

**GENEVIEVE ATWOOD AND DON MABEY**

**Salt Lake City, Utah**

**An Interview by**

**Greg Smoak**

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**THIS IS AN INTERVIEW WITH GENEVIEVE ATWOOD AND DON MABEY  
ON JANUARY 31<sup>ST</sup>, 2014. THE INTERVIEWER IS GREG SMOAK. THIS IS  
THE GREAT SALT LAKE ORAL HISTORY PROJECT, TAPE NO. U-3244.**

**GS:** Good morning. It is January 31<sup>st</sup>, 2014. My name is Greg Smoak, and this is an interview in the Great Salt Lake Oral History Project. I am happy to be here this morning with Genevieve Atwood, geologist, and her husband Don Mabey, geophysicist, who have long-time experience with Great Salt Lake. And we're at their home in the Avenues in Salt Lake City. Thank you for being with us this morning.

**GA:** Delighted to be here.

**GS:** I would like to start out with getting some brief biographical information. And I don't know if Don is a native of Utah, but I know that you are.

**DM:** Yes. I was born in Bountiful.

**GS:** Born in Bountiful. And Genevieve you are a Salt Lake City native, right?

**GA:** I'm a Salt Lake City person. I regret I was born in California, but I'm fifth generation Utah, which almost qualifies as a native.

**GS:** And was your family in California. Were your parents in the military?

**GA:** Yeah, military, exactly.

**GS:** Yeah, common story. And, since this is a project focused on Great Salt Lake, one of the things I like to ask people is their earliest experience with Great Salt Lake. One of the common themes I've found is that a lot of Utahans do not engage with the Lake, they sort of stay away from it. You hear that from a lot of young people as well. But I was surprised at the number of people I've heard that from. So, if I could ask both of you, what are your earliest memories of going to the Lake, visiting the Lake, or what you thought about it, if at all, as young people?

**DM:** Well I was raised mostly in southern Idaho. And we'd make annual trips to Great Salt Lake, Salt Lake City. The Lake, to me, was something you saw from a distance, and then visited, perhaps, down in the Saltair area. And I learned a little about the Lake early in my life. I knew that the Bear River was the major tributary, and that lava flows in the vicinity of our ranch had diverted the Bear River into the Great Salt Lake, and the drainage had resulted in the rise of the Lake Bonneville level. So it's always been something that I knew a little bit about and was interested in. And I was very pleased when I worked for the Utah Geological Survey and was able to do some actual work with the Lake.

**GS:** Now it sounds like—you said you knew that the lava flows had diverted the Bear River. Was geology an interest of yours from a very early age?

**DM:** Yes. My father had some interest in it, although he had no education in it. But John Rogers Mansfield, who did a lot of the early geologic mapping, spent one summer camped on our ranch. And he had sent my father a couple of US Geological Survey publications, which I started looking at at a young age, and not understanding, but it triggered my interest in earth science. So it's really been a part of my life ever since I can remember.

**GA:** I on the other hand was clueless [laughs]. I didn't have good eyes. And, as Don would note, here you can't see anything but houses and trees. I had no idea where Great Salt Lake was except it was adventure. So my father's commanding officer during World War II, up at Fort Douglas—(my dad was old and blind in one eye, but they let him join the military)—and the commanding officer discovered that this buck sergeant could type. And so my dad was really the right-hand person to the commanding officer up there,

writing lots of—And so they continued their friendship until they died. And Colonel Ralph Edwin Doty would come to Utah with these sort of adventures. And once he came with an alnico magnet. And we went out to the shores of Great Salt Lake with this remarkable tool—I was six or seven or something.

**GS:** Could you describe that? What kind of magnet is that?

**GA:** Oh, it probably weighs about ten pounds. I still have it downstairs. And I take it with teachers up to Little Cottonwood. And I drag it through the ground, and it picks up the iron. And so as a kid we used to go out, clueless, to Garfield smelter, and it was just awesome to watch the fiery furnace. We would watch it steam down. I mean, it was just entertainment. And so, Great Salt Lake was kind of out there where you had this fiery furnace, and you could go with a magnet. You could drag it through the sands and it would come up with all this iron. It was probably stuff (chips of slag) from the smelter. Who knows what it was. But to me, Great Salt Lake was a place of adventure, and smells, and even as you're talking about being exposed as a young person to something and then having it be a part of a sense of place, I think that that is one of the things that, for example, Friends of Great Salt Lake tries to do now, is get people out there deliberately young, even if they can't stand the smell. Don's son Matthew was just saying, "Make sure you tell them that we take grandkids out there, hike to places and do things." And that idea that the Great Salt Lake is a pathway for many people to a sense of landmarks, a sense of place, but often not really something that one loves. I think one sort of accepts it. I've spent enough time there that I really do love it. But I understand others who don't.

So that would've been 1950s. And then, in the 1950s, before the interstate, US-40 could take you all the way, 'course with adventures and these canvas sacks on the front of your car. Our car was a DeSoto, a 1954 DeSoto station wagon. It was gorgeous.

**GS:** Wood paneling?

**GA:** No. But it was bright red below with a beige top and named after the University of Utah mascot—how insensitive—Hoyo, the little Indian. And we could get that—my dad—I sometimes had to sit on a block, but he would let us drive the car, just steer it. And of course it was just two lanes. There are still sections of it. We really should protect that section of the highway that is still there on the north side of the interstate. And of course we could get that car going seventy miles an hour. And so to me, Great Salt Lake, I had no sense of where it was. We didn't know—but it was a place for adventure.

**GS:** Can I ask both of you about, then, because you're both scientists and you've both been involved in studying the Lake, about your education. I know, looking at your resume, you started out as a history major and then switched to geology, which is quite a switch.

**GA:** I decided I wanted to be a historian of science. And what's odd, I wanted to do it from high school. If I could've majored in 101, I would've. I'm just interested in everything. But I wanted to write children's books about science. And history of science was something that was offered at Bryn Mawr College, and so I, in part, went to Bryn Mawr to do history of science. I've always been focused, I just change my focus periodically. And so it isn't as strange as it sounds. So I took as many 101s—I didn't take geology, 'cause that was the one that non-scientists would take. If you can't do science

you do geology. So I actually took my first geology class in graduate school, fell in love with it, switched over and never looked back.

**GS:** Why do you think geology attracts non science majors?

**GA:** Because it's a gateway. In other words, I think it surrounds us. I think it is *the* pathway for teachers to understand science. It ties to a sense of place in terms of understanding. And it's accessible. So I think people are interested in history, and with just a little bit of introduction they can understand how you can tell older than, younger than. If something is laid on top of something else, that which it's laid upon has to be older. If something cuts something else, whatever got cut is older than that which cuts. And suddenly, in just ten minutes, or certainly in two hours, you can have people take an interest in historical geology. Now that isn't the way it's taught. And what I do now, my calling is I teach teachers, that's what I do. I teach them at the U, 'cause they have to take Geography of Utah. I teach them all summer long. I go out to the Great Salt Lake sometimes.

