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10 **BEFORE THE ARIZONA NAVIGABLE STREAM**  
11 **ADJUDICATION COMMISSION**

12 IN THE MATTER OF THE  
13 NAVIGABILITY OF THE SALT  
14 RIVER FROM THE CONFLUENCES  
15 OF THE WHITE AND BLACK  
16 RIVERS TO THE GILA RIVER  
17 CONFLUENCE, MARICOPA  
18 COUNTY, ARIZONA


Nos. 03-005-NAV and 04-008-NAV  
(Consolidated) (Salt)

**GILA RIVER INDIAN COMMUNITY'S  
FIRST SUPPLEMENTAL SUBMISSION**

19 In addition to the materials previously tendered in this consolidated matter  
20 before the Arizona Navigable Stream Adjudication Commission, the Gila River  
21 Indian Community submits the following attached materials for the record in this  
22 matter. A list of all materials submitted by the Community in this consolidated matter  
23 is attached to this filing.

24 DATED this 22nd day of January, 2016.

GILA RIVER INDIAN COMMUNITY

25 By   
26 Thomas L. Murphy

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**DOCUMENTS SUBMITTED IN THE CONSOLIDATED SALT RIVER  
PROCEEDINGS BY  
THE GILA RIVER INDIAN COMMUNITY  
Nos. 03-005-NAV and 04-008-NAV (Consolidated) (Salt)**

<b>Description of Document (Author/Title)</b>	<b>Date</b>	<b>Date Submitted to ANSAC</b>
Gookin, <i>Navigability of the Salt River</i>	July 27, 2015	8/7/15
Bartlett, <i>Personal Narrative, Vol. II</i>	1853	8/7/15
Berry & Marmaduke, <i>The Middle Gila Basin</i>	1982	8/7/15
Cortell, <i>Recreation and Instream Flow, Vol. 1</i>	July 1977	8/7/15
Cortell, <i>Recreation and Instream Flow, Vol. 2</i>	July 1977	8/7/15
Davis, <i>Man and Wildlife in Arizona</i>	2001	8/7/15
Dobyns, <i>Sonoran Desert Traders</i>	Sept. 15, 2002	8/7/15
Durrenberger & Ingram, <i>Major Storms and Floods in Arizona 1862-1977</i>	1978	8/7/15
<i>Population of the States and Counties of the United States: 1790-1990</i>	March 1996	8/7/15
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Hyra, <i>Methods of Assessing Instream Flows for Recreation</i>	June 1978	8/7/15
<i>Kent Decree</i>	March 10, 1910	8/7/15
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Thomsen & Porcello, <i>Predevelopment Hydrology of the Salt River Indian Reservation</i>	Nov. 1991	8/7/15
Walker & Bufkin, <i>Historical Atlas of Arizona, 2nd ed.</i>	1986	8/7/15
Webb, Leake & Turner, <i>The Ribbon of Green</i>	2007	8/7/15
<i>Transcript of Proceedings, Vol. II, No. 03-007-NAV</i>	June 17, 2014	1/22/16
Haury, <i>The Excavation of Los Muertos</i>	1945	1/22/16
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Abbott, Smith & Gallaga, <i>Ballcourts and Ceramics</i>	2007	1/22/16
Colburn, <i>Integrating Recreational Boating Considerations</i>	undated	1/22/16
Gookin, <i>Annual Virgin Flows in Central Arizona</i>	2009	1/22/16
Hodge, <i>Prehistoric Irrigation in Arizona</i>	July 1893	1/22/16
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<i>United States v. Utah</i> , No. C-137-59 (D. Utah), Findings of Fact and Conclusions of Law,	Dec. 15, 1960	1/22/16
<i>United States v. Utah</i> , Judgment & Decree	Dec. 15, 1960	1/22/16

Arizona Citizen, <i>Salt River Valley</i>	April 18, 1874	1/22/16
Arizona Journal-Miner	July 21, 1897	1/22/16
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Arizona Republican, <i>Water Route to Roosevelt</i>	June 28, 1910	1/22/16
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Arizona Sentinel	Dec. 28, 1878	1/22/16
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BEFORE THE  
ARIZONA NAVIGABLE STREAM ADJUDICATION COMMISSION

IN THE MATTER OF THE NAVIGABILITY )  
OF THE GILA RIVER FROM THE NEW ) NO. 03-007-NAV  
MEXICO BORDER TO THE CONFLUENCE )  
WITH THE COLORADO RIVER, GREENLEE, ) ADMINISTRATIVE  
GRAHAM, GILA, PINAL, MARICOPA AND ) HEARING  
YUMA COUNTIES, ARIZONA. )  
\_\_\_\_\_)

At: Phoenix, Arizona  
Date: June 17, 2014  
Filed: July 11, 2014

REPORTER'S TRANSCRIPT OF PROCEEDINGS  
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1 BE IT REMEMBERED that the above-entitled and  
2 numbered matter came on regularly to be heard before the  
3 Arizona Navigable Stream Adjudication Commission, State  
4 Senate Building, Hearing Room 1, State Senate Building,  
5 1700 West Washington Street, Phoenix, Arizona,  
6 commencing at 9:00 a.m. on the 17th day of June, 2014.

7

8 BEFORE: WADE NOBLE, Chairman  
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11 BILL ALLEN, Commissioner

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1 CHAIRMAN NOBLE: Good morning. We welcome you  
2 back to the Gila River hearing of the Navigable Stream  
3 Adjudication Commission. We will begin this morning  
4 with Mr. Fuller continuing and Mr. Hood. Please begin.

5 MR. HOOD: Thank you, Mr. Chairman.

6

7

JONATHAN EDWARD FULLER,  
8 called as a witness on behalf of State Land Department,  
9 was examined and testified as follows:

10

11

CROSS-EXAMINATION

12 BY MR. HOOD:

13 Q. Good morning, Mr. Fuller.

14 A. Good morning.

15 Q. My name is Sean Hood. I represent Freeport  
16 Minerals Corporation. Rich Burtell, our expert witness,  
17 is here today, and I expect that Shilpa Hunter Patel,  
18 Freeport Minerals' Senior Water Counsel, will be here,  
19 schedule permitting, throughout the week.

20 Mr. Fuller, I left a few documents up there.  
21 We may cross-reference as we go through our discussion  
22 today, our friendly discussion. I was told not to do  
23 cross-examination. We're just having a conversation.  
24 So, anyway, I've got some documents up there. We'll  
25 walk through them. And they include your upper Gila

1 report that you revised in 2003; is that right?

2 A. Yes, it does include the 2003 revision of the  
3 upper Gila report.

4 Q. I'll probably just refer to it as the upper  
5 Gila report. Will that work for you?

6 A. That's fine.

7 Q. Great. You were nice enough to bring your  
8 PowerPoint back. We'll certainly go through some of  
9 your slides from yesterday. You also should have the  
10 hearing transcript from the 2005 proceedings on the  
11 Gila. Is that there?

12 A. That's right here.

13 Q. Okay. And then you probably also have the  
14 declaration of Rich Burtell concerning the upper Gila  
15 River?

16 A. Yes, I do.

17 Q. Great. Let's start with that, because I think  
18 we can get that out of the way and I can actually make  
19 some room for you.

20 Some of my questions for you today,  
21 Mr. Fuller, are going to be specific to the upper Gila  
22 River, and I'll probably say upper instead of Segments 1  
23 through 3, okay?

24 A. So by upper Gila, you mean Segments 1 through  
25 3?

1 Q. Generally speaking, and I understand there's  
2 an issue about there was some flow data just downstream  
3 of Coolidge and therefore that sort of incorporates 4.

4 A. Right.

5 Q. So don't, don't -- if I say upper and you  
6 think you need to clarify that I'm also referring to  
7 that stream flow data, please do correct me or make that  
8 clarification. Okay?

9 A. Very good.

10 Q. Thank you. Would you turn to Table 15 of  
11 Mr. Burtell's declaration. I think I tabbed it for you  
12 on the right.

13 A. It is tabbed.

14 Q. Great. And Mr. Burtell here has compiled four  
15 accounts of historic boating pre-statehood along the  
16 upper Gila. Have you had a chance previous to today to  
17 take a look at this table?

18 A. Yes, I did.

19 Q. Are you aware of any other instances of  
20 boating before statehood on the upper Gila River other  
21 than these four examples?

22 A. Just the ones that I presented yesterday. I  
23 would have to go back and look through that list and  
24 separate them out by segment again.

25 Q. Okay. Well, let's do that, because I

1 definitely want to make sure we have a universe of  
2 historic accounts.

3 A. Are you ready?

4 Q. I am, yes.

5 A. Okay. So I'm at slide 100. These two  
6 descriptions, such as they are, occurred in the upper  
7 Gila reach as you defined it. Chiricahua Apaches and  
8 the Spanish explorers encountering what they call the  
9 River of Rafts.

10 Q. We're referring to, we're referring to slide  
11 number 100 on Mr. Fuller's navigation PowerPoint from  
12 yesterday; is that right?

13 A. It's the navigability of the Gila River.

14 Q. Right. What are your references for these two  
15 examples?

16 A. I believe these are referenced from the  
17 Tellman report that was submitted previously to ANSAC.  
18 Let me check in my notes and see if I wrote it down.

19 Q. Would that be the chapter that was included in  
20 the Final Report: Criteria for Assessing Characteristics  
21 of Navigability for Small Watercourses in Arizona?

22 A. Barbara Tellman had three different sources.  
23 One was a presentation she gave to ANSAC. It was a  
24 slide presentation, and there is information and  
25 transcript that goes with that. There is a chapter in

1 one of the Stantec reports that relates to boating in  
2 Arizona in general. And then also she had an article  
3 that she had submitted to some historical society that's  
4 in the evidence that the Arizona Attorney General  
5 submitted. Those are the sources that I was considering  
6 from Tellman.

7 Q. Okay. Let's skip ahead then to talking about  
8 the bull boats. Let's take, let's take a look at the  
9 upper Gila report, if you would, Mr. Fuller, and Page  
10 3-1. Are you there?

11 A. I am there, yes.

12 Q. This is the page that begins Introduction; is  
13 that right?

14 A. Yes, it does.

15 Q. Okay. If we go, it looks like three sentences  
16 down on that first paragraph, it says the Chiricahua  
17 Apache only rarely practiced agriculture but are  
18 reported to have built bull boats across streams, open  
19 parenthetical, although not specifically the Gila or San  
20 Francisco Rivers. Isn't that what you put in your  
21 report?

22 A. You're reading that correctly, yes.

23 Q. The other thing you have there is the Rio de  
24 las Balsas, River of Rafts. And first off, those were  
25 to cross rivers, not to go up and down them, correct?

1 A. That's as I understand it, yes.

2 Q. Let's take a look at the hearing transcripts,  
3 November 16, and you had, you had members of your  
4 project team testifying back with you at the '05  
5 proceedings; is that right?

6 A. Yes.

7 Q. Okay. And who was Mr. Gilpin?

8 A. Mr. Gilpin is a historian-archaeologist.  
9 Works for SWCA, Flagstaff.

10 Q. If we stay on Page 68, there's a question at  
11 the top there on line 2, "But there are no accounts on  
12 the Gila?" And this is Mr. Gilpin testifying. You can  
13 see that on Page 67.

14 And he says, "Oh, yeah. There's also the --  
15 and John reminded me..." and he's referring to you.  
16 "There is reference in the Coronado Expedition to the  
17 Rio de -- River of Rafts." And then he goes on. Do you  
18 see that, that discussion?

19 A. I do.

20 Q. Okay. And then the next question is, "But it  
21 is not clear, based on your evidence that you looked at,  
22 that it was the Gila River. Is that correct?"

23 "That's correct."

24 Was that the testimony that day?

25 A. It was.



1 Q. And you didn't correct Mr. Gilpin's testimony  
2 in that regard, did you?

3 A. Not at that time, no.

4 Q. Okay. Any other, any other examples of  
5 boating accounts on the upper Gila River prior to  
6 statehood other than what's in Mr. Burtell's Table 15?

7 A. One moment. James Ohio Pattie. There is a  
8 statement in Davis's master's thesis that Pattie claimed  
9 to have canoed from Safford to Yuma several times.

10 Q. Have you read James Ohio Pattie's memoirs?

11 A. Not in complete.

12 Q. So if there's evidence for that in his  
13 memoirs, you haven't read it. You couldn't point me to  
14 that location?

15 A. I'm pointing at the scholarly thesis that  
16 concluded that report.

17 Q. And I have the personal narrative of Pattie.  
18 If you could point -- it doesn't sound like you could  
19 point me to where in here it says he --

20 A. I could not.

21 Q. -- went up and down the Gila multiple times?

22 A. I could not.

23 Q. Okay. If we look -- if we stay on Table 15 of  
24 Mr. Burtell's declaration, we have, in 1869 we have a  
25 raft. In 1886 we have a dugout canoe. In 1891 we have

1 an unknown craft, and then in 1859 we have flat-bottomed  
2 craft, and that was the Evans and Adams Excursion you  
3 talked about yesterday. Do you agree with Mr. Burtell's  
4 accounting of what those craft were?

5 A. Yes. Meaning by boat type, you're talking  
6 about?

7 Q. Correct.

8 A. Yes. I agree with that.

9 Q. Mr. Fuller, let me try and summarize what I  
10 took away from yesterday. It seems to me that your  
11 understanding of the Daniel Ball Test is if you can  
12 float a canoe down a stream, that satisfies navigability  
13 for purposes of title. Is that a fair summary?

14 A. It's a partial summary. I would agree with  
15 the statement.

16 Q. Is there any other clarification you would  
17 need to make that more complete?

18 A. Well, I believe yesterday I showed that other  
19 boats could be floated down the Gila River, not just  
20 canoes.

21 Q. I appreciate that clarification. But if you  
22 can float a canoe, you think Daniel Ball has been  
23 satisfied?

24 A. Yes.

25 Q. What year -- until what year, approximately,

1 do you believe that the Gila River remained in its  
2 ordinary and natural condition?

3 A. I believe with the onset of irrigation  
4 diversions in the 1860s, that's when the ordinary and  
5 natural condition was materially -- began to be  
6 materially changed.

7 Q. And I think that's pretty consistent with what  
8 Mr. -- I think this was Mr. Huckleberry back in 2005.  
9 He testified, and by the late 1860s there were very few  
10 diversions, Anglo-European diversions. Is that  
11 consistent with what you just said?

12 A. Yes.

13 Q. Okay. And you're -- I think you touched upon  
14 a little bit -- well, maybe you didn't. Are you  
15 familiar at all with the Globe Equity Decree?

16 A. Just by name.

17 Q. Okay. And I don't think we probably need to  
18 find it in one of your two reports from '03, but you do  
19 discuss some of the dates at which the first canals were  
20 built and diverting water, and those are documented in  
21 the Globe Equity Decree. Early 1870s were some of those  
22 first diversions. Is that consistent with your  
23 understanding?

24 A. My understanding was in the 1860s, 1860, 1870,  
25 I'm not willing to --

1 Q. That general time frame?

2 A. Sure.

3 Q. Did I understand you correctly yesterday,  
4 Mr. Fuller, to say that you concluded personally that  
5 the San Pedro was not navigable in its ordinary and  
6 natural condition as of statehood?

7 A. Yes.

8 Q. Did you consult with the Arizona State Land  
9 Department when it was making its decision how to  
10 proceed with respect to the San Pedro?

11 A. Yes.

12 Q. And you gave them that opinion, and they ended  
13 up not taking a position on navigability on the San  
14 Pedro; is that right?

15 A. I did give them that opinion. They did  
16 conclude that. Not necessarily one led to the other  
17 solely, but that may have been part of their  
18 decision-making process.

19 Q. And you gave similar input on the Santa Cruz;  
20 is that right?

21 A. I did.

22 Q. Okay. Focusing on the -- what was your  
23 opinion as to the navigability of the San Francisco,  
24 going back in time a little bit?

25 A. Yeah, the State and I disagree on that one. I

1 felt like there was sufficient evidence that it could be  
2 a navigable stream, and the state felt like that was not  
3 the case.

4 Q. And I think that's because you concluded, you  
5 concluded in your upper Gila report, which also included  
6 a discussion of the San Francisco River, you concluded  
7 that there was probably about a foot of flow in ordinary  
8 and natural conditions on the San Francisco; is that  
9 right?

10 A. Yeah, it's been, what, 11 years since that San  
11 Francisco stuff I've looked at. That certainly could be  
12 true. You probably have a chart that says that.

13 Q. And I can -- I can actually point you to it  
14 quickly, if you don't mind. Upper Gila River report  
15 from '03. If you go to 5-25.

16 A. Uh-huh.

17 Q. It says, "The average flow depth in the river  
18 was probably about one foot." And you can confirm that,  
19 if you like.

20 A. You're on Page 5-25?

21 Q. 5-25, yes, it's the summary paragraph in the  
22 middle of the page, the second sentence.

23 A. Right. It does say that. I'd want to look  
24 specifically at the rating curves and the seasonality,  
25 but it does say that, about one foot. One foot would be

1 consistent with my testimony of yesterday. There are  
2 also instances of floating logs on that river and people  
3 do continue to canoe it today.

4 Q. So the fact that you felt there was probably  
5 about a foot of flow, that was a big part of your  
6 personal conclusion that the San Francisco probably was  
7 navigable?

8 A. That was a part of it.

9 Q. Why did the state disagree with you?

10 A. I don't know.

11 Q. San Pedro, San Pedro in its ordinary and  
12 natural condition had how much water, Mr. Fuller?

13 A. I don't recall at this point. I'm sorry.  
14 It's been a long time.

15 Q. What's your minimum threshold for finding  
16 navigability on a -- from a depth perspective? It's all  
17 about depth you said yesterday.

18 A. It is all about depth. I think you could --  
19 as I testified yesterday, a half foot of depth is  
20 sufficient to float canoes. To clarify that a little  
21 bit, I think that you want a half foot of depth more  
22 than just one day a year, more than just a couple days a  
23 year. I think you would want some regularly occurring  
24 minimum depth of a half foot, predictably, and above  
25 that from time to time.

1 Q. Didn't we have that on the San Pedro in its  
2 ordinary and natural condition?

3 A. You know, I just didn't come prepared to talk  
4 about the San Pedro.

5 Q. If you would be so kind, Mr. Fuller, as to go  
6 to -- let's go to your boating PowerPoint, if we could.  
7 I've tried to shuffle things so we'll stay on one  
8 PowerPoint or the other, and if we have to bounce a  
9 little bit, I apologize in advance.

10 Just to, just to tie the loop and make sure I  
11 understand comprehensively. We've got Mr. Burtell's  
12 Table 15. You mentioned Pattie. You mentioned the bull  
13 boats and the river rafts. Any other instances of  
14 boating the upper that you would contend occurred prior  
15 to statehood?

16 A. That's in the other presentation, and let's  
17 just go through the accounts here.

18 MS. HERNBRODE: Sean, would you like me to  
19 turn the lights off so that's a little more visible?

20 THE WITNESS: I'm happy because I'm looking at  
21 my computer screen.

22 MS. HERNBRODE: Well, I know you are.

23 MR. HOOD: It works for me if it would be  
24 easier for the Commission to have it darker. I'm  
25 flexible.

1 CHAIRMAN NOBLE: Mr. Henness has not  
2 complained.

3 VICE CHAIRMAN HENNESS: About sleeping?

4 THE WITNESS: I believe this is the same  
5 account. We're citing different newspapers and slightly  
6 different dates, but I think it's the same account.

7 BY MR. HOOD:

8 Q. Which account is this, referring to  
9 Mr. Burtell's paper?

10 A. The boating presentation, slide 109, and it's  
11 the third in his Table 15, 1891, 208 men. It sounds  
12 about the same.

13 Q. That was my interpretation as well. I think  
14 you're right.

15 A. Yeah, I think that's it.

16 Q. Okay. And actually, I want to shift gears.  
17 Is it all right if I approach the witness? I neglected  
18 to give him one of my documents.

19 CHAIRMAN NOBLE: Yes. You have been kind not  
20 to cross, so you can approach the witness.

21 MR. HOOD: I appreciate that, Mr. Chairman.

22 BY MR. HOOD:

23 Q. And what I've just handed Mr. Fuller is the  
24 Final Report: Criteria for Assessing Characteristics of  
25 Navigability for Small Watercourses in Arizona, and this



1 was prepared by Stantec Consulting, Stantec Consulting  
2 in association with J.E. Fuller, and the University of  
3 Arizona Water Resources Research Center. Is that  
4 correct, Mr. Fuller?

5 A. That is correct.

6 Q. And I would like to -- it's true, Mr. Fuller,  
7 that as a general proposition, pre-statehood in Arizona  
8 or from a -- let me back up. Let me rephrase that.

9 From an archaeological perspective as well as  
10 from a pre-statehood historical perspective, more  
11 generally, it's true that boats traveling through  
12 Arizona did not usually travel up and down the rivers;  
13 is that right?

14 A. The record indicates with the exception of the  
15 steamboats outside of the reach of your concern, all of  
16 the accounts are in the downstream direction.

17 Q. In fact --

18 A. Or crossing the river.

19 Q. And if we look at Page 25 of the Criteria For  
20 Assessing Characteristics of Navigability for Small  
21 Watercourses in Arizona, you see the third paragraph  
22 there? It says, "People who traveled."

23 A. You said page 25?

24 Q. Page 25, yeah.

25 A. The paragraph starts with "People who

1 traveled"?

2 Q. It begins "Boat use by settlers and  
3 prospectors."

4 A. Got it. Okay.

5 Q. Sorry. That was the heading. The actual  
6 text, body text begins, "People who traveled through  
7 Arizona on their way to someplace else used ferries but  
8 were not usually involved in travel up and down rivers."  
9 Correct?

10 A. Correct.

11 Q. So the examples, the examples that we have, a  
12 few isolated incidents, those are in fact the exception.  
13 Most did not travel up and down the rivers, correct?

14 A. I'm not sure that's correct. I have no idea  
15 of the number of people who used ferries versus the  
16 number of people who were using other kinds of boats, so  
17 I really couldn't say that one way or the other.

18 Q. I guess the clause that I'm focused on is that  
19 these people were not usually involved in travel up and  
20 down rivers.

21 A. As a general rule, people were doing other  
22 things with their days other than traveling on rivers,  
23 if that's what you mean. Mostly they were farming or  
24 mining or traveling other ways.

25 Q. Let's take a look at your boating PowerPoint,

1 Page 7. Okay? And this PowerPoint, Page 7 of the  
2 boating PowerPoint, is historical boat types, circa  
3 1912. Is that right, Mr. Fuller?

4 A. That is right.

5 Q. Okay. And it identifies some boats available  
6 in and near Arizona, circa 1912. Those include  
7 steamboats; is that right?

8 A. That's right.

9 Q. And I think we've just been over -- those were  
10 never used on the upper Gila, correct?

11 A. That's correct.

12 Q. And, in fact, I think you would admit that  
13 steamboats could not have been used on the upper Gila in  
14 its ordinary and natural condition?

15 A. Yes.

16 Q. Flatboats, skiffs, scows, and rafts, I think  
17 we have a raft, a flat-bottom and an unknown on  
18 Mr. Burtell's chart. But those are the only instances  
19 that you're aware of of someone using one of those types  
20 of craft in the upper Gila River; is that right?

21 A. The flatboats, scows and skips and rafts?

22 Q. Yes.

23 A. Historically, those are the only accounts that  
24 we have, yes.

25 Q. Canoes, we have, going back to the PowerPoint,

1 the next one is canoes, and we have one dugout in 1886;  
2 is that right?

3 A. Yes.

4 Q. And then you mentioned Pattie, and we'll  
5 probably address him in a different way later. But any  
6 other instances of canoes in the upper Gila prior to  
7 statehood?

8 A. There's the one account in Granger that says  
9 that Stanley Sykes, I think it was, canoed from Clifton  
10 to Yuma, and my interpretation of that was it was the  
11 other Sykes, but that's the only other one that's  
12 mentioned.

13 Q. Correct. And we'll talk a little bit about  
14 Sykes. My understanding is that he traveled from  
15 Phoenix to Yuma. Did you -- having read all of this  
16 stuff, do you really think he was traveling in the upper  
17 Gila?

18 A. Well, perhaps I misspoke. Let's look.

19 Q. That was in your presentation yesterday. And  
20 I've been going through the materials. It's my  
21 interpretation he started in Phoenix, but we can get  
22 there later, if you would like. Whatever is easiest.

23 A. It's your time, so --

24 Q. Okay. Rowboats, dories, and riverboats. Do  
25 we have any evidence of use of any of those craft in the

1 upper Gila River prior to statehood?

2 A. Well, there's the unknown boat that could  
3 potentially fit into that category. But other than  
4 that, no.

5 Q. And then you talked about many others  
6 available -- inflatables, motor, kayaks, dugouts. We  
7 have one dugout that we've already talked about. I sort  
8 of lumped that in with canoes. Any examples of  
9 inflatables, motor, or kayaks on the upper Gila River  
10 prior to statehood?

11 A. No.

12 Q. Your next bullet point there on that slide is  
13 "Boats were adapted to fit specific rivers and uses."  
14 And you gave one example of that yesterday, but it  
15 didn't relate to the upper Gila River. Do you have any  
16 examples where someone coming into the area said this is  
17 the kind of boat that I need to do in a different way  
18 for the upper Gila River and made that sort of  
19 adaptation?

20 A. No, I don't.

21 Q. Page 11 of your boating PowerPoint,  
22 Mr. Fuller, if you could turn there. And this is an --  
23 this is an excerpt that you included in your PowerPoint  
24 from the Utah case that was decided in 1931; is that  
25 right?

1 A. That's correct.

2 Q. And the Special Master looked at some  
3 different rivers in the State of Utah; is that your  
4 understanding?

5 A. That's my understanding.

6 Q. Have you read the Special Master's report?

7 A. Most of it.

8 Q. Do you recall what he had to say about the San  
9 Juan River?

10 A. Not specifically.

11 Q. Okay. And do you know what kind of depths he  
12 found there to be on the San Juan River?

13 A. I don't recall it from reading it. I know  
14 some of the other experts had pointed out certain  
15 depths, but my understanding is the depths that the  
16 Special Master found are not particularly binding on any  
17 other decision anywhere else.

18 Q. And so he did -- he did, looking here, he  
19 noted a wide cross section of available craft; is that  
20 right?

21 A. Yes.

22 Q. Some of them have more draw requirements; some  
23 of them have lower draw requirements; is that right?

24 A. That's also correct.

25 Q. Okay. And in fact, he looks at some of the

1 same craft you did. He looked at rowboats drawing 6 to  
2 12 inches. And he looks -- I'm not seeing it right now,  
3 but I'm pretty sure he had a canoe up there somewhere;  
4 is that right?

5 A. Yes, it's in the second bullet.

6 Q. Thank you. And he also had scows drawing 8  
7 inches, right?

8 A. Yes.

9 Q. The end of the first bullet. Okay. And so  
10 having noted those craft, if the Special Master had  
11 determined that the San Juan River was between one and  
12 three feet for 219 days each year, and for the other 146  
13 days had a depth of over three feet, and yet he  
14 determined that stream was not navigable; is it safe to  
15 say that's just inconsistent with your view of the  
16 Daniel Ball Test? It's all about depth, in your view.

17 A. Yes, that is consistent, and no, I don't think  
18 that the findings of the Special Master for Utah are  
19 particularly binding on this hearing here.

20 Q. That wasn't my question. Let me back up. I  
21 think you said "consistent," and maybe you meant  
22 "inconsistent," so I need to clarify, and I'm not  
23 really -- this is going to go a lot faster if you don't  
24 interject what you think is relevant or not. That's not  
25 really what we're here to talk about today.

1 My question for you is, if the Special Master  
2 determined that the entire year it was over a foot and  
3 for 219 days it was between one and three feet, and for  
4 the remainder of the year it was over three feet -- and  
5 in your mind it's all about depth -- and he determined  
6 that that stream was nonnavigable, that's just  
7 inconsistent with your view of the Daniel Ball Test;  
8 isn't that true?

9 A. Well, I guess my opinion is, if the Special  
10 Master were looking at the Gila, he would find it  
11 navigable.

12 Q. He would find it navigable having found the  
13 San Juan nonnavigable?

14 A. Yeah.

15 Q. Okay. Well, let me take it one piece at a  
16 time.

17 First of all, so do you think that the Special  
18 Master's determination regarding the San Juan is  
19 consistent with your view of the Daniel Ball Test?

20 A. Can you repeat the question?

21 Q. Yeah.

22 A. I wasn't prepared to talk about the San Juan  
23 River, so I'm trying to dissect the parts of the Special  
24 Master's decision that relate to the San Juan from what  
25 we're talking about here today on the Gila.



1 Q. I can represent to you -- and if you'd like a  
2 copy, I'm happy to provide it to you. But he found that  
3 for the San Juan for 219 days out of the year, it had  
4 between one and three feet of flow. For the rest of the  
5 year he found it had over three feet of flow. He  
6 determined that stream to be nonnavigable.

7 And so I'm asking you, based upon your  
8 interpretation and application of the Daniel Ball Test,  
9 is he at odds with your view of how that test is  
10 applied? It's all about depth in your view, and it  
11 always had a depth over a foot.

12 A. Well, as you've represented his opinion, and  
13 neglecting any other factors that went into his  
14 decision-making that's totally left out, if his decision  
15 was made solely on that, then yes, we disagree about  
16 depths.

17 Q. You would agree that as a general matter,  
18 Mr. Fuller, that draw is not equivalent to the depth  
19 that's required to navigate a boat, because you have to  
20 account for load. You have to account for the weight of  
21 the occupants, et cetera, correct?

22 A. The draw includes the load.

23 Q. Okay. Don't we at times have specified draw,  
24 and that's the base draw for a boat; and then as you add  
25 more into it, the draw increases, correct?

1 A. Correct.

2 Q. Okay. So if you say a craft has 6 inches of  
3 draw, that draw changes based on how much you put in  
4 there?

5 A. Usually, yes.

6 Q. Okay. And you'd agree that the draw, even  
7 having taken into account the draw required for the  
8 load, that draw is still not representative of your  
9 minimum depth, because you still need to account for the  
10 needs of the paddler, right?

11 A. I think you're starting off in the wrong  
12 place. Are you saying that a canoe draws 6 inches  
13 unloaded?

14 Q. No. I'm saying, I'm saying irrespective of  
15 what the draw is, that's not your minimum depth, because  
16 you still need to account for the occupant's ability to  
17 steer the craft and paddle?

18 A. If a boat draws 8 inches, 6 inches is not  
19 going to be enough to float a boat.

20 Q. But if it draws 8 inches, 8 inches isn't  
21 enough either. You need more than that.

22 A. You could probably get over an obstacle that's  
23 at 8 inches; but if the river is consistently 8 inches  
24 deep and your boat draws 8 inches --

25 Q. You're not going anywhere.

1 A. -- you're going to go there pretty slow. Yes,  
2 that's correct.

3 Q. Would you please turn to Page 20 of your  
4 boating PowerPoint. And here you're referencing  
5 steamboats used on the navigable Colorado; is that  
6 right?

7 A. Yes.

8 Q. And we've already discussed, you couldn't have  
9 used a steamboat on the upper Gila River in its ordinary  
10 and natural condition. But I still want to follow up  
11 with a couple of questions. What depths did the  
12 Colorado have in its ordinary and natural condition?

13 A. I don't recall specifically.

14 Q. Can you give me a general range?

15 A. I don't recall specifically.

16 Q. How about generally?

17 A. Deep enough to float steamboats.

18 Q. Okay.

19 A. But I really don't have a number for you.

20 Q. Was it as a general matter deeper than the  
21 Gila River?

22 A. As a general matter, at its median flow rate  
23 comparing apples-to-apples, probably, but I really don't  
24 know for sure. You said the upper Gila, right?

25 Q. My last question was about the Gila generally.

1 A. I'm not sure in the lower. In Segment 8 they  
2 may have been very similar.

3 Q. But taking the Gila as a whole, if you're  
4 looking at the general range of median flows, the  
5 Colorado is a bigger, deeper river, correct?

6 A. It is a higher flow river. Whether it's  
7 deeper or not, I really can't tell you.

8 Q. Yesterday you had a slide -- oh, boy. You had  
9 a slide on steamboat usage, and this is, unfortunately,  
10 your navigation section, but you talked about running up  
11 to Dome and you talked a little bit about that.

12 A. Yes.

13 Q. My question is just, what is your source of  
14 information suggesting that steamboats went as far as  
15 Dome on the Gila River?

16 A. Do you recall the slide number?

17 Q. I do, yeah, it's 99. And you have some  
18 sources on the margin there, but it's not clear which of  
19 your bullet points each one relates to.

20 A. I'm citing also Dr. Lingenfelter's declaration  
21 regarding up to -- you're asking specifically regarding  
22 Dome.

23 Q. Yeah.

24 A. As I sit here today, I don't recall which of  
25 those articles that relates to.

1 Q. But do you believe, do you believe that the  
2 excursions to Dome are going to be covered in one of the  
3 three or more of the three citation -- references you  
4 have there?

5 A. That or in the original Land Department report  
6 which I made notes for myself that discuss those. I  
7 have just this general recollection over the past 22  
8 years talking about the Gila, Land Department folks who  
9 were original authors of this report talking about the  
10 use up to Dome.

11 Q. Turn, if you would -- here we go. Would you  
12 turn to Page 49 of your boating PowerPoint, please?

13 A. Okay.

14 Q. And here we're talking about canvas folding  
15 boats; is that right?

16 A. Yes.

17 Q. And we have minimum depth of flow of three  
18 inches; is that right?

19 A. Yes.

20 Q. And how much water do you feel you need to  
21 complete the Daniel Ball Test with respect to a canvas  
22 folding boat?

23 A. You know, I think the three inches there is a  
24 spec from people who made that boat. I think three  
25 inches is kind of irrelevant, because I think the

1 minimum depths, even at base flow rates, were greater  
2 than three inches even in the upper Gila River.

3 Q. I'm going to have a lot of questions for you  
4 today, Mr. Fuller, that you might find no relevance in.  
5 And that's not really the purpose for these questions  
6 and answers. You've got to answer my question. My  
7 question is, how much water do you need to float that  
8 boat?

9 A. Three inches.

10 Q. Three inches. So any stream that has three  
11 inches of water, do you feel satisfies the Daniel Ball  
12 Test?

13 A. No, that's not what I said at all.

14 Q. Okay. Well, explain to me why that's not the  
15 case.

16 A. I think for the Gila River -- which is why  
17 we're here today -- three inches, it just doesn't  
18 matter. It doesn't exist on the river, so --

19 Q. I'm asking -- I'm not asking about the Gila.  
20 I'm asking hypothetically. If you have a stream that  
21 has three inches of flow and that's its ordinary and  
22 natural condition, based upon the minimum depth of flow  
23 you have indicated here for a canvas folding boat, does  
24 that in your mind make that a navigable stream under the  
25 Daniel Ball Test?

1 A. I guess you can use this against me whenever  
2 we adjudicate a stream that has minimum -- a maximum  
3 depth of three inches, but personally I would not say  
4 three inches would make a navigable stream.

5 Q. Why not? If you have a craft here you've  
6 identified that has a minimum depth of flow of 3 inches?

7 A. Because of my personal experience as a boater.  
8 Three inches is just not a lot of fun to boat, not a lot  
9 of practical use. It's not very deep. I don't think  
10 you would even use it as a highway of commerce at 3  
11 inches deep.

12 Q. But at 6 inches deep you're fairly confident  
13 you would use it as a highway of commerce?

14 A. Yeah.

15 Q. Can you describe the distinction?

16 A. Three inches.

17 Q. Okay. Good enough for me.

18 It's true -- you had some PowerPoints  
19 yesterday about inflatables, and we already talked about  
20 there's no evidence of using inflatables along the upper  
21 Gila River before statehood. More generally speaking,  
22 inflatables were not commonly used in Arizona until the  
23 1940s; isn't that right?

24 A. Were not commonly used?

25 Q. Yeah.

1 A. I don't have any evidence that they were  
2 commonly used or not commonly used before 1937, I think  
3 was the first trip in the Grand Canyon. But I do know  
4 that Whipple used it in the mid 1800s.

5 Q. Let's take a look at -- let's take a look at  
6 Page 22 of the Criteria for Assessing Characteristics of  
7 Navigability for Small Watercourses in Arizona. Page  
8 22.

9 A. Okay.

10 Q. Could you read out loud, please, the last  
11 sentence of the first paragraph?

12 A. "Use of inflatables, however, did not become  
13 common until the development of artificial rubber in the  
14 1940s."

15 Q. And this report goes on to say that inflatable  
16 boats did not become feasible until artificial rubber  
17 was developed during World War II. Do you recall that  
18 in this report?

19 A. I don't recall that.

20 Q. It's on Page 32. Second paragraph, second  
21 sentence, it says, "Inflatable boats were available as  
22 early as the 1850s, but these boats were awkward,  
23 difficult to maneuver, and not very durable, and it was  
24 not until artificial rubber was developed during World  
25 War II that inflatables became feasible." Is that what



1 it says?

2 A. It does say that.

3 Q. Ms. Tellman -- we talked about Mr. Gilpin  
4 specifically. Ms. Tellman was also a part of your  
5 project team who testified back in 2005; is that right?

6 A. Yes.

7 Q. And she said that native tribes from South  
8 America all the way up to Alaska all had some kind of  
9 boating if they lived anywhere near water. And I can  
10 point you to that point in the transcript, if you'd like  
11 to see it. Does that ring a bell?

12 A. It doesn't ring a bell, but I'm guessing that  
13 you're not lying about it, so --

14 Q. Do you have any disagreement with that  
15 statement?

16 A. Read it to me one more time.

17 Q. Sure. "Native tribes from South America all  
18 the way up to Alaska all had some kind of boating if  
19 they lived anywhere near a river."

20 A. Well, I agree that she said that, but I really  
21 don't have any knowledge of native tribes up and down  
22 the coast. I can't verify it or disclaim it.

23 Q. You would agree that as a general matter  
24 there's a lot of evidence of tribes and native peoples  
25 living near rivers and boating those rivers, correct?

1 A. Sure.

2 Q. Just as a general matter?

3 A. A general matter.

4 Q. And how do we know that? We know that because  
5 of records. We know that because of oral traditions.  
6 We know that because of archaeological findings,  
7 correct?

