Pedro Basin for a dam near Sierra Vista called Charleston Dam. There was constituency in the Tucson area that wanted a dam on the Santa Cruz River.

Then you get outside the state of Arizona and the power consortium or the power interest was much broader than Arizona. I mean, it included preference power customers in Southern California, in Nevada, Utah, as well as Arizona, but you get outside of Arizona, there was a need in Southern California to assure their long-term water supplies, and there was a demand on their part to limit the amount of water Arizona could take. Even though the Supreme Court decree upheld Arizona's right, there were still forces at work in Southern California to ensure that Metropolitan Water District's Colorado River aqueduct was full all the time in the future. "If at all possible, let's keep the Metropolitan aqueduct full."

There were interests in New Mexico that wanted to ensure that western New Mexico was not left to languish in the future, and that there would be some assured water supplies in western New Mexico. There were several projects, previously authorized projects, in Utah and Colorado that for one reason or another the cost that had been estimated at the time those projects were authorized was inadequate. They ran into geologic problems or they ran into construction problems, or they found that the right-of-way was more expensive than what they'd originally envisioned. So there was a desire to reauthorize those projects at higher appropriation authorities.

So the whole process tended to be give and take. "How do we add this increment to the project, or can we add this increment to the project? Is there a demonstrated need? If the need is demonstrated, does the costs of satisfying that need outweigh the benefits, or are the benefits greater than the cost of meeting the needs? Does it make sense to do it? Are there adverse effects? Do we need to mitigate those adverse effects? What are the costs of mitigating those adverse affects?"

This whole formulation process tended to meld together, and where we started from, which was basically the old '47 report, various components of the '47 report had to be abandoned very early because they weren't acceptable to the public. Still may have been totally viable from an economic or a constructability perspective, but the public desire, the public support just wasn't there.

I point to the dams in the Colorado River between Glen Canyon and Hoover. There was total public opposition to those dams, and once testimony was offered in 1965 to use those dams, and the outcry that came from that proposal, it was clear -- and Congress gave us that direction in 1966 -- was that there was no acceptability, that Congress was unwilling to accept any proposals that involved the construction of dams in the Colorado River. That's why in August of 1966 we sat down and said, "How can we reformulate CAP? We still have to have a source of energy to pump water from the Colorado River and we still have to have some form of irrigation assistance, and it would be nice if it came from power sales," but it wasn't required that it came from power sales.

In fact, when the whole equation was done and the whole calculus was combined in 1968, there was irrigation assistance. There was a participation in a privately owned coal-fired powerplant, but there was also other sources of revenue to help assist irrigation to meet its repayment obligation, and it came in the form of a trust fund called the Lower Colorado River Basin Development Fund, and that fund was to be supported by surplus revenues generated in the state of Arizona after Hoover Dam was paid out and after the Parker and Davis Dams were paid out. So there was a mechanism that Congress came up with over time that produced the same order of magnitude of revenue to assist irrigation as did the power dams [Bridge Canyon and Marble Canyon Dams] in the Colorado River.

Personally, I think that the Colorado River dams disappeared from our viewpoint because

Congress took action to direct us to not provide any support for those in the future. So you had both sides. You had the local constituency saying, "We want flood control," for example, at Orme Dam, and we found that that met the test of viability, and we included it in our proposal. From the other side, the Congress said, "We don't want those dams," so we took them out, and we found something else. So we got our direction from both sides of the equation.

Storey: While you were in the Reports -- let's see, this was a Division. It was planning and --

Morton: Planning and Reports Division, I think.

Storey: Were you in a section within the Division?

Morton: Well, I was in the group that focused principally on the Central Arizona Project. Like I said, there were people who were assigned to the Mogollon Mesa Project and the Flagstaff-Williams Project and the Prescott Project and so on.

Storey: But it was just one big division with Mr. Creighton at its head?

Morton: Mr. Creighton was the head, and then at least for the first two years or so of my tenure there, '65 and '66, maybe early '67, I worked with a team or a group that was headed by Bruce Blanchard, and Bruce Blanchard and Dick [Richard (Yogi)] Schaeffer and Ron Wilhite and I worked in this smaller unit. So I actually got my direct day-to-day supervision from Bruce Blanchard at that time.

Storey: At that stage in your career, did you see much of the political activity that was going on between Reclamation and the congressmen and the senators and so on?

Morton: Not the congressmen and the senators. The office we had, which was a larger office because we had four people kind of working real closely together, our office was situated right across the hall from the Project Manager/Assistant Regional Director at that time, Mr. Pugh, and since I was the junior staff member in that group, ofttimes I'd be called upon to carry a slide projector down to a meeting or deliver Mr. Pugh to a meeting or pick up Mr. Dominy at the airport or Mr. [Arleigh] West at the airport, the regional director, Mr. West, and take them to the governor's office or the state engineer's office, and oftentimes I had the opportunity to at least sit there and listen to what was going on, but in terms of -- and I guess I should say also the congressional staff people, but Senator [Barry] Goldwater, Senator [Carl] Hayden, Senator Fannin in that era, Congressman [John J.] Rhodes, Congressman [Morris] Udall, I never had the opportunity to really either meet or work or observe them, because it was seldom, if ever, they came -- it seemed like, that they would come and talk to Reclamation. But the folks that represented upper management in Reclamation, I did at least have the opportunity to provide them some services, whether it was carrying a slide projector or driving them around town.

Impressions of Regional Director Arleigh West

Storey: You know, we've already discussed Mr. Dominy today. Tell me your impressions of Mr. West, if you would.

Morton: I guess my impression was that Arleigh West had little, if any, interest in Arizona. It seemed like his interest was in Southern California, both in terms of the Metropolitan Water District of Southern California, the Imperial Irrigation District, and to a certain extent Southern California Edison.

At that time, the powerplant at Hoover was being operated co-equally by Southern California Edison and Metropolitan Water District. I'm sorry. City of Los Angeles. Los Angles Water and Power <u>and</u> Southern California Edison operated it, and Metropolitan Water District operated Parker Dam at that time.

So Arizona had kind of been a backwater for fifteen or sixteen years while the Supreme Court lawsuit was ongoing, and I think that the regional office's focus was delivery of water and power through Hoover, Parker, and Davis Dams downstream to Imperial Dam, and that tended to be the regional directors' livelihood if you will, their principal focus, their principal constituency, and I think probably in that era, California had forty-six votes in the House of Representatives and Arizona had two, so certainly the political influence of California was much stronger than Arizona.

In private observations, I think that Arleigh West was not terribly supportive of the positions that were being taken, for example, by Bill Gookin, the state water engineer at that time. He was very reluctant, seemed to be very reluctant. His visits tended to be real short and maybe more a formal-type visit than any kind of a working effort. He left most of the day-to-day details up to Cliff Pugh, I think.

Storey: Did he keep an office here?

Morton: We had a suite of offices at that time, and one office was designated for Mr. West. He would use it once every two or three or four months for a day, but he had an executive desk and half a dozen side chairs and a little conference table in that office. It was an office equal in size, in square footage, to Cliff Pugh's office, but it was vacant nearly all the time, 100 percent of the time. Of course, when one of the other assistant regional directors or the Commissioner, one of the assistant commissioners, would be in Phoenix, they would use that office as well, but it was the Regional Director's office by title, at least. He just didn't make very much use of it.

Impressions of Cliff Pugh

Storey: What about Mr. Pugh? Tell me about Mr. Pugh? Now, I think probably it would be profitable to talk about him in this early period when you were working in reports and so on, and then talk about him later also after construction began.

Morton: How do I say this without being too disrespectful? Cliff Pugh was a lovable person. He was crusty on the outside and soft as Jello on the inside, I think. Of course, he hired me. I mean, I came to work for him, and took about a five-minute interview and he said, "You're hired. Come back tomorrow and sign the papers." I mean, I've never experienced that in the first place.

But there was always two or three people in the chain of command between me and Cliff Pugh, but Cliff was not beyond coming across the hall and sitting down and just talking about things. I know that he from time to time could be just as rough and abrasive as anything, but I always thought of him as a kindly soul, somebody that was a people person. I know that might be contrary to what other people thought of him, but

I always thought of him as having an interest in what other people thought, and tried to get the most out of people.

Storey: Vernon Powell asked me to thank him for sticking up for him for a promotion. (laughter)

Morton: That was the kind of person that Cliff was. If he felt like you were doing your job and you were doing a good job, boy, he was going to reward you. He was going to ensure that you got what he felt you were due. He was always a gentleman. I've heard him screaming and hollering at people, but by the same token, they probably deserved it, in my view. (laughter)

Storey: Did things change over time?

Morton: I think after CAP was authorized and there was an attempt at least to force him to retire or to accept a job away from the Phoenix area after authorization, and subsequently several additional regional directors were appointed and he was not appointed as regional director, I think he got a little dissatisfied with the internal politics within Reclamation.

He would often comment that he'd been bypassed for regional director seven or eight times over the course of his career, that he had served as a senior staff person, senior advisor, to seven or eight different regional directors, whether it was the head of the Phoenix office -- well, in the capacity as head of the Phoenix office, which at that time was probably a GS-15 slot that he'd been bypassed as regional director for a number of times. I think that soured him on Reclamation to a certain extent.

I don't know that for a fact, but I know that his comments about being bypassed, his comments about the treatment that he'd received, the fact that a number of younger, less experienced individuals were now assistant commissioners or regional directors or assistant regional directors, those kinds of comments became more prevalent in his later years as a project manager.

Storey: I would think that the nature of the office changed after the authorization.

Morton: There's no doubt that it did. It took a couple of years for that to occur, primarily because of the timing. The budget cycle just really did not lend itself for the Phoenix office to move directly into construction, and, in fact, we had done much of our engineering work at a feasibility level or a reconnaissance level, and we really weren't prepared to move forward into construction. We did not have all of the engineering information necessary to move forward into construction.

The office in Phoenix changed as it moved from being a planning office to being a construction office

I think Cliff came to Phoenix about '56. From 1956 through 1968, the office staff had been predominantly a planning staff. The engineering work was at a degree of technical sophistication that would be suitable for planning, and good-quality planning, but it didn't have the refinements that were really necessary for construction.

Reclamation staff tended to be stratified with people being pigeonholed into specific kinds of activities

If you've been associated with Reclamation, we tend to become stratified, and once you're a planner, you're always a planner, and once you're a construction person, you're always in construction. If you're in O&M, you're always in O&M. And I may be the exception to that rule, but the bulk of our organizations function that way. The planners come in, they do the planning, they get the project authorized, and then they go someplace else and the construction staff comes in. The construction staff gets the thing built, some of them may stay around and become O&M personnel, but normally the construction staff moves on to the next construction job. They tend to stratify and retain themselves in those categories.

Cliff had the rep[utation], the office had the rep of being a planning office, and we were, no doubt about it. We were probably 130 or 140 people at that time.

We were a planning rather than construction office but Cliff Pugh felt the office could transition into a construction mode

Storey: At which time?

Morton: Well, at authorization, in 1968, but we weren't a construction office by any stretch of the imagination. We had people who had worked on construction jobs. We had people who had been at Glen Canyon, we had people who had been at Grand Coulee, we had people who had been at Cachuma and Casitas and other projects in the Western United States, but we were not organized and we didn't have the expertise that it takes to actually build the job.

I think that the office, and Cliff in particular, felt like we could move from planning to construction and the changeover would be relatively transparent. It really didn't occur that way, and I would have to say, after I saw the last twenty-five years of construction, I would have to say that the staff that we had at that time would have had difficulty assuming a major construction effort. We did need the expertise associated--we needed a construction engineer. We needed an office engineer. We needed a contract administration specialist to carry us to the next step from planning and authorization to construction. We needed that.

I'm not sure that Mr. Pugh accepted that, because Cliff was the type of person, and rightly so. I mean, he'd spent a lot of years in construction in Yuma and with the Corps of Engineers during the war, and he had construction experience, but over fifteen years or so he'd lost contact with the state-of-the-art in terms of construction, and he did not have the subordinates with the requisite construction experience to just take the Phoenix Development Office staff and make it the Central Arizona Project Construction Office. I think that he was of the impression that they could do that, and I think wiser people prevailed and a project construction engineer was assigned to the office, and the project construction engineer at that time brought his staff over a period of a year or so, brought his staff on board.

A project construction engineer was assigned to the office in Phoenix

Storey: Who was that?

Andy Dolyniuk is the first construction engineer for CAP

Morton: Andy Dolyniuk was our first construction engineer.

Storey: He came about --

Morton: Well, it couldn't occur immediately after, because we didn't have the financial--we didn't have the appropriations to start the process. I think Andy came about '71. It was about three years before we were able to gear up, and, in fact, as I said, right after authorization, my role changed a little bit.

I got out of CAP for a couple of years, became a planning person in my own right. It was about that time that it became apparent that we were going to have to change. <u>We, the Federal community</u> that planned water resource projects, was going to have to change. The National Environmental Policy Act had come into being in '69, late '69. The emphasis on economics,

Late 1968 became a planning person and role in relation to CAP changed

economics being the sole evaluative factor, was disappearing. Regional economics became as important as national economics. Environmental concerns, environmental enhancement opportunities came into being. Shortly thereafter we got into endangered species issues.

We got cultural resources, although the authorities were back in the forties, or even before that, I guess. Reservoir Salvage Act and others for cultural resource evaluations had been on the books for a number of years. The funding, the emphasis hadn't been there until the late sixties or early seventies. National Historic Preservation Act came on board in the early seventies.

Environmental laws were beginning to change the way Reclamation did business

Storey: No, in '66.

Morton: '66. Yes. Led that push certainly in the late sixties. So it became real obvious in Reclamation, I think it was about 1970 --

END SIDE 2, TAPE 1. APRIL 26, 1996.
BEGINNING SIDE 1, TAPE 2. APRIL 26, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry D. Morton on April 26, 1996.

[You were] talking about the changes that you felt were coming because of the changes in environmental laws and so on, and you were just getting ready to say that the Commissioner convened --

Morton: Convened a planning conference in Tucson in the summer of 1970, I believe it was, and I attended that conference.

1970 planning conference in Tucson in response to environmental laws and other pressures

Storey: That had a unique name, I believe.

Morton: I can't remember what it was, but I'm sure it did.

Storey: It's elsewhere.

Morton: That was one of the instances where I got to meet Assistant Commissioner Gil Stamm, and Gil eventually became Commissioner in '73 or '74. The focus and the procedures underwent radical change at that time, and I had CAP under my belt. I had formulated and been involved in two other projects and finalized those reports. One was a reimbursable project for the Bureau of Indian Affairs at Zuni, the Zuni Safety Dams Report and Project. That was one that I was principal investigator on. Then the water supply for the city of Prescott from Lynx Lake was the second project that I had worked on. I did those in 1969 and late '68, all of '69 and early '70.

As a result of the Tucson planning conference the focus and procedures for planning changed

Oversaw safety of dams project at Zuñi and water supply study at Prescott, Arizona

Following that planning conference at Tucson, it became obvious not only did we have to change our planning procedures because of the change in focus of the nation as a whole and generally toward improved environmental conditions, but also because it was taking twenty and thirty and forty years for Reclamation, from first gleam-in-the-eye to actual authorization for construction, to get a program going, and CAP was a good example.

Reclamation had to change because of a national shift in interest and because projects were taking too long to build

CAP was started in '44, it was authorized for construction in '68, and the conclusion of that group was that, one, we need to streamline our planning procedures, and, two, we need to be more receptive to current-day standards in terms of satisfying needs, and we need to look at more than just economic needs. We can't just be single-purpose type of an operation, we've got to look at environmental needs, social needs, recreation needs, fish and wildlife needs, cultural resource needs, etc., in our formulation strategies.

Conclusions of the Tucson planning conference in 1970

Out of that group came what they called the test cases, the Yellow Books, and for some reason I got assigned to a team that was going to develop a hypothetical project within the Lower Colorado region, and I became the team's economist. Don't ask me why, but they couldn't find anybody in the economics end of the business that felt comfortable in dealing with economic evaluations outside of the very narrow cookbook that they'd been dealing with for the past preceding -- I think since '58, when Senate Document 97 came out.

The Yellow Books developed as case studies from the 1970 Tucson planning conference

Senate Document 97 (1958)

But there is a ten-, twelve-year, fifteen-year period where the procedures for economic evaluation were all stylized, and it seemed like all the economists couldn't deviate from that approach, and so they said, "Well, we need to get a fresh view on this. Let's bring this dumb engineer in here, make him an economist." So I worked for the next six, eight months on a team that said, "If we plan this project," and fortunately they took a project I knew something about, because I had just completed writing the report for the Prescott Project, and they selected that one, and we redid all the displays and reconstituted the analysis based on regional economic development standards and national economic development standards, and the bottom-line answer still came out the same: it wasn't viable. (laughter)

Prescott water supply study used as a case study resulting from 1970 Tucson planning conference

We did a lot of those, it seemed like, where we did a lot of analysis, we developed a lot of data. Much of the data is still in use today, but when you came right down to it, it wasn't something the United States Government needed to involve itself with. It became more of a local sponsorship issue. If the city of Prescott and the Yavapai County would work within itself and fund the program, they could make it work for themselves. They didn't need the Federal government in there to make it work, and that was kind of the answer we got.

Anyhow, the bottom line was, I got some exposure in that era to the changing formulation strategy for water and related land resources, which eventually evolved into principles and standards and then subsequently principles and guidelines.

Storey: This would have been '70-'71?

Morton: Yeah, because it was about that time that the decree came down that our job was done, the planning office no longer existed, CAP was authorized, all these other projects you'd been looking at you'd proven both in the traditional methodology and in the proposed new methodology, you've proven that they're not viable and literally a dozen separate local water supply-type projects that we had been investigating over the preceding nine or ten years.

Small projects studied by the Phoenix Development Office that didn't proceed

Storey: Were determined --

Morton: That they just didn't have sufficient justification to go forward and seek authorization for.

Storey: Do you remember the names of them?

Morton: Oh, yeah. There's a lot of them. Black River, Springerville, St. John's, Prescott.

Storey: Zuni?

Morton: Zuni. Flagstaff-Williams, Winslow-Holbrook, Mogollon Mesa, Kingman, Sierra Vista, Fort Huachuca, Sasco Dam.

Storey: So out of all of them, CAP's the one that went?

Only CAP proceeded to construction

Morton: CAP's the one that went, and the only one at that era, but the bottom line was that in 1971, we anticipated that we would get a construction appropriation. Actually, it would have been for fiscal year '72, but it would have been appropriated in '71, because fiscal year '72 started like July 1, 1971.

It was right about that time that the -- and I don't know if this came from the Commissioner or from the regional director or where it came from, but we do know that Mr. Dominy was no longer the Commissioner. I can't remember who was at that era.

Storey: Ellis Armstrong.

Morton: Oh, yes. That's right. I believe Arleigh was still there in Boulder City. Arleigh West was still the regional director. I think it was in late '71 that Arleigh retired.

Regional Director Arleigh West plans to restructure Phoenix Development Office, and move Project Construction Engineer in to head it

Anyhow, the word came down in 1971 that the Phoenix Development Office no longer had a mission, that we were a bunch of planners and therefore we needed to reorganize and restructure the Phoenix Development Office, and be prepared to accept the construction engineers, the new head of the office.

Mr. Pugh took exception to that and said, "Well, we'll just see who's going to leave," and as it worked out, Mr. West left, not Mr. Pugh.

Storey: He told me the story about that yesterday, off tape, of course.

Regional Director Arleigh West is removed

Morton: Off tape. (laughter) Well, I don't know the ins and outs of it, but I know that there was a political battle, and I know that Cliff stayed and Arleigh retired.

Storey: He said that West informed a staffer for, I think it was, Congressman Rhodes, what he was planning to do, and he said, "Gee, I don't know what happened, but a month later he was gone." (laughter)

Morton: Well, I know that Cliff Pugh and John Rhodes had a good relationship at that time. But the other aspect of that change, whether Cliff stayed or went, or whether Mr. West continued to be the regional director or not was probably immaterial. What really changed was the planning staff, as a function, ceased to exist, and the new [Project] Construction Engineer came on site and went through the organization and said, "Okay, geologists, you can work for me. You've been planning geologists, but you know geology, so you can work for me. Drillers, foundation drilling, groundwater drilling, I can use your expertise. You can come to work on my staff."

Project Construction Engineer reorganizes office into construction on operations and maintenance personnel

Went into the engineering part of the organization, said, "Okay, you guys have been doing cost estimates and so on, but you can probably work in office engineering. We may have to downgrade some of you and retrain some of you, but you can work for me. Drafting, you can work for me."

He got around to planning and reports people and said, "I have no idea what you guys can do for me. We need to get rid of you." And he went and looked at the soil scientists and said, "You guys, you don't do anything I need. I don't need you."

So the bottom line was that we ran a RIF [reduction in force]. Several people were actually separated. The people that were separated were soil scientists. There were no engineers that were separated. And everybody else who was kind of left over became part of our operations organization, our O&M [operations and maintenance] organization, although none of us had really worked in O&M previously.

So there was an amalgamation of planners and hydrologists and soil scientists and engineers who were left over, and because we were left over and we weren't welcome in the construction organization, and there was no longer any planning organization, we became the O&M part of the organization, the old 400 Organization, if you will, Code 400.

Storey: Before we go ahead, let's go back and go over some of these wonderful topics that you've raised and skipped across the surface of.

Morton: Sure.

Size of the Phoenix Development Office in the late 1960s

Storey: Mr. Pugh's recollection, when I was talking with him yesterday, was that his office went down to maybe five or six people just before authorization. Could you give me your impressions of the office size when you came in, about the time of authorization and about the time we had geared up for construction?

Morton: Well, I have to compare it to the size of the office space, you know. When I came on board in the early sixties, '62, there were about sixty people and we had a small building on the corner of First and Roosevelt. As we expanded in '62 and '63, we had to acquire a private house several doors away from that office building just to take care of the overflow, and we had an interim lease while a new building was built for us at Second and Garfield. I think it was late '63 that we moved into the office space at Second and Garfield.

By 1967, we had moved into what would now be called the core area, the downtown area, at Second Avenue and Monroe, into what then was known as the Ellis Building. Between the field staff, and I say that somewhat advisedly, the laboratory, the drill yard, the drillers, the people who assembled off-site, we probably had about twenty people working in the laboratory or in the drill yard, and there were probably 100 people at that Ellis Building on the corner of Second and Monroe.

We stayed at that site until we moved into the Valley Bank Building in 1974, and with the exception of a construction engineer and his immediate staff, we didn't change size of buildings, and I don't think we added many staff in the downtown location. We did add staff, because we awarded two contracts in 1973, construction contracts, so we had construction inspectors, field engineers, etc., on site at those two construction sites in '73. I don't believe that we saw any reduction in staff other than a couple of soil scientists that were terminated or ~~separated from~~ [assigned] jobs in the Denver office, Greg Brockman and Willy Forrest, by name.

A transition from planning to O&M, where the rest of us ended up in, or because of the National Environmental Policy Act coming into being, we now had to have an environmental staff to write "EISs," environmental impact statements, and so we did have two of the ex-planners became the environmental organization.

What Cliff may have been referring to was that in this transition, his job title changed, and at one time he was the -- I think at the time I signed on, he had the title of area manager. I think that's what it was called. Area engineer, that's what it was called. The area engineer. That tended to be the head of a planning office, an area engineer, and then he became the Assistant Regional Director, duty stationed in Phoenix, and then he became the project manager. I'm not sure of the exact times when all those transitions [occurred], but it was in that sequence that they occurred.

What he may have been referring to is that right at authorization or just before or during that time period of authorization, the power struggle was under way, and I think that he ended up with an immediate staff, but the bulk of the office didn't report directly to him, that the people who worked in the office actually reported to the new area engineer, which was a fellow by the name of Ollie Lillard.

Storey: Ollie Lillard?

Morton: Yes, Oliver Lillard. That's the only thing I can think of, because by the time the construction engineer was appointed several years after authorization and came on board and became domiciled in the office, another person came on board by the name of Dick Shunick, and he became the assistant. Ollie Lillard retired and Dick came on board, and he became the Assistant Project Manager.

Dick had worked in Contracts and Repayment Division in Washington, and was a skilled negotiator, and the principal reason he came to Phoenix as the Assistant ~~Area~~ [Project] Manager was to develop the master repayment contract with the Central Arizona Water Conservation District.

Dick Shunick is Assistant Project Manager

So it was like -- I guess my view of Cliff, I don't have a lot of personal knowledge of this, but it was kind of like Cliff was an island unto himself, and even though he was, in title, the head of the office, in fact everybody in the office reported to somebody else, and then when he became the project manager, it was kind of like, well, he had two subordinates and neither one of those subordinates were necessarily his choice to be a subordinate. It was kind of like Dick Shunick was imposed on him and Andy Dolyniuk was imposed on him.

Andy Dolyniuk is Project Construction Engineer

Andy headed up with the construction side of the organization, the new construction organization, and Dick was now the assistant, but he headed up all of the contracts, repayment, operation, maintenance pieces of the puzzle. It was kind of like these two guys nominally had control of everything in those two areas, and Cliff was left without any centroid or any power base within the organization. I'm not sure when that exactly happened, I just know that Andy and Dick didn't show up until late '70, early '71 time period.

Storey: What kind of staff size would we have had about then?

Staffing in early 1970s in Project Office

Morton: I think we were still in the 120 orders of magnitude, but I don't recall any [increase] -- after authorization, I don't recall any wholesale departures. It was kind of like, "Oh, boy, we finally got this thing authorized. Now we're going to grow. Now things are going to blossom. We've got this construction."

There was a period there of about a year and a half, from September of '68 through June of '70, where there was little, if any, Federal money. In fact, we worked out a relationship with the state for CAP. There was little, if any, Federal money for CAP. We had a lot of these other ancillary planning studies that were funded federally. We used a lot of people on those, but we wanted to proceed to collect design data and begin the process that would lead to construction, and the state of Arizona put up, I think it was, $685,000 to fund us over that period of time.

Storey: What did we ultimately grow to in terms of staffing for Reclamation?

Staffing of the Phoenix Project Office in 1992

Morton: Oh, I think probably in fiscal year '92, we had about 640 FTEs and that was in terms of individuals and the movement of people back and forth and in and out of the organization, we probably had 685 positions on our rolls, 680 positions on our rolls that produced about 640 FTEs in that year.

Staffing in the Phoenix Area Office in Fiscal Year 1996

Storey: And where are we now?

Morton: Oh, we're down. We're going to hit about 320 FTEs for the year. I think today as we're talking, persons on board, probably about 315. We're over halfway through the year, but we're continuing on a decline and we're below what we will average for the year on FTEs.

Projected staffing for the Phoenix Area Office in 2000

Storey: What are the projections for where we're going to end up?

Morton: In anticipation that our program will be limited to the O&M and planning activities that we presently have in our budget, we'll probably bottom out at about 70 people in the year 2000 or 2001, if there's not some kind of consolidation that would take place, but if the status quo holds and what we have on the drawing boards for budget, it'll be in that order of magnitude, about 70.

Storey: '68, you became a planning officer? Is that the title?

Planning Officer for safety of dams study of Black Rock Dam, Zuñi, New Mexico

Morton: Yeah, and my first job, as I said, was doing a safety-of-dams planning job for the BIA at Zuni, New Mexico, which just was barely within our region.

Storey: What dam?

Morton: There's Black Rock Dam on the Zuni River and then there were two other dams, Bureau of Indian Affairs dams, small dams, very small dams, that had failed, Nutria 1 and Nutria 2, that were upstream of Black Rock, but Black Rock was a similar construction, for example, to Roosevelt Dam. It was a masonry dam, gravity, gravity masonry dam, situated immediately upstream from the town of Zuni, New Mexico, on the Zuni Indian Reservation.

BIA's concern was its proximity to the town of Zuni and that a potential -- it was at that time that many of the older dams -- I think Black Rock was built in 1913 through '15, it seems to me, something in that time frame, and, of course, the hydrologic design that went into the spillway, into sizing the spillway, was based on very limited amount of record in terms of runoff, and these smaller earthen dams, the Nutria dams upstream, had failed in '67 or '68, something like that, '67, I think, and so that gave concern to BIA.

In addition, the Black Rock Reservoir, as a result of the storms in '67, I guess, there had been severe erosion in the watershed. The sediment that was behind these two dams on the

Nutria River had also come down and deposited itself in the reservoir at Black Rock, so the reservoir capacity had been severely reduced as a result of sediment inflows both due to erosion, the watershed was not in very good condition, had been overgrazed for a number of years, and it was just a case that there had been no intense rainfall on the watershed for a number of years. I think it was '68. It might have been a year earlier, might have been '67. I'm sorry, it was either '67 or '66 that these storms occurred. Anyhow, they took out the two small dams and caused a lot of erosion in the watershed and, in turn, that had sedimented up the reservoir there at Black Rock.

So BIA was concerned. They had lost a lot of storage capacity in the reservoir, and now they had a history, at least one very severe flood in recent time that probably was at least equal to, if not exceeding, what had been designed into the spillway. So they were concerned that (a) the spillway would be overtopped, or (b) the storage capacity that was formerly there would not catch the antecedent conditions of any subsequent flood, and they would be subject to potential loss of the structure itself and resultant damage in the village or town of Zuni.

So they came to the Bureau and said, "We've budgeted some money. You do have some capability in the area of safety evaluation. Will you do us a study so we can take this information back to Congress and try and get Congress to authorize either the reconstruction of Black Rock Dam or the removal of sediment, or some measure that, in turn, will improve the risk situation that we've got here at Zuni?"

I worked on that program, was the planning coordinator for that program.

Storey: So that was the assignment?

Morton: That was the assignment. I was a planning officer on that program.

Storey: And as the planning officer, what did you have to do in order to meet the assignment?

Morton: I found all of a sudden that now I had to coordinate a whole lot of different activities, from budget activities to geologic investigations to determine the stability of the dam itself, to determine what the hydrology of the basin was, to determine what other risks there may have been out there, to formulate alternative measures, to coordinate with the Indian --

END SIDE 1, TAPE 2. APRIL 26, 1996.
BEGINNING SIDE 2, TAPE 2. APRIL 26, 1996.

Storey: You were saying you had to coordinate with a lot of groups, and two in particular were BIA and the Indians who didn't seem to talk to one another much.

Morton: No. We would meet in Albuquerque with the Bureau of Indian Affairs, and receive our charge from them. They, in fact, were paying for the study. My recollection, the total study ran about $240,000 for two fiscal years. Then we'd go to Zuni and we'd explain why we were there, why we had a drill crew taking core samples of the foundation of the dam, and why we had a survey party surveying the reservoir to determine how much volume there was remaining in the reservoir.

There were no topographic maps of the reservoir. Of course, it was a very easy job. The reservoir was dry. But we, nonetheless, had to create some topographic maps to determine the remaining storage capacity, and why our hydrologists were taking measurements in the basin so that they could figure out what kind of rainfall-runoff relationships they needed to impose on the theoretical storm that we were going to apply to the basin.

Storey: Why was it dry?

Morton: The Zuni River is an ephemeral stream and --

Storey: There hadn't been any water.

Morton: There hasn't been any rainfall. The Zuni River comes right off the Continental Divide, but at that location the Continental Divide near Grants, New Mexico, is probably 6,000, 7,000 feet high, so the normal snowpack is relatively meager during the winter.

For some reason we were in a dry sequence, so the rainfall was quite sparse. I think at Zuni itself, I think the average precipitation is on the order of 12 or 13 inches a year, but the watershed just does not produce a lot of runoff, so the reservoir was dry.

We were looking at two different scenarios from the safety-of-dams perspective. What was the stability of the dam? Was the dam in reasonably good, sound condition? It <u>did not</u> look very sound just from a cursory external view. It tended to be overgrown, salt cedars and creosote and various other vegetation growing in the dam.

It just really didn't give you the impression that it was a well-maintained dam, and I think that is probably the case, knowing the limited funds that the Bureau of Indian Affairs had to operate on on irrigation structures over the years. From an external viewpoint, it probably looked worse than it was. In fact, the geology reports from the core drilling would indicate that it was still a pretty sound dam, but we didn't know that without doing a little geologic investigation of the structure.

So we did that. We surveyed the reservoir to establish a elevation capacity relationship for the remaining storage in the reservoir. Had the hydrologists construct both what we would call probable maximum flood, which is the flood that we test the stability of the structure with, as well as several frequently types of floods, 25-, 50-, and 100-year frequency floods. So the hydrologists had to investigate the basin to determine what the runoff characteristics were, what the relative slopes were in the upper basin versus lower basin.

We found that there was another private dam at Ramah which was about twenty-five miles upstream, that was really in a very precarious position. In fact, our hydrologic analysis for the flood that we imposed on the basin assumed that under 100-year flood conditions, the Ramah Dam would fail, and the volume of water that was stored in that dam would be contributory to the runoff that would come down to Black Rock, but we had no control. That was a private irrigation dam, and it was under control or jurisdiction of the state engineer in New Mexico, so we advised the state engineer of our findings in our report, but, nonetheless, we could not assume that under those kinds of conditions that the dam would remain in place.

Storey: Why would we study that dam?

Morton: The Ramah Dam?

Storey: Yes.

Morton: Well, we didn't really study it. It was in the middle of our runoff computation, and we had to make some assumptions with regard to it. We got the approval of the owners of the dam to -- we didn't study it in the context of we drilled it out or anything like that, but the people who were developing the flood hydrology looked at the inspection records that were in the state engineer's office, walked the dam crest, looked at the toe of the dam, looked at the obvious signs of distress in the dam, and concluded that the reasonable assumption would be that under certain flow conditions the dam itself would fail, and the 7,000 acre-feet of storage that was contained in that dam when it failed would contribute to the runoff of the basin under those storm conditions. So there was another 7,000 acre-feet that was added into the calculations.

It was an earth dam, and the conclusion was that it would be somewhat of a catastrophic failure and the dam would wash out in a matter of several hours, so the volume of water would be released quite suddenly rather than seeping out over a period of time, and, in fact, it would be a catastrophic failure.

So all of that was combined into the analysis to determine what happens at Black Rock under these four conditions: 25-, 50-, 100-year frequency floods as well as the PMF, probable maximum flood. Then, in turn, all of that information was combined into a report that -- and then we did a little cost estimate to say that here are some potential alternatives, and we looked at a modification of the spillway, an enlarged spillway, and dredging the reservoir. Actually, since the reservoir was dry most of the time, it was not a dredge, it was a loader operation, like a borrow pit, where you would remove the sediment with loaders.

Then we developed some costs for those two potential methods of solving the problem. In fact, increasing the volume of storage in the reservoir really didn't do anything. The runoff that even the 50-year flood produced was far in excess of any reasonable capacity that you could generate in that reservoir. I think the volume of runoff was about 16,000 acre-feet under a 50-year frequency, and under the probable maximum flood it was 60,000 cubic feet per second. I remember 100,000 acre-feet or something like that.

The reservoir had 2,000 acre-feet of active capacity, and to move another 2,000 acre-feet of this recently deposited sediment was prohibitively expensive, as compared to expanding the spillway capacity. Now, expanding the spillway capacity faced problems with the town, because the town had encroached on the channel, the channel had been overgrown. The village of Zuni was situated when the Spanish came to New Mexico in the 1540s, I think, so I mean, the community had existed for 400 years, I guess, at that site, and had tended to encroach on the channel.

So if you changed the spillway configuration, you were just opening yourself up to a downstream problem through town, but that was another follow-on study to what we did. Our whole focus was on dam safety and was there a dam safety problem, and we concluded, yeah, there was potential for a big dam safety problem.

Storey: Did we make any recommendations?

Morton: Well, I guess the bottom-line recommendation was that, "Here are two more problems and you need to address those, Bureau of Indian Affairs. The problem is that your dam is going to be overtopped under 50-year flood inflow conditions. The only reasonable solution from a cost perspective is to provide additional spillway capacity so the dam is not overtopped, but the bottom line is, if you get this theoretical 50-year flood, half the village of Zuni is going to wash away, and you need to deal with it. We've dealt with your dam safety problem, identified what your dam safety problem is. You need to deal with the other problem, which is the development of the town of Zuni and the flood aspects there."

Storey: How would you characterize working with BIA? What was it like? Was it good, bad, indifferent, easy, hard?

Morton: Well, it was really my first experience. No, that's not true. As part of the Central Arizona Project, I had worked with the San Carlos Indian Irrigation Project and Salt River Pima Maricopa community in developing their piece of the Central Arizona Project. But it was the first opportunity I had on kind of an independent basis to deal with the Bureau of Indian Affairs, because I was the principal investigator, the study leader, the study manager, whatever title was appropriate.

I guess I was responsible for making decisions relative to how to fund it, how to approach the study, and operated somewhat independently, because it was my program. I guess I was not terribly impressed by BIA's either technical expertise nor their business practices, but it was obvious that they had a real significant concern and they were interested in preserving the culture and the people there at Zuni. They wanted to make sure that we could come up with a plan, or they could come up with a plan, that would assist people in the community who had a need. But I don't think they ever went to the community and explained that.

So their budget process, their business practices, they knew they had a problem, they just didn't know how to deal with it, so they came to us to act as their consultant. I think that was good. They knew they had a problem and they wanted to resolve the problem, and they wanted to do it in a manner that didn't adversely affect the community if at all possible. They were humanists, if you will. The agency was very humanistic in their approach, but the technical parts and the business-financial parts of their operation was in shambles compared to what I was familiar with, with Reclamation. I guess that's how I'd have to describe it.

Storey: Same question dealing with the Indians.

Morton: The tribal organization was just -- no, the Indian Self-Determination Act was years down the road. But they had a governor, they had a council, they had a business manager, and there was an agency superintendent there. They were moving away from the agency superintendency role and assuming more and more of the responsibilities that now under self-determination are pretty much embodied in the current community structure at most Indian communities today.

But at that time, this was all pretty new stuff, and it seemed like most of their programs were social programs. They were focusing on social programs at that time, and their business manager, his responsibility was primarily in the social arena.

I remember very clearly the first place we went to meet with the community elders was at the CAP office. I said, "You've got a CAP office? What is this?"

"It's the Community Action Program Office." They had a preschool and a day-care center. But this was the thing that they were focusing on, were education, social programs for the elderly, this kind of thing.

And when you started talking about, "Well, what about water supply? What about irrigation? What about safety of dams?" they had no real concept or interest. They had obviously seen the ravages of floods. Two of the smaller dams had washed out on the reservation. They knew about that. But it was like, "Those are secondary. We'll deal with them when they happen. They're not a day-to-day concern. Once every 25 years, once every 100 years, it rains or we have a significant amount of snowfall and watershed and the water runs off. We don't have the desire to deal with those issues on a day-to-day basis. We've got real hard issues today. We've got health care, we've got the young people who need to be educated, and that's all we've got time to deal with or the resources to deal with," I guess, time being a resource.

I'd have to say that that was a real viable approach. If you're faced with limited resources, you have to put it where it produces the most in a short period of time, and I think that focusing on health care and the elderly and the young people and education and things like that, was probably to their best interests, and they knew that. That's what they were doing.

So we'd go and talk to them and explain what the scope of study was and so on, and they'd say, "Well, we'd rather that BIA spent the money to do some improvement in the social arena here in our community, but we understand BIA has these other responsibilities, and if they have to go do that, fine. What do you want from us?"

"Well, we'd like somebody to employ somebody as a laborer to drive the water truck to the drill rig."

"Oh, no problem. We've got a water truck. We've got this individual that's available to work with you."

So we had some relationships concerning employment and that type of thing, but they kind of just put up with us and said, "Go ahead and do the work."

Storey: Running a project like that, were you out there quite often, or was it mostly an in-office job?

Morton: I usually got there about two or three days -- oh, every three or four weeks I'd leave here on Monday and drive up there and make sure the operation was progressing satisfactorily and so on. Every four or five months I'd go into Albuquerque and meet with the -- what did we call them -- area director. I think that's what it was. The Assistant Area Director. Meet with the Assistant Area Director for resources and give him an update on the status of the work. I'd fly to Albuquerque. But air travel wasn't all that good at that time to Gallup, and you had to drive another fifty miles to Zuni anyhow, so it was just as easy to drive from here to Zuni.

Storey: What kind of a drive is that?

Morton: Oh, it's a six-and-a-half, seven-hour drive. It's a pretty good drive. But I live in the east part of Phoenix, the metropolitan area of Tempe, so I'd leave early in the morning and I'd be up there by noon, spend the afternoon with the drill crew or the geologist or whoever was there working on collecting data, visit with the surveyors who were doing the topog[raphic] survey in the reservoir area, stop in, visit the business manager for the community or, on occasion, the governor, explain to him how things were going.

When the issue came up about Ramah, I went up to the irrigation company up there at Ramah and sat down with two members of their board and explained what we were going to do, and hopefully that they wouldn't object to us at least looking at the dam, because it potentially would affect the downstream. I think that there was some concern we were going to blow the whistle on them with the state engineer or get some kind of sanctions [so] that they'd have to repair the dam. I tried to gloss over that, if you will, trying to make sure that they understood that our role was not to in any way subject them to outside sanction.

Storey: How about the state engineer? Was he in this process at all?

Morton: No. The only commitment we had to the state engineer is we would furnish him a copy of our report once it was done, and it had a couple of paragraphs in there about our assumptions with regard to the dam at Ramah, but that didn't get into any detail about the structural integrity of it or not.