But I think the world's going to hell in a hand basket and the only savior will be if we educate women, for both the women and the men. So a lot of women are scared of science. And I find earth science is just a glorious entry. And I do it through the history hook. In other words, narrative grabs people's attention. So the idea—everyone hears that Antelope Island is old. Well its rocks are old, but as a landform it's actually young. And as a landform it's the same age as Stansbury Island and the Oquirrh and Fremont Island. So it's the spreading of the Basin and Range that brings you all these features. And when you break through to someone and say, "But Stansbury Island's rocks are a really

different age than Antelope Island's," they say, "Oh! Really? I get it!" And once you get them into that you can start thinking about process.

Now at a university, geology has usually been geared towards industry, so you've gotta know those minerals. Well let me tell you, the best way to turn people off to earth science, unless—ya know, a classifier loves classification. But if you really—when I talk to someone who's cutting my hair, and I'm not denigrating them, but they usually hate geology. And I say, "What made you dislike geology?" And it's rocks and minerals. I mean, you can teach rocks and minerals as a narrative—what is the story of this rock? — and you can grab attention. Or you can teach it as, "Isn't this cool? Bornite, sphalerite, chalcopyrite." I mean, gimme a break. Who's ever gonna use those words in their life? "It's irrelevant. I'm not interested. I don't see it. I don't get it. I hate science."

**GS:** And historians have a very similar problem. I think sometimes if history is taught as just the memorization of facts you lose students. But if it's as it should be taught, as a story, people will understand how it fits together.

**GA:** And that's one of the neat things also about Great Salt Lake is that its story is very cool. And it happens to be an important story about climate change. So, we're jumping ahead, but Lake Bonneville and Great Salt Lake are *the* best record of climate change in western North America, period. And it's why this place is crawling—well, maybe not crawling—with NSF people looking at it, because it keeps that record. And Don and I, our story's a little bit of romance because Don's interested in what's inside the earth and I'm interested in what's outside the earth, and Great Salt Lake addresses both of them.

**GS:** Well, Don, could you tell us a little bit about your education, undergraduate and graduate?

**DM:** Well I went to the University of Utah and majored in geophysics and physics. And I really came at Great Salt Lake from the Bear River Range, just a few miles from where the lava flows diverted the Bear River that caused Lake Bonneville to rise. And my father knew enough about the geology that he was able to explain much of it to me. But when I started working for the Geological Survey and got interested in earthquake studies and what not I became interested in Great Salt Lake as a dynamic feature in its relation to Lake Bonneville, its relation to earthquakes and things like that. So it was really a scientific interest in the Lake, rather than just a feature to view.

**GS:** And when did you start working for Utah Geological Survey? I guess it wasn't called that some years back.

**GA:** No, Utah it was Utah Geological Mineral Survey.

**DM:** What was it, 19...

**GA:** Let's start before that. Don had a distinguished career with the USGS. And that also included closed basin lakes. And so—well why don't you tell your story and then I'll fill in what I think you've left out.

**DM:** My real interest was in structural geology, and the impact of Lake Bonneville on the basin. The huge load of water causing a depression in the Earth's crust and whatnot tells you something about the structure of the Earth's crust. And it's one of the better historical features in the Basin and Range. And so I really came at it from the impact of the Lake on the geology of the region.

**GA:** And I think the idea that during World War II various technologies were developed for the war—magnetometers that can find submarines under water, being able to have a very sensitive feel for gravity—that then becomes a tool for science. And so,



Don, right after World War II, was able to take some of these geophysical techniques, meaning being able, to just barely be able, to see how much stronger the gravity pull would be if you were on bedrock, than if you were on sediment, and also some of the magnetics. And, by working in the West, one of the things—he worked in Death Valley and he worked in different places, and so this idea that you can look at Great Salt Lake and Lake Bonneville, not only from the surface, and not only with fascination for the structure, but you can have some extra clues. And so, Don, for example, would be able, and has with data, to say, gosh—the sediments, if you’re looking at sediment versus bedrock, and this is simplified, but basically bedrock’s the firm, coherent, continuously attached to Earth’s crust. And what I tell my students is, if I gave you ten thousand dollars, if you could take a shovel and give me a five by five by five pit, it’s probably bedrock. It isn’t bedrock if you can’t do—I’ve said it the reverse. But basically, if you can’t do that you’re in bedrock, and if you can do it you’re in sediment. So sediment’s the loose—sediment’s the story of the present, meaning the past two million years or so. The bedrock is the story of the past. And so, Utah Lake, for example, is in a somewhat closed basin; the river comes out so it’s open hydrologically, but it’s closed topographically. That’s three miles of sediments underlying Utah Lake, versus—and Great Salt Lake, our basin, is very deep too, but it isn’t quite so deep. So someone like Don would see that and then the rest of us can wonder why. And it’s that kind of thing, that extra tool that we had, is kind of a history of science. How does the technology allow us to take another view of Earth? And of course this was all through the time of tectonics suddenly becoming the way of putting so many things together.

So Don did many things with the USGS. When would you have joined? You would've joined the USGS in 1951, and been there to 1980 or so—distinguished service award, meritorious—I mean he was head of the Salt Lake office. The USGS tried to have offices in different places, and Don was the Utah person for the USGS. And I persuaded him to come to the Utah Geological Survey as head of the “applied geology program.” Gosh, we were good, if I say so myself. So Don had the respect of the USGS, and I had the dynamism and the ear of the governor. And, people love to be grumpy about the feds. And I showed up as State Geologist, meaning head of the Utah Geological Mineral Survey, and some of these Western folks were saying, “We don't want federal money.” I said, “Well we'll take it.” And so Don and I were able to get the USGS to shift its priorities on earthquakes to Utah. And I think that's one of the most significant things we did. Five million dollars may not seem like that much now, but throwing five million dollars toward understanding Utah's seismic—just building on what had already been done. And I don't mean to say that there hadn't been a lot done before, but Don and I were able to do that, in part because we were a dynamic duo on that, which was great.

And of course then we'll get to the story of the 1980s, 'cause I was State Geologist during the wet cycle. And if I had to choose a hazard it just couldn't have been—

**GS:** Well I noticed that looking at your CV, which you have online, it seems that early in your career you worked for a private geology firm. And then you entered working for the state and also were in the legislature of course. But I saw that shift in the work that you've done from really mine safety cleanup issues with coal and uranium, and then the

Lake really dominating a lot of what you published, and the shoreline and flood hazards—

**GA:** And you look back and you see that it sort of headed that way. My Master's—'cause I started out in history and then I got my degree in geology—took me an extra year because I really hadn't geology until I got to grad school. And I did limestones and that was fine. I sort of mapped my quad, checked that off; that's what real geologists do if you're lucky. And then I became interested in stabilizing things that had been disturbed, be they a coal mine or be they—really worked with a lot of uranium tailings piles. And you see, that's what I'm still interested in. In other words, how do processes of wind and water—glacial ice, ground failure, humans, the disturbed things—how do you make them stable? And as I was looking at these uranium tailings piles everywhere—I mean, I think one year I saw twenty-six of 'em in eighteen states or something like that. But they're all in these different physiographic provinces and they all have the same rules: You just cover 'em up with five feet and use some plastic and things will be fine. And I could understand, 'cause I was already in the legislature by that point, that one of the great things in government is fairness: Everybody has to do it the same way. Bureaucracy says, "This is how you're gonna do it." And then if you've done it you're okay. So I could understand the simplicity of saying, "If you've done the following things, we're gonna count this as stabilized." But I also realized that in the Basin and Range, which is dominated by deposition, such as Great Salt Lake with all those sediments, you really could use a different approach than if you were in the Colorado Plateau, which is dominated by erosion. And what you really oughta do is look for the stable landform. Having figured out the stable landform, and why it's stable, just mimic nature. And I

think by that point I really saw that, ya know, Francis Bacon: “Nature to be commanded must be obeyed.”