8 A. Those would be ways to know those kinds of  
9 things, true.

10 Q. You would agree with me that the Gila River  
11 has a long record of prehistoric use and occupation,  
12 correct?

13 A. Yes.

14 Q. And in fact, the Gila River has been used  
15 continuously for more than a millennium; is that right?

16 A. Yes.

17 Q. We have, in fact, a history of a thousand plus  
18 years of an irrigation-based civilization, true?

19 A. That's true.

20 Q. And yet there's no archaeological evidence of  
21 boating by those people on the Gila River, true?

22 A. Archaeological evidence on the Gila River.  
23 I'm not sure that that's true. There's certainly  
24 minimal evidence.

25 Q. Any evidence whatsoever of use of the river

1 for trade or commerce by those indigenous peoples living  
2 along the river?

3 A. I can't recall any at this time.

4 Q. Let's take a look -- let's take a look at your  
5 upper Gila River report from '03 on Page 2-23. If I'm  
6 not mistaken, Chapter 2 is relating to archaeological  
7 findings; is that right?

8 A. Yes, it is.

9 Q. That chapter titled Archaeological Overview of  
10 The Upper Gila and San Francisco River Valleys, and here  
11 on Page 2-23 we have a Summary and Conclusions; do you  
12 see that?

13 A. I do.

14 Q. Okay. And we have in summary, archaeological  
15 studies of the Upper Gila and San Francisco Rivers in  
16 Arizona have been fairly limited, and although  
17 archaeologists have documented some 11,000 years of  
18 human use of southeastern Arizona, and it goes on to  
19 describe some of the archaeological study and findings;  
20 is that right?

21 A. Yes.

22 Q. The last sentence reads, "Archaeological  
23 research has not documented any use of the river for  
24 commercial trade and travel nor any regular floatation  
25 of logs," correct?

1 A. For this segment of the river upstream of  
2 Safford, yeah.

3 Q. You don't disagree with that statement?

4 A. I have no reason to disagree with it.

5 Q. More generally -- because you're right, that's  
6 the upper Gila report. But more generally, Mr. Gilpin  
7 talked about archaeological evidence relating to the  
8 entire river when you testified back in 2005; is that  
9 right?

10 A. I would imagine that's correct, yeah.

11 Q. Let's take a look -- let's take a look at the  
12 November 16th transcript, Page 47.

13 A. Which date?

14 Q. It's November 16, 2005.

15 A. 47?

16 Q. Yeah. And I'll note for the record you can  
17 tell it's Mr. Gilpin testifying back on Page 45. It  
18 indicates that he is the witness. And if we go back to  
19 47, we have a question that begins on Line 18 on that  
20 page. Do you see "Okay"?

21 A. Yes.

22 Q. "And in the case of the river people of the  
23 Gila River, you have no knowledge of any record of any  
24 nature that at any time over the last 2,000 years these  
25 people -- these river people ever used that stretch of

1 the river that is currently encompassed within the Gila  
2 River Indian Reservation as a highway of commerce of  
3 transportation. Is that correct?"

4 Mr. Gilpin responded, "I do not recall that."

5 In follow-up the questioner said, "I'm not  
6 asking if you recall. Do you know of any instance?"

7 And Mr. Gilpin responded, "I can't give you an  
8 instance in which I know that that occurred," correct?

9 A. Correct.

10 Q. So we've covered the upper, and then it was  
11 actually Mr. Hestand at the time that was talking about  
12 the portion of the Gila River that goes through the Gila  
13 Indian Reservation. And you don't have any evidence  
14 that Mr. Gilpin didn't have about archaeological  
15 evidence of use of that stretch of the river, do you?

16 A. I can't recall any today.

17 Q. Any evidence of archaeological use of the  
18 river for trade or commerce on any other stretch of the  
19 river that you have today?

20 A. No.

21 Q. As I understood, going back to the transcript,  
22 as I understood it, you handled, you handled the  
23 hydrology and the geomorphology of the upper Gila  
24 River -- that's north of Safford -- and Mr. Huckleberry  
25 worked downstream of Safford; is that right?

1 A. Yes.

2 Q. Okay. There was a question asked of you back  
3 in 2005 towards the end of your testimony, about the  
4 lower portion anyway, of the lower Gila, whether you had  
5 any opinions as to navigability. And your statement was  
6 as to downstream of the confluence with the Salt, you  
7 did believe it was navigable; is that correct?

8 A. You need to show me. It's been a long time.

9 Q. Sure, sure, I understand. We're still on  
10 November 16th. It's Page 121. Middle of the page, Line  
11 12 there's a question from Mr. Helm. "So you have an  
12 opinion yourself based on the studies that you have done  
13 that -- what I'll call the lower Gila below the  
14 confluence where the Salt is in fact -- or was in fact  
15 navigable or susceptible to navigation at the time of  
16 statehood?" And it goes on, but you give your opinion  
17 that you felt that that segment was navigable, correct?

18 A. That's correct.

19 Q. Okay. You did not give any opinions back in  
20 2005 as to the navigability or nonnavigability of the  
21 upper Gila River in its ordinary and natural condition  
22 at the time of statehood; is that correct?

23 A. Not that I recall. And just to clarify, that  
24 was our understanding of our role at that time was to  
25 not offer opinions, and Mr. Helm was aware of my

1 testimony in another case, and that's the context of  
2 this discussion that you're quoting here.

3 Q. Back to your boating PowerPoint. Actually,  
4 let me ask you something more generally. You had a few  
5 different slides where you talked about populations at  
6 various times, and I think you even showed a curve of  
7 population growth over time. Do you recall those?

8 A. I do.

9 Q. Those population figures don't include Native  
10 American populations, correct?

11 A. I don't know that for a fact. They're U.S.  
12 Census Bureau data, and I don't know whether they  
13 counted Native Americans or not.

14 Q. Did you look into that?

15 A. No.

16 Q. You start off in the early 1800s with a very  
17 low population number. Is it probably a fairly safe  
18 assumption that that did not encompass Native American  
19 populations at that time?

20 A. I don't know.

21 Q. Let's turn to -- let's see, it's probably,  
22 it's probably 58 on your boating PowerPoint. My  
23 pagination is a little different. Is this navigability?  
24 Is this boating? My pagination is off. Give me one  
25 moment.

1 A. You wanted 58 of the Gila River presentation?

2 Q. Boating in Arizona.

3 A. Oh, that's where I was.

4 Q. Okay. Good. Actually, let's go to 62,  
5 please. Okay. You talked about -- your explanation for  
6 why there wasn't more instance of boating pre-statehood  
7 was there weren't enough people here when we had the  
8 water; and when there were enough people, we didn't have  
9 the water. Is that a fair summary?

10 A. That's part of the reason, yes.

11 Q. In that time frame though while we were still  
12 in our ordinary and natural condition, weren't there  
13 mining operations in the region?

14 A. Yes.

15 Q. Okay.

16 A. Well, the mining operations, as I understand  
17 them, were beginning at about the same time as the  
18 diversions. So you didn't have better knowledge of the  
19 onset of a particular mining operation, so --

20 Q. Are you aware of the mining operations at  
21 Clifton?

22 A. Yes.

23 Q. In that time frame?

24 A. My understanding, I thought they were in the  
25 1870s.



1 Q. Well, let me ask you this, Mr. Fuller. Your  
2 take on navigability is that the river is still  
3 navigable much of the year today even in its depleted  
4 state. If you're talking about a few years of  
5 diversions in the 1870s, there's not going to be enough  
6 impact to get below your threshold, is there?

7 A. Well, that's a different question than what  
8 you were just asking me.

9 Q. It's a follow-up though -- if your view of  
10 navigability is all you need is six inches, there was  
11 still six inches in the upper Gila River in 1873; isn't  
12 that right?

13 A. Yes.

14 Q. Okay. So that doesn't really explain away the  
15 nonuse of boating at that time, does it?

16 A. But the presence of diversions could have  
17 discouraged some people from taking boating expeditions.

18 Q. Why is that, if there was still enough water?  
19 It's all about depth.

20 A. Certain people don't like to boat past  
21 diversions. It wasn't an open river in some places.  
22 Some places water was being taken out.

23 Q. Are you aware of any instance of the Clifton  
24 mine ever being supplied by boat?

25 A. No.

1 Q. Are you aware that it was, until the railroad  
2 came in, that it was supplied by wagon?

3 A. That doesn't surprise me at all. I'll also  
4 point out that Clifton is not located on the upper Gila.

5 Q. Where is it located?

6 A. It's on the San Francisco River.

7 Q. Another stream that you feel is navigable and  
8 yet there's no instance of ever supplying that mine  
9 using navigation, correct?

10 A. Right, I spent a good deal of time yesterday  
11 talking about why the mines might choose not to use  
12 boats to ship their supplies and materials.

13 Q. Is it your contention that it was less  
14 expensive for mining companies to ship by wagon train  
15 than by using navigation? If they're bringing supplies  
16 up from Yuma or down to Yuma, is it cheaper to do a  
17 wagon train as opposed to use the river?

18 A. My understanding from working for mines is  
19 they choose the least cost option for everything they  
20 would do. I don't have any specific knowledge about  
21 tonnage rates for mules or wagons versus railroad or  
22 versus the boat. I can tell you that moving upstream on  
23 the Gila River in the kind of boats, as I mentioned  
24 yesterday, that the river can support, it would take  
25 many, many boats, many, many loads, and you would move

1 very slowly, much slower than a wagon.

2 Q. That's right. Not very feasible to go  
3 upstream on the Gila for those purposes, correct?

4 A. Feasible, but not very economical.

5 Q. And in fact, there's virtually no history, and  
6 in fact -- let me start over. There's no history  
7 pre-statehood of commercial travel upstream on the Gila,  
8 correct?

9 A. There are no documented accounts.

10 Q. Commercial or noncommercial upstream travel on  
11 the Gila, correct?

12 A. No documented accounts.

13 Q. Do you contend that it would have been faster  
14 for mining operations in the upper Gila to ship via  
15 wagon as opposed to using the river?

16 A. Yes.

17 Q. You do? What do you base that on?

18 A. Having been boating myself and flipped my boat  
19 around and worked my way upstream, it's a lot of work.  
20 You go pretty slow. Even going in the downstream  
21 direction, two, three miles an hour is a pretty typical  
22 rate.

23 Q. I got the -- if you had a higher flow river,  
24 you'd be moving faster as a general proposition,  
25 correct?

1 A. In the downstream direction?

2 Q. Correct.

3 A. All other the things being equal, more flow  
4 generally means more velocity.

5 Q. I got the impression from you yesterday -- and  
6 I don't have a quote written down, but I got the  
7 impression that your view is if upstream travel is not  
8 that feasible or if it's not susceptible to upstream  
9 travel, that's not really relevant for the Daniel Ball  
10 Test. Was that a fair perception that I had yesterday  
11 from your testimony?

12 A. Yes. My understanding of the Daniel Ball Test  
13 that I see no mention of the word "upstream."

14 Q. On Page 65, if you would, of this same  
15 PowerPoint -- we're still on the boating in Arizona  
16 PowerPoint -- you talked about some alternatives  
17 available that might be an explanation for the lack of  
18 use of the river, and you talked about railroads, and  
19 you say there 1870s. There were no railroads in the  
20 region prior the 1870s, correct?

21 A. That's my understanding, correct.

22 Q. And we talked a little bit about wagon.  
23 Obviously, there were no automobiles in that time frame,  
24 correct?

25 A. Not in 1870, no.

1 Q. Right. Right. Any other alternative means of  
2 supplying mining operations in that time frame that you  
3 feel maybe that's what they were doing instead of using  
4 the river?

5 A. There could have been horseback, walking in.  
6 I really can't think of any others besides that.

7 Q. And there were also military operations in the  
8 upper Gila River in that time frame when we're still  
9 dealing with a relatively undepleted stream, correct?

10 A. In the time frame of 1870?

11 Q. Yes.

12 A. I believe that there were some forts out  
13 there, yes.

14 Q. And I take it from our earlier discussions  
15 that you don't have any evidence suggesting that those  
16 forts or military installations were supplied using the  
17 river?

18 A. That's correct.

19 Q. And we had Post Offices in that same time  
20 frame, is that right, in the 1870s?

21 A. I would imagine. I don't recall  
22 specifically.

23 Q. And whether there were or weren't -- and we'll  
24 demonstrate that there were -- you don't have any  
25 evidence that those Post Offices were being supplied

1 using the river, true?

2 A. I do not.

3 Q. Could you flip, please, to slide 67?

4 A. All right.

5 Q. And you have some segments of Arizona rivers  
6 not conducive to carrying major tonnage. In your  
7 opinion, Mr. Fuller, would that description apply to the  
8 upper Gila River in its ordinary and natural condition  
9 at the time of statehood?

10 A. Yes.

11 Q. And again, here we touch upon it again. Not  
12 easy to travel upstream, and that would apply to the  
13 upper Gila as well?

14 A. Yes.

15 Q. And when you talk about rivers were diverted  
16 and dammed before statehood, we've talked about the time  
17 frame in which you feel that diversion started to take  
18 an impact?

19 A. We have.

20 Q. You had a slide yesterday.

21 A. Yes, I did.

22 Q. Yeah, you had a few of them. You had a slide  
23 yesterday talking about the amount of time it took for  
24 people to get up to speed on boating and acquiring skill  
25 to boat. Do you recall that?

1 A. I do. I'm assuming you would like me to find  
2 it.

3 Q. Yeah. I've got it --

4 A. It's slide No. 8 in the boating presentation.

5 Q. Right. Okay. It says, "27 years required to  
6 acquire skills and develop the type of boats needed to  
7 navigate the Missouri."

8 You don't contend it would have taken 27 years  
9 from when people started to populate the Gila River  
10 valley to start to boat it. That's not what you mean to  
11 say there, I assume?

12 A. What I'm assuming -- no, I guess the shortest  
13 answer to your question is no.

14 Q. Because we had people who were adept at  
15 boating in the area, right? We already had them on the  
16 Colorado going up and down the Colorado and so we had  
17 people with the skill in the area, correct?

18 A. There were people on the Colorado who had the  
19 skills to move on the Colorado, true.

20 Q. Do you feel that their skills would not have  
21 applied to the Gila?

22 A. I think that's one of the points of this slide  
23 right here is that you had people who were boaters who  
24 were probably using the Mississippi and when they turned  
25 to the Missouri, they needed to develop new skills.

1 Probably needed to modify their boats. That says  
2 something about evolving the type of boats. So whether  
3 it's 27 years or 40 years or 50 years, sometimes it just  
4 takes people time to develop the right kind of boat for  
5 the river.

6 Q. For someone who is an adept steamboat boater,  
7 how hard is it going to be for him to learn to use a  
8 dugout canoe? Is it going to take 27 years?

9 A. You know, that's a question about an  
10 individual, so, you know, who knows for a particular  
11 individual. So hypothetically speaking, depending on  
12 the person's physical characteristics, you know -- put  
13 it this way. If you had never been in a dugout canoe  
14 before, I feel fairly confident I could build you a  
15 dugout canoe and get you up to speed in using it within  
16 a year. But you look like a pretty healthy guy. Some  
17 other folks I try to teach canoeing, and it doesn't  
18 work.

19 Q. On Page 69, if you could flip over to 69 of  
20 the boating PowerPoint. Okay. You've got a number of  
21 bullets here. These are more reasons why you think  
22 maybe there wasn't more instances of boating on the Gila  
23 in its ordinary and natural condition. One thing you  
24 say is you don't own a boat. But we had plenty of  
25 instances where you've got cottonwoods there available



1 to build a canoe, right?

2 A. Uh-huh.

3 Q. There were cottonwoods in the area that were  
4 suitable for that purpose?

5 A. If you knew what you were doing, you could try  
6 to build a dugout. I don't know if you've ever tried to  
7 build a dugout. It's not for everybody.

8 Q. There are instances of people navigating the  
9 Colorado by doing just that; isn't that correct?

10 A. There are, yes.

11 Q. If you go to the next slide, please, which I  
12 think is 70, I think. Yeah. Your fifth bullet down it  
13 says, "You can't risk capsizing." And can you explain  
14 what you mean by that?

15 A. Whatever it is that you're carrying would be  
16 dangerous for it to flip into the water, like your baby.  
17 Something like that.

18 Q. Does this apply not only to dangerous  
19 circumstances, but perhaps where you're worried about  
20 losing the value of what you've been working on all  
21 those years?

22 A. Sure, could. If it were nonrecoverable.

23 Q. Today you're going to put it in some sort of a  
24 plastic container and tie it off and so forth and you  
25 have waterproof containers. Those didn't exist back

1 then, correct?

2 A. I'm not going to put my baby in one of those,  
3 but if I had my nugget of gold. Yeah, there were  
4 floatation devices and things that you could strap onto  
5 parts of your boat, whatnot.

6 Q. Were their failsafe waterproof products  
7 available back in its ordinary and natural condition on  
8 the Gila?

9 A. You know, I don't even know the answer to  
10 that. Could be. I know that the Powell Expedition had  
11 sealed compartments in their boats. There weren't  
12 plastic Pelican cases, I can tell you that.

13 Q. You talked about some accounts of log floating  
14 in Arizona. But that does not apply to the upper Gila  
15 River; is that true?

16 A. That's true.

17 Q. Page 76, please, of your boating PowerPoint.  
18 Okay. And these are the Federal Minimum Standards for  
19 Boating is the title of this slide; is that right?

20 A. That's right.

21 Q. And these are -- these are modern recreational  
22 boating standards for recreational craft, right?

23 A. That's the title of the slide, yes -- or the  
24 table.

25 Q. Are these referred to as the Hyra method?

1 A. I don't know.

2 Q. Have you seen -- have you seen where at  
3 various times Mr. Hjalmarson has relied on these same  
4 standards?

5 A. I know that Win had a number of things in his  
6 presentation. I don't recall specifically what he used.

7 Q. And if using these standards, the San Pedro  
8 would have been navigable in its ordinary and natural  
9 condition, you just don't recall. I think we touched on  
10 that. You're just not --

11 A. I did not come prepared to talk about the San  
12 Pedro.

13 Q. Let's talk about on Page 77 of your boating  
14 PowerPoint -- it's the next page. You list some state  
15 standards for boating, and one of them is Washington.  
16 And it has a depth classification: Probably not, maybe,  
17 and probably; is that right?

18 A. That's right.

19 Q. And probably not is for streams of what depth?

20 A. I don't recall specifically. I know it's in  
21 Mr. Burtell's report. I believe it's in Mr. Burtell's  
22 report. It might have been in Mr. Gookin's report. It  
23 was in one of the expert reports that came in.

24 Q. Okay.

25 A. I had never heard of it before, and so we

1 called up the folks that did it and tried to find out  
2 what we could.

3 Q. Does it sound about right that under the  
4 Washington depth classification if a stream is less than  
5 two feet, it is classified as probably not navigable?

6 A. That's my vague recollection, but --

7 Q. If I'm wrong, we can look at the standards.

8 A. There you go.

9 Q. Okay. I want to -- I apologize for circling  
10 back. We talked a little bit about bull boats before,  
11 and we referenced, we referenced one excerpt from your  
12 upper Gila report from 2003. But I want to circle back  
13 and also take a look at one other portion of that  
14 report. If you go to page 8-3.

15 A. This is in the upper Gila report?

16 Q. Correct.

17 A. All right.

18 Q. This is -- I guess this is a little  
19 superfluous. But I just want to point this out. The  
20 last paragraph on that page, the second sentence, it  
21 reads very similar to the one we read before, but it  
22 says, "The Chiricahua Apaches of the region were known  
23 to construct boats made of bull hides stretched over  
24 wooden frames for crossing streams, although no  
25 instances are specifically recorded for the upper Gila

1 and San Francisco Rivers," correct? That's what it says  
2 in the report?

3 A. That's what it says in the report. As long as  
4 there's a pause here, I'm just going to take the  
5 opportunity to say the reason that we believe that to  
6 use the Gila River is that absent the Gila or the San  
7 Francisco, there aren't a lot of other rivers out there.  
8 I'll also say that I don't think the case is made or  
9 break based on alleged Chiricahua use of bull boats  
10 crossing the stream, so --

11 Q. I agree with that. We're just talking about  
12 bull boats going across the channel. Okay. We're in  
13 agreement that's probably not extremely relevant.

14 A. And yet you brought it up. And you wanted me  
15 to hurry.

16 Q. You brought it up yesterday. I would have  
17 skipped over it. I would have rested on the report if  
18 that was not in your PowerPoint prominently.

19 Let's take a look at -- let's switch over to  
20 your navigability PowerPoint now, please.

21 CHAIRMAN NOBLE: Are we switching?

22 MR. HOOD: To PowerPoint, yeah, a different  
23 PowerPoint.

24 CHAIRMAN NOBLE: Is this a good time to take a  
25 break?

1 MR. HOOD: Now is a great time, Mr. Chairman.

2 CHAIRMAN NOBLE: Gary, is that good with you?

3 THE REPORTER: Sure.

4 CHAIRMAN NOBLE: We'll take a 15-minute break.

5 (Recessed from 10:11 a.m. to 10:24 a.m.)

6 CHAIRMAN NOBLE: Mr. Hood, you're on.

7 MR. HOOD: Mr. Chairman, I appreciate it.

8 BY MR. HOOD:

9 Q. Mr. Fuller, I want to talk generally about fur  
10 trappers that operated along the upper Gila in the  
11 1820s. Okay?

12 A. Okay.

13 Q. And those included -- we talked a little bit  
14 about Pattie. Also included Ewing Young and Kit Carson;  
15 is that right?

16 A. Yes.

17 Q. Okay. And if you take a look at page 8-2 of  
18 your upper Gila River report, the middle paragraph there  
19 about halfway down, two-thirds down. But let me  
20 start -- let me back up a little bit. The third  
21 sentence says, "By the 1820s Mexico had won its  
22 independence from Spain, and American fur trappers, such  
23 as James Ohio Pattie, Ewing Young, and Kit Carson  
24 explored the upper Gila and San Francisco Rivers;" is  
25 that right?

1 A. Yes.

2 Q. "Trapping beaver along the rivers," correct?

3 A. Yes.

4 Q. "And establishing a travel route into  
5 Arizona," correct?

6 A. Yes.

7 Q. Okay. And then the report goes on to say,  
8 "These early trappers traveled primarily on horseback or  
9 on foot in the study area, although their records  
10 indicate that they built and used canoes and rafts when  
11 they reached the Colorado River downstream of the study  
12 area," correct?

13 A. That's correct.

14 Q. So this is an instance, the river did go where  
15 they were going because they ended up, they ended up at  
16 the mouth of the Colorado; is that right?

17 A. The river does go from the Gila-San Francisco  
18 confluence down to the Colorado, that's correct.

19 Q. And so this -- and I understand what you had  
20 to say about Pattie earlier, but you don't have any  
21 evidence that Ewing Young or Kit Carson boated the Gila  
22 River, correct?

23 A. I do not.

24 Q. Let's talk one more time about Pattie.

25 MR. HOOD: Mr. Chairman, can I approach the

1 witness one more time?

2 CHAIRMAN NOBLE: Yes, thank you.

3 BY MR. HOOD:

4 Q. Okay. This is, this document is titled Man  
5 and Wildlife in Arizona: American Exploration Period  
6 1824 to 1865 by Goode P. Davis, Jr. And let's take a  
7 look at Page 21. If you look a little bit past halfway  
8 down, you can see where they're talking about the Beaver  
9 River, the San Pedro where Pattie reported that they  
10 found beaver in considerable numbers. Do you see that?

11 A. I don't. Which paragraph are you on?

12 Q. It's Page 21. It is -- it is about a little  
13 past halfway down. It says, "They pushed on."

14 A. Yes.

15 Q. They pushed on to Beaver River, and goes on in  
16 the next paragraph it says, "Back on the Gila, the  
17 trappers were forced by hunger to eat some of their dogs  
18 and horses." Is that right?

19 A. Apparently.

20 Q. Okay. At the end of that paragraph it talks  
21 about the party reached the Colorado on December 1st,  
22 1827. Do you see that?

23 A. Yes.

24 Q. And this is -- it was at this point that all  
25 but seven of the trappers revolted against the authority



1 of Sylvester Pattie, who I understand was James Pattie's  
2 father; is that right?

3 A. That's what I understand.

4 Q. Okay. If we go down to the next paragraph, it  
5 says, "Below the mouth of the Gila, misfortune again  
6 plagued the eight men of the Pattie company. Indians  
7 stole all their horses and the mountain men had to  
8 compensate by hollowing out Cottonwood logs to serve as  
9 canoes."

10 And if we turn over to the next page, it says,  
11 "All the pelts and supplies were loaded" -- then you  
12 have to turn to page 22 -- "into the dugouts, and the  
13 expedition proceeded downriver on December 9. They  
14 hoped ultimately to find a Mexican settlement in the  
15 delta of the Colorado to which some Indians had vaguely  
16 alluded."

17 Doesn't Mr. Davis's interpretation of the  
18 Pattie memoirs indicate that those eight canoes were  
19 navigated on the Colorado, were not used on the Gila?

20 A. That seems to be what it's saying right here  
21 about the delta area.

22 Q. Well, let's back up. On Page 21 it says, "The  
23 party reached the Colorado on December 1, 1827." And  
24 then it goes on to talk about them constructing the  
25 canoes, right?

1           A.       Yeah, I think it might be open to  
2 interpretation. In the second paragraph that you read  
3 to me, it says, "Back on the Gila, the trappers were  
4 forced by hunger to eat some of their dogs and horses.  
5 "On November 15, on the lower Gila River, Pattie and his  
6 companions stopped to construct a canoe so they could  
7 trap both sides of the river which he states was too  
8 deep to be forded on horseback. The canoe, presumably  
9 some sort of dugout, apparently functioned  
10 satisfactorily and the party reached the Colorado on  
11 December 1."

12                       So it sounds like there is at least one canoe  
13 that went from someplace on the lower Gila down to the  
14 Colorado. The canoes they're talking about sound like  
15 they were in the delta.

16           Q.       They were on the Colorado River?

17           A.       Yes.

18           Q.       Okay. And there was discussion in Pattie's  
19 memoir about them constructing a single canoe, and they  
20 used that to cross the river back and forth, to lay  
21 traps and not have their scent throw off the beavers; is  
22 that right?

23           A.       Sounds reasonable. I don't know.

24           Q.       You aren't familiar with that portion of  
25 Pattie's memoirs?

1 A. No.

2 Q. Okay.

3 A. I have seen quotes where he talked about using  
4 it to trap beaver. In regard to the scents and whatnot,  
5 that I don't know.

6 Q. But you agree that the -- according to this,  
7 the 8 canoes are on the Colorado, not on the Gila?

8 A. In the paragraph we just read, they're  
9 describing being on the Colorado, correct.

10 Q. On your navigability PowerPoint -- are we  
11 still there?

12 A. Yes.

13 Q. On Page 75 towards the bottom, you have a  
14 bullet point that reads, "Why did they canoe the  
15 Colorado," and then you say, "There were no land  
16 alternatives." What do you mean by that?

17 A. To get across the river, you needed a boat to  
18 get across the river.

19 Q. Okay. That's to cross the Colorado?

20 A. Right.

21 Q. Okay. If you're traveling along the Colorado,  
22 it's a wide alluvial plain. You can certainly travel  
23 along the stream on horseback and by wagon, so forth,  
24 correct?

25 A. Certainly parallel to it, yeah.

1 Q. You had a series of slides yesterday on river  
2 descriptions. Do you recall that?

3 A. I do.

4 Q. And I believe they're going to start on  
5 probably about 78.

6 A. Okay.

7 Q. And I just want, I want to flip through them  
8 and just identify the ones that relate in any way to the  
9 upper Gila, okay?

10 A. I think each of them has the segment, it's  
11 listed there.

12 Q. Okay. So as I flip through -- let's see, 78  
13 and 79 don't relate to the upper. If we turn to 80, you  
14 have this James Ohio Pattie description, and where do  
15 you get that description from?

16 A. It actually came out of a draft document that  
17 the Arizona Attorney Generals had provided with their  
18 statement of facts. I don't know if that's been  
19 disclosed or not, if it's a work product. And what they  
20 were doing was citing to the record that are arguments  
21 submitted. It's kind of pointing as in a daisy chain  
22 back to something that's done there.

23 Q. Okay. And I don't think Mr. Katz wants to  
24 give me his draft statement of facts just yet, so --

25 A. Probably not.

1 Q. Can you tell me what the ultimate source for  
2 that is? And it sounds like maybe you can't.

3 A. Not today. I would have to pull out that  
4 secret document.

5 Q. This is one statement that you're attributing  
6 to all segments, and it's hard for me to evaluate that  
7 when I don't know where you got this from. You must  
8 have been talking about one particular place when he  
9 said beautiful, running between banks with tall  
10 cottonwoods and willows, plenty of beaver?

11 A. He may have been, or he may have been saying,  
12 my general impression of the river was this. The way I  
13 wrote it down, to me it implies that it's his general  
14 impression of the river. It may not be. We can clarify  
15 that.

16 Q. Okay. And again, he does talk again about the  
17 tall cottonwoods which are suitable for dugout canoes,  
18 correct?

19 A. Sure. Yes.

20 Q. If we go to the next slide, which is 81, we  
21 have the Kearny Expedition discussion, doesn't relate to  
22 Segment 1. We have a description from Johnson, 30 feet  
23 wide, one foot deep on the shallows. Pebbly bed,  
24 fringed with trees. Again we have trees, and what is  
25 your source for this statement?

1 A. It's one of the documents describing the  
2 Kearny Expedition. I'm sorry, I didn't write that down.

3 Q. Okay. And if we turn to Page 83, this is the  
4 other one that you have that you corresponded with  
5 segments, one of the segments in the upper Gila. We  
6 have Segment 1, twelve yards wide, one and a half foot  
7 deep, abounds in trout. Whose account is this?

8 A. I don't recall today. Sorry, I didn't write  
9 that down.

10 Q. Those are the only ones that relate to the  
11 upper Gila that you put in your PowerPoint as I read  
12 your PowerPoint; is that fair?

13 A. Let me quick check.

14 Q. Sure, please.

15 A. That's correct.

16 Q. And I want to -- if you turn to Page 3-1 of  
17 your upper Gila report, I realize that I misspoke  
18 earlier, and I want to correct this for the record.

19 I have a nagging sense that I said that the  
20 railroad was constructed in the 1860s, and it was  
21 actually in the 1870s; isn't that right, Mr. Fuller?

22 A. It was in the 1870s, and I don't recall you  
23 saying that it was the 1860s.

24 Q. Good. Maybe I didn't make that mistake then.

25 If we turn to Page 3-1, towards the bottom of

1 the last paragraph on the page, it says, it talks about  
2 the early forms of transportation in the area. Do you  
3 see that?

4 A. Okay.

5 Q. It says, "Early forms of transportation  
6 included horses, mule trains, wagons, and stagecoaches,  
7 and railroads to the mines began to be constructed in  
8 the late 1870s," right?

9 A. Okay.

10 Q. And sort of conspicuous by its absence among  
11 the early forms of transportation noted here is any form  
12 of navigation of the river, correct?

13 A. It does not mention navigation of the river  
14 here.

15 Q. Turning to -- let's stay in the same report  
16 and turn to page 3-25. We have a block quotation from  
17 Patton, and it talks about Clifton, and consistent with  
18 the omission of any mention of using the stream on the  
19 prior note we looked at, it says, "In the very earliest  
20 days of Clifton, i.e., in the 1870s, the town had two  
21 connections with the outside world. One of these was a  
22 stage road to Solomonville 45 miles down the river." So  
23 following the river, but not using it.

24 There was another stage road to Silver City,  
25 New Mexico, a hundred miles to the southeast. So

1 according to this, there were two connections between  
2 Clifton and the outside world, and neither one of them  
3 was by boat, correct?

4 A. It does not mention boats in this paragraph,  
5 that is correct.

6 Q. You would agree, Mr. Fuller, that we have no  
7 evidence of significant commercial boating industries  
8 developed on the upper Gila and San Francisco Rivers as  
9 of 1912?

10 A. You asked if we have no evidence of commercial  
11 boating industries developed on the upper Gila as of  
12 1912; is that correct?

13 Q. Yes. Your team's words, not mine. I probably  
14 wouldn't say it exactly that way.

15 A. Just reviewing what we've learned, and as I  
16 sit here today, I can't recall of any industries of  
17 commercial boating as of 1912.

18 Q. Question -- let's see, Page 91 of your  
19 navigability PowerPoint, and this is a photo of the Gila  
20 River in Duncan Valley, and do you know what date this  
21 photo was taken?

22 A. I don't.

23 Q. Do you know what its source is, the source of  
24 the photograph?

25 A. Hang on a second. No, I didn't write it down.



1 Q. Okay. Do you think you would be able to find  
2 out and let us know?

3 A. Yes.

4 Q. Turning to Page 101 of your navigability  
5 PowerPoint.

6 A. I'm not going to let you know unless I write  
7 it down here, so -- sorry, go ahead.

8 Q. Page 101 of your navigability PowerPoint.  
9 We're back to our good friend Pattie. And I just want  
10 to point out the second sub-bullet here, 1828, eight  
11 dugout canoes, comfortable descent. And it sounds like  
12 we may have some discrepancies between different works  
13 by Davis, but at least according to the ones that you  
14 and I just went over moment ago, those eight dugout  
15 canoes were on the Colorado, not on the Gila?

16 A. In the account we just read, those were on the  
17 Colorado River.

18 Q. And I apologize for the repetition, but I  
19 can't remember exactly what you said. The next bullet  
20 where we talked about canoed from Safford to Yuma  
21 several times, was that the slide where we had three  
22 citations, and you think one of those will give us an  
23 indication where you got that information?

24 A. Thank goodness. If you can't remember your  
25 questions, I can't remember either, so I don't recall,

1 I'm sorry.

2 Q. Let me ask you differently. You're not able  
3 to tell us where you got the information that he canoed  
4 from Safford to Yuma several times?

5 A. I believe that comes from -- it was  
6 attributed -- it was cited in Tellman's report, and I  
7 think she attributes that to Davis.

8 Q. Which Tellman report?

9 A. Arizona Changing Rivers.

10 Q. And again, if that's reflected in Pattie's  
11 memoirs, you're not familiar enough with his memoirs to  
12 show us where that is, correct?

13 A. That's correct. I believe she was citing his  
14 master's thesis, not this document here. That's my  
15 recollection.

16 Q. Let's take a look at -- we're still on your  
17 navigability PowerPoint. It's 115. Okay. And here  
18 we're talking again about Sykes. And you have here that  
19 according to Granger, Stanley Sykes of Flagstaff canoed  
20 the entire length of the Gila in Arizona?

21 A. Right.

22 Q. Okay. Do you recall what the testimony was  
23 about this trip back in 2005?

24 A. I don't.

25 Q. Okay. Let's take a look at the November 16th

1 transcript from the 2005 proceedings. Here we have on  
2 Page 106, she's talking about Stanley Sykes. Do you see  
3 at the top of the page?

4 A. Yes.

5 Q. If you go down to Line 4, "So he and his  
6 friends decided to see if they could go from Phoenix to  
7 Yuma by boat," and she goes -- this is Ms. Tellman  
8 testifying. For the record, you can get that from Page  
9 102 that she's the witness at this time. And she goes  
10 on to say, "The trip was quite unsuccessful." Do you  
11 see that on Line 9?

12 A. I do.

13 Q. Okay. It says, "Only one person could be in  
14 the boat at the time because the other one would weigh  
15 it down too much. So one person would walk along and  
16 pull the boat while the other one sat in it, or  
17 sometimes they both would pull the boat." Is that  
18 right?

19 A. I see that she said that, yes. I have no idea  
20 where she got that information. In the accounts that I  
21 read, I never saw that description.

22 Q. Let's take a look at Page 28 of the Final  
23 Report: Criteria for Assessing Characteristics of  
24 Navigability for Small Watercourses in Arizona.

25 A. Okay.

1 Q. The second paragraph you see she's talking  
2 about newspapers describing several adventuresome trips.  
3 Do you see that?

4 A. I do.

5 Q. The third sentence down it says, "Godfrey  
6 Sykes' brother Sidney," and I think you said  
7 yesterday -- and I agree with your interpretation --  
8 that's probably meant to be Stanley. Is that what you  
9 said yesterday?

10 A. Yes.

11 Q. Yeah. "Built a canvas boat around 1910," and  
12 again, you related it to your 1909. You thought they  
13 were probably the same trip. "Which he used for an only  
14 moderately successful winter low water trip down the  
15 Gila from somewhere downstream of Phoenix to the  
16 Colorado having to tow the boat much of the way."  
17 That's what her report said?

18 A. It says that, correct.

19 Q. Okay.

20 A. Again, I'm not sure where she got that  
21 statement. The accounts of that that I saw in the  
22 record stated that he went from -- it was the entire  
23 length. I'm not sure of her sources.

24 Q. Kino, Father Kino and his companions, the  
25 other Spaniards, they navigated the Colorado; is that

1 correct?

2 A. I don't recall.

3 Q. You don't recall that? Let's take a look at  
4 Page 21 -- same report, sorry. Final Report: Criteria  
5 for Assessing Characteristics of Navigability for Small  
6 Watercourses in Arizona. Again, this is Stantec  
7 Consulting in association with J.E. Fuller and the  
8 University of Arizona Water Resources Research Center.  
9 On Page 21 you see Arrival of the Spaniards?

10 A. Yes, I do.

11 Q. Okay. "Several groups of Spaniards arrived by  
12 sea along the California coast and the Sea of Cortez in  
13 large sailing ships. They proceeded up the Colorado  
14 River, probably not much farther than the mouth of the  
15 Gila River in their ships or in smaller ships, boats of  
16 various types, rowboats or canoes."

17 It goes on the sentence later, "The Spaniards  
18 are not known to have used boats on other Arizona rivers  
19 as their exploration inland was on horseback and on  
20 foot." Is that what it says?

21 A. That's what it says.

22 Q. Okay. And you're familiar with Kino and his  
23 group exploring parts of the Gila, the Santa Cruz, and  
24 the San Pedro over a period of time?