The Black Rock Dam, of course, was a Federal dam and the state engineer didn't have jurisdiction there.

Storey: Well, I'd like to keep going, but we've used up our two hours again, very profitably, I have to add, I think. So I'd like to ask you if you're willing for the information on these cassettes and the resulting transcripts to be used by researchers.

Morton: I'd be very happy to, yes.

Storey: Good. Thank you very much.

Morton: Thank you.

END SIDE 2, TAPE 2. APRIL 26, 1996.

BEGIN SIDE 1, TAPE 1. MAY 20, 1996.

Storey: This is Brit Allan Storey, Senior Historian of the Bureau of Reclamation, interviewing Larry Morton, the Assistant Area Manager of the Phoenix area office, in the Phoenix area office on May the 20th, 1996, at about one o'clock in the afternoon. This is tape one.

Mr. Morton, one of the things that has come up since we talked last is that there was evidently a model that Reclamation did of the Grand Canyon and the effects of Bridge and Marble Canyon and the rest of Reclamation's projects. Do you know anything about that, by chance?

Model showing effect of Bridge and Marble Canyon Dams on the Grand Canyon

Morton: Yes, I had the opportunity in about 1965-66 time frame to serve as a public information person associated with the model, kind of a guide, explaining the ramifications of Bridge and Marble Canyon and its relationships to the Grand Canyon. To the best of my recollection, the model was built in response to Commissioner Dominy's request as a result of the hearings on the authorization of the Central Arizona Project and the Pacific Southwest Water Plan in 1965.

There was a lot of objection to building dams in the Grand Canyon, and Commissioner Dominy asked that the laboratory, the shops in the lab in Denver, construct a model suitable for public viewing to demonstrate that neither Bridge nor Marble Canyon would "flood the Grand Canyon." During those public hearings that were held in Washington concerning Bridge and Marble Canyon, there were full-page ads taken out by the National Audubon Society in the *New York Times* that stated that the Grand Canyon would be flooded as a result of constructing either of those two dams.

A fairly large topographic model, I would guess something on the order of 30 feet in length and 20 feet in width, was built. It consisted of about, I'm guessing now, but ten to twelve tables about three-foot-by-six-foot in size, each with a portion of the Grand Canyon topographically displayed on it. The tables bolted together from the underside, and a person could walk around and actually see the course of the river from Glen Canyon downstream to the headwaters of Lake Mead. Within the topography that was illustrated by that model, a very narrow ribbon of water could be observed, or painted water that represented the water, and an insert could be placed in or out of the model to demonstrate the effect that would result from the construction of either Marble Canyon or Bridge Canyon.

So Bridge Canyon had a height roughly of 600 feet, so you could actually see that depth in the canyon. Of course, the canyon at that location is about 6,000 foot, so 600 feet and 6,000 feet, the comparison could be drawn immediately that, no, you weren't flooding out the Grand Canyon. I think it served the Commissioner's intent very well.

The model was designed to travel around. You could put it in a U-Haul van and haul it around, these separate tables. I believe, I was not in Washington at the time, but I'm told that it, during some of the hearings, was actually located in the Capitol, had been set up in the Capitol so that the congressmen and senators could observe for their own edification what the effect of Bridge and Marble were, or could have been.

Then here in Arizona, since the dams would have been constructed, had they been constructed, would have been constructed in Arizona, various types of activities that were going on, for example, National Reclamation

Association, I think we had an annual meeting or a committee meeting here in town, we put it up in the ballroom at the old Adams Hotel.

We also had it at the State Fair, and when it would come to the State Fair, various people on the Phoenix Development Office staff would volunteer to be guides, and that's how I got involved. It was an opportunity to hand out literature, explain to the public, who were looking at the model, what it entailed, what it was to represent and so on. So I think I was at at least two State Fairs with the model. It was a pretty effective tool for demonstrating what could occur in the Grand Canyon had those dams been built.

Storey: What kinds of comments were you getting?

Morton: Generally, I think people were more impressed by observing the Grand Canyon in a model sense rather than what the dams were all about. The north rim of the Grand Canyon, for example, is about 2- or 3,000 foot higher than the south rim, and I don't know that people are really aware of that. But it could be very easily seen from the model, and people would come up and look at the canyon and marvel at all the rock formations that the model-makers had made and the fact that the north side was higher than the south side. They would get around to asking you, well, "What is this supposed to represent?" and you tell them Bridge and Marble Canyon.

Well, they either had one view or another of Bridge or Marble Canyon. If they tended to be maybe developmental in nature, they'd say, "Oh, there's a good way to get some cheap hydroelectric power," or, "It will lower my power rates, won't it?" Those [were the] kind of comments that you'd hear. The people who, perhaps, were more familiar with the natural aspects of the Grand

Canyon and maybe had an environmental concern associated with it, they were more concerned with how it would affect river rafting or fishing or adversely affect the scenic view from the rim. So their comments would tend to be, "Well, I certainly don't want to see the Grand Canyon flooded," was their attitude.

Storey: How long was it [the model] around?

Morton: Well, as far as the CAP and the thrust to build Bridge and Marble Canyon, I think its utility, probably by 1967, was probably done. I mean, it no longer had any utility by that time. At least pieces of it, if I remember right, actually were set up in Building 56 in Denver for a couple of years after that, just because it was being stored there and was something that the model-makers in the Denver lab were very proud of. It kind of retired to that location. But I think probably late '65 through early '67 was the extent of its real utility.

Tucson Planning Conference in 1970

Storey: I appreciate it. I guess we had talked about the Tucson Planning Conference in '70, was it?

Morton: I believe that's right.

Prescott Project implemented as a result of Tucson Planning Conference

Storey: You were beginning to be the Planning Officer on the Prescott Project about that time, I think, and I was wondering what kind of effects there were there and tell me about the Prescott Project, also.

Morton: Well, Prescott at that time, here in Arizona, was a small town of about thirteen to 15,000 people and relied primarily on groundwater with some minor surface water from the Lower Lynx Lake, I think it's called. The town is a very nice climate and is well known for its educational facilities, its recreational facilities and so on, so it was becoming the new retirement community of central or northern Arizona, and they were running out of water, was about the size of it.

Reconnaissance studies along the Mogollon Rim in the late 1960s

During the late sixties, mid to late sixties, we did a--"we," the Phoenix Development Office -- did a number of reconnaissance studies along what's known as the Mogollon Rim from Kingman on the west to Springerville on the east. There are many communities along the Mogollon Rim, including Flagstaff and Williams and Ash Fork and Winslow and Holbrook and Black River and Springerville and St. John's and Prescott. And we looked at each of those, surveyed their needs, tried to assess what opportunities there were for additional water supply, tried to develop some scale of economic cost to provide water from those available sources.

Following the 1970 planning conference, Reclamation concluded that it could no longer rely solely on benefit-cost ratio, national economic development terms, to justify project needs. It was about that same time, of course, that the National Environmental Policy Act came into being. It became evident that regional economics had to be evaluated, environmental issues needed to be considered, social well-being as a function needed to be looked at. The Bureau concluded that involving the public at the earliest stages was also essential.

I think, generally, prior to that, Reclamation had a constituency, a traditional constituency, whether it was the National Reclamation Association, whether it was Chambers of Commerce, whether it was state legislatures or state water resource agencies, but there was a fixed clientele there that Reclamation generally dealt with. And as a result of the '70 planning conference, the expansion to consider input from the very broadest spectrum of public input kind of came into being, I think.

I was not the planning officer on that job, but what we concluded was, as a result of the guidance we were getting, to change our method of evaluation was to focus on one project per region to test out the new procedures. A fellow by the name of Ron Wilhite was the planning officer for this test case, if you will, and for some reason I became the economist. As you know, I was a civil engineer, but they needed somebody who knew something about economics and knew something about Prescott and the inner workings of Prescott's economic situation, not that I knew all that much about it, but I volunteered to serve on the team, and they didn't have an economist and I was probably the junior person, so they made me the economist.

So it was kind of a unique opportunity. I got to look into the economic aspects of Prescott's economy, if you will. I found out that while there was a lot of talk about the use of Prescott as a retirement community, at that time we found that most of the economic activity in Prescott was associated with the cattle industry and with tourism, but that in all likelihood, retirement was not a big input into the region's economy. Today that's probably changed quite a bit. There are a lot of retired people that live in Prescott, and I think that the Department of Economic Security's forecasts were probably well founded. But at that moment in time, 1970, I think in terms of economic activity, retirement was probably about sixth on the list, if I remember right.

But we evaluated several sources of water. The only source of water that really produced the volumes that were anticipated to be needed was on the Verde River, it's about forty miles away from Prescott. We examined a plan that would pump water from the shallow aquifer of the Verde River, put well points down in the Verde River basin and pump the water into Prescott to be treated in Prescott. The plan would have consisted of the well points there in the basin, a pumping plant, about thirty miles of pipeline and a water treatment plant and then the connection to the existing water supply system for the city of Prescott.

I don't remember the cost anymore, but from a pure economic perspective, total national economic development costs, the costs exceeded the benefits, I do recall that. Under our traditional planning procedures, it would not have stood the test, the economic test of viability.

We examined some of the other opportunities. Obviously having a larger water supply increased the local economic benefits, which at that time we called regional economic benefits, so there was a very positive aspect in the regional economic account. The social account, if I remember, was also benefitted as a result of bringing that additional water supply in, primarily because of improved infrastructure, better living conditions, broader spectrum and diversity of population. The environmental impacts were rather extensive, generally adverse. We were removing water from a flowing stream. Subsequently, as a result of later legislation, that stream became a wild and scenic river. So you could understand its importance in that category, but we didn't know it was a wild and scenic river because that hadn't been defined for us at that moment in time. But just to give you a perspective of what the Verde's like.

The Verde does form the southern boundary of a wilderness area, so it had wilderness values, at least downstream from the point of diversion. And today it's the home of several endangered fish species, so while we didn't have the Endangered Species Act in 1970, we did know that the reduction in flow would have an adverse effect on some of the fishery resources, but we didn't have the forethought to identify those as threatened or endangered in 1970. But subsequently had we proceeded along those lines, we would have had an adverse effect on an endangered species, several endangered species.

So we produced a report that recommended no action because it was kind of a push, two categories that was a plus and two categories that was a minus and the procedures had yet to be developed. This was just merely an experimental test case to prove out our proposed planning process. In all likelihood, twenty years later or so, the city of Prescott adopted a similar plan as their plan to take and use CAP water through a downstream exchange, and Reclamation concluded that that was not an acceptable plan and we would not fund that plan through our loan program. So I think the bottom line result we proved out.

Storey: This was in the nineties?

Morton: Yeah, late eighties, early nineties, yeah. Prescott has subsequently transferred, reassigned their CAP contract, their Central Arizona Project Water contract, to the city of Scottsdale. The development companies in Scottsdale have paid the city of Prescott, and I'm not sure of the exact sum, something on the order of $5 million, I think, for their contract entitlements. The city of Prescott will have to find other sources of water other than CAP to fulfil their future needs.

Scottsdale buys Prescott's CAP entitlement

Storey: That's ninety miles or so from here?

Morton: That's about right, about ninety miles, yeah.

Storey: So they didn't want to pump it?

Morton: Well, that's a long way to pump it when you're paying the electric bill and you've got to go uphill about 4,000 feet roughly, 3,000 feet or 3,500 feet.

Storey: So that's the significance of the Mogollon Rim?

Morton: Yeah.

Storey: You have this big topographic rise.

Morton: Right.

Storey: And I presume a climatic change, then, or a vegetation change?

Morton: Oh, all of that, yeah.

Storey: I've never been up in that area.

Morton: Prescott is right on the divide between the pines and the chaparral, and it's a very beautiful part of the country. It's right in the rocks, it's not perhaps as scenic as Sedona, for example, but it's a beautiful setting. The higher hills and mountains around Prescott are Ponderosa pine, right in town it's oak and cottonwood willow.

Storey: So it's going to be cooler there.

Morton: It's a year-round climate. They have some snow. It's right at 5,200 foot elevation, very similar to Denver.

Storey: In this study that you all were doing, you only studied the Prescott needs?

Morton: What we were asked to do, each region, Reclamation at that time had seven regions, each regional planning officer was directed to nominate one project that had at least gone through what we called at that time a reconnaissance evaluation. Select one reconnaissance grade study and evaluate it at what now we would call feasibility grade standards, but rather than just do it based on traditional national economic development principles, evaluate it for a series of accounts. I think at that time there were four accounts that we looked at: the environmental account, the national economic development account, the social well-being account, and the regional economic development account. So there were four.

Each region studies one project using new evaluation criteria

Storey: Were you coming up with a formula?

Morton: I think the intent was to see if we were covering the full range of evaluative factors that you would want to present to Congress and present to the public to get buy-in for a future Reclamation project. In fact, that effort moved forward into what the Water Resources Council ultimately called principles and standards for planning water and related land resource projects. I think I got that right. But this ultimately culminated in I guess now what they call in principles and guidelines. At that time they were much broader, and they called them principals and standards, and there was a -- I hesitate to call it a cookbook, but that's kind of what it was. It laid out every category and every activity that you needed to report on, and gave the planning peoplequantitative and qualitative measures to evaluate individual projects against.

Shifting from a pure benefit-cost ratio approach to project evaluation

For example, within Reclamation we could take a project to Congress and say, "This is the best of what we have today to seek for authorization." In other words, you could compare across any region or across any problems and needs. You could compare and present your information both in quantitative and qualitative terms to Congress so that Congress could make the decision on whether this project should be built or not. I think prior to that time you just had a B-C ratio, which really didn't tell you a whole lot. It just said if I invest a dollar, I'm getting more than a dollar back in benefits.

Storey: The benefit-cost ratio?

Morton: The benefit-cost ratio. But it didn't tell you whether you had to invest $100 million or $10 million to get that dollar and a nickel or dollar and a dime or two dollars or whatever it was. You know, there was the order of magnitude of costs and there were a whole lot of other things that might make that undertaking inadvisable or against the policy of the government or against the direction that the government wanted to go. You really didn't know, because you looked at things like, here's problems and needs for the area, here's a series of alternative solutions, here's the best solution amongst that series of alternatives. But it was only best because it had the best B-C ratio. None of the other potential concerns or interests of the decision-maker were explored in that form of analysis.

Storey: Let's see if I'm understanding what I think I heard. Reclamation had a planning conference in Tucson, and, among other things, they said "just relying on the benefit-cost ratio is inadequate, we need to factor in these other things." Somewhere along the way, the Water Resources Council became involved, and this evolved into a national policy movement for water. Is that what I'm hearing?

Morton: That's pretty much it. If I remember right, the Water Resources Council was authorized as part of the Colorado River Basin Project Act in 1968, and they were appointed, if I remember right, by the President with the concurrence of the Senate. And they hired some staff, and more than likely there was a lot of interplay between the council staff and Reclamation's senior planning staff, but I think that there was feedback between those two entities that basically said, "This is the way we think we want to go, but we're not prepared to put this into policy yet. It's not going to become the policy of the country to evaluate water resources and associated land resources until we have a better feel for this potential procedure. Why don't you guys in the Bureau of Reclamation give it a try? Why don't you do a little groundwork for the Water Resources Council to see if in fact this makes sense? Is it something we can do? Does it cover all the bases? Does it give the decision-maker a full range of factors to base his decision on?"

I think that was the guidance that came through Reclamation. Why they chose Reclamation as opposed to the Corps of Engineers or the Tennessee Valley Authority or somebody else, some other agency within the government, I don't know.

But we did these test projects, if you will, one for each region, and I think it was probably both the Council on Environmental Quality and the Water Resources Council were kind of working together at that same time and they both promulgated their procedures in the *Federal Register* about the same time so . . .

END OF SIDE 1, TAPE 1. MAY 20, 1996.
BEGIN SIDE 2, TAPE 1. MAY 20, 1996.

Storey: You were saying that the regs at both CEQ and the Water Resources Council came out about the same time.

Morton: I think they were trying to produce procedures and regulations that were consistent, and neither of those two entities of and by themselves had written an environmental impact statement (EIS) or done a planning report, and so they were looking for a Federal agency to be a guinea pig, if you will, and test the procedures that were going to be adopted. I think that's what we kind of did in the Prescott Project, was test the procedures that had yet to be put on paper. We were just formulating those procedures as we went along.

Prescott study was designed to test new environmental statement procedures

Storey: The CEQ's regs that you're referring to are for the National Environmental Policy Act, I presume?

Morton: That's right.

Storey: Critics of Reclamation might likely jump to the conclusion that Reclamation was trying to get around the cost-benefit ratio by saying it wasn't so important so that they could implement projects that weren't as "good projects." How would you respond to that kind of thinking?

Morton: Well, to be a good project doesn't necessarily mean you get a dollar of economic return for every dollar invested. The Federal government invests a lot of money in activities that don't produce a dollar of benefit that you can define as a dollar of benefit, but it may do other things that are very good and needed for the country. I mean, an example might be welfare. Does welfare produce a dollar's worth of benefit for every dollar that's spent on welfare? I think most economists will tell you no way will that occur. But does it produce social well-being? Well, we hope that it does. I mean, that's the cornerstone of the welfare program is that it produces health and benefits like education and so on, provides a way of life for people who don't have the economic means to provide it for themselves.

So I think Reclamation came to the realization, as did the Congress, as did various executive commissions at that time, that just because it was good economically didn't necessarily make it something you want to implement, or vice versa. Just because it was "bad economically," it didn't produce a dollar's worth of benefit for every dollar invested; just because it didn't do that didn't mean that it was bad for the country. If there were other overriding social or environmental concerns that the program or project produced in the way of benefits that couldn't be claimed as economic benefits, that made it something you wanted to implement.

Many things like, for example, that are associated with endangered species, it's very difficult to try and put a dollar value on the loss of a species or for, vice versa, the preservation of a species. But it may be something that the country at large demands, save that species at all costs. Well, you can go and spend a lot of money and yet nobody will be able to define that you've created a benefit that will offset that cost.

So personally I think that just relying solely on a benefit-cost ratio as the only measure to make a decision whether you build a water resource project or not is probably an error. The water resource project is so complex, generally speaking, and serves so many competing functions that you need to evaluate each of those functions, and if you can't put them in quantitative terms, then you need to describe them for the decision-maker in some qualitative terms. I think that was the direction that we were given as a result of the bureauwide planning conference back in '70 and the direction that the Water Resources Council eventually implemented in the principles and standards.

Storey: Now, all of this would be complicated by the fact that Reclamation projects had originally been intended to be reimbursable. How would you respond to that?

Well, but now wait a minute, in effect I'm asking the question from outside, right? Wait a minute. What you're saying to me is that you don't want the costs reimbursed to the Federal government.

How changing the criteria for evaluation of new Reclamation projects affected repayment approaches

Morton: No. I think that some costs should be reimbursed to the Federal government. I mean, that's the cornerstone of Reclamation. Certainly, where the costs entailed benefits to the nation at large, they should probably be non-reimbursable. But to the extent that the benefits flow specifically to one segment of the economy, then that segment of the economy should be willing to reimburse that expenditure of funds by the United States.

I think that's traditionally been our method or procedure, is that things of national economic benefit, like navigation or like flood control, are non-reimbursable. Things that benefit a small segment of the economy, local domestic water supply, an irrigation project that benefits a limited number of farmers, 10, 50, 500 farmers, they should be willing to pay for that.

When you deal with the economics of the situation, that's another test that also needs to be illustrated for the decision-maker, is that those people or those entities that receive this measurable benefit need to have the ability to repay the costs associated with those benefits. So the finances also enters into that process. But a local entity shouldn't be burdened with the national policy of protecting an endangered species or protecting a national historic landmark to the extent that we need to provide protection for cultural resources or endangered species or scenic beauty. It's a national goal, yeah, we should be prepared to accept that cost as part of our national responsibility.

Storey: I think I see here the seeds of a couple of different kinds of things that I'm really interested in. One would be that there had to be a dialogue, a discussion, a debate, whatever you want to call it, going on about how you allocate costs and to whom and to what and so on. Were you beginning to see a dialogue like that at that time?

Morton: Well, at my level, we were dealing with relatively minor aspects of a cost allocation. Certainly, there's any number of ways to allocate costs and through that allocation make certain costs reimbursable or non-reimbursable. I guess from my perspective, I think I was probably a GS-12 planning officer, erstwhile economist, sometime engineer, it became more of a number-crunching process rather than a broad philosophical argument on whether we should or shouldn't pay, and if we did, who should be the recipient, who should be the benefactor, were there other mechanisms of a very broad nature that could be brought to bear to make up any inability of the direct beneficiary to pay. Those all came about, certainly, as a result within the context of the Central Arizona Project.

Arizona passes an ad valorem tax in support of CAP

Those all were debated leading up to the time we actually entered into a master payment contract for CAP. The state of Arizona saw those types of debates, concluded that if we went forward, if the state went forward to implement CAP, they were going to have to come up with some additional monies, because all formulations of reimbursement for CAP demonstrated that there was not enough revenue, surplus revenue, available to take care of the obligation that the state was going to undertake.

So the state, in its wisdom, implemented an ad valorem tax, authorized the legal subdivision of the state, the Central Arizona Water Conservation District, to levy a tax to make up the deficiencies that could not be borne by the direct beneficiaries. There just wasn't enough income, enough repayment capability within the direct beneficiaries to pay out the Central Arizona Project, and so the state legislature did authorize CAWCD to levy a property tax.

Storey: But that's, I believe, only in three counties.

Morton: Well, CAWCD only exists in three counties. Other counties could join if they elected to.

Storey: So it isn't statewide?

Morton: No, it's just in three counties. The CAWCD is a municipal entity of the state, but it was only represented in three counties.

Storey: Another topic that I'd be interested in and I suspect is being planted in here has to do with the fact that Reclamation is a big bureaucracy. It's also a very traditional bureaucracy, I think, in my experience and traditionally has expected things to move from the top down. There's a lot of inertia in a big bureaucracy like that, generally.

Right at this period of time we're beginning to have a lot of changes in the way the country looked at Reclamation and the way it was doing business and its business. It begun, I believe, with Wild and Scenic Rivers Act, National Historic Preservation Act, National Environmental Policy Act, and then a whole slew of things as you get --

Morton: Endangered Species Act, Clean Water --

Storey: -- Endangered Species, Clean Water, Clean Air and so on and so on and so on. What did you see happening in Reclamation as these things came in and began to affect Reclamation's projects and its planning and its construction activities and so on and so on?

How Reclamation reacted to environmental legislation beginning in the 1960s

Morton: Well, as we talked earlier at the planning conference, one of the objectives of the conference was to "streamline" the process of planning. It became evident that if Reclamation was going to exist in its former traditional role, we couldn't wait from 1940 to 1968 to get new projects authorized as took place with the Central Arizona Project. It was a gleam in someone's eyes in 1944, and it wasn't authorized 'til 1968, and if we had to wait for twenty-four more years for the next big Bureau project, the Bureau was going to cease to exist. I mean, that was the general philosophy in that era.

Tuscon Planning Conference hoped to streamline Reclamation planning

So I think that the focus of the planning conference was to provide more information to the decision-maker, to ensure that there was a full buy-off early on in the planning process by greater public involvement, greater public participation, to make sure that we didn't hit these stumbling blocks like we did in the case of CAP in 1950 when it was introduced in the House, and the House said, "Don't come back with a bill until you've got your water rights established." If we'd have know that was part of the process, we'd never have taken a bill to the House in 1950, or in 1965 when we took a bill to the House and it had Bridge or Marble Canyon as part of the project and find out that, "No, another dam in the Grand Canyon between Glen Canyon and Hoover is not acceptable. Find some other mechanism to provide pumping power."

If we'd had broader public participation, undoubtedly we would have known that, and our planning would have not taken us in those directions, hopefully. I mean, as you said, we had top-down guidance and we were a very somewhat autocratic organization. Maybe our leadership would have taken us in the wrong direction, too, but at least our leadership would have known in advance that we had a public perception problem to deal with and that we were going to have to gain some broader consensus on these kinds of issues.

So I guess I would say that our focus at that time needed to change, but we were kind of hide-bound. We were a big organization, big bureaucracies don't move very rapidly, and as a result of that it probably was another, I don't know, five or six or more years, probably with the Carter Administration, that we finally woke up to the fact that times had changed and perhaps we were behind the times, so to speak. Of course, that's another story with the "hit list" and President Carter and Secretary Andrus and Commissioner Higginson.

Storey: I think that pretty directly affected CAP.

Morton: Yeah. Yeah, it had a big impact.

Storey: So we'll get into that a little later I think.

Morton: We'll get to that later. But I guess to answer your question, from my perspective we kind of hung on by our fingernails, and various parts of the organization were unwilling to change and other parts of the organization could see the handwriting on the wall, tried to change.

Reclamation develops environmental specialists in its structure

We implemented one of our first multi-specialist organizations at that time in Denver under Wally Christianson. We had an economist, we had a social factors analyst, we had a public relations person, a public affairs person on that staff. They did some very good work, but none of it came to fruition, but it did demonstrate that there were forward-thinkers within Reclamation and they could see the handwriting on the wall.

I think that the other parts of Reclamation kind of dug their heels in and said, "Well, this is all fine and nice, but we're not going to change right away." It was probably 1977 and the Carter Administration that woke them up to reality.

Storey: If you think back on this, would you say that the upper-level managers tended to be more forward-looking than the rank and file of Reclamation staff? What would your impression be?

Morton: My impression was that there were some "upper level" managers willing to make the changes. When I sit here and think about Wally Christianson and Bill Klostermeyer and Yogi Schaefer and George Wallen, they were willing to do that. Wally was the area manager over at San Bernardino and he moved into Denver to head up that group. He brought one of the first multidisciplinary staffs into being. They all, I think, worked together real well at that time, in the early seventies. They formulated a lot of good projects, developed the inventory of Western Water Resources Projects that was mandated by the Colorado River Basin Project Act, but from a practical sense, didn't really produce an implementable project that could be constructed.

They tended to provide guidance primarily to the rest of the organization. They were our cookbook. They showed us how to really deal with these broader issues. They developed more definitive procedures than the Water Resources Council guidelines gave us. The guidelines were a framework, and they fleshed it out and gave us the tools. Dr. Darrell -- who was the social --

Storey: Darrell Adams?

Morton: -- Adams, yes, Dr. Adams, he was with that group in the social arena.

Storey: They brought him over, I believe, from the University of Denver.

Morton: Yeah. So that was the first true multidisciplinary team, and now, even though it's twenty-four years later probably, twenty-five years later, now it's the way of doing business. I mean, you're not dominated by a bunch of civil engineers anymore. I mean, you have economists; you have biologists; you have sociologists; you have social factors analysts; you have public involvement specialists; you have people skilled in developing consensus and facilitating meetings, and that's a way of life. But it demonstrates that it's a long time to either slow inertia or pick inertia up. It just tends to move at its own speed, and I think Reclamation was definitely one of those kind of organizations. It had a fine history, it had an admirable history, but when it was time to change, it took a long time for us to change.

Storey: Where did the changes take place? At one level, at all levels?

Morton: No, I think it was pockets, a pocket here, a pocket there, and eventually the pockets grew. I guess I didn't have a whole lot of experience with the Washington office, we still had assistant commissioners in Washington at that time, and I didn't see a lot of change, but neither did I see that level of the organization on a day-to-day basis. But within just the Phoenix Development Office and the Arizona Projects Office here in Phoenix, it was difficult to make the changes.

I think the only reason I served on this trial program with Prescott, the Prescott Project, I think the only reason I was there as an economist was the fact that the other economists didn't want to do it. I mean, we had a branch or a section of economists, we had six economists on staff at that time, and one of them went on to become a regional director, and when they were asked to serve they all said, no, they weren't interested in serving. They couldn't see any reason for evaluating local economic development as a factor in making a decision. Why would you consider how many new tires could be sold or how many new cars could be sold if you had more people in town? That was not germane to a national or a Federal decision. The Federal decision should be based on what it meant to the Federal Government. Did you get a dollar's worth of return for every dollar you invested?

Storey: So they were slow to change also?

Morton: Yeah, I think so.

Storey: When did the project office, the area office, begin to see staffing changes?

Morton: Well, I think in our last interview we talked in terms of our termination as a planning office and our ultimate creation of a project office. I think that was in the '69 or '70 timeframe after authorization.

Storey: That's when Andy Dolyniuk came in?

Morton: Yeah, Andy came on board, I think in '71, as a construction engineer.

Storey: Is that when these new disciplines began to be added to the staff here at this level?

Morton: No, we were slow to do that, too. I mean, the National Environmental Policy Act was passed and we were responsible for environmental impact statements. I don't think we had a biologist on staff 'til about '73, so it took two or three years for us to kind of get up to speed in that regard as well.

Phoenix Project Office developed environmental staff beginning in 1973

Storey: Has the staff continued to grow over the years or has it remained stable?

Morton: Well, of course, we grew from one civil engineer who wrote environmental impact statements to a full-blown environmental organization, archaeologists, biologists, environmental specialists, water-quality people, etc. It's been pretty stable for the last ten years. There's about fifteen interdisciplinary staff, I think.

Can we take a break?

Storey: Sure. [Tape recorder turned off]

Storey: We were talking about this environmental complex of things that was going on toward the end of the sixties, beginning of the seventies. I'm wondering if where you were sitting you saw any difference as Floyd Dominy went out and Ellis Armstrong came in.

Morton: It was pretty transparent. Of course, as you've said, the National Environmental Policy Act had just come into being in that transition, in that period of transition, and the only change you saw in our office was one of the lead engineers in our planning and reports unit transitioned into an environmental reports writer rather than a planning reports writer. There was a legal requirement to produce an environmental impact statement to accompany all of our planning reports and/or to accompany our implementation plans for the Central Arizona Project, so it was obvious that we were going to have to prepare EISes. We didn't know what an EIS looked like. Nobody else did either.

The first environmental statement in the Phoenix Project Office

I think the first EIS that was done in the Phoenix Area Office, Phoenix Development Office, was a two-page EIS to transfer some Salt River Project land from Federal ownership to municipal ownership. The city of Phoenix had needs for some Reclamation land for extending Sky Harbor Airport, and, of course, we had had a cattle-feeding operation located on that land as a leasehold for about twenty years, and we had to go out and clean it up, and we wrote an environmental impact statement on the impacts of the transfer and the clean-up operation. I think it was all of about two pages long. Today it would probably take about fifty pages to do the same thing, but the bottom line was we had no knowledge of what went into one until there had been a body of law established and some guidance that came out of CEQ, Council on Environmental Quality. I think it took CEQ about four years to get their regulations in place.

Storey: This person who transitioned to writing environmental statements, did they stay in the planning office? How did that work?

Morton: We just cut him off from the planning organization and moved him into an organization that reported directly to the area manager. We called it the Environmental Division. The fellow's name was Dave Creighton, and Dave became the environmental officer and reported directly to Cliff Pugh at that time.

Storey: And became a division of one?

Morton: He became a division of one and then a division of two, and we had a soil scientist who had majored in agronomy and minored in biology. He was about to be RIFed [reduction in force] because we had completed, as I mentioned in some of our last interviews, we had completed, all of our irrigability studies, and all of our soil scientists were being moved on to other jobs. He had enough qualifications that he could assist in this area, so Mel Persons became our first professional, if you will, environmentalist with an agronomy and biology background.

END OF SIDE 2, TAPE 1. MAY 20, 1996.
BEGIN SIDE 1, TAPE 2. MAY 20, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry Morton on May the 20th, 1996.

You were saying about '72 or '73 we added Gene Rogge to all this.

Morton: Yeah, Dr. Rogge was an archaeologist and we added him to staff. It might have been -- I'm trying to remember. I guess probably '73, Gene came on board. Then we added more biologists. Endangered Species Act increased our biological needs. Dr. Jim Labounty, who is in the labs in Denver, he was probably one of our first professional biologists. So it grew until about 1978 or '79, we ended up with about fourteen, fifteen people working out of the environmental organization, and it has stayed pretty constant since then.

Storey: I looked at Dr. Rogge's new book on the construction camps on the Salt River Project. It's interesting.

I had dinner with Karen Smith the last time I was here, from the Salt River Project, and I couldn't resist chiding her about the fact that U.S. Reclamation Service photos were credited to the Salt River Project.

Morton: That had a lot to do -- I think Gene had probably left at that time, gone to work for Dames & Moore, but we did award a contract for the HABS/HAER[7] documentation of all the central Arizona dams, including those that weren't SRP dams, to SRP. In fact, they're the ones that were the location of the archives where most of the photographs had came from, so Gene had to go back to them to get the photographs for the book.

Storey: Yeah, I understood that, but I just couldn't resist poking her a little bit.

Morton: Well, she was the contractor on that job.

7. *Historic American Building Survey/Historic American Engineering Record.*

Storey: I meant to ask you, you mentioned a whole string of towns along the Mogollon Rim, and I thought I heard you say that Reclamation had studied all of them.

Morton: Had studied all of them at the reconnaissance level. The only one that was authorized for feasibility study was the Flagstaff Project. I think we might have called it the Flagstaff-Williams Project. Yeah, it did include a small pipeline that went to Williams. It underwent a more rigorous analysis in the late sixties and early seventies, but it didn't pan out either.

Storey: The planning process at that time, reconnaissance study was a very sort of cursory look to see whether or not it might prove to be a logical project for us to participate in?

Morton: Right. It generally did not address details of benefits or costs. It evaluated problems and needs, identified that there was a need, identified alternative solutions, and at least from a cursory perspective, determined that the solutions were in the range of the benefits, order of magnitude type of benefits, but didn't get any more specific than that. Did not look at the repayment aspects, did not ask pertinent questions with regard to the financing of an undertaking. Generally indicated an entity that was willing to enter into a repayment contract, but that was the extent of it. Whether the entity had the financial wherewithal to enter into the contract or not was really not explored at that level of study, just identifying it.

The city of Flagstaff, for example, would have been the contracting entity, and that was probably the extent we discussed the issue with the City Council and they said, "Yeah, we're interested in the project, and if you can make it worth our while, maybe we'll pay you back for it." That was probably the extent at that level.

Storey: What was the next step in the planning process?

Morton: Normally we went from -- and today I think they call that level of study an appraisal study, but when I was involved in planning it was called reconnaissance and then the next level was feasibility. I think it was the Water Resources Planning Act that required us to get specific authority to even initiate feasibility studies, but in the sixties and early seventies you could initiate a feasibility study just on a finding of acceptability or a finding that there was some opportunity to generate a project. You could enter into a feasibility study merely by going to the appropriation committee and notifying the appropriation committee. I think today, now, to move to a feasibility study you have to have at least some limited authorization from Congress to allow you to do that.

Reclamation's planning process in the early 1970s

Storey: And that study would have --

Morton: Those studies generally were very much in-depth, dealt with a very broad range of costs and benefits, impacts and attributes, would deal with financing of the program, cost-sharing, would deal with whether an entity had the authority to enter into a repayment contract, whether the entity had the capability to cost-share, validated in more rigorous terms the types of needs, whether it was a need based on population, a need based on loss of water supply, an indefinite water supply that you needed to firm up, would provide pretty good cost data.

We would actually go out and do topographic surveys on the ground, define quantities generally, so many yards of earth, so many cubic yards of concrete and so on as a basis for our cost estimate. An appraisal of reconnaissance grade we would rely pretty much on rules of thumb, if you would, prior experience in the area with traditional construction techniques. But at the appraisal grade we'd actually go out and do quantity take-offs and try and determine what was involved.

As we moved into the new planning procedures, we'd also do environmental impact, social impacts, regional benefits. So there was a much broader spectrum of analysis and a much more in-depth analysis in those areas that we may have covered at the reconnaissance level, but just needed to explore the situation more in-depth. And it would actually culminate in a formal report that would be presented to the Secretary with a recommendation to proceed to seek authorization or to cancel the study. So there was at least two decision points in that process, one in the recommendation to the Commissioner and one to the recommendation to the Secretary.

Storey: Did you have any sense of how many of these were recommended to go ahead, of the studies that were going on?

Morton: In this region in that time frame, I'm only aware of two programs out of probably thirty or forty that we had active at that time, I'm only aware of two that were recommended to proceed, CAP being one and the Southern Nevada Water Supply Project being another. Let me back off, there was also another one. There was a third that was more of an accommodation to the State Department, and that was the Yuma Desalting Plant that came out of Title I of the Colorado River Salinity

In the late 1960s and early 1970s only three of four major projects were approved in the Lower Colorado Region

Control Project.[8] So I guess there were three in that era of '68 to '75.

And by '75 we'd basically closed out all of our studies, both here, in Yuma, Southern California, we had an office, the region had a planning office at San Bernardino. There was a regional office in Boulder City, the Boulder City Development Office, they'd closed that up. So by '74 or '75 for the Lower Colorado Region, we basically worked ourselves out of planning. Our traditional processes pretty much were terminated by that year, by that period of time.

Storey: So after you got through the Commissioner and the Secretary, then it went to the political process and the authorization and appropriation process?

Morton: Right. There's one other one, but it was really a reauthorization, it kind of piggy-backed on CAP. Dixie Project, I think was authorized in Utah about '63 or '64. When they started doing their definite planning process, their preconstruction activities, they found a major fault in their dam site or in their reservoir site and that, of course, required additional remedial measures at an additional cost.

So as part of the Colorado River Basin Project Act that authorized CAP, the Dixie Project was reauthorized at a higher cost. But from a practical sense, when you got around to try and getting, I think it's King County, Utah, and the town of St. George, there would have been a water supply system for the town of St. George, when you got around to trying to get them to enter into a repayment contract, it was a no sale. They chose not to implement that authorization, so it never went anyplace.

So I guess out of the thirty or forty regional programs that I had some knowledge or

[8] *Colorado River Basin Salinity Control Act of 1974 (Public Law 93-320, 88 Stat. 266).*

involvement with, I can only point to three that ever really got implemented: Central Arizona Project, the Desalting Plant at Yuma, and Southern Nevada Water Project that delivers water to the city of Las Vegas.

Storey: What project would you have been involved with after the Prescott Project, or were you doing parallel things?

Morton: Well, we always had CAP sitting there. We weren't moving forward very rapidly because of the appropriations. We had no appropriations in fiscal year '69 and '70. We were doing some work, but it was from an advance from the state of Arizona. The state of Arizona advanced Reclamation $685,000 to at least continue to collect design data for the Havasu Pumping Plant and to, at that time, by 1970 at least, begin the process of preparing the environmental statement, and in 1971 or so, begin negotiations on a master repayment contract.

Arizona advanced money to keep work on CAP alive before appropriations arrived

So I think, those were the three things that we -- well, there was another one, too, that I was involved in and that was the preparation of an operating model for the Central Arizona Project. How can we get the water? How will it operate in order to provide design data for the Havasu Pumping Plant so it could be designed? Which is the point at which water is taken out of the river and put into the aqueduct system, the point of diversion for the aqueduct system. The designers needed to know what the operation of the plant would be. That was one of the parallel activities that I was engaged in in '69, '70, '71, was to formalize that design criteria. How many stops and starts would we need on each of the motors? How long would a unit have to operate continuously? Did we need fish screens on the

Preparation of an operating model for CAP

diversion channel? How were we going to address sedimentation? Were we going to over-design the plant and over-design it for where, in anticipation that the sediment that comes into the reservoir would adversely affect it? Were we going to protect the impellers from sedimentation, the turbine from sedimentation by some artificial means?

I mean, the plan that was adopted was to build a training dike that would go out into the lake for about half a mile or so and preclude the sediment from actually getting into the pump units. So rather than over-designing the pump units.

Storey: That's the sediment from that river that comes in?

Morton: Bill Williams River was a tributary to Lake Havasu. So those were the kind of issues that were ongoing in our office. When we were working on CAP in that era, those were three or four different things that were being examined, because we didn't have the full capability, didn't have enough money to go forward with all the activities we needed to in a parallel fashion, so we kind of stretched it out and we had a number of planning authorities, like the Black Rock Dam up on the Zuni Reservation or Zuni Safety of Dams Program and Prescott and these other, Mogollon Mesa Projects and the Flagstaff-Williams and all those planning studies were going on at the same time. They were all parallel studies, and most of our staff were engaged in one form or another, but we were gearing up, if you will, making ready to proceed to construction once we were able to get a construction appropriation authorized.

Storey: How did the Phoenix Development Office react to the authorization of the project and the fact that the appropriations didn't come right away? And maybe first the authorization, then --

Morton: Well, we were too late in the appropriation process. The CAP, the Basin Act, was authorized in September of '68, and we were already into what would be the fiscal '69 budget year, so it was too late to get any construction money appropriated. Up until that point in time, we'd always felt that we were leading a charmed existence, you know. Senator Hayden [fn Carl Hayden and career] sat on the Appropriations Committee. We'd come up to the eleventh hour, the bill's about ready to be signed, and the Phoenix Area Office was $200,000 short of making payroll, good ole Senator Hayden would write in an extra $200,000. We really did lead a charmed life, in our view. I think that a lot of people were jealous that we had a mentor like Senator Hayden at that time.

But it just seemed for several years there where we thought, "Oh, my goodness, we're not going to have enough money to get through this year. We'll have to run a RIF. We're going to be faced with downsizing," and then at the very last minute, whatever it was we needed got written into the appropriation bill and we lived another year. But that didn't happen after authorization. There was a period there where for one reason or another Senator Hayden or his chief aide, Roy Elston , decided we didn't need the money, or they forgot about us, I'm not sure which. But it was two or three years where we didn't get any support from the Federal Government in terms of construction appropriations.