And so my interest in Great Salt Lake for research is, how does that lake work with respect to modifying the landscape? So it’s called process geomorphology. Now many geomorphologists, someone like Don Currey, who is such an important character in my life, he was interested in, what do these shorelines tell us with respect to age, which one came first, which one came second? And you sort of have this baseball bat with everybody putting their hands on it, and which one’s on top, and things like that. And then you have Don over here who’s interested in how does the character of the subsurface—what do we know about it, and how is *it* affected by these processes. So even though it looks like a big shift, that’s one of the lesser shifts that I’ve gone through, and I’m still fascinated by it. And one of the reasons that it’s important is things that are horizontal or straight in geology are awesome, because if they change, they’re not straight afterwards. Then you know something happened. So if you have a fence and then you whack it with a fault, you’re able to see how far it moved. So one of the reasons that shorelines are so awesome is they start out virtually horizontal. And then when you see that there’s a warp to them you say, “Aha! How could that be?” So both Don and I have been interested in that variation from horizontal. It can be pretty subtle as you whack it with a fault or raise it.

So these features have an importance. But actually understanding how they came to be in the first place and how they modified the landscape is what I study—and I’m really grateful I joined the Utah Survey. As I was looking at my career: in the 1950s, went with Uncle Ralph and did those fabulous things. And then, I was elected to the

legislature in 1974. And I didn't realize I couldn't be elected, which is probably one of the few reasons that I got elected. [laughs] I didn't really know I couldn't until I was in the primary and JD Williams, who—I was close friends with Robert H. Hinckley. He and my dad lived—Mr. Hinckley had the ranch up in Eden, but he had a place in the Mayflower just two blocks from over here, which is where my family had moved in 1960. And my mom had died and Mr. Hinckley's wife had died at approximately the same time. And so, just out of the goodness of my heart my dad said, "Go have dinner with this person when you're able." I was still in Washington. And I went out to dinner with Mr. Hinckley, and he said, "Submit your life to the fun test." I thought, *What's that? I don't do fun*. Anyway, he said, "What do you wanna do? Do you wanna go to grad school or do you wanna work for a mining company?"—'Cause I was in transition—"Or do you wanna run for the legislature?" And, ya know, I'd been student body president in my college. So I, power crazed in my own way—because I'm just helpful, I'm compulsively helpful. I try to do something helpful so I don't have to be helpful to Don sometimes. I mean, I just do this. And so I came back and Mr. Hinckley had me talk with JD Williams, and the seat was open, and I ran. And I didn't know I couldn't win until after the primary. I saw JD coming at me 'cause he'd set up that we could play tennis together, 'cause he was really just gonna mop me off the floor after the primary was the basic reason to meet with me. And I saw the astonishment on his face. And I realized he never thought I had a chance of winning the primary. And having won the primary, even though it had been a Democratic district, I was able to win the general election.

And that was the first time I went to Antelope Island, was in the '70s. So there was really a twenty year gap there. So I went out to Antelope Island. It was kinda cool, I

was out there for a date or something like that, ya know, I couldn't convince people to go on field trips and stuff like that.

And then those were the years in the legislature. And the legislature is always interested in water. And one of the principles, of course, of Great Salt Lake is everything goes somewhere. And a lot of it goes to Great Salt Lake. And the issue for the mining companies, chemical extraction, was whether the state, which granted water rights, also granted mineral rights in the Lake. That was one of the first times, actually the very first time, it was the third day I was up in the legislature. They decided that they were going to set a planning level for Great Salt Lake. And we had our phones right next to us, 'cause remember this was before cell phones and before these other things. So you couldn't email someone quickly. And I was sitting there and someone was saying, "I have 4202." "I've got 4204." "No, I think it's 4198."

**GS:** So they're bidding on what the lake level average should be?

**GA:** They're bidding on this level and I'm sitting there—remember I was young, I was twenty-eight I think. So I grab the phone and I call the Utah Geological Survey and talked to Don McMillan, who said, "I don't know," gave me to Howard Ritzma, and I said, "You've gotta give me a number. You've got to give me—is 4202 a good planning level?" So 4202 it is! Bam. And that was one of the reasons I got interested.

And then there was the whole issue of is the state going to guarantee to mining companies, extraction companies, their chemicals? And so the chemical people were saying, "Yeah, we do all this stuff. You've gotta give us money for this. If we don't get our water out of there —" And the decision was, "No. You have a right to put your straw in, but we don't guarantee that you get anything out of that straw."

**GS:** So what would the state have to do to guarantee they get—

**GA:** We would've just said you did. We would say, "If you're getting a state lease we will count chemicals as minerals. We're going to put this under a different kind of law." And they were really saying—I mean, people go up to—when I was in the legislature it was the beginning of the big shift, where people figured out it was just a lot easier to change the law than to do something better, quicker, faster. I mean, by the time I was leaving there were individual pieces of legislation saying, "Let this industry have a slight break," and particularly if it's a Utah industry competing against someone else. So, with the Lake going up in the 1970s, people were concerned that they were gonna go broke. So a good industry, one, would say it isn't right that you tinker with the Lake, with causeways or whatever else, it's affecting us, it's a taking of our livelihood, and can we figure out a way. And people are doing it with the water law right now. We're in the legislative session and there are probably six bills up there that are saying let me have your water. And it's only fair because we have people and you have water: Why don't we have your water? It seems totally logical. And pretty soon you will see things privatized and whatever it is.

And then there were always those water issues of whose water is it? And Governor Rampton, who I adored, but I didn't always know what he was up to, 'cause the Democrats had the Senate and the House and both of our reps and all the rest of it. I mean, this is hard for people to remember, but I was in the minority party when I was elected as a Republican. And he said, "We wanna change the rules so that water, the beneficial use of water, is broader." And the water teams came at us. One of the votes I really regret because I didn't understand what beneficial use really meant, and we

defeated his initiative on having there be more of a basis of an environmental value to it. He also had gotten the state to fight with the feds, and he considered it one of his great achievements, to have the state of Utah manage the bed of Great Salt Lake rather than the feds.

And how do you feel about that Don? Why don't you give our opinion on that?