25 A. Vaguely, yeah.

1 Q. Okay. And unlike the Colorado, there's no  
2 evidence that they navigated any of those other streams,  
3 true?

4 A. That's what it says here.

5 Q. You don't have any evidence to the contrary,  
6 correct?

7 A. No. If I did, it would have been in my  
8 accounts that I put in yesterday.

9 Q. Let's turn to, back to your upper Gila report,  
10 please. On Page 8-2, it's true that the American  
11 military expedition of Stephen Watts Kearny and William  
12 Emory in 1846 included explorations of the upper Gila  
13 and San Francisco; is that right?

14 A. Yes, it is.

15 Q. And there's no record of them using the stream  
16 for transportation or for shipping or for any other  
17 purpose; is that right?

18 A. There's no record of them using the stream for  
19 boating other than anything I might have said otherwise.  
20 But in this sentence, it does not describe them using  
21 any boats on the river. They may have -- you said or  
22 any other purpose.

23 Q. Okay.

24 A. So kind of open-ended sort thing.

25 Q. If you had any accounts of them using the

1 river for boating, they'd be in your report, and we  
2 would have heard about them yesterday, correct?

3 A. That's correct.

4 Q. Same thing, same sentence here. They're  
5 talking about Bartlett's Boundary Survey. Again,  
6 there's no record of him using the stream for travel?

7 A. I would refer back to my presentation  
8 yesterday. Those are the accounts of boating that I'm  
9 aware of.

10 Q. And in fact, Bartlett, he recounted that his  
11 belief was that the Gila was not navigable, true?

12 A. I believe he also said that it was navigable,  
13 too. He earlier said that it was navigable, and then  
14 later said that it was not.

15 Q. Okay. Well, let's just look at what's in your  
16 report, Page 8-4. First full paragraph, "Early  
17 descriptions of the upper Gila and San Francisco Rivers  
18 do not differ significantly from contemporary  
19 descriptions of the rivers. Bartlett, 1854, believed  
20 that the Gila River was not navigable except during  
21 irregular floods." Is that right?

22 A. That's what it says here.

23 Q. And, of course, irregular floods would not be  
24 part of the natural or ordinary condition of the river?

25 A. I would agree with that.

1 Q. Turn, if you would, please to -- we're on your  
2 navigability PowerPoint, please. And we're on -- if you  
3 could turn, please, to slide 152. Okay. And here,  
4 you're talking about Mr. Burtell's reconstructive flow  
5 of the upper Gila; is that right?

6 A. Yes, that's correct.

7 Q. And for Segment 1 you say 1.7 to 1.8 feet  
8 hydraulic depth at Virden, correct?

9 A. That's correct.

10 Q. And we can cross-reference with Mr. Burtell's  
11 report at Table 10, if you like. But if you recall, he  
12 actually stated his depths as a maximum, correct? So he  
13 said less than 1.7, for instance?

14 A. He did.

15 Q. Is that true?

16 A. I believe that's right. Let me just  
17 double-check.

18 Q. Again, it's Table 10.

19 A. Yeah.

20 Q. So his depth for Virden is less than 1.7, less  
21 than 1.8, so forth, correct?

22 A. For his mean depth, yes.

23 Q. Okay. And then if we look at -- let's take a  
24 look at the Clifton numbers that you have here. For  
25 Clifton, you say 1.5 to 2.5, is that right, on your



1 slide?

2 A. Yes.

3 Q. And I think that might have accidentally been  
4 pulled out of the average velocity row from  
5 Mr. Burtell's table. He actually shows less than two  
6 feet.

7 A. You're correct.

8 Q. And a similar thing, I think just the wrong  
9 row was referenced for, let's see, for Bonita. Again,  
10 it doesn't say 2.5. It's actually the depth for below  
11 Bonita Creek is 1.1 to 2.2, and 1.5 to 2.5; is that  
12 right?

13 A. You're correct.

14 Q. Okay. On slide 194 of your PowerPoints.  
15 Okay. You're talking here about Jon Colby who testified  
16 back in 2005, and it says he ran this Cimarron  
17 Adventures and Gila Box for 17 years, recently stopped.  
18 Do you know when he discontinued that operation in Gila  
19 Box?

20 A. No, I don't know the exact date. But it was  
21 recent, according to the conversation that was related  
22 to me from Cheryl Doyle at the Land Department.

23 Q. When was that conversation with Ms. Doyle?

24 A. May 28th, this year.

25 Q. Sir, if you would please turn to 156 on the

1 same PowerPoint. We're on the navigation PowerPoint.  
2 And I just want to make sure I understand. I think I  
3 do. But when you're suggesting that a certain  
4 watercraft can be boated at a certain flow level, it's  
5 based on depth that you're relating back to the  
6 recreational watercraft federal standards that we talked  
7 about a little bit earlier; is that correct?

8 A. That's correct.

9 Q. And if we turn --

10 A. In part. So that's one of the sources I used.  
11 I also used my own personal experience in boating as  
12 well.

13 Q. Well, do you ever make a determination that a  
14 boat could be used on a particular depth that's  
15 inconsistent with that federal recreational standard?

16 A. I was speaking in terms of the flow rate as  
17 they relate to those depths, so --

18 Q. Okay. But ultimately the depths you're  
19 relating back to that federal recreational standard?

20 A. Yes.

21 Q. If we turn to Page 164.

22 A. Yes.

23 Q. Okay. You have a dotted line there that I  
24 don't have on what was sent around to the parties last  
25 week. And so I just -- I wasn't really clear on exactly

1 what that dashed line is. It looks like a flow duration  
2 curve that isn't on this one, on my copy.

3 A. It's not a flow duration curve. It's --  
4 hopefully, I got this one right. This was Mr. Burtell's  
5 reconstructed median monthly flows.

6 Q. Okay. And this is for Segment 3?

7 A. Correct.

8 Q. Okay. And if we turn to Page 167 on the same  
9 PowerPoint, does that appear again here, Mr. Burtell's  
10 median flow?

11 A. It is also from his report. They look like  
12 they're different. They're different, so probably using  
13 a different reach.

14 Q. Okay. And what about slide 172?

15 A. That looks like it's using the same as the one  
16 you just asked me about for Segment 4.

17 Q. And it's from Mr. Burtell's report?

18 A. That's right.

19 Q. He didn't look at Segment No. 5; is that  
20 right?

21 A. No, but I believe he -- this is the data that  
22 you had mentioned earlier that it's downstream of the  
23 reach you're concerned about, but it applies to that  
24 reach.

25 Q. I think actually that would be reach No. 4,

1 right, the data just below?

2 A. Correct.

3 Q. Right. So I skipped over that one because  
4 that does probably relate to actual data that  
5 Mr. Burtell looked at.

6 Segment 5 you superimposed calculations from  
7 Mr. Burtell for a reach he didn't look at, true?

8 A. Correct. The drainage there is not  
9 significantly different and the source of flow was  
10 basically from Segment 4.

11 Q. So you superimposed Mr. Burtell's data from  
12 Segment 4 onto Segment 5?

13 A. I have.

14 Q. And did you do -- what data did you use for  
15 Segment 6, which is a couple slides later?

16 A. That's on slide 177. And that's just a  
17 generalized average monthly flow. I'm just trying to  
18 show the seasonal fluctuation at that point. I don't  
19 have any monthly median flow rates for that segment.

20 Q. Do you agree, Mr. Fuller, that commercial  
21 recreational rafting did not really get started until  
22 the 1930s?

23 A. Commercial recreational rafting?

24 Q. Yeah. Again, your team's words. Not mine.  
25 We can go to the report, if it's easier.

1 A. Show me where that is in the report.

2 Q. Sure. Let's take a look again at the Final  
3 Report: Criteria for Assessing Characteristics of  
4 Navigability for Small Watercourses in Arizona, and this  
5 is on Page 32.

6 And about two-thirds of the way down there's a  
7 heading in italics, Recreational Boating After World War  
8 II; do you see that?

9 A. Yes, I do.

10 Q. And it goes on to say, "Commercial  
11 recreational rafting started in the 1930s." Is that  
12 right?

13 A. Yes. This is referring to use of inflatable  
14 rafts on big rivers.

15 Q. Okay. Well, it's talking about more than  
16 inflatable rafts, isn't it, because it says, "The  
17 development of durable, small boats, plastic, fiberglass  
18 and other modern types of canoes and kayaks, inflatable  
19 boats for single paddlers and for groups, all  
20 contributed to the rising popularity of river running in  
21 Arizona, especially on rivers not previously considered  
22 boatable or boatable only very rarely because of low  
23 water." Is that what it says?

24 A. Yes, that is what it says.

25 Q. And in fact, it also says that while

1 commercial recreational rafting started in the 1930s, it  
2 developed in the 1970s; is that right?

3 A. Yeah, I'm not sure what the person who wrote  
4 this -- this is probably Barbara Tellman's work -- what  
5 exactly she meant by that.

6 Q. And it's talking about developed in the 1970s  
7 on the Colorado River, correct?

8 A. Yeah.

9 Q. And later on the Salt, Gila and Verde Rivers;  
10 is that right?

11 A. In terms of commercial, popular commercial on  
12 those particular rivers, that's the statement that she  
13 makes right here. Factually, I'm not sure that's  
14 correct, nor do I think that -- well, there was  
15 commercial recreational traffic on the Colorado River  
16 through the Grand Canyon as early as 1910. So I think  
17 she's talking about in general when it became a much  
18 larger industry.

19 Q. Let's take a look, this is sort of a similar  
20 statement here on Page 33. Same report. Under the  
21 Conclusions section. And this is in the report prepared  
22 by your team. This isn't from a newspaper editor. It  
23 says, "Some daring adventurers traveled on the Gila and  
24 other rivers throughout the historic period, but rivers  
25 were not generally used for recreational travel until

1 the development of new materials, such as fiberglass and  
2 artificial rubber after World War II." Is that what it  
3 says?

4 A. Yeah. Just to clarify, I was not the editor  
5 or lead author on this report, so those are not words I  
6 would have chosen, particularly in light of how those  
7 adjectives have been repeated far more than the original  
8 adventurers did themselves. It says, "Some daring  
9 adventurers traveled on the Gila and other rivers  
10 throughout the historic period, but the rivers are not  
11 generally used for recreational travel" -- I think by  
12 generally, they mean popularly -- "until the development  
13 of new materials, such as fiberglass." And I've got to  
14 tell you that fiberglass is not a particularly durable  
15 material. It's subject to shattering. "And artificial  
16 rubber after World War II." And that's also an  
17 incorrect statement regarding the kind of rubber that  
18 was available, and I presented that information  
19 yesterday.

20 Q. Did you review the work by Ms. Tellman and the  
21 rest of the team before it was published as a final  
22 report submitted to this Commission?

23 A. I was not a project manager for this. I  
24 was -- participated in certain parts of it.

25 Q. The front page says Stantec Consulting in

1 association with J.E. Fuller; isn't that right?

2 A. It does.

3 Q. Okay. So do you also take issue with the  
4 statement in your report that a river that is boatable  
5 by neoprene raft or fiberglass canoe may not be boatable  
6 by wooden rowboats, for example? Is that okay, or do  
7 you have a problem with that as well?

8 A. It depends on the wooden rowboat.

9 Q. Do you agree, Mr. Fuller, that as of the date  
10 of statehood, the upper Gila River consisted of a wide,  
11 braided flood channel?

12 A. On the date of statehood there are portions of  
13 the upper Gila River that probably had a wide, braided  
14 flood channel, correct.

15 Q. And that at least some of the braided  
16 condition resulted from flooding that occurred in 1905  
17 and 1906; is that right?

18 A. Yeah. As I pointed out yesterday, the  
19 braiding that they're talking about really is irrelevant  
20 to navigability. It's not --

21 Q. That's not my question. That's not my  
22 question.

23 A. That's my answer though.

24 Q. My question is, my question is, the braiding  
25 that is described in the upper Gila River as of the date



1 of statehood is the result of floods in 1905 and 1906,  
2 correct?

3 A. The braiding of the flood channel is a result  
4 of floods, sure.

5 Q. And that is a natural condition of the river,  
6 just like it is of any river, right?

7 A. The braided flood channel is a natural  
8 condition of the river. You might get a little bit of  
9 argument on that, but that -- there were human  
10 influences on that. But sure, flood channel can be  
11 braided naturally, sure.

12 Q. If you disagree with this or don't remember,  
13 we can go back to the transcript. Do you remember in  
14 2005 Mr. Huckleberry testified that flooding has a much  
15 greater impact on the geomorphology of the stream  
16 channel and the stream channel's geometry than does any  
17 impact by man?

18 A. Yeah, but Gary was talking about, Gary  
19 Huckleberry was talking about the flood channel then.

20 Q. That's my question. I'm asking if you agree  
21 with that statement. That floods have more of an impact  
22 on the channel than do diversions?

23 A. In some cases, that's true. It's not a  
24 uniformly true statement.

25 Q. Let's go to the transcript from November 16th,

1 Page 94. And you can see middle of the page -- this is  
2 Mr. Huckleberry answering questions, right?

3 A. Yes.

4 Q. And it should actually be Dr. Huckleberry  
5 there?

6 A. Yes, it is.

7 Q. Not my mistake. It's in the transcript.  
8 Bottom of that page, the question is, "And I was  
9 curious, in the discussion that has been going on  
10 regarding the effect of diversions on the river, on how  
11 you might compare the impact on the river channel of  
12 diversions? In other words, the effect of diversions  
13 versus the effects of floods on -- and of course, I'm  
14 thinking of the period from about, what, 1905 up through  
15 and including statehood?"

16 CHAIRMAN NOBLE: Mr. Hood, could you slow down  
17 just a little bit?

18 MR. HOOD: I sure could.

19 CHAIRMAN NOBLE: Thank you.

20 BY MR. HOOD:

21 Q. The answer is, "That is a very good question.  
22 My feeling is that in terms of channel changes in the  
23 floodplain, the floods have a much greater impact on the  
24 morphology of that channel than the diversions do." Is  
25 that what it says?

1 A. That is what it says.

2 Q. Then it goes on to say, "In terms of the  
3 overall geometry of the floodplain, and particularly the  
4 flood channels, it's the floods that have the greatest  
5 impact." Is that what it says?

6 A. Yes, and you notice emphasis on floodplains  
7 and flood channels.

8 Q. Do you agree, Mr. Fuller, that the  
9 geomorphology of the upper Gila is substantially  
10 unchanged from its condition at or before statehood?

11 A. The geomorphology of the upper Gila is  
12 substantially unchanged? I believe you're citing a line  
13 from the upper Gila report, and it's important to note  
14 the distinction between the boundaries of that report  
15 and the upper Gila, as you've defined it for our  
16 discussion today. And I think that's a pretty true  
17 statement for the boundaries of the upper Gila report  
18 which went from Gila Box up to the New Mexico line. I  
19 would say as applied to the reach downstream of the Gila  
20 Box, not so much.

21 Q. So you would agree with that as it relates to  
22 the area upstream of the Safford Valley?

23 A. Right, in terms of the geomorphology, and by  
24 that what I meant was the basic channel, low flow  
25 channel conditions.

1 MR. HOOD: That's all I have. Thank you,  
2 Mr. Fuller. Appreciate it.

3 THE WITNESS: You're welcome.

4 CHAIRMAN NOBLE: Who is next? Mr. McGinnis?

5 MR. MCGINNIS: Yes, sir.

6 CHAIRMAN NOBLE: If you'll give Mr. Hood just  
7 a moment, he'll bring his cart up. And we're going to  
8 take a break for ten minutes.

9 (Recessed from 11:10 a.m. to 11:19 a.m.)

10 CHAIRMAN NOBLE: Let's begin.

11 MR. MCGINNIS: Thank you, Mr. Chairman. Mark  
12 McGinnis for the Salt River Project.

13

14 CROSS-EXAMINATION

15 BY MR. MCGINNIS:

16 Q. Mr. Fuller, I'd like to start up where  
17 Mr. Hood left off. He was asking you right before you  
18 finished some questions about Mr. Huckleberry's  
19 testimony from 2005 regarding impacts of floods on the  
20 channel. Do you recall that testimony?

21 A. I do.

22 Q. And my understanding, best I could write down  
23 while you were talking, was that you at the end of your  
24 answer said, "Gary, Mr. Huckleberry, was emphasizing the  
25 floodplain and the flood channel." Do you recall saying

1 that?

2 A. I do.

3 Q. Do you recall your testimony in 2005 where you  
4 talked about the shape of the low flow channel and the  
5 location of the low flow channel being altered by  
6 floods?

7 A. I don't.

8 Q. Okay. I have -- there in front of you is a  
9 copy of the transcript. It's a little different,  
10 different copy than what Mr. Hood had, but hopefully  
11 it's the same thing. Move to the November 16th  
12 transcript from 2005, Page 61. Page 61, this is you  
13 testifying, right?

14 A. Yes, it is.

15 Q. On Line 18 it says, "We do find that flood  
16 impacts are significant to this river. It does change  
17 the shape and the location of the low flow channel as  
18 well as flood channel." Do you see that?

19 A. Yes.

20 Q. And that's your testimony from back in 2005?

21 A. Yes, it is.

22 Q. And you did testify back at the experience we  
23 all had in 2005 out at the LaQuinta on this river; do  
24 you remember that?

25 A. Yes.

1 Q. Okay. At the hotel. Would you agree with me  
2 that the character and nature of your testimony  
3 yesterday was somewhat different than it was back in  
4 2005?

5 A. No, not that I recall.

6 Q. Do you recall --

7 A. Well, I am offering a specific opinion. Is  
8 that what you're getting at?

9 Q. That was one of the things I was getting at.

10 A. Yeah.

11 Q. And Mr. Hood covered a little bit this  
12 morning -- do you recall back in 2005 being reluctant to  
13 give an opinion about whether any portion of the river  
14 was navigable?

15 A. Yes.

16 Q. And you recall the very -- toward the very end  
17 of your testimony, Mr. Helm asked you some very pointed  
18 questions that finally got you to say you had an opinion  
19 about a particular reach of the lower Gila?

20 A. That's correct.

21 Q. And then yesterday, you testified here  
22 relatively zealously that every inch of the Gila from  
23 New Mexico all the way to California was navigable,  
24 right?

25 A. Well, zealously is your adjective, but that is

1 my opinion, that the Gila River is navigable.

2 Q. What made the -- what made the change? Why  
3 are you different this time than you were last time?

4 A. The difference is in what I was hired to do.  
5 Last time, Land Department, when they hired me, said  
6 that I was to present the facts regarding the  
7 characteristics of the river and that their opinion was  
8 the Commission would make this decision.

9 Q. Did you have different instructions this time?

10 A. This time the State has filed an opinion that  
11 the river is navigable, and we are here to support that  
12 opinion.

13 Q. So you would agree with me that you are more  
14 of an advocate this time than you were last time?

15 A. I am advocating for navigability this time,  
16 that's correct; but as Mr. Katz pointed out, and  
17 Mr. Hood as well, we have not advocated for navigability  
18 of all river segments. So we've been selective based on  
19 the facts.

20 Q. And another difference between the last time  
21 and this time is last time you had a whole team of  
22 people who testified at the hearing, right?

23 A. We did have more people testify.

24 Q. Dr. -- Mr. Gilpin testified; do you remember  
25 that?

1 A. Mr. Gilpin, and yes, he did testify.

2 Q. And he testified about historical issues?

3 A. Yes.

4 Q. And we already talked about Mr. or

5 Dr. Huckleberry testified last time?

6 A. Dr. Huckleberry.

7 Q. Dr. Huckleberry. What did he talk about; do  
8 you remember?

9 A. He was just talking about the geomorphology of  
10 the middle Gila, the middle and lower Gila.

11 Q. And Ms. Tellman testified last time as well?

12 A. Correct.

13 Q. And she talked about boating, right?

14 A. She did.

15 Q. So another difference between last time and  
16 this time is last time you had four different people  
17 testifying. This time you're talking about everything?

18 A. That's correct.

19 Q. And you don't have any training or education  
20 in history, do you?

21 A. I have a lot of history with this project,  
22 that's for sure. And I certainly took history classes  
23 in college. I am not certified by anybody as a  
24 historian. I think there are a fair number of people  
25 that would argue that geology is a discipline of



1 history. But I am not a registered historian, if that's  
2 the question.

3 Q. So when you were in college doing your degree  
4 in geology and then your master's in geoscience, did you  
5 take any courses that talked specifically about how one  
6 views and analyzes and interprets historical documents?

7 A. It's been a long time since I was in college.  
8 Yeah, I would imagine that our history classes did go  
9 over that kind of interpreting historical data. I took  
10 a number of history classes as an undergraduate. But  
11 I'm willing to concede that I am -- my profession is not  
12 listed as historian.

13 Q. And you talked some yesterday about  
14 interpretations of various court decisions. Do you have  
15 any legal training?

16 A. No.

17 Q. Are you glad about that?

18 You also talked quite a bit yesterday about  
19 your personal experience in boating; is that right?

20 A. I did.

21 Q. And you've got a lot of experience. Do you  
22 consider yourself a pretty well-qualified boater?

23 A. Better than some, not as good as some.

24 Q. Okay. On a scale of say 1 to 100 where 1 is  
25 somebody who has never been in a boat and 100 is one of

1 those guys on the Olympics that run the slalom course in  
2 the whitewater, where are you?

3 A. Going to depend on the boat type. As a solo  
4 canoeist, I'd probably put myself in the 65 range. As a  
5 whitewater rafter -- I don't know -- 50. As a kayaker,  
6 50.

7 Q. Do you consider your personal boating skills  
8 part of the standard that you incorporate into your  
9 opinion about what's navigable or not?

10 A. As part of the standard of what I consider?  
11 I'm not sure about the word "standard" and how you mean  
12 that. I would say that I do consider my personal  
13 experience sitting in a boat. That helps me tell what's  
14 boatable and what's not boatable.

15 Q. So would you say a river is navigable if Jon  
16 Fuller could have boated it?

17 A. A river is navigable if Jon Fuller could have  
18 boated it? It's hard to apply that to any river  
19 anywhere. I do believe that based on the  
20 reconstructions that I've seen that I could have boated  
21 the Gila River, and I also believe that the river is  
22 navigable. So those -- a Venn diagram of those two sets  
23 overlap. I'm not sure that's a hard and fast rule.

24 Q. Are there certain rivers that you with your  
25 experience could boat that somebody with less experience

1 maybe couldn't boat?

2 A. Sure.

3 Q. Would you consider those rivers less navigable  
4 than a river that that person could have boated?

5 A. I want to put a little asterisk next to this,  
6 because we're talking hypothetically. It would be  
7 better to have this conversation regarding a specific  
8 river and its specific characteristics. But it is  
9 possible -- now I've lost your question. But I think  
10 that you asked me whether it's possible I would consider  
11 a river navigable that someone else could not boat or  
12 would not be able to boat. I can't think of any  
13 offhand. By not being able to boat, what do you mean by  
14 that? That they would be unable to learn how to boat  
15 it? They would be unable to develop the skills to do  
16 it?

17 Q. Couldn't successfully go down from one end of  
18 the river to the other on the first try. That's what  
19 I'm asking in this question.

20 A. I'm not trying to be difficult, but what do  
21 you mean by "successfully"?

22 Q. Get down to the other end in the water.

23 A. No, I don't think so.

24 Q. So does the skill of the boater play into your  
25 impression and definition of what's navigable and what's

1 not?

2 A. It plays into it. I wouldn't say it's the  
3 defining characteristic, but certainly there is a skill  
4 element -- as I pointed out in my slides yesterday,  
5 there is a skill element to boating rivers, much as  
6 there is a skill element to driving a car or pretty much  
7 any other thing we do.

8 Q. And for purposes of applying the legal test of  
9 navigability to the Gila River, what level of skill did  
10 you assume a boater would have?

11 A. A novice.

12 Q. So somebody who had never boated before has to  
13 be able to boat the river in order for you to believe  
14 it's navigable?

15 A. Never boated before, has to be able to -- no,  
16 I don't think I said that someone who has never. I said  
17 a novice boater. So you'd have to have some  
18 understanding of how to sit in your boat, how to load  
19 your boat, how to hold a paddle. I mean, there are some  
20 basic skills that you would need, and the fewer of those  
21 skills that you have, the tougher time you would have  
22 getting down the river.

23 Q. And you obviously have boated lots of  
24 different rivers, right?

25 A. I have.

1 Q. And in other different states, I assume?

2 A. I have.

3 Q. And you understand that the outcome of a  
4 particular determination of navigability on a particular  
5 river could have an impact on the accessibility of those  
6 rivers for boating, right?

7 A. Well, I would hope that the boaters would  
8 continue to be able to boat rivers, if that's what  
9 you're asking me. But I'm not exactly sure how that  
10 would play out.

11 Q. You understand -- you're aware, aren't you,  
12 that some of the concerns that boaters have about  
13 private ownership along stream beds are things like  
14 barbed wire fences going across the river, things like  
15 that, right?

16 A. Yes, I've heard that concern voiced.

17 Q. And you understand, don't you, that if the  
18 State owned the riverbed, the private property owners  
19 might not be able to put up those barbed wire fences,  
20 right?

21 A. They might not, I suppose.

22 Q. And so people like you who like to boat the  
23 rivers could have more access to the rivers based upon  
24 the determination of navigability, right?

25 A. I suppose that's possible.

1 Q. And that includes you personally?

2 A. Yes.

3 Q. Mr. Katz asked you a question yesterday going  
4 back to the '90s about whether the State Land Department  
5 gave you any instructions at that time about what your  
6 findings should be. Do you recall that?

7 A. I do.

8 Q. And your answer was very specific, and you  
9 said, "Nobody from the Land Department told me that."  
10 Do you recall that?

11 A. Vaguely.

12 Q. Was there anybody else at that time that told  
13 you what your findings would be -- should be?

14 MR. KATZ: Are we talking in reference to  
15 navigability?

16 MR. MCGINNIS: I'm talking in reference to the  
17 question you asked him yesterday.

18 THE WITNESS: So the question that you asked  
19 me was, did anyone --

20 BY MR. MCGINNIS:

21 Q. Back in the '90s.

22 A. -- tell me what the decision should be,  
23 whether navigable or nonnavigable? I think there were  
24 lots of voices saying yes, no, yes, no, yes, no. But  
25 certainly nobody at the Land Department or AG's Office

1 or the State didn't direct me one direction, one way or  
2 the other.

3 Q. And you testified, I think yesterday, that you  
4 came to the opinion that the San Pedro River and the  
5 Santa Cruz River should be navigable, right?

6 A. Should be navigable?

7 Q. Are navigable.

8 A. No, wait. You said that I came to the  
9 conclusion that the San Pedro and Santa Cruz are  
10 navigable?

11 Q. Yes.

12 A. No, I did not.

13 Q. Okay. You didn't testify yesterday that you  
14 believed that the San Pedro and the Santa Cruz in the  
15 ordinary -- in their ordinary and natural condition were  
16 susceptible to navigability?

17 A. Yeah, no, that's not what I testified  
18 yesterday.

19 Q. Okay. Do you have an opinion about whether  
20 the San Pedro River is navigable under the standards  
21 that you applied to the Gila?

22 A. Yeah, I'm not here to discuss the San Pedro  
23 today.

24 Q. Okay. I asked you a question. Could you  
25 answer it? I think you answered it already, but maybe I

1 misunderstood your answer?

2 A. Yeah, my recommendation to the Land Department  
3 was -- and they are free to choose whatever they choose.  
4 But my recommendation was not to pursue a finding of  
5 navigability for either of those two rivers.

6 Q. Okay. Both of those rivers, the San Pedro and  
7 the Santa Cruz, are tributaries to the Gila, right?

8 A. They are.

9 Q. Okay. Are you familiar with the confluence of  
10 the San Pedro and the Gila?

11 A. Yes.

12 Q. Are there characteristics of the San Pedro  
13 just upstream from that confluence that are different  
14 from the characteristics of the Gila at that confluence  
15 that would make it less likely to be navigable?

16 A. Are there characteristics -- I'm sorry, there  
17 was a lot of stuff in there. So the characteristics of  
18 the San Pedro River just upstream of the confluence that  
19 are different from the Gila River. The answer to that  
20 is yes. Certainly today it's very different.

21 Q. Okay. In its ordinary and natural condition,  
22 were there differences between the San Pedro at the  
23 confluence and the Gila at that same confluence that  
24 would make one river navigable and the other not?

25 A. Again, I'm surprised at being asked to answer



1 questions about the San Pedro River. I'm not really  
2 prepared.

3 Q. Well --

4 A. You know, I'm going to have to take a pass on  
5 that. The rivers are different. There are different  
6 characteristics. I do believe the Gila River to be San  
7 Pedro -- the Gila River to be navigable. And it was my  
8 opinion that the San Pedro was not.

9 Q. But as you sit here today, you can't tell me  
10 why the difference between those two exist?

11 A. Why the difference between the San -- why the  
12 San Pedro River is different from the Gila River, or why  
13 my opinion about them is different?

14 Q. In terms of navigability why your opinion is  
15 different between those two rivers that meet each other?

16 A. Yeah. Yes, I could. We could spend a long  
17 time talking about those differences. I'm not sure how  
18 it's relevant to the Gila, but -- I'm just not sure why  
19 it's relevant to the Gila, the San Pedro. Am I required  
20 to answer this question?

21 CHAIRMAN NOBLE: We would like you to.

22 THE WITNESS: I'm not sure that was a yes.

23 CHAIRMAN NOBLE: The answer is yes.

24 THE WITNESS: All right. The San Pedro River  
25 has a smaller watershed. It has lesser flow. It has a

1 different history in terms of its use. It has a  
2 different seasonality of flow. The flow depths are  
3 generally less. It certainly has a more complex history  
4 of what the ordinary and natural condition would be.  
5 There's lots of scientific arguments about the role of  
6 arroyo-cutting and whether that's human caused or not  
7 human caused. Boiling it down to hopefully as short an  
8 answer as we can possibly get, let's just say less flow,  
9 lower depths.

10 BY MR. MCGINNIS:

11 Q. If I asked you the same question about the  
12 Santa Cruz, would your answer be generally the same?

13 A. The Santa Cruz, you're asking specifically to  
14 the confluence area?

15 Q. The Santa Cruz near the confluence with the  
16 Gila in the ordinary and natural condition of both  
17 rivers.

18 A. Yeah, it's my understanding that the Santa  
19 Cruz almost never flows to the Gila River.

20 Q. Okay.

21 A. Continuously.

22 Q. My question is --

23 A. So in the confluence area, almost never any  
24 runoff.

25 Q. And my question was in its ordinary and

1 natural condition; did you understand that?

2 A. Yes.

3 Q. And your answer is the same?

4 A. Yeah.

5 Q. You talked about early yesterday morning or at  
6 some point yesterday morning, and my understanding was  
7 that you said the differences in drafts of boats between  
8 modern-day boats and boats from the 1800s, the  
9 differences in drafts weren't much.

10 A. That's correct.

11 Q. Do you recall that?

12 A. Yes.

13 Q. What are the differences between modern-day  
14 boats that you use, for example, today in your canoeing  
15 and a boat that was available in 1860?

16 A. There were specific slides that addressed  
17 that, but from recollection, the main differences are  
18 with regard to the materials that are used. We now have  
19 materials that didn't exist back then. And durability.  
20 So some of the materials we use today are more durable  
21 than some of the materials that were available in 1912.

22 Q. You had some testimony yesterday where you did  
23 an analogy between boating on the Gila in the 1800s and  
24 driving on the U.S. 60 today. Do you recall that?

25 A. Yes.

1 Q. And my understanding is, you weren't trying to  
2 equate the frequency and number of occurrences of people  
3 who drive on the U.S. 60 today with the occurrences that  
4 happened in the 1800s with boating on the Gila, right?

5 A. I think if you live in the East Valley, you  
6 probably recognize that there are a few more people on  
7 the U.S. 60 than you see on the river.

8 Q. I do live in the East Valley.

9 A. An easier drive.

10 Q. And you talked some about the Apache threat  
11 yesterday being a reason why people maybe didn't boat on  
12 the Gila River; do you recall that?

13 A. I do.

14 Q. Do you know if the Apaches were on the lower  
15 Gila down between the Salt River confluence and Yuma?

16 A. They were dominantly in the upper Gila area.

17 Q. Several times yesterday in your discussion  
18 with Mr. Katz you used the term "boatable." Do you  
19 recall that?

20 A. I do.

21 Q. Do you make a distinction between "navigable"  
22 and "boatable"?

23 A. Thinking back as to how I used the word  
24 yesterday -- I think folks in your profession may think  
25 of those terms differently. I'm generally using them

1 synonymously.

2 Q. So anything you can float a boat on is  
3 navigable; is that what your opinion is?

4 A. No, I wouldn't necessarily say that. I'm  
5 saying I tend to use the words interchangeably.

6 Q. Several times in your discussions yesterday  
7 with Mr. Katz, you were talking about particular boating  
8 accounts. And you said in your response, nobody died.  
9 Do you recall that?

10 A. I do.

11 Q. Is that part of your definition of what a  
12 successful boating trip is?

13 A. Yes.

14 Q. Is that sort of a minimum standard in your  
15 account?

16 A. It was one of the standards.

17 Q. Yesterday afternoon you said -- and I tried to  
18 write down the quote -- and you were talking about  
19 modern boating. You said, "If there's water and you can  
20 get there, people will boat it."

21 A. Yes.

22 Q. Do you remember saying that?

23 A. Yes.

24 Q. And you're talking there about modern times?

25 A. Yes.

1 Q. Okay. Yet when you talked about the 1800s,  
2 you had several slides that explained why people  
3 wouldn't boat even if there was water there. Do you  
4 recall that?

5 A. I do.

6 Q. Do you have any reason for why people would  
7 boat anyplace there's water in 2014, and they wouldn't  
8 boat if there was water there back in 1860?

9 A. Primarily, they have a lot more time.

10 Q. So you're thinking about recreational boating?

11 A. Yeah. The comment regarding if there's water  
12 there, people will put a boat in it, it's just a  
13 reflection on my observation of looking at a lot of wet  
14 places in Arizona, and people have found ways to throw a  
15 boat in there for whatever reason.

16 Q. But you don't think that was true, say, in the  
17 late 1800s?

18 A. Well, it was less true in the sense that there  
19 were less people there. And I would imagine pioneer  
20 Arizona was a little different in terms of availability  
21 of funds and time to do things like that.

22 Q. But we've seen in some of the documents though  
23 that those people had -- the folks in the 1800s had some  
24 recreational activities, right?

25 A. They did.

1 Q. They fished?

2 A. Yeah.

3 Q. Right? There's no reason that you think they  
4 wouldn't have boated if they could have, is there?

5 A. Again, I believe that argument of if they  
6 could have, they would have applies to some people. So  
7 we're kind of looking at the same thing from different  
8 angles. I'm saying you're going to find some segment of  
9 the population that will use rivers as long as there's  
10 water and a gate that let's them in there. And other  
11 folks who will choose not to boat for a variety of  
12 reasons that have nothing to do with whether the river  
13 is wet or not.

14 Q. Again, I understand that. What I'm trying to  
15 get at is, do you believe that the segment of population  
16 that would boat if they had the opportunity didn't exist  
17 in the 1800s in Arizona?

18 A. Oh, I don't know that.

19 Q. You talked some yesterday -- and I can't  
20 remember which segment. It was Segment 3 or 4. You  
21 talked some about the reach between Coolidge Dam and  
22 Ashurst-Hayden. Do you recall that?

23 A. I do.

24 Q. Would you agree with me that that reach has  
25 flows that are not in their natural condition?

1 A. The hydrology of that reach has certainly  
2 changed from its ordinary and natural condition. There  
3 are times when the flows mimic that which occurred in  
4 the ordinary and natural condition; but as a general  
5 rule over the year, yes, the distribution of flow has  
6 changed significantly in that reach.

7 Q. And wouldn't you agree with me that there are  
8 certain times of the year, at least, where the flows  
9 between Coolidge Dam and Ashurst-Hayden are more regular  
10 and more predictable than they would have been under  
11 natural conditions?

12 A. Can we go to the chart there for that segment,  
13 and that will help me answer that question.

14 In this chart --

15 Q. Which slide is that, Jon?

16 A. I'm sorry, slide 167 from the Gila  
17 navigability, the Gila River presentation. It's titled  
18 Gila River Segment 4 Historical Boatable Flow Range.  
19 And you can see the distinction in the hydrology -- I  
20 lost my pointer here -- between the two dashed lines.  
21 And there is a time of the year, if you look at the gage  
22 data, which is the -- I can point with my mouse. Here  
23 we go.

24 This line right here is from the modern gage  
25 record, and this line right here is from the



1 reconstructed flow that Mr. Burtell put together. And  
2 you can see there's a differential there. I'm sure  
3 that's the time period when the flow is elevated now  
4 above its historic -- its reconstructed historic time.

5 Q. Because part of the function of Coolidge Dam  
6 is to store water during the flood flows and let it out  
7 gradually over time, right?

8 A. That's correct.

9 Q. So would you agree with me that at least part  
10 of the year that segment is more navigable than it would  
11 have been under ordinary and natural conditions?

12 A. I would say the flow depths, the flow depths  
13 were greater during that time of the year. At that  
14 point it's kind of like -- I don't know what a good  
15 analogy would be. Is two cookies better than one  
16 cookie? It was navigable at either flow rate.

17 Q. Would it have been easier to navigate under  
18 the artificial conditions now though, right?

19 A. I don't think so. I think it would be about  
20 the same.

21 Q. But I thought you said in your testimony  
22 yesterday, and some today, that it's all about depth,  
23 right?

24 A. I did say that yesterday. It's all about  
25 depth.

1 Q. And wouldn't the depth of that stretch from  
2 Coolidge Dam to Ashurst-Hayden during the part of the  
3 year when they were releasing water out of Coolidge Dam,  
4 wouldn't it be deeper than it would be under natural  
5 conditions?

6 A. In that particular time frame that my mouse is  
7 still pointing at, yeah, there's a period of time where  
8 there would be slightly greater depths. However, it  
9 would be, it would be like saying the Colorado River is  
10 more navigable because the depth was 4.2 feet instead of  
11 4.1 feet. It may be that trivial of difference in the  
12 depth, and from a low draft boating standpoint, it would  
13 be an insignificant difference. I'll grant you that the  
14 water would be deeper, in all likelihood. That doesn't  
15 necessarily make it easier. It may be just about the  
16 same, may be just about the same.