But the state, through the Interstate Stream Commission, did loan us some money. Congressman Rhodes at that time was instrumental in talking the state into providing that for us. And even to this day, John Rhodes will tell you that that was just intended to be a loan; at some point in time the Federal Government should pay the state back. But we never have, and right now we're calling it a prepaid investment on the part of the state in our financial records. I think Reclamation has concluded that that was just an advance payment on their future repayment obligation. (laughter)

So from a construction perspective, we kind of limped along. There were details to be finalized with the Navajo Generating Station, the consortium that was going to build the generating station was developing its plans, was entering into its contracts. The conclusion of how Salt River would hold the Federal entitlement in trust was developed. Jack Pfister was at that time an attorney for the Salt River Project, he was very much instrumental in negotiating those contracts. So we had that parallel process ongoing, the negotiation of the Navajo Generating Station agreements.

So there were a lot of ancillary things, but the thing that everyone really was interested, i.e., throwing dirt and placing concrete, really couldn't happen for a couple of years because there were just a number of prerequisites that had to be put in place and had to develop a staff. Although we had a construction engineer working in Phoenix at our sister agency, the Parker-Davis Project, and he eventually became the first CAP construction engineer, but even Mr. Dolyniuk had to build transmission lines for a couple more years with Parker-Davis before he could join us at the Arizona Projects Office.

Storey: I think I'm recalling that Senator Hayden retired in '69, very soon after the project was authorized.

Morton: I think, yeah, that's true.

Storey: That must have been a bit of a damper on the process.

Morton: Well, certainly with the seniority system in Congress, it changed things for us.

Storey: One thing I'd like to talk about very briefly before we finish for the day, I've been reading a recent biography of Carl Hayden. He was holding out for a limitation of twenty-seven years on giving California priority for its 4.4 million acre-feet a year. I was wondering if that ever actually made it into law. I believe the Act in '68 specified that California would have a priority.

How California's priority over CAP could affect the Arizona entitlement in years of water shortage

Morton: Yeah, and from a practical sense, it's in perpetuity in the current law.

Storey: So he didn't get that in the process?

Morton: No. No, there was no time limitation on that priority. From a practical sense, CAP diversions could go to zero before California would take a shortage. We've done a lot of hydrologic analyses, a lot of worst-case scenarios on the Colorado River hydrology, and from a practical perspective, we, Reclamation hydrologists, think that the minimum diversion that CAP would be saddled with would be in the 400-, 450,000 acre-foot-a-year range. Under the worst set of circumstances, we could be cut back from a million and a half acre-feet a year down to about 450,000 acre-feet a year. California would have its 4.4 million acre-feet, Nevada would have its 300,000.

The 1.3 million acre-feet of uses in Arizona along the river would also be honored.

CAP would be the only entitlement holder that would be reduced, and it would be reduced a little more than a million acre-feet. So basically what that says is that beneficial consumptive uses in the lower basin under the worst set of circumstances envisioned would be reduced from 7.5 million acre-feet to just a little bit less than 6.5 million acre-feet.

Storey: I thought I understood that the Upper Basin States were obligated to deliver an average of 7.5 million acre-feet a year to the lower basin.

Morton: Plus one-half of the Mexican Treaty.

Storey: Yeah. Oh, plus?

Morton: Yes.

Storey: Oh, I thought it reduced that 7.5.

Morton: You're talking to a Lower Basin person. (laughter)

Storey: Okay.

Morton: If you want to chat with some of the Upper Basin former Reclamation employees, I'm sure they have a slightly different viewpoint. Cliff Barrett, for example, you might ask Cliff that same question.

Storey: Okay, good. Well, I appreciate it. I'd like to ask you again whether you're willing for the information contained on these tapes and the resulting transcripts to be used by researchers?

Morton: Yes, I'm willing to do that.

Storey: Good. Thank you.

Morton: Thank you.

END OF SIDE 1, TAPE 2. MAY 20, 1996.BEGIN TAPE 1. MAY 21, 1996

Storey: This is Brit Allan Storey, Senior Historian of the Bureau of Reclamation, interviewing Larry Morton in his offices at the Phoenix Area Office[9] on May the 21st, 1996, at about ten o'clock in the morning. This is tape one.

I had asked a question about the canal always being full, and you had said we ought to talk about that a little more, and I forgot to ask it yesterday.

Morton: I'm trying to remember the rationale.

Storey: I think it had to do with storage and that it's always full, it isn't always flowing.

Why the aqueducts on CAP are always full

Morton: Right. I talked a little bit about having the canal checked up and the top of the water surface always at one elevation, and I think my explanation for that was somewhat simplistic in that I approached it from the structural perspective. In other words, if the canal's not full, there's a hydrostatic pressure that builds up behind the lining, and to the extent that the canal is full, the lining has pressure on it, from the weight of the water, that holds the lining in place. But if you remove, if you draw down the canal, the canal runs 16.5 feet deep, if you draw the canal down, say, ten feet, there's pore pressure behind the lining, so you have ten foot of water pressure behind the lining and nothing holding it in place because you've evacuated the prism so the lining will fail structurally. The pressure will force the

Lining failure could occur if the canal is dewatered

9 Mr. Morton later states that the new name was the Arizona Projects Office rather than the Phoenix Area Office. The name Phoenix Area Office appeared in 1994.

lining [out] -- cause it to fall into the canal. That's certainly one reason to keep the canal full, but the overriding, the real justification for keeping the canal full is the fact that it's inherent in the operation of the canal.

Operations on the CAP require, inherently, that the aqueducts be full

In order to get instantaneous flow changes in the canal, which was how the canal was designed, by having a number of small short pools, six miles in length, along the length of the canal, you can open the gates at Lake Havasu, open the gates in Phoenix simultaneously, and you'll have an instantaneous increase in flow along the entire length of the canal.

How CAP has instantaneous flow in the aqueducts

We were talking earlier about early canals that were totally gravity-driven, had no checks in them, and the fact that you needed two or three days of lead time for an increase or decrease in flow to reach the point at which you made your diversion. Typically in these older canals, you had wasteways to take care of--wasteways or off-stream storage facilities--to take care of the shortfall or the overage. If you ordered too much water and it was *en röute*, you just opened your wasteway and you wasted that water to natural water courses. Vice versa, if you needed to vary your water order, you would have small regulatory storage ponds along the length of the canal and you could refill the canal or increase your flow by releasing water from one of these storage areas.

Older canals are totally gravity driven systems, but the CAP system is an instant response system

So what we've gone to on C-A-P is a totally contained water prism. We have no wasteways. We <u>cannot</u> evacuate water out of the prism of the canal. We regulate our deliveries by opening and closing the check gates that regulate the flow in the canal. So you always have a full canal prism, it's always 16 and a half feet deep from the invert of the canal.

It isn't possible to waste water from the CAP aqueducts

Storey: Was that a new approach for the Central Arizona Project, do you happen to know?

Morton: Well, it really wasn't a new approach. It's used in the California Aqueduct, it's used in the Metropolitan Aqueduct, the Colorado River Aqueduct. It's new in the concept of being an automated system from a centralized location. The California Aqueduct, the State Water Plan in California, has three control centers. Even the Delta Mendota Canal in California has reaches that are checked. It also has reaches that flow straight by gravity and they use San Luis Reservoir, for example, to vary their water deliveries based on the [water] orders. So there's always some opportunity to take water out of the canal systems, pump into the San Luis Reservoir or vice versa, release water from San Luis Reservoir back into the canal system to increase it if, in fact, you have a very dry spell, for example, and you need additional water supplies, you can always release water from San Luis Reservoir.

The CAP system used a new approach in a centralized control room for the entire system

So I guess what I could say is that in relatively large systems like C-A-P and in systems that involve pump lifts where the water's fairly expensive, you want to adopt this kind of strategy, you don't want to waste water, you want to make sure that you have the flexibility to meet, on demand, your deliveries, but you don't want to have a system that can't meet that flexibility. So you either install storage devices *en röute*, in-line storage devices, or you use a checked canal and you operate the checks automatically.

Where water is fairly expensive, you don't want to waste it

In the case of the Metropolitan Aqueduct in Southern California, that takes water from the Colorado River and delivers it to the Los Angeles area, their system is not automated from a central location. They do have a checked prism, but they have a ditch rider and he has to go down the line. They have several ditch riders and each of those has a circuit that they ride and they have to go down the line and open the checks if, in fact, they have a change in order.

Storey: Was the Granite Reef Aqueduct and the whole complex originally designed this way?

Morton: Well, originally if you go back to '44, it was not designed that way in '44. It would have been a 3 and a half-day transit time from Colorado River to the Phoenix area. If you had a dry spell or you had a storm move into the area and your water order changed, we would have to address that. In fact, the plan was to waste water at the Salt River if your demands were less than the water that was *en röute* or vice versa, to resupply the canal from Orme Reservoir. In the '44 report it was called McDowell Reservoir, but the same reservoir. But you would have freshened the canal with additional water supply if your water orders had increased over and above what you'd anticipated three days previously.

As originally designed in 1944, the aqueduct would have a three and one half day delivery time for water from the Colorado River to Phoenix

The original plan for CAP provided for wasting water at the Salt River

Storey: So in that twenty-five or so years, twenty to twenty-five years, there'd been a change in thinking and advancement in technology and sophistication?

Morton: I think it was more communication, microwave systems became reliable, you could communicate these changes instantaneously, and there was more reliance on the system, other systems that evolved. The California Aqueduct, for example, was probably the preeminent water delivery system. I mean, it was much larger

The major change between the original design and the one implemented was technological capabilities

California Aqueduct was a model for CAP

than C-A-P and equally or more sophisticated than C-A-P, so it kind of became the model, even though it wasn't built by Reclamation.

Storey: But still not centrally controlled?

Morton: Still not centrally controlled in that they had operating facilities or control facilities at the southern terminus, at the northern terminus, and in the Los Angeles Basin, so they had three. They still do. They segregate their canal system into three components and they operate each component independently, so they have the northern system from the Delta down to San Luis, and then they have the reach from San Luis down to A. D. Edmondson pumping plant at the Tehachapis [Tehachapi Mountains]. Then they have the reach downstream of the Tehachapis on the south side of the Tehachapis that distributes water through the Los Angles Basin.

California Aqueduct was not all controlled from one location

Storey: I visited the control room at San Luis at the pumping plant there. I've forgotten the name of it. It isn't nearly as sophisticated as this control room here in this building. It's interesting.

Morton: But they have a much cleaner floor at their pumping plant than the Reclamation facility. (laughter) At least that was my experience in 1975, or so, when I visited the California Aqueduct system. The difference between the level of maintenance that was exercised by the California Department of Water Resources versus a Reclamation contractor was--it was indescribable the difference between the two of them. I mean, you could eat off the floor at a pumping plant. I wouldn't want to eat off of a floor at one of our pumping plants. (laughter)

Cleanliness in pumping plants

Storey: They've always looked pretty clean to me.

Morton: Well, compared to the California Department of Water Resources, at least in that era, ~~when~~ the California Department of Water Resources had some of the best and most well-maintained facilities I've ever seen.

Storey: I've visited quite a few plants with non-Reclamation folks, either contractors who are doing things for us or family, and everybody has commented on how neat and clean all the generating plants and everything is.

Morton: I don't disagree with that, but having gone through the Tracy plant in the Delta and then gone over to the Delta plant that DWR operated, it's like night and day.

Storey: Yeah, they were a lot different.

Morton: Now, obviously the Tracy Plant was thirty years older, it was constructed in a different time period, so the Delta plant for DWR would look much better just because it was much newer.

Storey: I would presume we moved into final construction planning and drawings and so on after the authorization in '68.

Lack of appropriations slowed implementation of CAP after authorization in 1968

Reclamation moved as rapidly as possible given funds available

Morton: Well, we were inhibited from moving as rapidly as we would have liked because of the lack of appropriations. But other than that, we moved as rapidly as we could. Our objective at that time, realizing that the construction program was going to just take a number of years, whether it was ten years or twenty years or thirty years, depending on how the money came, it was, nonetheless, going to take a long period of time.

So we attempted to concentrate our efforts initially on those parts of the aqueduct system that would, one, provide an early benefit, like a flood-control benefit, knowing we weren't going to be able to deliver water because to get water to Phoenix, we had 190 miles of canal we had to build and five or six pumping plants, depending on which plan we were talking about at the time. But there were some traditional civil engineered works that would have to be built that could be bulk-headed, could put a fence around and nobody would bother it. Just sitting out there in the sun for five, ten, fifteen years really wouldn't bother them. Things like tunnels, things like pipe siphons, they were underground, we could fill them with water, they'd just sit there and they would not deteriorate, we thought.

Reclamation concentrated on features with immediate benefits, such as flood control

Reclamation also built major features that could then be held in suspension without damage or public danger

But the intent was that if we built those things early on, they would withstand the ravages of time, they would be there, they would present no liability, nobody was going to fall into a siphon unless they really made an effort, broke locks and so forth, removed manhole covers or what have you. There was no way for anybody to injure themselves on these types of facilities. So we did tend to concentrate in those two areas, things that could be bulk-headed and protected, boarded up, fenced off, and they could withstand the ravages time. Or to the extent that they would furnish immediate benefits, as was the case for the Reach 11 dikes which provided flood control for North Scottsdale, <u>that</u> was our initial criteria, in other words.

The Reach 11 dikes were features with immediate benefits

Some CAP features were delayed in anticipation of possible technological advances, e.g., pumps, communications systems, and electrical equipment

The other side, the other evaluative factor was technology was changing and perhaps there would be a breakthrough on more efficient motors or more efficient turbines for the pumping plants or better communication systems. So we pretty much concluded that the last thing we wanted to build before we delivered water were things that were electrical or electronic or had the opportunity for some new technology to evolve that would give us a better product. So we kind of held off on designing and building pumping plants, for example, or designing and building control systems or major communication systems like our backbone microwave system. We left those things toward the end of our program, our construction program, and we built the tunnels and the siphons first. Then we built the concrete canal prism, and then we followed that up with the pumping plants and the electronic facilities, control systems, telecommunication systems, microwave systems. So that was kind of the rationale behind how we staged the construction.

Storey: The electronic communication system, we're talking the control system here, as well as other things?

Fiber optics is a technology we would not have had if we had built the control system early

Morton: We have voice grade and control, you're right. Computer systems and telephone or telephonic-type systems. I guess the case in point would be if we'd have built the control system initially, we would not have had the advantage of fiber optics. Now we have a fiber optic cable down the line that can carry substantially greater number of circuits than what the coaxial cable would have carried at the same cost. So you know, that's one thing you can point to by saying, oh, we waited a few years, built that aspect last, and we got the benefit of fiber optics. Because fiber optics, while it was in its infancy at the time we were thinking about it, it had yet to prove itself, and ten years later it was the standard.

Storey: And computers, of course, were different.

Morton: And computers. Same way on computers. Although you've visited the control room here and I think you're aware that that's a fifteen-year-old computer that we operate the canal system with.

Computers evolved while we waited to build the control system and have evolved since we built it

Storey: Yeah, and they're going to move it onto a desktop some day soon.

Morton: That's exactly right. Right now the control module is eight feet long and three feet wide, and even though it uses semi-conductors, it's nowhere near as efficient as what you could get today in a PC, if you will.

Storey: Let's see, this question, let's see if I can formulate this question so it makes sense and isn't too long. Back in the sixties, we knew we had the project, and this decision on how to stage the construction was being made. We still knew that we wanted a canal with instantaneous control, and so that intellectual conceptualization was there. What we were doing was saying "the longer we wait, the more up-to-date equipment, the more up-to-date technology we're going to be able to install in order to achieve the end, we've already decided on." Is that correct?

Morton: Yes. I think there's also the one other aspect in terms of evolvement, and that was the software development for the control system. There's no off-the-shelf software to <u>model</u> the control system. In other words, you've got to be able to respond to changes in flow *régime*, you have to be responsive to things like cows falling in the canal, you have to know what a change in one level of a pool means relative to the downstream and upstream pool, you have to know how to what they call stroke the gates. The gate-stroking model that's used, if you open it too fast, you get a surge, you get a wave. The wave can build as it goes down the canal, it can over-top the canal, it can damage the canal, it can wash out the embankment or the O&M roads.

Importance of computer software development for control of the aqueduct system

Stroking the gates on the aqueduct

So you have to be able to describe in software and use that software to <u>actually</u> raise and lower gates. You get into a situation, potentially, if you raise it too fast and then you close it too slow, you end up bouncing the pools back and forth and can cause damage not only to the structural integrity of the canal, but also the sensing devices that are in the canal.

Not properly implemented, the control system could damage the aqueducts

So I guess I'd have to say that before we could write a specification that told bidders what we wanted them to build, we needed to know the response mechanisms and the software range of operational capabilities to do that. So that was another aspect of the control system that we had to work on and have a complete understanding of what was going to be required before we could specify what needed to be built.

So we had a team of individuals that just worked on software development. They really didn't even concern themselves -- they knew that if the software was there, the hardware would follow. But they needed to understand what you needed in the way of software, what you needed

A team of individuals developed software for the control system

in the way of response time, change in condition. You know, the gate could open at so many millimeters per second. You know, it had to have that response rate, it had to be able to operate within a range of 0 to 16 and a half feet. It had to have certain electrical characteristics with response to the motors that lifted the gates. So there was a lot of experimentation that we needed to do before we could actually define what we wanted the contractor to build. [Tape recorder turned off.]

Why a special software development team was necessary

Storey: We were talking about the computer software development.

Morton: The software development had to precede our design of the hardware, and I think we set up our team in the late seventies to look at the software, and they spent a lot of time working with the hydraulics lab in the Denver office, for example, to design the flow characteristics of the canal, the gate response mechanisms, then to actually develop the software that could operate the system.

"software development had to precede our design of the hardware"

The staff made several trips to Spain and France. There were advances in software development being made there that apparently far outshadowed what we were doing here in the United States in that regard. It took a team of about six engineers three or four years to really focus on and develop the software that now runs the aqueduct system.

Storey: When were they doing this?

Morton: This was in the late seventies, '78, '79. I think the spec for the computer system was probably issued in '80 or so.

Storey: So had the system been designed by that point? Where were we in the design of this physical system?

Morton: Oh, we had a number of reaches of canals built by that time, yeah. I'm sure by that time the Havasu pumping plant and some of the other in-line pumping plants were in some stage of construction. This was fairly late in the sequence, you know, as we were saying, what were the first things that were built. The Buckskin Mountains Tunnel, the Agua Fria Tunnel, those were built early on. The seven major siphons that we have on the project, the inverted pipe siphons that crossed major river crossings, Cunningham, Centenniel, Jack Rabbit, Hasayampa, Agua Fria River, New River, Salt River, those were all built early on. The Reach 11 flood detention dikes were built in the early seventies. They were one of the first facilities to be built.

Early construction included: Buckskin Mountains Tunnel, Agua Fria Tunnel, seven major siphons at major river crossings, and the Reach 11 flood detention dikes

Storey: Were these engineers employees of the area office here?

Morton: Yes.

Storey: Or were they Denver Office employees?

Morton: No, they were Phoenix office employees, Arizona Project Office employees. The only one of those employees that's still here is an individual that works for C-A-W-C-D, but the entire team was disbanded over time. As we moved from this design process and software development process into implementation several individuals were offered jobs in the operations end of the activities with the Central Arizona Water Conservation District, which ultimately became the operator. Most of the government employees, for one reason or another, chose not to go with the district. There's just one, Tim Casorick , who is the manager for operations with C-A-W-C-D, he's the only former Bureau employee that stayed with the organization.

Storey: I have talked to enough engineers that I understand that sometimes you design things and it doesn't work properly. So what I'm hearing is that we have a situation where we don't yet have the physical system, we don't yet have the communications system to be able to get to what we do have, we do not yet have the computer hardware, yet we're developing the software. I would feel really, really insecure in a situation like that. How does Reclamation assure a comfort level that makes this a logical thing to do?

How does Reclamation assure its comfort with developing software for a system that doesn't exist?

Morton: I think that due to our history and our knowledge of the technology, we knew that the communications would be there. Whether it was fiber optic or coaxial cable, we knew that we could just put a power pole up along the length of the canal and string a telephone wire on it. That technology was there. We were waiting for it to evolve into something better. The computers were there, I mean the computer control system. There had been process computers built for chemical processes and desalting plants and gasoline refineries and for all of that kind of stuff, the process control systems are there. That's nothing more than we've got to operate the C-A-P is a process control computer. That's there. It's going to get better, it's going to get smaller, it's going to become less expensive, it's going to operate

Process control computer systems were well known

faster, it's going to be able to test the algorithms, the software algorithms faster, but the basic structure is there.

I mean, the technology's evolved and it's going to get better, but we know what we've got today and whatever it is that's going to come in the future is just going to be so much faster, so much smaller, so much more efficient. But we did not have the software, the algorithms, the code. We didn't have that. That was the thing we were lacking. Well, the California Aqueduct had some of it and some of the aqueduct systems and water flow systems in Spain and France, they had software associated with it. It's customized for the shape of the prism, the length of the reaches, the physical parameters that are out there in the ground.

So we had to develop a custom set of software to fit the physical geometry of what was being built, and that was the key, because once we knew that the software would work, we had developed the software, then we could go out and specify all the hardware in the world, and we knew that the supplier would come and develop that hardware for us, because they had developed it in the past for innumerable operations.

"once we knew that the software would work. . . then we could go out and specify all the hardware. . . , and we knew that the supplier would come and develop that hardware for us"

Storey: I didn't ask that question quite correctly, I can tell. (laughter)

Morton: Okay.

Storey: I talked a lot about what wasn't there. My sense of discomfort is not that that stuff wouldn't be there eventually, but that you couldn't test the software.

Morton: Oh, I see what you're saying. Well, and that's true. I mean, you build it in a laboratory, but until--

END OF SIDE 1, TAPE 2. MAY 21, 1996.
BEGIN SIDE 2, TAPE 1. MAY 21, 1996.

Morton: As I was saying, you're absolutely right. The proof is in the pudding, and until you had the prototype, there was always that mental anguish, possibly, that things would not function the way they were designed. We didn't know if the system would turn the pumping plant on from 190 miles away. We didn't know if the unit would operate under that kind of control system. In every plant we put an manual stop/start button. I mean, we knew that a operator could stand there and push the button and turn the unit on, but we didn't know that somebody here 190 miles away could actually do that.

We knew that the gates and the motors and cables that we were installing on the check gates - that an operator could stand on the deck of the check and push the button and start the motor and raise or lower the gate, but we had no way of knowing for certain that our design would work. It had been proven, I mean, in various process controls, a gasoline refinery, for example, you sit in a central control room and you control the flow of petroleum products throughout the plant. Obviously that works. It's been tested over short distances, it's been tested over long distances in pressurized systems like cross-country gasoline or oil pipelines.

Reclamation's knowledge that process control systems do work was important in development of our control system

I mean, the process control systems do work and we have ample witness of that within the infrastructure here in the United States. But we were talking a gravity system with intermediate pumping plants, with literally 200 dual check gates along the length of the canal system, fifteen pumping plants, something like 112 or 109 pumping units themselves, motors and turbines to lift the water. So it was a major undertaking, and we knew we could do it manually. It's been done in many other places manually. We knew we could do it at least semi-automated because it's been done in the past on a semi-automated basis, but we didn't know for sure we could do the whole thing from one location.

"we didn't know for sure we could do the whole thing from one location"

Storey: Well, let's take this line of thought to its logical conclusion. When we had the computer installed, did we have any trouble getting the computer?

Morton: Well, of course, it was custom-made. It was what they call a Mod-Comp computer. The manufacturer was in Florida. The contractor, Johnson Controls, was well known in the gasoline pipeline and refining industry. As a matter of fact, they're well known in the heating and cooling industry. In many, many major buildings in the United States, their cooling systems and heating systems had been installed by Johnson Controls. So it was a reputable firm, but like anything else, when you build the first prototype, you have some concerns that things just won't function.

The computer for the control system was custom made

I think, from my recollection, it was a fairly uneventful construction activity. We had some cost overruns, we had some changes during the installation process, but they weren't out of the ordinary. It's pretty consistent with major construction efforts like this one.

Storey: We're talking about the computer, is that right?

Morton: Um-hmm. We anticipated that we would need three computers. We had dual redundancy at the control center and then we had a third computer that we were going to use for training purposes to train the operators on so that they could have similar kinds of responses that would occur in a day-to-day operation. So we ordered basically three separate computer systems, and, like I said, they were manufactured, I think, if I remember right, in Florida and were delivered on site and installed here in the Control Center at the headquarters building, C-A-P headquarters building.

"We anticipated that we would need three computers. We had dual redundancy at the control center and . . . a third computer . . . for training purposes"

Storey: Then we installed our software?

Morton: Then we put the software on.

Storey: And?

Morton: Well, you're going to have to bear with me on this. To the best of my recollection, it worked adequately. I mean, I don't recall that there were any significant problems. There were some minor problems, but I just don't recall anything of any great significance.

Storey: If I were an operator, and I told it to open check 52, does the computer know how it's supposed to open check 52, or is the operator the one who knows this, or is it a combination? Do you know how this works?

Morton: Well, actually, both of them know. The computer, it's been pre-programmed, the computer knows based on the fore-bay and after-bay elevations, of the water elevations, how fast it can open. It has preset limits on rate of opening.

How the control computer and the operators interact in managing the system

It has built-in redundancy. Each individual check has its own computer on site, little small process computer, that if we lose communications or we lose power, we have a little gas generator there that will fire up and power the system down, and there's a preset sequence in the software that allows the check to operate independently in any kind of emergency, a lightning strike, truck run into the gate or what have you. I mean, it's a pretty self-sufficient redundant system.

The operator can intervene, but, in fact, the operator is mostly there to override alarms, as far as I can tell. I mean, the bottom line is that the operator puts in changes, whether it's flow changes, you know, if you want Turnout A to increase its flow rate from ten cubic feet per second to fifteen cubic feet per second, that's the kind of input that the operator makes.

The software actually figures out how fast I should open that turnout gate or how I should adjust the check gates in the canal to accommodate that increased flow. Same way on animals. I mean, we've had animals get through the fence for some reason or another, deer, cattle fall into the canal, become lodged against the gate. The operator on site at the control center will get a warning or an alarm to indicate that something's amiss. He can dispatch a crew to look at the gate, physically observe it to see what the problem is. But in the meantime, the computer will actually control the gate to minimize any adverse effects, like rising water in the fore-bay or, vice versa, a loss of water, a decreased elevation in the after-bay.

If you decrease the water surface in the after-bay too rapidly, you could have structural failure of the canal lining, so you don't want to evacuate the downstream prism too rapidly.

Normally our rule of thumb is a half a foot a day of drawdown in the canal, and if one of your gates becomes inoperable in a fully raised position or in a fully closed position, you could potentially de-water that downstream reach of canal much faster than what your criteria would allow, in which case the other gate--these are dual gate checks--the other gate will have to be raised at a greater rate to a greater height than what might considered normal just to balance the downstream section so that you don't incur those differential hydrostatic pressures.

Storey: As I understand it, with the control system that we use, they put in a day's orders, twenty-four hours of orders in in advance, and then the system works through it.

Morton: Well, actually they put a week in at a time and then update it daily.

Storey: Oh, okay.

Morton: So the computer really has at least a week's worth of anticipatory operations already resident in its memory, and each day they update it for any changes that would result, and so then the adjustments are made with the software.

"the computer . . . has at least a week's . . . anticipatory operations already resident in its memory, and each day they update it"

Storey: Okay. Well, we hopped, skipped, and jumped from what you were going do after the Prescott Project.

Morton: Oh, my goodness, that was a long time ago. Let's see. I think that time-line-wise, the Prescott Project was this test case on the new planning procedures. We probably finished that late in 1970 maybe, maybe December, January of '71, something in that time frame, it seems to me. Because the planning conference was in the

The Prescott Project as a case study in streamlined planning procedures

spring, if I remember right, of '70, and shortly after the planning conference, the Regional Planning Officers and the Assistant Commissioner determined that each region would do this test case. I think we had about a six-month time line to deal with that. So it probably was December or January, December '70 or January '71, when we put the final touches on that report.

Tucson Planning Conference was held in 1970

Storey: Before we go on, though, I think you mentioned that you met Mr. Stamm at that conference.

Met Gilbert Stamm at the 1970 Tucson Planning Conference

Morton: Yes.

Storey: What was he like? He, of course, became Commissioner three or four years later.

Morton: I didn't spend a lot of time with Gil Stamm, but I was kind of the junior member. How old was I in 1970? I was like twenty-eight years old, so I'm still not sure why I attended, but each region was allotted ten people and then there was the Denver planning group that had another ten or so people in attendance and then the Washington staff, there was probably ten or twelve people out of the Washington staff there. So bureau-wide, there was probably close to 100 people at that conference, and I was probably the youngest and most junior of that entire group.

I'm still not sure to this day why I was selected, but our office out of the region, out of the ten in the region, our office was allotted two people to go to the planning conference, and I was one of the two. The other one happened to be the Chief of the Planning Division, so the senior-most member of the planning staff at the Phoenix Office and the junior-most member.

But while I was there one evening, there was no planned activities that evening, everyone was on their own for dinner, and I was sitting in the lobby. Tom Clark, who at that time was on the Washington planning staff, wandered through the lobby and he saw me sitting there and he says, "Why don't we go to dinner? Gil Stamm wants to go to dinner and we'll go show him some good Mexican food." Tom and I both knew Tucson, the geographical area. Tom had gone to school at the University of Arizona, and having been in Arizona for some twenty years at that time, I was pretty familiar with the Tucson area. So we found a nice Mexican restaurant there in Tucson and had dinner with Mr. Stamm.

I don't know that I really learned a lot from Gil Stamm that evening, but that was the first opportunity I had to socialize with a Commissioner or an individual who eventually began Commissioner. We talked generally about business. His concerns seemed to be the concern of the conference, which was that it took so long to move from inception of a project through the planning process and on into implementation. The sponsors, the people who actually had put the program together, they had prepared a booklet which rated some statistics on typical time frames to move from initial inception, initial thought process, to actual implementation. The obvious result of that was that it was somewhere between twenty-five and thirty years on average to get a bureau project authorized and to begin implementation. In that era it was considered too long. It was considered that the process required streamlining. I think those were generally the kinds of topics that Gil Stamm talked about that evening at dinner.

"the concern of the conference . . . was that it took so long to move from inception of a project through the planning process and on into implementation"

"it was somewhere between twenty-five and thirty years on average to get a bureau project authorized and to begin implementation"

Storey: At that conference, what were people attributing the length of time to?

Morton: It seemed like there were concerns, as there are still concerns today, with the government, that it needed to be reinvented, that there was too much bureaucratic process involved. You know, five levels of review before a planning report would actually be presented to the Secretary and then another two levels of review with the department and with OMB before it would ever be presented to Congress, the review process, the bureaucracy. And it wasn't just a planning report, it was the entire review process for each facet of the planning report. Every part of the organization had an opportunity to review the technical aspects, the cost estimate, the economics, the cost allocation, the problems and needs statement.

Reclamation wanted to speed up its planning and review processes in 1970

I mean, something as basic as problems and needs would be reviewed in peer review in the area or project office, it would be reviewed in the regional office, it would be reviewed in the Denver office, it would be reviewed by the technical planning staff in Washington, and it would be reviewed by the policy planning staff in Washington. At that time you had quite a cadre of staff in the Washington office. Later on, of course, a number of the staff moved out to Denver and there was some effort to decentralize that presence in Washington. But in the late sixties and early seventies, that continuum of review, it dealt with every aspect of the investigation that was ongoing.

Then there were delays due to authorization, the congressional process. There were delays in getting appropriations so you could institute construction. Ofttimes even in the planning process we'd start and stop for one reason or another, whether it be the lack of funding, or in the case of the Central Arizona Project, dispute over water rights, court actions. Lots of different things caused the delay. But the things that could be controlled within Reclamation appeared to be traditional bureaucratic types of things: what can we get off our plate? What can we eliminate? How can we reinvent our processes?

This was twenty-five, thirty years ago that people were saying the same thing that the current administration is saying now. Whether we're talking about the personnel manual or whether we're talking about principles and standards for planning water resources projects, everybody felt like we were too bureaucratic, had too many levels of review, we needed to simplify things.

Storey: Anything else about that conference stand out for you? Personalities or issues that came up? I presume there was a report of some kind.

Morton: Yeah, I don't recall that I still have a copy. If it is, it's in my archival storage. But there was a report. It's my recollection it was a fairly substantive report, slick paper, photographs, the whole bit. It was a fairly elaborate report for the times, for the kind of documents we normally produced, to my recollection.

There was a substantial report regarding the Tucson Planning Conference

Storey: Then you moved into the Prescott Study?

Morton: We did the Prescott Study.

Storey: Let me again, because you bring up these wonderful things to talk about--what did you do after Prescott was done?

Winding up several general investigation studies in the period after authorization of CAP

Morton: Well, I think concurrent with, and in addition to, Prescott, this whole continuum there was the undercurrent that we needed to move out of planning, create an area office and get on with construction. There were a number of small programs that were still ongoing. We talked about Flagstaff, Williams, Winslow, Holbrook, San Pedro, Santa Cruz, etc. There were a lot of these general investigation programs that we were in the process of winding up in that post-authorization period, but prior to establishment of an area office. We were still the Phoenix Development Office. I think that the office had -- Mr. [Clifford] Pugh was still the Assistant Regional Director at that time. I mean, that was his title.

The Phoenix Development Office was engaging in collection of data about aqueduct routes

It was generally presumed that the office, everybody in the office, had something to do with planning, even though we did have some ongoing data-collection work relative, leading to design and construction. But it was not really considered true construction, it was more topography, geologic foundation information, groundwater geologic information, etc. It was perhaps more like basic data rather than design data, because we just didn't have good topography, we didn't have good information. I mean, we were crossing 150 miles of desert land and no roads. We had driven it, we had traversed it, we had walked it, we generally knew the alignment. But there was a lot of variation in that alignment and we didn't have a lot of site-specific types of basic data to form the criteria for our design.

So that was ongoing. In context, it was not really planning, it was just creation of basic engineering data. That was about 50 percent of our staff. The other 50 percent of the staff was dealing with, I think we were about seventy people, seventy or eighty people at that time.

The other thirty or forty people were dealing in the realm of the traditional general investigation program for Reclamation, planning-type reports. We've illustrated, two, that I worked on Zuni and Prescott and there were, I don't know, eight or ten others that other people were managing or participating in as team members.

In Fiscal Year 1972 the Phoenix Development Office began moving toward becoming a true construction office

But at the end of 1970, in anticipation of Federal appropriations in Fiscal Year '72, which would have been July of '71 through June of '72, in anticipation that we would have construction appropriations at that time, the movement toward a true construction office, an area office, was initiated and we were designated ~~an area office~~. [the Arizona Projects Office]

Project Construction Engineer, Andy Dolyniuk, named

A construction engineer was named. Initially he was the construction engineer at the Parker-Davis Project, which was a power generation and transmission arm of Reclamation located in the Phoenix area. Because he was resident in the Phoenix area, he kept his office out of Parker-Davis, but he would show up at the old Phoenix Development Office two or three times a week and kind of got to know people.

Construction Engineer begins to look at reorganizing the office

There was about a six-month period of time where everyone knew that Andy Dolyniuk was going to become the C-A-P Construction Engineer, but he hadn't really been vested with that, charged with that responsibility. It was common knowledge, and we all got to know Andy. Andy went down through the organization and took names and took numbers and evaluated people's capabilities.

Categorization of people in Reclamation: construction, planning, O&M

As you probably know, having interviewed a number of people in Reclamation, you tend to get put into categories, and that certainly was the case with Andy Dolyniuk. If you were a planner, you didn't fit in construction, you had to be a planner; you couldn't be a construction hand. Similarly, if you were a construction hand, it was very rare that you worked in the O&M arena, you worked in construction and you moved where the next construction job was.

Of course, when the Phoenix Development Office had staffed up in the early sixties, we'd hired people who had worked on construction jobs and their résumés indicated that. We had folks who'd come from Glen Canyon. Glen Canyon wound down in the early sixties, and we had a need for people in Phoenix and so we had a number of folks that had worked at Glen Canyon. We had a few folks that had worked on construction jobs in California, Casitas Dam, Cachuma Dam. So there was a smattering of individuals in the Phoenix Development Office in 1971, who in their credentials had construction experience, and Andy made sure that he knew exactly who those people were.

The Construction Engineer organizes his staff

So I think it was probably, I'm guessing now, I don't really recall for certain, but my guess would be that immediately after the appropriations were authorized, Andy was officially named the Construction Engineer. He came into the office and said, "These are the people that I'm willing to take on my construction staff. They have the requisite experience in construction. I'm going to bring all my own people from Parker-Davis as my division chiefs, but these other people will be allowed to join my organization." Needless to say, the folks whose background was solely in investigations or planning, they had no entrée into the construction organization, and all funding for planning ceased to exist after fiscal year '71 going into fiscal '72.

Storey: So planning and design are not the same thing?

Morton: Oh, no. No, they're miles apart. Miles apart. Yeah, you do a very rudimentary, if you're talking about creating a cost estimate for a planning report, you have to do at least a rudimentary design. But a real planning person, a real planning design engineer, he deals with generalities, he deals with lump sum kinds of estimates. A real good planning estimator, just by looking at the job, can tell you within 10 percent what the cost of that job will be. He doesn't have to sit down and figure out to the minute detail what each item is that goes into that specification, how each item interrelates with one another.

It's a much more precise activity in the construction design arena. I mean, the type of design that you do is much more rigorous. You look at structural capability, you look at types of materials, you look at quantities, you look at foundation bearing strength. A planner who does a design activity generally knows--

END OF SIDE 2, TAPE 1. MAY 21, 1996.
BEGIN SIDE 1, TAPE 2. MAY 21, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry Morton on May the 21st, 1996.

A planning design engineer knows the generalities?

Morton: Right.

Storey: Doesn't know whether the soils will hold the canal?

Morton: Doesn't know whether the bearing strength is in the soils, doesn't really care. He just knows that if you throw enough money at it, you can overcome any inadequacies in the physical structure of the material you're working with, and knows that on average you're going to run into some problem areas, but you're also going to have some relatively easy construction, and he factors that into his estimate, and nine times out of ten he'll be within 10 percent of what the actual construction cost is.

How you can get into trouble in the planning phase of a project

Where you run into trouble is, for example, as I mentioned early on in some of our earlier interviews, we had an authorized project in Utah called the Dixie Project, and there was a dam site there. Well, nobody investigated the dam site, it had not been drilled for foundation strength, for water holding capability, what have you. When they got around to the construction design aspects, they went out and drilled the reservoir and found it had a big fault running right through the reservoir. To remediate that fault would have made the dam two or three times as expensive. Well, in that instance, the planning designer missed the mark, because he was unaware that there was a fault. But at that level of investigation, he just assumed that it was at least reasonably stable, he put enough unlisted items, enough contingency factors in his estimate for what he thought a reasonable level of effort would have been to construct that dam. But when you find a major fault that you haven't yet found the bottom of and it underlies the whole width of the dam site and the whole length of the reservoir, that's more than you can overcome with a contingency allowance in the cost estimate.

Staff with no construction experience in the Phoenix Development Office were put in O&M work

So there were, as I said, there were people who had worked on construction like Glen Canyon Dam who had done take-off quantities or had done some minor design work, and their credentials were such that the Construction Engineer asked them to join his staff. There were, oh, I'm going to guess now, somewhere around ten of us out of the eighty-person office at that time before we started staffing up, there were about ten of us whose total background and total experience was in the area of planning. We had one person in that group who became--well, let me back away.

Planning activities terminated in the office as construction began

The planning activities, though, had terminated. At the same time construction was beginning, planning was ending. I mean, all of our GI programs had run out of funds or we had prepared the reports and there was nothing more for us to do. There were no programs that were "good enough" to move forward into an authorization mode. For one reason or another, they didn't have local support. There was no repayment entity. The BC[10] ratio was poor. They had adverse environmental impacts. For whatever reason of these seven to ten planning studies that we had under way, none of them panned out, demonstrated sufficient viability or feasibility to move forward into an authorization process.

So the question was, well, what do we do with these old planners? The Construction Engineer has no need for them and we have no planning activities. The bottom line came about that, "Well, there's other things we have to do. We've got to do EISs now, the National Environmental Policy Act is now law and we've got to do EISs. That's one thing we could do with these planners. And we've got to plan for operation and maintenance. At some point in time, the construction is going to be done and there's going to be something that's going to have to be operated, and so let's put these people in an O&M group. Let's call it the Division of

"we've got to plan for operation and maintenance"

[10] *Benefit/Cost Ratio.*

Irrigation or the Division of Operation and Maintenance."

So all of us who were ex-planners became the new O&M cadre for the Phoenix Area Office or the Arizona Projects Office, I guess that's what--it went from the Phoenix Development Office to the Arizona Projects Office, and went from a planning/pre-construction type of an organization to a construction/pre-O&M type of an organization.

The office "went from a planning/pre-construction type of an organization to a construction/pre-O&M type of an organization

So I think that there were about eight of us, as it ended up, who became O&M, and then as we talked yesterday, there were two people, Dave Creighton and Mel Persons, who became the new environmental unit that dealt with environmental impact statements.