**DM:** Why don't you do it?

**GA:** It's the worst thing that happened to Salt Lake. In other words, if it had continued or been allowed to be protected by the feds, we would have a totally different view of the Lake.

**GS:** What would be the fundamental differences?

**GA:** Well at the moment, anything that is below the meander line, which was—so I'll back up. In England there is something called "sovereign lands," and among the sovereign lands—lands that belong to the sovereign, you can't own it, they're not private, you can't have 'em—are anything that is navigable. And navigable means you can float a twelve inch thing, whatever you're doing there. And I think the logic really was you can't deny access. I think if you were really go back and say what's the reason for that, it's very societal. And so those same rules applied. But you have to say on what day and it's whatever day, February 3<sup>rd</sup> or 4<sup>th</sup>, 1896, could you or was any water body in Utah navigable? And Great Salt Lake was. So it's a difference in terms of how much money is derived. In the 1970s Utah was looking at the petroleum resources of Great Salt Lake, we were looking at the mineral resources of Great Salt Lake, we were thinking that the clays of Great Salt Lake would be great for drying flowers or they might be used for something else. Even today, I mean you're looking at the DNA of Great Salt Lake and you're



thinking about the innumerable ways the Great Salt Lake could be a resource. But the feds, in the '70s, had shifted to an environmental ethic, even Richard Nixon, or particularly Richard Nixon. I mean, I really come from that part of a Republican team. So, I mean to me it was the Republicans who were defending the environment not these folks back in Massachusetts who were church-dominated, ya know: rape and pillage of the land—'cause you see I'd been back East before I came back home. So, boy, I got on a tirade there.

But Rampton really thought it was our lake and we should manage it. But we haven't protected it. So the Great Salt Lake has no water rights—and he should've and I should've. But he should've recognized that we should've filed some water rights—

**GS:** Some in-stream flow claims to make sure that the water level—

**GA:** The same kind of thing. Now he knew it was illegal. But there could've been ways to do that. And later I served on the Division of Forestry, Fire and State Lands. Forestry Fire and State Lands Advisory Board. To have the fire department running Great Salt Lake!? I mean, this has got to be a group of people that are clueless, with all due respect. They have one or two people who are devoted to the Lake, sometimes more devoted than others. And the DFFSL is an inappropriate place to put that [the responsibility to protect the Lake]; it's an extracting place. And at the moment the state of Utah is just killing that lake with a thousand cuts. You get 320,000 acre-feet of in-lake water being able to evaporate for salts—just recently been added to the evaporation—evaporation that you can take out. We're gonna allow them [GSL Minerals] to lower the canal. I mean, how low can the Lake go with respect to mineral extraction? Well it can go as low as you put the bottom of the canal. In other words, if you allow them to dredge the

canal, to lower than it's been historically or whenever, you can keep lowering it to that level. And yet we are in direct conflict with China, and US Magnesium is *The*—I think it's one of three, but very few sources of magnesium in the free world. And I think it is the only one in North America. And we need this metal. I mean, this flies our planes, it's what makes the steering wheels of our cars. If you're wondering how your car can be lighter than it is—I don't know whether you've noticed—I have a new car. I don't get them very often 'cause I really like my old cars. And I notice that my old CRV you could bump it with someone else's door, not that you'd do it deliberately, but it wouldn't leave a scar. I mean, this new Jeep of mine is just—things give, and one of the reasons is that you've added some magnesium, it's lighter, and it goes farther on the same gallon of gas. But only Great Salt Lake delivers that at the moment. So I see these battles going on. But I think if it had been the feds they'd have protected it [Great Salt Lake]; they'd have seen it as a national resource.

**GS:** Let me ask you this, and again we're talking about history here and experience, but if you had control of this, one or two things that you would like to see the state do in regard to the Lake that is different from the policies that are being pursued now, one or two changes that you think would help. From what I'm hearing you're saying what we need to do is strike a balance between the needs of industrial production and actually protecting the Lake itself as a resource.

**GA:** You're absolutely right. And I might pass it back over to Don for the beginning, 'cause I usually feel like a powerful person, that I make a difference, but with Great Salt Lake I'm obviously in victim mode, 'cause I don't think, in general: What would I do? I would have the equivalent of a dead pool. I would say that the Lake has water rights and

that they are like those of the Native Americans, they preempt others. So I do understand “first in time, first in right.” And I do understand that it’s a watershed. So to say that we’re just gonna yell at the folks with evaporation rights—let’s say you have an old water right of an extraction company such as Great Salt Lake Minerals, I think they have some old ones, and you have young ones now. I mean, obviously they don’t get to do their young ones. But my sense is, you also have the upstream people. You have the folks who are taking the groundwater of let’s say Utah County or Salt Lake County, you’ve got the in-stream flows of the Provo River and all those. You’ve got people upstream that are now going into massive real estate developments and everything else. So to say the only people we’re gonna chop off are the mineral industry—I can understand that it’s a watershed and everyone should feel the hurt. But I think that having a base level below which Great Salt Lake just trumps, in terms of its water rights, is essential. And I think that would be the historic low.

So I would say at 4193 or 92—at 4193 you start sounding the alarm, at 4192—at 4192 you really stop all sorts of folks, and that means Salt Lake City isn’t gonna get some of its water, the irrigation people aren’t gonna get their water, people are gonna be screaming in the upper part of the Provo. Now the question would be, what are you gonna do with “foreign” water? ’Cause water comes in from the Duchesne. So we take everyone’s water. So it would seem to me that it isn’t quite right for Great Salt Lake to claim the Colorado River that’s coming across the Central Utah Project, or some of those. So maybe those guys would not have to feel hurt. I mean, I’m reasonable up to a certain point. But I think this idea that Great Salt Lake is important to us—it’s important in terms of our weather—Brigham Young knew this. It’s important in terms of our ski industry.

It's important in terms of our sunsets and our air quality. You could say it's bad for our air quality because of the ozone in the summer, but I'm sure of the rest.

So, I think that I would have a dead pool, the equivalent of a reservoir. And I would have it be relatively healthy. And that would be something that I would require.

**GS:** Let me ask you about the lake level itself. One of the things I've heard a couple of people talk about is you talked about 4202, 4200, and the legislature deciding. Now I've heard people say 4198 should be the average, 4197. Does that make any sense to you as a scientist?