17 Q. Maybe I misunderstood this. I thought when  
18 you were talking to Mr. Hood this morning, you said  
19 there was a distinction between three inches of flow and  
20 six inches of flow. Do you remember that discussion  
21 about the draft?

22 A. I do.

23 Q. Okay. So now you're saying that a tenth of an  
24 inch or something along that magnitude is insignificant?

25 A. The discussion I was having with Mr. Hood

1 related to the low end of boating. Now we're talking  
2 about something that's above those thresholds.

3 And just one more clarification on "It's all  
4 about depth." That statement was made relevant to or  
5 relating to susceptibility, and, of course, there are  
6 other factors that go into determining whether a river  
7 is navigable or not besides depth.

8 Q. The river at Niagara Falls is probably pretty  
9 deep, right?

10 A. Yes, it is.

11 Q. And unless you're in a barrel, you're probably  
12 not navigating it?

13 A. That's true.

14 Q. What are the other factors other than depth  
15 that you would consider?

16 A. Well, the presence of a world-class, largest  
17 waterfall would be a factor.

18 Q. How about boulders in the river, would that be  
19 a factor?

20 A. It would depend on the number of boulders. So  
21 a boulder in the river, no, you boat around it. If  
22 there were 25 miles of continuous boulders that were  
23 spaced two feet apart and the flow depth was such that  
24 all of those boulders were sticking out by half their  
25 diameter, that would certainly be an obstruction to

1 floating that reach of the river, anyways.

2 Q. How about one mile of the same boulders?

3 A. Could be, could be.

4 Q. You talked a little bit this morning about the  
5 draft statement of facts that you got from the Attorney  
6 General's Office?

7 A. Yes.

8 Q. Did that statement of facts form any part of  
9 the basis for your opinion?

10 A. No. Basically it was just a summary of things  
11 that were already out there.

12 Q. I'm doing the best I can with the page numbers  
13 on your PowerPoint. Just bear with me a minute. Let's  
14 go to your Gila River PowerPoint now. I'll get the page  
15 numbers off it. Page 142. You talk there about the  
16 rating curves, the hydraulic rating curves; is that  
17 right?

18 A. Yes.

19 Q. The depths that come out of those curves,  
20 where in the river is that depth?

21 A. It's at the fallway, so it would be in the  
22 main flow, low flow channel. It would typically be the  
23 deepest point.

24 Q. Is that deepest point always in the middle or  
25 can it be someplace else?

1 A. It could be, it could be in the middle. Could  
2 be someplace else.

3 Q. And so that's not an average depth across the  
4 whole fallway. It's one maximum deepest point; is that  
5 right?

6 A. Sure, yeah. Yes. Based on my experience in  
7 being in rivers and measuring rivers, when you talk  
8 about it being a point, it's very unlikely to be a  
9 point. Typically the channel has some relatively  
10 flatness to it, some width of that, that depth.

11 Q. You've been out on the Gila lots of times,  
12 right?

13 A. I have.

14 Q. You want to walk across the Gila, right?

15 A. Some days.

16 Q. If you walk across the Gila, as you walk  
17 across, it gets generally progressively deeper?

18 A. Yes.

19 Q. Right? Until you get somewhere around the  
20 middle, maybe not exactly the middle; then it gets  
21 progressively shallower?

22 A. I would say from the edge, it's clearly a zero  
23 depth at the edge of the waterline. It gets deeper at  
24 some point, and then typically you walk along, let's say  
25 the central portion of the river as opposed to the

1 middle, and you have something that's of more  
2 significant depth for a distance, and then sometimes it  
3 gradually comes up to the waterline. Other times it's a  
4 sharper rise. Sometimes it's sharp on both sides. It  
5 varies.

6 Q. And sometimes you're walking across the middle  
7 of the river, and all of a sudden it gets shallow.

8 A. I can't think of any particular times like  
9 that, but it's not impossible to imagine that scenario.

10 Q. There can be sandbars in the middle of river,  
11 right?

12 A. Oh, there sure can, yes.

13 Q. And there are times it gets shallower, and you  
14 take the next step, and it gets deeper all of a sudden?

15 A. It does, yes.

16 Q. So in natural conditions, ordinary conditions,  
17 those rivers aren't smooth parabolas necessarily, right?  
18 The Gila?

19 A. You know, I would say you could approximate  
20 the geometry with a smooth parabola.

21 Q. But the walking across the river that you and  
22 I just talked about wouldn't happen unless it was a  
23 smooth parabola, or quite that way, would it?

24 A. It could. Usually you could -- well, you  
25 could approximate a river geometry with some kind of

1 parabolic shape. Is it going to be a mathematically  
2 defined parabola at every point on a river? Of course  
3 not. But I think that's a reasonable approximation of  
4 the geometry of a river.

5 Q. Let's go to your navigability Gila River  
6 PowerPoint. Let's stay on that. Let's go to Page 4.  
7 The last bullet point there said -- it talks about an  
8 update, and it says, "This presentation provides that  
9 update." Do you see that?

10 A. Yes, I do.

11 Q. What empirical work have you done since 2005  
12 as part of this update?

13 A. By empirical, you mean mathematical?

14 Q. Mathematical, work in the field, anything that  
15 comes up that results in data or observations.

16 A. "Data" is kind of a broad term, as is  
17 "observations." Well, I'll tell you what we've done.  
18 We did a more extensive search of literature,  
19 particularly newspaper accounts. When we previously did  
20 these updates -- let's hit the pause button there for  
21 just a second. It's important to know that the previous  
22 updates were basically taking the reports as published  
23 and really not adding any new information to those at  
24 that time. It was just updating the language to reflect  
25 the changes in the legislation.

1           So the first update had to do with the  
2 presumptions of nonnavigability, and we added material  
3 to the report to adjust those. The second was to take  
4 those out. And in this update here, we did a few  
5 different kinds of things. We looked at the newspaper  
6 accounts. We looked for other historical information as  
7 it came available. There were more flow data available.  
8 It's been 20 some years.

9           Also you asked about the fieldwork. I went  
10 out and boated segments of the Gila that still are live  
11 streams and documented those in photos. We did  
12 classification of the rapids all along the river. And  
13 there may be some other things I'm forgetting. But  
14 basically the material you saw yesterday would be our  
15 update.

16         Q.     In the work you've done since 2005, did you  
17 find any new flow data relating to the period before  
18 1912 that you didn't already have?

19         A.     No.

20         Q.     You, I assume, in the work you've done in the  
21 20 years or so here on navigability and the work you've  
22 done in other states, have reviewed various court  
23 decisions relating to navigability of particular  
24 watercourses?

25         A.     I'm aware of them, yeah.



1 Q. Of the work you've done and the cases you've  
2 looked at, what's the lowest median flow that you're  
3 aware of of any watercourse that any court or any other  
4 tribunal has ever found navigable?

5 A. You know, I haven't, I haven't looked at  
6 those, that information, so --

7 Q. So you haven't looked at other cases around  
8 the country, other rivers around the country and said  
9 here is a watercourse that the court found navigable and  
10 look at what the flow rate was?

11 A. The only time we've done anything like that is  
12 I know that you folks, I believe, submitted a list of  
13 rivers that had mean annual flow rates. I've looked at  
14 that data set right there. But no, I haven't done a  
15 search for that. I know that each river is supposed to  
16 be considered on its own merits.

17 Q. You said you had done some work on  
18 navigability in Alaska?

19 A. I have.

20 Q. What rivers have you worked on up there?

21 A. The Chitina and the Mosquito Fork, the Forty  
22 Mile.

23 Q. Have those watercourses been litigated in  
24 terms of their navigability yet?

25 A. No, they're in process.

1 Q. Will you testify in those cases?

2 A. In the Forty Mile case, it's likely that I  
3 will.

4 Q. Have you presented an opinion that either of  
5 those watercourses is navigable?

6 A. I have not.

7 Q. Have you presented an opinion that either of  
8 those watercourses is not navigable?

9 A. I have not.

10 Q. Flipping over to Page 9 of your navigability  
11 Gila River PowerPoint. The second bullet there talks  
12 about a compound channel. And you discussed a compound  
13 channel yesterday, and I appreciated the clarification  
14 on it.

15 The compound channel can have more than one  
16 low flow channel, can't it?

17 A. It could, yes.

18 Q. And if there's a given amount of water coming  
19 down the river, and some of the water goes in one low  
20 flow channel, and some of the water goes in another low  
21 flow channel, there's by definition less water in each  
22 of those two channels than there would have been if they  
23 were all in one channel, right?

24 A. Well, it would be the same amount of water;  
25 it's just divided in two.

1 Q. So each channel has less water in it?

2 A. Yes.

3 Q. Have you done any empirical work on the Gila  
4 to look at the amount of flows that were present in  
5 different low flow channels when there was more than one  
6 channel that existed?

7 A. Well, I've canoed most of river from the New  
8 Mexico line down to Safford, and then from the dam, the  
9 Coolidge Dam down to Ashurst-Hayden, and I would say 99  
10 percent of the river is in a single channel.

11 Q. Okay. There are times though when there's a  
12 separate channel?

13 A. Oh, sure.

14 Q. Do you think that there were also times under  
15 ordinary and natural conditions where there was more  
16 than one low flow channel at any part of the Gila?

17 A. Oh, it's likely that there was a split channel  
18 here and there. It's a situation that occurs on the  
19 Colorado. It's a situation that occurs on the  
20 Mississippi. It's not unusual in rivers at all.

21 Q. But you don't have any way to know in those  
22 instances what portion of the water went in which  
23 different channel?

24 A. I could tell you about the relative percents  
25 of distribution of flow on the portions of rivers that

1 I've boated, but I couldn't speak specifically to a  
2 split that existed a hundred years ago.

3 Q. Flip over to Page 18 of your --

4 CHAIRMAN NOBLE: Mr. McGinnis.

5 MR. MCGINNIS: Yes, sir.

6 CHAIRMAN NOBLE: Would this be an appropriate  
7 time to break for lunch?

8 MR. MCGINNIS: Any time you'd like would be an  
9 appropriate time.

10 CHAIRMAN NOBLE: We are now broken for lunch.  
11 We'll get back together at about 1:15.

12 (Recessed from 11:57 a.m. to 1:15 p.m.)

13 CHAIRMAN NOBLE: We might as well go ahead and  
14 start. Please go ahead.

15 MR. MCGINNIS: I have one housekeeping matter  
16 before we start. We have a PowerPoint for Dr. Mussetter  
17 who is going to testify tomorrow or day after, whenever  
18 we get to him. We filed that with the Commission by  
19 e-mail today. And there are hard copies here so people  
20 have them.

21 CHAIRMAN NOBLE: Thank you.

22 BY MR. MCGINNIS:

23 Q. Good afternoon, Mr. Fuller. Yesterday, when  
24 you were testifying, you talked some about the general  
25 Land Office surveyors that had been in the area in the

1 1800s; do you recall that?

2 A. I do.

3 Q. And you said, generally you said those folks  
4 weren't focused on navigability. Do you recall that?

5 A. Yes.

6 Q. What's the basis for your opinion or your  
7 statement there?

8 A. The purpose of their surveys was to set the  
9 boundaries.

10 Q. What documents did you look at to determine  
11 what the purpose of the surveys was?

12 A. That's just what GLO Surveyors were doing.

13 Q. Did you review any of the survey manuals that  
14 they were working under, personally?

15 A. Just reviewed -- I've read the excerpts that  
16 have been presented in various expert reports, whatnot.

17 Q. But you didn't personally go and do any  
18 research into the --

19 A. No.

20 Q. -- instructions those folks were working  
21 under?

22 A. No.

23 Q. We're still on your Gila River PowerPoint,  
24 right?

25 A. We are.

1 Q. Is that what's up there? Yes?

2 A. It is.

3 Q. Let's go to slide 97. This says Gila River  
4 near Wilton Crossing. Do you know where Wilton Crossing  
5 is?

6 A. You know, I looked it up and I do not.

7 Q. Do you think that might be Welton?

8 A. I thought about that. It came out of  
9 Littlefield's report, so --

10 Q. We talked some this morning about the  
11 possibility of multiple channels. Do you recall that  
12 discussion?

13 A. I do.

14 Q. Is this one situation where it looks like  
15 there are multiple channels in the Gila River?

16 A. It's difficult to tell where exactly the  
17 channel is in that. Certainly there are multiple flood  
18 channels there.

19 Q. And the water in each one of those channels is  
20 less than it would have been if there was only one main,  
21 one channel, right?

22 A. Yeah, I'll also point out that the date here  
23 that's listed is 1910. So you're not looking at the  
24 ordinary and natural history of the river.

25 Q. You don't know that that wasn't also the

1 condition at that particular place sometime under  
2 ordinary and natural conditions, do you?

3 A. From this photograph, all I know is this is  
4 what it looked like in 1910.

5 Q. Let's go to slide 121 on the same PowerPoint  
6 presentation. We talked some during our discussion this  
7 morning about what you consider a successful boating  
8 trip for purposes of determining navigability. And this  
9 is the slide that you have in your presentation on that  
10 subject, right?

11 A. This is slide 121 of my presentation.

12 Q. And there you have, it says definition of  
13 failure. So you're talking about things that you would  
14 consider an unsuccessful boating adventure, right?

15 A. Yes.

16 Q. So if somebody dies, it's unsuccessful?

17 A. Yes.

18 Q. If somebody gets seriously injured, you would  
19 consider it unsuccessful?

20 A. Particularly for those persons. However, I  
21 guess I can conceive of a case where there were lots of  
22 people on a boat and one person died; someone might  
23 judge the overall success of it. But certainly it's a  
24 black mark on the record.

25 Q. Some person gets injured that you wouldn't

1 consider serious, that doesn't necessarily mean it's a  
2 failed trip?

3 A. Yeah, particularly, you know, I guess I should  
4 clarify here. I'm talking death due to boating. So,  
5 you know, if somebody died of a heart attack because  
6 they were old, that has nothing to do with boating. So  
7 clearly somebody died because of the boating trip.

8 Q. So the next bullet says cargo lost, not  
9 recovered. So if the cargo of the boat spills out, gets  
10 in the river, and you can sometime recover it back in,  
11 you would consider that a successful trip?

12 A. Sure.

13 Q. And the next bullet says boat destroyed, not  
14 repairable. So if there's damage to the boat, that  
15 doesn't make it unsuccessful?

16 A. Correct.

17 Q. So in your definition of navigability, if we  
18 have one event, just one account on the river, somebody  
19 is injured but not seriously, cargo all gets spilled  
20 into the river but they later pick it up down the river,  
21 and the boat is harmed but not destroyed, you would  
22 consider that successful?

23 A. Yes.

24 Q. And you would consider that evidence, that one  
25 trip under those conditions evidence that the river is



1 navigable?

2 A. That's not the case at all. There's many  
3 trips here.

4 Q. No, I'm talking about if there was one trip of  
5 the way we just talked about, would that mean that the  
6 river was navigable?

7 A. So in that hypothetical situation, I guess  
8 I'll wait for a river in which that's the situation and  
9 consider all of the evidence that's available and make  
10 my decision at that time.

11 Q. Okay. The evidence that's available in my  
12 question is that one trip with the same flow pattern  
13 that you have on the Gila. Would that river be  
14 navigable under your view of the definition?

15 A. So you're saying -- your hypothetical  
16 situation, what you're saying is it's a river exactly  
17 like the Gila River, and yet the only thing that we know  
18 about it is this one trip that occurred, and in this one  
19 trip a person was injured in his account, and there was  
20 some type of damage to a boat but the boat was still  
21 usable, and they reached their destination, although  
22 somewhere along the way they dropped some of their  
23 material in the water and picked it up again.

24 Q. Yes.

25 A. That's the only information that's available

1 of any kind of which to make a navigability decision.

2 Q. That's my question.

3 A. It's kind of out there in the reality there.

4 Q. I didn't ask you if it's out there. I would  
5 ask you to answer the question. I agree that it's out  
6 there. Okay. Let's stipulate to that.

7 A. Yeah, I guess if that was the only kind of  
8 information that anyone had of any kind, yeah, I guess  
9 that's a successful attempt.

10 Q. Let's go back to Page 18 of your Gila River  
11 PowerPoint.

12 A. 18?

13 Q. 18, yes. Sorry for skipping around. Page 18  
14 you have the second bullet point there that says  
15 braided, meandering compound rivers can all be navigated  
16 if; do you see that?

17 A. Yes, I do.

18 Q. What goes into that blank after "if"?

19 A. If the river is deep enough.

20 Q. So if there's a whole lot of water, all of  
21 those things can be -- all of those characteristics can  
22 be there and the river can still be navigable?

23 A. Yes.

24 Q. So would you agree with me that braided,  
25 meandering and compound channels, rivers with those

1 channels require more water to float a boat than would a  
2 single channel?

3 A. A meandering channel is a single channel.

4 Q. Okay. A braided channel, does that require  
5 more water to float a boat in in total than a single  
6 channel?

7 MR. KATZ: Only question I have, are we  
8 talking about flow channel or the flood channel?

9 MR. MCGINNIS: Well, however he defines  
10 braided channel.

11 THE WITNESS: Well, if we're talking about the  
12 low flow channel, the boating channel, if it were  
13 braided and those braids had a cumulative width that was  
14 larger than the single channel, and all other factors  
15 were equal, then in all likelihood the braided channel  
16 would be less deep. In some circumstances under low  
17 flow conditions, that might make it, in that individual  
18 braid at that particular location, it might make it not  
19 navigable at that point; it might make it not boatable  
20 at that point.

21 BY MR. MCGINNIS:

22 Q. What if the cumulative width of the total of  
23 the braided channels is the same as the width of the  
24 single channel? Wouldn't the water level on each of the  
25 braided channels be lower?

1 A. If the cumulative width of the braids were the  
2 same as the single channel width? I'm thinking about  
3 that one. Kind of thinking the boundary roughness would  
4 increase. Might actually be deeper.

5 Q. If you can't answer it, that's fine.

6 A. You're telling me the widths, when you say the  
7 cumulative width, you mean, I've got, let's say, two  
8 braids. Make it a simple case. One braid is ten feet  
9 wide and the other braid is ten feet wide, and you're  
10 comparing that to a twenty-foot wide channel.

11 Q. Yeah. What's the difference in the widths of  
12 those two situations?

13 A. Widths would be the same.

14 Q. Going to Page 20.

15 A. This is 18, 19, and what?

16 Q. Are we on the right one?

17 A. You know what? I'm sorry. I was scrolling  
18 down, going the wrong direction.

19 Q. I spent the last 24 hours trying to figure out  
20 the pagination of your two versions of the PowerPoint,  
21 so don't mess me up any more than I already am.

22 The bottom bullet point there says, talking  
23 about PPL Montana, and you say, not so brief that it is  
24 not a commercial reality. Do you see that?

25 A. Yes, I do.

1 Q. And I'm assuming that's a reference to the  
2 U.S. Supreme Court decision in PPL Montana?

3 A. Yes, it is.

4 Q. In your view of how you applied the standard  
5 here, what would be so brief as to not be a commercial  
6 reality? How do you apply that standard?

7 A. Well, I think like so many things in science,  
8 there isn't an exact number that says this is the  
9 length. But I'm taking that as a relatively common  
10 sense so that certainly a navigable portion -- wouldn't  
11 consider a river navigable if it had a 200-foot long  
12 pool that was six feet deep and everything else on the  
13 river was two inches deep.

14 Q. How about in terms of time, duration of which  
15 something is navigable?

16 A. Well, I guess it depends on what the  
17 conditions, the climate and geographical conditions of  
18 the river are. I know in Alaska there are navigable  
19 rivers that are frozen for six months of the year.  
20 There's not a lot of water, not liquid water anyways.

21 I guess as we've gone through the navigability  
22 cases over the last couple decades here, I know we  
23 talked a lot about ephemeral streams. I think that's  
24 certainly an example where there is a spike due to a  
25 hard rain, river comes up, river drops down in the

1 course of 24 hours, 48 hours, something like that.  
2 Certainly that's too brief. The way I've interpreted  
3 the Daniel Ball Test in terms of ordinary would be  
4 regular and expected. Something that somebody could  
5 reasonably plan on the water being there. Is that  
6 enough of an answer for you? You get where I'm going --

7 Q. Close.

8 A. -- or do you want a number of days?

9 Q. No, that was my next question though. Is  
10 there some minimum number of days that you have in your  
11 mind as the standard that you applied in this instance?

12 A. No, I never thought about it, and it never  
13 came up in this case.

14 Q. How about if something that was capable of  
15 being navigated in some years but not others?

16 A. Yeah, I think that speaks to the ordinary and  
17 natural conditions I talked about yesterday. So I want  
18 to eliminate years that are drought years. So that you  
19 might have -- really doesn't matter in this case,  
20 because I think there are drought periods that lasted  
21 for portions of years, but we had some historical  
22 descriptions that I showed you yesterday where somebody  
23 observed that the river was dry. I think that was in  
24 Segment 6, at some point in that section. But that was  
25 for a period of time, and certainly that evidence that's

1 been submitted by experts other than me indicate that  
2 the median flow rates are substantially larger. So what  
3 I'm getting to is that if ordinarily it were dry for  
4 most of the year, that doesn't sound like a navigable  
5 river to me at all.

6 Q. When you did your PowerPoint that you gave us  
7 yesterday, did you take some slides out from the  
8 PowerPoint that you had done a week or two ago that got  
9 submitted to the Commission?

10 A. I may have.

11 MR. MCGINNIS: Your Honor, may I approach?

12 BY MR. MCGINNIS:

13 Q. I had a question. There was a -- there was a  
14 slide that I saw in your first one that's not in this  
15 one. Does that seem familiar?

16 A. Yeah, I took that out because it's in the  
17 boating presentation.

18 Q. Okay. That's slide 21 that was in your  
19 original PowerPoint from the last week?

20 A. Right.

21 Q. So that is now -- you just changed, moved it  
22 to the other PowerPoint?

23 A. It was in both, and I decided we didn't need  
24 to go over it twice.

25 Q. Let's go to Page 26 then of the Gila River

1 presentation. And you talked about this slide some  
2 yesterday. My question is, for example, in the second  
3 bullet point, the second bullet point there, it says  
4 gage record underestimates natural flow rates. Do you  
5 see that?

6 A. Yes.

7 Q. How do you know that's true?

8 A. That's been the conclusion of every expert in  
9 court I've seen. If I compare the rates that are in the  
10 USGS record, the long-term records from USGS, the median  
11 monthly flow rates are all lower than those estimates  
12 that have been done by others.

13 Q. Okay. Other than the fact that other people  
14 have come to the same estimate you have, how do you know  
15 that's always true?

16 A. No, no, no. I'm saying in respect to the Gila  
17 River. I'm not trying to make a general principle for  
18 other rivers other than the Gila River.

19 Q. Okay. If there were no human depletions from  
20 the system, would your statement still be true?

21 A. If --

22 Q. If there were no diversions?

23 A. No diversions from the river, there was no  
24 storage, there were no changes, and you're saying if we  
25 were in -- the ordinary and natural conditions had never



1 changed, USGS records should be fairly representative of  
2 ordinary and natural conditions.

3 Q. Have you done, yourself, have you done any  
4 analysis to determine how much higher the natural flow  
5 rates were than the gage records at any point along the  
6 Gila?

7 A. In our original reports we reported on  
8 pre-development flow estimates that were available at  
9 the time, but for this update I did not do any new  
10 calculations.

11 Q. Flipping over to Page 28 of your PowerPoint,  
12 still on the Gila River PowerPoint. On the third bullet  
13 there you say that the Gila River is still used for  
14 navigation. Can you tell me which reaches you're  
15 talking about, which segments?

16 A. 1, 2, 4, 5.

17 Q. Not talking about 6, 7 or 8 there.

18 A. No.

19 MR. KATZ: What was the question again? I'm  
20 sorry.

21 MR. MCGINNIS: What segments --

22 THE WITNESS: What segments were used for  
23 navigation today? And I guess there's some minor parts  
24 of boating that goes on in Segment 7.

25 BY MR. MCGINNIS:

1 Q. In Segment 7, the kind of boating you're  
2 talking about really is on artificial flows created by  
3 effluent releases, right?

4 A. That's correct.

5 Q. And return flows for agriculture?

6 A. Yes.

7 Q. Have you done any analysis to determine  
8 whether the frequency and regularity of those return  
9 flows and effluent flows is different than what the  
10 natural flows would have been in the river?

11 A. I haven't done any analysis, not specifically.

12 Q. Would you expect the effluent flows from 91st  
13 Avenue Treatment Plant to be more regular than the  
14 natural flows in the Salt and Gila Rivers?

15 A. I understand they go up during halftime of the  
16 Super Bowl, but they were very different from the  
17 natural condition.

18 Q. And actually more uniform, right?

19 A. Yes.

20 Q. Except for the halftime of the Super Bowl.

21 Also there on slide 28, last bullet, you say  
22 the Gila River was more susceptible to navigation before  
23 it was dammed, diverted, and altered. Do you have any  
24 way to gage how much more susceptible it was?

25 A. No.

1 Q. Before there were dams built on the rivers  
2 upstream, the river was subject to flood flows, right?

3 A. Yes.

4 Q. More subject to flood flows?

5 A. The river downstream became less  
6 susceptible -- it was less susceptible to flooding  
7 downstream of the dams.

8 Q. And I think you talked about this morning that  
9 the flood flows are one of the things that changes the  
10 geomorphology of the channel, and can, at least for some  
11 period of time, cause them to be less navigable?

12 A. My testimony was that the flood flows can  
13 change the flood channel, but they make no significant  
14 difference in the local channel.

15 Q. I thought the very first question I asked you  
16 when we sat down, we looked back at your testimony from  
17 2005 where you said they changed the low flow channel,  
18 too. Did I miss that?

19 A. I said yes, they do change it. But it doesn't  
20 necessarily -- I didn't say that it made it less  
21 navigable.

22 Q. But it does affect it?

23 A. It changes -- it can change the geometry of  
24 it, the location of it.

25 Q. Page 48 of that same PowerPoint.

1           You talk there about -- this is in Segment 6,  
2 from Ashurst-Hayden to the Salt River confluence being a  
3 losing stream with declining flow. Do you see that?

4           A.     Yes, I do.

5           Q.     And that's your opinion also with respect to  
6 Segment 7 and 8, correct?

7           A.     Yes.

8           Q.     A losing stream, my understanding of a losing  
9 stream is it's a stream where it loses water as it goes  
10 down its course, correct?

11          A.     Typically the flow rate declines in the  
12 downstream direction.

13          Q.     So if the flow rate declines in a downstream  
14 direction, it would be possible for a river to be more  
15 navigable upstream than it is downstream; is that  
16 correct?

17          A.     Yes.

18          Q.     Have you done any analysis to determine the  
19 level of -- the magnitude of the losing nature of the  
20 Gila River?

21          A.     No.

22          Q.     Do you know if anybody else in this case has  
23 done any of that work?

24          A.     I believe Mr. Gookin has some estimates from  
25 flow rates coming in and going out of Segment 6,

1 specifically.

2 Q. Have you done any analysis to determine the  
3 amount of losses per mile on any segment of the river?

4 A. No.

5 Q. Based upon evapotranspiration and natural --

6 A. No, I have not.

7 Q. Have you done anything to determine what the  
8 amount of the evaporation is from phreatophytes in the  
9 lower Gila River?

10 A. No.

11 Q. Let's go to slide 57. At least I'm going in  
12 order. Slide 57 deals with Segment 7, which is the Salt  
13 River confluence to Dome, right?

14 A. That's correct.

15 Q. And were you the one that made the  
16 determination of where you break the segments off?

17 A. Yes.

18 Q. Why did you stop this one at Dome?

19 A. As I said yesterday, it had to do primarily  
20 with the use, historic use of the river.

21 Q. Is there anything different about the river  
22 between upstream of Dome and downstream of Dome?

23 A. Not till you get to the backwater area which  
24 is very near the confluence.

25 Q. Have you been on the river in that area around

1 Dome?

2 A. Only at road crossings.

3 Q. Do you know of any geologic features that  
4 occur in that area around Dome?

5 A. There are some low mountains that the river  
6 passes through in its valley.

7 Q. There's actually a mountain that comes really  
8 close to the river right there at Dome, right?

9 A. Where it's at right now, yeah.

10 Q. Do you know about whether there's the presence  
11 of bedrock in that area around Dome that would push  
12 water to the surface from the subflow of the river?

13 A. That may be possible.

14 Q. You don't know one way or the other?

15 A. I don't know.

16 Q. Do you know what the elevation change is from  
17 Dome to Yuma, the surface elevation?

18 A. I have the information, but sitting here today  
19 I don't know.

20 Q. Is it more or less than from Dome to Phoenix?

21 A. I don't -- total elevation or the slope?

22 Q. Change in elevation.

23 A. You know what, I don't know either, so either  
24 way.

25 Q. Go to Page 57. 57 deals also with Segment 7.

1 You have a bullet point there that says perennial. Do  
2 you see that?

3 A. Yes.

4 Q. Is part of your opinion that Segment 7 is  
5 navigable based upon your understanding that that part  
6 of the river is perennial under ordinary and natural  
7 conditions?

8 A. Yes.

9 Q. And if there was evidence in the record that  
10 there were at least days when portions of that segment  
11 were dry, would that change your opinion?

12 A. If it were days, no.

13 Q. But if it was weeks?

14 A. If it were months, sure.

15 Q. Is a perennial stream ever dry?

16 A. Yes.

17 Q. How long could a perennial stream be dry  
18 before it's no longer perennial?

19 A. It also depends on whether we're talking about  
20 in its ordinary and natural condition or we're talking  
21 about extreme drought. But if it occasionally dries up,  
22 my understanding is that rivers can be classed as  
23 perennial even if they occasional dry out for short  
24 periods of time.

25 Q. So just because you put perennial on the slide

1 doesn't mean that this portion of the river didn't  
2 occasionally dry up even under ordinary and natural  
3 conditions?

4 A. I'm unaware of it drying up in ordinary and  
5 natural conditions.

6 Q. Let's go to Page -- slide 65. I'm sorry, I'm  
7 trying to read the page number. 65 deals with some of  
8 the archaeology; is that right?

9 A. Yes.

10 Q. The middle bullet points there says,  
11 river-dependent people in all segments. Do you see  
12 that?

13 A. Yes.

14 Q. Were you at the hearing on the Gila River  
15 during the portion of the hearing back in 2005 when  
16 Mr. Gookin testified about the uses of the river by the  
17 Pima Indians?

18 A. Yes.

19 Q. Do you remember him testifying that the Pima  
20 Indians, when they wanted to travel along the river,  
21 they didn't use boats, they ran?

22 A. I don't recall it specifically, no.

23 Q. Let's go over to slide 72. Slide 72, the  
24 bottom bullet point there you say that the Native  
25 American tribes along the Gila River were not



1 boat-dominated societies? What did you mean by that?

2 A. I'm just trying to express that the  
3 archaeological record of any kind of boat use in the  
4 interior areas is relatively scant. So they don't call  
5 themselves "We are the boating people."

6 Q. You understand that one of the Pima tribes, at  
7 least, called itself the river people?

8 A. Yes. That's what I meant by the previous  
9 slide.

10 Q. And in your experience in dealing with other  
11 navigability cases and just dealing in your work in  
12 general, do you find that tribes that live along  
13 navigable rivers often were not boat-dominated  
14 societies?

15 A. Often? Navigable rivers? There are -- I'm  
16 not quite sure how to answer that, where you're going  
17 with that, Mark. But I can tell you that yes, there are  
18 Indian tribes that live along rivers that do use boats.

19 Q. In your work in Alaska and other places, for  
20 example, do you have any place where there's an Indian  
21 tribe that lives along a river that's navigable that  
22 there's not any history of boat use?

23 A. No. There's a lot of rivers in Alaska, and  
24 I've only worked on a handful.

25 Q. The ones you worked on, were there Native

1 American tribes living on them?

2 A. Yes.

3 Q. Did they use boats?

4 A. I'm not aware of the Chitina using boats,  
5 although it wouldn't surprise me.

6 Q. Moving over to Page -- slide 75. Here you're  
7 talking about why the trappers and explorers didn't use  
8 boats, right?

9 A. Yes.

10 Q. About halfway down the page there's a bullet  
11 that says, Character of the country overland travel  
12 easier; do you see that?

13 A. I do.

14 Q. Have you read all the historical accounts of  
15 the people going across the Gila Trail and other of  
16 these -- other overland traveler accounts that are in  
17 the record?

18 A. I doubt that I've read all of the accounts of  
19 those things.

20 Q. You've read some of them?

21 A. I've read some of them.

22 Q. Sound like a pretty miserable trip for those  
23 folks in some of those instances?

24 A. They certainly encountered some difficulties.

25 Q. And you still, even after seeing all those

1 difficulties, believe that overland travel was easier  
2 for a lot of people than going down a navigable river?

3 A. Yes.

4 Q. I'm sorry, what was your answer?

5 A. Yes.

6 Q. And why is that?

7 A. They had a wagon. They had oxen. They had  
8 gear. They didn't have boats, necessarily. Would have  
9 needed to build a boat. They were used to traveling in  
10 their wagons, horses, whatever. That's what they were  
11 familiar with. They didn't have a map necessarily that  
12 said this is what this river is going to be like if you  
13 go down there. They would have needed to disassemble  
14 whatever they were traveling on, load it on a boat,  
15 reassemble it when they got to wherever they were going.  
16 Plenty of reasons.

17 Q. At the bottom of that same slide you have a  
18 statement that says, why did they canoe the Colorado?  
19 There were no land alternatives. And I know you talked  
20 a little bit about that with Mr. Hood this morning. Can  
21 you tell me what you meant by no land alternatives?

22 A. The same thing I told Mr. Hood this morning.  
23 If you go to California and you need to cross the river.

24 Q. You didn't mean that there were no land  
25 alternatives to go up and down the Colorado, right?

1 A. No.

2 Q. The terrain up and down the Colorado is not  
3 radically, at least until you get to the Grand Canyon,  
4 it's not radically different than the terrain up and  
5 down the Gila, is it?

6 A. There certainly are similarities.

7 Q. And you know there was an overland mail route  
8 that went from Yuma up through Ehrenberg in that area in  
9 the 1800s. Did you see that evidence in the record?

10 A. Yes.

11 Q. So there was a land alternative up and down  
12 the Colorado, right?

13 A. Yeah, I'm not sure that it was there in 1820  
14 but --

15 Q. But in the 1800s sometime there was --

16 A. In the 1800s, sure.

17 Q. Go to Page 99. And there was some discussion  
18 yesterday and this morning about the steamboats going up  
19 to Gila City. It's your understanding Gila City is  
20 about the general area where Dome is?

21 A. I'm not exactly sure where Gila City was.

22 Q. Okay. So you don't know how many miles up the  
23 river it was?

24 A. As I sit here today, no.

25 Q. Do you know any record of any steamboats ever

1 going up the Gila past Gila City or Dome?

2 A. No.

3 Q. And the accounts in the 1860s, that was before  
4 substantial upstream diversions anywhere on the Gila  
5 watershed, right?

6 A. As far as I know, yes.

7 Q. So as far as you know, when the river was in  
8 its ordinary and natural condition, steamboats went up  
9 the Gila River to around Dome or Gila City and then  
10 stopped there?

11 A. That's my understanding.

12 Q. Is your recollection from reading the  
13 materials that there was quite a bit of competition for  
14 business among the steamboat companies around Yuma?

15 A. I don't recall that specifically.

16 Q. If I may approach.

17 I'm giving you a document that was submitted  
18 by the State Land Department. It's Exhibit 33 or tab  
19 No. 33 in the Land Department's submission. Direct your  
20 attention to what I believe is the -- they're not  
21 numbered unfortunately -- the sixth page.

22 Sixth page, the top of the page says, Colorado  
23 River is an opposite for Yuma. Do you see that?

24 A. Yeah, I'm on that page.

25 Q. Okay. Second full paragraph there says the

1 increase in competitive paddle wheelers. Do you see  
2 that?

3 A. Yes.

4 Q. Could you read that paragraph -- and you can  
5 read it to yourself or out loud, whichever you prefer.

6 A. I've read it.

7 Q. Okay. So this paragraph of this document that  
8 the State Land Department submitted talks about there  
9 being a lot of competition among the steamboat operators  
10 in Yuma, right?

11 A. Yes.

12 Q. And it even talks about because of the  
13 competition, some of the steamboat companies or at least  
14 one steamboat company was looking into expanding its  
15 roots all the way up to a place called Callville. Do  
16 you see that?

17 A. I do.

18 Q. Do you know where Callville was?

19 A. I have a vague understanding of where it is.  
20 I've seen it discussed, yeah.

21 Q. Pretty far up the Colorado, right?

22 A. A bit.

23 Q. And they were going to make a deal with some  
24 folks in Salt Lake City to take things up to Callville  
25 in an overland to Salt Lake City. Is that what this

1 says?

2 A. Yes.

3 Q. And that's in 1864, right?

4 A. Yes.

5 Q. The same time that we think, according to your  
6 testimony earlier, that steamboats were going up, a few  
7 miles up the Gila to Gila City or Dome and then stopping  
8 there, right?

9 A. That is that same time frame, yes.

10 Q. Have you seen any information at all that  
11 steamboat operators in Yuma, while this competition that  
12 they were in for business was going on, tried to expand  
13 their steamboat operations any further up the Gila other  
14 than to Dome or Gila City?

15 A. In this paragraph, no.

16 Q. Have you seen anything anywhere in the record  
17 that talks about that?

18 A. No.

19 Q. Let's go to Page 101 of your PowerPoint. And  
20 you talked about this at some length with Mr. Hood, and  
21 I'm not going to plow old ground. This is the --  
22 Mr. Pattie's use of the river. And my question is, he  
23 asked you questions about going back and forth  
24 between -- going from Safford to Yuma several times,  
25 right?

1 A. Yes.

2 Q. My question is, do you know how he got from  
3 Yuma back to Safford?

4 A. I do not.

5 Q. Do you know how long each trip took?

6 A. I do not.

7 Q. You talked some earlier with Mr. Hood about  
8 the Davis book, Goode B. Davis. Is that the book you  
9 were talking about?

10 A. He showed me an excerpt from that book, yes.

11 Q. This is State Land Department's Exhibit No. 3,  
12 which I think is the same document you were talking with  
13 Mr. Hood about earlier.