Come to think of it, we had a couple of other loose ends out there, we had a couple of small Reclamation Project Act loans, so we had a loan officer, this was Ron Wilhite, and he had one person working for him. [Tape recorder turned off.]

Storey: You were talking about Ron Wilhite.

Morton: Yeah, Ron and one other engineer worked in the loans program, so we had a small unit, a two-person unit, that worked in loans, both rehabilitation and betterment loans, we had an R&B loan with the Salt River Project, and we had a couple of Small Reclamation Project Act loans here locally in the Phoenix area, one with Roosevelt Irrigation District and one with the Roosevelt Water Conservation District.

So Ron had those activities under his jurisdiction. Dave Creighton headed up the environmental unit, and the rest of us, I think seven or eight of us, were in a unit that then became the O&M unit. The head of that unit was a fellow by the name of Keith Pinkerton. Keith had worked at Glen Canyon Dam. But that wasn't quite enough for the Construction Engineer, because Mr. Dolyniuk looked into Keith's background and found out that Keith really worked at Glen Canyon as the Bureau's administrator for Page. At that time Page, Arizona, was a government camp, and Keith, I guess, had been like the vice mayor, the number-two person in the running of the infrastructure for the town of Page. So while he could raise his hand and said, "I worked at Glen Canyon," when you got right down to it, he really wasn't a construction hand, he was more of an O&M person. You know, he made sure that the water system was operating and the sewer system was operating and the streets were paved and the garbage got collected and that kind of thing.

So Keith had some good background and experience in O&M, so he was probably the logical choice to head up the new O&M unit. The other five or six, I guess six of us that he inherited, we were all relatively young and totally focused on planning. I mean, we didn't know an O&M from the word go. But nonetheless, that was where they decided to put us.

Reclamation had to determine the parameters within which the aqueducts would be operated in order to design the system

One of the things that they needed to know, that the designers needed to know and the construction staff needed to know was, how can we best operate this canal? What kind of criteria will be placed on the operation of the canal so that we can properly design the pumping plants and the check structures and all of the hardware that goes into actually building the Central Arizona Project? There were questions about what's the availability of water. How frequently do we have to vary the flow? Is it a daily, a weekly, a monthly basis? Are we going to have to evacuate the canal?

Planning for sediment in the aqueducts

Traditionally, here in the Phoenix area, the Salt River Project has what they call a dry-up. In colder climes, not only do they have a dry-up, they have a freeze-up. I mean, they evacuate the delivery system for the winter. In Arizona where, of course, you don't have a need to evacuate the delivery system, the system does get clogged with sediment. And the Salt River Project in their operation of the works here in the Phoenix metropolitan area -- during low demand months, during the winter months, will dry up sections of the canal system for about thirty days and get into the canal prism itself and remove the accumulation of sediment.

So that was a question that the construction people needed to know. Are we going to have to dry up the canal? If we do dry up the canal, what kind of equipment are you going to use to get the sediment out? Well, we found out we didn't have a sediment problem. If we had a closed prism, if none of the cross drainage that came off of the surrounding foothills washed into the canal, other than windblown sediments, there was no source of sediment to accumulate in the canal, so we wouldn't have a sediment problem.

Developing a computerized monthly operations model for CAP

So those were the kind of operational questions that were asked of our group, and we set out to try and answer those questions. I was assigned to one of the hydrologists here in the office, he's still here, a fellow by the name of Tom Burbey. I guess we were probably both GS-12s at the time. Tom and I's task was to develop an operating model, a monthly operations model that would properly reflect over time how we would take water out of the Colorado River and what the variations in the flow would be and how we would actually deliver it to the various turnouts. At that time we were looking at principal turnouts in the Phoenix metropolitan area, Tucson metropolitan area, and about 900,000 acres of land between Harquahala Valley, which is about fifty miles west of Phoenix, down to the Cortero- Marana Irrigation District, which is about ten miles north of Tucson.

Oversaw computer operations as collateral duty

So there were these centroids of water demand that we were to deliver water to, there's a supply at the river, and we were charged with developing a computerized model. We did have a computer at that time. That was another one of my collateral duties, was -- I got to oversee the computer system because I was the only one at that time that had any experience in using a computer.

But we were charged with developing that model, and neither Tom nor I had much experience. I had a very limited experience, with software development, programming. Tom had a lot more experience than I did in the actual operation of systems. He understood the physical operation that was entailed. I generally could take what he could describe and relate that into flow charts. I could break down the physical characteristics of the system in the flow charts that could then be used by a software programmer to actually write the code for the computer.

Works with the staff in Denver to develop computerized operations model

I think it was in 1971, sometime in '71, that we went to Denver and met with Darrell Webber, who at that time was the Chief of Engineering ADP,[11] I think they called it at that time. Darrell loaned us a fellow. Come to think of it, it was the summer of '71. Loaned us a fellow, a young fellow on his staff, for ninety days and said, "We'll detail this guy down to you

[11] *Automated Data Processing.*

for ninety days." This fellow ended up being Jim Malila, who is now the, whatever his title is. What's Jim's title? Director of the Reclamation Service Center?

Storey: I guess it's Director of the Reclamation -- something like that.

Morton: Something like that. Yeah. So for one summer we had Jim Malila down here in Phoenix. To this day he rues that summer. I think it was probably 115 degrees, and we worked him twelve hours a day, and he wrote the code. Tom would develop the math strategy, I would take the raw math and equate it to flow charts, where you needed decisions, how you dealt with the decisions, branched the flow charts to the various other decisions that needed to be made, the arithmetic computations. Then Jim would write the code.

So the three of us worked as a team there during the summer of '71 and developed a computer model for an IBM 1130 computer, which was old, had tubes in it rather than semiconductors. But it was a relatively small disk-operated system. Programmed the model in BASIC. I spent a lot of time testing the model and using the output to describe the long-term operation and describe the extreme cases that the designers needed to know about. But that was the first assignment that I had when I moved out of planning and into O&M.

First assignment outside planning in O&M

On the sideline, of course, the Construction Engineer was moving forward with initiating the design for the C-A-P system, the beginning construction.

Storey: Then what did you move on to?

Morton: I think we experimented with the model. We did a lot of production runs. Still forms the backbone for the model we use right now for evaluation purposes, called the CAPSIM, C-A-P-S-I-M, Central Arizona Project Simulation Model. We use it primarily for creating data sets for cost-allocation purposes. The cost allocators need to know what the benefits are, and to determine the benefits, you need some kind of long-range model that will forecast actual water deliveries. The model's capable of doing that. They need power demand schedules over a long period of time, fifty-year payout period. So the model's capable of calculating power demands. In turn, you can create what you need for project power, then the reciprocal of that, of course, is the amount of power that's available for commercial sales. So out of that you also develop your power benefits, how much commercial power you can sell.

Development of the Central Arizona Project Simulation Model (CAPSIM)

CAPSIM is used for cost allocation purposes

CAPSIM predicts water deliveries and power demands

So the model has a number of uses, and so we spent probably, after the initial coding, we probably spent another year, maybe even two years, testing the model, developing the procedures, developing the various reports. That probably took the majority of my time in that time period, '71, '72 time period, was working on CAPSIM.

One of the other things I did was I was the office's IRM coordinator, and we kind of developed an approach, a strategy for computing. We ended up with a joint strategy with Parker-Davis where we would jointly purchase a computer. We bought one of the first centralized computer systems, this IBM 1130 I told you about. We located it at the post office building in downtown Phoenix, the idea being that, well, if we were going to pay for it, neither office should have an advantage over

Joint computer purchase by Arizona Projects Office and Parker-Davis Office

"We bought . . . this IBM 1130[, and] . . . located it at the Post Office building in downtown Phoenix, the idea being that . . . neither office should have an advantage . . . using it"

using it, and therefore we put it at a third site so both offices had to travel to use the facility.

The fellow that was in charge of the actual operation of the computer had done unit record equipment, data processing for Parker-Davis. As a power generation and transmission organization, they also had a number of clients that they had to bill for the electrical energy and that they did sell from Parker Dam and Davis Dam and to maintain all their meters and relays, they had a lot of records to keep that lent themselves to automatic data processing.

Computers in the early 1970s

At that era what was then called ADP, or automatic data processing, was just unit record equipment where you keypunched literally millions of Holorith cards and fed them, IBM cards, through the computer, and all they could do is add and subtract and sort and de-list, and then you could print them out. So that was generally the process that we followed. We put all our data on IBM cards, had boxes and boxes of IBM cards in storage there. So we spent a lot of time data entering, testing the system, running, for various purposes, running water supply analyses.

O&M group provided data used in negotiating master repayment contract

The negotiations of a master repayment contract were started also in about 1971. I wasn't personally involved in that, but oftentimes we would get requests for information. The master repayment contract and the water service contract defines points of delivery, it defines a number of parameters that we were having to deal with in our operations prospectus. So the team that was involved in that repayment contract negotiation went off and asked questions of our group with regard to the physical operation, anticipated operation of the aqueduct system.

Dick Shunick comes to Phoenix to negotiate the master repayment contract

It was about that time, in the '71 to '72 time period, I think the contract was -- I know the contract was signed in '72. It was in that time period that Dick Shunick came to the Arizona Project's Office. Dick had been Special Projects Officer in Division of Water and Land in Washington. He came out to head up the Reclamation side of the negotiating team. He brought with him a contract specialist from Washington by the name of George Blake. The field solicitor's office for this region at that time was in Riverside, and so John McBurney-Meade, the regional solicitor, headed up the team on behalf of Reclamation, and Dick Shunick was the senior Reclamation person on that. George Blake did all the legwork and wrote all the contract articles that were eventually consummated in 1972 in the master repayment contract between Reclamation and C-A-W-C-D.

Master repayment contract finished in 1972

Reclamation begins to develop an strategy for writing environmental impact statements

While that was going on, the environmental unit at the Arizona Projects Office, of course, was charged with developing a strategy for environmental impact statements. Many of us who were engaged in the operational characteristics of C-A-P and trying to figure out how we would operate were also asked because we had some writing skills or had been involved in the planning process, we were asked to participate, write sections up of what at that time we called the Programmatic EIS. We concluded early on, I guess probably in 1971, that prior to the decision to execute the master repayment contract, the Secretary would require some type of an environmental document. We could not fully describe what all the environmental impacts of a $1.2 billion, at that time, Central Arizona Project would look like. We had no idea of the total acreage that would be

Reclamation develops programmatic environmental impact statement for CAP involved, the types of plants and animals, the types of cultural resources that would be affected as a result of the construction.

So I think late in '71 we concluded that while we needed an environmental impact statement, we could not be specific about what all of the impacts associated [with] construction would look like, and so we would develop a programmatic statement with a commitment to follow that programmatic statement with site-specific statements for each major component of the Central Arizona Project. That decision has served us well for twenty-five years. I mean, we've stood the test of, I guess, probably five or six lawsuits, and it's been a good process, I think.

Reclamation commits to write site-specific environmental impact statements for major components of CAP

But in that time frame, late last half of '71, early '72, that was the kind of thing we were involved in, the development of an operating strategy, the implementation of new technologies like computers and assisting in describing the extent of the Central Arizona Project and what the general impacts would be for the programmatic EIS.

It was a rather encyclopedic EIS. It was probably two inches thick and incorporated a lot of conjecture because we just didn't have good hard data to base our impact analysis on. But the programmatic EIS allowed us to execute the master repayment contract, and it moved us down the path to a process that allowed construction. And that's the start of the new story, is construction in 1973.

The nature of the programmatic environmental impact statement

Storey: The computers. I believe at this time most [Reclamation] people had to work with the VAX system in Denver or the UNIX system? I'm blanking out the word, the computer name.

In the early 1970s we did not have communication links to the Denver computers

Morton: Well, we didn't really have communications. I'm trying to remember the name of the system, too. You had to send everything up to Denver to run, I mean, physically. You didn't have telecommunications as you do today. If you wanted something run, you went into their mainframe and they ran it on the mainframe there in Denver. It's pre-Cyber. VAX is really a mini computer; it's not the big mainframe. Somewhere between the GE 650 and the Cyber, there was another era of computer, and I'm with you, I can't remember what that was.

Storey: But what I wanted to get at is why did the Phoenix Area Office get a computer?

Morton: Well, we didn't get a computer. The Parker-Davis Project Office got a computer. And why did the Parker-Davis Project Office get a computer? Because they had billing requirements and they had requirements associated with the maintenance of their hardware, their relays, you know, you need to have all your settings documented for all your relays. You need to document your maintenance records for your meters. You need to have all your meter readings in some automated format. And Parker-Davis couldn't afford, of their own volition, to move from unit record equipment to a computer, a true computer system, and we kind of became the mechanism to allow that to occur.

The computer in Phoenix was justified by Parker-Davis's massive data storage needs

The two project managers got their heads together and said, "We can move Parker-Davis into the late twentieth century and we can get our feet on the ground if we can combine resources and finances," and that's what happened.

END OF SIDE 1, TAPE 2. MAY 21, 1996.
BEGIN SIDE 2, TAPE 2. MAY 21, 1996.

Storey: . . . a[n Otto] Magnum-Cliff Pugh decision then.

Morton: Yeah, it was a combination effort on their two parts. Otto was the project manager at Parker-Davis at that time, and his young assistant was a fellow by the name of Ed Hallenbeck. So that was the first opportunity I had to work with Ed Hallenbeck, was working out the financial arrangements and the siting arrangements for the joint computer that was really on the property rolls as part of Parker-Davis's property, but we had total functionality and use of it, too.

Storey: Then the IBM cards, you could do those at your office?

Morton: Yes.

Storey: You could do the data input, then you would have to go physically to the post office to run the cards through the computer?

Morton: Correct.

Storey: Without any phone lines? No remote terminals, that kind of thing?

The Phoenix Projects Office had a way to communicate with its computer, but it was not very practical

Morton: Well, at that time IBM had a little programming language that they called APL, which stood for "A Programming Language." It was the only system that IBM supported, or the only software that IBM supported, that you could tie into the 1130 through telecommunications. So you could get a terminal, and we did have a terminal at the Arizona Projects Office, and you could tie that back to the 1130 at the post office over the telephone line. It had a modem coupler and you put your phone handset in the modem coupler and you could transmit.

The only problem was you had to pull everything off the 1130 that was running BASIC or FORTRAN or RPG, which was generally the type of report generator that the Parker-Davis Project used for the billings and so on. You had to offload all of that stuff, put a dedicated disk into the computer to run APL. So there was not a lot of enthusiasm on the part of the Parker-Davis employee who was actually the operator of the system. There was not a lot of enthusiasm on his part to pull all his operations off the computer, dedicate it for a solid block of time so somebody that was, oh, I think we were about six blocks away, city blocks away, we were at Second and Monroe at that time and the post office was down at First and Fillmore, about six blocks down the street, he wasn't all that enthusiastic about pulling his activities off the computer and dedicating a block of time for somebody to experiment with APL.

Trying to get other engineers interested in using the new computer

So I learned APL, I tried to teach it to some of the engineers. They really didn't like it. It was an operator hierarchial language. FORTRAN and BASIC were much better, they were more conversant with those programming languages. I don't know that APL -- I kind of lost track of it, I don't think it became adopted universally. I think it just kind of wilted on the vine. But it was kind of an interesting language. I think Dartmouth University had adopted it.

Storey: Did Mr. Magnum and Mr. Pugh have to go to anybody to get permission to purchase the computer, do you remember? Do you know?

Morton: That's a good question, and I really don't know the answer to that. I would expect so. I would expect that the IRM structure or the ADP structure within Reclamation would have had to approve that, but I don't know that for a fact. I do know that Darrell Webber and the engineering side of the ADP operation in Denver were our friends, if you will. They supported our efforts. But at that time, the IRM organization was more administrative-driven than technically-driven. I mean, it was the administrative applications that had payroll and budgets and program documents and safety, and all of the administrative functions were the cornerstone or the support for the computer systems in Denver.

At that time the computer was driven by administrative applications, rather than technical ones

There wasn't a whole lot of technical stuff on the computers at that time, other than what Webber's organization did, and they sat within a whole different unit of the Denver office. I mean, they were -- I can't even remember where they were organizationally located, I think somewhere in the Chief Engineer's office, but I just don't -- it was fairly down in the organization. It was like a branch. It wasn't even a division at that time, it was a branch or something.

Storey: Did the computer activity occupy a lot of your time?

Morton: Not a lot. As the advocate in the office, I tried to stir up interest, I'd run a weekly seminar, and so that probably took two hours for the seminar and four or five hours to prepare for it. I'd get half a dozen people who expressed an interest and wanted to try something. It tended to be the people who were engaged in cross-drainage, calculations of artificial hydrographs for cross-drainage design, overshoot design, flood designers. They tended to be the type of people that were willing to try data processing.

I think that was probably one of my failures. They said, "We've got this deal with Parker-Davis and we get to use the computer a certain amount of time. We want you to try and beef up our utilization to make sure we get our fair share of the use of the computer," and I did a lot of things to try and attract people to it. It was probably just the wrong era. I mean, we had brought in a lot of staff who just had no exposure to the computer and had done it that way, you know, manually for twenty-five or thirty years, and they just weren't prepared to make that change to the computer.

So I became more of a computer practitioner in using it to do evaluations for the things I was involved in, like the operation of the aqueduct system and operation of the reservoir system and that type of thing. I won't say I was the exclusive person that used it, because that's not true, but on a regular basis I was probably one of only three or four people who made any significant use of that computer resource in the '71, '72 time period.

Storey: The CAPSIM and the computer activity, they were parallel?

Morton: Yeah. I think the computer activity was actually justified prior to starting CAPSIM. I mean, we had a joint team that worked together and figured out what Parker-Davis' needs were and what the Arizona Project Office's needs were and wrote a report and got buy-in from the Regional Director, and allocated funds for the purchase of the equipment, put a spec out, selected the IBM from the list of offerers and so on.

So I think the CAPSIM was pretty much independent of the computer, but they were relatively concurrent. We wouldn't have developed CAPSIM if we hadn't had that computer. We wouldn't have used the BASIC language if we hadn't had that one model of computer and so on.

Storey: At the same time you were working on environmental statement development?

Morton: I think everybody who formerly worked in planning got assignments from the environmental chief to work out various aspects. You know, C-A-P was more than just the canal bringing Colorado River water to Phoenix and Tucson. It involved -- there were four dams authorized, the Orme Dam, Hooker Dam, Charleston Dam, Buttes Dam. During the planning era, '65 through '70 or '71, most of the people that were the leftovers, if you will, of the Arizona Projects Office, the non-construction organization, had worked in some capacity on one of these dams or on the planning for the aqueduct or on some of the ancillary features like the distribution system, or had worked on one of the big aspects of C-A-P is the delivery of water to Indian communities.

Most of the former planning staff worked on environmental statements

I had experience, I had some know-ledge about the San Carlos Indian Irrigation Project, which furnishes water to the Gila River Indian Community, which was to become probably our single largest contractor for C-A-P water. So we all had some background in some aspect of C-A-P, so it fell on those individuals who had this knowledge and experience to actually write those sections of the programmatic EIS that dealt with Charleston or Buttes or the delivery system.

Storey: I'd like talk about that more tomorrow.

Morton: Okay.

Storey: However, I think our time's up today, and so I'd like to ask whether you're willing for the information in these cassettes and the resulting transcripts to be used by researchers.

Morton: Sure, I certainly will.

Storey: Good. Thank you very much.

END OF SIDE 2, TAPE 2. MAY 21, 1996
BEGIN SIDE 1, TAPE 1. MAY 22, 1996

Storey: This is Brit Allan Storey, Senior Historian of the Bureau of Reclamation, interviewing Larry Morton in his offices at the Phoenix Area Office on May the 22nd, 1996 at about ten o'clock in the morning. This is tape one.

Yesterday when we were talking, you talked about CAPSIM and your work on development of that. I think you said you spent a couple of years, am I remembering correctly?

Development and evolution of CAPSIM

Morton: That's right. Every time we turned around, we found that there was a need to add a little something to it. I guess the basic operating model was to model the delivery of water from the Colorado River to entities here in Central Arizona, and it didn't consider local stream runoff like from the Salt River that could have been captured by Orme Dam or like additional water that would have accrued to C-A-P from

The basic CAPSIM operating model was for water deliveries from the Colorado River

Buttes Dam if it had ever been built. So we added those refinements to the CAPSIM model. The reservoir operation for Orme Dam and the reservoir operation for Buttes Dam, were subsequent additions to the basic model.

Then as the water allocation strategies became more well known, including allocations to the Indian communities and higher levels of proposed deliveries to municipal and industrial sectors and so on, then the delivery points in the model were modified, and the floor and ceilings were raised accordingly into maximum and minimum monthly deliveries. So there was always some modifications ongoing to the basic structure of the model.

CAPSIM was always being modified

There was also relatively constant need for updated information, years of record on the rivers and the tributaries would add to the amount of data that you would input regarding the hydrology of the Colorado River, the hydrology of the Salt and Gila [rivers]. So you had to update the model for additional data sets that became available. Then on an annual basis for both budget justification purposes and for consultation with C-A-W-C-D in terms of their repayment, we would update the cost allocation. Much of the basic data that went into the cost allocation in order to do the benefit evaluation and in order to do the energy and water supply calculations would come out of the CAPSIM model.

CAPSIM data is continually updated with actual figures replacing projections

"Then on an annual basis for both budget justification purposes and for consultation with CAWCD in terms of their repayment, we would update the cost allocation"

So we would run it for official ones usually twice a year, once for budget estimates and once for budget justifications. So we would usually run the model officially and lock in on the results like in May and December of every year for reporting purposes.

CAPSIM is used for budgeting

Storey: But it's constantly evolving, or it was at that time?

Morton: It's pretty stabilized now, the model itself. As I said, it's used for cost allocation and repayment purposes. They still use it twice a year. Right now, as we begin the transfer process for the Regulatory Storage Division, in 1993 we transferred the aqueduct system to C-A-W-C-D and we transferred the responsibility for repayment, so there had to be an official analysis run at that time which we called the Cost Allocation and Repayment Study 1, shortened term was CARS 1. We're now in the process here in 1996 of finalizing the cost allocation for the Regulatory Storage Division, and so we're redoing it for CARS 2.

CAPSIM is now stable with new data input as available

Reclamation in process of transferring the Regulatory Storage Division of CAP

1993 transferred aqueduct system and repayment responsibility to CAWCD

So the model is updated in terms of data, but in terms of its operating parameters, its software coding, it's pretty much been set in concrete now for about, I guess probably about eight years or so. The last modification was to change from an Orme analysis to a Waddell Dam analysis. The software was rewritten, eight -- oh, heck, I guess it's about ten or eleven years ago now. How time flies. But it's been redone by our hydrology staff several years ago for that purpose.

"the [CAPSIM] model is updated in terms of data, but in terms of . . . its software coding, it's pretty much been set in concrete . . . for . . . about . . . ten or eleven years"

Storey: I guess I need to ask, what is the purpose of the model? I jumped to a conclusion, but I'm not sure if it is the correct one.

Morton: Well, initially the model was to give us operational data that we could provide to the designers who were going to design the pumping plants and design the canals and design the turnouts and things like that. Today the model is used for cost allocation and financial evaluations only. I mean, the design is complete; it's locked in concrete.

CAPSIM evolved from an operations model into one for cost allocation and financial evaluations

Storey: Literally.

Morton: Literally. Literally locked in concrete. But because of that, the software, all the parameters in the software now are fixed. We know exactly what the maximum capacity to turn out water to any given entity would be. Conceivably, at some point in time a new contractor for C-A-P water could come on board and the contractor could say, "We're prepared to put a new turnout," at a location where a turnout does not exist today. In that case, then we'd have to go back and recreate the software to take that new turnout into account. But right now, from a practical sense, the model is pretty well a static model. The turnouts have all been identified. The water supply sources have all been identified.

In other words, we get water from the Agua Fria River, the natural flows of the Agua Fria River that's stored behind new Waddell Dam. That's all been configured in the model. The reservoir operation has been hard-wired, if you will, into the model.

How CAPSIM uses data to project operations, cost allocation, etc.

So the only changes are what assumptions you have relative to inflows which are traditionally historical inflows. We don't use stochastic hydrology or any artificial-type hydrology. We just take the natural run-off of the Colorado River and the Agua Fria River and operate the model with those flows for different periods of records. So we'll do a <u>trace</u> that starts in 1905, we'll do a second trace that starts in 1911. We'll do another trace that starts in 1917. So we'll just do -- I think we're doing sixteen traces now, offset by five or six years.

So we cycle those historical flows through the Colorado River reservoir system and the C-A-P reservoir at Waddell. Each of those traces will give you a different answer on yields and benefits and so on, but then we amalgamate all that and say these sixteen traces are representative of the long-term average that we would expect from C-A-P.

Now, as we get additional data, every five years we update the data sets so we'll extend the input data, the hydrologic input data, for example, from, I think we updated it last in 1993, we'll update it again in 1998. We'll add the historic flows of the Colorado River and the Agua Fria River and then we'll add another trace. We'll go from sixteen traces to seventeen traces. So that's about the limit of our updating. We don't really change the model, we just change the data inputs. Whether it's hydrologic data inputs or it's water demand inputs, because the population projections are determined to no longer be valid, we may be growing faster than what was anticipated five years ago, Department of Economic Security may put out new population projections. Normally we check back every ten years on the census data to make sure that the census data is consistent with what our projections were in the model.

The bottom line is we anticipate we're going to sell 640,000 acre-feet of M&I water, but as the population projections vary over time, the date at which we will achieve that level of delivery varies from as early as 2015 to as late as 2040. It's just worked that way. So all of that needs to be updated. Then we put a study together for that common point in time and for whatever purpose the study is, whether it's a budgetary purpose or it's an establishment of the C-A-W-C-D's repayment obligation, whatever the purpose is, that study for that common point in time becomes locked in. That becomes the

"we anticipate we're going to sell 640,000 acre-feet of M&I water, but as the population projections vary over time, the date at which we will achieve that level of delivery varies from as early as 2015 to as late as 2040"

basis for some determination, i.e., C-A-W-C-D's repayment obligation is $2 billion, for example.

Storey: I presume from what you're saying that Reclamation is able to ask for different kinds of reports out of the model.

Morton: There is some limited report-generating capability within the model, but generally speaking, it produces a fixed set of reports. It produces a report on water yield that identifies the various sectors that the water is delivered to. In other words, municipal and industrial water, Indian water, non-Indian irrigation water, and water delivered to entities outside of the C-A-W-C-D, because each of those is part of the equation that goes into the cost allocation. The model produces a data set with regard to energy consumption for project purposes, and it produces a data set relative to energy available for commercial sales, one to evaluate the O&M costs associated with the delivery, the variable O&M costs associated with the delivery of project water, so that we can identify what the price of water will have to be in order to recover 100 percent of the O&M cost.

CAPSIM generally produces a fixed set of reports

CAPSIM projects CAP energy consumption and power available for sale

Then the converse of that argument, of course, is how much energy is sold. It becomes a revenue stream to help assist in the repayment of the project. So the amount of energy that's available for sale at a given rate will produce two things: it will produce a data set on revenue and it will produce a data set that is present valued for benefit purposes, how many dollars worth of annual equivalent benefits, dollar benefits, do you get from commercial power sales. And that, of course, goes into the cost allocation.

Storey: Do we have a power plant --

Morton: Sure.

Storey: -- in Navajo?

Morton: No, we have a small plant at New Waddell, a pump generating plant. But the bulk of the energy we're talking about is at Navajo, yeah.

Storey: So we don't necessarily use all of the energy, is that what I'm hearing?

Morton: No, no. I'm trying to remember the exact numbers. My recollection is that we have 24.3 percent, we have an entitlement to 24.3 percent of the energy that's generated at Navajo. My recollection is that that is about 4,300 gigawatt hours a year, and <u>on average</u> to deliver C-A-P's water entitlement we require about 2,800 or 2,900 gigawatt hours per year.

Reclamation doesn't use all the power it has available for CAP

Reclamation is entitled to 24.3% of power from the Navajo powerplant

We talked previously about surplus conditions and the declaration of surpluses on the Colorado River. In a year in which there's a declared surplus on the river, C-A-P's entitlement increases from 1.5 million to about 2.1 million acre-feet. In <u>that</u> year, all the energy entitlement that we can get out of Navajo would be dedicated to pumping C-A-P water. So that's how we sized the entitlement that we would buy in Navajo. It was predicated on a full canal, pumping 3,000 cubic feet per second 365 days a year. How many kilowatt hours do you need to do that? And that was the basis for setting the entitlement that we would purchase out of Navajo.

How Reclamation determined how much power entitlement it had to buy at Navajo Power Station

But, from a practical sense, we vary. In some of the winter months we may be pumping one unit twelve hours a day or sixteen hours a

Reclamation tries to maximize power revenue income day, that's only 500 cubic feet per second, diversion at Lake Havasu for sixteen hours, perhaps. The generating plant's putting out a whole lot more energy than that. We also use the Waddell Reservoir as a power enhancement function, so when power's in short supply in the summer or has a higher value during the summer,in order to get the most revenue that we can, we use up all of our energy in the winter. We pump the water into the Phoenix metropolitan area and store what we can behind New Waddell Dam, and then we can match during the summer the peak power demands during the summer, and obtain greater revenues.

For example, we can take one or two or three units at Havasu off line during the daytime hours in the summer and make up that -- each unit at Havasu is 500 cubic feet per second, so we could take a 500 cubic foot per second unit off line at Havasu. We could make up the 500 cubic feet per second by releasing it from Waddell during the daylight hours. We get the added benefit of generation when we make that release from Waddell, we're generating it during the daytime, real high value energy. We've also stopped using some of our energy because we've curtailed our operation at Havasu. So in turn, that energy that's available to us can now be sold on the marketplace, too. So we get two benefits from that form of operation.

How the powerplant at New Waddell figures in management of Reclamation power needs and income

Storey: And the powerhouse at new Waddell is a Reclamation facility or a C-A-W-C-D facility?

Morton: Well, it's owned by the Bureau of Reclamation. It's been turned over, or it will be turned over in September of '96 as part of our Declaration of Substantial Completion. It will be turned over to C-A-W-C-D for care, operation, and maintenance. But first title to the plant is vested in the United States.

Storey: We own this 24.3 percent of Navajo.

Morton: Well, it's not like we own the physical facility. We own the entitlement. Salt River Project acts as the Federal trustee. The 24.3 percent is held in trust by SRP. There's a joint tenancy agreement among the participants at Navajo. There's five participants. Three of the participants hold their own shares. SRP holds SRP's share and the United States' share. It was determined early on that the United States would not acquire title. So Salt River holds the title to the facility. The Federal share of that title is held by SRP in trust for the United States. But we have entitlement to use the power for 24.3 percent of the plant.

Salt River Project holds Reclamation's entitlement to Navajo Power Station electricity in trust

Storey: Obviously this leads us into an area I wanted to talk about anyway. This is a fairly complex ownership arrangement.

Morton: Oh, yes. (laughter) I couldn't even describe how complex it is.

Storey: It was even, if I recall, the first component of the C-A-P that was actually under construction.

Morton: That's correct.

How was Reclamation involved in construction at Navajo Power Station?

Storey: Did Reclamation have any hand in the design and management, construction management, for that plant? Did we participate?

Morton: No, in fact, the construction agent for the plant was Salt River Project. The Navajo Project is broader than just the plant. The Navajo Project consists of three components. There's the power-generating station at Page. There's what they call the Southern Transmission System, which is a series of transmission lines that begins at Page and terminates at Westwing Substation here in the Phoenix metropolitan area. And there's a Western Transmission System that also begins at Page and terminates at McCullough Substation just outside of Las Vegas.

The generation and transmission system for Navajo Power Station

The Arizona Public Service was the construction agent for the Southern Transmission System. The Salt River Project was the construction agent for the Navajo generating station. The City of Los Angeles Department of Water and Power was the constructing agent for the Western Transmission System. The Nevada Power Company <u>operates</u> the Western Transmission System. Salt River Project <u>operates</u> the generating station, and Arizona Public Service <u>operates</u> the Southern Transmission System. So there were four entitles involved in either construction or operation of the three components of the Navajo Project.

Storey: Did we actually pay for 24.3 percent of the construction costs?

Morton: Roughly. Most of our power comes through -- I think it comes through the Southern Transmission System. We do route some power through the Western Transmission System and then through the Davis-Parker No. 2 line to Havasu. The generating station was clearly a 24.3 percent share, but because of the amount of energy for each entitlement holder that flowed through the various transmission systems, we paid a little bit more, a higher percentage of the Southern Transmission System, I believe, and a lesser percentage of the Western Transmission. And because the Southern Transmission System was more expensive, I think, than the Western, when you added it all up, I think we probably paid like 25.1 percent of the total cost of the whole project, but that just was because the various components were allocated in variable shares.

Storey: If I'm recalling, Navajo went into operation in '73?

Morton: No, '76, I think, was the first unit went on line. '76, '77, and '78 they put one unit on line each year.

Storey: And we did not deliver water until the mid-eighties?

Morton: Right.

Storey: So what was happening to Reclamation's 24.3 percent of the power between the time of construction and the time that we needed to pump water?

Reclamation's 24.3% of Navajo Power Station power prior to delivery of water

Morton: Well, that was one of the complex parts of this interrelated series of contracts that was put into place in 1969. It was anticipated that we would be in that situation in 1969, and so the people that formed the power contracts designed what they called the Layoff Contract. The Layoff Contract provided that the participants would buy the Federal share during this time, and we would lay that share of the pumping energy re-

The Layoff Contract at for Navajo Power Station

quirements off to the participants in proportion to their need. They traded and swapped it around and, in fact, got other people involved, including Southern California Edison, who ended up with a piece of that surplus energy. The revenues associated with that went into the [Lower Colorado River Basin] Development Fund and, in turn, were used to pay the costs that were allocated to commercial power.

Power revenues went into the Lower Colorado River Development Fund

So as the Navajo Generating Station became plant in-service, removed from construction status to plant in service or operating status, the Lower Colorado [River] Basin Development Fund showed a proportion of the Navajo plant in 1976 as plant in service and established a repayment obligation. As revenues accrued and we paid for the O&M, in other words, there were O&M expenses associated with the transmission system, or associated with the coal that was burned in the plant, normal maintenance on the plant, all of those were part of the operating expenses. Those were deducted from the revenues, and any net revenue was applied against the power allocation function.

Power revenues at Navajo Power Station went to payment of O&M costs and repayment of generation costs

I think prior to the time of the Declaration of Substantial Completion for C-A-P in 1993, I think, to the best of my recollection, we had prepaid or repaid about $90 million of the power function. We had paid that out of these interim revenues, these layoff revenues.

Prior to 1993 Reclamation repaid about $90 million of the costs of power development

Storey: How much did we pay for our share of the entitlement?

Morton: Well, our entitlement in the Navajo Project, including the Transmission Systems, the total estimated cost was $230 million, and our actual expenditures to date have been about, I think, about $224. There were some capital improvements that were proposed as part of the original plant. They're still unconstructed, but they were part of the original plan as designed, and so we've always kept that in reserve.

In other words, to the extent it's agreed that Salt River should construct those capital improvements, we would have the appropriation ceiling to go seek those funds from Congress. Now, that was the original plant itself. In 1993, I believe, the Secretary of the Interior, to settle a lawsuit, agreed -- all the participants, including the Secretary of the Interior, agreed to install scrubbers on the Navajo stacks, and the total cost of that endeavor is currently estimated to be about 500 million dollars. Our share of that's roughly 118 or [1]20 million dollars, I think, something in that order of magnitude.

Storey: Then has this been installed, it's in the process?

Morton: It's in the process of being built right now, the scrubbers. So when all is said and done, the Federal share of Navajo is going to be something on the order of 350 million dollars.

Storey: But initially over 200?

Morton: Initially over 200, yes.

How the CAP authorization automatically increased

Storey: Which, if I'm recalling correctly, is over one-quarter of the entire C-A-P project?

Morton: Well, it's one-quarter of the entire C-A-P project as provided for in the authorization. But the authorization also contains language that allows for increases due to inflation and it provides for increases due to general legislation.

Storey: Indexing?

Morton: Well, there's two aspects. One is indexing; one is general legislation. For example, when we designed the C-A-P and sought authorization for C-A-P, there was no Endangered Species Act. And because there was no Endangered Species Act, we had no knowledge in our cost estimates that there were going to be additional burdens placed on the project to pay for reasonable and prudent alternatives to eliminate potential jeopardies to endangered species. We've gone through something on the order of forty-five consultations with Fish and Wildlife Service on various endangered species issues and, in fact, we've invested something on the order of $60 million to eliminate potential jeopardies to endangered species. Those are project costs and are additive to our appropriation ceiling.

Costs for Endangered Species Act compliance

So you have to look at the broad picture over a long period of time to get a true perspective. Today that $832 million, which was indexed for inflation and indexed or increased for new general legislation subsequent to 1968, now totals about $3.8 billion. So the price of the project, or the authorized appropriation ceiling, that which we can go to Congress and seek appropriations for, has increased by about $3 billion since 1968. And part of that is --

END OF TAPE 1, SIDE 1. MAY 22, 1996.
BEGIN TAPE 1. SIDE 2, MAY 22, 1996.

Storey: You were saying that the project had increased through indexing and all of that to 3.8, and that the scrubbers were included in this figure now.

Morton: The scrubbers are included in our cost estimate. As I was going to explain, several years ago the

Reclamation stops to index appropriations ceilings

Office of the Inspector General audited Reclamation at large and part of the results of that audit indicated that Reclamation should not use general legislation as a mechanism of increasing the appropriation ceiling for its projects. Reclamation was not willing to accept, in total, that finding of the Office of the Inspector General, but it was concluded we wanted to resolve that issue, and, in turn, we advised the IG, the Office of the Inspector General, and the Congress that after, I believe it was January 1st, 1994, we would cease all indexing of appropriation ceilings based on general legislation.

So, in fact, from a practical sense, while it's clear that the increased cost, the 120 million dollars worth of increased cost associated with the Navajo Generating Station were necessitated by two pieces of legislation, the Clean Air Act and the Wilderness Act, those two pieces of legislation which postdated the C-A-P authorization necessitated, drove us, to install scrubbers at Navajo because that was the basis of the lawsuit and that was the basis of the stipulated settlement in the lawsuit. We have not used that 120 million dollars as a component in our indexing of our appropriation ceiling, because in order to resolve the IG audit, the Commissioner agreed to cease all indexing based on general legislation.

I'm thinking maybe -- I'm unclear of the time frame. It may have been '93 rather than '94, because I'm thinking that Commissioner Underwood signed that agreement rather than Dan Beard, so I think maybe it was Underwood that committed to that. So that would move it back a year, about a year. So I think effective January 1st, '93, no Reclamation project has used general legislation, but anything on our books prior to that date as a result of general legislation stayed on the books. In fact, I think then Secretary [Bruce] Babbitt signed the stipulation in the Navajo Generating Station lawsuit in '93 or '94.

So that was the time at which those costs were enrolled as a project cost, but we could not enroll those costs as a legitimate increment in our appropriation ceiling, and we continued to go down the line. We've consulted perhaps seven or eight times since that 1993 date with the Fish and Wildlife Service, for example, on endangered species, and we've not incorporated those additional costs to resolve endangered species conflicts. We've not incorporated those in our ceiling either.

Storey: If they aren't included in our ceiling, how do we pay for them?

Cost-sharing with other groups on CAP

Morton: Well, fortunately we've gone into some cost-sharing arrangements in the past to offset these increases in ceilings that weren't justified by general legislation. We've obtained over $200 million in local contributions to supplement appropriations. The Salt River Project has contributed for the modification of the Roosevelt Dam. The cities of Phoenix, Scottsdale, Mesa, Tempe, Chandler, and Glendale have all participated to the tune of about $43 million. The Flood Control District of Maricopa County, the Central Arizona Water Conservation District contributed $175 million for the construction of New Waddell Dam. So to the extent that there is a potential shortfall in Federal appropriations, in turn, we've made that up by seeking local cost-sharing, up-front payments, to offset the availability of Federal money.

Another thing that we've done, or that we're currently doing, I don't know how it will work in the future, but currently there's a difference in our appropriation ceiling and our current estimated cost for the entire project, including all units of the project. That includes Hooker, or suitable alternative in New Mexico. That would include Buttes Dam on the Gila River. It would include the distribution system to Indian communities.

If we were to build all of those, our total cost as of today's date would be about $100 million more than what we have ceiling available to us today. And in order to give Congress some comfort and to not violate the requirement that we not exceed our appropriation ceiling without amending the Basin Act,[12] we have indicated to Congress for the past three years that we will indefinitely defer the construction of Buttes, Hooker, and the Drainage Division.

Well, amongst all three of those units of the project, there's about -- over $300 million worth of ceiling that we've told Congress that we don't intend to utilize immediately. Our explanation to Congress also indicates that to the extent that we move forward on any one of those units, we will come back and seek amendatory language to increase the ceiling. We're within ceiling. We've spent 3 billion dollars to date. We have a ceiling of 3.8 billion dollars. Of the 3 billion dollars we've spent to date, over 250 million of it has been in local contributions. So we're still solvent, so to speak.

[12] *Colorado River Basin Project Act of September 30, 1968. Public Law 90-537, 82 stat. 885).*

Storey: I want to talk about Hooker later.

Morton: Okay.