**GA:** Well I think there's the issue of planning level. And in the 1970s when they were looking at it, they were really saying we can manage with a purpose. And I think that we're human beings, and it is fine to manage with a purpose. This idea, the ethic of treating the environment as a garden as opposed to pristine wilderness or rape and pillage. I think the ethic of saying this is in the best interest of us and this is acceptable is a very good idea. I think to manage Great Salt Lake towards a level is fine by me. Then you'd say, "What level should it be?" With climate change it may be changing, but I think you can sort of say 4198, 4200, 4202, people could vary. But at some point it's making a series of impacts, which I think they did a wonderful job in terms of an approach this year, with a comprehensive plan to Great Salt Lake. They sort of said, the brine shrimp people would love to maintain the level perfectly for the brine shrimp, and that would be this level. Now what's fascinating is the health of the Lake depends on its going up and down. If you manage it for a level the next thing you know the corixidae are gonna come in and you're not gonna have brine shrimp. So the health of the Lake, really, it has to go up and it has to go down. You've gotta have these wetlands migrating inland

and back and forth, and people don't like that. People really wanna say, "I wanna be able to put my fence here. I wanna be able to have my brine shrimp have exactly those algae that aren't so crunchy, so that they're just big enough that they're delicious." I mean, that's just fine. And then of course everyone's supposed to pray for rain, well I assure you US Magnesium does not pray for rain. I mean they may mutter something when they're in church but they're not saying, "God send us rain," they're saying, "Let it shine, let it shine." I mean, they could just have it be as dry as can be out there.

So I think this idea of treating Great Salt Lake, as it were, more as a garden that's sustainable and different areas of it. I think we're getting there, but if the law basically is that you can dry it up and there's no protection—'cause you see, there isn't an in-stream logic to Great Salt Lake. So these folks were able to come with rights to evaporate—in-lake water rights. Central Utah Project is bringing to Great Salt Lake, and this is a big project, 100,000 acre-feet. So when you say 300,000 acre-feet is the most recent that's been given as in-lake water rights to extract, I think to Great Salt Lake Minerals, and for all I know US Magnesium. The result is death to Great Salt Lake. And I like these guys. Well, Don says I like everyone but I don't like everyone.

**DM:** One of the interesting things about the Great Salt Lake and its level is that it could be controlled. The Bear River supplies more than fifty percent of the water in the Lake. In the Soda Springs area in Idaho, it used to flow out into the Snake River Plain and the Columbia River. It would take a dam, what, forty feet high or something like that. Part of the water now is diverted out of the Bear River over into the Snake River drainage, and you could divert the whole river if you wanted to. So one of the things that they

considered when the Lake was rising was diverting part of the inflow of the Bear River.

So it's an interesting problem.

**GA:** And then thinking about, how could you manage how low it could go? Managing how high it can go—

**GS:** Yeah, you can shut off the tap, but how do you fill that tap again.

**GA:** Yeah. But then the question would be is there any way—so we look at cloud seeding and we look at more inflows. But of course it's the drought end of things that endanger the real health of the Lake, to me. And you could say it's "natural." You can go back not that far in the geologic record, after the Ice Ages, there are dry times and wet times. And you can see that the Lake has been considerably drier than it has even now. But if you're looking at it from not just, nature's pure and whatever nature does is fine, if you're saying we're treating this as a garden then it's not okay. I mean, how do you keep enough water that the system is still functioning in a way that benefits humanity? And by that I don't mean just the mineral extraction I mean like us, me [laughs]. And it's a dilemma.

So where would I put it? I would probably take it [managing Great Salt Lake] out of the Department of Natural Resources and do what Olene Walker was really thinking about of planning in the watershed basins. So everything goes downhill. But I might even put it [management of GSL] in the Office of Planning and Budget, which I think she was thinking about, having areas of government, instead of being by counties. So go back to John Wesley Powell and Brigham Young saying government would be better if the upstream folks and the downstream folks were in the same county so that they thought about this. And this is certainly one of the reasons that Salt Lake County I think can

function—not that I can’t go on a tirade about Salt Lake County—but at least it’s a watershed of sorts, as is most of Utah County, as is most of Davis County.

**GS:** It’s not a big, square straight lined county or seat.

**GA:** So I think one of the things that I would do, now that you’ve let me be dictator, is I would probably plan not only for Great Salt Lake but other places by watersheds. And that would do good things. It would do good things for air. It would do good things for water. But I would certainly give Great Salt Lake’s management some logic. I would take it out of where it is now, ’cause it really does not belong with people who fight fires and manage timber. And part of the problem with where it is (DFFSL) is even when you have good people, and at the moment you’ve got a couple really good, brave people there, there is no upward mobility for a professional. Because if you’re gonna be in the Division of Forestry, Fire, and Great Salt Lake, basically it’s not “state lands”—I mean, they’ve got part of the Jordan River flood plain—but they were so not managing according to what state lands, that they split those people off. So SITLA used to be all under the Division of Forestry, Fire, and State Lands, and that gave ’em some heft. But now it’s really just Great Salt Lake. I mean, this isn’t even a tail wagging the dog, this is a dog that has no tail, this is like a Corgi, okay, I mean there’s just nothing on that dog over there. So I’d take them, managers of GSL, out of the extractive industry view and give them a role in terms of thinking about, how does this system work? The management could go into Wildlife Management, for example, I think. So there are various organizations that I would consider gardeners. They may be odd groupings, but Division of Wildlife is a “gardener”—you could say that the Division of Forestry is not. Fire’s going to be so big with the state. And the management of GSL goes with a lot of money.

I mean, most agencies would say, “Let us head that. They are fully funded.” We’re getting plenty of money from Great Salt Lake to manage Great Salt Lake. It isn’t as if this is a poor relative. So, that was a tirade.

**GS:** That’s all right.

**GA:** So let’s see some of the other things here. I wanna tell you what I really did for Great Salt Lake that some people know. I don’t think Antelope Island would be a state park if it weren’t for Genevieve. So in 1973 I was elected, ’74, ’76, ’78. And the people who had kind of owned Antelope Island sold it to a very powerful, rich person, Anschutz. And he had daughters, and he said, “I wanna have an island.” That’s pretty neat. So the Island Ranching operation had really been quite neat in that respect—and I hope Carol Olwell is on your list, she’s a historian and she knows it—and the Doolys were able to use Antelope Island as a place to lamb, because you only needed one or two people out there, those sheep weren’t gonna wander anywhere. So it was terrific. And then they would graze there sheep out on the West Desert or wherever else. They made an unfortunate decision from their perspective—they needed money. They were land rich, I assume, and money poor. They were never poor, but, still. So they gave to the state, sold to the state, a snippet at the north end of Antelope Island. And that of course just changed the whole nature of the whole island, ’cause once you let people on there they’re not gonna stay on the north end they’re gonna be wandering all over the place. So they sold to the Anschutz, and then the state said, “We want this.” And in their agreement to the Anschutz there must’ve been a clause that said, “If you sell this in five years,” or whatever it was, “you have to give the Island Ranching interests some of the money.” So the Hatch family, which was very big in terms of communications, wanted the island



sold. And I was still young, and said to myself, “Condemning? Condemning private property? It’s just a playground? This doesn’t feel right.” I mean, I really am Republican. I’m a friendly Republican. But I had problems with it. And my basic way I voted was, is there a problem? Does this address the problem? Does it create worse problems? I thought it created worse problems. And it didn’t really seem to be a problem. And then it was, how would my district vote if they had the information I had? I had a wonderful district, it was the Avenues here. And the more I studied state acquisition of Antelope Island the more I really was able to convince myself that Anschutz really did want the money more than anything else, and that my district really wanted it. I not only swung my vote, I swung about four other votes. And it had failed and failed and failed. So, *the* Genevieve Atwood brought you *the* Antelope Island State Park.