14 Direct your attention to Page 9 of that  
15 document. Is this a document you would consider  
16 authoritative?

17 A. It's certainly a document that I would  
18 consider.

19 Q. Okay. It's one that you relied upon in coming  
20 to your opinion in preparing your report or not?

21 A. Actually, technically I relied on what other  
22 people had relied on in this, in this report or some  
23 other document by Mr. Davis.

24 Q. On Page 9 in the first full paragraph about  
25 two-thirds of the way down there, there's a



1 characterization of Pattie's memoirs by Goode Davis I'm  
2 going to read to you. It says, "Pattie was not  
3 attempting to produce a scientific treatise, but rather  
4 an exciting adventure story." Do you see that?

5 A. I do.

6 Q. Based on your understanding of Pattie's  
7 memoirs, would you agree or disagree with that  
8 statement?

9 A. That's a statement I've heard before.

10 Q. So does that statement give you any concern  
11 about the historical or scientific validity of the exact  
12 details of Pattie's memoirs?

13 A. Not with respect to information that I'm  
14 using. I'm not sure how exciting saying we paddled the  
15 river several times is. I'm not sure what really that  
16 adds. So no, I don't have any particular concerns about  
17 that.

18 Q. Let's go to Page 102 of your PowerPoint. This  
19 one talks about the Mormon Battalion account; is that  
20 right?

21 A. Yes, it does.

22 Q. And you talked some this morning about  
23 Mr. Gilpin who testified as part of your team back in  
24 2005 as a historian and an archeologist. Do you recall  
25 that?

1 A. I do.

2 Q. Here on this slide you say that the Mormon  
3 Battalion effort was a complete failure. Do you agree  
4 with that?

5 A. No.

6 Q. What do you disagree with about it?

7 A. My point yesterday when I talked about this  
8 slide was that Colonel Cooke, that was his words. He  
9 characterized the episode as a complete failure. But  
10 when you look at the actual facts of the story, the  
11 boat, the boatmen, once they had modified their boats  
12 and their load, arrived in Yuma. So I would call that a  
13 success. As I said yesterday, I'm not quite sure what  
14 Colonel Cooke had in his mind when he called it a  
15 failure. Certainly they had some difficulties along the  
16 way. But like I say, once they got their boat and  
17 boating gear figured out they seemed to do pretty well.

18 Q. Would you say that Colonel Cooke would be in a  
19 better position than you to determine whether it's a  
20 success or a failure?

21 A. I'm not disputing whether he considered it a  
22 failure, and I don't know what criteria by which he was  
23 measuring it. By the criteria I would use, it was a  
24 success.

25 Q. Do you still have the transcript there from

1 November 16, 2005?

2 A. I do.

3 Q. We just established that Mr. Gilpin or  
4 Dr. Gilpin was an historian on your team at that time,  
5 right?

6 A. That's correct.

7 Q. Let's look at Page 38 of that transcript.  
8 I'll read this one for you because it takes -- splits  
9 some of the pain of having to do the reading. You just  
10 make sure I'm reading it right. Page 38, starting in  
11 the middle of Line 21. And this is, again, Mr. Gilpin's  
12 testimony, right? Can you tell if this is Mr. Gilpin  
13 testifying at this point?

14 A. That's my understanding.

15 Q. He was talking about the Mormon Battalion trip  
16 and he says, starting in the middle of Line 21, "So that  
17 was really an unsuccessful experience, and the  
18 commander, Captain Philip St. George Cooke, in his  
19 journal bitterly denounced his subordinate, Lieutenant  
20 George Stoneman, for basically not warning him that this  
21 wouldn't work, and then once he tried it, not being  
22 successful." Did I read that right?

23 A. You read what's on the page, correct.

24 Q. And this is Mr. Gilpin's words, the person  
25 that you worked with on this project?

1 A. Yes, it is.

2 Q. Is he a Mister or Doctor? I'm sorry.

3 A. Mister.

4 Q. And if you flip over to Page 81 of that same  
5 transcript, Page 81 starting on Line 17, again, this is  
6 Mr. Gilpin responding to some questions from Mr. Helm.  
7 Starting on Line 17, "And Captain Cooke flat-out stated  
8 that he considered it an unsuccessful..." Do you see  
9 that?

10 A. I do.

11 Q. But as you sit here today, you disagree with  
12 Mr. Gilpin's characterization of the trip?

13 A. Mr. Gilpin is saying what -- he's quoting  
14 Colonel Cooke. I don't see anything where he says --  
15 you asked him, "Do you consider it a failure and by what  
16 criterion?"

17 Q. You recall Mr. Jackson testifying --  
18 Dr. Jackson testifying in 2005?

19 A. I remember that he did testify.

20 Q. Do you recall him also testifying that Cooke  
21 considered this event unsuccessful?

22 A. Mr. McGinnis, I'm telling you right in front  
23 here of the slide, I put right there that yes, Colonel  
24 Cooke considered it a failure. We're not arguing that  
25 point at all.

1 Q. But you sitting here a hundred and some years  
2 later think it was successful?

3 A. The boats arrived. They arrived ahead of the  
4 land troops.

5 Q. Nobody died?

6 A. Nobody died. Nobody was injured. That seems  
7 like successful boating. Whatever Colonel Cooke had in  
8 his head that made that a failure, maybe it was  
9 insubordination, maybe it is the fact that they had to  
10 lighten their load, maybe that -- who knows what it was.  
11 But I don't know what it was.

12 Q. Flip over to Page 103 now -- your slide 103.  
13 Again, you talked with Mr. Hood a little bit about this  
14 Howard family trip, I think this morning.

15 A. I don't recall talking about this one.

16 Q. Okay.

17 A. Maybe yesterday.

18 Q. I'm sorry?

19 A. We talked about it yesterday.

20 Q. Okay. This is the Hood family trip?

21 A. Howard.

22 Q. I'm sorry, Howard. Yeah, the Hood family.

23 The Howard family trip, and you talked  
24 yesterday, maybe it was yesterday you talked about the  
25 commander -- comandante at Fort Yuma actually sending

1 out the cavalry for these folks?

2 A. I don't know if it was the cavalry.  
3 Supposedly they sent some troops up, yes.

4 Q. Okay. And you don't know why they did that?

5 A. Do not. In the newspaper articles it  
6 expressed some sort of concern about danger of some  
7 kind.

8 Q. Okay. And this is one of the same newspaper  
9 articles that talks about the folks on the boat as  
10 reckless voyagers?

11 A. I don't recall that in particular, but it  
12 could be.

13 Q. This is State Land Department's document 14.  
14 Is this the account, as far as you know, that you relied  
15 upon for that particular trip?

16 A. Looks to be, yes.

17 Q. If you look on the second page of this  
18 exhibit, not counting the numbered page. Should be one  
19 that -- okay.

20 They're all just one really long paragraph.  
21 Do you see that? Second paragraph, really long, starts,  
22 "The boat referred to."

23 A. Yes.

24 Q. And then I'm going to read for you about  
25 two-thirds of the way down in that paragraph starting at

1 "Being informed." Do you see that?

2 A. Yes.

3 Q. Okay. This says, "Being informed by some  
4 advance riders of the immigrant party that one of their  
5 number with his family was coming down the river by  
6 boat, he at once sent a detachment from the Post up the  
7 river to give such aid to the expedition as the  
8 Lieutenant afterward told the writer....," and then  
9 there's a word there, but I can't read it. Maybe you  
10 can. See what that next word is?

11 A. I can't.

12 Q. "Not only the possible but probable outcome  
13 might require. But the squad passed without seeing the  
14 reckless voyagers and did not put an appearance at the  
15 fort until several days after the latter had arrived  
16 here and in safety." Do you see that?

17 A. Yes.

18 Q. So he sent -- the commander sent the troops  
19 out to rescue or what he thought would require a rescue  
20 of the folks he referred to or the article refers to as  
21 reckless voyagers?

22 A. He did send troops out, and it was to assist  
23 those boat travelers who ended up not seeing the troops  
24 and arriving safely.

25 Q. If boating the lower Gila in the 1840s was

1 something that people thought was normal or usual or  
2 considered safe, would there have been any reason to  
3 send the cavalry out for them?

4 A. Indians.

5 Q. Is there any mention of Indians in that  
6 article that you know of?

7 A. No.

8 Q. There's a mention of boating in that article  
9 though, right?

10 A. It does say the word "boating." It doesn't  
11 say that he sent it out because they were boating.

12 Q. Okay. Do you have any other information about  
13 that Howard trip?

14 A. There are several things in the record that  
15 discuss that. I remember, seems like Mona McCroskey may  
16 have written about it, and there was another gentleman  
17 who has an article that was written, includes this  
18 account.

19 Q. Here is a book by Pancoast. Does that sound  
20 familiar?

21 A. There is a book by Pancoast where they talk  
22 about -- it's not the one that I was thinking about, but  
23 yes.

24 Q. That's the State's document number 17?

25 A. Okay.



1 Q. Sorry. That's the wrong document. Hold on to  
2 that.

3 A. Hold it back?

4 Q. Just keep it. We'll get to it.

5 47 is the one I was thinking about. Sorry.  
6 This is the Pancoast book. Do you know who Pancoast  
7 was?

8 A. Other than the author of this, no.

9 Q. It's your understanding that Pancoast was a  
10 person that also accompanied the Howards on that trip,  
11 at least the overland part of that trip?

12 A. Are you waiting for an answer?

13 Q. Yeah.

14 A. I don't know. I have a vague recollection of  
15 that, but it's not one of the details that I was  
16 particularly paying attention to.

17 Q. Have you actually read this chapter from  
18 the Pancoast book?

19 A. I have, but I was only really thinking about  
20 Mr. Pancoast himself, but if you say so, Mark, fine.

21 Q. Okay. On Page 250, do you see Page 250?

22 A. I do.

23 Q. The first full paragraph there, they start  
24 talking about what I believe, at least, is the Howard  
25 excursion on the boat. Is that what this is?

1 A. He talks about rafts. My understanding of the  
2 Howard was they had a wagon that was built as a, partly  
3 as a boat and it was decked and it was one. I'm not  
4 sure I recall that there were multiples.

5 Q. It talks about a woman having labor pains?

6 A. Yeah.

7 Q. Do you think that's the same trip as the  
8 Howard trip?

9 A. It sure sounds like it because they named the  
10 baby Gila.

11 Q. And right above that part of the passage  
12 there's a statement that says, "The crew told us  
13 afterwards that they found the river shallow and full of  
14 bars and the current very rapid."

15 A. Uh-huh.

16 Q. "They frequently found themselves aground and  
17 had much difficulty in getting off."

18 A. Uh-huh.

19 Q. Is that consistent with your understanding of  
20 what the Gila River would have been in its ordinary and  
21 natural condition?

22 A. It does not surprise me that there are  
23 sandbars on that portion on the Gila River. Shallow is  
24 a relative word. Depends, I guess, relative to the kind  
25 of boat you're trying to put down in. We don't really

1 know much about the draw or the loading of this  
2 particular boat. So the fact that there are bars there,  
3 yes. The current being very rapid, that seems kind of  
4 high; but I would expect there to be some current,  
5 certainly.

6 And somebody taking a wagon down or a raft  
7 down the river would not be unusual for them to  
8 occasionally run aground. I don't know what they mean  
9 by frequently.

10 Q. Frequently is kind of the opposite of  
11 occasionally, isn't it?

12 A. Hmm.

13 Q. It's not a synonym for one another, are they?

14 A. Depends how you use it. Frequently it could  
15 be everyday we ran aground once in some person's mind.  
16 Another person it might be frequently every ten minutes  
17 we were running aground. We don't really know. All we  
18 do know is they got down to Yuma.

19 Q. Let's go over to Page 120 -- slide 120. Here  
20 you talk about ferries on the Gila, right?

21 A. Yes.

22 Q. Do you recall there being some testimony by  
23 Mr. Gilpin back in 2005 about a ferry at Maricopa Wells  
24 that had broken loose, gone down the river and got  
25 stuck?

1 A. Yes.

2 Q. And that's not something you mentioned in your  
3 PowerPoint here, is it?

4 A. There are a lot of things that are in the  
5 record that I haven't mentioned in my PowerPoint.

6 Q. Are there any other accounts of boats getting  
7 stuck, going down the river and not being able to move  
8 down the river that you've neglected to put in your  
9 PowerPoint?

10 A. Yeah. So specifically relating to the ferry,  
11 so a ferry was designed for cross-river use, as you  
12 yourself have pointed out a number of times. It was not  
13 really designed for downriver use, and my understanding  
14 in this case was a pilotless boat floating downstream,  
15 and was not really rigged for downriver navigation, and  
16 the fact that it got stuck eventually is not  
17 particularly unusual at all. My recollection, too, is I  
18 believe this is the account where they went down the  
19 stream and they towed it back up to their place and  
20 continued to use it.

21 Q. Again, my question was, are there any other  
22 accounts that you're aware of of unsuccessful boating  
23 trips on the Gila that you didn't include in your  
24 PowerPoint?

25 A. No, not aware of any. I really wouldn't

1 consider a broken-loose ferry a boating trip. That's  
2 why I didn't include it.

3 Q. Slide 113. This is one about wood floating  
4 down to Yuma, right?

5 A. Yes.

6 Q. Okay. Do you know where they were floating  
7 wood to?

8 A. My understanding is they were floating it to  
9 the prison.

10 Q. At Yuma?

11 A. Yes.

12 Q. Do you know where they were floating wood  
13 from?

14 A. I do not. Upstream, other than upstream.

15 Q. Could have been half a mile, could have been  
16 ten miles; you don't know?

17 A. It could have been.

18 Q. And you don't know whether the wood -- the  
19 source of the wood was above or below Dome?

20 A. I do not.

21 Q. You obviously must have thought it was below  
22 Dome because you included this account in Segment 8  
23 only, right?

24 A. To be honest, I didn't really think about  
25 that. I didn't think about that because I guess my

1 thinking pattern was that other accounts of going up the  
2 river to get wood were in that same reach. So I just  
3 associated with that reach, and the only point that I  
4 knew for sure was down near the prison in Segment 8,  
5 so --

6 Q. And you have the date 1897 on this slide.  
7 That's the date of the newspaper article, right?

8 A. That's correct.

9 Q. And in the newspaper article they're talking  
10 about something that used to happen?

11 A. That's correct.

12 Q. So whatever happened, could have happened  
13 before 1897?

14 A. It probably did. And the point of the article  
15 was that they were replacing what was just floating of  
16 logs down the river with this boom that was collecting  
17 the wood out of the river.

18 Q. Let's go over to slide 136. This slide shows  
19 average monthly flow data at different locations on the  
20 Gila, correct?

21 A. It does.

22 Q. Do you know if there are any natural inflows  
23 of water between Gillespie and Dome?

24 A. From time to time there are natural inflows.  
25 I'm not aware of any -- between Gillespie and Dome. No,

1 I'm not aware of any.

2 Q. And I thought you testified earlier that  
3 Segment 6, 7, and 8 were losing reaches; is that right?

4 A. Yes.

5 Q. If that's true, how can your average flow at  
6 Dome, which is downstream, be higher than your average  
7 monthly flow at Gillespie?

8 A. You notice the period of record is different.

9 Q. Okay.

10 A. So the data sets that were used to create that  
11 average likely include different events.

12 Q. It's different, but it overlaps by a  
13 substantial majority of the time, right?

14 A. Yes. But the substantial majority of the time  
15 was for post-depletion.

16 Q. So you don't believe that the average monthly  
17 flow under ordinary and natural conditions at Dome was  
18 higher than the average monthly flow at ordinary and  
19 natural conditions at Gillespie?

20 A. Yeah. In fact, these are not ordinary and  
21 natural discharges. These are post-disturbance  
22 discharge rates.

23 Q. So is it your understanding that in the  
24 ordinary and natural condition, the flows at Gillespie  
25 were higher than the flows at Dome, or lower?

1 A. I would expect them to be higher at Gillespie  
2 than at Dome.

3 Q. Okay, over to slide 187. One of the things  
4 you say there about Segment 8, which is the area between  
5 Dome and Yuma, right?

6 A. Yes.

7 Q. Is that one of the reasons it isn't boated is  
8 because of the distance from major urban centers?

9 A. Yes.

10 Q. Was that also true at the time of statehood?

11 A. Yeah, I don't think there were any major urban  
12 centers at the time of statehood.

13 Q. Relative to the number of people who were in  
14 Arizona in general, Yuma was a relatively thriving  
15 metropolis, for lack of a better term, in the 1800s,  
16 right?

17 A. Yeah, by that standard. We don't have a list  
18 of population by city at a certain time. I could  
19 actually look it up, but my guess is relative to other  
20 cities compared to now, its proportion of Arizona  
21 population was greater in the 1800s than it is today.

22 Q. And, for example, in 1849 it was a  
23 transportation center that a lot of the Forty-Niners  
24 went through on their way to California?

25 A. Some of them did, yes.



1 Q. And it was a port on the Colorado River,  
2 right?

3 A. Yes.

4 Q. And it was also at a time when there were  
5 steamboats going up the river, at least to Gila City and  
6 stopping, right?

7 A. In the 1800s, yes.

8 MR. MCGINNIS: I don't know how we're doing  
9 for a break. I have some questions about his other  
10 PowerPoint. We could kind of stop, or we could just  
11 keep going.

12 CHAIRMAN NOBLE: It might be a little bit  
13 early. I was planning on stopping around 2:30.

14 MR. MCGINNIS: I'm fine. We might be able --  
15 we might be done by then.

16 BY MR. MCGINNIS:

17 Q. All right. Let's go to your other PowerPoint,  
18 Jon. This is the boating PowerPoint, right?

19 A. Yes, it is.

20 Q. Slide 4 of that PowerPoint, I think you talked  
21 about this a little bit with Mr. Hood this morning, and  
22 I don't want to belabor the point. But your last bullet  
23 point there says basically navigation was not wagon,  
24 hoof, or feet on stream beds, right?

25 A. That is correct.

1 Q. And you'd agree with me that somebody who is  
2 walking along the river, that doesn't mean navigable?

3 A. Not according to the Daniel Ball Test.

4 Q. You would agree with me somebody walking along  
5 the river pulling a boat doesn't mean it's navigable?

6 A. They are not navigating on water in that  
7 particular instance. Whether the river is navigable or  
8 not, that would not be evidence.

9 Q. As a matter of fact, the U.S. Supreme Court in  
10 the Montana decision that you said you read basically  
11 says if you're dragging your boat in the water and  
12 walking, that's not navigation. Do you remember that?

13 A. I don't recall that specifically.

14 Q. But you don't, you don't know that that's not  
15 correct?

16 A. As we talk about it, I have a vague  
17 recollection of it, but I'm just not prepared to testify  
18 that's what it said.

19 Q. Do you know -- back to what we were talking  
20 about Yuma and the Colorado River -- do you know what  
21 the median flow of the Colorado River was in its  
22 ordinary and natural condition?

23 A. I do not.

24 Q. Do you have a guess?

25 A. No.

1 Q. Do you think it was -- can you give me a  
2 ballpark at all?

3 A. No.

4 Q. Was it more or less than the Gila?

5 A. It would probably be more.

6 Q. Quite a bit more?

7 A. What do you mean by quite a bit? I don't  
8 know.

9 Q. Do you think it's double the flow of the Gila?

10 A. I don't know.

11 Q. You didn't look at that?

12 A. I didn't.

13 Q. Over to Page -- slide 8 of your boating  
14 PowerPoint. Again, Mr. Hood dealt with this some this  
15 morning, and I'll try not to go too long on it. But you  
16 talked with him some about the -- this quote here about  
17 the 27 years to get the boats right and get the  
18 technique right. Do you see that?

19 A. I do see that.

20 Q. In the standard as you applied it of  
21 navigability, if that 27-year period, or whatever that  
22 number of year period is, ended after statehood, would  
23 the river still be navigable?

24 A. Yes.

25 Q. So if there wasn't a boat that could navigate

1 the river at statehood but 27 years later somebody  
2 developed a boat that could, you would say under the  
3 Daniel Ball Test it was navigable?

4 A. Well, that's a complicated question. First of  
5 all, I don't believe that there's a case where somebody  
6 invented a kind of boat that would navigate the Missouri  
7 River after statehood that didn't exist prior, or I  
8 don't think there were any substantially different kinds  
9 of boats that were invented after Arizona statehood that  
10 created the opportunity to navigate on the Gila River  
11 compared to what was available before statehood. But  
12 again, going back to your hypothetical, which you seem  
13 to like, if the -- it needs to be a boat that was  
14 conducted in the customary modes of trade and travel. I  
15 interpret that to mean boats, types of boats that were  
16 available.

17 Q. Okay. And I'm not trying to dream this  
18 hypothetical up out of nowhere. This is just a quote  
19 you have on your slide. It said it would take another  
20 27 years to "evolve the boats, the experience and the  
21 maneuvers required to navigate the Missouri." And you  
22 testified about that at this PowerPoint on the Gila  
23 River, right?

24 A. I did.

25 Q. And you actually have a bullet point right

1 next to it that essentially repeats the quote on  
2 slide 8, right? Can we go back to slide 8?

3 And again, my question was, if statehood  
4 occurred during that 27-year period, would you consider  
5 the river navigable or not?

6 A. Are we talking about the Missouri River or are  
7 we talking about this hypothetical river?

8 Q. Well, suppose it's the Gila River and there  
9 was a period of time after statehood while people were  
10 still trying to evolve boats, as it says here, to be  
11 able to navigate the river. So it's the Gila River, but  
12 it's a hypothetical fact I just gave you.

13 A. First of all, the point of this slide is not  
14 to discuss the specifics of that particular boat and  
15 when it developed. The point of the slide is that  
16 sometimes it takes time from the initial attempt to boat  
17 something to develop the technology and skills to boat  
18 it. So that's the point I was trying to make to the  
19 Commission here.

20 A lot of these accounts of first descents of  
21 rivers and the time it took before the river changed  
22 from its ordinary and natural condition didn't exist in  
23 Arizona, particularly given the low population and few  
24 opportunities.

25 So to answer your question directly, if there

1 were a river in which it couldn't be boated by any type  
2 of boat that was available prior to statehood, and that  
3 sometime after statehood there was a boat that was  
4 invented or evolved that allowed that boating, I don't  
5 think that would meet the Daniel Ball Test.

6 Q. So if, for example, if fiberglass boats were  
7 the only kind of boats that could navigate the Gila  
8 River, and fiberglass was devised, or invented or  
9 however they got to fiberglass, after 1912, then the  
10 river wouldn't be navigable?

11 A. If fiberglass boats, but not just a matter of  
12 the fact that it was made of fiberglass. If the very  
13 existence of fiberglass caused it to be more buoyant or  
14 something. I can't imagine what that would be in that  
15 event. What I really don't want to see is a posthearing  
16 memorandum that says Fuller said fiberglass boats, the  
17 invention of fiberglass is responsible for navigability  
18 of the Gila River. That's not what I'm saying at all.

19 I'm saying in this hypothetical construct that  
20 you've crafted here, which I don't believe applies to  
21 the Gila River or its history, but sure.

22 Q. And if inflatable rubber rafts, the type that  
23 became available after World War II, were the only kind  
24 of rafts that could navigate the Gila River, then the  
25 Gila River wouldn't be navigable under your definition

1 of navigability, would it?

2 A. Again, inflatable rafts were available well  
3 before statehood. The type of rubber used changed after  
4 statehood. But the concept of an inflatable raft --  
5 just talking about the change in the durability, the  
6 need to fix it, how many times you could bump into  
7 something before you wore through it, that was the  
8 difference. Really, the difference wasn't in the draft  
9 or its maneuverability or anything like that.

10 Q. Now, I tried to be specific in my question,  
11 and maybe I wasn't specific enough. I think my question  
12 was, if inflatable rubber rafts of the type that became  
13 available after World War II were the only type of craft  
14 that could navigate the Gila River, would the Gila River  
15 be navigable under your application of the federal test?

16 A. I think you asked me the same question, but  
17 you substituted "inflatable" for "fiberglass."

18 Q. I meant to ask you exactly the same question  
19 because you didn't answer it. So can you answer the  
20 question?

21 A. I did answer it. I'm telling you that in your  
22 construct, if there were some imaginary type of boat  
23 that could be invented, be it fiberglass or inflatable,  
24 that appeared suddenly sometime later after statehood  
25 that allowed navigation in its ordinary and natural

1 condition, which is just prior to statehood, sure, that  
2 would not meet the Daniel Ball Test. It was not a  
3 customary mode of travel.

4 Q. Let's go over to slide 15 there. Slide 15  
5 there at the bottom you say, if rivers weren't boatable,  
6 why did people have boats? Right? That's a question  
7 you testified about yesterday --

8 A. It is.

9 Q. -- and a little bit this morning. Okay. If  
10 you're a farmer, homesteader in the 1800s along the Gila  
11 River, and you farm on an island or on an area that's  
12 subject to inundation by the river, and you need a boat  
13 to get in and out of your property a few weeks a year,  
14 don't you think you would get one?

15 A. Here we are in a hypothetical situation again.  
16 I might. I might not.

17 Q. So if you were a farmer that needed a boat one  
18 or two weeks a year to get to your property, and you had  
19 a boat, there'd be a reason for it, right?

20 A. If you needed a boat and you could afford a  
21 boat and you knew how to use a boat, you would probably  
22 have a boat.

23 Q. And even though you only needed that boat a  
24 week or two or a day or two in a year to get to your  
25 farm, if you can't get out and you can't get in without



1 the boat, it's a pretty good reason to have a boat,  
2 wouldn't it be?

3 A. It would be a reason to have a boat. Might  
4 not be the only reason to have a boat. I'm not sure  
5 that's the case.

6 Q. Well, you know there are situations, there's  
7 several accounts in the record of people using boats to  
8 get to their property or out of their property during  
9 floods on the Gila, right?

10 A. During floods.

11 Q. Right. And that was my question, I thought.  
12 Did you not understand my question to include that  
13 concept?

14 A. You said a couple weeks a year.

15 Q. Okay. Have you reviewed all of the exhibits  
16 that the State put in?

17 A. I tried to.

18 Q. Did you assist in picking which exhibits got  
19 submitted?

20 A. They asked me for a list of things that I  
21 would like submitted.

22 Q. Did you review the exhibits relating to the  
23 advertisements from 1908 from a store in Phoenix called  
24 Penney and Robinson? Do you recall that?

25 A. How many pages of materials are there? I

1 don't recall that one specifically.

2 Q. Being an outdoorsman, I thought you might have  
3 remembered the sporting goods catalog.

4 A. Alas.

5 Q. Pardon me?

6 A. Alas, I do not.

7 Q. This is 56. State's Exhibit 56. Document 56.

8 A. Oh, I do remember this.

9 Q. And this is an advertisement from Penney and  
10 Robinson. It looks like a sporting goods store on  
11 Center Street in Phoenix that the State submitted as an  
12 exhibit, right?

13 A. Yes.

14 Q. And this document talks about it basically  
15 being time to go fishing, right?

16 A. Yes.

17 Q. Okay. And it lists some of the things that  
18 the store sells here in Phoenix for fishing, including  
19 poles, rods, lines, reels and hooks. Do you see that?

20 A. Yes.

21 Q. No mention in any of these advertisements  
22 about boats, right?

23 A. That's correct.

24 Q. Do you ever recall seeing in any documents,  
25 any of the historical documents any advertisements from

1 anybody in Arizona, any store in Arizona selling boats?

2 A. As I sit here today, no, I don't. Not to say  
3 that they aren't there, but I don't recall any.

4 Q. Go over to slide 18. This is a photograph of  
5 a steamboat, some kind of boat on the Gila -- on the  
6 Colorado, right?

7 A. Yes.

8 Q. Do you have any photographs in all the  
9 photographs you've seen of steamboats on the Gila?

10 A. If I had them, you would have seen them  
11 yesterday.

12 Q. So as far as you know, none exist?

13 A. As far as I know.

14 Q. And there are several different photos of  
15 steamboats on the Colorado, right?

16 A. True.

17 Q. There's photos, there's drawings, there's  
18 several different things.

19 A. Yes.

20 Q. Go over to Page 50. This is in your boating  
21 PowerPoint. Here are some more pictures of boats. Any  
22 of the boats in this picture, can you say with certainty  
23 as you sit here today that any of them were ever used on  
24 the Gila River?

25 A. Those particular boats, no.

1 Q. Any of the boats in any of the pictures you  
2 have from before statehood, can you say any of them were  
3 ever used on the Gila River?

4 A. There are some ferry boats we have pictures of  
5 that were on the Gila. Those are the ones that come to  
6 mind.

7 Q. Go over to Page 55. I'm going to ask you some  
8 questions about the inflatables. I know Mr. Hood  
9 covered some of that this morning.

10 I think you testified this morning that 1937  
11 was the first inflatable trip through the Grand Canyon?

12 A. That was what was reported in -- says right  
13 here, yes.

14 Q. Do you recall Ms. Tellman testifying about  
15 inflatables back in 2005?

16 A. Not specifically -- well, in general, but --  
17 sure. You need to point me to the text to refresh my  
18 memory.

19 Q. I'll help you out. Take a look at the  
20 November 16th transcript, 2005, page 115. This is where  
21 my recollection, at least -- and if yours is different,  
22 tell me. My recollection is she was going through her  
23 PowerPoint that had some pictures. I'm going to start  
24 reading on Line 14, Page 115. She's talking about a  
25 particular picture. She said, "This is from the 1940s.

1 This is the first inflatable boat that we know of in  
2 Arizona -- this is the Verde River -- made up of modern  
3 artificial rubber, which was developed during World War  
4 II. Natural rubber did not turn out to be very useful  
5 for inflatable boats in the conditions of being wet and  
6 suddenly being very hot and dry."

7 Did I read that correctly?

8 A. You did.

9 Q. And you don't have any information about any  
10 boats, inflatables in Arizona before, say, 1937 or 1940,  
11 right?

12 A. Just the Whipple Expedition that the  
13 Whipple -- Lieutenant Whipple crossing the Colorado  
14 River, but not on the Gila.

15 Q. Let's go to Page 61. This is your paradox.  
16 And I think I understand your testimony in this where  
17 you said, back when there was water in the rivers, there  
18 weren't any people. And then when the people came, they  
19 basically took all the water out of the rivers so there  
20 wasn't any water in the river?

21 A. Well, that's paraphrasing, but it's close.

22 Q. And on 61, slide 61, you show that there are,  
23 what, 9,000 and some people in Arizona in 1870?

24 A. Yes.

25 Q. Right?

1 A. Yes.

2 Q. Those folks lived in Arizona. They didn't  
3 have cars, right?

4 A. Not in 1870, no.

5 Q. Didn't have trains until sometime in the  
6 1870s, right?

7 A. Yeah.

8 Q. Didn't have any other modern forms of  
9 transportation, correct?

10 A. Correct.

11 Q. Why wouldn't those folks have needed water  
12 transportation, maybe even more than what we need today?

13 A. A lot of them didn't live along the river.  
14 Some of the population centers at the time, Tombstone,  
15 Tucson, Wickenburg, Prescott, Flagstaff.

16 Q. Phoenix, Yuma?

17 A. Phoenix and Yuma were on a river. Population  
18 of Phoenix in 1870 was like 1800 people. Tempe was 130  
19 or so. I don't know what Yuma was.

20 Q. If somebody wanted to go from Phoenix to Yuma,  
21 they couldn't get on a train, right? Couldn't get in a  
22 car?

23 A. Correct.

24 Q. If there was a navigable river running right  
25 between the two of them, wouldn't that have been a good

1 way to go?

2 A. Go faster on a horse. Go faster on a  
3 stagecoach. Go faster in a wagon. Probably go faster  
4 on foot.

5 Q. Doesn't there come some point where the  
6 transportation on the river is so slow that it's no  
7 longer commercially viable?

8 A. I'm not aware of any court case that says  
9 that. Compared to the Pacific Ocean, the current is  
10 pretty slow.

11 Q. Doesn't Montana talk about having some  
12 things -- they have to be commercially reasonable,  
13 commercially viable in the Montana case?

14 A. I don't recall the commercially viable  
15 statement.

16 Q. Commercial reality? Remember that when  
17 they're talking about the segments?

18 A. I'm not sure.

19 Q. If I'm floating down a river or going down a  
20 river and the only way I can do it makes it slower than  
21 me walking, would that make it, the river commercially  
22 viable?

23 A. Depends on the load. There's no current at  
24 all in the Pacific Ocean, and people boat it.

25 Q. There is a current in most rivers though,

1 right?

2 A. There is.

3 Q. Page -- slide 64. And this is again one of  
4 your slides about why there wasn't more boating,  
5 explaining why there wasn't much boating, and the  
6 question I had really was about two-thirds of the way  
7 down where you talk about parts of the Gila which were  
8 in Mexico until 1853. Do you remember testifying about  
9 that some yesterday?

10 A. I do.

11 Q. How does the fact that some of the Gila was in  
12 Mexico make it less likely that people would boat, or  
13 reasons why people didn't boat, I guess is what you're  
14 saying here?

15 A. This is a reason why people were not  
16 necessarily going along the Gila because the south side  
17 was -- you got cliffed out on the north side, and you  
18 had to cross.

19 Q. Don't Mexican folks go in boats, too?

20 A. I suppose they do.

21 Q. Have you seen any accounts of anybody from  
22 Mexico using the Gila when it was the border -- when it  
23 ran along the border?

24 A. I have no information about the Mexican  
25 population, Baja Arizona.



1 Q. Slide 65, you talked some about this  
2 yesterday.

3 A. Well, now that you ask about it, it seems like  
4 the history that I've read, the population centers that  
5 were south of the Gila were in Tucson, in Agua Prieta  
6 which is on the other side of Douglas. Those are not on  
7 the rivers. Those population centers were not on the  
8 Gila -- for whatever reason. Could have been the Indian  
9 threat. I have no idea.

10 Q. Tucson is actually on the Santa Cruz that you  
11 thought was navigable?

12 A. Not on the Gila.

13 Q. Tucson is on the Santa Cruz though, right?

14 A. I'm aware of that.

15 Q. And the Santa Cruz was one that you thought  
16 should have been navigable?

17 A. No.

18 Q. So you don't believe the Santa Cruz was  
19 navigable either?

20 A. No.

21 Q. Page -- slide 65. You talked about this some  
22 yesterday about, the last bullet point about alternative  
23 modes were required to get into and out of Arizona. Do  
24 you see that?

25 A. I do.

1 Q. And the Gila actually runs into New Mexico,  
2 right?

3 A. Yes.

4 Q. And the route from Yuma, if you could go down  
5 the Gila from Phoenix to Yuma, you also could go down  
6 the Colorado from Yuma to the Gulf of California and go  
7 by water all the way to San Francisco, right?

8 A. You said from Phoenix to Yuma?

9 Q. Yeah.

10 A. On the Salt?

11 Q. Salt and Gila.

12 A. Okay.

13 Q. Yeah. Okay. So if there was a land route --  
14 excuse me, if there was a water route from Phoenix to  
15 Yuma, then you wouldn't necessarily need an alternative  
16 mode of transportation to get out of Arizona because you  
17 could stay on water, different kind of boat maybe, stay  
18 on water and go all the way to San Francisco?

19 A. In its ordinary and natural condition.

20 Q. Let's go to slide 68. You list the factors  
21 involved in the proposition that if the river was  
22 navigable, people would have regularly boated it. Do  
23 you see that?

24 A. Yes.

25 Q. Flow depth is actually part of the

1 navigability determination, correct?

2 A. That's correct.

3 Q. So it's not really a reason why if the river  
4 was navigable, people would have regularly boated it?

5 A. No. The point of this bullet item here is  
6 there are many factors, one of which is depth but it was  
7 not the only factor.

8 Q. How does depth play into this particular  
9 concept that's on the slide?

10 A. I just said, flow depth was one of the factors  
11 involved in deciding whether you boat it. Certainly if  
12 the water is deep enough, that's a good indication that  
13 maybe I could throw a boat in there. If the depth is  
14 zero, not too many people are going to throw a boat in  
15 there. If the depth is an inch, not too many people are  
16 going to throw a boat in there. If there's sufficient  
17 depth, somebody might consider, yeah, I might be able to  
18 throw a boat in there.

19 That's not your only reason for thinking I  
20 think I'm going to boat to Yuma instead of take the  
21 train. What else do I have to think about? Well, do I  
22 have to boat it? Do I like to boat it? Is it going to  
23 be less expensive for me to boat it? And that's the  
24 point of the other bullets there. Part of the  
25 decision-making process.

1 Q. I still don't understand you. The proposition  
2 you're trying to dispel here, it looks like, is if the  
3 river was navigable, people would have regularly boated  
4 it, correct?

5 A. Correct.

6 Q. And the flow depth is one of the factors to  
7 determine whether the river is navigable in the first  
8 place, right?

9 A. Yes.

10 Q. Let's go to slide 70. One of the things here  
11 you have about reasons why not to boat a navigable  
12 river, that the river was remote, no access in 1912.  
13 You'd agree with me that wouldn't necessarily apply to  
14 the Gila River, would it?

15 A. Parts of the river are difficult to get to.

16 Q. The lower Gila or the middle Gila were pretty  
17 accessible, weren't they?

18 A. Not compared to today, but there were ways to  
19 get to it, yes.

20 Q. They could be accessed -- if you're right  
21 about being navigable, they could be accessed from Yuma  
22 by a steamboat, right?

23 A. Parts of Segment 8 --

24 Q. Well --

25 A. -- in its ordinary and natural condition.

1 Q. If everything from New Mexico to California,  
2 if the whole thing is navigable like you say it is, then  
3 all those segments would have been accessible by boat  
4 from Yuma, correct?

5 A. Correct.

6 Q. Do you know whether the road from Tucson to  
7 Phoenix in this 1800s period of time actually crossed  
8 the Gila?

9 A. I have a map of roads in there, but as I sit  
10 here today, I don't know.

11 Q. Do you have any information about whether  
12 there was a port on the Gila where the road crossed the  
13 river?

14 A. A fort?

15 Q. A port --

16 A. A shipping port --

17 Q. Yes.

18 A. -- or a military fort?

19 Q. Port with a P.

20 A. Got it. I'm not aware of any place called a  
21 port.

22 Q. But if there was, people could have gone down  
23 the road to the river and then got on the river if it  
24 was navigable and gone all the way to Yuma, correct?

25 A. If the river were navigable, yeah, people

1 could take boats down there.