Storey: As I understand, the money that goes into the projects, there are two sort of basic sets of funds. One is repayment money and one is O&M money. Now, what I think I heard you say was when we got revenue from the power, we would subtract the O&M and then the remainder would go for repayment, and that was the instance on the powerplant. But if there wasn't enough money to cover the O&M, wouldn't we be requesting annual payments from the contracting organizations?

Morton: Yeah. Oh, certainly, certainly.

Storey: So that's an annual fee that they have to keep up?

Morton: Let's go back to the interim power revenues, that layoff time frame from 1976 to 1993. During that time period, our only source of revenues -- well, that's not true. Between 1976 and 1985, the only source of revenue was the sale of layoff power. The contracts provided that the recipient of that power would pay 85 percent of their decremental cost. So if they got a kilowatt hour of energy from us, the most expensive component of energy that they would lay off from their own system would be calculated, and they'd pay us 85 percent. Well, as it worked out, generally speaking, that was equal to, or greater than, the O&M cost. When we did this and agreed to it in the contract in 1969, we'd done a number of analyses where in everybody's system their cost would be located.

Navajo is a really very efficient plant. It produces energy at a very low cost. So we felt real comfortable in giving them a "break," but we understood at that time that the "break," if you will, would more than cover the O&M that was going to be charged to us. So from a practical sense, we always recovered, between 1976 and 1985, we always recovered the O&M costs that were being charged to us by the Nevada Power Company, by the Arizona Public Service Company, and by the Salt River Project. So there was always a surplus on an annual basis. There was always a surplus in the Development Fund, and then that surplus was applied against the powerplant and service allocation, with interest at 3.342[%]. So there was always an interest payment being made to the Treasury and some payment being made against the capital allocation.

Storey: And all of the O&M costs?

Morton: And all of the O&M. So the revenues we were getting from our partners in the Navajo participation agreement was more than sufficient to pay 100 percent of the O&M that was being charged to us for the creation of this energy and the transmission of this energy, and always left a little bit over to pay for interest and $80-90 million of the capital allocation.

Reclamation first delivery of CAP water in 1985

In 1985, Reclamation first started delivering water to C-A-P customers, and, as our O&M contractor, we contracted with C-A-W-C-D to actually do the operation and maintenance. So there was a transition from a Reclamation O&M function to a district O&M function, but we hadn't yet gotten into repayment. So all the revenues that were being

Revenues went to the Lower Colorado River Basin Development Fund

obtained from the sale of water and the sale of power were revenues of the Lower Colorado River Basin Development Fund, which was managed by Reclamation.

Reclamation pays CAWCD to operate and maintain the canal system

Then, in turn, during this period of 1985 through 1993, we would pay from the Development Fund, we would pay C-A-W-C-D their cost to operate and maintain the canal similar to the preceding ten years or so that we paid the Navajo participants to operate and maintain the powerplant and the two transmission systems. So C-A-W-C-D became another variable in the equation of O&M payments.

Before water delivery it was necessary to capitalize O&M costs through appropriations

Because we had only limited water -- I shouldn't say water -- we had only limited customers, in other words, we could only deliver water from the Colorado River to Phoenix. The remainder of the system wasn't in-service, but over 50 percent of the cost of maintenance was really associated with the water that was supposed to go down to Pinal County and on into Tucson. So there was a need to capitalize. We needed to go to Congress and ask for appropriations for maintenance during construction, O&M during construction. In turn, we had to capitalize those costs as a construction cost, because, in fact, we were making payments to C-A-W-C-D to maintain a facility that had a future capability but no current capability in that year to deliver water, because we only had 50 percent of the system in operation that could deliver water to customers.

So during the period 1985 or '86 through 1993, we really didn't have all of our O&M expenses covered, because the sale of water and the sale of power did not cover the entire cost of O&M, but the rationale being that some of the cost of O&M was for future water service, and we hadn't yet completed the system to deliver that. So we requested those funds be appropriated and, in turn, we capitalized those funds as part of the construction cost of C-A-P. That's allowed under the Basin Act and, in fact, the capitalized O&M is not part of the ceiling, and that's explicitly defined in the act as well.

So up until 1993, between '76 and '85, we were a money-making proposition. Between '86 and '93, we were operating at a deficit and the deficit was being made up by appropriations. And then in '93, we turned the system over to C-A-W-C-D, we put it into repayment, and it's <u>their</u> responsibility now to ensure that the first increment of revenue, which is a 100 percent of the O&M, is met. So they have to produce, through their own devices, 100 percent of the O&M.

1976-85 CAP made money in terms of O&M

1986-93 CAP O&M operated at a deficit

Since 1993 CAWCD is responsible for O&M costs of CAP operated by it

Storey: They're incurring all of the O&M expenses, is that correct?

Morton: That's correct, with the exception of the Regulatory Storage Division. The Regulatory Storage Division is still <u>in</u> construction status. It has not been transferred. It's in operation, but it's still in construction status. It will be transferred to C-A-W-C-D.

The Regulatory Storage Division has not yet been turned over to CAWCD for O&M

Storey: What is it?

Morton: It's New Waddell Dam and Roosevelt Dam.

Storey: How did Roosevelt get in on all of this? Roosevelt is on the Salt River Project, right?

How did Roosevelt Dam become involved in CAP?

Morton: Right. If you go back to the authorization, you've got to go back to 1968 and look at the authorization, and the authorization says the

Roosevelt Dam is part of a suitable alternative to Orme Dam

Secretary of the Interior is authorized to construct Orme Dam or suitable alternative. In 1975, we were prepared to construct Orme Dam.

Storey: For what purpose?

Morton: The purpose is it would have been a multi-purpose facility. It would have been the regulatory storage component for C-A-P. It would allow us to do this power optimization that we talked about earlier relative to New Waddell. It would provide flood control, which was an authorized function of C-A-P; it would provide flood control for the City of Phoenix; it would have provided flat water recreation, lake recreation; it would have provided some power generation similar to Waddell, the pump generating plant at Waddell, there would have been a power plant; and it would have conserved surplus flows of the Salt River and Verde River system, flows that could not be controlled by the existing Salt River Project. Normally it would spill Granite Reef Dam and flow down to the Gila and then down the Gila to the Colorado at Yuma. So those were the basic functions that Orme would have done.

The purposes intended for Orme Dam

Storey: But the first basic function was to store water out of the Granite Reef Aqueduct?

Morton: Right.

Storey: Now known as the Hayden-Rhodes aqueduct.

Morton: Exactly. And to re-regulate those flows for delivery to the city of Phoenix and to re-regulate the flows through the Salt-Gila Aqueduct, which is now known as the Fannin-McFarland

Aqueduct, on to Pinal County and to Pima County and the city of Tucson. So that was its Colorado River water supply and power operation function. So it had a Colorado River tie to the aqueduct system for both water and power; it had an independent water supply function associated with the unregulated flows of the Salt and Verde River; it had a flood control function to protect the city of Phoenix along the Salt River; it had a recreation function associated with flat water recreation.

Opposition to Orme Dam

In 1975, we prepared a draft environmental statement on the construction of Orme Dam, and there was a substantial public outcry in opposition to Orme Dam at that time. We had a public hearing at the Phoenix Civic Plaza. Over 5,000 people showed up. The vast majority of those people were opposed to Orme Dam. We had something on the order of 12,000 separate comments on the draft environmental statement, and it became very obvious that Orme Dam was not well thought of in some circles.

Orme Dam had a very good benefit/cost ratio

Orme Dam, from an economic perspective -- and this goes back to our discussion earlier about principles and standards and how the Bureau evaluates water resource projects -- from a pure N-E-D perspective, Orme Dam was probably the most efficient facility ever conceived by Reclamation. It had an incremental B/C[13] ratio of something like four to one, because there was tremendous flood control benefits associated, tremendous power benefits, and water supply-type benefits that emanated from Orme Dam.

Orme Dam had a lot of associated problems

We could increase the average annual yield to the project by over 100,000 acre-feet a year. We had over $26 million a year in annual flood control benefits. It had a fantastic B/C

[13] *Benefit/Cost Ratio.*

ratio, but it had a lot of other problems associated with it. It had water quality problems. It had impacts to Indian communities. It had adverse social impacts. It had impacts to stream flow recreation. It had impacts to riparian habitats. It had endangered species impacts, adverse impacts to endangered species.

I mean, if you looked at it from the broad perspective of the value of it, well, at that time we really didn't have the quantitative tools to take those impacts and relate them in the traditional benefit/cost mold. They certainly could be qualitatively described, and when you arrayed in qualitative terms the types of adverse impacts you were engendering on the natural systems in Central Arizona at that time, and compared them to the four-to-one B/C ratio, the four-to-one B/C ratio paled in comparison to this litany of qualitative adverse impacts that you had.

Qualitative adverse effects of Orme Dam outweighed the very good benefit/cost ratio

Storey: And this had to be done because of NEPA?

Morton: This was done as a result of NEPA, yes.

Storey: And they received new standards of regs?

Morton: You know, my thought process basically says that they weren't in place yet, it seems to me. They had yet to be adopted by CEQ. They were being massaged, and I think that there had been a draft or two in the *Federal Register*. A lot of the commenters said you really need to wait until these regulations are in place and then you need to comply with those regulations.

NEPA and compliance for Orme Dam

But from a practical sense, NEPA was just a redundancy. I mean, if the regulations had been in place and NEPA had been in place, you're going to do it for one or the other, and it probably sufficed for both. Of course, in the preparation of the NEPA document, we considered all of the draft regulations and made sure that what we were putting in the NEPA document also would have sufficed had the regulations been put in place.

Storey: A lot of that list of impacts that you're talking about here, we can all jump to conclusions about what that was about, but the social impacts, to me, is like grabbing a hand full of Jell-o. What kinds of social impacts are we talking about?

Social impacts of Orme Dam

Morton: Well, if you believe my good friends on the Fort McDowell Indian Reservation, it would have destroyed their way of life. And, they made that eminently clear, that their traditional way of life, their nomadic presence along the flowing streams of the Verde River would had been adversely impacted. Their sweat lodges would have been no more. They would have been reduced to living in traditional Anglo houses. They would have been forced from the riparian areas and forced to live in the foothills or the flatlands of the valley. I don't know that the end result, as we look at it today some twenty-five years later, would have been much different, because that's exactly what I think has really happened. Some of the elders still frequent the riparian areas, but, in fact, the Fort McDowell community has developed the riparian areas for stream-flow recreation. They've moved to the foothills, they've built new houses in the foothills with proceeds from gaming.

Impacts on the Fort McDowell Indian Reservation

The future at that time in 1973 and '74, when we were evaluating it, the future without -- basically was the status quo. We've missed the mark. The future without in 1996 is dramatically different than the future without as was displayed in the EIS, and so the impacts were definitely overstated from the social perspective, because, in fact, gaming and urbanization and financial development and irrigated agriculture in the non-traditional Native American culture form no longer exist at Fort McDowell. I mean, they have a large corporate farm, they grow cash crops like cucumbers for the pickling industry, they grow 500 acres of cucumbers, and that is not a traditional Native American type of agriculture, obviously. The community of Ft. McDowell has definitely urbanized. I mean, there is a lot of new housing, a lot of new infrastructure, and the dam was never built.

Storey: The dam would have been on the reservation?

Morton: The dam and the lake would have been on the reservation, but the payments that would have been made would have provided equivalent land. It just is, it would not have been along the stream and the opportunity to be along the stream would have evaporated, it would no longer have been there. So, you know, at that time we performed that evaluation, there was substantial opposition, not only from the Indian community, but from the Audubon Society, from the recreationists, from the inner-tubing community, the people who used the flowing stream channels of the Verde and Salt River to float. They wanted moving water recreation. They didn't want a bunch of motorboats. They were opposed to the lake because while it provided substantially more in the way of economic benefits for recreation, the form for that recreation was substantially altered.

Opposition to Orme Dam came from a variety of sources

So while the N-E-D perspective showed an increase of like a 10 or 15-fold increase in dollar value of recreation, it was because you were going from 10,000 visitors per day, two days a week and the weekend in an inner tube, which produces relatively small benefit to a boating enterprise with $20,000 sailboats and $25,000 inboard motorboats on the lake that was available, for practical purposes, 365 days a year. You know, it just produced immeasurably greater benefits.

So if you look at it from the perspective of the economic terms as we were discussing several sessions ago, in economic terms it was just a really great wonderful thing. But from the recreating public, you lost bird-watching, you lost communing with nature, you lost float trips. On the environmental side, you lost substantial acreage of cotton[wood], willow, mesquite bosque, you lost a lot of the mesquite bosque. You lost not only that type of habitat --

END OF TAPE 1, SIDE 2. MAY 22, 1996.
BEGIN TAPE 2. SIDE 1, MAY 22, 1996.

Storey: This is tape two of an interview by Brit Storey with Larry Morton, on May 22, 1996.

You were saying that we lost a lot of wildlife.

Morton: Yeah, the loss, the environmental loss, the social loss, the recreation loss was, while in economic terms, was very small, just in terms of creating even a shorter supply of those types of opportunities, it was a travesty. I mean, it was a <u>really major</u> adverse impact. I guess traditional Reclamation evaluation wouldn't have shown that. It would have said, "Hey, let's do away with these things, they just don't add to the economy. Let's come in and have flat-water recreation and fishing and motorboating and water-skiing and sailboating."

Storey: And the water benefits?

Morton: And the water conservation benefits and the big flood control benefits. In economic terms, those are the things we really want.

Effect of the Election of 1976 on Reclamation processing of Orme Dam

Anyhow, the bottom line was, as a result of the adverse comment, the fact that in 1976 a major national election took place, in the year following the publication of the draft environmental statement, we accepted all the comments, we accepted the testimony. About four of us, I think, my recollection is, about four of us were assimilating, spent over a year assimilating that testimony and comment, prepared responses, developed a final EIS that addressed all those concerns.

But when it came time to actually finalize or publish the final environmental impact statement for Orme Dam, the decision could not be made within Interior at that time to do that. The election was upon us, we were moving from a Republican administration to a Democratic administration, and the comments were so adverse with regard to Orme, politically it was inexpedient to move forward with a decision to implement Orme.

Effect of the Carter "Hit List" on Orme Dam

Orme Dam deleted from the Central Arizona Project

So the preliminary draft, FEIS, final EIS, sat on the shelf and we waited -- found other things to do. Then as a result of subsequent action, called the Carter "hit list" and the Secretary Andrus water projects review process, Orme Dam was deleted in 1977 from the Central Arizona Project. Fortunately or unfortunately, the authorizing legislation provided for Orme Dam or suitable alternative and for those of us in the Arizona Project's Office, presented an opportunity to start anew and try and find an alternative for Orme Dam.

Study of Suitable alternatives to Orme Dam begins

That's another story, and we're in a long process here of talking about Orme Dam, but what it ends up with, getting back to the original question of about an hour ago, is we went through a subsequent planning process, and the Secretary of the Interior in 1984 adopted, as an alternative, or as a replacement for Orme Dam, the construction of two dams, New Waddell Dam on the Agua Fría River and Roosevelt Dam on the upper Salt River -- modified Roosevelt Dam on the upper Salt River.

New Waddell Dam and Roosevelt Dam substitute for Orme Dam in the Central Arizona Project

Now, you asked the question, how do those two dams relate to C-A-P and Orme Dam? Well, the obvious one is that New Waddell became, or provided, the replacement components for the regulatory function of the Colorado River flows, and it provided the power benefits associated with managing the power resource from the Navajo Generating Station. So New Waddell Dam was justified on its water conservation and water supply benefits and its power benefits.

Benefits to CAP provided by New Waddell Dam

Roosevelt Dam, on the other hand, was intended to provide the flood control benefits, or at least a share of the flood control benefits that would have been developed by Orme Dam. Obviously, sitting on the upper Salt River, it could not control the Verde. That was a unique benefit of Orme Dam. It was located at the confluence of the Salt and Verde Rivers and with one structure you could control floods from either tributary, from either stream.

Benefits to CAP provided by Roosevelt Dam

Roosevelt couldn't do that, but it could provide a substantial level of benefit, a flood control benefit, to the City of Phoenix. It also produced some incremental water supply benefits from the surplus flows of the Salt River, whereas Orme Dam would have been able to control both the Salt and Verde and would have stored those inflows and would have conserved those locally available surface waters. Roosevelt could do the same thing, at least for the Salt River side, the surplus Salt River flows.

Roosevelt Dam and the Reclamation Dam Safety Act of 1978

As a result of subsequent legislation, the Reclamation Dam Safety Act of 1978,[14] we were going to have to do something with Roosevelt Dam because of its inadequate spillways. In other words, when the Reclamation Dam Safety Act required us to examine all of the Federal structures owned by Reclamation to determine under current hydrologic conditions whether the dam was safe, and Roosevelt did not meet that test. It was unsafe. The current hydrology as compared to the hydrology that was used to design Roosevelt Dam was dramatically different. The historical record prior to construction of Roosevelt Dam was about ten years of flow data. Now we have ninety years of flow data. The hydrology was more well known for Roosevelt in 1985 than what it was in 1905.

So we basically had a need to make a major investment in Roosevelt Dam to correct its safety deficiencies. So we got the benefit of providing safety, we got the benefit of providing flood control, and we got the benefit of providing local water conservation. All of those would have been part of the original function of Orme. So we basically took Orme Dam out of

[14] *This is an Act of November 2, 1978, and is cited as Public Law 95-578, 92 Stat. 2471.*

the picture, looked for alternatives, and split the functions to two new structures from what Orme Dam would have provided had it been built.

So that's the reason why Roosevelt Dam is part, the modified Roosevelt Dam, the recent $430 million Federal investment, total investment, that includes contributions, so $430 million worth of investment in Roosevelt Dam, part of that is a C-A-P cost, even though it's a Salt River Project dam. And what we get is about 600,000 acre-feet of flood control space and we get another 285,000 acre-feet of water conservation space that potentially can yield up to 400,000 acre-feet a year under the permit we have from the Department of Water Resources.

"So that's the reason . . ., part of that [$430 million investment in Roosevelt Dam] is a CAP cost"

Storey: For the C-A-P?

Morton: For the C-A-P. In fact, we've sold that entitlement as part of our local funding agreement, we've sold that entitlement to the six Central Arizona Valley cities that I spoke about, Phoenix, Glendale, Scottsdale, Mesa, Chandler, and Tempe.

Reclamation sold new water conservation space behind Roosevelt Dam to Phoenix, Glendale, Scottsdale, Mesa, Chandler, and Tempe

Storey: Well, my next question was going to be, does this mean C-A-W-C-D is repaying costs on the Salt River Project's Roosevelt Dam?

Morton: Obviously somebody's been talking to you. (laughter) Either that or you're very discerning, because, yes, that is an issue. On one hand, it's a point of litigation, but from a practical sense, if the litigation is decided in favor of the United States and consistent with the contracts we feel we have with C-A-W-C-D and the other participants in the modification at Roosevelt Dam, the answer is, yes, C-A-W-C-D will owe perhaps as much as 10 to 12 percent of the cost

CAWCD is repaying project costs on Roosevelt Dam

of construction, will owe reimbursement to the United States for those costs over the fifty-year repayment period.

Repayment obligations of various entities for the modifications of Roosevelt Dam

The reason for that is that C-A-W-C-D, as well as the valley cities, as well as the Flood Control District of the State of Arizona and the Federal Government and Maricopa Water District and the City of Tucson in 1986 entered into a contract that's commonly known as the Plan 6 Funding Agreement. The Plan 6 Funding Agreement fixed the formula by which various entities would contribute to the construction of modified Roosevelt Dam and New Waddell Dam. And in the case of C-A-W-C-D, it was a fixed sum of money; it was $175 million. No ups, no downs, bottom line, no variation: $175 million.

But all of the other entities, Salt River Project, the six cities that I've mentioned, the Maricopa County Flood Control District, they all contributed based on some allocation strategy and it varied from entity to entity. Salt River Project, for example, was obligated to pay 15 percent of the reimbursable safety of dams allocated costs. Reimbursable and allocated costs. The Flood Control District was obligated to pay on a very imaginative formula that basically involved 20 percent of the ratio of the flood benefits resulting from Roosevelt Dam to the total flood control benefits for C-A-P, times the cost allocated to flood control. The cities agreed to pay 10.2 percent of the total cost, not the allocated cost but the total cost, of constructing modified Roosevelt Dam.

When you go through a cost allocation -- the way the master repayment contract is set up, Roosevelt and New Waddell are a unit, are a division of the C-A-P, and the master repayment contract provides that that division or that stage of construction will be factored into their repayment obligation at the time they go into service. Waddell construction preceded the completion of Roosevelt by about a year, but because they are combined as one unit or one division of the project, we've had to delay the notice of substantial completion until Roosevelt is complete, and we will issue that notice sometime this summer, summer of '96.

The cost allocation will be performed, and there will be a net reimbursable function because all of the contributions do not equate to the total reimbursable function, they come up short, short of the mark, and C-A-W-C-D was a participant in that agreement. They signed off on limiting SRP and the cities and the flood control district to a certain sum of money, albeit calculated by a formula, but in that agreement they also agreed to pick up whatever the remaining reimbursable cost was.

The cost of new water developed behind Roosevelt Dam

So the net effect is when we formulated the cost allocation procedures in 1986, we missed the mark, and I think we missed the mark in the arena of how much the cities paid. And C-A-W-C-D agreed to fix the cities' payment for the new conservation space at Roosevelt by the average cost of the delivery of water to C-A-P -- the average cost of delivery of Colorado River water. Well, from a practical sense, that measure is less expensive than what the cost of conserved water at Roosevelt is.

When you go through the cost allocation, the cost of water in this 278,000 acre-foot new conservation space at Roosevelt is more expensive than what the average cost of M&I water is from the Colorado River. And since C-A-W-C-D agreed to that and, in turn, that was equated to a percentage of the actual cost of construction, based on 1968 estimates, the bottom line is that C-A-W-C-D inherited the residual reimbursable cost by virtue of their master repayment contract.

That is under litigation. They've indicated in their complaint that they should not be obligated to pay that. We'll see how it comes out. But from a practical sense, somebody's got to pay for it and the cities' payment is fixed by contract. So the residual flows to C-A-W-C-D by virtue of contract. I mean, it's just part and parcel to the contractual process.

CAWCD agreed by contract to repay any costs not borne by others for the Roosevelt Dam modifications

Storey: Is Salt River Project still running and controlling and operating at Roosevelt?

Morton: Yes, that was also part of the Plan 6 agreement that the Salt River Project, following declaration of substantial completion, would take over the care, operation, and maintenance. Reassume, I guess, is a better term. Reassume the care, operation and maintenance, because as a result of their 1917 contract with the Bureau of Reclamation, they always had that responsibility to care [for], operate, and maintain the original Roosevelt Dam. As a result of the '86 contract, once construction has been completed, that responsibility will revert to SRP.

Who runs the Salt River Project with a modified Roosevelt Dam

In fact, as we have completed various minor components of the Roosevelt modification, we've restored that responsibility to the SRP under a separate O&M contract. So, for example, early on in the construction, we completed some drainage adits to drain water away from the toe of the dam, and SRP reassumed the responsibility for O&M on those drainage adits three or four years ago now.

Restoration of O&M to the Salt River Project after Roosevelt Dam modifications

So as I say, various minor components, the road to the power plant, for example, we had to rebuild the road to the power plant as part of the modifications, and when the contractor was completed with that, we turned the road back to SRP to operate and maintain, just to minimize our cost. And they were more than willing to do that. I mean, it had been something they had been doing for eighty years anyhow, so it wasn't anything new to them.

Storey: So we have the Salt River Project running a facility which provides C-A-P flood control, and I presume that's done under one of these guidance documents that the Corps of Engineers provides and that we endorse or something like that?

Corps of Engineers is in process of developing a regulation for operation of Roosevelt Dam

Morton: Well, we hope so. We've gone through the formulation process, the NEPA process, and we're now into the *Federal Register* noticing process. We are certainly hopeful that the Corps will promulgate its flood control regulations in its water control manual sometime this year. But, yes, we have gone through that process. We've paid the Corps over a million dollars to develop the flood control manual under Section 7 of the '44 Flood Control Act,[15] and presumably we will have a fully noticed and implementable regulation for Salt River to operate under next January.

Storey: But this is specific to Salt River?

How Roosevelt Dam is operated under the Corps of Engineers' regulations

Morton: It's specific to Roosevelt Dam and, in turn, because Reclamation's the owner of Roosevelt Dam, the guidance for the operation, the water control manual is promulgated by the Corps. It comes to the Bureau and the Bureau assigns it to Salt River. So they will operate the space behind modified Roosevelt Dam between elevation 2151 and 2175, in accordance with the

[15] *The Flood Control Act of 1944 is an Act of December 22, 1944, which is cited as ch. 665, 58 Stat. 887.*

Corps' direction. There's almost 600,000 acre-feet of storage in between those elevations.

Storey: Then along with this, there's the potential that they have in there stored water which now goes to the six cities that you mentioned, is that correct?

Morton: Well, no, let me try and explain it. It's an easy concept if you just think in terms of elevation. The old dam had a maximum storage elevation of 2,136 and we modified that former dam, the original dam, and raised it a net increase of 77 feet. So the new top of storage is 2,218. Is that right? Well, it's 2,141 including freeboard, so that's the 77 feet, I'm sorry; 2,218, 2,141, isn't that 77 feet? Yeah.

How storage in Roosevelt Dam is allocated

So, 2,218 is the top of the dam. We can store water to 2,216. We got two-foot of freeboard on the top of the new dam. The old dam, the maximum water surface was 2,136. The top of the dam including the parapet wall was 2,141. So we went from 2,141 to 2,218, a difference of 77 feet. So we added 77 feet in the modification. In that 77 feet, between elevation 2,136, which was the top of the old conservation space, to 2,151, there's 15 feet of new storage space there. That's called the new conservation space. That's the space in which the cities can store their water. We have a permit. We have a permit to store and the cities have a permit to use. When I say "we," the Reclamation under state law applied for a water right, and the Department of Water Resources has granted the right to store to the Bureau of Reclamation, to the United States, any surplus flows that would have normally spilled from the system. We can store between 2,136 and 2,151.

New conservation space behind Roosevelt Dam

The cities in turn, as co-applicants for the water right, have the right to use the water that's stored in that space. That's over and above the pre-existing rights that Salt River [Project] had to store water throughout the range of the old reservoir up to 2,136. The flood control space is on top of this new conservation space. You got original conservation space up to 2,136, you got new conservation space between 36 and 51, and between 51 and 75 you now have flood control space. That's the space [for which] ~~that~~ the Corps of Engineers, through their regulations, will direct the operation. And that direction will come from the Corps to Reclamation and then will be assigned to Salt River.

So Salt River on one instance will have their own operation for however they normally operate their own system up to 36 -- 2,136. The next 15 feet they will operate in accordance to the direction they get from the valley cities and consistent with the water rights permit that's been granted by the Department of Water Resources. So if the cities direct Salt River to operate in a certain manner and that manner is in conflict with the permit that's been granted by DWR, Salt River will be prohibited from operating in that manner because the permit is, in fact, the direction in which they will have to operate.

So then above 2,175 is what we call the safety-of-dam space or the surcharge space, and that is intended to surcharge or to temporarily store the maximum probable flood, because the criteria for safety-of-dams says we have to safely pass the maximum probable flood, and generally that includes not overtopping the dam. So the criteria for the actual height of the raise, as well as the size of the spillways, was dictated by how much temporary storage do you need to control the maximum probable flood so it won't overtop the dam. And all that's factored into the hydrology of how you design the dam. So basically, those are the components that are in the new structure.

Storey: Not being an expert on how this works, if I were the Salt River Project and I had everything below, what was it, 2,136, and the cities had 2,136 to 2,150, whatever it is filled up, I'd drain water out of the reservoir. There's no longer any water between 2,136 and 2,150 or whatever it is.

Morton: Well, but once it gets there and you didn't withdraw it, if, for example, it was stored for a period of days in that area and then Salt River drained it out, the cities will have already earned those credits. So from a credit and debit, they would have already accrued those credits in the system.

Storey: So there's a computer somewhere saying, "Ah! The reservoir has gone to X. Therefore, the cities are entitled to a certain number of acre-feet," or however you measure that.

Morton: Right. And if they got 100,000 acre feet of credits in the total reservoir and they've never drawn on that, they've always got that 100,000 acre-feet of credits.

Storey: So until they say, "Send my 100,000 downstream," they have a credit?

Morton: Right.

Storey: What do you do about evaporation?

Morton: Well, it's factored into the operating procedures. We went through a rather lengthy negotiation. We kind of sat on the sidelines. Reclamation sat on the sidelines and kind of facilitated and moderated the effort, but the cities and Salt River Project sat at the negotiating table for probably a year or more and negotiated things like bank storage and things like evaporation and issues like how rapidly can we pull that water out of storage. You know, there's a limited amount of flow capacity through the turbines. SRP would like to run all the water through the turbines and get the generation from the water. There's additional capacity from the river outlet works, but they don't like to bypass the turbines. They like to make sure they get every kilowatt hour of hydroelectric energy they can.

So they negotiated for about a year on weekly or bi-weekly meetings to lay out that whole operating plan, and then that was the basis for the cities and Reclamation to go to Department of Water Resources and request a water rights permit, a storage permit and the right to use -- permit to use. And the consumptive use permit that the cities have from DWR recognizes the operating procedures that they negotiated with SRP. So the cities can't go to SRP and ask them to operate differently than the operating procedures, nor can SRP of their own volition operate differently. And the operating procedures do identify how the credited accounts will be debited for things like evaporation, and bank storage, and seepage, and other mechanisms of water loss like that.

Storey: What's "bank storage?"

Morton: Well, when you initially fill a reservoir some of the water seeps into the terrain, whether it be a canyon wall or --

END OF TAPE 2, SIDE 1. MAY 22, 1996.
BEGIN TAPE 2, SIDE 2. MAY 22, 1996.

Storey: I had just asked you what bank storage is.

Bank storage

Morton: As I was saying, as the reservoir fills, certain square feet or square miles or acres of terrain are covered with water, and when they're covered with water, the water infiltrates into that terrain. So the net observable gain in storage is less than the total gain in storage because some of the water that has come into that storage space has gone into the banks of the reservoir. That's what we call "bank storage."

From a practical sense, if there's no seepage paths around the dam, when the water levels are lowered, the water comes back out of the banks and is retained in the reservoir. So the net effect is if you look at your storage capacity curve and it says for this one foot of storage I have physically 10,000 acre-feet of volume and I fill that up, in fact, because of the bank storage factor, I may have had 10,500 acre-foot come in, but you only observe 10,000 acre-foot of storage taking place. So there's 500 acre-feet that went to bank storage. Well, when you evacuate that space, the 500 acre-feet will come back out of that storage, and so it's a valid credit to the overall system. So you need to reflect that in your operating plan or whatever. The cities are entitled to the bank storage, even though they won't see it until the space is evacuated at some future date.

Storey: I'm a little surprised to hear you say that we had a year of negotiations, and then we went and applied for the water rights. I would have expected Salt River Project to say, "Wait a minute."

Morton: Well, the Salt River Project, whether it was a management decision or a conscious political decision, I really can't say, but when we negotiated the Plan 6 funding agreement, the Salt River Project was initially offered the opportunity to purchase the new conservation storage. We knew that as a result of our design we were going to create an additional volume of storage that would be there for 100 years because we had provided for 100 years' worth of sediment encroachment in anticipation that we wanted to protect the surcharge space, this new space that we were building to protect against the maximum probable flood. We wanted to make sure that that was available to us over the normal economic life of the dam, so we embedded in our analysis an additional volume of space -- 266,000 [perhaps] 278,000, I forgot the number exactly, but a given volume of space was dedicated that it would be available for the first 100 years until sediment started to encroach into it, it would be available for other things.

Salt River Project decided not to apply for new water when Roosevelt Dam was modified

We offered that to SRP. We felt like they were going be the natural entity that could benefit from that water supply. Well, the 1984 amendments to the Dam Safety Act had a little quirk in them, and it basically said that 85 percent of the cost of any modifications for dam safety purposes would be nonreimbursable to the extent that there were no additional benefits that accrued to the original beneficiaries of the dam.

Storey: Besides dam safety.

Morton: Besides dam safety. The '84 amendments required that we go back and reallocate the costs of any additional benefits to the original beneficiary and assign those costs to the original purposes that the project was authorized for.

Why Salt River Project may have decided not to take additional water

About that same time, Reclamation was in the process of promulgating rules and regulations pursuant to the Reclamation Reform Act (RRA), and I believe that Salt River Project was concerned, at that time, 1984, 1986 time period, the Salt River Project had paid out. The Salt River Project was not subject to the requirements of the Reclamation Reform Act. I believe they politically evaluated the ramifications of an increased water supply as the result of this new conservation storage as opposed to the downside of possibly coming under Reclamation Reform Act provisions and concluded that the net benefits weren't worth the costs, or what they viewed the costs to be, as a result of RRA. I'm pretty sure that was their rationale.

But we offered it to them. They gave recognition to the fact that costs would be reallocated to them and as a result of this new repayment contract, they would be subject to RRA. I mean, that was standard contract policy at that time. I'm pretty sure that they decided to just -- there were so many dis-benefits in their mind associated with RRA as opposed to the benefits that came from a little bit of additional water supply, they chose not to buy the water.

They were very careful in their negotiations with the Plan 6 funding agreement that it was obvious to everyone that they had no intent. I mean, they sat in the negotiating sessions and stated they had no intent to receive any incremental benefits from the safety-of-dams activity that would require Reclamation to reallocate cost to them and require SRP to enter into any kind of a subsequent contract arrangement that would, in turn, require them to comply with the Reclamation Reform Act.

Storey: When I think in terms of the Reclamation Reform Act, I think in terms of the increase of the acreage to 960 or 920 acres per holding, or whatever it is. Do they have an acreage limitation problem?

Morton: If they do, it's very small. I think it just comes back to -- they may have one or two or three landowners in the whole. Salt River Project is 238,000 acres. Much of the area has urbanized. There are probably only -- today there are probably only 60,000 to 65,000 acres that are still in field accounts are still actively in commercial agriculture. Out of that 60,000 or 65,000 acres there are a few ownerships that probably exceed the 960-acre limitation situation. There are several large corporate farms on the Salt River Project, but I think it became more of the bookkeeping burden and just the <u>perception</u> of big government as opposed to the situation now where their reporting requirements are fairly limited. I mean, they do participate in our annual crop census and some of the other reporting requirements, and they readily participate in that, but it was just more burdensome regulations, more reporting requirements, just the <u>perception</u> that they were subservient to big government bureaucracy, I think, more than anything else.

Storey: Before we go on, did you attend any of the public meetings, that public meeting for Orme Dam?

Morton: Yeah, unfortunately I did. (laughter)

Storey: How did you participate and what were your impressions? What was the tenor of the meeting?

Morton: The tenor of the meeting was not very friendly. Generally the tenor of the meeting was total opposition to Bureau of Reclamation and the Orme Dam proposal. By that time in my career, I was still working in the operations end of the Arizona Projects Office, but I think I was personally working on the Buttes Dam Draft Environmental Impact Statement. But I'd made inputs into the Orme draft statement in the operations end. Because of my involvement with CAPSIM, I had described in narrative terms the operation of the aqueduct system in conjunction with the operation of Orme and had provided statistical data on frequency of areas inundated, and there was concern about the number of acres of riparian habitat, the number of acres of upland habitat that was going to be inundated, and the frequency of that inundation, and I had done a number of those studies to develop that tabular data. So I had made inputs into the Orme Draft Environmental Statement.

Public meetings for Orme Dam

The representative from the solicitor's office was the hearing officer at that public hearing. The public hearing was for two days, and it involved an afternoon and an evening session; in other words, four sessions over a two-day time period. I think I attended two or three of the sessions. I was not there full-time, but I did go down and sit in on the sessions. To be honest with you, I was concerned about announcing that I was an employee of the Bureau of Reclamation. I kind of stood in the back of the room and watched. The speakers were -- I can't remember the time limit, I can't remember if it was five minutes or ten minutes, but there was a time limit established for each speaker.

I think that to the best of my recollection, the project sponsors, the advocates, in this case the Central Arizona Water Conservation District, the Flood Control District of Maricopa County, some of the major boating interests, the Chamber of Commerce types, the City Council or a representative from the City Council for the city of Phoenix, they were on the speaker's podium initially. They were the first speakers, and they probably took all of a half an hour for ten or twelve speakers who were strong advocates of constructing Orme Dam. And then the opposition took over and that went on for the remainder of the hearing. I think each session was about three hours in length, so like from one 'til four, and from seven 'til ten, on two days. So in perspective, you know, what would that be, that would be like twelve hours of total testimony, maybe, not more than an hour of advocacy and roughly eleven hours of opposition.

People were sitting out in the hallway, they had placards, they paraded in front of the -- this was at the Civic Center, which is a fairly large building. The room we were in probably comfortably would seat about, the way it was set up, probably about 500 people. There were people lining the walls, standing in the aisles. I think that the management for the Civic Plaza had to ask some people to leave or to stay outside because the fire rules or whatever just didn't allow everyone that was there into the meeting room.

Storey: I think you said 5,000 earlier and 500 now?

Morton: Well, I think there were like 5,000 people gathered at the Civic Plaza and then like 500 in the meeting room where the testimony was offered.

Storey: You've talked about how the analysis proceeded. Tell me about how people at the Arizona Projects [Office] reacted. I've talked to Manny Lopez, and he said, "You know, I'd call down there and they would tell me there's no way there's an alternative to Orme Dam."

Morton: Well, that's true from a N-E-D perspective.

Storey: N-E-D is?

Morton: National Economic Development perspective. Like I said earlier, Orme Dam was probably the most efficient from a net benefit perspective or from a benefit-cost ratio perspective. It was possibly the best program or project Reclamation had ever formulated. It just produced three or four times the benefits over the costs. Under traditional evaluation procedures, it was just the greatest thing you could have formulated. It was a multi-purpose facility that produced substantial benefits in all categories that you were dealing with. But it also raised, and I'm not sure that even the national environmental organizations, they certainly indicated their opposition to it. I mean, there was testimony offered before Congress and appropriation hearings and so on at the national level. But generally I would have to say that the opposition that attended the public hearings were local grassroots opposition. And that opposition did a very effective job in marshalling its forces and having them attend that public hearing.

Storey: How did the people in the Arizona Projects Office react? What was going on? What was being said back at the office?

Morton: I think we were shocked. We had met with, you know, there were several major groups in opposition to Orme Dam, and we had met with those individuals or the leadership of those groups, and we understood their concern and we felt like we had represented that concern in the document. I mean, there were no surprises in the document, in our mind. We understood the concerns for flowing water recreation and the concerns of the Fort McDowell Indian Community for the loss of tribal homeland, which wasn't really tribal homeland, but you know. We had a good grasp in our mind of what those adverse effects were, and we thought the document was a reasonable representation for a decision-maker to say, "Hey, there's a lot of bad stuff here and there's a lot of good stuff here, and I have to weigh in my own judgment my decision. Do I build Orme Dam or don't I build Orme Dam?" This is the responsibility of the Secretary -- Secretary of the Interior.

Reaction to the Orme Dam public meeting in the Arizona Projects Office

We felt like we had presented a rational evaluation of the pros and cons. The comments and the testimony obviously demonstrated how wrong we were. I mean, it wasn't merely, "I'm opposed to it because it's big government moving in," or, "It's going to destroy this or that." I mean, they came up with impacts we hadn't even envisioned, and some of their proposed impacts had no substance. I mean, they talked about the fact that there was a [geological] fault in the reservoir. Well, we knew there was a fault in the reservoir. We drilled, you know, I don't know how many lineal feet, but literally thousands of lineal feet of core drilling to expose that fault. We knew about that. But it was like because we hadn't put that in the environmental statement and hadn't indicated that there was a slurry cutoff trench in the design of the dam that rendered the [geological] fault a non-entity, you know, that stuff wasn't in the environmental statement, so obviously we were hiding the fact that there was a fault existent.

There was, I don't know, tens of millions of dollars in the cost estimate to remediate the fault. We knew about the fault. But because the environmental statement did not specifically spell out the fault and all of the ramifications that might result from that if it wasn't designed for in the dam, we were hiding something. And, in fact, testimony was offered that indicated that we were creating another Teton Dam failure. You know, there was this fault in the Orme Reservoir and when we built this earthen dam, all it would do would be to slough away and the water would seep through the fault and the dam would fail, and this wall of water would come down through the city of Phoenix. And this was the story that was being portrayed to the public during the hearing process, one of the many stories.

Storey: When was this?

Morton: I guess this was probably before Teton, wasn't it? This was '75. This was '75.

Storey: Yeah.

Morton: Was '82 Teton?

Storey: No, '76.

Morton: '76. Well, the analogy, maybe they didn't say Teton, but the analogy was that the dam would fail because Reclamation didn't recognize the fact that there was a fault in the reservoir, because Reclamation's document, the environmental impact statement, did not divulge the fact that there was the fault.

The opposition forces brought busloads of Fort McDowell community members into town. Elders from the community testified in their native language. We had to run out and find an interpreter. That's pretty hard to find an interpreter. But of course, we were maintaining a transcript of the hearing and we had to have the transcript in English, so we had to go find an interpreter.

Storey: But you didn't provide an interpreter at the meeting?

Morton: We didn't know we were going to have [to] -- it was like fifteen minutes before Hiawatha Hood was going to testify, that they said, "Oh, by the way, he's going to testify in his native language."