One of the other things was that during the 1980s it was awesome to be with the governor. I got to work with Matheson *and* Bangerter, and I liked them both. Governor Bangerter and I were the only two Republicans elected to the Utah House in 1974. This was during Watergate. So we sat next to each other. And one of the ways I can tell whether I like someone is whether—particularly when my smelling was better, not my smell—and Norm and I sat next to each other, you’d be in that hot room—this was before they redid—so the sun would beat down on you. And you know the guys had to wear their jackets and I was wearing pants or whatever. And I’d sit next to Norm and we would just talk. I mean, it was bonding there. So I knew Norm Bangerter. And so I was his State Geologist, and before that Matheson’s. And so Matheson, we’d be in Matheson’s office and they’d have to take, ya know, sort of a crane and grab us and take us out, ’cause Matheson was fascinated by how the Lake worked. And he wanted

government to run better. And Bangerter wanted government to run well. And you know, frankly, it's a good attitude on both of 'em.

**DM:** An interesting experience, I was Genevieve's deputy when Matheson was in there. We would call him occasionally and explain something to him. He actually sponsored a major conference for us. And I didn't know anything about Bangerter. After he took office, Genevieve was out of town, and he needed to make some decisions on Great Salt Lake, so I gathered up all my information materials to explain the problem to him. Sitting up there in his conference room, and he comes in and he looks at me and he says, "I wanna talk about the solution not the problem." [laughs]

**GA:** And he did. And by the end of Bangerter's regime we were winning awards for having the right monies in the right places. We understood things. Val Oveson had us ticking along, winning awards for the best run state and a whole bunch of things, 'cause he wanted to run things well. But frankly he really didn't care why things were the way they were. And in fact he probably made it safe for the railroad by just the pumping project—is he gonna be on your list? I hope so. It would be interesting to see what he says. But he really had to do something and he chose to do the West Desert Pumping. So that was interesting. Let's see what else.

**GS:** I do wanna come back to that. One of the things I wanna ask both of you about, since you were with the Survey at the time of the high lake level, that seems to me to be a critical time and you both have insights on that that other people don't have, and into that decision-making process about what to do within government about the rising lake level in the mid-1980s. So if you have other things you wanna go to first, but I do wanna come back to that. So when the Lake started to rise, was there any—obviously this was a

natural cycle—is there any perception before it started to rise about possible problems?

Was there any planning in state government, contingency plans for a rising lake?

**GA:** Yes and no. So, let's think about who were the water gurus. So you'd have the USGS. And they had actually come out, I believe, and said the Lake was not gonna get higher than what it was historically, because we're taking so much out by irrigation that it won't. Then you have USU, who's always been sort of the state theory equivalent, and they were saying "We can look at this as a stochastic thing and we can just figure it out, based on the past, what it's gonna do in the future. So it's not gonna go up, but we couldn't tell you what it's gonna be." Then you have the 1970s, where things had spooked up. 'Cause you see I arrived just when they were doing this—4202, 4204, what are we gonna do? Because the mineral industries were really saying, "We're gonna go broke if this thing goes much higher." So it isn't as though that we hadn't had a spooking up in 1974 about what we're gonna do on this. We had a bunch of people who had looked at it. And then you had us at the Utah Geological Survey making the state safer, richer, better understood geologically. And we had been looking at hazards as well.

So the kick-off of the wet cycle began in September of 1982, when we had just the wettest month ever, of September, and things started to rise. But also remember that that meant saturated ground. So in early 1983 what we were really looking at were just these hillsides coming down, and incompetence, ground failure; it was fabulous. And the Utah Geological Survey did great. We worked with those entities. And Matheson was there. And we had different people with different approaches. We did Thistle. So with Thistle, there you are looking at "Is this thing gonna fail? Genevieve, is it gonna fail?" And people like Bob Morgan just did fabulously on that. Our Survey did well, it was

really kinda cool 'cause the toe of the landslide kept rising, so you could actually do the geology just being on an elevator shift. It was an exciting time. And we were sending our folks out to find these things, and people were losing their water supply, but meantime, Great Salt Lake was doing its thing. And Utah Geological Survey, with Wally Gwynn, who'd been working with industry. You have all these different people. It was a heady, awesome time, but we weren't really thinking yet of the consequences. And I don't think people had really recognized how much we had built across the historic flood plain of Great Salt Lake. And so we hadn't really realized the corridors, the interstates, and the transmission lines, and the railroads, and everything else.

Now the railroads are very savvy. So, when I left the Utah Survey, I'd been so young, that I decided I might as well go back to school and get an MPA, and study what I should've known and could've known and wanted to know—and it actually was wonderful, I did my Master's at the U in Public Administration, on the different approach of industry and government to the hazards of the 1980s. And I looked at Thistle. Because the railroad was all over us. They wanted the geology, they wanted the formations. They were in our office, they were with our staff. We could *not* get the Department of Transportation of Utah to use any of our stuff. The railroad does not like sharp turns. They stayed in the competent unit as they went around the slide. They pounced on the best place that they had. They did not have failures. They came through their tunnel—that marvelous picture of the locomotive with its American flags on it, on July whatever it was. They were losing a million dollars a day and they were on it. They loved geology. Meanwhile, the Department of Transportation is getting how many new trucks? I mean, the hazards in the 1980s saved Utah County's economy. There were classes from Utah

Valley College, or whatever it was called then, and they were studying all the kinds of equipment one could have, because this was the best thing that had happened to the Department of Transportation and the economy of Utah County. And of course they had ground failures, I mean, they put that out through unstable ground—they didn't care. Their point was if you gotta go from point A to point B, let's just do it. It's very complex geology there with units that have lots of clays in them, other units that are incompetent. The next time you go over the summit there just look at the series of units there. The only reason you can get a railroad through there to Price is that you have landslides. I mean, you're going through the Rocky Mountains. Nobody ever says, "I'm grateful for these things." But you wouldn't be able to sneak that railroad through. And the railroad of course even has problems—now, the railroad is on skids. So they just let the landslide go underneath 'em and they jack the thing back up. They're on this.

So you had the railroad that was also crossing Great Salt Lake. The railroad is just a lifeblood for economics. And so it was really the railroad I think that pushed Norm Bangerter.