2 Q. Last set of questions. I know the Chairman is  
3 wanting to take a break.

4 Page -- slide 79. Do you recall, you said you  
5 did a bunch of small minor watercourse studies, right?

6 A. I did.

7 Q. Do you know how many watercourses the  
8 Commission has determined the navigability of since it  
9 started, roughly?

10 A. I believe there's 39,000 individual  
11 watercourses, something like that.

12 Q. And here on slide 79, one of the things you  
13 say about the Gila, Salt and Verde Rivers is the  
14 continuous regular shallow flow is the only real  
15 obstruction to boating?

16 A. Yeah.

17 Q. Wouldn't that be true on all the other 39,000  
18 rivers?

19 A. Of course. But this is --

20 MR. MCGINNIS: No more questions. That's all  
21 I have.

22 CHAIRMAN NOBLE: We'll take a break. Let's  
23 try 15 minutes.

24 (Recessed from 2:35 p.m. to 2:49 p.m.)

25 CHAIRMAN NOBLE: Mr. Murphy, would you like to

1 proceed?

2 MR. MURPHY: Thank you, Mr. Chairman.

3

4 CROSS-EXAMINATION

5 BY MR. MURPHY:

6 Q. Good afternoon, Mr. Fuller. My name is Tom  
7 Murphy, and I represent the Gila River Indian Community.  
8 I don't believe we've met before, have we?

9 A. No, I don't believe so.

10 Q. Let me start with -- I don't know if you're on  
11 the boating or the navigability PowerPoint.

12 A. This is boating.

13 Q. Why don't we stick with the boating then, and  
14 if you could go to slide number 3, I will begin.

15 And in this slide you outline what the federal  
16 standard for title navigability is, correct?

17 A. Correct.

18 Q. Now, I know you have the phrase "on water"  
19 underlined; but if I read the Arizona Revised Statute  
20 next to it, it indicates that navigable or navigable  
21 watercourse means a watercourse that was in existence on  
22 February 14, 1912, and at the time was used or  
23 susceptible to being used in its ordinary and natural  
24 condition as a highway for commerce over which trade and  
25 travel were or could have been conducted in the

1 customary modes of trade and travel on the water.

2 Now, my question for you is, you indicated  
3 that you used the terms boatability and navigability  
4 interchangeably in your testimony; is that right?

5 A. I tend to use them that way, yes.

6 Q. But boatability is not navigability, is it?

7 A. How so?

8 Q. Well, boatability basically gives meaning to  
9 travel on water but does nothing for trade on water,  
10 right?

11 A. Is travel not trade?

12 Q. So you're saying travel and trade are the same  
13 thing?

14 A. They can be.

15 Q. How so?

16 A. Travel is -- paying for travel? You could be  
17 engaging in travel for the reason of performing trade.  
18 I think, for example, of the Kolb brothers who traveled  
19 down the Grand Canyon taking pictures with the intent to  
20 sell those, lecture circuit and whatnot, and sell the  
21 movies, continued to sell to people like royalties, I  
22 guess, off those movies. If I sat here longer, I could  
23 think of other instances. You're asking me for legal  
24 interpretations of this meaning, meaning of this  
25 statement here. I'm no attorney.



1 Q. Okay. Commerce is business, right?

2 A. Commerce, yeah, what exactly commerce means in  
3 terms of what you mean by business? What do you mean by  
4 business?

5 Q. Well, I mean, it's your slide. Highway for  
6 commerce, what does that mean?

7 A. Corridor. I would interpret this to be a  
8 corridor over which some sort of activity could occur.  
9 Yeah, there's certainly some overlap between business  
10 and commerce. I'm not really prepared to debate the  
11 meanings of those two words. I have a general  
12 understanding that rivers being used for commerce is  
13 discussed on this particular slide here where I talk  
14 about these are typical trade and travel uses.

15 Q. Okay. Let's stay on this slide since you did  
16 pop it up. How is travel a trade use? Because you have  
17 travel listed as a trade and travel use.

18 A. Well, it says trade and travel.

19 Q. Right.

20 A. So travel is addressing the travel part of the  
21 trade and travel.

22 Q. Doesn't that mean trade and travel that both  
23 occur together?

24 A. I'm not sure that it does.

25 Q. Well, could the test have been articulated

1 trade or travel?

2 A. I suppose it could have.

3 Q. And if we go down this list, some of these  
4 things are travel but not trade, right? For example,  
5 carrying mail is using the river to travel, but mail is  
6 a government function. It's not trade, right?

7 A. Seems like these days government is involved  
8 in a lot of business and commerce. I know one of my  
9 biggest competitors is the federal government, so --

10 Q. The Postal Service?

11 A. The federal government has other branches  
12 besides the Postal Service.

13 Q. Military. I mean, that's a use of a river for  
14 travel, but that's not trade, right?

15 A. I would consider, personally I would consider  
16 the military as a commercial activity.

17 Q. Okay. Would you consider survey a commercial  
18 activity?

19 A. Yes.

20 Q. Would it be fair to say that in your analysis  
21 of the navigability, or in your analysis, I guess, of  
22 boating in general, that your focus is primarily on  
23 simply the ability of the river to float the boat?

24 A. Focuses primarily on that? I don't know about  
25 primarily. But I would say the ability to float a boat

1 would be a key part of a navigability consideration,  
2 yeah.

3 Q. Okay. We'll go to slide 12. You talked about  
4 historical boat materials, and I know that -- I think it  
5 was mentioned earlier that rubber was not commonly  
6 available for use until after World War II for boats.  
7 Was that --

8 A. I believe the statement was that the chemical  
9 composition of rubber, artificial rubber changed around  
10 that time and that it made it more durable. That was a  
11 statement in one of the reports that was brought up  
12 today.

13 Q. And with regard to aluminum, that wasn't  
14 widely available until after World War II as well,  
15 right?

16 A. No, actually I believe it was 1894 was the  
17 citation in one of the documents that was submitted as  
18 part of the record. 1894.

19 Q. For what?

20 A. Aluminum boats.

21 Q. Okay. I wasn't really asking about when the  
22 boats first appeared. I was talking about the  
23 availability of aluminum.

24 A. Like I say, in terms of how widespread it was,  
25 I'm just citing articles that said that aluminum boats

1 were available in the 1890s.

2 Q. In determining susceptibility to navigation  
3 and in looking at boats, is it your position that if any  
4 boat that might be available anywhere in the United  
5 States could possibly have been utilized here in  
6 Arizona, then that's the boat you go with?

7 A. No.

8 Q. Well, which boat do you pick then?

9 A. You pick the boats that were available as of  
10 the time of statehood. I broke my presentation down  
11 into several slides here. This one just talks about  
12 boat materials that were available. I also had slides  
13 that talked about types of boats that were available in  
14 and around Arizona. That's really the only point I'm  
15 trying to make here. I deliberately excluded boats that  
16 were not used around Arizona. There's types of kayaks,  
17 for instance, that were probably suitable for Arizona  
18 rivers but really weren't used in the Southwest.

19 Q. Well, with regard to some of the catalog  
20 materials, I mean, did you go through and determine, you  
21 know, where sales were being made of catalog boats?

22 A. No.

23 Q. Some of the boats were kind of pricey, right,  
24 for the time period?

25 A. My recollection is they seemed pretty

1 reasonable.

2 Q. Okay. If you would go to slide 52. So this  
3 slide talked about the use of canvas folding boats,  
4 right?

5 A. Canvas canoes, yes. Folding canvas boat is  
6 from the first bullet.

7 Q. Now, with regard to the 20-foot boat that  
8 carries 3,000 pounds and costs \$65, I mean, that might  
9 be a boat more so than a 9-foot boat that carries 350  
10 pounds to have some commercial use, right?

11 A. No.

12 Q. You don't think it would be more likely to  
13 have commercial use if it could carry more?

14 A. It would certainly give you a different range  
15 of things that you would need to carry, could carry.

16 Q. Any indication that the 20-foot boat that  
17 carries 3,000 pounds was ever used on the Gila River?

18 A. No.

19 Q. And again, this would have just been simply a  
20 publication that offered over the mail a boat for  
21 purchase, right?

22 A. Right.

23 Q. All right. Go to slide 55. And this is where  
24 you talked earlier about inflatables, am I correct,  
25 which is the first use of an inflatable recognized in

1 Arizona on this slide was 25 years after statehood?

2 A. No. The first use in Arizona would have been  
3 Whipple crossing the Colorado in '53.

4 Q. Oh, okay. Any indication that these types of  
5 boats were regularly used?

6 A. Again, on Arizona streams, I'm presuming  
7 you're asking?

8 Q. Yes.

9 A. (Nods head.)

10 Q. All right.

11 Let's talk for a few minutes then about Native  
12 American boating. If you'll go to slide 59. Now, this  
13 slide talks about natives using disposable canoes and  
14 boats, but this is in a general sense and not specific  
15 to any Arizona tribe, right?

16 A. Yes, the boating presentation is intended to  
17 apply statewide, not specifically to the Gila River.

18 Q. Well, this isn't even specific to Arizona  
19 though, right?

20 A. In and about Arizona, sure.

21 Q. Well, I'm looking at the source, and it says  
22 the Bark Canoes and Skin Boats of North America in 1938.

23 A. That's the source, correct.

24 Q. And then the next slide discusses reasons for  
25 limited boating by Native Americans, right?

1 A. Yes.

2 Q. And the two quotes that you have on this slide  
3 are both from the Special Master report in the Utah  
4 case, correct?

5 A. That's correct.

6 Q. That was sometime around 1930?

7 A. Sounds about right.

8 Q. And these quotes were in the context of his  
9 determination of navigability of rivers in Utah, right?

10 A. Correct.

11 Q. And the only tribes he references are Navajo  
12 and Utes; is that correct?

13 A. That's my understanding, yes.

14 Q. And the rationale that the Special Master  
15 provided in 1930 or thereabouts with regard to Navajos  
16 and Utes, are you suggesting that it could be  
17 generalized to the tribes in Arizona along the Gila  
18 River?

19 A. I guess all I'm suggesting here is that there  
20 are other potential reasons for having a limited record  
21 in the archaeology by saying that I'm acknowledging  
22 right up front there is a limited record.

23 Q. A number of tribes have really strong oral  
24 traditions, right?

25 A. Yes.

1 Q. Are you aware of any of the stories or oral  
2 traditions among the tribes in Arizona along the Gila  
3 River?

4 A. Only in what I've read in the navigability  
5 reports.

6 Q. Is there any indication -- and would it be  
7 fair to say that the tribes at Gila River Indian  
8 Community, which are the Akimel O'otham and the  
9 Pee-Posh, at least with regard to the Akimel O'otham,  
10 they resided along the Gila River for thousands of  
11 years, right?

12 A. That's my understanding.

13 Q. And in those thousands of years and in all the  
14 information collected, is there any indication that they  
15 regularly boated the Gila River?

16 A. No, I believe that's the point of the slide  
17 here that there's not much record at all.

18 Q. Well, those tribes at this point have been  
19 studied extensively, right?

20 A. I'm sure there have been many studies.

21 Q. And presumably, those studies would include  
22 the practices of the Native Americans, right?

23 A. Yeah, I guess I'm not in a position to say one  
24 way or the other whether every fact that could possibly  
25 be known about these tribes is currently known.



1 Q. So are you aware of any cultural beliefs about  
2 rivers that the Apache, the Akimel O'otham or the  
3 Pee-Posh might have that would preclude the use of the  
4 river for boating?

5 A. I'm not.

6 Q. When I say river, I mean the Gila River.

7 A. I am not.

8 Q. Would it be fair to say that if those tribes  
9 had engaged in boating in prehistoric times as a  
10 cultural tradition, that they would have likely  
11 maintained that cultural tradition?

12 A. I don't know about likely, but it's certainly  
13 possible. I guess it wouldn't be surprising.

14 Q. We'll go to slide 61. One of the arguments  
15 that you've made or I should say one of the things that  
16 you have testified to is when the rivers had the water,  
17 Arizona didn't have the population, and you note in 1870  
18 that the population of Arizona was about, is it 9658?

19 A. That's correct.

20 Q. That didn't count though natives, right?

21 A. I have no idea whether it did or didn't.

22 Q. And so you wouldn't know whether or not  
23 natives were counted in the census beginning in 1900?

24 A. I would not.

25 Q. Would you know that the population of the Gila

1 River area in Maricopa and Pinal Counties in 1900 was  
2 about 5000?

3 A. I have no knowledge of that.

4 Q. And that in the San Carlos Apache area,  
5 probably around 3,000?

6 A. Similarly, I do not know.

7 Q. It's possible that in 1870 that the native  
8 population in Arizona may have been larger than the  
9 nonnative population?

10 A. I still don't know.

11 Q. Now, if we assume for the purposes of my  
12 question that the native population in 1870 was  
13 significant, then -- and that that population was on or  
14 near the Gila River, that that would tend to -- I guess  
15 that would tend to cut against your argument here,  
16 right?

17 A. Not really. Even if you doubled that number,  
18 it's still not a lot of people.

19 Q. When you're talking about early population  
20 centers in Arizona, you're talking about early nonnative  
21 population centers, right?

22 A. That's correct.

23 Q. And if one of your rationales for why there  
24 wasn't boating is the people weren't on the river, but  
25 if, in fact, there were uncounted individuals who were

1 on the river, you would expect they would be boating  
2 them, right?

3 A. I don't think that's a different argument at  
4 all. Folks are making the argument if people were  
5 there, then they would boat the river. And as I've  
6 mentioned, seems like a number of times now, that there  
7 are many other reasons for choosing not to boat a  
8 navigable river. Today people drive on interstate  
9 highways next to the Mississippi River, railroads next  
10 to the Mississippi River. Doesn't make a bit of  
11 difference whether the Mississippi River is navigable or  
12 nonnavigable. There are many reasons for choosing to be  
13 on a river or not.

14 Q. Go to slide 67. Now again, this is your  
15 explanation for why there weren't more boating accounts  
16 on Arizona streams. Some segments of Arizona rivers  
17 were not conducive to carrying major tonnage.

18 What you're saying there then is that some  
19 segments of Arizona rivers aren't conducive to large  
20 commercial use, right?

21 A. Large deep draft boats, that particular type  
22 of commercial use, yes.

23 Q. And then the next slide --

24 A. That's bullet or slide --

25 Q. 68, next slide.

1 Now, if you're using navigability and  
2 boatability interchangeably, then this slide could be  
3 retitled Reasons Why Not to Navigate a Navigable River;  
4 would that be fair?

5 A. When I say that I use the terms  
6 interchangeably, I'm saying as my practice, I find  
7 myself using those terms interchangeably. I understand  
8 that navigability as a legal definition, particularly  
9 title navigability, and that's why we're sitting here  
10 today, just to clarify that point.

11 Q. Now, when you say many factors are involved  
12 here, you say flow depth is a factor, and then yesterday  
13 I know you testified a few times that depth is a  
14 critical element in navigability, right?

15 A. It is.

16 Q. So if flow depth isn't -- does not allow  
17 navigation, I mean, that means the river is  
18 nonnavigable, right?

19 A. If the river is not deep enough that you can  
20 put a boat in it in its ordinary and natural condition  
21 for the entire year, let's use that case right now,  
22 yeah, sure, it's not navigable.

23 Q. What about one day out of the year? If you  
24 could put a boat in a river one day out of 365, does  
25 that make the river navigable?

1 A. I had this conversation with Mr. McGinnis just  
2 a minute ago, and the answer is no.

3 Q. Now, if you go to the next slide, which I  
4 think is 69, you said additional reasons why not to boat  
5 a navigable river. If you go down to about two-thirds  
6 of the way down, wagon, horse, car, et cetera, are  
7 faster. The reason why they would be faster might have  
8 to do with the natural condition of the river, right?

9 A. Yeah, I suppose. I can't think of too many  
10 rivers that are faster than cars. I can't think of too  
11 many rivers that are -- I'm sorry, any rivers that are  
12 faster than a railroad.

13 Q. Well, let's talk pre-development, wagon versus  
14 river.

15 A. A wagon is faster.

16 Q. If you go down to the next line, it's too cold  
17 or hot or rainy or windy. I mean, those are all natural  
18 conditions, too, right?

19 A. Yeah. Have you boated a river at all?

20 Q. Yeah.

21 A. You feel the weather more when you're on the  
22 water. When you're on your horse and the wind is  
23 blowing at you 15 miles an hour, it's not a big deal.  
24 When you're in your boat, it's a little extra exercise.

25 Q. Go down to the next slide, which is 70. And I

1 should say with regard to this series of slides on  
2 reasons why not to boat a navigable river, these are  
3 just in general, not specific to the Gila, right?

4 A. Yes, that's correct.

5 Q. Let's go to slide number 73. In your note at  
6 the bottom here you say, actual historical boating is  
7 not required to demonstrate title navigability. Only  
8 susceptibility to boating is required. Now, the  
9 susceptibility standard was developed in the Utah case,  
10 right?

11 A. I don't know. You know what, it's in the  
12 Daniel Ball case, the Daniel Ball definition, so it must  
13 have been prior to that.

14 Q. Go to the next slide, 74. You have a quote  
15 from U.S v. Holt. Did you, in terms of the PowerPoint  
16 presentation, did you have any assistance in putting  
17 this together from anybody else?

18 A. Yes.

19 Q. Who?

20 A. My son helped me with some of the graphics.  
21 Certainly those who prepared the previous reports on the  
22 Gila River, other boating reports, other materials that  
23 had been submitted to me drew heavily on work that was  
24 already existing. In terms of this particular  
25 PowerPoint this time around, it's dominantly my work. I

1 did sit down with the State's attorneys and talk through  
2 the slides.

3 Q. If you'll look at the last line of the Holt  
4 quote, it says that the stream in its natural and  
5 ordinary condition affords a channel for useful  
6 commerce. Do you see that?

7 A. I do.

8 Q. And again, for the most part, your  
9 presentation doesn't -- I would say on the Gila River --  
10 doesn't really address the commerce aspect. It focuses  
11 more simply on the use of the river for travel aspect.

12 A. I wouldn't agree with that. I would say that  
13 I presented evidence of use of the river for commerce.  
14 There was an account of some trappers that had come down  
15 the river, and then certainly we talked about the aspect  
16 of susceptible for use in navigation.

17 Q. Go to the next slide, which is 76. You refer  
18 to these as federal minimum standards for boating, but  
19 these aren't really established by law as federal  
20 standards, right?

21 A. Not that I'm aware of.

22 Q. They just appear in a study that was paid for  
23 by Fish and Wildlife Service, right?

24 A. They do.

25 Q. And I think you told Mr. McGinnis this, but

1 just to confirm, these are the standards that you used  
2 when you get to your charts for each of the segments  
3 that have the pictures of the little boat or little  
4 kayak on them. You're relying on this standard for  
5 where you're putting those, right?

6 A. It's part of what I relied on, yes.

7 Q. Okay. And this study that was done in 1978  
8 was a study of navigability in relation to modern  
9 recreational boating, right?

10 A. Yes. That's my understanding.

11 Q. And so these figures assume modern  
12 recreational watercraft, right?

13 A. I don't know that for a fact, but that would  
14 be my guess.

15 Q. Now, with regard to the numbers that appear in  
16 this chart, the .05 minimum for canoe and kayak, that is  
17 in the study labeled as a physical minimum depth for  
18 those watercraft, right?

19 A. Yes.

20 Q. It is not a safe minimum depth for those  
21 watercraft, right?

22 A. I'm not aware of any safety issues in a half  
23 foot of depth; but no, it doesn't say safety in the  
24 title.

25 Q. Well, in Appendix A-12 to this study, Mr. Hyra



1 has a chart, and in the chart he has three categories,  
2 physical, safety, and optimum. This would be for canoe  
3 and kayak. And under depth, under physical, he has 0.5  
4 feet. Under safety, he has 1.0 feet. And under  
5 optimum, 2.5 feet. My interpretation of that would be  
6 that he considers no less than 1.0 feet to be the safe  
7 depth for that particular watercraft. Would you agree?

8 A. No.

9 Q. How would you interpret it?

10 A. Having been a boater for quite some time, I  
11 can't imagine any particular hazard associated with a  
12 half foot depth of flow.

13 Q. Why do you think he used the word "safety"  
14 then for one foot?

15 A. I'm not sure.

16 Q. These are minimums, right? Ideally, you want  
17 more?

18 A. They are minimums. Sometimes you want more.  
19 More than a half foot would be more fun than -- one foot  
20 would be more fun than a half foot. Usually.

21 Q. Let's go to slide 108. Now, you cite the PPL  
22 Montana case here for the proposition that modern  
23 watercraft are meaningfully similar to those in  
24 customary use at the time of statehood.

25 Now, PPL Montana also had holdings relative to

1 recreational use as it relates to navigation, right?

2 A. I'm sorry, what do you mean by "had holdings"?

3 Q. The Court addressed the issue of whether  
4 navigability could be proved through modern recreational  
5 use, right?

6 A. It had a discussion of how modern recreational  
7 use should be used, yes.

8 Q. And the Court said no, right?

9 A. No, I didn't interpret it that way at all.

10 Q. So the Court said you could base a  
11 navigability determination on modern recreational  
12 boating?

13 A. If they were meaningfully similar to the  
14 use -- the type of boats that were in use at the time of  
15 statehood and the river hadn't materially changed. That  
16 was how I read that. And again, I'm not an attorney.  
17 So you guys can debate that amongst yourselves.

18 Q. All right. If we could go to your PowerPoint  
19 on the Gila. Go to slide number -- I think it's 18. So  
20 the question you address in this presentation is whether  
21 the flowing part of the river is deep and wide enough to  
22 float boats, right?

23 A. Yes.

24 Q. And that's travel, not trade and travel,  
25 right?

1 A. Either.

2 Q. Excuse me?

3 A. It could be either.

4 Q. Go to your curve which is slide number 22.

5 Where did the numbers that you used to develop this  
6 curved line come from?

7 A. You're talking about this line right here?

8 Q. That's the curved one.

9 A. That would be a yes. Those lines, that line  
10 came from the average monthly flow. I believe this is  
11 from either the Virden or the Gila River at Clifton.  
12 Really there are no numbers here. There's a trend.

13 Q. And you referred to this yesterday, I think,  
14 as a generalized curve?

15 A. Yes.

16 Q. Is that -- I mean, is that a fair  
17 characterization?

18 A. Yes, it is.

19 Q. If you look at the actual day-to-day numbers  
20 at any part of the Gila, it's not necessarily going to  
21 be a nice smooth curve, right?

22 A. No.

23 Q. Now, is this curve based upon -- and it's  
24 broken down by month, but I'm assuming it's intended to  
25 be over a period of years, right?

1 A. It is an average over a period of years.

2 MR. KATZ: Excuse me, what slide number is  
3 this?

4 THE WITNESS: 22.

5 MR. MURPHY: 22.

6 BY MR. MURPHY:

7 Q. So for -- the point on this curve for each  
8 month, I mean, would this represent an average of  
9 medians, an average of means for each of those months,  
10 or neither?

11 A. Those are a median day-to-day discharge.

12 Q. Okay.

13 A. It's how these data sets are normally  
14 produced, reproduced and discussed.

15 Q. Are you familiar with Searcy Flow Duration  
16 Curves?

17 A. I can't see that from here. I know what flow  
18 duration curves are.

19 Q. This is from James K. Searcy Flow Duration  
20 Curves, 1959. He says, "For most streams the monthly  
21 discharges are unsatisfactory for showing variation of  
22 flow. The duration curves of annual mean discharges  
23 would have little use because their range in variation  
24 is comparatively small because only a few values are  
25 available for defining the curve." Do you agree with

1 that?

2 A. I think the monthly averages are very  
3 representative of how they're being used in this context  
4 right here. Normal seasonal variation. The average  
5 monthly flow data that are generalized on this curve are  
6 not the only flow data. The flow duration data are also  
7 shown on this curve. That's the 10 percent, 90 percent,  
8 50 percent. So it shows both.

9 Q. Now, in your next slide you talk about the  
10 word "unstable." And I know previously in the  
11 presentation you discussed the word, I think, "erratic."  
12 Was that in there?

13 A. I believe "erratic" is in this presentation as  
14 well.

15 Q. And then "unstable." I mean, what was your  
16 purpose in addressing these terms?

17 A. In the past hearings and whatnot, the river  
18 has been characterized as being erratic and unstable,  
19 and I wanted to put those in the proper context. So we  
20 could look at that term in its meaning as it relates to  
21 navigation on the river as opposed to its meaning  
22 relating to use of the river for irrigation or use of  
23 the river corridor for building a bridge or something  
24 else.

25 Q. Now, you're not suggesting that changes in the

1 river over time are irrelevant, are you?

2 A. Changes in the river over time? What kind of  
3 changes are you referring to?

4 Q. Well, I mean in your slide you say all natural  
5 rivers change with time -- meandering, sandbars, flood  
6 erosion.

7 A. That's true.

8 Q. Now, are you still saying that these things  
9 are irrelevant to navigability?

10 A. Yes, navigable -- you can have rivers that are  
11 meandering that are navigable. You can have rivers that  
12 have sandbars that move around that are navigable. You  
13 can have rivers that are subject to flood erosion that  
14 are navigable. All of those characteristics and more  
15 apply to the Colorado River. They apply to the  
16 Mississippi River.

17 Q. In terms of the overall decision that the  
18 Commission makes, during pre-development times, the Gila  
19 River might be subject to flooding that causes braiding  
20 in the channel, you know, causes other changes that I  
21 think you told Mr. McGinnis would be considered to be  
22 part of the natural condition of the river, right?

23 A. You snuck a couple of questions in there on  
24 me. Yes, I did tell Mr. McGinnis that changes due to  
25 flooding are part of the natural condition. Flooding

1 itself is not part of the ordinary condition of the  
2 river, and we're not really talking about flooding --  
3 boating or navigation during flooding periods. We're  
4 talking about boating during ordinary and natural  
5 conditions of the river.

6 Q. The effects of a flood on the river can last  
7 for years, right?

8 A. On the river corridor, sure.

9 Q. Why do you get to pick the river in a  
10 condition where it has the channel for saying that it's  
11 navigable instead of in a natural condition after a  
12 flood when the river is braided?

13 A. The braided part of the river, again, is the  
14 flood channel. It's not the low flow channel. There  
15 are places where the low flow channel has a braid or  
16 two. Dominantly in all the pictures that I've seen, the  
17 vast majority of pictures I've seen, the maps that I've  
18 seen, the river is not mapped, depicted, photographed as  
19 having a braided low flow channel. It has a single  
20 channel, and that channel reappears after the floods, or  
21 it would if it were still in its ordinary and natural  
22 condition.

23 Q. Go to slide number 30. Now, if we don't say  
24 erratic or unstable, we can say though that the Gila  
25 River is variable, right?

1 A. What about the Gila River is variable? Over  
2 its course it's variable, or do you mean at a particular  
3 point it's variable?

4 Q. Well, you say that it's variable over its  
5 course in Arizona, right?

6 A. In the context of the slide, yes. The geology  
7 of the river varies over its length.

8 Q. Now, these factors listed in this slide number  
9 30 all can affect navigability, right?

10 A. You're asking specifically related to the Gila  
11 River?

12 Q. In general.

13 A. In general, sure. Geology can affect  
14 navigability.

15 Q. Channel characteristics can affect  
16 navigability?

17 A. Depth and width and channel pattern can affect  
18 navigability. Certainly the flow rate can, yes.

19 Q. Let's skip ahead to slide number 51, Segment 6  
20 of the Gila River that you've identified as the portion  
21 that flows through the Gila River Indian Community,  
22 right?

23 A. It does, yes.

24 Q. Now slide 51 here is two maps kind of cobbled  
25 together, for lack of a better way to put it?



1 A. Yes.

2 Q. Now, if you look on the right, which is the  
3 Florence 1902 map, it shows the Gila River as a single  
4 channel, correct?

5 A. Correct.

6 Q. If you look on the left, which is a 1907  
7 Sacaton map, it shows the river, I would say meandering.  
8 I don't know if the shaded areas would reflect sandy  
9 areas. But what is depicted in 1907 is substantially  
10 different, right?

11 A. I wouldn't say substantially different. You  
12 see in the 1907 map on the left downstream of --

13 Q. Shows meandering, braided, sandy areas, right?

14 A. Not braided, but it definitely shows some bar  
15 areas that I would interpret as I read that map they  
16 look to me to be sandbars. It would be part, perhaps  
17 part of the ordinary high water mark or within the  
18 ordinary high water mark but not part of the low flow  
19 channel.

20 Q. Now, anything happen between 1902 and 1907  
21 that might have caused the river to change?

22 A. Well, there was a -- it continued to have more  
23 diversions. There was the 1905 flood which was a large  
24 flood.

25 Q. Okay. And even if a flood is not an ordinary

1 event, again, it will impact the natural condition of  
2 the river and future navigation, right?

3 A. Flood will impact the river corridor. It will  
4 not necessarily impact the navigability of the boating  
5 channel. The boating channel could be relocated as a  
6 result of a flood. The overall characteristics of the  
7 channel are not going to be substantively different in  
8 its ordinary and natural condition after a flood.

9 Q. Go to slide 55. Is the red dot supposed to  
10 mark the end of the segment?

11 A. Yes.

12 Q. Kind of missed the mark a little bit, didn't  
13 it? I mean, at the end of the segment is the confluence  
14 of the Gila and the Salt, right?

15 A. Yes.

16 Q. That dot appears to be on the Gila to me.

17 A. I think you're applying a little too high a  
18 standard --

19 Q. Oh, okay.

20 A. -- where that dot is located. It's just  
21 generally indicative.

22 Q. Your intent though was for the dot to be at  
23 the confluence, right?

24 A. Yeah.

25 Q. How much did you take into account on Segment

1 7 the effect of the water that is being put into the  
2 river by the 91st Avenue Wastewater Treatment Plant?

3 A. Not at all.

4 Q. That's a lot of water that it puts in though,  
5 right?

6 A. It's not part of the ordinary and natural  
7 condition.

8 Q. So really that picture that we saw in your  
9 presentation that showed the beaver dam was in that  
10 general area, right?

11 A. It was, yes.

12 Q. So that's not a picture of the ordinary and  
13 natural condition of the Gila River?

14 A. It is not.

15 Q. If we go to slide 90 -- no, 65.

16 A. Had hopes there for a second.

17 Q. Yeah. So one of your findings with regard to  
18 archaeology is that there was a reliable and dependable  
19 flow based upon a thousand plus years of irrigation,  
20 right?

21 A. Yes.

22 Q. Now, the Hohokam though utilized canals,  
23 correct?

24 A. I believe they did, yes.

25 Q. And the flow for irrigation is not the same as

1 a flow for navigation, right?

2 A. I'm not exactly sure what you mean by that,  
3 but are you saying that -- maybe you could rephrase the  
4 question.

5 Q. Well, I mean, you can impound water in a  
6 canal, can't you?

7 A. In the bay water in the canal. I suppose you  
8 could impound, you could trap -- impound would be to  
9 trap. You could trap some water in a canal if you had a  
10 gate.

11 Q. And then use it if you need it, right?

12 A. Yeah.

13 Q. Go to slide 72. You talk about the Tohono  
14 creation account. That's a reference to the Tohono  
15 O'odham Nation, right?

16 A. I believe so.

17 Q. And Tohono O'odham means, roughly means desert  
18 people, right?

19 A. I don't know.

20 Q. Now, this account that involves a canoe,  
21 basically in that account, Montezuma in preparing for  
22 the great flood was told by the Coyote to build a canoe,  
23 right?

24 A. That's my understanding.

25 Q. And that flood wiped out everybody and

1 everything?

2 A. Right.

3 Q. Except for Montezuma, correct?

4 A. Yes.

5 Q. And there's no indication of where this took  
6 place in that story, right?

7 A. That's correct.

8 Q. No indication of when it took place, right?

9 A. That's correct.

10 Q. I mean, would you consider the story of Noah's  
11 arc to be relevant to the navigability of the  
12 Mississippi River?

13 A. No, I wouldn't.

14 Q. But you're kind of making the same  
15 generalization here, aren't you?

16 A. Really, I'm not saying that Montezuma and his  
17 canoe went down the Gila River. What I'm saying, the  
18 point I made when I described this was just the  
19 existence of a canoe was not something that was unusual  
20 or unexpected. They knew what a canoe was. At least  
21 they had some legend or story about a canoe.

22 Q. Well, at least in the translation of whatever  
23 that account was to English, it became canoe, right?

24 A. There you go.

25 Q. All right.

1 A. I'm not sure -- I can tell you for sure that  
2 my decision whether the river is navigable or not is not  
3 hanging on the interpretation of the word "canoe" in  
4 this particular account.

5 Q. Now, there was a portion in this slide that  
6 you took out when it was first submitted to the  
7 Commission, and that was a reference to Frank Cushing  
8 who found the remains of the canoe, right?

9 A. Yes.

10 Q. Why did you take it out?

11 A. It's on the Salt River.

12 Q. Oh, okay. Go to slide 76. Now, some of these  
13 early river descriptions are from newspaper articles,  
14 right?

15 A. Yes.

16 Q. Some of them are from histories that are  
17 written, correct?

18 A. Yes.

19 Q. Be fair to say that some of the individuals  
20 involved in these historical descriptions like to  
21 exaggerate?

22 A. I have no, no idea.

23 Q. Let me ask you about generally the newspaper  
24 descriptions, because I do want to talk about some of  
25 those.

1           Was it your goal to simply assemble as many  
2 newspaper articles about the Gila River and its use  
3 during that time period as possible, or was there some  
4 sort of qualitative analysis of the content of those?  
5 What was sort of the decision calculus there?

6           A.     The newspaper accounts primarily related to --  
7 are you asking about the historical descriptions or the  
8 boating accounts? Both?

9           Q.     Let's talk about the newspapers.

10          A.     Yeah, so there are newspaper articles  
11 primarily oriented to boating accounts, and we just  
12 searched the archives. We took whatever information was  
13 previously generated, was already in the record, and  
14 looked for accounts of boating. And did online searches  
15 in the archive website where you can search by keyword  
16 and picked out by river name, boat, canoe, kayak,  
17 whatever sort of boat descriptor we could come up with,  
18 and simply read the accounts and put all of the accounts  
19 that we found in there. There was no real filter on  
20 there with the exception of, I think it was specifically  
21 described as being used during the flood, and we did not  
22 include those. When it came to historical descriptions,  
23 I don't really specifically recall any descriptions that  
24 are coming from newspapers, but there really was no  
25 filter there. We looked through all the ones we could

1 find.

2 Q. Okay. Slide 79. First of all, can you tell  
3 me where the Escalante description on Segment 6 was  
4 located?

5 A. You mean what part of Segment 6 they're  
6 describing?

7 Q. Yeah.

8 A. No, I cannot.

9 Q. Do you have a citation for the information?

10 A. Somewhere I do, whether I have it with me  
11 today. I believe it came out of the Land Department  
12 report, but I don't have a page. If you would like me  
13 to look it up, I will.

14 Q. No, not today. So de Anza, 1775, the  
15 description there says dry, halfway up legs, reaching  
16 horses' shoulders. I mean, that all sounds very  
17 equivocal to me. I mean, is that how it's intended to  
18 sound?

19 A. Equivocal?

20 Q. Well, I mean, the river is halfway up legs but  
21 dry. What does that mean?

22 A. That doesn't sound consistent to me at all.  
23 That sounds like a contradiction.

24 Q. Okay.

25 A. And that was one of the points I was making in



1 these historical descriptions is that sometimes they are  
2 not consistent. Therefore, you need to look at the  
3 whole of the descriptions, the whole record, all of them  
4 and try to figure out what the general theme is.

5 Q. Didn't de Anza, when he was in what is now the  
6 Gila River Indian Community, in that area, didn't he  
7 describe the river even in 1775 as dry in some places?

8 A. It says dry right there, yeah. But the  
9 complicated part is that he also described it as  
10 nondry.

11 Q. Did a member of his party also describe the  
12 river as so sandy that in some places the water would  
13 sink into the sand and then come out at other places?

14 A. I don't recall having that quote in my  
15 presentation, but I have the vaguest recollection of  
16 somebody else making a quote along those lines.

17 Q. Let's go to slide 81. Kearny Expedition. The  
18 description that Lieutenant William Emory gave of the  
19 lower Gila was about a hundred yards wide, a hundred  
20 yards wide and flowing gently along the sandy bottom.  
21 Wasn't the interpretation of this in your report in 2003  
22 that this description implies a braided sandy stream?

23 A. Can you show me in the report where I said  
24 that?

25 Q. Sure. I'm on the Roman Numeral VII-6. It's

1 probably the lower Gila. I'll read the passage. It  
2 says that Lieutenant William Emory of the Kearny  
3 Expedition in 1846 described the lower Gila River as  
4 about hundred yards wide and flowing gently along a  
5 sandy bottom. However, a rancher described the river  
6 near Powers Butte in 1889 as having a well-defined  
7 channel with hard sloping banks lined with cottonwood  
8 and bushes. The water was clear with five or six feet  
9 deep containing fish. The forward description implies a  
10 braided sandy stream, whereas the latter suggests a  
11 relatively narrow, deep channel. However, the latter  
12 description may be of the main flow channel within an  
13 overall braided channel.

14 Does that sound accurate at all?

15 A. Yes.

16 MS. HERNBRODE: I'm sorry, Tom, what page was  
17 that?

18 MR. MURPHY: VII-6.

19 THE WITNESS: I think that was kind of my  
20 point of the discussion of the compound channel. When  
21 some people are describing the channel, they're  
22 describing something that includes portions where the  
23 water isn't, where the water is not, that are dry; and I  
24 think for boating purposes we're thinking about where  
25 the river is wet.

1 BY MR. MURPHY:

2 Q. Slide 81. Let's try 82. These numbers are  
3 small. The Mormon Battalion, as I understand it, was  
4 forced to jettison some of their cargo; is that right?

5 A. Yes.

6 Q. I think if you go to slide 83, and then slide  
7 84 on the Forty-Niners, I mean, there's no source  
8 citations to any of this, is there?

9 A. It all comes from the Land Department report.

10 Q. Okay. If we go to slide 86, the description  
11 of Segment 6 in this slide says, low flow, navigation  
12 doubtful, completely dry at Pima Villages due to  
13 irrigation. And that was over 50 years prior to  
14 statehood, right?