I don't know, it's really hard to judge at this time. I'm firmly convinced that we were probably too tradition-bound by economics and we probably should have been more sensitive. Whether we would have gone to an environmental impact statement or not, we probably <u>had</u> to go to an environmental impact statement or some other document to get the whole spectrum of concerns out on the table, and that's what it did. It just brought out the entire spectrum of concern and made it a public issue. I don't know how we would have done that except the way we did, but we really stumbled into it, in my mind. We felt like we had done a good job of equitably addressing all of the community's concerns about Orme Dam and just did not realize the extent of the opposition. There was just a high level of opposition to the construction of Orme Dam, and it came from a broad spectrum of community activists. I can't say much more about it, other than it really did not develop the way we'd anticipated.

How Reclamation approached responding to comments on the Orme Dam environmental statement

Then we were faced with, you know, I can't even -- you know, ten feet of transcripts, it seemed like, to try and respond to all of the comments and, of course, we got written comments. We got forty-some-odd pages of comments from our sister agency, the Fish and Wildlife Service, and they had written a Fish and Wildlife Coordination Act report for us that was part of the document. And then they spent forty pages telling us what was wrong with our EIS. I mean, we had comments from every state agency, every Federal agency that had any presence in Central Arizona. We had comments from school kids and comments from environmental organizations and written comments from national Native American organizations and, you name it, we had it. If they had any thoughts at all, positive or negative about Orme Dam, it was provided for the record.

Storey: And it took you by surprise, it took us by surprise?

Morton: Well, we understood that there was opposition, but the sheer weight of the opposition really did take us by surprise, yeah. And I suspect that it took management in the Department [of the Interior] and in Reclamation by surprise as well, because as far as we knew, you know, we were going to proceed with Orme Dam just like we proceeded with Havasu pumping plant and the Buckskin Mountains Tunnel and the Granite Reef Aqueduct. I mean, these had all come previous to that time period.

I mentioned the other day that we did a programmatic EIS, and subsequent to the programmatic EIS we agreed to do site-specific. I mean, Orme Dam was, I think it was probably our <u>fourth</u> site-specific EIS. I think we had one on the diversion complex at Havasu, the tunnel, and the Havasu Pumping Plant. We had a second one on the transmission system. We had one on the Granite Reef Aqueduct. I'm pretty sure we had three site-specific EISs under our belt by that time, so Orme was like the fourth one.

The Granite Reef EIS did engender some opposition, but it wasn't anywhere near to the extent or depth that the Orme statement did. So, yeah, it was just a real surprise to get that level of opposition and comment. For the next year, from a practical perspective, three or four of us worked almost full time just on trying to respond to all of the comments and making sure, for example, that we were being consistent because the same issue would be raised by ten commenters and we'd try to group all the comments and make sure the person that was attempting to respond to those comments was the same person so that even minor variations in response, even though we all had a general concept of how to respond to a given comment, just the style deviation, variation between individuals, the writing response style, would vary. So it became a major editing chore just to make sure that we were being consistent in all our comments or all of our responses to the comments and to make sure that the same author was basically doing the same kind of questions. If he got on one track concerning hydrology and he wanted to make sure that somebody with a little different viewpoint wasn't authoring a response that would appear to be inconsistent with somebody else's, because as a result of the public opposition, we felt like we're going to have to do a first-class job of responding to this because there's just so many facets of the opposition that we have to address. And in all probability, if we finalize this document, it's going to be litigated. So we can't make it litigation-proof.

END OF SIDE 2, TAPE 2. MAY 22, 1996.
BEGIN SIDE 1, TAPE 3. MAY 22, 1996.

Storey: This is tape three of an interview by Brit Storey, with Larry Morton, on May 22, 1996.

You were talking about making sure the responses to the comments were consistent. We weren't writing back to everybody. What we were doing was compiling everything and responding to each comment in a document, isn't that correct?

Morton: That's correct.

Storey: That's standard EIS processing, I think.

Morton: Right. We had anticipated that we were probably going to have to put together three or possibly four additional volumes of appended material in response to the comments, both the oral comments that were taken at the public hearings and the written comments that we had received during the review period.

As I was saying, we wanted to make sure that we were doing a quality job, because there was ample recognition at that time that if we did go to a final EIS and a decision was made to build Orme Dam, that there would be litigation. And while you can't make a document litigation-proof, you can at least ensure that you will have a good chance, a reasonable chance of prevailing, on any complaint that might be filed.

So we were cognizant of that and we assembled a pretty senior staff. I mean, the people that were involved had ten or fifteen years of experience and had been dealing with environmental statements for three to five years. So we were a pretty experienced group that was having to deal with responding to these comments.

Storey: Well, I appreciate it, and I see our time's up, so I'd like to ask you again whether you're willing

for the information on these tapes and the resulting transcripts to be used by researchers.

Morton: Yes, I am.

Storey: Good. Thank you.

END SIDE 1, TAPE 3. MAY 22, 1996.
BEGIN SIDE 1, TAPE 1. MAY 23, 1996.

Storey: This is Brit Allan Story, Senior Historian of the Bureau of Reclamation, interviewing Larry Morton in his offices at the Phoenix area office on

May 23, 1996, at about ten o'clock in the morning. This is tape one.

Yesterday we talked about CAPSIM at the beginning of the interview and then we went other places, and now we're back there again. I'm wondering how such a radical evolution from a model to assist in the design of the project, using basically the same reports, as I understand it, could now be used for repayment. I'm not connecting yet on how that works.

Morton: Okay. The model, as you said, was originally designed to give us data so as to assist the designers in the design of the physical system, and the model simulates the physical system, the 340 miles of canal and the 50-some-odd turnouts in the canal and the distance between those turnouts, the surface area of the canal prism itself, the various pumping plants *en röute*, with the intent of saying, if you divert X acre-feet or X cubic feet per second at the Colorado River and convey that through the physical system and deliver it to various contract uses *en röute*, what is the average annual yield from the system?

Creation of CAPSIM, the Central Arizona Project Simulation Model

Well, the designers aren't interested in the average annual yield or the long-term deliveries to any given entity, but they do need to know what the extremes in variation, and frequency of those extremes in variation, is over time so that they can design the system with some degree of reliability. They need to know how frequently a pump motor has to start or stop or how frequently a gate has to be reset, there has to be some gate movement, so they can design the motors to accommodate that frequency. If you operate a gate once a month, you can go with a lesser quality motor than if you have to operate a gate and turn the motor on and off fifty times over the course of a day. So that's what the CAPSIM is intended to do is to give the

CAPSIM started as a model to assist in construction of CAP

designer, was originally intended to do, was to give the designer those extremes in variation and extremes in settings that in turn would dictate the physical design of the facilities to be built.

CAPSIM subsequently was used for cost allocation

But by also incorporating things like flow rates, energy requirements, and so on, we were able to produce data sets that are now available for the economist to conduct a cost allocation and to conduct the financial repayment studies, because as a result of the model, we can evaluate water deliveries to any of the given sectors that are associated with the various turnouts. So where we model a turnout that delivers water to the city of Phoenix, and for the designer, we give the designer data, like the turnout is used 300 days a year, the variation in flow rates is between 15 cubic feet per second and 45 cubic feet per second, the frequency of change is once every other day. That kind of information can come out of the model, and in turn the designer can design the motor stop rate, the check structure in front of the city of Phoenix's turnout, and to operate the turnout gates in the facility that delivers water to the city of Phoenix.

CAPSIM can be used to determined revenues from the CAP

But, also by integrating that over a long period of time, a period of years, you can determine what the average annual delivery to the city of Phoenix is, and integrating it over a shorter period of time, you can determine what the average single-year delivery is, so in turn that can represent, by applying a unit cost of the water delivery, you can represent revenues, so amalgamating, adding up all of the various turnouts in terms of how much water is delivered over the course of a year, we can calculate what the revenue would be based on a given unit rate for water delivery, $60 or $70 an acre-foot. We know how much revenues we can get. In turn, that goes into the repayment analysis. It becomes a stream of data, an annual stream of input data for the repayment analysis.

Storey: I think what I'm hearing is that the model is fairly stable, because you aren't changing a lot in where the deliveries are made and so on, but you're applying new data to it all the time.

Morton: Correct.

Storey: Because you might deliver more to Tucson this year than to Phoenix this year or something along that line, and that's why you have to have two runs a year.

Morton: Correct.

Storey: Oh, okay. I didn't understand.

CAPSIM is used for budget projections for CAP

Morton: We do two runs a year because we have to report on the expected operation of the system, the long-term expected operation of the system in our budget submittals. We do an initial budget submittal for Reclamation and the department and OMB to look at. That's our budget estimates. And then once decisions are made concerning what the President's budget will be, then we do another run as a basis for our budget justification, which is the formal submittal, the annual submittal to Congress. That's the formal submittal that we make.

Storey: And because you may be plugging in variables over the year, those may be somewhat different.

Morton: They may be somewhat different for any number of reasons, but primarily just because the data continues to be updated. The assumptions on population projections may not vary only but once every two or three or four years, but you've got a historical period of time, which is relatively small in the big picture. I mean, we do these repayment and cost allocations based on fifty years of assumed operation. So your actual historical operation may be only 1 percent of your projection, but we do update it for that 1 percent change.

There are also potential changes in rate structures. For example, the actual O&M costs may vary over time, in which case, where we might make a run based on $55 an acre-foot for O&M and $20 an acre-foot for capital, the District may come back and tell us, "Well, our actual costs were not $55. They were really $56.50." And so we will update the cost of water by the additional $1.50 that actual experience would have dictated. So there's always some kind of change, it seems like, when we do these updated runs. Sometimes they're relatively small. They don't affect the net outcome of the analysis.

Probably, in terms of the actual repayment analysis, the biggest changes during the course of a year come about because of changed construction conditions, in which case we will have modified a contract to pay the contractor more money because he's uncovered a geologic problem or has had damages occur due to floods or whatever. Those types of changes are what cause the biggest difference in annual evaluations from one year to the next. It's usually due to variations in anticipated expenditures.

Storey: So that would be for repayment?

Morton: That would be for repayment.

Storey: What are other kinds of variables? You mentioned the cost of water from, I presume, C-A-W-C-D.

Morton: We would get our input from either C-A-W-C-D or from Salt River, one of the entities that is responsible for operating a portion of the system, whether it's Salt River Project in the case of the Navajo generating station, or Arizona public service in terms of the southern transmission division of the Navajo project, or C-A-W-C-D in terms of the aqueduct system.

Storey: Very interesting. I was confused by the fact that you said, "Well, it doesn't change much," and then I was hearing you say, "Well, we run it twice a year." So it's the variables that are the important thing here.

Morton: Yeah. And the only reason we run it twice a year is that we want to ensure that whatever we're providing to the department and to Congress is the best information we can have available. It doesn't take any time to run it. I mean, you can make the changes in the variables in terms of input data in a matter of a couple of minutes and you can run the model in an hour and a half. Everything's pretty well automated nowadays.

Cost projections for CAP water in the 1970s

Storey: Now, we're still talking back in the period right around 1970, and what were we projecting the cost of water was going to be at that time, do you remember?

Morton: Back in '70, I think our irrigation water, if I remember right, was like $15 an acre-foot.

Storey: Is what we were projecting?

Morton: Yeah. It was $13 an acre-foot O&M and $2 capital. So the total cost of the water was, in that '68-70 time frame, just right after authorization, we were in that $15 an acre-foot range. And I think that the M&I rate was a few dollars more, like $18 or $20 an acre-foot.

Storey: And what is it now for M&I?

CAP water costs in 1996

Morton: M&I today, I believe the District is charging its contractors like $87 an acre-foot for M&I, whereas it was probably $20 in 1970. The biggest increase proportionately, I think, is in the O&M rate. The fixed O&M is running about $20 or $22 an acre-foot. The variable O&M, the energy component is running about $37 an acre-foot. So that gives you $57, $57 or $59, somewhere in there, a little bit less than $60 an acre-foot. And then I think that their current surcharge for capital repayment for M&I purposes is about $25 or $27. In aggregate, it's over $80 an acre-foot.

Storey: Yeah. The way a Reclamation project was conceived was that Reclamation would build the project and there would be a local recipient. How did the local recipient come about in the case of C-A-P [Central Arizona Project], and why wasn't it the Salt River Project, which seems like a logical candidate to me for some reason?

Where CAP's water contractor came from

Morton: Well, in early January, I think it was about the 6th of January 1969, Commissioner [Floyd] Dominy and Secretary Stewart Udall came to Phoenix, and they met with the governor and the state legislature and all of the water interests in Phoenix, and they told the assembled group that it was their intent -- well, the Secretary is responsible for allocating Colorado river water under his responsibilities as watermaster of the river. He explained to the state interests that it was not his intent to preclude the wishes of the state, and he basically said that he expected the state to make recommendations to him or to the

Secretary of the Interior on how they intended to take and use their C-A-P entitlements, and he put that burden squarely on the back of the state of Arizona.

There was also a provision in the Basin Act in the Colorado River Basin Project Act.

Storey: In '68?

Morton: In '68. Well, the act became law in September, September 30, 1968, so this was just like three months, a little more than three months after the act had passed. There was a provision in the act that basically said that the Secretary may require a consolidated or a sole independent repayment entity -- may require. And it was at that time, just three months later, that the Secretary said, "In addition to the state of Arizona providing for recommendations on how the water should be taken and used, where it should be delivered to, and so on, I think we really should have one entity responsible for repaying the cost of the project."

Secretary Stewart Udall decided there should be only one repayment entity on the CAP

Under traditional Reclamation law, we, Reclamation, could have gone to each of the hundred or more water users and entered into separate and independent repayment contracts with each of those, but our bookkeeping and accounting processes and water service contracting process would have been taxed and overburdened had we done that. So I think the Secretary at that time was right on line with recommending that way, that the state provide a centralized repayment entity. It was just, I think, two years later there was -- I think it took two sessions of the state legislature, because the state legislature normally meets in Arizona from like January through April of the year, and I think that by the time the Secretary made these statements in early January of 1970, the legislative agenda had been pretty well for the state legislature.

Storey: '69 or '70?

Morton: Oh, '69, you're right. I'm just not certain of the actual date at which the legislature enacted the law necessary to set up C-A-W-C-D, and it was probably, now that you correct me, you're probably right, it was probably 1970 that C-A-W-C-D was actually, the authorizing legislation was put into being within the state statutes. So I'm guessing that it didn't occur in '69, just because they probably already had their legislative agenda in place for the '69 legislature, so it's probably 1970 that the state legislature enacted the enabling law that would allow C-A-W-C-D to be formed.

The Arizona legislature created CAWCD

Storey: And then it was formed in '71.

Morton: I think that's right, yeah, because by '71 we were undertaking negotiations on the initial master repayment contract, so that would probably be the right time frames.

Storey: It would seem to me that there had to be a lot of politics going on at that time. This was, after all, a major share of the state's water.

Morton: There's no doubt about it, and I think that your earlier question concerning the Salt River Project -- in fact, the master repayment contract that was executed in 1972 and the initial enabling legislation that allowed a repayment entity to be set up within the state of Arizona did not address the issue of who should -- whether the repayment entity would be the entity that would actually operate and maintain the project or not.

Negotiation of the master repayment contract for CAP

Why Salt River Project didn't become the repayment entity for CAP

I think that at the time that it was being debated there were two considerations, and Salt River Project, as I said earlier, has service authority to about 238,000 acres, both their water delivery system authority and their power authority. Their retail power sales authority is pretty much limited. Their power sales authority is a little broader than their agricultural service area authority, but not a whole lot larger. The Salt River Project was a very powerful utility in Arizona, and I think there were concerns from the rural communities and from Tucson, and probably those areas outside of the Salt River Project whose utility service came from the Arizona Public Service Company or some of the other, Tucson Electric Power Company, for example.

I think there was a lot of political opposition to vesting in SRP, that authority, to be either the operator or the repayment entity for C-A-P, but no one, or at that time at least, the legislature was unwilling to grapple with the issue of who should operate it. Their sole interest in the '70-71 time frame was to set up an entity that could contract with the Secretary of the Interior for the water supply and the repayment responsibilities for C-A-P. So that's all the initial legislation provided for. It just provided for a minimum of a three-county municipal entity to be formed, and it had to be formed on a vote of the electorate, and set down some criteria on how the governing board would be elected and made an apportionment on representation on the governing board.

Representation on CAWCD's board

As it came out, Pima County ended up with four members, Pinal County ended up with one member, and Maricopa County ended up with ten members on a fifteen-member board. The legislation required that those three counties, Maricopa, Pinal, and Pima County, had to

~~partition~~ [participate]. If one of the counties chose not to participate, the municipal entity could not be formed. All three of those counties had to participate. But it allowed the opportunity for other counties, should they become water users, water contractors for C-A-P water, allowed them, Mohave County, Yuma County, any of the adjoining counties, should they choose to, to also become a participant in the Central Arizona Water Conservation District. None have to date, but there are some water deliveries, some water contracts have been executed for areas outside the District, and the District has developed a policy on how to recover their costs for those entities that are outside the three-county area.

Water deliveries outside CAWCD's boundaries

Storey: How do the board members hold office?

Morton: Well, initially they were appointed, and they were appointed for staggered terms. The intent was that the board members serve for six-year terms and that five members be elected every two years. So every two years, five members would go off the board and ten members would be retained on the board and five new members would be elected or incumbents would be reelected.

Storey: Elected by whom?

Morton: Elected by the county in which they serve from. So if you held a seat from Maricopa County, you would be elected at large from Maricopa County.

CAWCD board members are elected from the county they represent

Storey: By the voters, not by the county commission or whatever?

Morton: No. The initial appointments were made by the governor. The legislature invested in the governor the right to make the initial appointments, and so he appointed five people for a two-year period, five people for a four-year period, five people for a six-year period, and then the electoral process took over at that time.

Storey: C-A-W-C-D was created for the purpose of having a legal entity that could be the repayment vehicle, is that right?

Morton: Right.

Storey: And they were planning also to take over the project eventually?

Morton: They certainly, in the negotiations of the repayment contract, they certainly left the door open to become the operating entity for the project, but the United States could have retained authority. I mean, there were provisions in the master repayment contract for either one of three methods. The United States could have retained jurisdiction to operate the project, C-A-W-C-D could have been the operating entity, or a third party could have been the operating entity. Like you asked earlier, "what happened to the Salt River Project?" Well, in 1972, when the master repayment contract was signed, the contract was sufficiently broad that a third party like SRP could have stepped in and become the operator.

CAWCD and operation of the project

Storey: Okay, we have this board. Did they start staffing up?

Morton: No. They basically became a figurehead organization. They went out and hired a legal counsel and they hired a business manager, and they relied on at that time what was the Arizona Interstate Stream Commission as their staff.

At first CAWCD's staff function was filled by the Arizona Interstate Stream Commission

In other words, Mr. Wes Steiner was the state water engineer. He was the general manager, if you will, the lead staff person for the Interstate Stream Commission, and he became basically the technical staff for C-A-W-C-D. And Mr. Burr Sutter who was an attorney with Snell and Wilmer, a major private law firm here in the Phoenix metropolitan area, Burr became the District's counsel of record, and I would have to say Mr. Steiner and Mr. Sutter were the principal negotiators of the 1972 master repayment contract.

CAWCD hires an office manager

They hired another individual, Ms. Zada Darter, and she became the office manager. It was like a business manager or office manager and a clerk, so it was a two-person staff, and Zada had a couple of responsibilities. Her principal one was to ensure that the board was knowledgeable about what was going on with regard to repayment and the contracting process, and she arranged the monthly board meetings.

CAWCD taxation authority and investment of revenues

But C-A-W-C-D also, as a result of their legislative authority, had the authority to levy taxes, ad valorem property taxes, and, of course, one of the things that they needed to do was to invest those taxes to provide the various reserve funds that were required by the master repayment contract. So that was another activity that Zada Darter, as business manager, was responsible for was to invest the tax proceeds under the state investment laws to ensure that the investment wasn't too risky, but it earned a relatively high rate of return, etcetera.

I think those were her primary duties, were to ensure that the board was knowledgeable and arrange for board meetings and transcripts, and just the operation of a large, fifteen-person board, and to track and invest the tax proceeds, because they basically had no costs. I mean, they paid the salary of their attorney and they paid the salary of the two staff people, but in terms of O&M expenses or labor costs or anything like that, their costs were relatively small at that time.

Storey: Tell me about the major discussion items in the repayment contract.

END OF SIDE 1, TAPE 1. MAY 23, 1996.
BEGIN SIDE 2, TAPE 1. MAY 23, 1996.

Storey: I had just asked you what the major discussion issues were in the repayment negotiations.

Morton: I wasn't really that close to the negotiations. I think I mentioned several days ago that Dick Shunick, who had just joined our staff from the Washington office, was the principal field negotiator. George Blake and people out of the regional office, as well as the solicitor's office in Riverside, headed up the negotiations. I did sit in on one or two discussions.

Some concerns in the repayment contract negotiations

It seems to me at that time that the concern on the part of the District, I believe, was that the water delivery would build up over time, and the United States, of course, was trying to recover its investment as rapidly as possible. I mean, that was an obvious objective from the United States' perspective was to get repayment as rapidly as possible. The District, on the other hand, had some major concerns about the fact that the revenues available for repayment would be relatively low in the early years of the project and would grow over time.

And then in addition to revenue from water sales and the power sales, there were also dedicated to the Lower Colorado River Basin Development Fund, which was the true cash register for assisting in the irrigation repayment component, there were additional revenues that were to accrue to the development fund after Hoover Dam paid out. Ostensibly, later in the C-A-P repayment period, when Hoover paid out, then revenues from Hoover would flow to the development flow, and 18.5 percent of those revenues would be available to assist C-A-P, supposedly. And when the Parker-Davis Projects paid out, then the share of the Parker-Davis surplus revenues would be available to assist C-A-P.

So all of these led C-A-W-C-D to conclude that C-A-W-C-D wanted a relatively small repayment obligation in the early years, growing over time, and that resulted in a payout schedule that is fifty years long. The United States could have insisted on a forty-year repayment schedule, but we did allow it to be extended to fifty years -- which was consistent with law. There was an exception in the Basin Act that allowed up to fifty years. It didn't require fifty years, but it allowed up to fifty years, and C-A-W-C-D got that maximum length of time. So that was obviously a plus on their side of the column.

CAWCD repayment obligation grows through the 50 year repayment period

Storey: To begin when?

Morton: To begin upon declaration of substantial completion of the project.

Storey: And when did we make that declaration?

Morton: Well, we haven't yet. The amended repayment contract in '88 established some stages and brought the United States some benefit. The amended contract produced an improved repayment stream, from the United States' position. What we did in September of '93 under

Staged implementation of repayment on the CAP

the amended contract was to declare substantial completion of the Stage 1 construction. If we had not had that amendment, we still would not be in repayment with C-A-W-C-D. The intent was that they didn't start paying until the whole project was built under the initial contract, or the '72 contract. And we're still building on the whole project, so they would not have been in repayment if we had not executed an amendatory contract in '88.

The sliding repayment scale for CAP

But, in the '72 negotiations, as I said, they got an extended time period, a fifty-year time period, to repay, and they got a sliding scale of repayment. The first seven years, they're only obligated to repay 1 percent of their repayment obligation, and then that's increased for the second seven years, year eight through fourteen, to 1.3 percent, and then years fifteen through twenty-one, they repay at 1.6 percent, etc. Every seven years, the amount of <u>annual</u> repayment obligation is ratcheted up three-tenths of 1 percent, until the whole project is paid out by the fiftieth year. So, at least from C-A-W-C-D's perspective, the two big issues were, how long and how fast, and at least in the initial contract, in the '72 contract, they won on both of those issues.

I think some of the other nitty-gritty kinds of issues that were in the master contract involved how to do the cost allocation, how to treat water deliveries to entities <u>other</u> than the contractor, <u>other</u> than C-A-W-C-D. It was anticipated we would be making water deliveries in New Mexico, so the strategy, the procedures that would be necessary to allocate the costs to New Mexico and make that burden a New Mexico burden rather than an Arizona burden [was an issue]. It was envisioned that we would be building Charleston Dam on the San Pedro River, and the question in '72 was, will the yield, will the water conserved at Charleston Dam, be delivered to Tucson or will it be used within the basin? We don't know. Sierra Vista's growing. Fort Huachuca's growing. They have a demand for water. Perhaps the yield out of Charleston would be best used in Sierra Vista, Fort Huachuca, downstream areas along the San Pedro River, downstream of the dam site. So the repayment contract provides for a mechanism to allocate the cost of Charleston Dam and Hooker Dam in New Mexico and to allocate the costs of water deliveries to entities perhaps other than C-A-W-C-D.

Repayment of costs for delivery of Indian water through the CAP

And then there was also a big unknown in terms of the United States's intent to deliver water to Indian communities, and for some reason C-A-W-C-D concluded that that was the sole responsibility of the Secretary of the Interior. It was not C-A-W-C-D's obligation or responsibility to either repay those costs or to enter into contracts with the Indian communities. So there was also a formula in the master repayment contract that dictated how the costs would be allocated so that C-A-W-C-D would bear none of the costs associated with delivery of water to Indian communities here in central Arizona.

So, those were some of the big issues, I think, that were resolved as a result of the master repayment contract -- how you do cost allocations, what the formula is, how long it takes, and how much per year C-A-W-C-D's got to pay. A lot of the other stuff was what we would characterize as boiler plate, points of delivery, what constitutes the constructions costs, compliance with normal reporting requirements, ability to inspect books and records, all the standard boiler plate stuff that would go into any governmental contract.

Storey: And when the legislature created them, they gave them taxing authority in the three counties.

Morton: Yes.

Storey: Would you go over again why they needed to apply taxes in those early years, before they had any expenses, really?

Why CAWCD needed to collect taxes in the early years

Morton: They had no revenue of and by themselves. I mean, they were a municipal entity. And they had a relatively small staff. They had to pay a couple, three, or four salaries. They had to pay the Interstate Stream Commission for some of the technical support that they were getting from the Interstate Stream Commission. The Stream Commission wasn't interested in providing that without cost, so they had to reimburse the Stream Commission.

Within the master repayment contract, there were two reserve funds that had to be built up to a certain level by the time that the project repayment was initiated. There was an O&M reserve fund, and there was a repayment reserve fund. So the District taxed, within the exterior boundaries of the district, taxed those lands at a relatively low rate. Of course, the legislature was not willing to give them *cärte blänche* in terms of taxation, so they capped the District's taxation authority to 10 cents per $100 of assessed valuation, so that was the maximum that the District could tax.

In those early years, in the early '70s, my recollection is that they taxed about 2 to 4 cents a hundred. They weren't anywhere near what their allowed ceiling was. As a result of subsequent legislation, I think that the District now has a cap of about 14 cents a hundred today, but at that time their cap was 10, and I think they started at 2, and maybe by '76 or '77, somewhere in there, they jumped it to 4 cents.

Storey: So they were building surplus funds?

Morton: Right. A war chest, whatever you want to call it.

Storey: Why?

Morton: Well, for this repayment reserve, I think, more than anything else. I think, according to the last financial records I've seen, they have about $200 million in capital sitting out there earning interest in various types of accounts.

CAWCD builds a repayment reserve

Storey: The Arizona Interstate Stream Commission, I presume, was a state entity?

Morton: Right.

Storey: Talk about that relationship for me a little more.

Morton: In the '40s -- I believe it was in the '40s -- when Arizona got serious about utilizing its Colorado River entitlements. Up until 1944, the state of Arizona had no contract with the Secretary of Interior for Colorado River water. They were the only state that did not enter into a contract through the Boulder Canyon Project Act at that time [1928], in the late '20s and early '30s. They objected to the -- well, not to the compact, but to the Boulder Canyon Project Act. The state of Arizona objected to the Boulder Canyon Project Act and chose not to enter into a contract.

The history of the Arizona Interstate Stream Commission/State Engineer

But by '44, I think more in the form of a defense mechanism to [protect against] Arizona's entitlement being contracted to Mexico as a result of the Mexican Treaty in 1944, Arizona did enter into a contract, and, I believe I'm correct on this, the legislature authorized the governor to set up a commission to monitor and be the technical body to evaluate the Colorado River and all of its ramifications, what the Secretary was proposing in his operation. The Secretary's responsible, on an annual basis, to consult with the governors of the seven basin states on how he intends, as the watermaster, to operate the river, and the commission was set up to be the body to do that.

Of course, the commission is an appointive organization, and they didn't have any technical staff. They established the technical staff initially in the state highway department, so the state water engineer was also the state highway engineer, because they figured, well, civil engineers know highways and they know water supply and so on, so we've got a staff here building roads with the state highway department. We'll just make the state highway engineer the state water engineer.

Well, that worked in the early '40s, and the mid-'40s, late '40s, up until the time it became obvious that Arizona, as a result of no congressional action on the Central Arizona Project until Arizona approved its water rights in the Colorado River. When the decision was made to prosecute California before the Supreme Court to substantiate Arizona's water rights, it was at that time they decided, hey, we better hire a state water engineer, somebody that can represent us. We don't want to be sending the state highway engineer up to testify before the Supreme Court or before the special master. We better get somebody that's really a water engineer. So they did establish a staff position within the Interstate Stream Commission as the state water engineer, and that position was the primary technical person throughout the litigation in *Arizona v. California* before the Supreme Court, before the special master and then subsequently before the Supreme Court, on presenting Arizona's case for its entitlement to Colorado River water.

Central Arizona Project Association, a private booster organization

The Interstate Stream Commission also, during the authorization process for C-A-P, was also one of the principal involved parties in seeking the authorization of C-A-P. There was a lobbyist group known as the Central Arizona Project Association, a kind of chamber of commerce operation, if you will, and then there was a team of people who represented some of the principal water and other power interests in Arizona that guided Arizona's efforts to lobby Congress in seeking authorization. That group consisted of full-time representatives, individuals who were on the payroll at the Salt River Project, and Arizona Public Service predominantly. I knew a couple of those people, Frank Scussel and -- I can't remember his name now. Anyhow, those people were the principal lobbying effort on behalf of Arizona to seek authorization of C-A-P.

Arizona hires Wes Steiner, deputy director of the California Department of Water Resources

I'm trying to remember now if it was in the year prior to authorization or right at authorization. The conclusion was reached that the Interstate Stream Commission staff was just understaffed, undergunned. They couldn't really compete with California. And so they went to California and hired the deputy director of the Department of Water Resources in California to come to Arizona and become the staff director of the Arizona Interstate Stream Commission, and that was Wes Steiner. In that era, he became known as Arizona's water czar, Wes did.

And then Wes expanded his staff and convinced the state legislature that the commission model was not really the best model for water in Arizona and it was probably better to set up a branch of government within the state of Arizona, and, in turn, the Arizona Department of Water Resources was formed as an executive department within the state government. But that's another story.

I just don't remember if it was '68 or '69. I do know that in the early hearings before Congress, Mr. Steiner represented the state of California and spoke in opposition to the authorization of C-A-P, and within two years he was one of C-A-P's most significant advocates, because his employer changed.

The office of the Arizona state water engineer in 1962

At the time that Steiner came to Arizona, I think that the Stream Commission staff consisted of two or three people. It was a relatively small staff, as well. I remember when I first came to work for Reclamation in '62, I was introduced to the state water engineer. At that time, it was a fellow by the name of Bill Gookin, and it was kind of a sidelight for Bill Gookin. He had his own consulting firm, Gookin and Associates, and he operated as the state water engineer out of his firm's offices. He probably gave 10 or 15 percent of his time to the state's business and the remainder was his own civil engineering consulting firm, which did pipeline design and built irrigation ditches for various irrigation districts in the central Arizona area.

Storey: So then C-A-W-C-D, when it was created, used this group for their expertise and basically reimbursed them?

Morton: Yes. I think initially it was kind of like -- Let's use Wes Steiner and his staff for a while. We don't want to go out and hire and incur a lot of costs. We've got resident expertise in the Interstate Stream Commission and soon to be the Arizona Department of Water Resources. We've got this expertise. We don't need to duplicate it. Besides, we're only a repayment entity.

The C-A-W-C-D at that time was just a repayment entity, and they obviously needed advice on costs, they obviously needed an oversight role to make sure that the United States was building a good, quality product for them, and they felt like the technical staff, which consisted at that time in the '70-71 time frame of, I think they had two economists, and three engineers, and an accountant, and Wes Steiner. I think they probably had about six or seven people, several engineers, several economists.

Storey: How would you characterize Reclamation's relationship to C-A-W-C-D in those early days?

Reclamation's relationships with CAWCD

Morton: I think we've had a good relationship with C-A-W-C-D ever since its inception. At that time, it tended to be -- like I said, it was just a business manager and a board of directors, and I think most of our contact through the Project Manager was with the chairman of the board of directors and through Mr. Steiner and Mr. Sutter, primarily, not that we did not attend the board meetings or make presentations to the board meetings, but the daily business of the board was left up to the chairman of board or the president of the board and the two staff people, the legal counsel and Mr. Steiner as the technical expertise, the engineering expertise of the organization.

So I think our day-to-day or week-to-week relationships were primarily with Burr and Wes, and at that time I'm not even sure, some ex-governor. There were a lot of ex-governors that got appointed to the first [CAWCD board] -- I don't remember who it might have been at that time, maybe former Governor Jack Williams. I just don't even remember who [during] the first couple of years who the president of the board was.

Storey: Well, we've gone on a two-day divergence, which isn't a problem. But in this period, '70 to '73 or so, we were sort of outlining C-A-P, I think, in the design and planning process.

Morton: I think that's a good characterization, yeah.

Storey: What did that outline look like at that time? What was the system going to be?

Morton: Well, the system, as we envisioned it, would consist of the four authorized reservoirs -- the Orme Reservoir, Hooker, Charleston, Buttes. It would consist of an aqueduct system that started out at the Colorado River at 3,000 cubic feet per second. The aqueduct would have the ability to regulate water in Orme Reservoir behind Orme Dam. We didn't know whether we were going to deliver that water by gravity or have to pump it into the reservoir, because we were still trying to figure out how high we would have to lift the water.

The CAP as envisioned by Reclamation in the early 1970s

The original '44 plan had the water actually -- well, it's synonymous with the name. The aqueduct from the Colorado River to the Phoenix area was known as the Granite Reef Aqueduct. The reason for that was, the water was intended to be delivered to the Granite Reef Diversion Dam, which is a facility of the Salt River Project, and it was believed in 1944 that the water could be delivered to Granite Reef and then conveyed from Granite Reef through the existing canal system to everybody in Phoenix who wanted it. Well, by 1971, Phoenix had leapfrogged across the Salt River canal system and was now ten or twelve miles to the north, and it was obvious at that time that the full supplies that were going to be intended for the city of Phoenix customers couldn't be necessarily delivered at Granite Reef. And, we concluded that in order to get around the urban expansion and minimize our right-of-way costs, we were going to have to take a higher elevation as our grade line to deliver water into Phoenix and then on to Tucson. The water surface in the Orme Reservoir, as we envisioned it, was about 200 feet higher than Granite Reef [Diversion Dam]. Well, that's not quite right, 150 feet higher than Granite Reef. I think the water surface elevation and top conservation was about 1450 in Orme and it was about 1307 or something like that at Granite Reef. So we recognized that we had to make some decisions about where to deliver it, but we knew we going to deliver water into Orme and it would regulate those flows.

In the early 1970s Reclamation relocated the grade of the aqueduct because of suburban Phoenix expansion

We envisioned that the aqueduct from the Salt River south into Pinal County would probably be about an 1,800 cubic foot per second canal, that it would deliver water principally to agricultural developments in Pinal County, and then we would re-lift the water in southern Pinal County into Pima County and on to the city of Tucson, and we were looking at about a six-foot diameter pipeline that would have delivered about 150,000 acre-foot a year into Pima County -- 100,000 acre-foot a year into Pima County. It would have been 150 cubic feet per second and would have delivered 100,000 acre-feet. [Tape recorder turned off.]

Storey: We were talking about the pipeline into Tucson, I think.

Morton: Yeah. The other unique part of that situation was that at that time we anticipated the pipeline would end in northwest Tucson, out near Marana, because of the uncertainty as to where Tucson expected to have delivery made, the terminus for the C-A-P system would have required Tucson to build a delivery system out to Marana, roughly, and then pick up --

END OF SIDE 2, TAPE 1. MAY 23, 1996.
BEGIN SIDE 1, TAPE 2. MAY 23, 1996.

Storey: This is tape two of an interview by Brit Story with Larry Morton on May 23, 1996.

You were saying that the delivery was intended to be to Marana in the northern area of Tucson.

Morton: Right, the rationale being, of course, that the city of Phoenix was going to have to go some distance to either a canal-side turnout or to the Granite Reef Diversion Dam or to Orme Dam to the Orme Reservoir to pick up its water supply, so it would be appropriate for Tucson to construct its delivery system in a similar manner; in other words, that each entity should have the responsibility of putting the water into their delivery system and providing that infrastructure at their own costs rather than any federal cost.

In the early 1970s Reclamation expected to deliver water to five Indian tribes

There was consideration for delivering water to five central Arizona tribes. We believed that we would deliver water to the Salt River Tribe, the Fort McDowell Tribe, the Gila River Indian Community, at that time the Papago Tribe at the village of Chuichu, and to the Ak Chin Indian Community.

Storey: And now the Papago is the --

In 1996 Reclamation has contracts to deliver water to ten Indian tribes at twelve locations

Morton: Tohono O'odham Nation. But now our contracts involve ten entities at twelve locations rather than the five I've just mentioned. We have contracts for delivery of water to both the Schuk Toak Community, on what formerly was the Papago tribe, and to the San Xavier community. So we actually have three points of delivery to the former Papago Tribe, which is now the TohonoO'odham Nation.

We've expanded our contracts to include the San Carlos Apache Tribe, the Camp Verde Apache Tribe, the Yavapai-Prescott Tribe, the Tonto Apache Tribe. Our anticipated Indian contractors expanded by about two and a half times over what we envisioned in the early '70s.

Storey: What was driving Indian deliveries in the early '70s?

Morton: In the early '70s, it was just basically equity with the non-Indians. The five tribes I mentioned, Salt River, Fort McDowell, Gila River, Ak Chin, and Chuichu, all had irrigation projects, all had a history of irrigation within the direct gravity service area of the Central Arizona Project. So we classified those Indian lands just like we classified the non-Indian lands, and they constituted 10 or 12 percent of the total irrigable area within the C-A-P service area. And so we just naturally assumed they would get 10 to 12 percent of the agricultural water, just like any of the other non-Indian irrigation districts would have gotten.

Storey: Nowadays when you read any of our literature, it talks about the Indian irrigation water and the non-Indian irrigation water. At that time, was it subdivided that way, also?

The Secretary of the Interior's trust responsibility to Indians and how it affected CAP water deliveries

Morton: Yes, it was, because two things happened. One, the Secretary asked the state of Arizona to make recommendations, but because of his unique trust responsibility to the Indian communities, he concluded that that was his call, that it was the department's call to determine how much and at what locations C-A-P water would be delivered to the Indian community. So he reserved the allocation of water to Indians to himself. He did not request the state to make recommendations on how they would distribute C-A-P entitlements to the Indians.

Federal uses for water and their affect on CAP

And then the second part of that was, in the master repayment contract it recognized that there were potential contractors other than C-A-W-C-D who would receive water, and while it did not spell those out by name, the intent was that they would include any Federal uses, including uses for Indian communities. Other uses potentially could have been on BLM [Bureau of Land Management] lands or for fish hatcheries or wildlife refuges that were managed by the Forest Service or the Fish and Wildlife Service, or for national park lands. Those were all envisioned to be independent and direct contracts between the Secretary and those other governmental entities and weren't part of the equation that the state of Arizona was going to make recommendations to the Secretary about.

Storey: How did the relationship with C-A-P to the Indian community change, both in terms of why were more Indian groups involved and were there any philosophical sort of underpinnings that changed? And then the third part of that question is, who paid for the Indian water?

Morton: Oh, well, now that one's easy. (laughter) There was a major migration in dealing with water supply for the Indians over time. In the initial stages, shortly after the master repayment contract was signed in 1972, the state, on behalf of C-A-W-C-D, I'm not sure if they were called the Department of Water Resources yet, but Wes Steiner and his staff, indicated that it was necessary, before they could formulate their recommendations on how Arizona's entitlement should be allocated, needed to know how much the Secretary was going to reserve for Federal uses, and Federal uses encompassed that wholelitany of potential contractors they talked about, including Indians.

We were of the mind that, in order to finalize our designs, to know where to put the turnouts, to know how far north or how far west or how far east it would make sense to build the canal system, it sure would be nice if you would give us some guidance on where you think you're going to deliver this C-A-P water, state of Arizona; and the state of Arizona would always come back and say, "But if you would only tell us how much water you're going to be delivering to Indians and wildlife refuges and Federal lands, then we'd have a basis to conduct our economic evaluation and determine where we want C-A-P water to go for non-federal uses, for C-A-W-C-D-authorized uses." So it was always that chicken or the egg -- I won't say it was a confrontation, but the dialogue was always chicken-or-the-egg kind of dialogue, where who comes first or who goes second kind of situation.

Reclamation begins to determine Federal water use in the CAP

It was about '73, '74, when Gil Stamm first took office as the Commissioner. He concluded that the government needed to make the first overture on reserving Federal water from C-A-P. So he contacted the project manager, Cliff Pugh, and Cliff went to the guys that supposedly knew something about how C-A-P would operate, namely Tom Burbey and me, and said, "I want you to get out there and meet with all those Indian tribes and find out what their intent is. Are they really interested in taking some C-A-P water? If they are, how much do they want? Where do they want it delivered?"