**GS:** Yeah, they were desperate as that was about to lap over the top of the causeway.

**GA:** They were desperate and they were really ready to pull out. They were ready to say "bye bye." And so from Norm Bangerter's perspective the problem wasn't necessarily the physical flooding. Because when the planes come down—land—you don't want the runways to go squish. So the airport's a big deal but they were pumping the water from under the runways. I mean, they were coping. And bad things were happening. And I'm not saying bad things weren't, but the landslides were just being coped with—everything was going on, but it's a matter of, what is the problem and how

are we going to address it? Does it create worse problems? And Bangerter's problem really was economics in this state: "we cannot lose that railroad." Now from our perspective, we were saying to ourselves, "We really oughta figure out a way to control this thing, and there are various ways to do this. And there are ways that are better than others." And so, as my brother, the great doctor, says, "The enemy of good is better, and the enemy of better is best." You could certainly say that what we did with respect to pumping—Bangerter did not go with "the best." And I thought there were gonna be real problems. I thought we were gonna have air quality problems associated with pumping all that salt out there. I thought we were gonna lose an awful lot of our resources for what we did, but of course people went out there and got a lot of it. And geologists so often are sitting around saying, "Yada yada yaddy," 'cause we often just see something that just didn't quite look smart. But in terms of working with the system, it's whose problem? And there was a flooding problem, and there was the railroad problem, and there was the safety problem. We did really well in terms of the safety of it; I'm really proud of what we do, and really proud of the Utah Geological Survey. We were really, really good.

**GS:** Besides the pumps what were some of the other solutions that were considered, and which was the one that you would've considered the best?

**GA:** Okay, let me tell you the ones that weren't so good. You could dye the Lake. So if it were darker it would change albedo—

**GS:** Increase evaporation.

**GA:** Then there was this wonderful geologist, William Lee Stokes, and I worry that I'm gonna be there and someone's gonna have to write me this letter. He just said, "Nuke a hole and put the Lake in it." And Matheson said, "You gotta write this kook." And I

said, “This kook is one of the great geologists of time! This is Mr. Dinosaur.” He said, “You write him. I want this guy not talking like this. This guy’s off the charts.”

**GS:** Was he ever involved in Operation Ploughshare before?

**GA:** Well, you know, he came out from, probably Duchesne or that area through the Uintah Basin. And, I mean, people had a different view. I remember going in this old “Hoyo,” the DeSoto station wagon with a Geiger counter and just thinking it was fun. That’s what one did. It may be one of the reasons why I became a geologist. Well, except that everyone secretly wants to be an earth scientist.

**GS:** So you wrote him?

**GA:** So I went and saw him and then I wrote one of those really remarkable bureaucratic letters, where you can’t understand a word of it. I mean, if someone read that it would’ve been, “This woman can’t write.” And that’s what we sent him. But I talked to him, and just sort of said, “Dr. Stokes —” I love Dr. Stokes, and among other things we both loved this particular unit of Utah rock, and it’s called the Mancos Formation. And they say even the lizards don’t like the Mancos Formation. But Dr. Stokes and I both love the Mancos. I even named a cat after Mancos, just a beautifully grey cat. So I could talk to him. And he basically—I’m not saying he did it ’cause I had those beautiful brown eyes, but I think he knew he had to cool it. And that was good.

But then there were others. There was the diversion of some of the water, as Don was saying, up into Idaho. Of course, they were flooding. And I think that the one we didn’t do was just say we’re going to protect the key facilities, ’cause almost all our sewer systems, they go downhill. And so places like up in Box Elder County and there were several places where you just really could’ve built a barrier around them. You can

have a conference and you can try to understand it. And we did do that. And I think that was still with Matheson's time. But it might've been later. You could really say what do we understand about how high it could go? And the idea that you can look at the climatology, there's a wonderful conference report, that was up at the U—Kay, I think, is the lead author—and it would say that given what we knew about climate then, and it may still be true, it is within the possibilities of climate to have seven years in a row—the classic seven years of drought—and we'd only had five. And if you have seven of these things it's going to take you, potentially, above the 4212 level. At 4214 there's a spillover, naturally, to the West Desert. And if you have waves on top of that it can take you to 4215. So you can have a planning level of sort of 4214. You really are okay below that, even though the groundwater's coming in and your horses are gonna have hoof rot and things are gonna be wet and there's gonna be problems with ice and there's gonna be a whole bunch of other things.

[break in recording]

**GS:** Okay, so we're back and we're talking about what to do about the high lake levels, what were the options that were considered.

**GA:** So as you're looking at it just think of it as a process. So, you can think of change of volume, which is lake level, is a function of what comes in and what goes out. This is called *the* water equation. It's very simple, it just has  $\Delta S = \Delta I - \Delta O$  [ $\Delta \text{surface elevation} = \Delta \text{inflow} - \Delta \text{outflow}$ ]. That's all it is. So if you're gonna try to control the Lake you're gonna say to yourself, "I either want to get more O out, or I want to get more I in less." That's sort of the clue. So ways to control what goes out: evaporation, so you increase the albedo. That would be having the color differences or



whatever, or you can effectively pump it out, if you're gonna change lake level directly. The other thing is you can just really protect facilities. So by the end of the 1980s, remember our science—it's so exciting to be a geologist now. In my lifetime I've really done tectonics, big time, and we've got climate change. Instead of having to do it all in one with a couple surges here and there, we've got forty of these glacial—we know so much more now. The idea that we—by the end of the 1980s discussions we really realized that the upper limit of flooding was where it would go to the West Desert naturally, which would be about 4215—

**GS:** So you said 4214. What was the absolute high? Was it like 4212.9 or something in there?

**GA:** 4212.2 or something like that. 12.4 I think. And it hit it for two years in a row. And certainly, one would say the pumping was tested before it hit the second high. But it probably didn't make any difference to that high. What pumping did make a difference to was how fast the Lake went down. So the pumping just accelerated. That lake went up so much faster than we thought it could go up. And then it went down even faster than we thought it could go down. But a lot of that was the pumping. And it's easy to laugh at those pumps. I mean, think about how much money we've spent maintaining them. And I can understand the derision for it. But, "nature to be commanded must be obeyed." And even Brigham Young had looked at pumping to the West Desert. And it probably was, for what was being addressed as The Problem—if the issue was the railroads, it addressed it. But not if the issue was, "it's gonna keep going up and we were really in trouble" as we were looking at the airport, as we were looking at the refineries, as we were looking at so much.

**GS:** Interstate 80.

**GA:** Interstate 80. I know. And now we have all those barriers and people can't look at Great Salt Lake. I know. So I think the state did well. I'm proud of us. But if we were to start over—this is the sort of “let me be a dictator” part—I would probably make it so that we just took our chances. We would dike the critical facilities. We would be able to put dikes around them or whatever it takes. And we would do the state parks, certainly the sewer facilities, we'd do the roads, we'd do the railroad.

**GS:** And that's what Terry Tempest Williams says in *Refuge*, and the one thing that's not considered is not doing anything. You're not saying not doing anything, but actually letting it just play out as a natural cycle.

**GA:** So Don what would you do? Don doesn't usually—I asked him what does he think of the legislature and he looked and he said, “I can't.” But what do you think?

**DM:** I would probably mess with the inflow if I could. But it could cause considerable problems that I would rather try to reduce the cause than to try to fight with the results.