15 A. 1849. It also mentions that it's June, July,  
16 which would be the seasonal low flow period.

17 Q. And then the next page or next slide -- let's  
18 try 88. In 1869 in June the river was dry at Florence,  
19 right?

20 A. Yes.

21 Q. This would have been before the pumping in the  
22 upper valley, right?

23 A. Yes.

24 Q. So this is the river in its natural condition,  
25 right?

1 A. Very close to it.

2 Q. Virgin flow, right?

3 A. Very close to it, yeah.

4 Q. And it's dry?

5 A. Close to the description, yes, in June in  
6 1869.

7 Q. Let's go to slide 98. Where does that figure  
8 of 1 to 4 feet come from?

9 A. In my reading --

10 Q. Excuse me?

11 A. Finish your question. Sorry.

12 Q. Where does that come from?

13 A. In my reading of the descriptions. I'm just  
14 approximating based on the observations.

15 Q. So this slide just reflects sort of  
16 generalizations that you're making on the basis of the  
17 prior river descriptions, right?

18 A. It's a summary of those descriptions, yes.

19 Q. Let's go to slide 100. I know you talked, I  
20 think with Mr. Hood, about the bull hide boats used to  
21 cross the river. The wicker baskets and the River of  
22 Rafts, I mean, that's essentially two labels for the  
23 same thing, right?

24 A. I'm not sure that that's the case. I believe  
25 the Spanish explorers described them using rafts. I'm

1 not sure they were wicker baskets. I don't recall the  
2 details of that.

3 Q. Okay. You wouldn't know if the reason they  
4 referred to it as River of Rafts was because they did  
5 observe the wicker baskets, right?

6 A. The citation I'm using just said it was River  
7 of Rafts. It did not describe the type.

8 Q. Let's talk about slide 103. The Hood family  
9 trip.

10 A. Howard family trip.

11 Q. Howard family trip. Does a boat with wheels  
12 count as a boat?

13 A. It's a boat if it floats on water.

14 Q. What if 90 percent of the time it's on the  
15 water the wheels are turning? Is that navigating the  
16 river or is that pulling a wagon in the river?

17 A. I think I would go back to the Daniel Ball  
18 Test and say is it floating, is it on the water, and  
19 probably not meeting the criteria of craft that are  
20 commonly used. I don't recall a lot of wheeled boats in  
21 any of the accounts, and I certainly don't see them in  
22 my trips on the river. I'd say if it's being supported  
23 by its wheels, then it's a wheeled craft; and if it's  
24 being supported by its buoyancy, then it's a boat.

25 Q. Now, again, you haven't made what I would call

1 substantive evaluations of these newspaper accounts,  
2 right?

3 A. I don't know what you would call a substantive  
4 evaluation of a newspaper account.

5 Q. Well, sometimes, I mean, if you read these  
6 newspaper accounts, they may not be internally credible,  
7 right?

8 A. Internally credible? I wouldn't say that, in  
9 my opinion, I have made substantive interpretations of  
10 these. I've looked at as many accounts as I could find.  
11 I've looked for fanciful language. I've looked for  
12 whether it's tongue-in-cheek. There are articles that  
13 are published that I did not include that seem to be  
14 tongue-in-cheek. I'm looking for newspaper articles  
15 that look like news.

16 Q. Was the baby a boy or a girl?

17 A. There's some discussion about that, and the  
18 last report that quotes the father, I believe, as saying  
19 it was a boy -- or it was the boy himself.

20 Q. The Pancoast piece that's in the State's  
21 evidence says the baby was a girl, right?

22 A. Yeah, whether it's a boy or a girl really  
23 isn't substantive as to whether it's navigable or not,  
24 so I didn't really focus on that too much. But I know  
25 there is some debate about it. There's an article

1 titled something like "Was It a Baby Boy?" or "Is Gila a  
2 Boy or a Girl?" or something like that, and that's how  
3 I'm aware of the debate. I'm really more interested in  
4 the character of the boat.

5 Q. Well, if we don't know if the baby was a boy  
6 or a girl, do we know whether the boat had two wheels or  
7 four wheels?

8 A. My understanding is they took the wheels off.

9 Q. Oh, okay. The next, which is 104. In this  
10 account of "Many Gila Trail Travelers Had Thus Reached  
11 the Colorado River," I mean, that's a newspaper account  
12 from an unsigned letter, right?

13 A. Yeah, as I mentioned yesterday when I talked  
14 about this account, there's very little details  
15 associated with this. That's been cited in the record.

16 Q. Let's go to slide 107. This was the Bucky  
17 O'Neill account. Now, your slide doesn't say this, but  
18 my understanding is the editor of the Phoenix Gazette  
19 disputed this claim, right?

20 A. Yeah, my understanding is that Mr. O'Neil said  
21 that he made it to Yuma, and the editor said that he had  
22 it on good information that he had only made it to Gila  
23 Bend.

24 Q. Are you counting this as a successful  
25 navigation or not?

1 A. Successful down to Gila Bend. There seems to  
2 be concurrence that they made it on down there. I also  
3 qualified this account. There's a lot that's unknown  
4 here.

5 Q. When you put this slide together, why didn't  
6 you put in this slide the fact that a portion of this  
7 account was disputed?

8 A. Because I brought it up when we discussed it.

9 Q. Look at the dates at the bottom. Your report  
10 indicates that this trip took 6 days, but I'm seeing two  
11 citations to a newspaper. One is 11-30. The other is  
12 12-3. Can you explain that discrepancy? I mean, that's  
13 like three days, right?

14 A. I don't know that I really can explain it.

15 Q. I mean, that might be part of the substantive  
16 evaluation of these which would be is the time period  
17 that they said credible based upon when the reports are,  
18 right?

19 A. Yeah, like I said, there are a number of  
20 questions with this report. I don't think in my  
21 discussion of it, description of it yesterday -- you'll  
22 check the transcript when it comes out -- I don't think  
23 you'll find that I was describing this as the most  
24 definitive account of boating on the Gila River.

25 Q. The slide before this, which is 106, does the



1 Cotton and Bingham trip, does the source for this  
2 indicate that they completed this trip or that they are  
3 leaving tomorrow for Yuma by way of the Gila and Salt  
4 Rivers?

5 A. I believe this one says that they are leaving  
6 tomorrow, and we have no knowledge that they didn't make  
7 it. We have no knowledge that they did make it. There  
8 were no problems reported anywhere.

9 Q. But why does your slide not say that they were  
10 leaving tomorrow? This slide seems to imply that they  
11 completed the trip.

12 A. We have no information that they didn't  
13 complete the trip. We have no information that they  
14 did. I guess when you put up the PowerPoint  
15 presentation, you can put on whatever bullets you'd  
16 like. That's up to you.

17 Q. Here is my question about the bullets you did  
18 or didn't pick. Why are you picking the bullets that  
19 seem to indicate these trips were successful, but you  
20 seem to not be putting bullet points in that either cast  
21 doubt or raise questions about these trips?

22 A. I believe I gave a fair accounting of each of  
23 the trips, according to the record. I don't believe I  
24 omitted any key facts at all.

25 Q. Are you counting this trip successful or not?

1 A. It's certainly not unsuccessful.

2 Q. Not unsuccessful?

3 A. That's correct.

4 Q. You don't know if they made it.

5 A. You don't know that they didn't.

6 Q. All right. So if somebody takes off on the  
7 Gila River and we never hear from them again, that's  
8 successfully navigating the river. That's what you just  
9 said.

10 A. No, I said it's not unsuccessful is what I  
11 just said.

12 Q. Okay. Let me go back to the question though.  
13 If somebody takes off on the Gila, and we don't know if  
14 they made it or not, is that a successful navigation?

15 A. I'll answer the question again. It's not  
16 unsuccessful. That's the limit of the information that  
17 I'm taking from it. Is there a place where I said this  
18 is a successful trip?

19 Q. Don't you have a slide where you say that all  
20 but one of these trips was successful?

21 A. That's our knowledge. That's our knowledge  
22 base. Should I throw it in the unsuccessful case  
23 because we don't know?

24 Q. Is that good science?

25 A. Yes.

1 Q. To make a conclusion from the absence of  
2 information?

3 A. I didn't make a conclusion. You're making a  
4 construct here and it's not correct. That's not how I  
5 used the data.

6 Q. How many documented instances are there of  
7 floating logs on the Gila River?

8 A. One that I'm aware of.

9 Q. Which segment?

10 A. 8.

11 Q. Any idea how many logs or what the size of  
12 the --

13 A. No, you saw the citation.

14 Q. If somebody is -- let me ask you, too, about  
15 the Sykes trip, and I think you talked with Mr. McGinnis  
16 about this. This is slide 108. Now, my  
17 understanding -- and I think you said this to  
18 Mr. McGinnis -- is that most of the time it was one guy  
19 in the boat, one guy walking along on the river bank,  
20 right?

21 A. No, that's not what I said. That's what's in  
22 Barbara Tellman's discussion about this trip or a trip  
23 by another Sykes. What I said was I was unaware of  
24 where she got that information.

25 Q. Oh, okay. So where did you get the

1 information?

2 A. Coconino Sun.

3 Q. And is that this article, "Story of Boating  
4 Trip Across Desert Told by Local Oldtimer"?

5 A. Yes.

6 Q. And this says, "There was not what could be  
7 called too much water even here, but most of the time  
8 one of us could stay in the boat. The other one walked  
9 along the bank with a gun, occasionally getting a shot  
10 at a quail or rabbit with consequent improvement of the  
11 grub pile."

12 A. One of them was hunting and one of them was  
13 boating.

14 Q. And not out of necessity for hunting, but  
15 because one had to stay -- only one could be in the  
16 boat, right?

17 A. Could you read that back to me?

18 Q. "There was not what could be called too much  
19 water even here, but most of the time one of us could  
20 stay in the boat."

21 A. Okay.

22 Q. That didn't make it to your slide either, did  
23 it?

24 A. It did not.

25 Q. If one person is in a boat and one person is

1 walking on the river but the intent is for two people to  
2 be in the boat, is that a successful navigation of the  
3 river?

4 A. It's successful for one person. Perhaps they  
5 overloaded that particular boat with their gear.  
6 Perhaps the boat was unwieldy.

7 CHAIRMAN NOBLE: Mr. Murphy.

8 MR. MURPHY: Yes?

9 CHAIRMAN NOBLE: Would this be a convenient  
10 time to take a break?

11 MR. MURPHY: Sure.

12 CHAIRMAN NOBLE: Thank you. Let's try ten  
13 minutes.

14 (Recessed from 3:56 p.m. to 4:06 p.m.)

15 CHAIRMAN NOBLE: Mr. Murphy, please proceed.

16 BY MR. MURPHY:

17 Q. Let's look at slide 118.

18 A. I would like to point out before we leave  
19 slide 108, that if you notice in the bullets -- there's  
20 the implication you're making that I'm leaving out  
21 specific pieces of information. I would invite you to  
22 reread the bullets on this slide. I don't believe  
23 they're all favorable to navigability. I do point out  
24 that there were dry reaches until they got to the Gila.

25 I would also point out in regard to your

1 conversation about one of them walking alongside, they  
2 do point out that after the dam it was normal water and  
3 they made pretty good time down to Yuma. So the bulk of  
4 their trip their description was that they made pretty  
5 good time.

6 Q. Okay. Thank you. Let's look at 118. This  
7 talks about other accounts of historical boating on the  
8 Gila. The 1883 account states that the Gila has been  
9 navigated to its junction with the Santa Cruz. Now, if  
10 you go look at that newspaper article and pull it up,  
11 the first line of this reads, "A California  
12 correspondent wishes to know if the Gila and Santa Cruz  
13 Rivers are navigable to Tucson. Yes." Does that make  
14 sense to you?

15 A. They are not.

16 Q. Now, when you hear something like that or when  
17 you read this, I mean, doesn't that cast doubt in your  
18 mind about the veracity of this article? It makes no  
19 sense, right?

20 A. With regard to the getting to Tucson, yeah.

21 Q. But yet the line you pick out of this article  
22 is the Gila has been navigated to its junction with the  
23 Santa Cruz.

24 A. The Gila doesn't go to Tucson, so boating to  
25 Tucson is irrelevant to the Gila River presentation.

1 Q. Okay. So you picked out the part that made  
2 sense, and you left out the part that didn't make sense?

3 A. I picked out the part that related to the Gila  
4 River. The part that didn't relate --

5 Q. No, no, this says a California correspondent  
6 wishes to know if the Gila and Santa Cruz Rivers are  
7 navigable to Tucson.

8 A. Can you show me the article?

9 Q. What?

10 A. Can you show me the article?

11 Q. Yeah. Here, I'll just read the whole thing.  
12 It's small.

13 A. Can I look at it myself?

14 Q. Sure.

15 MS. HERNBRODE: Do you have the exhibit  
16 number?

17 MR. MURPHY: It's whatever yours would be, the  
18 Arizona Weekly Citizen in 1883.

19 MS. HERNBRODE: I was just hoping you knew it  
20 off the top of your head, so --

21 MR. MURPHY: No.

22 MS. HERNBRODE: All right.

23 MR. KATZ: You don't have an exhibit number?

24 MR. MURPHY: Nope.

25 THE WITNESS: It's very blurred. I'm not sure

1 I have the whole article here. I don't know its  
2 context.

3 BY MR. MURPHY:

4 Q. I mean, you agree though that the first line  
5 of that article casts doubt on what I would say is the  
6 overall veracity of the article, right?

7 A. Yes.

8 Q. Let's talk about the next example down, the  
9 dugout, Clifton to Florence. This guy actually walked  
10 from Riverside to Florence, right?

11 A. Yes. I don't know about Riverside, but  
12 somewhere in that neighborhood, yeah. He walked a good  
13 deal.

14 Q. So really, it should say dugout, Clifton to  
15 Riverside, correct? Because that's the part he boated,  
16 not the part he boated and walked?

17 A. Yeah, and if you were here yesterday, I spent  
18 a good deal of time talking about, pointing that out  
19 specifically, that this was an account of an  
20 unsuccessful boating adventure, and he did walk out  
21 there. Yes, that is something that I discussed in  
22 detail yesterday.

23 Q. Okay. Let's go to slide 121. Would it be  
24 fair to say that the definition you have here of success  
25 and the definition of failure are definitions that were



1 formulated by yourself?

2 A. Yes, they are.

3 Q. And to some extent, the definition of failure  
4 you have here is subjective, right?

5 A. I think they're fairly objective standards.  
6 If you're saying it's something that I postulated based  
7 on my understanding of the record and boating  
8 experience, then yeah, there's that.

9 Q. If the navigation of a river is difficult to  
10 the point that the individual who navigates it chooses  
11 not to do it again, I mean, would you consider that to  
12 be a successful navigation?

13 A. Are you talking if the individual -- what you  
14 just said to me was if the individual decides not to  
15 continue on, is that successful navigation?

16 Q. Well, let me rephrase it this way.

17 Does navigability of a river involve  
18 repeatability of travel on the river?

19 A. It certainly should be susceptible to  
20 repeatability of travel.

21 Q. Meaning people should do it over and over,  
22 right?

23 A. People should be able to do it over and over.

24 Q. In all of these accounts, how many of these  
25 accounts involved individuals or groups who repeated

1 their travel along the Gila River after the first time?

2 A. There's James Ohio Pattie who claims to have  
3 done it multiple times. We've already discussed that  
4 account. I don't need to go back there. There were  
5 trappers that came down the Verde to the Salt to the  
6 Gila who said they intended to. There were the  
7 steamboats that made multiple trips on Segment 8, lower  
8 part of the Gila. And as I sit here today thinking  
9 through the accounts, my recollection being what it is  
10 at 4:00 in the afternoon, I don't recall any others that  
11 specifically discuss a repeat trip.

12 Q. And would it be fair to say that in a fair  
13 number of the accounts that you do address in your  
14 presentation, that there was a failure of the commercial  
15 purpose?

16 A. No.

17 Q. In some of these accounts, the cargo capsized  
18 or the cargo was lost, right?

19 A. Which accounts are those?

20 Q. I'm trying to remember.

21 A. I can think of one.

22 Q. Which is what?

23 A. The prospector that we were just talking  
24 about. The news account of that particular account  
25 mentions that it was the result of a sawyer or a

1 strainer that caused his boat to flip, be damaged and  
2 lost his load. As I pointed out yesterday, it's  
3 basically a rookie mistake. He didn't tie down his  
4 load. He didn't pay attention to the strainers, and he  
5 had a problem. And again, I put that in the  
6 nonsuccessful category.

7 Q. Let's talk about slide 123. Now, your  
8 criteria under historical boating episodes being  
9 successful were no deaths, no injuries, all but one boat  
10 reached its destination, right?

11 A. That's correct.

12 Q. And we know from our discussion that more than  
13 one of these instances ended up with boats not reaching  
14 the destination, right?

15 A. Which were the other ones?

16 Q. Well, the guy from Clifton walked to Florence,  
17 right?

18 A. That's one.

19 Q. The one, Cotton and Bingham, we know they  
20 left; we don't know if they got there, right?

21 A. That's correct.

22 Q. That's two.

23 A. I don't think you can put it in the category  
24 of not successfully reached there. You don't know that.

25 Q. You don't know that they did, and you're the

1 one saying they're successful, right?

2 A. I'm saying there were no deaths, all but one  
3 boat reached its destination. So from the information  
4 we have, we only know of one boat that didn't reach its  
5 destination.

6 Q. And so unless we know for certain -- I won't  
7 go down that road.

8 There may be situations where deaths and  
9 boating are an indication of navigability, right?  
10 Drowning?

11 A. I would not say that death is an indication of  
12 the navigability. I would say the fact that somebody  
13 used a boat would be an indication of navigability. A  
14 death may be a product, a byproduct of somebody using a  
15 boat carelessly or chance got them. Who knows? But the  
16 death in itself is not an indication. In fact, when  
17 somebody drowns, it doesn't indicate that it's  
18 navigable.

19 Q. It indicates there's water in the river,  
20 right?

21 A. Certainly does.

22 Q. In all these historical boating episodes, any  
23 indication of deaths by drowning?

24 A. I don't recall any. There was a flood boating  
25 thing, but again, I'm not -- floods are not part of the

1 ordinary and natural condition.

2 Q. Let's go to slide 148. These are your rating  
3 curves for Segment 6 of the Gila which goes through the  
4 Gila River Indian Community. First of all, there's no  
5 current flow at Olberg, right?

6 A. Typically, no.

7 Q. And what is the impact on any interpretation  
8 of this chart that everything in the left-hand column  
9 are asterisks?

10 A. There's no flow frequency associated with  
11 these flow rates. It is as reported in the Land  
12 Department report.

13 Q. So you don't know when at particular times  
14 these flows take place?

15 A. No, there's no need.

16 Q. Let's go to slide 153. When you say potential  
17 issues with cross section model with regard to  
18 Mr. Gookin's model, what do you mean?

19 A. Mr. Gookin provided two cross sections  
20 purported to fix the, I guess the basis of his rating  
21 curve for a segment of the river that I call Segment 6.  
22 It's fairly technical stuff. Ask me if you want further  
23 explanation. He used an "n" value of .02. I think  
24 that's far too low for an alluvial stream.

25 Q. A mean value for what?

1 A. An "n" value.

2 Q. An "n" value?

3 A. Of .02 is the roughness coefficient. It's a  
4 parameter and an engineering equation used to estimate  
5 flow of loss, depth, et cetera. It suggests that a  
6 minimum of .035 would be appropriate, and considering  
7 the other factors of the channel and the width of his  
8 cross section, something above .045 would probably be  
9 more realistic.

10 The depths that he is producing in his results  
11 are much lower than what we see in the historical  
12 observations, particularly for a median flow rate. The  
13 section itself doesn't adequately depict the existence  
14 of a low flow channel. The number of points used to  
15 depict the width of the channel doesn't really pick up  
16 the geometry, and then the topo that he's using by  
17 necessity -- it's the oldest topo that's available -- is  
18 not from the ordinary and natural condition of the  
19 river. It's from long after the river has been  
20 disturbed.

21 If you look at the depths, for instance, this  
22 cross section needs about 20,000 CFS to fill it. At  
23 about 10,000 CFS the depth is still less than two feet.  
24 If that were representative of the river, it's hard to  
25 understand why anybody would need a ferry if at 10,000

1 CFS, which is a pretty large, unusually large flow, if  
2 it's less than two feet. So those would be the issues  
3 that I would look at both from the parameters used and  
4 the results. Having said that though, even with those  
5 criticisms of that cross section, the depths that he's  
6 projecting there are greater, generally greater than a  
7 half foot. In this case it meets the standard of  
8 boating.

9 Q. Your column under Kelvin where you have the  
10 parentheticals, you have the mean of 1.1 feet, median  
11 1.4, and low flow 1.7. Did you get those backwards?

12 A. Looks like I did.

13 Q. Okay. Gila River Segment 4, slide 167. From  
14 a scientific perspective, let me ask this. Your  
15 conclusion with regard to, I think, most of these  
16 segments was they were boatable 90 percent of the time,  
17 right? The historical data does not match the fact that  
18 these rivers were boated 90 percent of the time, right?

19 A. How so? You mean --

20 Q. You would expect there to be more accounts of  
21 boating if indeed these segments were boatable 90  
22 percent of the time, right?

23 A. Well, I think I spent a good deal of time  
24 yesterday explaining why there were not as many  
25 historical accounts as you might suspect, population

1 being one of them, remoteness, and many other reasons.

2 Q. If the history doesn't match your data,  
3 certainly we look for explanations, right?

4 A. Yeah, that was actually one of the reasons  
5 that I liked the results that came up here is because I  
6 think these depths that we're predicting do match the  
7 historical descriptions.

8 Q. But one of your concerns would be the data  
9 you're using, wouldn't it?

10 A. In what way?

11 Q. Well, if the historical use doesn't match the  
12 data that you have, you may want to ask yourself is it  
13 the data, right?

14 A. Sure. And I don't think it is the data.

15 Q. I mean, in, you know, one of the methods that  
16 I think you cite to for recreational standards for  
17 navigability which is Cortell -- I don't know if you're  
18 familiar with that -- it's 1976.

19 A. Yes.

20 Q. His methodology involves after you get the  
21 data, going out and field checking the data against the  
22 stream, right?

23 A. That's a great point. So what I did,  
24 particularly --

25 Q. I'm asking whether --



1 A. -- 103 is --

2 Q. I'm asking --

3 A. -- I went out there with my boat --

4 Q. I'm asking --

5 A. -- and put it in the river and determined that  
6 the depths that I computed were completely reasonable.

7 In fact, they're probably underestimating the depths.

8 Q. That's fine. But I didn't ask you that. I  
9 just said, his method involves getting the data and then  
10 field checking the data with actually going out in the  
11 field, right?

12 A. You said field checking, and I'm explaining  
13 that I did field check it.

14 Q. It's an easy yes or no question.

15 A. I did my field checking with a boat.

16 Q. So your answer is yes?

17 A. I did do field checking, yes.

18 Q. That wasn't my question. My question was, his  
19 method involves field checking the data that you  
20 obtained with, with -- and your field checking though  
21 was not the ordinary and natural condition of the river,  
22 right?

23 A. No, it was at the depleted condition. So it  
24 was a lower flow rate than the ordinary and natural  
25 condition.

1 Q. When you were talking about Segment 4, the  
2 gage data indicates Coolidge Dam, but yesterday you  
3 mentioned Kelvin. Can you just clarify which it was?

4 A. Kelvin is downstream of Coolidge Dam.

5 Q. Okay. So the data for this would come from  
6 the gage at the Coolidge Dam right?

7 A. For Segment 4, yes.

8 Q. Not Kelvin.

9 A. Kelvin would be in Segment 5.

10 Q. All right. Segment 6, slide number 177. What  
11 would the source for the data on this graph be?

12 A. Which particular data?

13 Q. Any of it.

14 A. The gage data?

15 Q. Yeah.

16 A. From the gage at Kelvin, the Gila River at  
17 Kelvin. It's in the upper right-hand corner; it's noted  
18 there. That's where the flow duration data that I'm  
19 putting in there. The other data cited on there is --  
20 it mentions each of the lines there. I can show you via  
21 the mouse.

22 That's the average flow rate that's reported  
23 by the Land Department report. That's Mr. Gookin's  
24 median flow rate. That's the gage data. That's  
25 Mr. Gookin's low flow estimate for pre-development

1 conditions. That's the source of those data. Then the  
2 rating curves are also from the Land Department report  
3 as well as supplemented by my -- are supplemented from  
4 the Land Department. We're in Segment 6, sorry.

5 Q. Let's talk about Segment 7, slide 181. What  
6 would the gage data source be for this?

7 A. There's not much gage data here at all. I put  
8 in the curving line right here. It's just generalized.  
9 Again, I'm putting that in only just to show the normal  
10 seasonal fluctuation, and the other data sets are all  
11 cited there. As you can see in the upper right-hand  
12 corner, the source of the data is the Land Department's  
13 report for 2003, Hjalmarson's flow estimate,  
14 Mr. Gookin's flow estimate, Land Department's average  
15 flow, and Mr. Hjalmarson's base flow condition.

16 Q. Can we go to slide 192. You spent a fair  
17 amount of time in your presentation talking about modern  
18 recreational boating on the Gila, right?

19 A. I did talk about modern recreational boating.

20 Q. Now, if I go to one of these websites like  
21 paddleon.net and I'm a boater, I can actually click on a  
22 link there to get flow data, right?

23 A. Probably. It's possible.

24 Q. When you go out to boat, do you just pick any  
25 time or do you check the flow data first?

1 A. Typically I check, I check the flow data,  
2 yeah.

3 Q. Because you want there to be water there when  
4 you go out to boat, right?

5 A. Boating is a lot more fun when you have water,  
6 yes.

7 Q. In fact, with regard to recreational boating,  
8 you go when there's water and when it's convenient for  
9 you, right?

10 A. Yes.

11 Q. And that's not a commercial activity with  
12 regard to your boating personally, right?

13 A. Commercial aspects to it, but I'm not paying  
14 myself to boat.

15 Q. You indicated that the Needle's Eye run was  
16 quite popular, but when I went to paddleon, it states  
17 that it's rarely run. Would you disagree with that?

18 A. Yeah, if you talk to Gene who runs the  
19 paddleon site, the reason that's not run more than it is  
20 is because there are gates that are locked now.

21 Q. When I looked at the paddleon site, too, I saw  
22 your name there. Do you contribute to the site?

23 A. I talk to Gene from time to time. I met him  
24 for the first time this year. We've communicated in the  
25 past just about, hey, how do you get to this river? I

1 think he used, maybe he used some of my pictures. He  
2 came along on a trip on that particular segment. First  
3 time I met him.

4 Q. Do you contribute to any of these other sites?

5 A. By contribute, I'm just saying we communicate.  
6 I don't have any financial, if you're --

7 Q. Do you submit pictures to them?

8 A. No, Gene takes his own pictures. I did give  
9 him copies of my pictures, but I'm not sure -- his are  
10 much better than mine.

11 Q. Do you submit trip reports?

12 A. No, I don't do those kind of things; and these  
13 other things you asked me about, no, I've never  
14 contributed to any of those things. Again, by  
15 contribute, I mean provide information.

16 Q. If we could go to slide 198. In Arizona  
17 versus California, 1931, the Court took judicial notice  
18 of the navigability of the Colorado, right?

19 A. I'm going to leave that. You can argue that  
20 point with the attorneys. They told me this was the  
21 cite that he said to use and I used it.

22 Q. Oh, okay. So you really can't give any  
23 context to what's in this slide?

24 A. Not in terms of the Arizona v. California. I  
25 can tell you the navigability legislation, as I

1 understand it, says we assert our right to the east half  
2 of the Colorado River.

3 Q. Do you know if the Court has ever taken  
4 judicial notice that the Gila is navigable?

5 A. I do not.

6 MR. MURPHY: That's all I have, Mr. Chairman.

7 CHAIRMAN NOBLE: Okay. What do we want to do  
8 next? Joe, are you up next?

9 MR. SPARKS: Yes, sir, I am.

10 CHAIRMAN NOBLE: And you can get done in ten  
11 minutes?

12 MR. SPARKS: No, sir.

13 CHAIRMAN NOBLE: Let's go ahead and get  
14 started, if that will be all right.

15 MR. SPARKS: All right.

16 CHAIRMAN NOBLE: Mr. Fuller, how you holding  
17 up?

18 THE WITNESS: Keep 'em coming.

19 CHAIRMAN NOBLE: Okay.

20 THE WITNESS: I can sit here as long as you  
21 can.

22 CHAIRMAN NOBLE: And shall we, while  
23 Mr. Sparks is coming up, let's talk about tomorrow  
24 morning.

25 MR. KATZ: Right now it would be our likely

1 intent to call Don Farmer who is a boating expert. I  
2 would expect he would be an hour or not very long on  
3 direct examination, hour, hour and a half, if that long.  
4 I just can't for sure predict. And then he'll have to  
5 be cross-examined, and then finish up with Mr. Fuller's  
6 cross, if we have any, and pending any redirect, which  
7 I'll try to cut down and not repeat too much because  
8 we've already heard, because we can do that in briefing  
9 or argument later.

10 CHAIRMAN NOBLE: Is there anyone other than  
11 Mr. Sparks that intends to have questions for  
12 Mr. Fuller?

13 Did I see your hand go up, Mr. Helm? I  
14 couldn't see it.

15 MR. HELM: Yes. I can't resist it.

16 MR. SPARKS: Then it's his turn.

17 CHAIRMAN NOBLE: Self-denial is good for you.

18 MR. HELM: I've been quiet for two days. It's  
19 a record.

20 CHAIRMAN NOBLE: Then we will go until 4:50,  
21 4:55 at the maximum. We need to vacate the room by 5:00  
22 p.m., and we will reconvene in the morning at 9:00 a.m.,  
23 and we will proceed as it has been outlined by Mr. Katz  
24 in the morning. And after we talk to the boating  
25 expert, Mr. Farmer -- is it Mr. Farmer, Dr. Farmer?

1 MR. KATZ: Yeah, it's Mister. He's not a  
2 scientist.

3 CHAIRMAN NOBLE: Okay. Then Mr. Helm is going  
4 to have a shot at Mr. Fuller.

5 Are you ready?

6 MR. SPARKS: Yes, sir, except they forgot to  
7 put the telephone book on this chair so I could see over  
8 the table, but I'm hanging by my chin here.

9 My name is Joe Sparks, for the record.  
10

11 CROSS-EXAMINATION

12 BY MR. SPARKS:

13 Q. And Mr. Fuller, after 21 years, how we doing?

14 A. Older, fatter, grayer.

15 Q. The good news is we still have hair.

16 I have some questions that I -- I know you  
17 wouldn't believe me if I said I had a few questions, so  
18 I have some questions.

19 A. I would be happy to believe you.

20 Q. And one of the things I wanted to talk with  
21 you about, just momentarily, is the Daniel Ball case.  
22 And I think that everyone who has been up here so far  
23 acknowledged that you're not a lawyer, but I heard you  
24 make oral argument a while ago. It sounds like you're  
25 picking up some stuff.



1 But in any event, you did read the Daniel Ball  
2 case one or more times, right?

3 A. I have seen the Daniel Ball case.

4 Q. What time of day was it?

5 Anyway, what do you recall the case being  
6 about?

7 A. I don't recall specifically.

8 Q. Do you know what kind of -- do you know what  
9 states it involved?

10 A. Offhand, I do not. I don't recall.

11 Q. What watercourses?

12 A. I do not.

13 Q. An ocean? An ocean meeting a river? Do you  
14 remember that, anything about that?

15 A. You can ask me the same question several  
16 times. I'm going to tell you I don't recall.

17 Q. You don't remember anything about it?

18 A. I remember the definition here.

19 Q. Well, was the definition for navigability at  
20 statehood?

21 A. This is the definition of navigability that  
22 I've been given, that I've seen in the state statutes,  
23 and that's how I'm using it.

24 Q. So when you cite to the Daniel Ball case, and  
25 Mr. Katz asked you if you were familiar with the case,

1 and you said yes, that's the extent of your familiarity  
2 is that you know the name, and then you know you've been  
3 told to use this definition; is that right?

4 A. That's what I'm recalling at this moment.

5 Q. You think tomorrow you're going to remember it  
6 better?

7 A. I certainly could go home and refresh my  
8 memory.

9 Q. At the beginning of your testimony of like a  
10 month ago -- but it was actually Monday -- I think you  
11 mentioned in your PowerPoint and in your verbal  
12 testimony that you wouldn't be testifying, you would not  
13 be testifying about all the evidence that the State Land  
14 Department has submitted for the record; is that  
15 correct?

16 A. That's correct.

17 Q. Is there any evidence that the State Land  
18 Department has submitted that you're not testifying to  
19 that you think would substantially, would provide a  
20 material contribution to the understanding of at least  
21 Segments 3 and 4 of your description of the Gila River?

22 A. You're asking me if any of the evidence would  
23 substantially contribute to determination of  
24 navigability in Segments 3 and 4 that I have not talked  
25 about already?

1 Q. Yes.

2 A. I can't guarantee you that there isn't a piece  
3 of evidence that would possibly contribute, but I feel  
4 like the information that I've provided is  
5 representative of the information that's available for  
6 those segments.

7 Q. What do you think we're doing here today? Why  
8 are we having this hearing, from your standpoint?

9 A. We are here to determine navigability of the  
10 Gila River or to present evidence for the determination  
11 of the navigability of the Gila River.

12 Q. So it's not your -- you don't understand that  
13 this may be about whether any one or more segment of the  
14 Gila River is navigable?

15 A. That's not what I said.

16 Q. No. I'm understanding what you said and  
17 asking you this question. You're not here to help the  
18 Commission determine whether any one segment, one or  
19 more segments of the Gila River is navigable?

20 A. I don't see how that's a different question  
21 than what I answered. But yes, obviously. I presented  
22 information on segmentation. So clearly we would be  
23 determining by segment navigability.

24 Q. So when you -- you read the Arizona Appellate  
25 Court decision about pre-development conditions on the

1 river. Do you recall seeing that?

2 A. The ordinary and natural conditions of the  
3 river.

4 Q. About how you would go about determining the  
5 ordinary and natural conditions of the river?

6 A. About how I would be doing that?

7 Q. How anyone should go about it.

8 A. Refresh my memory.

9 Q. That's it. That's the question. You  
10 remember, either you understand what the Court asked us  
11 to do or you don't.

12 A. I understand the Court asked us, directed us  
13 to look at the river in its ordinary and natural  
14 condition as if dams and diversions did not exist.

15 Q. Now, I was wondering about just exactly why,  
16 from your standpoint, why looking at the ordinary and  
17 natural conditions that necessarily meant before the  
18 date of statehood. Why do you refer to times prior to  
19 statehood for that information?

20 A. As of the time of statehood there were dams  
21 and diversions in place that had altered the condition  
22 of the river. So we're looking at the condition of the  
23 river prior to the time when those disturbances existed.

24 Q. I think your testimony here has been that  
25 doesn't matter when you look, before or after statehood,

1 or recently. It's all navigable from New Mexico to the  
2 confluence with the Colorado River, right?

3 A. I don't believe I've ever testified that today  
4 in its existing condition the entire river is navigable.

5 Q. And so to get to that conclusion, you have to  
6 add back in water that has been diverted out?

7 A. That's correct.

8 Q. And then when you add the water that's been  
9 diverted out, for instance, where do you add the water  
10 back in on each of these segments?

11 A. Where do you add it back in?

12 Q. Yeah.

13 A. I don't believe there's an adding back in.  
14 It's a -- it's a -- I'm not really sure how to process  
15 that question, Mr. Sparks.

16 Q. Well --

17 A. Where you add it back in. You add it back in  
18 at the point where it belongs.

19 Q. Okay. Well, that's your term from your report  
20 from your slide show here. You add it back in -- that's  
21 what you said you do -- to determine how much water has  
22 been depleted from the system since prior to statehood.  
23 You add it back in. That's what your slide says, right?

24 A. Right.

25 Q. Okay. Where do you add it back in?

1 A. You add it back into the river. You add it  
2 back in at the point where it flowed previously.

3 Q. So do you add it back in at a known gaging  
4 point that you also use for reference in your report?

5 A. You add it back in over the entire river  
6 segment -- not at a particular point, at a -- at which  
7 point. It's a line. Again, that's a difficult question  
8 to process.

9 Yeah, you put the flow back in the river along  
10 the river. You could get various experts that make a  
11 computation of the pre-development flow as it relates to  
12 reaches, as it relates to specific gage locations, and  
13 they're applying those data over those reaches, much in  
14 the same way that the modern gage data is measured at a  
15 point that applies over a reach.

16 Q. So did you go back and look at a specific  
17 gage, say the Calva gage, and decide how much water  
18 should be added in to the readings of the Calva gage to  
19 adjust it for the pre-development conditions?

20 A. Other folks -- as I mentioned yesterday, my  
21 approach was to take the long-term gage record and use  
22 that as a minimum estimate, knowing that other expert  
23 reports had been submitted that had produced estimates  
24 that were higher than those.

25 So if I could relate a rating curve that

1 showed that in the long-term modern record it was  
2 generating boating depths, generating sufficient boating  
3 depths, and knowing that the pre-development flow was  
4 even greater, then I knew the depths were even greater.  
5 So it was only just, only more navigable than in the  
6 past.

7 Q. So the answer is no, you didn't do that?

8 A. I didn't -- as I said yesterday in my  
9 presentation, I did not --

10 Q. I'm trying to get the answer to this question.

11 A. I'm giving you that answer.

12 Q. Did you add the data back in at the Calva gage  
13 for the amount of water you felt had been depleted by  
14 modern activities?

15 A. I did in the sense that I used the data that  
16 other folks had come up with. I felt those estimates to  
17 be reasonable. Did I do the computations myself? No.  
18 As I pointed out yesterday, I did not do any separate  
19 calculations myself.

20 Q. Do you remember when you were testifying about  
21 your canoe trips from up by Duncan down to the Safford  
22 Bridge?

23 A. Yes.

24 Q. How many times have you done that?

25 A. Once. Once. I've done from Duncan downstream

1 once. From the 91 Bridge down to the Old Safford  
2 Bridge, I've done that twice.

3 Q. And did you do a continuous float from Duncan  
4 all the way to the Safford Bridge on any one of those  
5 occasions?