So that was the task that was assigned to Mr. Burbey and myself, and we met with the communities we thought were, topographically at least, and throughout the legislative history of the authorization process were the logical Indian communities and farmers to take the C-A-P water. And so we met with them, and the bottom line was, most of the tribes were of the opinion they could take and use more C-A-P water than there was available in the Colorado River.

How initial CAP water allocations to the Indian tribes were made

For example, the Gila River Indian Community said that they weren't interested in just delivering a supplemental supply to the 77,000 developed acres that were on the Gila River Indian Reservation. They'd prefer that C-A-P provide them a full supply, 5, 5 1/2 acre-feet per acre, for the entire arable acreage on the Gila River Indian Reservation, which is probably in excess of 200,000 acres. Well, just multiple that one out, and you can get 1.3 million acre-feet right there.

It was obvious that we were kind of worlds apart, and so we reported this information back and said that the designated representatives, who happened to be non-Indian attorneys that we were dealing with, were of the opinion that under *Winters*[16] and under *Arizona v. California*,[17] they wanted to use C-A-P as satisfying their full water rights for tribal lands, whose measure under *Arizona v. California* was practically irrigable acres, a full supply for all practically irrigable acres on the reservation. There seemed to be fairly consistent consensus among all the representatives of the five tribes I mentioned, five central Arizona tribes.

We went back and reported this and had a couple of phone conversations with Gil Stamm and other people in the Washington office. We were not in a position to negotiate with the communities. We were merely dealing with the situation on a technical basis. We knew that, at least in the case of Gila River, while we had not done a land class[ification study] or certified the

[16] *Winters v. United States, U. S. Supreme Court 1908.*
[17] *PLACE LEGAL CITATION HERE.*

land as susceptible to irrigation, we knew that they had over 77,000 acres of quality land that met the test of irrigability, and even at 5 acre-feet per acre, that was going to be almost 400,000 acre-foot of water just on the Gila River [Indian Community]. And if they wanted a million two [1.2 million acre feet], far be it from two GS-12 engineers to say they couldn't have a million two, but we didn't think that was going to be terribly acceptable politically.

Mr. Stamm's direction, finally, after some consultation, was, "Have your team there in Phoenix work with the Indian representatives to determine how much supplemental water they would need for the lands that they presently have a history of irrigation for. Take into account all of their local groundwaters. Take into account all their locally available surface waters. Take into account all of their unique farming practices that they may have." There were some acreages that were farmed more in the traditional mode that probably only used 2 or 2 1/2 acre-feet of water a year. There were other farming practices that were a large corporate farm, very similar to their non-Indian neighbors, where they grew major cash crops, like cotton, that were relatively high water-using crops. So we were directed to work with all of the tribes to develop a water budget for each tribe that had its basis as being the identified acreage with a history of irrigation.

There is a provision in the C-A-P authorizing legislation that states that water can only be delivered to lands with a recent history of irrigation, and in the master repayment contract it had been agreed with C-A-W-C-D that that definition meant that for ten years prior to authorization, if the land had been farmed, then it was deemed to have a recent [irrigation] history. And so then we knew what our parameters were, and Mr. Stamm just directed us to extend those parameters to the Indian communities, although the legislation did not place that burden on the Indian communities. The legislation only talked about the recent history of irrigation in the context of the non-Indian lands. But to be equitable, this was the direction we got from the Commissioner.

For the next, it seems like about ten years, but I know it was only about a year or year and a half, we worked very diligently to establish agreement through B-I-A [Bureau of Indian Affairs], through both the area office and the agency offices in the various Indian communities, and the tribal representatives themselves to define how many acres had a recent history of irrigation, the types of crops that were grown on those acres, the water duty that was associated with those crops, what sources of groundwater that they had, how much groundwater was in storage, was it economically recoverable, what kind of surface water and variations in surface water did they have each and every year, to develop a water budget for each of the five Indian communities we were dealing with.

As a result of that, we concluded that the five Indian communities, based on that set of parameters, would be entitled to about 257,000 acre-feet of C-A-P water, and that was the offer that was laid on the table. I would have to say it was probably about 1976, I think, that we concluded those studies. The Indians, on their own behalf and through BIA, of course took exception to all the numbers. I would have to say we didn't gain consensus on any one number, but we certainly endeavored to. We demonstrated all of the involved parties' positions in our documents. We made some conclusions and tried to justify why our conclusions were right and theirs weren't right, and that was what we presented through the Project Manager to the regional director and on to the commissioner's office. Like I said, the result of that was, five tribes and 257,000 acre-feet of water.

There was other dynamics going on. There was discussions about the need for Indian water rights settlements, where did the water come from for these settlements. There were political dynamics of the communities themselves and B-I-A lobbying within the department, lobbying in Congress for additional water.

Changes in Indian water issues on CAP during Secretary of the Interior Cecil Andrus's term

And then in 1977 there was a change in administration, and the attitude towards providing water for Indian communities expanded substantially, because during Secretary [Cecil] Andrus's administration, the total number of tribes changed from five to ten and the number of locations changed from five to twelve. So in Secretary Andrus's administration there was -- not that the work we had done over that period of time was negated. It just is there were additional quantities that were earmarked for other tribes and other locations, at least on the Papago reservation. So the base allocation went from 257 to 310 [310,000 acre feet] as a result of this expansion during the Andrus years. Who was the --

Storey: Keith Higginson?

Morton: Well, Higginson was in Reclamation. I'm thinking of after Andrus.

Storey: Oh. James Watt, maybe?

Morton: Watt, right. And then during the Watt administration there was some attempt to reduce that number, but the numbers stayed the same. The 310,000 acre-feet stayed the same, but Secretary Watt did change the procedure for calculating water supplies during times of shortage, and that procedure was at a decided disadvantage to the Gila River Indian Community, which happened to be the only Indian community that chose not to sign a contract with Secretary Andrus and Deputy Assistant Secretary Dan Beard, because, in fact, in 1980, just shortly before the Democratic administration left office, Mr. Beard came to Arizona and signed a series of contracts, as the Secretary's representative, signed a series of contracts with the Arizona Indian tribes, and the Gila River Indian Community was the only tribe that chose not to sign a contract at that time.

Dan Beard of Carter Administration signs water contracts with several Indian communities in 1980

Storey: Because they wanted more water or what?

Morton: Yes, because they felt that the offer was insufficient, both in terms of quantity and the other terms of the contract weren't to their liking.

Storey: How did the additional five tribes, how were they added? What was the criteria or basis or whatever?

Morton: I think it was a political advocacy kind of thing, where the tribes came in and said, "We were not considered." All of the additional tribes at that time were outside what we had envisioned as being the gravity flow service area. The tribes were ~~either~~ located well upstream, but through the principle of exchange had the ability to take C-A-P water.

How five additional Indian tribes received CAP water

In other words, they would divert water that was entitled to downstream water rights holders, but C-A-P water would in turn be exchanged for that diversion and C-A-P water would be delivered to the downstream water rights holders. At least that probably is the mechanism that will be used for the San Carlos Apache and the Tonto Apache and the Camp Verde Aapache and would have been for the Prescott Yavapai, would have been for the San Xavier -- if we hadn't changed the design of the Tucson Aqueduct.

But in the '70s, with the Tucson Aqueduct terminating in northwest Tucson, or northwest of Tucson, it was still another forty miles, roughly, to the San Xavier community. So at that time San Xavier would have probably, to take C-A-P water would have pumped groundwater out of the Santa Cruz River channel, delivered it to the existing farmlands at the village of San Xavier, and C-A-P water would have been delivered to the city of Tucson to make up whatever adverse impacts on the city of Tucson's groundwater. But the bottom line is, there were plumbing arrangements, if you will. There were exchange mechanisms available to make the thing work. But our direction at the time we went through the technical evaluation process was focussed solely on the direct service, the Indian communities who had the potential for direct service, who were, if you will, downstream or within the gravity service area of the canal system.

But anyhow, the tribes themselves went to Congress and went to the Department and said, "We've been overlooked. The authorizing legislation authorizes exchanges. Why didn't the Bureau of Reclamation come to us and ask us what our needs are? We certainly have the ability, through the exchange principle, to take this water." And in the Andrus administration, that was found to be a compelling argument, and, in turn, many of those tribes are not agrarian tribes. They don't have irrigation systems. But they have what at that time was called a "tribal homeland" need for the water, and that definition of tribal homeland is still open, but could include, in the case of the San Carlos Apache Tribe, for example, recreation developments, small lakes, fishing lakes. It could include -- once again, a good example would be in the case of San Carlos, who has a substantial amount of minable ore bodies on the reservation, it could have been mining. It could have been industrial types of activity.

Anyhow, the tribes themselves then went to the Secretary and said, "If you're comfortable, based on the legislation, with offering us a contract, these are the kinds of things we could make use of, apply the water to, and here's the amount of water we would need to make these things work." And so Secretary Andrus adopted another definition of water use, and he called it tribal homeland use, which was basically any use that the various communities would choose to make of it. In certain instances, where they had small irrigation projects, as the San Carlos Apache do have at Bylas and at the village of San Carlos. They have some small irrigated plots. He also made irrigation allocations to some of the tribes, some of those exchange tribes.

I really can't speak to why they were overlooked in the mid-'70s, but they were, and that was corrected during the late '70s and 1980, at least.

Storey: You spent a couple, three years working with the Indian groups. I've met with Indian groups, not in this area, but in other areas, and I'm interested in a couple of things in particular. One is, were you actually meeting with the Indian groups or were you meeting with their attorneys or a combination, number one. And the other is, how would you characterize the meetings and the cultural differences and expectations for meetings and that kind of thing?

Morton: The Indian representatives were almost universally non-tribal members. They were engineers and/or attorneys, or attorneys and once in a while an engineer who represented the tribes, with the exception of Ak Chin and Gila River, I don't think in any of our -- we generally had individual meetings. We were meeting with five groups individually, and then maybe like once a quarter all the groups would come together in one big meeting to say, "Well, here's the status of where we are on Salt River, and here's the status . . ." so everybody heard the same status report.

But then Gila River didn't want Salt River to know what they were doing and Fort McDowell didn't want Ak Chin to know what they were advocating, so we had to have separate meetings with each tribal group when we were going through the technical stuff. But then on a regular basis, maybe it was semiannual. No, it was more like every three or four months, I guess.

END OF SIDE 1, TAPE 2. MAY 23, 1996.
BEGIN SIDE 2, TAPE 2. MAY 23, 1996.

Storey: You were saying you didn't think the process took more than about a year and a half.

Morton: Yeah, and we probably had four of these large status meetings over that period of time, so it was every three or four months that we would convene a major meeting. But we probably met with each tribal group every other week and kind of negotiated with them on what kind of crops they grew on these lands, and, "Well, we've got aerial photos that show you didn't have any cotton out there."

Of course, they were trying to ensure that they got the maximum amount of C-A-P water they could get, so they would strongly advocate, you know, you could look at their crop census that the Agency had or you could look at the aerial photographs and you could see that, well, they were growing carrots or melons or something, and melons take 2 acre-feet per acre and carrots take 11 inches per acre, whatever. "Oh, no, we're fully intending to put cotton on that, and alfalfa. If we can just get a cattle-feeding operation down here, we're going to grow a whole lot of alfalfa." Of course, alfalfa takes maybe 6 acre-feet or 6 1/2 acre-feet per acre.

So they were trying to demonstrate that their economy was based on having a cotton gin and growing cotton or having a cattle-feeding operation that they needed grains and alfalfa or having a dairy, but those weren't existent at the time. I mean, they were prospective kinds of needs that they were trying to demonstrate that they would implement. Anyhow, that was the kind of dialogue that we would go through, and we would spend three or four hours a day with each community. Over maybe a two-week cycle, we'd meet with all five of them, and then we'd go back and we'd take what they presented to us and we'd go get collaborative data and try and approve or disprove what the representatives have said.

That doesn't answer your question. Who did we deal with and how did we deal with them? Like I said, with the exception of Ak Chin and Gila River, I don't think we ever had a tribal representative or tribal member at a meeting, with the possible exception of these big status meetings. But in terms of a technical meeting or a negotiation, the spokespersons were normally an attorney and the attorney would have an engineering consultant and/or a representative from the Bureau of Indian Affairs at those meetings.

Generally, the representative from Indian Affairs, sometimes they would have people from the agency who actually had on-ground experience as far as what the agricultural types of commodities grown were. They had good records, and they knew exactly what was going on. But normally the representative from BIA would be someone from the trust responsibility side at BIA, and so he was generally of the ilk that practically irrigable acres should be the measure of how you constrain these water rights and the Bureau of Reclamation should satisfy the Secretary's trust responsibility by dedicating the whole C-A-P to that satisfaction.

Gila River and Ak Chin both had large corporate farms and they both had non-Indian farm managers, but their board of directors on the corporate farms included tribal representatives, and the tribal representatives, in their own capacity, while they were members of farm boards, also farmed fairly large holdings on their own, with their own capital. In the case of Gila River and Ak Chin, there were some -- first of all, the farm manager for the large farms, the entire Ak Chin community was treated as one large corporate farm, and so when they came to the meeting, the Ak Chin would bring the farm manager, their farm board attorney, and usually one or two representatives of the farm board who were tribal members. From a cultural perspective, you wouldn't have known they were Indian. I mean, they were fully acclimated, fully integrated into the non-Indian society. They spoke in current economic terms. They knew what the stock market was doing. They knew what the commodities market was doing. There were no cultural differences in the positions they would take as opposed to a non-Indian position. They were fully integrated into the economy of the state.

Gila River, on the other hand, had -- and that may have been why Gila River never signed the contract in 1980 is, they had a lot of different cultures. They had a culture of elders who were growing subsistence-type crops. They had an acre of Indian corn and an acre of squash and an acre of melons that they grew up behind their house, and so they had to represent that component. And then they had the what I'd call the small family farmer, perhaps, more than subsistence. Maybe he had gone out and taken all his fractionated heirships and integrated them, and maybe he had twenty acres, or maybe even forty acres, and while he had a full-time job, he also had a forty-acre farm that he was actually in some form of commercial operation.

Then you had a group that had leased their land to a non-Indian farmer, so they were concerned about was their leasehold going to have to pay for this water or were they going to be obligated to pay for the water. So they had a different mind-set. And then within the community themselves they have a large community farm, 16,000-acre community farm. And so they would bring one or two of their board members, who generally were like the Ak Chins. They had farming enterprises in west of Phoenix or south of Chandler or wherever. They had their own private farm, and then they served on the farm board and took some of the proceeds off of the farm for the good of the community. And then, of course, they would be represented also by the non-Indian farm manager and an attorney, and normally each party would have a consultant, an engineering firm.

So when we met with Gila River, we'd have a dozen people in the room, all of whom had a little bit different agenda, because they came from a little bit different culture. The individuals who would be in the room, if there were a dozen people there, there were probably four or five tribal members, a couple of whom represented the farm; one or so who was a traditionalist, small subsistence farmer; another one who maybe was a "family farmer," trying to make a go of it with two jobs, one of which included the farm and maybe forty acres; and then you had a couple of different attorneys, who had different agendas, one who would have been for the corporate farm, another one would have been for the tribe itself.

The San Carlos Indian Irrigation Project and its relationship to the Gila River Indian Community

Then the other aspect was that, of course, 50,000 acres of the developed land was on the San Carlos Indian Irrigation Project. Fifty thousand acres of the 100,000-acre San Carlos Indian Irrigation Project is located on the Gila River Indian Reservation, and that's operated by an independent instrument of the Bureau of Indian Affairs. So, of course, they had an interest because they wanted to know, "Well, are you going to use our canals and rights-of-way to run your C-A-P water, and if you are, how will it affect our operation? Are you going to pick up our O&M rather than us having to pay it?"

Gila River Indian Community is now the biggest single contractor for CAP water

Gila River was just -- they were undoubtedly the most complex, and still the most complex, of any of our water contractors. I think now today the community does have a contract. They did not enter into a contract until '82, I believe it was, and on the basis of that contract, they are our largest single contractor for C-A-P water at 172,000 acre-feet a year. Bigger than Tucson. Tucson likes to say they're the biggest M&I contractor at about roughly 149,000 acre-feet, but Gila River Indian Community is the largest single contractor for C-A-P water, and they're still the most complex, because they have this diversity of interests that they have to -- it's impossible to reach a consensus, because there are just too many facets of the community to deal with.

They have, I believe it's ten districts, and each district has its own mission statement, its own objectives. Some of the districts by plurality of vote have determined that they want to go back to the way it was in the 1880s or 1850s or in that era. They want to see water flowing in the Gila River. They want the riparian forest to be established along the Gila River. Other of the districts want to see large corporate farming, with lots of jobs, improvement in their school systems, etc., etc., as a result of those jobs. So it's just one of the most diverse cultures and diverse points of view of any community. I mean, for a community that has 350,000 acres, they're a community of 350,000 acres, ten districts, and probably twenty different viewpoints on any given issue. Very complex, very difficult to reach one common direction in terms of using their C-A-P entitlements, and I don't think it will be one common direction. It'll result in some of the water being used for -- I don't think we can make the Gila River flow again, but certainly we can build riparian areas. We can establish artificially constructed wetlands, if that's the purpose to which they want to put the water, and I think that they will likely do that.

You look at the community outside of the water arena, the Gila River Community. They've got two large gaming casinos. They have a major recreation area that they hold rock concerts and have drag races and drag boat races. And then they have the more traditional cultures that were probably prevalent, like I said, in the 1800s. It's a magnificent setting, but it's really difficult from a cultural perspective, and from an Anglo-Saxon viewpoint, it's really hard to deal with that kind of diversity.

Storey: Are they near Phoenix here?

Morton: Yeah, they're just south. They abut Phoenix and Chandler and Gilbert. They're just on the southern boundary of Phoenix, Chandler, and Gilbert.

Storey: I presume that Commissioner Stamm consulted with other people before he gave you direction on how to look at the Indian communities?

Morton: I'm sure that he did.

Storey: I mean, it wasn't that you called him and he gave you direction on the same conversation, was it?

Morton: No. No. I think we probably had half a dozen different conversations with the Commissioner to update him on what we were finding, and I think he was -- I know that he consulted with others. It was a case here that there was a limited resource. He had agreed to make the first move in the chess game of water allocations, obviously, and when the results came back that the five central Arizona tribes were more than willing to take the entire supply, I think it kind of took him aback, as it did us. I think we finally got our marching orders about six or eight weeks after we first explained to him what our initial results were of trying to establish the problems and needs of the five Indian tribes that we were dealing with.

Storey: You mentioned that the Indians, of course, were trying to maximize their water allocation with, I think I could characterize it as projected needs on already developed land, say.

Morton: Right.

Storey: When it was all said and done, did they actually get more water than a strict interpretation of the ten-year rule and the existing crop rule and all of those other guidelines would have given them, or did you stick pretty closely to it?

Morton: I think we adhered reasonably well to it. The actual acreage under production was pretty well defined. We missed some small -- like the subsistence farms. It's really hard to tell from a photograph or the fact that a land classifier was down there but he missed the acreage. He was looking for traditional -- not traditional crops, but for cash crops, that crops that were in --

Storey: Corn and melons.

Morton: Yeah, five-acre plots or larger. The land classifier is just not really looking for a half acre here and a half acre there. And so there were some of those types of discrepancies that they brought to our attention, and we had to acknowledge their existence. Our staff, who had surveyed the communities in the late '60s, just missed it, and we acknowledged that. But in terms of total number of acres, it was relatively small, and we were in pretty close agreement.

Of course, the Indian representatives and the Indians themselves were stating, "But we have so much more than this," and they did. I mean, there's a <u>lot</u> of arable acreage on the Indian reservations that's never been farmed, but our task was to determine, cooperatively with the communities, how much had actually been farmed, and I think we got real good closure on that type of analysis.

The issues of, well, do we establish a budget based on the more traditional crops or do we establish a budget based on prospective, anticipated needs, that became more subjective. In some instances they came in and they would say, "Here's a proposal we've gotten from a farmers cooperative gin company, and they're prepared to build a gin here if we'll guarantee 5,000 acres of cotton on an annual cycle," and so on and so forth. Well, it was an economic prospectus. You kind of had to give some credence to that, and we did.

There were some really what I would call fly-by-night proposals. One of the attorneys for Ak Chin, I remember he came in with a proposal. It was a proposal for a chicken, a Tyson chicken plant. I remember this because the sheer weight of chicken manure would have been fantastic. It took him about three hours to make this presentation about how we can grow chickens for the fried chicken industry and how you -- I don't remember now if it's an eight-week cycle or a twelve-week cycle. I think it's twelve. You have eleven chicken buildings, eleven buildings, and each building houses a chicken of the week, and then the twelfth building is vacant because you haven't put the eggs in it yet to incubate, and so you're cleaning out that building. So every week you go to a new building and clean it out, and then you incubate the eggs and the eggs hatch and the chickens grow.

The whole story is, in order to do this you've got to grow chicken feed, and the end of the story is, the type of chicken feed you grow takes about 4 acre-feet per acre. It's an annual process, and you've got to grow -- I don't even remember what it was, barley or corn, some agricultural crop that you had to grow and you had to grow it 365 days a year and it took a lot of water, and the bottom line is, it produced a whole heck of a lot of economic benefit. There's a whole lot of revenue involved here, because every week you've got like 10,000 chickens coming off the conveyer belt, and so every week you've got to process these chickens. So that was the story that unraveled.

When you got right down to it, this would have provided 90 percent of the chicken requirements of central Arizona in this one complex that they were trying to advocate as a future prospective economic use of the tribal lands and the farming enterprise. Anyhow, we kind of discounted that one and didn't include it in our perspective, and they still don't grow any chickens.

Storey: I have two more questions for today. You said who paid for the Indian water was an easy one.

Morton: It's easy because there is a piece of legislation called the Leavitt Act, and the Leavitt Act provides for irrigation water. If the irrigation water is within the ability to pay, the payment is deferred until the land goes out of Indian trust. So if you have a piece of property that you're using for irrigation and it's held in trust for the Indian community, the debt within the ability to pay is deferred for time immemorial. So you never collect on it. It's just sitting out there as a future obligation, like a lien.

Who pays for Indian water in CAP

If it leaves trust, and it's vested in individual tribal members or it's sold -- the United States divests themselves of that trust responsibility for that land, a lien goes with that divestiture. Any additional cost that's in excess of the ability of the land to pay for is declared non-reimbursable. And so roughly right now we figure that, similar to the non-Indian land, the ability to pay is about $2.00

an acre. And so if there's 100,000 acres of Indian land, then there's $200,000 a year of capital repayment, and when you look at the delivery system, there's over a billion dollars allocated -- I'm sorry. If you just look at the backbone system, the main aqueduct system, there's over a billion dollars allocated in the backbone C-A-P system for delivery of water to the Indian communities. At $200,000 a year times fifty years, you can figure out how much actually gets deferred under the Leavitt Act and how much is actually declared non-reimbursable, and, of course, the bulk of those costs will be non-reimbursable.

Storey: So Reclamation's paying them through its budget?

Morton: That's about the size of it, yeah. It becomes a Federal obligation.

Storey: Okay. Were you doing this work with the Indians for a year, year and a half full time or was this one among duties?

Morton: It comes back. It was in the same time frame that we were writing an EIS for Buttes and a writing a draft EIS or Orme. It was an amalgamation of activities that was focused on what I characterize as the leftover planners that were integrated into the O&M organization, the Division of Water and Land, as we call it today.

And then, of course, the CAPSIM modifications from time to time. As we got better data from the engineers as construction progressed, we'd have to do some tweaking of the CAPSIM model. And then the economists would need a water supply run or a power run, and we'd actually manipulate the model. I'm not saying revise the software, but we'd actually do a production run with the model and provide that data to the designers and/or the economists. It was just a series of those kinds of activities in that '73 through '76 time period.

Storey: Okay, good. Well, I appreciate your time today. I'd like to ask you again whether you're willing for the information on these tapes and the resulting transcripts to be used by researchers.

Morton: Yes, I would.

Storey: Thank you.

END OF SIDE 2, TAPE 2. MAY 23, 1996
BEGIN SIDE 1, TAPE 1. MAY 24, 1996

Storey: This is Brit Allan Story, Senior Historian of the Bureau of Reclamation, interviewing Larry Morton in the Phoenix Area Office on May 24, 1996, at about ten o'clock in the morning. This is tape one.

Yesterday we were talking about some of the things that were going on concurrently, and along with CAPSIM and the other things, you were involved in writing some of the early environmental statements, I believe four of them. Could you talk about that, please?

Writing environmental statements for the early years of CAP

Morton: Well, since I'd been reassigned to the operations organization and at least had some knowledge about the authorized features of the project, I was asked to be involved in the writing of those chapters that related to the operation of the facilities and the description of the facilities that were expected to be constructed. The initial document was a programmatic environmental impact statement that basically described the overall effects of the project, described what we understood at that time to be the physical facilities that would be constructed, how they would be operated, and made commitments for future site-specific EISs as we learned more and more about the actual system that we intended to build.

The first site-specific EIS had to do with the diversion facilities at Lake Havasu, principally about a $150-million complex that incorporated the Havasu pumping plant, the Havasu intake channel, and the Buckskin Mountains Tunnel. That was an extremely site-specific EIS. It encompassed a relatively small area of terrain that would be disturbed. There are a number of sensitive issues that needed to be explored, including sedimentation; including the importation of Colorado River biota into central Arizona; the transport of exotic, non-native fish into central Arizona from the Colorado River; the need to construct fish barriers to protect against that transport.

Issues connected with the Havasu Pumping Plant and the Buckskin Mountains Tunnel

We had a number of meetings with the U.S. Fish and Wildlife Service. At that time, the Service was in transition, as was the rest of the government, with regard to environmental concerns. Many of the people who worked in the Service in that era, in the early '70s, had been involved with the more economic national N-E-D objectives of water resource development, and their focus was on the fishery aspects, the economic aspects associated with fishing. So they were coming from a mind-set that said, "We should not allow the fishery resource to escape Lake Havasu." There was a major recreation component ongoing in Lake Havasu, so their concern was the loss of large striped bass and other fish species who were resident in Lake Havasu and, in turn, a decline in the economic activity that related to fishing.

A number of years later, the [Fish and Wildlife] Service had intended to move away from the economic aspects of recreation and fishing to the protective aspects of [protecting against] importation of exotic species, so the Service has done a flip-flop in their method of evaluation. I suspect that the decision would have been the same, i.e., we don't need to build a set of fish barriers in the forebay of the Havasu pumping plant. But it's an interesting dynamic in that the philosophy of an agency changes and the rationale for making a decision also changes, even though in all likelihood the decision was correct in either instance. We were looking at a potential capital outlay of about $20 million, plus $3 to $5 million a year in operating expenses, had we had to install fish barriers or fish screens in the forebay of the Havasu pumping plant.

Another significant issue in that environmental statement was --

Storey: Excuse me. Before we go on, why did they decide we didn't need fish screens there?

Morton: Well, they looked at it, primarily at that time, from an economic perspective and concluded that the recruitment -- what we did do is we built an intake channel with a long causeway, and they concluded that the larger-size fish would be able to escape the flow velocities in that intake channel, because it was a very large intake channel as opposed to having a fairly narrow orifice that you would suck the water and recruit fish. And so we went through an analysis on the flow velocities in the intake channel, and the bottom line was that even very small fish would not really be significantly recruited from the reservoir. In other words, they could overcome that less than one-foot-per-second flow velocity and could move back out into the lake if, in fact, in terms of the numbers of fish that would be in that channel and the relative flow velocities, it concluded that the fish would not be sucked into the pumps.

Obviously, some fish of the lake would be recruited, but they would be the relatively small fish, the fry. The larger fish could escape the flow velocities and go back out into the lake. So in sheer numbers of fish biomass that would be recruited, it was concluded it would be only a small portion of what was actually produced in the lake, and therefore we didn't need to concern ourselves with the economic loss of those fish.

Today the other side of the coin will be importation of exotic species, non-native species from the Colorado River into central Arizona, and then through bait bucket transfers or other transfer mechanisms, moving those fish into the headwaters of central Arizona of the Salt and Gila River drainage systems and having adverse effect on endangered native fish, like Spikedace and Gila Topminnow and so on. So today the philosophy is, should we have put fish barriers at Lake Havasu? Well, the bottom line answer is: "probably not because the relatively small fish -- fry, eggs, etc. -- would still go through the pumping plant." A fish screen or fish barrier is not 100 percent effective, so, in fact, you would get Colorado River biota in the canal and they would reproduce in the canal, and so the exotic species would still be in Phoenix at the Salt River or in Pinal County at the Gila River, and through bait bucket transfers or other mechanisms, the fish could bi-migrate upstream and into the headwaters, where the endangered native species were originally. So the net answer was, "no, we won't build fish screens," but it took a lot of analysis and a lot of debate to reach that conclusion.

The other issue -- well, there were a couple of other environmental issues. There was a [Great] Blue Heron rookery in proximity, within a half a mile, of the Havasu pumping plant, and the concern for that rookery was, it was located on an island, and our original plan included an intake embankment, a dike, that went out into the lake and would have connected to the island and provided access for coyotes and other predatory animals, as well as human beings. So the concern was, we needed to protect the rookery, and so we did that by just redesigning the channel so that the dike that forms one side of the channel did <u>not</u> connect to the island.

The Havasu Wildlife Refuge extends into the lake in proximity, within about a quarter of a mile of the Havasu pumping plant. There were concerns for adverse effects, additional people, noise of construction, lights from construction, affecting the refuge, and we accommodated that through requirements in the construction specification that precluded various kinds of disturbances from occurring in the refuge and protected the refuge from human intervention.

I guess I would have to say it's probably one of the easier EISs. The types of issues that were there were very site-specific to that Havasu complex. The issue of importing water was not an issue for that statement, but rather for the overall statement, and there were always concerns about taking water off the Colorado River or having adverse effect on downstream flows, having an adverse effect on flow regimes within the reservoir. We had generally addressed most of those in the programmatic EIS, and they did not become issues of any consequence in the Havasu complex EIS.

The Granite Reef Aqueduct environmental impact statement

The third EIS that I worked on was the Granite Reef aqueduct EIS. The Granite Reef aqueduct runs from Lake Havasu to the northeast of Phoenix near the Salt River. That was significantly more difficult to describe in terms of the location and the physical facilities, because this was just -- I think it was '74 that we did the Granite Reef EIS, and we still didn't have a real good understanding of a lot of the terrain that the canal would traverse. We knew where the point of diversion was. We had figured out where the terminus point would be in terms of geographical location and elevation, but there was a lot of unknowns between the beginning and the end.

We were still deliberating at that time on four in-line pumping plants. We ended up building only three. The physical locations of the siphon crossings were still somewhat unknown. We knew that within a mile or two on the major water courses, but the site-specific nature of those crossings was somewhat up in the air in that time frame. And there was concern because, of course, as you cross these major water courses, the limited riparian habitats that are in Arizona would be potentially affected. To get around this, we generally made specific references to those riparian habitats and indicated that our design and actual construction would not adversely affect riparian habitats that were existent at that time.

Endangered Species Act concerns on the Granite Reef Aqueduct

The Endangered Species Act had just come along, and the concern for endangered species -- not many plants or animals had yet been enrolled as endangered species, had not been listed yet, but here in the central Arizona there were a couple that had been listed -- the Bald Eagle, for one, the Yuma Clapper Rail, for another, and both of those birds -- well, the Clapper Rail's primarily a wetland-dwelling bird. So if we crossed any of these major water courses with the canal, we had to provide commitments that we would not adversely affect the wetland type of habitat that was -- whether the Yuma Clapper Rails were resident or not, we had to document that we would not adversely affect those wetlands, because we had no real surveys to determine whether or not the Clapper Rails were present.

We had much better surveys for the Bald Eagle. We knew where most of the breeding pairs in Arizona at that time were resident. We knew which stands of cottonwoods and willows served as nesting locations for the Bald Eagle. We knew which streams the Bald Eagle generally habitated for its forage purposes. So we were able to consult on the Bald Eagle with some degree of assurance that we were not going to have an adverse effect on the Bald Eagle.

Cultural resources surveys in the early years of CAP

The impact analysis generally significantly looked at both biological resources and cultural resources. In that era, our cultural resource surveys were probably what we call "class two surveys"[18] today. There were a few "class three surveys," where we had actual on-the-ground surveys, but because the precise location of the canal was generally not known, we committed an EIS to go back and do site-specific on-the-ground class three surveys, once we knew where we thought we were going to build the canal, and we developed a programmatic 106 procedure with the state historic preservation officer that committed us to a program of mitigation associated with the cultural resource sites.

We had similar types of overarching commitments for biological resources, primarily, as I said earlier, the endangered species like the Yuma Clapper Rail and the Bald Eagle, <u>and</u> the more valued types of vegetative resources, like wetlands and riparian areas. The upland habitats,

[18] Generally speaking, a "class one survey" involves a literature search for known cultural resources sites, a "class two survey" involves adding a sampling on-the-ground survey for unknown cultural resources sites to a
(continued)

we indicated what the adverse effect was, roughly the loss of 20,000 acres upland habitat. We described that in general terms in the EIS. But we made no commitment for mitigation or restoration, other than indicating that the areas upstream of the canal would be available for green-up as a result of cross-drainage water that impounded against the upslope side of the canal, and that we would fence out those green-up areas from cattle and from off-road vehicle recreation.

That was generally the scope of our impact analysis and our mitigation. To get down to site-specific mitigation, the EIS did not specifically address that. It was fairly general, in anticipation that as we got into construction, there would be mitigation programs to protect wetlands and riparian areas and mitigation programs to deal with effects to cultural resources.

[18] (continued) class one survey, and a "class three survey" involves intensive on-the-ground survey for unknown cultural resources sites. These levels of survey are used for different planning purposes. Class one and class two surveys are generally used for EIS purposes, with a class two survey attempting to give projections about overall impacts of a project on cultural resources sites. A class three survey is generally undertaken prior to ground-disturbing activities and final compliance with Federal historic preservation laws.

Working on the Orme Dam environmental statement

Following the Granite Reef statement, then we worked on the Orme statement, and as an immediate follow-on to the Orme statement was the Buttes statement. As a result of the negative outcry against the Orme statement, the Buttes statement never saw the light of day. We curtailed our activity on Buttes immediately following the public hearings on Orme and set it aside, and it's never been resurrected. I mean, we set it aside about 1976, and we've never gotten that far along again on the planning or the environmental impact statement associated with the Buttes Dam and Reservoir.

The Buttes Dam environmental statement is set aside

Storey: Is Buttes the fourth of the early ones?

Morton: It would have been the fifth. It would have been the fourth site-specific or the fifth total. It was programmatic to have a Havasu diversion complex, the Granite Reef aqueduct, Orme Dam. We were just going down the line.

Storey: I had a list of four, but I missed that you were counting the programmatic as one.

Morton: And Buttes and the Salt-Gila Aqueduct -- and, in fact, it was a toss-up whether the Salt-Gila Aqueduct or Buttes Dam and Reservoir would have been the fifth in the series.

Storey: Buttes was in a different location.

Morton: Right.

Storey: Not on the McDowell Indian Reservation.

Morton: No.

Storey: Why was it shelved? It seems to me as if it's a different situation.

Morton: It's a different situation, but environmentally and socially it has substantially more -- not more, but at least similar types of impacts. Buttes Dam and Reservoir would have been located on the Gila River, about fifteen miles upstream east of Florence, Arizona, and the water from Buttes Reservoir would have inundated the Gila River just about up to the mouth of the San Pedro, the confluence of the San Pedro and the Gila. It would have inundated both very high-quality riparian habitats, habitats that support some endangered species, like the Peregrine Falcon, like the Mississippi Kite, I believe it is, Zone-tailed Hawk. Even today it does not support Bald Eagles, but the habitat was conducive to Bald Eagles, so there was always the concern that we might have Bald Eagles in the reservoir area.

The reservoir area is a checkerboarded area of BLM and private lands. Most of the private lands are owned by mining companies.

There are <u>are</u> copper ore deposits throughout the region. The copper at that time was being mined both at Silver Bell Mine on the Santa Cruz River and the open-pit mine at Casa Grande, were hauled by railroad to the smelter, to the PD smelter, Phelps Dodge smelter at I believe it's Kearny or Ray, in that vicinity. That goes right through the reservoir area, and the mining company that owns the railroad was going to require that we relocate the railroad, so the cost of relocating the railroad was more than the dam in its entirety.

The towns of Winkelman, Sonora and a third one that escapes my memory right now [Kelvin, Hayden, Kearny?], portions of those towns were either within the reservoir or their wastewater treatment systems would have to be relocated because of the reservoir, the backwater effects of the reservoir in the wastewater treatment plants. And so there were major relocations to people, so there was a social impact, at least on the folks who lived <u>upstream</u> of the dam. The road would have had to be relocated. A new bridge across the Gila River would have had to have been put in.

Probably equally unsettling was the relationship with the San Carlos Indian Irrigation Project. The San Carlos Project stores water in the current existing Coolidge Reservoir, and then that water is released from Coolidge and runs down the Gila River and is diverted at Asher-Staden Dam, which would have been immediately downstream of Buttes, and the waters from Coolidge ~~are~~ diverted at Asher-Staden are delivered to 50,000 acres of non-Indian lands that are in the project and another 50,000 acres of Indian trust land that are located on the Gila River Indian Reservation.

Working out the water rights and the crediting of deliveries and diversions was, or at least at that time appeared to be, a very difficult process. One of the things that the operation staff did was to try work out an operating plan that would have no adverse effect on the San Carlos Project, but the San Carlos Project was of the opinion that every cubic foot per second of water that could actually be diverted to Asher-Staden Dam was their rightful entitlement, even though it could not be immediately put to beneficial consumptive use and would, in fact, under their normal operations, would have bypassed Asher-Staden.

Their demand was that if they had vacant canal capacity to divert it, they were entitled to the rights of that water. So if you use that type of an analysis in justifying the yield from Buttes Dam in computing how much water you could store for the benefit of the Central Arizona Project, it reduced the economic benefits of Buttes by a substantial measure. In fact, our B/C ratio was right at or perhaps even a little bit under 1 to 1 on an incremental basis. It had obvious economic problems. It had serious problems with development interests, like mines and like communities, all of which could be solved with extra dollars, but to the extent that you sat down and negotiated with the mine on relocation of their railroad or you negotiated with the three small towns that were along the Gila River -- Riverside was the third town -- those negotiations would in all likelihood result in increased costs.

There was a substantial amount of uncertainty both in terms of the value of the private properties within the checkerboard, and, of course, on the BLM properties within the checkerboard land, all the claims had yet to be adjudicated. Some of those claims were obviously going to be declared valid by BLM, and we would have to provide fair market value to the claimant, which, in turn, would drive up the cost of what we saw there at Buttes. And then just because it had rather significant biological -- I forgot to mention all of the cultural aspects of the site.

The cultural resources were, and still are, a major resource in central Arizona. The Gila River, in historic terms, in the mid-1800s was the highway for travel from the east to the west. It was a major stopover for folks who were moving to California. It was a major byway for the military. It was an area in prehistoric times that was farmed by Native Americans, and there were a number of both historic and prehistoric remains and dwellings along the banks of the Gila River, and the reservoir would have inundated those facilities. It had some beautiful coke ovens from the 1860 era that are still there in the [proposed] reservoir that would have been flooded. So the value --

END OF SIDE 1, TAPE 1. MAY 24, 1996.
BEGIN SIDE 2, TAPE 1. MAY 24, 1996.

Storey: You were just saying that the value from a cultural resources and a biological perspective was --

Morton: Very high (laughter). And I guess when we started putting all this together as a result of our experience in 1975 with Orme, the general conclusion was, until we get over the Orme situation -- we don't want to replicate the Orme situation, and this Buttes has all the makings of producing the same kind of disaster, if you will, as what we heard in the Orme draft EIS public hearings. Probably a different group of people, but people with significant concerns.

In other words, as you said at the beginning of this interview, if we didn't have to face the

Fort McDowell issue or the folks that inner-tubed on the Salt and Verde River as their Saturday and Sunday recreation, then that's right, we didn't. But we would have had decided controversies with bird watchers and copper companies and people who lived in the reservoir area and an Indian irrigation project who basically opposed the construction of Buttes Dam, if it adversely affected what they viewed their rights to be.

Storey: And San Carlos, Coolidge, I believe we built that, and then it was turned over to BIA. Am I thinking correctly?

Morton: Well, my understanding is that in '35 the Indian Irrigation Service built Coolidge. More recently, however, we, through the Reclamation Dam Safety Act as amended in '84, were charged with modifying Coolidge Dam to ensure that it met current dam safety criteria standards, and so we've been involved and have just completed dam safety modifications at Coolidge Dam.

Storey: There were two other dams, Charleston and Hooker, that were originally intended to be part of the C-A-P. Were they also in line for environmental statements?

Morton: They were, but they were relatively far off in the future. I mean, our objective in that era was to produce every year or two an environmental impact statement, depending on the progress of what we had accomplished to date.