**GA:** So there already is a diversion across into Idaho. Is that the Lost Chance Canal?

**DM:** Last Chance.

**GA:** Last Chance Canal. So there actually is an exchange there. Now they [Idaho] weren't looking forward to that. And I think they would want to keep some of the water. I mean, wouldn't you? You help us, we help you. And so, that would be one. Now as you think about how much water comes in above Soda Springs, which is what you'd be diverting, versus what comes in below that, you're not taking the whole big flow there, and it is about fifty percent of the surface water that comes in. No it's two-thirds of the surface water and fifty percent of the water that comes in to Great Salt Lake. So that's a

big one. Building reservoirs doesn't do a hoot of good, because if you build a reservoir and then you fill it, then you're just adding in and out. You'd have to have these empty reservoirs, and we don't do that in Utah. That wouldn't be okay.

So, I'm just trying to think of what some of these others were, of either increasing what could go out, which is what we really did, versus decreasing what was coming in. I thought there was another decreasing of what would come in. There were the reservoirs. There were the diversions. There were fifteen of them [suggested alternatives]. And Wally Gwynn was on that, Paul Sturm was on that. They tended to be our Lake people on that, as opposed to our hazards people. I think if you were to go back and do it you might have more emphasis on a systems approach—I mean, the Utah Survey had, as with most organizations, looked at the Lake as a mineral resource, as opposed to the brine shrimp. The Lake now is more than one resource—I think most people recognize the Lake as a diversity of resources that everyone wants to sustain—that we have allegiance to. Even the snow, and I think even the air quality and stuff like that. I think now people look at the Lake much more as a system, whereas government really looked at Great Salt Lake as: you get to do the wildlife; Utah Geological Survey, you get to do the minerals; somebody else gets to do this. And of course, just by nature, it's a watershed.

**GS:** So how much input did your office have in that final decision to go with the pumps? And then when that decision was made were you involved with the planning and any of the decision-making process that went forward from that point?

**GA:** Yes and no. We'd been involved with all of it up to that point, and then there was this meeting that Don went to. And why don't you talk a little bit about what it was like,

what happened beforehand? 'Cause you met a little bit beforehand with Paul Morgan and Dee Hansen, and they had a back of an envelope I believe.

**DM:** I think the governor wanted a solution. He didn't really want to think about the overall problem. He wanted to stop the Lake from going up. And the only, really, thing that you could do with it in the short term was start pumping it out. And I don't think he really was thinking about the long-term aspects of the problem. He had an immediate problem to deal with and he wanted something [a solution]—

**GA:** I think now about how we talk about neoliberalism or whatever it is and we can put a price tag on things. Bangerter was really intelligent in that regard. He wanted a state that was run well. He wanted a state that respected money. And so he looked at this as an economic thing, with the railroad, gotta save the railroad, gotta pump. This is one where if the economics of this is so much cheaper, if you just pump it from the north part of the Lake rather than the south part of the Lake, it's lots cheaper, and let's do it. He wasn't saying to himself, I've got seven different things to be evaluated, and one of them is, am I pumping a whole bunch of our resources elsewhere? Am I ending up with a causeway which is going to help one industry versus another industry, and within that industry it's gonna really be great for one of them and terrible for another of them? He wasn't trying to do a balancing act. He was exceptionally good at saying, "This is the problem, and this is going to be the answer." And he did.

But Don at this meeting—and I forget where I was—was really great. Don was sorta the inside person and I was the outside person. And so my job was to get money and do resources, and those we were accomplishing thrived, ya know, and it was. And Don was called into this meeting. And he did come ready to explain what was going on. And

before the meeting they just did a back of the envelope of, “This is the difference in cost of whether we take it the way it was originally designed, or do we reduce the cost phenomenally and then pump whatever it was,” twenty percent of the Lake’s resources out into the West Desert. And I think that took about twenty minutes in a meeting before a meeting, and that was it. And on that one we were witnesses. ’Cause you see it was really an engineering solution as well at that point, ’cause the nature of the problem had shifted from one of working with the Lake and controlling it by natural processes or some processes, to economics. I was thinking of one other thing that I was gonna tell you that was our perspective that was neat.

**DM:** They’d never considered the consequences of the causeways that they were putting in the Lake. And there was a small culvert that let flow from this side of Antelope Island, it’s essentially the Jordan River, into the north. So one of the things that they were able to do was to bridge that drainage and increase the flow, the connectivity between the bays.

**GA:** So just pitching back to basic science. The reason that you can tell a freshwater from a salty lake is that if you have an open system, it will flush its salts. Utah Lake flushes its salts, and it goes to Farmington Bay that flushes its salts. But if you have a closed system, meaning it’s closed topographically and hydrologically, it will become salty because that which has been carried into it becomes there. So what we’ve done is artificial change to a terminal lake. There are really five major bays of Great Salt Lake: Bear River Bay, Weber, Ogden Bay, Farmington Bay, then the sort of south part, and Gilbert Bay and Gunnison Bay in the north part. What we’ve done is they alter flow-throughs. And by changing the amount of flow-through from the south, Gilbert Bay, to

the north, Gunnison Bay, you've in essence made what was for a while, for industry, a closed basin system for both of them; you've now made the one an open system, that is gonna be flushing its salts, and you've made the northern one be the closed basin. And so you've changed the dynamics of that lake, and of course you've changed the dynamics of the economics, because the north one is going to always be getting the salts.

**GS:** It's hyper-saline, yeah.

**DM:** The Lake on the east side of Antelope Island was frozen over there for a while.

**GS:** Because there's so much freshwater.

**GA:** And so we tend to think about the north part of the lake and the south part of the Lake, 'cause during the 1960s there really was no east part of the Lake. But if we can really get it through people's heads, it's the east side of the Lake and the west side of the Lake that matters. And one of the things that we argue against is when people talk about the south part of the Lake in terms of its monitoring, it is Gilbert Bay, Farmington Bay, Ogden Bay, and Bear River Bay are all considered the south part of the Lake. And you say, but parts of them are north. It's a term that doesn't work. And the navigators had to have some navigation, and they came to the Utah Geological Survey, and Don was a part of it. And, I mean, they needed some places. So we did Gilbert Bay, 'cause, ya know, GK Gilbert, the greatest geologist who's ever worked in Utah. Gunnison Bay, we came up with these good names. And of course bays change as the Lake goes up and down. And people still haven't embraced Gilbert and Gunnison as names for bays, but I'm adamant on it, 'cause this idea of north and south is totally artificial, particularly when you realize that the science of the south is including all of them: the Bear, the Ogden, the Farmington, and Gilbert. Those, in the 1960s, were determined to be the fresh-only bays

because the [unclear] was so low. All of us have our things about Great Salt Lake that we wish other people would understand. That's one of the ones for me. Anything else that you're thinking about Don?

**GS:** Well, again, I think that what I'd like to do is if we could sit down again.

**GA:** Oh, I'd love to.

**GS:** Let's just plan on doing that, because we've gone for over, oh, an hour and twenty minutes now. And so I'd be happy to come back, we could talk about some of the educational programs you've been involved more recently. And I think that's important as well.

**GA:** I'd love to do that, sure, 'cause Great Salt Lake teaches us.

**GS:** All right, well thanks for today, and I will be in touch shortly and we'll set up another time to talk some more.

**GA:** Thanks for being so interested. I think it's an important project.

**GS:** Thank you.

**END OF INTERVIEW**