Our original strategy, as we discussed earlier, was to build things either that you could protect, both protect people against and protect the facilities by mothballing them in some fashion once the construction was done, or to build facilities that would produce an immediate benefit, because all the reservoirs were authorized as multipurpose facilities, and even though they might not immediately produce, because you didn't have the aqueduct systems in place to move water around, they might not immediately produce water supply benefits, they would produce immediate benefits in the area of flood control and recreation and possibly power generation, if there was a power plant associated with them.

We kind of got going on the Granite Reef Aqueduct, got construction under way there, and then our concept was to do at least two or three reservoirs, get them under construction, and then come back and pick up the rest of the aqueduct and the distribution system infrastructure. But after we had analyzed Orme and found that it led to a lot of protest and we analyzed Buttes and found we had equivalent adverse environmental and possibly even economic impacts at Buttes, we backed away from that philosophy of proceeding with the dams and came back and started the aqueduct system to extend the water delivery area from Phoenix to Tucson along the eastern portion of the project.

Storey: How many of you were there working on these environmental statements?

Reclamation's environmental impact statement staff in the 1970s

Morton: Well, because the input was made to a coordinating group, our environmental organization at that time numbered in '76 probably about eight people. Two people were writer/editors. The senior person on the staff was the former head of the planning and reports division, Dave Creighton, and Dave's forte was editing. I mean, he was an excellent writer. So he took it upon himself to become the author, the editor of the EIS, and he had another fellow on his staff that was pretty skilled in writing, as well. But then the environmental staff consisted of biologists and archaeologists who did the analysis relative to biological and cultural resources.

But the rest of the environmental statement, which had a general format of a general description of the facility, specific description of the facility, how the facility operated, how one would construct it. Of course, in any of these instances, as you construct something, you have a need for concrete and steel and cement and soil or earth. That's just what the facilities are built from. So you'd have to describe the impacts of borrow areas and haul roads and all of the infrastructure that would go into a large-scale construction operation. So we would rely on several folks that had writing skills and analysis skills in the construction engineer's office for that part of the write-up. And we'd rely on one or two of us who worked in operations to describe what the operation would be, and perhaps the folks that had been around the longest, including me, would describe the general terrain and general topography and the climate and the recent economic history of the area, and so on, just because we had those skills or those knowledges.

In total, it was a part-time job for maybe fifteen or twenty people throughout the whole organization, the construction side of the organization, the operation side of the organization. We'd have to bring the economists in to describe what the economic impacts would be from a regional economic development scenario. You dump $200 million worth of construction and a work force of 500 people on a town the size of Florence where there were only 2,000 people, you're going to strain <u>their</u>

infrastructure -- the schools, the shopping, etc., housing.

All of those kinds of analysis needed to be portrayed in the EIS, so we were drawing from a fairly large segment of the Arizona Projects Office staff to provide this background. And then within the environmental divisions, which, I said, was about eight people at that time, they would perform the specific cultural and biological types of analysis that generally formed the bulk of the impact analysis, although there were chapters and sections devoted to social and economic types of impacts, as well. So twenty plus eight in the environment, we probably had close to thirty people at any given time working on an environmental impact statement.

Storey: Mr. Creighton had been transferred over from the [Phoenix] Development Office?

Morton: Yeah.

Storey: He was one of the old pioneers?

Morton: He was one of our old, as we talked earlier, one of the ten that didn't make it to construction. At that time, of course, NEPA [National Environmental Policy Act] had just come into law, and he was appointed to be the project environmental officer, although he was a civil engineer by training and probably a writer/editor by experience.

Storey: Were there issues that came up in this transition? Was it a difficult transition to make, implementing NEPA?

Morton: Well, it was something new. There was no guidance. You kind of had to do it by the seat of your pants initially. We started off with relatively short letter-type documents, one-, two-, three-page environmental impact statement.

How Reclamation transitioned in implementing NEPA

However, by 1972, when the programmatic EIS for C-A-P was written, it was about an inch-and-a-half thick document. So there was a rather quick transition from one- or two-page memorandums to the file, which today is probably equivalent to what we would call a categorical exclusion, wouldn't even meet the test today of an environmental assessment in terms of the depth and breadth of an impact analysis. Today it wouldn't even meet -- what we put out on the street today as an environmental assessment, in 1970 and '71 was considered an EIS.

There tended to be more reliance on generic types of impacts. If you didn't know precisely what the impacts were, you made commitments to either come back and reassess the impacts or you made commitments to not adversely affect that resource, which we did in terms of riparian areas and wetlands along the length of the Granite Reef aqueduct. Or the cultural resources we couldn't survey because we didn't know within five miles where the aqueduct would actually be located, so we could hardly walk the alignment and try and determine what cultural remains were actually within the right-of-way. So we did tend to rely on future commitments. They became really what I'd have to call encyclopedic in nature in that they tried to address everything under the sun just so that if you did get sued, you could at least point to the court and say, "No, we covered that issue. It's right here on page so-and-so, section so-and-so." We didn't do a very good job of scoping because we didn't understand what the concerns of the public were, so we made them encyclopedic and anticipated that we could beat any legal challenge, because if we covered all the potential concerns,

Reclamation relied on future commitments because of the tentative nature of Reclamation's planning in the early days of NEPA obviously it would have covered any specific concerns, so we put everything in the world in the environmental statement to make sure that we had it covered someplace.

I don't know that it was so difficult as much as it was time-consuming and frustrating for lack of guidance and the fact that many of the things that were put in the environmental statement really weren't the definitive issues of the time. Obviously, some issues are universal -- endangered species; cultural resources; here in the Southwest, wetlands and riparian areas. You could deal with those. But when you had to deal with whether the bus ran back and forth between Winkelman and Hayden every hour or every three hours because construction traffic was getting in the way, sure, that was going to be an issue and, yeah, there might be a letter of comment or a speaker at the public hearing that's going to say, "I'm offended. I have a problem with your EIS because it didn't describe how this is going to impact my transportation needs between Winkelman and Hayden." But people endure that impact all the time. I mean, you have detours and you have flagmen standing out there in any construction environment, and you might have to wait for five minutes. But we made sure all of those kinds of impacts were in this encyclopedic EIS, and if you went out and did a good job of scoping, you would tend to dismiss those as the true issues for evaluation analysis. But we tried to cover everything we could think of in those early EISs.

Storey: What about the institutional approach to the environmental statement process, although at that time they didn't know it, but this was the <u>last really big</u> Reclamation project that had been authorized, has been authorized. Reclamation had a way of doing construction, and environmental effects, they weren't ignored, but they certainly didn't have the same priority that they had after the passage of NEPA and these other laws. What kinds of institutional responses did you see to this process?

Morton: The people who were assigned to work on EISs, I think generally found it acceptable. You know, that was their job. They acknowledged that, they accepted it. They tried to do a good job of framing the issues and analyzing the impacts and then documenting it in a decision-making document.

Some Reclamation staff were uncomfortable with the new environmental laws

Many of the other people, for example, that were in the construction arena, they found it to be an impediment to moving and throwing dirt. "Our job is to move dirt, to place concrete. Why do we have to wait for you guys to get an EIS approved and a record of decision promulgated?" That was their attitude. Many senior construction people <u>believed</u> that the work that they were doing was of <u>benefit</u> to the environment, bringing a million and a half acre-feet [of water] into central Arizona will substantially benefit the natural environment, even though they had a D-9 out there moving dirt and perhaps destroying highly valued cultural resources or irreplaceable wetlands or riparian areas.

"Our job is to move dirt, to place concrete. Why do we have to wait for you guys to get an EIS approved and a record of decision promulgated?"

They saw it in the context of "economic development is a benefit to the environment, and the resources that are being plowed under or disposed of, that is necessary just because we need to have progress, we need to have economic development, we need to provide infrastructure for people. People are part of the environment, as well as endangered species or any other species, and we're here to help people and make a better life for people who live here in central Arizona." That tended to be a philosophy, and you continually had to bring them back and point out, "Well, there's other ways of doing business. By moving the construction fifty feet upstream or downstream, you can eliminate your adverse impact to a wetland. By putting up a fence and a jersey barrier and declaring it off-limits to a D-9, a Cat operator won't go driving through a major cultural resource, a prehistoric site or what have you."

But it took a long time to educate the people who were directly involved in the construction activities that there's other ways of doing construction over what you formerly did. The objection to change was, "Well, the least costly way of doing this is to just drive right through it, excavate the canal prism right through a prehistoric Hohokam site or excavate a trench right through a riparian area of mesquite *bosque* that's taken 200 years to grow." It took a long time. And the rationale was, "Well, the shortest distance between two points is a straight line, and the least cost method of getting water from point A to point B is right through that valuable cultural or biological resource, let's go that way. It's cheaper." But from a practical sense and from a true value to the world sense, it probably wasn't cheaper. It's just cheaper than what you had to pay the contractor to do that piece of work.

". . . it took a long time to educate the people who were directly involved in the construction activities that there's other ways of doing construction over what you formerly did."

Storey: In those early days, who won the discussions?

Morton: Oh, it was probably a stalemate. We lost some valuable -- I don't know about cultural resources, but at least I know we lost some valuable riparian habitats. Some old cottonwood trees, some mesquite *bosques* generally were lost as a result of construction. Other aspects of construction, we're now dealing with those today. Waste oil that was left on-site and covered up we're now uncovering and remediating. Things that were burned, packing boxes, crates, what have you. Old tires were buried. We would make commitments on dust and noise abatement, and two days after construction started we were out there with the landowner trying to mollify the landowner because the construction sequence was operating twenty-four hours a day and keeping nearby landowners up all night. So we lost some, no doubt about it. What we would call traditional construction techniques continued to be used. Irrespective of our desire to eliminate some of those kinds of abuses and adverse effects, they still ended up occurring.

Storey: And as the project continued, was there a change in that?

The way environmental concern at Reclamation has changed

Morton: It took a while, but, yeah, there's been a change. We do a better job. We've conditioned our inspectors and they've become educated in what to look for, when to stop a contractor. There's been instances where we've unearthed some cultural remains, pot sherds, pieces of pot, a burial, and the Bureau inspectors will stop construction immediately. I think even some of the contractors now read their specification paragraphs and of their own volition will stop operations if they run into something like that. I think we do a much better job of disposing of petroleum waste -- well, any waste product, petroleum or any wastes from construction, hazardous materials, paint solvents, sealing compounds, etc. We do a much better job of that. They're not dumped and left behind on site.

Storey: How would you describe the process that's resulting in these changes?

Morton: Well, I think it's education and awareness. I don't know that I can characterize it any better than that.

Storey: Okay. Good. Let's see. Is this the period when Charleston and Hooker sort of fell off the side of the map?

Morton: Well, no. It was actually, in terms of Hooker it was the Carter hit list and the 1977 water projects review conducted by the Department of Interior that really eliminated Hooker from the project, but also opened the door for consideration of other alternatives, and it wasn't until the early eighties, I guess it was, that we actually went back into New Mexico and made a concerted planning effort to determine what the problems and needs of western New Mexico were and where we should go with the authority that was in C-A-P. That was probably five or six years down the road from the time frame we've been talking about for the Hooker studies.

Hooker Dam is dropped because of the Carter "hit list"

Charleston became more of a political football with regard to whether Tucson was going to take C-A-P water or Tucson was not going to take C-A-P water. Charleston was conceived initially as the source of a water supply for the city of Tucson. It was designed to convey 12,000 acre-feet a year from the San Pedro River to the city of Tucson, which is in the Santa Cruz drainage. So the pipeline that would have conveyed that water would have to cross the drainage divide between the San Pedro and the Santa Cruz River, and it would have been a relatively small facility, 12,000 acre-feet, about 18 cubic feet per second. I think it was about a 30-inch or a 36-inch pipeline, not large by today's standards, relatively small.

What happened to Charleston Dam in relation to CAP

Increased capacity in the Tucson Aqueduct replaces Charleston Dam

It was fairly expensive, because you were building a dam and a pumping plant and sixty miles worth of pipeline. For a 12,000 acre-feet water supply, it was a fairly expensive proposition, and being smarter than the average bear, somebody finally realized that, gee, for an additional 18 second feet, we only need to add 7 inches of additional lining height on the canal system and we can move that all the way to the city of Tucson through the C-A-P. We can bring Colorado River water in at a relatively small incremental cost, even if you consider that you're going to make the canal a little bit bigger all the way from Phoenix.

The size of the canal from Lake Havasu to Phoenix was sized by law. I mean, that was not going to get any bigger, and so long as the state of Arizona agreed to pay for it -- which they did -- the difference between 2,500 cubic feet per second and 3,000 cubic feet per second for the Granite Reef, or what's now known as the Hayden-Rhodes Aqueduct, you were talking only about a relatively minor incremental cost from Phoenix to Tucson to convey 18,000 or even 100,000 acre-feet, because in the scheme of things, you're going to take 900,000 acre-feet a year or 1,000,000 acre-feet a year south of Phoenix.

So if Tucson's needs were 100,000, that was only one-ninth or one-tenth of the cost, and on an incremental basis was even less than that. It was maybe 5 percent rather than 10 percent or 12 percent. From an incremental perspective, it was probably only about 5 percent, and that was significantly less than the Charleston facility. So I guess the bottom line was, by 1977 or '78 --

END OF SIDE 2, TAPE 1. MAY 24, 1996.
BEGIN SIDE 1, TAPE 2. MAY 24, 1996.

Storey: This is tape two of an interview by Brit Story with Larry Morton on May 24, 1996.

You were talking about Charleston and upsizing the canal.

Morton: Yeah, I was just going to say that by the time '77 came around and we were asked by the Department [of the Interior] and the President to conduct an overall review of the Central Arizona Project as a result of the Carter "Hit List," what's known as the Carter Hit List, it was reported in that document that we prepared that Charleston was very <u>inefficient</u> in terms of providing the water supply to the city of Tucson, that there were substantially less expensive mechanisms, and the supply that <u>could</u> be garnered from the San Pedro River was only in the range of 12,000 to 15,000, 20,000 [acre-feet] max, per year anyhow, and Tucson needed substantially more than that. We were projecting that the City of Tucson would contract for something on the order of 100,000 acre-feet. So from the perspective of building Charleston, it made much more sense, economically speaking, to just slightly enlarge the aqueduct south of Phoenix and deliver Colorado River water to Tucson.

Reclamation's report for the Carter "hit list" indicated that Charleston Dam was a relatively expensive project

As I said, that was reported in the '77 Water Projects Review report of the Secretary of the Interior, and, by that time, Charleston was a dead issue. The cost ceiling that was embodied in Charleston was transferred to the Tucson Aqueduct. I think that was reported about 1980 to the Congress that we had transferred those costs. We've never sought, nor has Congress imposed, a de-authorization for Charleston Dam, but from a practical sense, it won't be built. I mean, it's really not in the cards. The authority is still there. There were other multi-use purposes associated with Charleston, including recreation and fish and wildlife. We're using that authority for the Charleston site to assist the town of Sierra Vista.

The town of Sierra Vista is using a wastewater treatment technology that involves a wetland development to polish their wastewater, and we've provided some funding from the Central Arizona Project to Sierra Vista in anticipation that that wetland development will provide additional habitat for fish and wildlife species in the area, and that would be the C-A-P contribution toward fish and wildlife enhancement that might have occurred had we built Charleston.

We are still doing some things in the San Pedro Basin under the C-A-P authority, but they're dramatically different than building a traditional dam and creating a reservoir and, in turn, creating some economic benefit as a result of the reservoir. I suspect at some point in time, if this fish and wildlife enhancement program is productive and demonstrates a viable new resource, I suspect that other communities in the basin will be looking for similar kinds of opportunities with Reclamation, and/or the recreation interests. The original concept of Charleston Dam did incorporate some separable recreation facilities as a project function, and I would suspect that the folks in the general geographical area of Sierra Vista and Fort Huachuca at some later date may come forward with a cost-sharing proposals for some recreation developments, as well. But from a practical sense, Charleston Dam itself will never be built.

Storey: Let's go back to Hooker. If I'm understanding this, Hooker would not receive water from the Colorado River. It was providing water to New Mexico. I don't understand how this became part of the C-A-P at all. (laughter)

How Hooker Dam became a part of CAP

Morton: Well, I think it was a fellow by the name of Senator [Clinton Presba] Anderson that figured that all out. He was a senior member of the U.S. Senate in the mid- and late '60s and a good friend and colleague of Carl Hayden. If you wanted your legislation to move, it had to move through Mr. Anderson's committee, and so anything that would be of benefit to [New] Mexico was looked on by Senator Anderson in very positive terms.

I guess the bottom line is, the Hooker Dam site has been considered and reconsidered and thought about since before the turn of the century, the twentieth century. I think the first time it was reported as a potential dam site on the Gila River was about 1891 or something like that. At least I've seen references to a report of that vintage prepared by the Geological Survey, who pointed out what an excellent dam site it was and how the flows of the river could be manipulated at that site. The Corps of Engineers has investigated it for flood control, although while it will control floods, there's not a lot of infrastructure that would get damaged by a flood for a long ways down the river, so the flood control benefits are minimal. It's a nice dam site, but it can't do a lot for flood control, because the terrain and facilities that will be damaged are relatively minimal, other than the natural terrain that's there.

For some reason that I can't really explain, it [Hooker Dam] was in the '44 report, or the report that went to Congress in '47. I don't know if that was a political effort to get a vote or two out of New Mexico in 1947 or not, but it did appear as a feature of the Central Arizona Project. It was evaluated in the Pacific Southwest Water Plan back in '63 and '64, and since it had been in the '47 report, the Secretary's report on the Central Arizona Project in 1947, by the time we did our supplemental report to update economic conditions and population conditions and so on in 1964, it became part of the C-A-P supplemental report, as well.

During the legislative process, and I'm sure that it [Hooker Dam] stayed in the authorizing bill at the insistence of the congressional delegation from New Mexico. . . In the late 1970s, by the time we actually tried to formulate a real project up there -- let me go back. In the 1977 Water Projects Review report, it was concluded that Hooker Dam should not be built, and the basic reason for that was, the reservoir itself would have stored water into a wilderness area. The objection to Hooker Dam was its adverse effect on one of the earliest wilderness areas ever established under Federal law.

There are a lot of other problems with the dam site, including long haul distance and remote, high construction costs, uncertainty of where the water would be delivered, if there was actually a need for the water, etc.. But we didn't get into any real definitive evaluation. The department concluded just the fact that it would inundate portions of a wilderness area was more than enough adverse impact to recommend its deletion from the project, and that was done by Secretary Andrus and the Department during the Water Projects Review.

But similar to Orme, as we've discussed previously, when it was deleted, it was concluded in Reclamation that we shouldn't let it die, because the authorization didn't specifically say the Secretary of the Interior is authorized to construct Orme Dam or Hooker Dam. Both Orme and Hooker carried a brief phrase after it, "<u>or</u> suitable alternative." The Secretary is authorized to build Hooker Dam <u>or</u> a suitable alternative. So being good planners, in the context of an agency that builds dams, we came back in 1979, after it had been deleted from the project, and said, "We think we ought to at least study the alternatives to Hooker Dam," and the Department said, "That makes sense." Of course, they'd been beat up for two years by the New Mexico delegation for deleting Hooker, and so they said, "That makes good sense. Why don't you study the alternatives to Hooker Dam?"

Alternatives to Hooker Dam are studied by Reclamation

I think it was about '79 or early '80 that we put together a planning team, and they went to New Mexico, visited with the Interstate Stream Commission, toured the whole western part of the state to evaluate what the problems and needs of the region were. Suitable alternatives were identified both on the San Francisco River and on the Gila River. Areas that might be able to use water from either the San Francisco or the Gila were defined, and, in fact, they went over into the Rio Grande Basin to identify possible recipients of the water, in the Mimbres Basin, for example, and identified a couple of locations, Lordsburg, for example, outside of the Gila Basin, but do a trans-basin diversion of water into the Rio Grande Basin, which is not unknown. You've got the San Juan-Chama Project that already does that.

When we focused on who actually needed the water, it was a relatively uncertain future in western New Mexico. Much of western New Mexico is cattle country, grazing land. Those areas that have developed have developed primarily as a result of mining enterprises, whether you're talking Silver City, for example, who appeared to be a prime candidate. The copper company, Phelps-Dodge, was thinking about closing up. One time you went to talk to them, they were going to run out of ore in two years. They didn't need any water. The next time you went to talk to them, they had a fifty-year stockpile, but it wasn't economic to mine it. It was cheaper to import copper. The next time you went to talk to them, it was, "We'll buy water tomorrow. We're all set to expand the mine." So you got a mixed bag in terms of who was going to be the client, who was actually going to be the beneficiary of this water supply.

The C-A-P enabling legislation, the Basin Act, says that the Secretary shall offer to contract with the state of New Mexico for 18,000 acre-feet of water. We concluded, and the Secretary supported us in that regard, that we shouldn't offer to contract with the state until somebody had some idea of who was actually going to take and use the water that came out of this contract. So we have yet to comply with that provision of the Basin Act after almost thirty years now, twenty-eight years. The Secretary has never made an offer to New Mexico because we've never been able to come up with a viable project to use the water. In fact, a viable project does not necessarily require a dam.

What you have to do is, you have to find an entity that will agree to repay a share of the costs to convey Colorado River water to a downstream water rights holder, either on the Gila River or one of its tributaries. Well, that pretty much eliminates the test of economic viability, because you're talking about a substantial amount of cost in the aqueduct system being allocated to some entity in New Mexico for repayment, because in order to convey that water from the Colorado River to -- probably the only location you can convey it to is to the San Carlos Indian Irrigation Project, because they are the downstream water rights holder on the Gila River that's within the C-A-P direct service area that would be adversely affected by increased diversions on the Gila River at the Hooker site or on the San Francisco River at Reserve. Wherever the actual consumptive use would take place, the effect would be to reduce the water rights of a downstream entity, and so we'd probably have to convey the water from the Colorado River to the San Carlos Project, for example, to make that exchange arrangement actually work.

But in New Mexico, in terms of a facility to divert the water and convey it to some beneficial use, you don't necessarily have to have a dam. I mean, you could put a well or a pumping plant along the stream channel and a little pipeline up the hill to Reserve or to Lordsburg or to Silver City or to whatever entity would become the user of the water at a relatively small cost, as compared to building a major dam and reservoir. So there's always out there an option, and the master repayment contract with C-A-W-C-D recognizes that option of offering the contract with counties or cities or towns in western New Mexico for the delivery of this 18,000 acre-feet that's been identified.

But after almost thirty years, we have yet to find an entity willing to develop the local infrastructure to actually divert the water and distribute it to their retail clients and pay for the operation and maintenance and capital costs associated with the aqueduct system here in central Arizona, which would become part of their overall obligation.

So from a practical sense, it's very, very unlikely that a dam will be built in New Mexico, specifically at the Hooker site, but we investigated the Counter site and the Reserve site and the Alma site. They're all nice little dam sites, but their economic viability and the financial wherewithal of western New Mexico to pay for it is yet to be proven.

Storey: One of the things you mentioned yesterday intrigued me, or it may have even been the day before, but that has to do with Federal water coming in the Central Arizona Project. Basically what I understood was, Arizona got a share of the Colorado River. Was it 2.8?

Morton: 2.8 million acre-feet.

Storey: Yet, Uncle Sam seems to be saying, "We're going to take a slice off the top before you get it." That doesn't seem to conform to Western-appropriative water rights law somehow, and I'm wondering what's going on there.

How water in the Colorado River is allocated

Morton: Well, the Colorado River, of and by itself, is not appropriated under state law. It's an interstate, an international, stream and in turn the apportionment of water is dictated by the interstate compacts that are in place from the '20s and the 1944 treaty with Mexico. Here in the Lower Basin, seven and a half million acre-feet was apportioned by compact, and Arizona received entitlement to 2.8 million acre-feet; California, 4.4 million acre-feet; and Nevada received 300,000 acre-feet.

The Mexican treaty of 1944 and the Colorado River

The Mexican treaty requires the Secretary to deliver a million and a half acre-feet to Mexico in any given year. So the total beneficial consumptive use in the Lower Basin -- i.e., below Lee's Ferry on the Colorado River -- is 9 million acre-feet a year, and the Secretary, as the water master, is responsible to ensure that that 9 million acre-feet is apportioned and delivered in accordance with the contracts that he has with the various entities.

Prior to 1944, the bulk of Arizona's water was not under contract or was not a present perfected right. In other words, it was not a right-of-use established prior to the Colorado River compact in 1922, I believe it was. So up until 1944, when the state of Arizona finally entered into a contract with the Secretary, the only entitlements for use within Arizona were those present perfected rights that existed and were recognized by the compact in 1922. I think they were on the order of about a million acre-feet.

So Arizona had no legal entitlement until 1944 to use more than what those present perfected rights were, because there was no contract. Arizona, through the state legislature and the governor, signed a contract with the Secretary in 1944 which entitled Arizona to use, in a beneficial consumptive-use perspective, the 2.8 million acre-feet that was apportioned in the '20s. But that apportionment and that contract was subject to secondary contracts with individual water users, and it was at that time that various entities <u>immediately</u> along the Colorado River began to enter into secondary contracts, subordinate contracts, with the Secretary and the Bureau of Reclamation for water delivery.

Some of the areas that had been developed under Reclamation law in the Yuma area, like the Gila Project, Indian tribes along the river, the Fort Mohave Tribe, the Gachans , the Cocopahs, the Colorado River Indian tribes, <u>they</u> all entered into contracts with the Secretary. Some of the smaller municipalities, like Kingman, Bullhead City, Lake Havasu City, Ehrenberg, and some of the non-Reclamation irrigation programs, like Cibola Valley Irrigation District, all entered into contracts with the Secretary between 1944 and 1968.

Why 1.5 million acre feet of water is available for CAP in a normal water year

So by the time C-A-P came along in 1968, either in terms of present perfected rights or specific contract rights along the river, there were about 1.3 million acre-feet, 1.2 million acre-feet, somewhere between those two amounts, <u>under</u>

contract within Arizona that were credited against Arizona's 2.8 million. So when C-A-P came along, the C-A-P water service contract provides for the remaining water supply to come through C-A-P, but since C-A-P, under authorizing legislation and legislative history, was intended to benefit not only non-Indians but Indians located in central Arizona, and the state of Arizona elected not to figure out how much water would be delivered to Indians out of the C-A-P -- they put that burden back on the Secretary -- the Secretary has never relinquished that trust responsibility to the state of Arizona. Whether that's a protective mechanism or just based on his unique trust responsibility to Indian communities, I can't really say. I presume it to be the latter, but certainly, when we have offered to contract, we've allocated water and offered to contract with central Arizona Indian tribes, that has been a unique relationship between the Secretary and the tribes.

It has not been similar to the situation we have with other contractors or subcontractors. We enter into three-party contracts -- the Central Arizona Water Conservation District, the Secretary of the Interior, and the entity. Whether the entity be an M&I contractor like the city of Phoenix or whether it be an irrigation contractor like the Harquahala Irrigation District, they are three-party contracts. So the Secretary has authorized, by the '44 contract, 2.8 million acre-feet of beneficial consumptive use in Arizona, but he has not relinquished his authority to allocate within that 2.8 million acre-feet the water that may flow to Federal purposes.

That is even broader than just Indian trust purposes, but also the potential is there to allocate water to other Federal installations. We could allocate water to -- and did, as a matter of fact -- allocate a little water to a couple air force bases, for example. They figured out it was cheaper to buy their water from the city of Mesa and the city of Peoria, respectfully, so Luke Field and Williams Air Force Base, Luke Air Force Base and Williams Air Force Base, while initially offered a separate contract, concluded that by the time they built the delivery system and built a water treatment plant, that it was going to be more expensive than just buying water from the municipalities that already served them, but at least the Secretary made an offer to those installations.

We could certainly offer to contract, from a Federal perspective, with national fish hatcheries or wildlife refuges or National Forest Service lands or Bureau of Land Management developments, but the only reservation that's been made to date is for Indian trust lands.

I don't know if that really explains the question, but it's just a practical fact of life that the Secretary has reserved, discretion, and he has brought broad discretionary powers to allocate Colorado River water for Federal purposes and is <u>not</u> required by law to file with the state, for example, for a water right. Now, that doesn't extend to tributary streams. Certainly in the case of the Agua Fria River where we built [New} Waddell Dam or the Salt River where we remodified Roosevelt Dam to provide additional conservation storage, we made water rights applications to the state for those two streams and those two dams, and [we] were granted permits to store and to use the water from the director of the [Arizona] Department of Water Resources.

Reclamation complies with state water law on tributaries to the Colorado River

So we do comply with state law on all the tributaries, but in the case of Colorado River water, I guess primarily as a result of the Colorado River compact and the subsequent Boulder Canyon Project Act, the Secretary is responsible for the distribution of the water from the Colorado River and is the watermaster of the Colorado River.

Storey: You mentioned yesterday --

END OF SIDE 1, TAPE 2. MAY 24, 1996.
BEGIN SIDE 2, TAPE 2. MAY 24, 1996.

Storey: You mentioned yesterday that as the repayment contract was being negotiated with C-A-W-C-D that one of the things that was being planned on was revenues after Hoover was paid off and after Parker-Davis was paid off. I got the impression that those extra revenues didn't materialize, and I wondered if you would talk about that some more, please.

How it was thought the Lower Colorado River Basin Development Fund would contribute to repayment of CAP

Morton: The 1968 Act actually established what is known as the Lower Colorado River Basin Development Fund, and it required that revenues in excess of the O&M, the operation and maintenance, needs for both the Boulder Canyon Project, Hoover Dam nominally, and the Parker-Davis Project, and the Northwest-Southwest Intertie Project would be deposited in a development fund.

Well, as we know today, the Northwest-Southwest Intertie, portions of it were built, but it never became a major revenue producer and is yet to repay and will probably in all likelihood <u>never</u> repay the cost of those portions that were built. So in terms of a revenue producer for the Basin Development Fund, I think that's pretty much a zero-sum game.

Hoover and Parker-Davis are all three anticipated to pay out, and the <u>portion</u> of revenues that results from activity in Arizona -- <u>all</u> the surplus revenues, after payout, go in the

Development Fund. Those portions that result from activity in Arizona, sales in Arizona if you will, are then available to the C-A-P repayment entity, to apply against its debt, to assist in repayment.

If I remember right, in 1968 it was anticipated that Hoover would pay out in 1987 and that 18.5 percent of the net surplus revenues would be available to assist in C-A-P repayment. The other eighty-one and a half percent that results from Boulder Canyon power sales in California and Nevada and Utah would be resident in the Development Fund, but could not be used by the state of Arizona. They were to be made available at some future unspecified dates for other programs or projects that Congress might implement at a later date.

Similarly, the portion of Parker-Davis that was generated revenue was about 50 percent that came from Arizona. In other words, 50 percent of the output of Parker and Davis Dams, of the electrical output from the power plants, is marketed through the Arizona Power Authority, and so 50 percent of the revenue that was surplus was made available to C-A-W-C-D or the repayment entity. At that time in '68, nobody knew who C-A-W-C-D was, because they hadn't been invented yet. But the repayment entity was to receive the benefit of those revenues to help defray its cost of repayment out of the development fund.

From a practical sense, Hoover still has yet to pay out. Like I said, in '68 it was envisioned that it would pay out in '87, because that was a fifty-year term from 1937, when it was declared in-service. The contract with L.A. [Los Angeles] Water and Power and Southern Cal Edison for the operation of the powerplant terminated after fifty years. The government could reassume responsibility -- and did -- for the operation of the powerplant. When the Bureau of Reclamation staff got into the powerplant, we concluded that the infrastructure within the plant had not been fully replaced during the period. It had been used up, so to speak, and so there needed to be major replacements. In view of the inefficiencies of the units, the units could be substantially uprated with today's technologies. A major replacement and uprating program was undertaken, and so the capitalized cost of Hoover, rather than being totally paid out, was substantially increased.

Why the Boulder Canyon Project (Hoover Dam) was not paid out in 1987 as anticipated

More recently, in the '90s, due to the press of public viewing and recreation associated with Hoover Dam itself, a major capital expenditure was undertaken, called the Hoover Visitors Center, and all of those facilities are also subject to current debt retirement -- the Hoover Visitors Center, the powerplant uprates and the powerplant replacements. I'm not sure what all those costs embodied, but I would suspicion, since they were done in the 1980s and 1990s, those investments were probably greater than the whole [initial] investment of Hoover Dam, and the rate that the Hoover Dam participants pay, is going to take a long time to fully repay these new capital expenditures that were incurred in the late '80s and early '90s of this century. So the bottom line is, in terms of a component being available to help defray C-A-P, in the short run it's just not going to be there.

To offset the fact that we would not apparently receive any revenues from the sale of electrical energy from Hoover, as a vision in the '68 act, the Hoover Powerplant Act came into being in the mid-'80s. The Hoover Power Plant Act requires that the Western Area Power Administration, in their rate setting for sales of electrical energy from Hoover, charge a surcharge on top of the base rate to recover the capital costs and the cost of operation and maintenance. I believe that's 4.5 mils per kilowatt, if I remember right.

The development fund is now supplemented by this 4.5 mil surcharge, and 18.5 percent of that 4.5 mil surcharge is now available for use in Arizona, either for construction or for operation and maintenance, and any residual in any given year that's not used for construction or operation and maintenance is then available to C-A-W-C-D for its repayment obligation. So from a practical sense, 4.5 mils on every kilowatt hour that's sold from Hoover Dam is deposited in the Development Fund. I think, if I remember right, the Western Area Power Administration takes their administrative charge off that revenue, and so it's not truly 4.5 mils. It's 4.5 mils <u>less</u> Western's administrative costs.

So that's deposited in the Development Fund. Then 18.5 percent of that is applied against the Central Arizona Project, it's <u>available</u> to the Central Arizona Project. And of that 18.5 percent, normally about a million dollars is charged -- in recent years it's been around a million dollars -- is charged as an O&M cost by the Federal government, by the Bureau of Reclamation, to administer the C-A-P operation and maintenance, although we don't physically do any operation and maintenance. We <u>do</u> maintain the Development Fund. We account for it, we make the reports to Congress. We act on behalf of the Project in terms of engineering and operation oversight of the Navajo Generating Station and its transmission system. We oversight C-A-W-C-D's O&M program on the aqueduct system.

We administer a number of separate environmental commitment programs from those revenues, things like commitments to provide water for wildlife watering facilities along the aqueduct, commitments to protect wildlife corridors. We provide fencing around wildlife corridors. We subcontract with the Pima County Parks Department to maintain the fences and to provide security so that wildlife can move across the canal through these corridors. We maintain arrangements with the Arizona Game and Fish Department to remove wildlife from entanglements in the canal or in the fences. We just have a number of relatively small, in terms of dollars, relatively small contracts, for specific project operation and maintenance activities that C-A-W-C-D chose, for one reason or another, not to assume on our behalf. They didn't have the expertise, they didn't have a major presence in the area, whatever. But we're still obligated as a project to operate and maintain all the facilities of the project, not just the backbone aqueduct system, which C-A-P has taken over.

Of course, all the things C-A-P has taken over are revenue producers and are not necessarily revenue users. So for these things we need revenues for, we rely on the 4.5 mils that goes into the development fund for that. Once the government's costs are deducted from the available project revenues, then whatever's left over goes to the treasury as an offset against C-A-W-C-D's debt in the year in which those revenues accrued in the development fund.

Parker-Davis has got the same kind of situation. It just is they will pay out -- I think in '68 we were looking at 2008. I think they're proposing now to pay out, under their current rate structure, in 2011. There's no surcharge on those facilities, so we envision that there will be some net of operation and maintenance for Parker-Davis after about 2011, and that revenue would go to the Development Fund.

Storey: Money spent from the revenue fund [Development Fund] by Reclamation for these little small contracts you were talking about, they're cost reimbursable?

Morton: Generally speaking, they're either cost reimbursable or firm fixed-price, depending on the nature of the contract. For one reason or another, for example, we may have entered into a contract with the Game and Fish Department. They service five water catchments and water oases, and maybe three of them are ours and two of them are theirs. To maintain the records to justify what would be a cost reimbursement, actual costs associated with the Reclamation facilities against the amalgamation, they've decided it's better to bid the job as a fixed-price contract rather than trying to keep all the records that might be necessary to demonstrate to an auditor what the actual specific costs are so that they could get a cost reimbursement.

Of course, our staff evaluates that proposal and concludes, yeah, that's probably a responsible and reasonable cost to enter into the contract. Generally speaking, it would be a cost-reimbursable contract, but from a practical sense, some of them are fixed-price contracts.

Storey: And is it reimbursable by C-A-W-C-D?

Morton: Oh. It's part of the O&M costs, and if there were no revenues, then we would be billing C-A-W-C-D, yeah. But from a practical application, the revenues are there in the Development Fund, so we use the revenues. C-A-W-C-D's objected to that process, but it's been supported as a legal and viable process. The IG's looked into it, the solicitor's office has looked into it, so we feel like we're on good, solid ground.

Storey: You mentioned earlier today that 7.5 million acre-feet supposed to be delivered to the Lower Basin states, and then there's a 1.5 million obligation to --

Morton: Mexico.

Storey: Mexico. My understanding was, the states were supposed to proportionally contribute the 1.5 million acre-feet, so it doesn't seem to me that there should be 9 million acre-feet. I'm missing something in the equations.

How the water of the Colorado River is split in the Lower Basin

Morton: Well, and in fact, the states can't proportionately provide it, because most of the tributary flows to the Colorado River come out of Arizona. There's practically no tributary flows into the Colorado River from Nevada or California.

We had talked earlier about how the Upper Basin operates the Colorado River at Glen Canyon and what their burden is to the Lower Basin, and from a Lower Basin perspective, the Upper Basin's burden is to deliver 8 1/4 million acre-feet. In other words, the 7.5 million acre-feet that would be apportioned within the Lower Basin, plus one-half of the Mexican treaty burden, or 750,000. So 750 plus 7.5 would be 8,250,000 acre-feet.

The Lower Basin also has to make up its treaty obligation, as well, the other half of the treaty obligation, and from a water accounting perspective, that's done by tributary inflows, whether the tributaries are the Little Colorado River, the Bill Williams River, or the Virgin River. But it just so happens that all of those rivers, Kanab Creek, any of the tributaries in the Lower Basin, it just so happens all of those tributaries come into the Colorado River in Arizona. And so Arizona would view those as

Arizona's making up the whole tributary contribution, which, in effect, becomes the contribution of the Lower Basin to the Mexican treaty.

But that's just the luck of topography and the luck of precipitation. From a water accounting perspective, the Secretary doesn't care whether it comes out of the Little Colorado River or flows down one of the washes that gives rise in California. He's responsible to account for the inflows and the outflows within the Lower Basin, and, in terms of making up the treaty, there's more than sufficient inflow in the Lower Basin to make up the Lower Basin's 50 percent obligation to the treaty.

Then one would say, "Well, what happens to the evaporation at Lake Mead and Lake Havasu and Lake Mohave? There's another 600,000 acre-feet of evaporation that occurs in there. And aren't there some losses within the channel to riparian habitat and whatnot? Yep, there sure is. Now, what happens there?"

Well, the bottom line is, you can't meet all those water budget requirements for the Lower Basin and still consumptively use 7.5 million acre-feet in a beneficial manner among the three basin states. Mathematically it just doesn't work. And so that gets us back to this issue of shortages and surpluses and can the Upper Basin really get their 7.5 million acre-feet of development and, on average, can the Lower Basin continue to make use of 7.5 million acre-feet? And the answer is, on the average, very close to, but only at the expense of the Upper Basin. The bottom line is, if the Upper Basin delivers the 8¼ million acre-feet, that it has to deliver at Lee's Ferry. It can never develop the 7.5 million acre-feet of

"The bottom line is, if the Upper Basin delivers the 8¼ million acre-feet, that it has to deliver at Lee's Ferry. It can never develop the 7.5 million acre-feet of consumptive use that was envisioned in the Colorado River compact."

consumptive use that was envisioned in the Colorado River compact.

Based on a lot of hydrologic study, the Upper Basin can probably only develop 5.6 million acre-feet of use. The Lower Basin, on the other hand, is going to experience shortages from time to time, and the magnitude of those shortages has been estimated to be something on the order of a million acre-feet. The reason we know that is, we've had to evaluate it for the C-A-P, because in the Basin Act the C-A-P was the last increment of water use on the totem pole. California's entitlements, Nevada's entitlements, the entitlements in Arizona along the river will be satisfied before C-A-P.

". . .in the Basin Act the C-A-P was the last increment of water use on the totem pole"

From a practical sense, that means that C-A-P must curtail its deliveries during times of shortage, and the question was, is there going to be any water in the aqueduct system when those shortages occur? We've evaluated that time and time again, and the answer appears to be that, from a long-term cyclical operation, when these shortages occur, C-A-P will have to cut back to about 450,000 acre-feet a year as opposed to the normal operation, which would indicate we could divert about a million and a half acre-feet. So we'll reduce the delivery to C-A-P by about a million acre-feet a year to ensure that California and Nevada and the other water users in Arizona receive their entitlements.

". . .is there going to be any water in the aqueduct system when those shortages occur?"

". . .when these shortages occur, C-A-P will have to cut back to about 450,000 acre-feet a year as opposed to the normal operation. . ."

Storey: Well, time flies, and our time has flown. I'd like to ask you again whether you're willing for researchers to use the information on these tapes and the resulting transcript.

Morton: By all means, I will.

Storey: Thank you very much.

END OF SIDE 2, TAPE 2. MAY 24, 1996.
BEGIN SIDE 1, TAPE 1. JUNE 17, 1996.

This page intentionally left blank