6 A. No, as I mentioned yesterday, I went from just  
7 upstream of the Duncan Bridge down several miles and  
8 took out my boat. I drove down near the community of  
9 York and put my boat back in and paddled from there.

10 Q. Was there a reason why you took your boat on  
11 your vehicle in that, for that stretch?

12 A. Yes. I felt like having observed the river, I  
13 wasn't going to learn anything new by going further. I  
14 only had one day to do that section of the river.

15 Q. Are you familiar with the area just below  
16 Duncan called Cosper's Crossing?

17 A. Not by that name.

18 Q. Well, it's not known by any other name. So in  
19 all the cases about the Gila River and studies, Cosper's  
20 Crossing is always what it is. Are you familiar with  
21 that area?

22 A. As I just mentioned, not by that name. I'm  
23 familiar with the area. I've looked at aerial  
24 photographs. I've been to portions of the reach. I'm  
25 just not aware of that name.



1 Q. Are you aware that the Cosper's Crossing is a  
2 stretch of the river where the river simply goes dry for  
3 long periods of time?

4 A. I'm not.

5 Q. Well, that's one of the situations where if  
6 you had a canoe and did that part, you would need  
7 wheels. I just wondered about that.

8 A. I've looked at the aerial photographs. I've  
9 seen continuous flow from Duncan on down to the Old  
10 Safford Bridge from the aerals that I've looked at. So  
11 it may go dry on occasion. I'm not sure that's relevant  
12 to the ordinary and natural condition. But that's not  
13 the condition that I'm aware of.

14 Q. Are you familiar with the San Jose diversion  
15 canal?

16 A. Is that the one that comes out at the head of  
17 the Safford Valley?

18 Q. There's two that come out there. Brown Canal  
19 and San Jose. Are you familiar with either one?

20 A. I'm aware that they exist.

21 Q. Have you been to them?

22 A. I've been by there. Not stood on the dam. I  
23 believe it's no access. And I've looked at it.

24 Q. Have you ever seen any flow below either one  
25 of those diversions?

1 A. Yes.

2 Q. How far below?

3 A. The next bridge downstream. When I was there  
4 in February, it was flowing out of the Box and it was  
5 flowing down to the next bridge, and I'm forgetting the  
6 name of the bridge -- something like 16th Street or so  
7 where the river dried up, and then further on down it  
8 was flowing again.

9 Q. Well, in February, do you know whether they  
10 were diverting into the Brown or San Jose at that point?

11 A. I don't know.

12 Q. Do you know what the cropping season is in the  
13 upper Gila Valley?

14 A. I don't recall. I believe we have some  
15 information on that in the report. I don't recall at  
16 this moment.

17 Q. Do you know how the San Jose Canal, the Brown  
18 Canal diversion devices work in the river?

19 A. My attention to the modern conditions of the  
20 river is a little bit less given the Court's direction  
21 to look in the ordinary and natural condition. So I  
22 didn't really focus on the operations of nonnatural  
23 structures.

24 Q. So you wouldn't have looked at whether the  
25 cut-off wall under the dam goes into an impervious layer

1 or bedrock at those locations, right?

2 A. It's impossible for me to look underneath the  
3 surface.

4 Q. You didn't look into it, whether they did or  
5 not?

6 A. I did not.

7 Q. And if they did go, let's say to an impervious  
8 layer, they would be lifting the underflow of the river  
9 to the surface so it could be diverted, wouldn't it?

10 A. Again, you're asking about the nonordinary and  
11 natural condition of the river, so we did not focus on  
12 that.

13 Q. But what I'm trying to figure out is what you  
14 did evaluate in determining what you should add back in  
15 and why. And are you telling the Commission that you  
16 didn't evaluate anything?

17 A. Well, actually, as I mentioned previously, I  
18 did not perform unique calculations -- I just said that  
19 a second ago -- of what to add back in. I was relying  
20 on -- I used the evidence that was produced by other  
21 experts, and I'm using the long-term flow records, as I  
22 mentioned. So again, I believe you've asked that  
23 question. I've answered that question.

24 Q. I think you also mentioned that you used the  
25 sum of approximately 22,000 acres of irrigated lands in

1 the upper Gila in order to determine how much had been  
2 diverted for agriculture; is that correct?

3 A. Where did I make that statement?

4 Q. I think you did make the statement. No?

5 A. Can you tell me where?

6 Q. No, this is not a pop quiz for me. It's one  
7 for you.

8 A. You're asking me -- are you saying that I made  
9 a statement? I'm asking you to tell me where I made  
10 that statement.

11 Q. Okay. The answer to the question is, do you  
12 recall whether or not you made that statement?

13 A. I don't recall as I sit here right now.

14 Q. Do you recall what number you may have used in  
15 terms of the irrigated acreage in order to determine  
16 whether generally you were in the neighborhood of  
17 cultural depletion by irrigation?

18 A. Okay. I've answered this question already,  
19 and I'm telling you that I did not do unique  
20 calculations for the pre-development hydrology,  
21 including about the figuring out diversions. I did not  
22 do that. I'm relying on the estimates of other experts,  
23 your side's experts, for those numbers.

24 Q. And from the report beginning in 1993 to the  
25 present, have you added new, any new information about

1 Stretch 3 -- Segment 3 from the San Carlos boundary  
2 which is near Fort Thomas, Arizona, to Coolidge Dam for  
3 the record before the Commission?

4 A. Is there new information in that segment? The  
5 information that I'm presenting is in the report in the  
6 presentation that I gave you. There's a lot of  
7 information that the Land Department's attorneys put  
8 together. Some of that could apply to that reach. And  
9 as I sit here today, I'm not able to be telling you  
10 specifically which of those items are that may apply to  
11 that particular segment.

12 Q. The same question about Segment 4. Have you  
13 provided, since the draft report in 1993, have you  
14 provided any new information about the segment of the  
15 Gila River that begins at Coolidge Dam and goes to  
16 Kelvin which is substantially on the San Carlos  
17 Reservation?

18 A. Yes.

19 Q. Do you have any new information?

20 A. Yes.

21 Q. What is it?

22 A. The information would include photographs of  
23 our boating trip down that segment. And that would  
24 go -- include part of the San Carlos Reservation as well  
25 as areas that are off the reservation. You said down to

1 Kelvin, so --

2 Q. In all of the photographs that you put in the  
3 report or you showed to the Commission, how many of them  
4 are photographs of a trip when you were on the river?

5 A. They're all. The photographs that I showed  
6 yesterday I was on that trip.

7 Q. And in the report, those photographs on the  
8 river, are you in one of the boats on the river in each  
9 of those photographs?

10 A. No. There are some photographs where I'm not  
11 in the photograph, if that's what you're asking me; but  
12 I was on the trip. I was there. They're my  
13 photographs. I took the pictures or my bowman took the  
14 pictures.

15 Q. And I think somebody was asking you to try to  
16 evaluate the, I guess the level of skill that you  
17 thought you perhaps had or do have in terms of boating,  
18 and I thought that question was something like,  
19 Mr. Fuller, do you know how high "up" is? And so I  
20 think that's a difficult one to answer. But I was  
21 wondering, are you familiar with the publications that  
22 are put out by the BLM and Forest Service and Park  
23 Service? One of them would be called River Information  
24 Digest for Popular Western Whitewater Boating Rivers  
25 managed by the federal agencies?

1 A. I don't recall that one. I may have seen it  
2 in the past. As I sit here today, I don't recall having  
3 seen it.

4 MR. SPARKS: I'm going to, Your Honor, I mean,  
5 Mr. Chairman, may I approach the witness?

6 CHAIRMAN NOBLE: Just don't throw things at  
7 him. Is this going to take more than a few minutes?  
8 Because we're getting close to wrapping up for today.

9 MR. SPARKS: Well, I'll introduce it, and then  
10 if there's any need to follow up, I will.

11 CHAIRMAN NOBLE: Okay. It just depends on how  
12 you want to present it.

13 MR. SPARKS: I was trying to do a line of  
14 questions that would fit in the time that I thought we  
15 had so --

16 CHAIRMAN NOBLE: Joe, you get three minutes,  
17 max.

18 BY MR. SPARKS:

19 Q. Okay. If you switch to, I guess it's item 10,  
20 Mr. Fuller, says the Gila River -- it's in print. Do  
21 you see that?

22 A. Yes.

23 Q. Okay. What this is is a collection of  
24 information about the Gila River. There's other rivers.  
25 We've just excised the part about the Gila. Then

1 there's a chart that is visible only to an ant which  
2 looks like this.

3 A. Yes.

4 Q. And I gave you an enlarged version of that so  
5 that you could see what I'm seeing, and then the section  
6 held vertically like this. In the section on the right  
7 margin it says, Gila River, Arizona; Gila lower; BLM;  
8 Gila middle; Gila upper; do you see that?

9 A. Yes.

10 Q. Okay. And you see the part where it says  
11 Period Runnable on the left margin?

12 A. Yes.

13 Q. And under Spring, under those four categories  
14 of the Gila, all -- that has a box in it, an X in the  
15 box all the way across for Spring, right?

16 A. Yes.

17 Q. And it doesn't have any Xs for Summer or Fall.  
18 Do you see that?

19 A. That's correct.

20 Q. And it has an X under Gila -- I don't know  
21 where under Gila -- but it has an X under Winter for  
22 Gila, Arizona. Do you see that?

23 A. I do.

24 Q. Okay. Do you have any -- your testimony would  
25 disagree with this river runners' guide, right?



1 A. Yes.

2 Q. And it would disagree because as far as you're  
3 concerned, the river under ordinary and natural  
4 conditions would be runnable all the time?

5 A. Most of the time, yes.

6 Q. And then down lower there's a section that  
7 says small craft, kayaks. It talks about the kinds of  
8 boats, and it doesn't have an indication or an X in any  
9 of the watercraft boxes except small craft and kayaks,  
10 and it has that for the upper Gila, and it says small  
11 craft, kayaks, et cetera, correct?

12 A. Yes.

13 Q. And it wouldn't indicate that these federal  
14 agencies think that any other watercraft or any other  
15 section of the river is appropriate at all, right?

16 A. There's a reason for that.

17 MR. SPARKS: And Your Honor, I --

18 Mr. Chairman, I think that's my three minutes.

19 CHAIRMAN NOBLE: Joe, we appreciate that very  
20 much.

21 We'll see everybody in the morning at 9:00  
22 a.m.

23 (The proceeding recessed at 5:00 p.m.)

24

25

1 STATE OF ARIZONA )  
 ) SS.  
 2 COUNTY OF MARICOPA )

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I, GARY W. HILL, Certified Reporter No. 50812  
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 foregoing printed pages constitute a full, true and  
 accurate transcript of the proceedings had in the  
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WITNESS my hand this 29th day of June,  
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PAPERS  
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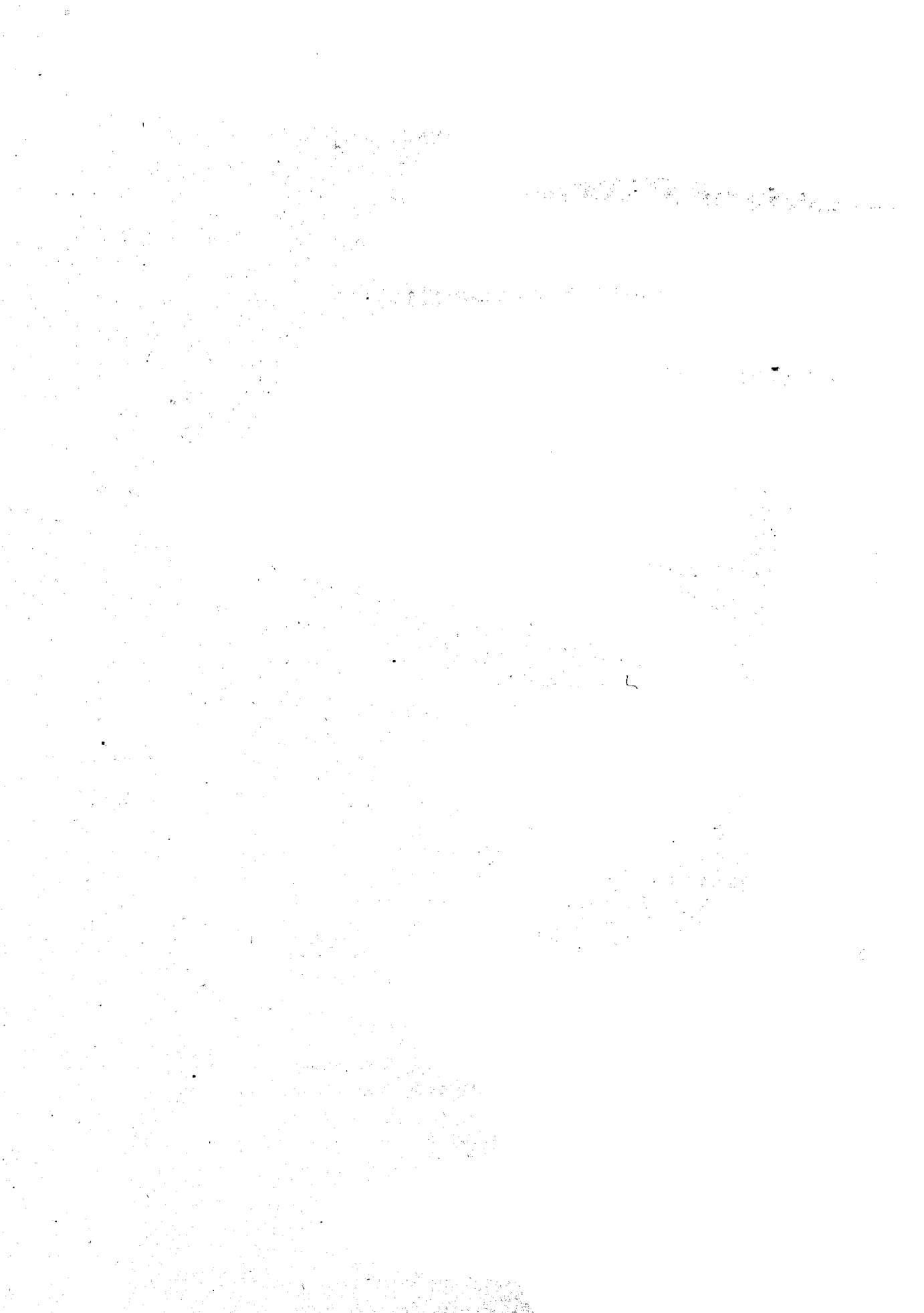


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TO  
THE MEMORY OF MARY HEMENWAY  
WHOSE INITIATIVE, GENEROSITY, AND UNDERSTANDING  
SET IN MOTION THE FIRST ORGANIZED ARCHAEOLOGICAL  
WORK IN THE SOUTHWEST

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## FOREWORD

THE not unpleasant task of preparing this foreword has been assigned to the writer because he chanced to be the sole survivor of the Hemenway Southwestern Archaeological Expedition of 1886-1889, and therefore in the belief that he could render a more or less personal account of its organization and activities. By far the pleasantest part of the assignment, however, is the consciousness that, by rendering this bit, he is enabled in a very meager way and after such a long period to pay homage to the memory of a great woman.

In connection with any archaeological research in the Southwest, it should not be overlooked that the first avowedly scientific work in the ancient remains of that region was that of the expedition sponsored by Mrs. Hemenway, with an equipment and with facilities never before equaled. Moreover, Frank Hamilton Cushing, the organizer of the expedition, justifiably believed that the only way in which intensive archaeological work could be conducted was by excavation. In this Cushing should be accorded every credit.

Chiefly through lack of means — for archaeological excavation is expensive — all research of the kind in the Southwest had hitherto been largely in the nature of reconnaissance and was therefore superficial. At best, archaeological study, however pursued, can contribute in only a relatively minor degree to a restoration of the culture of the people to whom the ancient remains are attributable. Without by any means decrying the value of Bandelier's years of research in the Southwest, for example, it was solely by reconnaissance that he made his observations on the prehistoric remains of the Pueblo peoples. Like his contemporaries — and we exclude the mere relic-hunters as beyond the pale — Bandelier used a meter-long walkingstick instead of the magic spade to reveal what treasures of information lay beneath the surface, consequently anything in the nature of culture stratification, which has proved to be of such prime importance to archaeology, was never suspected by Bandelier, Cushing, the Mindeleffs, or even by Fewkes, the latter of whom uncovered scores of ruins in the years following.

Let due credit therefore be accorded Cushing for developing a new method of Southwestern archaeological field research, which, with almost unlimited facilities, without being trammelled by official formalities such as hindered government researchers, and with lavish support, should have produced results of such marked importance that the work of the Hemenway Expedition would forever have stood as a noble monument to scientific endeavor.

Barring certain details in which the public would hardly be interested, Dr. Haury has covered so well the historical phases of the Hemenway Expedition that little else need be recorded in that direction. A few facts, however, should not be overlooked, for the success or failure of any scientific endeavor must rest with its organizer and director.

Frank Hamilton Cushing's spectacular adventure, early in 1882, in conducting four Zuñi Indians and a Hopi to the East, where they were everywhere enthusiastically received, was well exploited by Sylvester Baxter in his article, "An Aboriginal Pilgrimage," published in *The Century Magazine*, followed by Cushing's "My Adventures in Zuñi" which appeared in the same magazine in 1882-1883. There is little wonder, therefore, that Cushing and his Indian companions created almost a furor wherever they went. Representatives of the press followed them everywhere; they were entertained royally by savants and industrialists alike, by artists and journalists, by Wellesley students and by P. T. Barnum. They became a news feature of the period and their visit lingered long in the memories of the good people of Boston especially.

The Indians, however, attracted no more attention than Cushing himself, with his longish tow hair, his elaborate reddish deerskin costume adorned with many silver ornaments (his Navaho name meant "many buttons"), headband, eagle-feather erect, turquoise necklaces galore, all in strong contrast to the simple raiment of his Indian companions. But this was merely a reflection of Cushing's esthetic composition, for he had the making of a sculptor and painter of no mean ability. He was

likewise a visionary, with an almost uncanny insight into that which to others would be the unseen, as witness his assertion that were it possible to remove the elaborate wrappings from a ceremonial atlatl in the University Museum in Philadelphia, a turquoise bead, the "heart" of the implement, would be found within. Some time later the atlatl was exposed to X-rays, when, behold, the outline of a bead was clearly visible. Again, at Camp Hemenway in the Salt River Valley during the operations of the Expedition, Cushing was expounding to some visitors his belief that the Pueblo de los Muertos, where excavations were then in progress, had been destroyed by an earthquake. "But," interposed one of the visitors, "earthquakes have never been known in this valley." Scarcely had the words been uttered when the entire party jumped to their feet as Cushing quietly remarked, "An earthquake, gentlemen!" And, surely enough, this was the great Sonora earthquake of 1887 that was felt throughout southern Arizona.

Cushing's earlier years, those of a sickly child (he weighed a pound and a half at birth), were spent in the woods whenever opportunity afforded, living alone a part of the time in a wigwam of his own making. He became so immersed in Indian lore and Indian ways as to learn the process of stone-implement making, the fashioning of pottery, and the like. The first address before the Anthropological Society of Washington after its founding in 1879 was by Cushing on "Relic Hunting," followed shortly afterward by another on "Arrow-head Making." Leading the life of a primitive, the youth, even without the companionship of Indians at that time, in some strange manner learned and followed their mode of thought, which became a veritable part of him throughout his life. He never felt more at home than when squatting on the floor and addressing a company of distinguished guests; and he often seemed to forget on similar occasions that he was not one of an Indian gathering in Zuñi Pueblo.

With this insight into Cushing's mental equipment there is little wonder that during his life at Zuñi he acquired a great fund of intimate information, most of which has forever been lost. Considering his exceptional opportunities, the product of his studies in the

pueblo, where he was indeed a Zuñi familiar and a member of the tribe by adoption, may be characterized by its paucity; for instead of recording copious notes on his ethnologic and linguistic observations, he depended almost entirely on his memory and imagination.

Cushing's physical disability seemed not to curb his mental activity, for in those moments when a disordered stomach permitted him, he was as alert and agile as a cat, and as ready a speaker as ever graced a scientific assemblage. On one occasion when a lecturer of the evening before a large audience in Washington became stagestruck and could not proceed beyond the first few words of the address, Cushing leaped to the platform, and although he had never been in Mexico, presented a marvelously appealing and entirely impromptu comparison of certain Zuñi and Aztec concepts, much to the delight of the audience and the salvation of the announced lecturer.

Even if not always accurate in his statements, whether voiced or written, and even if given to exaggeration to gain a point, Cushing always was both plausible and appealing. It doubtless was this side of Cushing that was revealed to Mrs. Hemenway, as to many others, while his ill health added in no small measure to the sympathy which he aroused. Although Mrs. Hemenway was deeply interested in the research Cushing had outlined while at Manchester in 1886, the good lady was constantly solicitous of his health, which was to be of first consideration, the scientific research in the field to be subordinate thereto. And it was this, as much as anything, that led Cushing to forego much that he could have done at Camp Hemenway, for even during the most favorable periods of his health he devoted much time to trivial things while the work of excavation, conducted entirely by Mexican laborers, proceeded under its own momentum.

It may be ungracious to thus speak of one who passed away more than forty years ago, yet it seems important to the science of which he was an advocate that this insight into his character and attitude be revealed, since it had a vital bearing on the methods and results of his work, and explains in some degree the lack of information that the operations of the Hemenway Expedition suffered.

If a paucity of material was left by the di-

rector of the Expedition, it was due also in part to an overwrought imagination and a species of egotism that brooked no opinion adverse to his own and accepted no suggestion of scientific help on the part of others. We may cite the instance of the hard-fired mescal pits uncovered in the Salt River Valley, which Cushing insisted were "smelters" on the ground that some copper bells (obviously of Mexican origin) were unearthed round about, as elsewhere at many Southwestern sites.

It is hardly necessary to appraise the objective scientific results of the Hemenway Southwestern Archaeological Expedition, as this has been ably done by the author of the accompanying memoir. The artifacts are extensive and important, especially in the light of comparative archaeological research in more recent years, in which Dr. Haury has taken an impor-

tant part. That the director of the field work of the Expedition, with all the facilities at his command, left such a woefully small body of descriptive data pertaining to the excavations and their results is sincerely to be regretted; but it arouses admiration for the author of the present monograph, who has performed a difficult task so well, even in the face of this lack. The splendid support by Mrs. Hemenway in this, as in other endeavors, to increase and diffuse knowledge, is worthy of the highest praise by every student of Southwestern archaeology. It is a pity that the results in the present instance could not have been commensurate with her interest and beneficence.

F. W. HODGE

May 1, 1942  
Los Angeles, California

oven in the Hohokam is from Colonial Period sites<sup>36</sup> and they appear to date from approximately the same time in villages of the Mogololon Culture.<sup>37</sup> They are very common in sites showing a blending of these two cultures in southeastern Arizona.<sup>38</sup>

In an 11th-century site on the Zuñi Indian reservation in New Mexico, Roberts uncovered an oven with a lateral inclined flue,<sup>39</sup> a feature never seen in the ovens farther south.

Modern survivals of pit oven cooking are to be found on every hand. The Hopi and Zuñi employ it, as do the semi-nomadic Navaho and Apache, the Paiute, and Yavapai.<sup>40</sup> Farther south the Pima<sup>41</sup> also use the pit oven.

Since there are modern examples which in details are close copies of those used prehistorically in the Gila and Salt there can be no question of the use to which the ovens of Los Muertos were put. It is even reported that charred corn and mescal remains were found in the pits.<sup>42</sup> But because the Hohokam practiced cremation, it has sometimes been felt that the large heavily burnt rock-filled pits were used for that purpose. Evidence is accumulating

that a pit was used in cremating but it is somewhat different from the earth oven and is therefore not to be confused with it. In the ovens, the absence of pieces of burnt bone, however small, which eluded the gatherer of the ashes after the fire, and the abundant presence of burnt rocks which would be a hindrance rather than a help where flesh and bone are to be consumed, argue against their use in burning the dead. The cremation pits, on the other hand, are shallow excavations, seldom if ever exceeding 2 feet in depth, but sometimes reaching a width of 4 feet,<sup>43</sup> and do not contain the burnt rock. In cremating, a grating of wood was laid over the pits, the body laid thereon, and the fuel was then ignited. Ashes and all fell into the pit from which they could be later gathered for enshrining in an urn. This custom of using shallow pits has its modern equivalent among the Mohave<sup>44</sup> and the Diegueño,<sup>45</sup> and a similar treatment seems to have been followed by the Hopewell Culture of Ohio.<sup>46</sup> A distinction can and should therefore be drawn between the pits used in the preparation of food and those used in the process of cremation.

### CANALS

As already pointed out, the location of Los Muertos at a considerable distance from Salt River was made possible by the development of hand-dug canals which directed the water to the residential district and to the fields in the vicinity. Because of their magnitude, they have long attracted much attention. The writings of Patrick,<sup>47</sup> Hodge,<sup>48</sup> Fewkes,<sup>49</sup> Cummings,<sup>50</sup> Turney,<sup>51</sup> and the more recent survey by Judd,<sup>52</sup> make further mention of the sys-

tems at large and of the general character of the ditches unnecessary. But of that group of canals with which the Hemenway Expedition came into immediate contact, something may be said.

The map of the canal system (fig. 24) is based largely on the observations of James C. Goodwin and Herbert R. Patrick and supplemented by surveys of Hodge and Garlick in 1887-1888. This map shows a rather elaborate

<sup>36</sup> Woodward, 1931, p. 15; Haury, 1932, pp. 57-66; Schroeder, 1940, p. 76.

<sup>37</sup> Haury, 1940, pp. 56-62.

<sup>38</sup> Trischka, 1933, pp. 417-433; Fulton and Tuthill, 1940, pp. 20-25.

<sup>39</sup> Roberts, 1932, pp. 44-45.

<sup>40</sup> Spier, 1928, p. 119.

<sup>41</sup> Russell, 1908, p. 70.

<sup>42</sup> McClintock, 1887.

<sup>43</sup> Such pits have been uncovered in the Gila Valley by Woodward who informs me that he has found fragments of burnt human bones in them, as well as

fragments of the offerings that passed through the crematory fire; also Gladwin, Haury, Sayles, and Gladwin, 1937, p. 95.

<sup>44</sup> Kroeber, 1925, p. 750.

<sup>45</sup> Kroeber, 1925, p. 716.

<sup>46</sup> Shetrone, 1930, fig. 47, p. 97.

<sup>47</sup> Patrick, 1903.

<sup>48</sup> Hodge, 1893, pp. 323-330.

<sup>49</sup> Fewkes, 1912, pp. 114-115.

<sup>50</sup> Cummings, 1927, pp. 9-10.

<sup>51</sup> Turney, 1929.

<sup>52</sup> Judd, 1930b, 1931, pp. 157-166; Halseth, 1932.

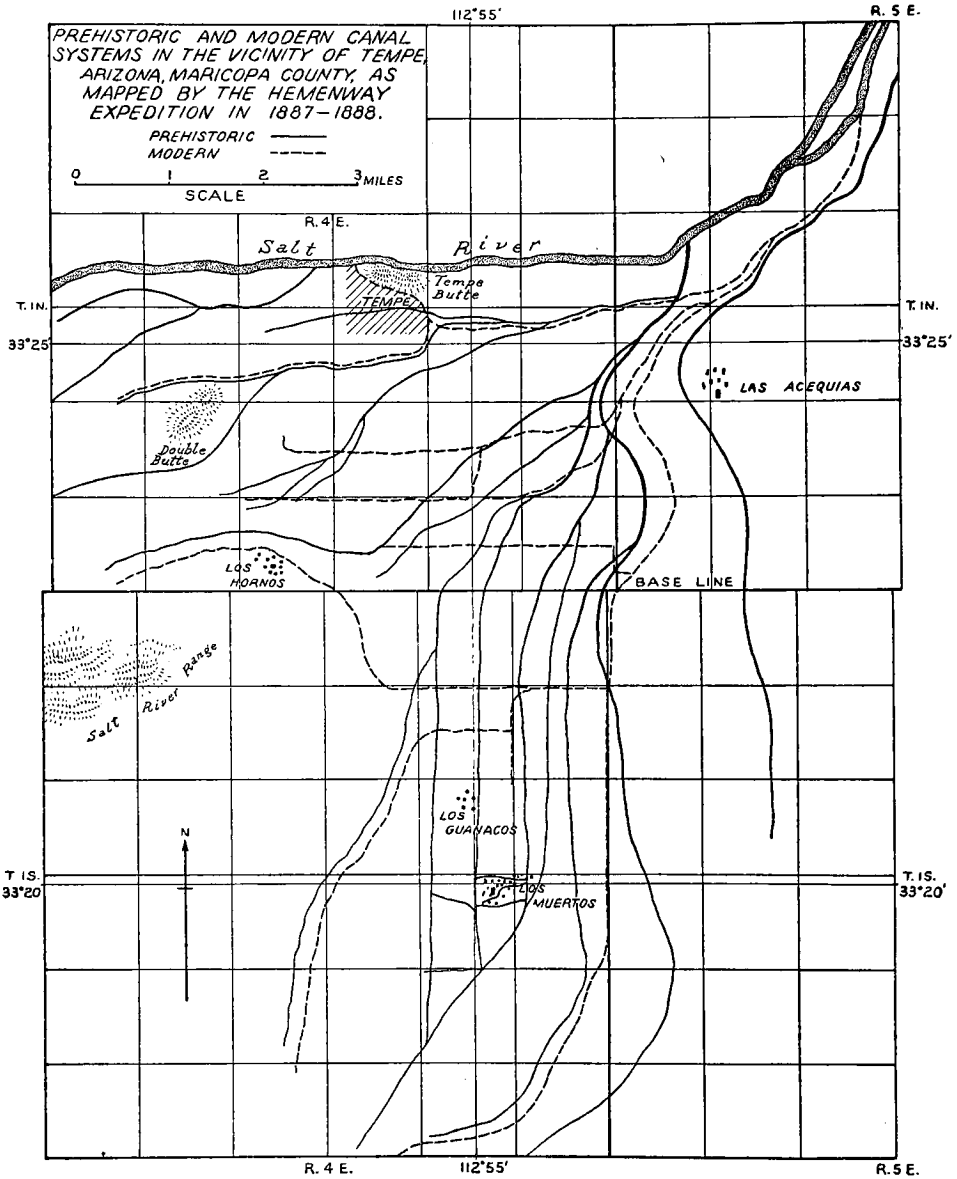


FIG. 24. Hemenway Expedition map of the aboriginal irrigating canals reaching from Salt River south to Los Muertos and beyond.

network of waterways branching from a single master canal whose intake was about 3 miles east of Tempe. From this point the general trend of the ditches was south and west. At a distance of 8 miles from the river, six branches are shown and three of these continue to a distance of 10 miles from the source. The aggregate distance traversed by this "Los Muertos system"<sup>53</sup> was over 75 miles. The four ditches in the immediate vicinity of Los Muertos

doubted that the Hemenway map is thoroughly reliable.

Los Muertos was flanked on either side by several main ditches and at least one passed directly through the settlement. After a section of this was cleared of all washed-in material, it was found to be 30 feet in width and 7 feet in depth.<sup>54</sup> These dimensions, found at a distance of over 6 miles from the intake, illustrate the great size attained by the canals. In

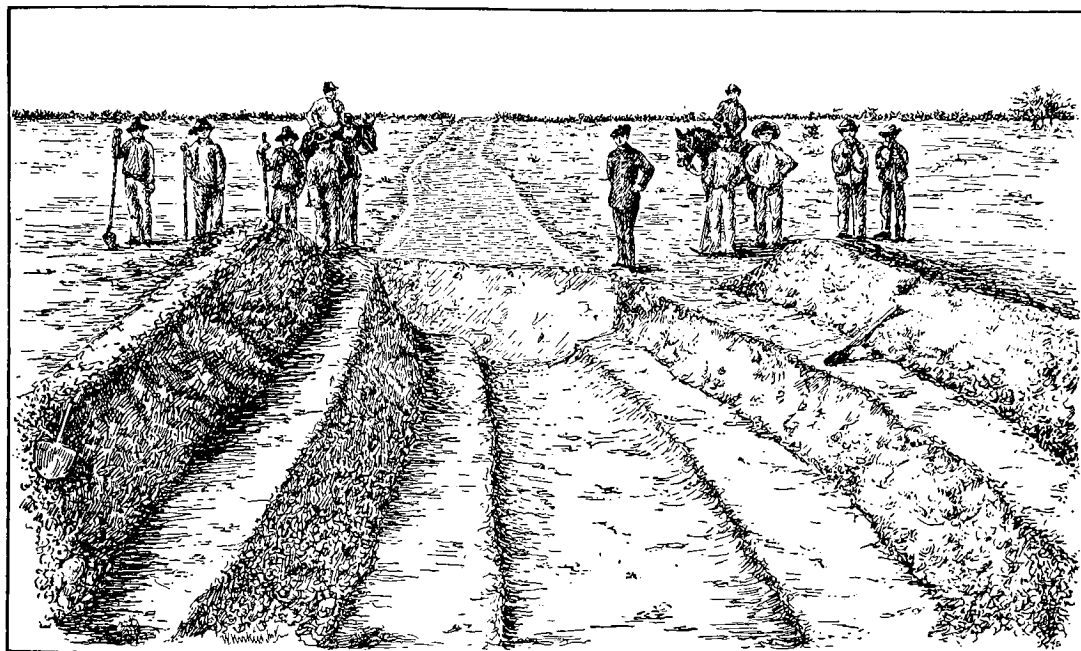


FIG. 25. A sketch showing a small secondary ditch within the major canal as revealed by excavations in Los Muertos. Courtesy of Brooklyn Museum.

ultimately joined to form one branch and they were further united by several cross-canals.

Patrick's map which appeared in 1903 and was compiled from data gathered over the twenty-five previous years does not show the extensive system about Los Muertos; Turney's plan, on the other hand, which was published in 1924 was taken largely from the Hemenway map and is almost an exact duplicate of it. Turney shows a settling basin near the intake of the master canal which the Hemenway plan does not include. Since most of the canals have now been entirely obliterated, the accuracy of the maps cannot be tested; but it is not to be

the bottom of this canal there was found a small secondary ditch. This feature has also been found in the canals on the Gila by Cummings, and is generally interpreted as a measure for conserving water when the flow in the river was low. An early pen sketch of the excavated canal at Los Muertos showing this feature will be seen in figure 25. Matted reeds, found during the course of this work, which had undoubtedly floated in from the river, convinced Cushing that navigation by *balsas* was known to the natives. Needless to say, there is no justification for this view.

By referring to figure 2, it will be seen that

<sup>53</sup> Turney, 1924, pp. 6-7.

<sup>54</sup> Hodge, 1893, p. 325.

three small lateral ditches extended westward from the main canal to the very core of the Los Muertos settlement. Two of these emerge at a widening of the canal south of Ruin XXV and the third leaves the main artery 1000 feet farther to the south. These were obviously designed solely to carry water for domestic purposes to within easy reach of all house units. The two southern ditches joined in the main settlement and were divided here and there for this purpose. How large these ditches were is not reported.

Near Ruins XII and XIV, branches of the ditches ended in depressions, serving as storage basins for the water. Hodge describes the one near Ruin XIV as having been 100 feet in width

and 200 feet in length and a trench cut through the short dimension showed that the original depth was 15 feet.<sup>55</sup> While the community could have been deprived of water by a hostile party diverting the water at the intake, these basins would have held a considerable reserve supply.

A question of interest in connection with the whole irrigation problem of the Gila-Salt region concerns the origin of the canal systems: whether the Hohokam knew this art before the Saladoans arrived, or whether the latter introduced irrigation. This has been effectively answered by the evidence at Snaketown indicating that the Hohokam had well-established canals as early as the Colonial Period.<sup>56</sup>

### THE AGE OF LOS MUERTOS

Concerning the age of Los Muertos, Cushing says, ". . . the date of abandonment . . . could not have been less remote than from fifteen hundred or two thousand years, and it might have been very much more remote."<sup>57</sup> Methods for determining the ages of Southwestern ruins have been so much improved within the past decades that Cushing's estimate may be entirely revised. The present figures are the direct antithesis of his, since they are as recent as his were early.

Objects of Spanish or historic origin were not found in Los Muertos. Although the Southwest did not receive its first great influx of Europeans until after 1700, we can be reasonably sure that the occupation of the site predates the earliest landings of the Spaniards on the coast of the New World, on grounds which will presently be shown. Dating by tree rings can be ruled out because the types of wood usable in this technique were probably not found in the remains of Los Muertos, since the altitude is much too low there for coniferous growth.<sup>58</sup> Consequently, it is necessary to rely upon other means for a date determination, and pottery becomes the most useful material. Gila and Tonto Polychromes, the pottery of the immigrant Pueblo group in Los Muertos,

has been dated in several sites outside of the Gila Basin where tree-ring material has been available. At Gila Pueblo these types were found in a room which produced a log dating from 1385. The same types were found intrusive in several cliff ruins of the Sierra Ancha whose occupation can be placed in the final years of the 1200's, and extending into the first two decades of the 1300's. The period of Canyon Creek ruin<sup>59</sup> lasted roughly from 1326 to 1348 and several intrusive vessels of the wares mentioned were found there. Further, Gila and Tonto Polychromes were found in the Four-mile and Showlow ruins whose last period dated in the final half of the 1300's. The bulk of the evidence, therefore, indicates that these types are strictly of the fourteenth century and, since they are the same as those found in Los Muertos, the occupation there is indirectly placed in that period.

A still further check is obtained from intrusive sherds in Los Muertos. Four-mile Polychrome pottery, centering in the upper Salt and in the southern part of the Little Colorado drainage, has been allocated to the 1300's by dates from numerous ruins. Jeddito Black-on-yellow, a proto-historic Hopi ware, has likewise been stamped as a product of the 1300's.

<sup>55</sup> Hodge, 1893, p. 329.

<sup>56</sup> Gladwin, Haury, Sayles, and Gladwin, 1937, p. 57.

<sup>57</sup> Cushing, 1890, p. 186.

<sup>58</sup> Nevertheless, some of the structural beams of Casa Grande were of pine, obtained from many miles away, and the same may have been the case in Los Muertos.

<sup>59</sup> Haury, 1934a.



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December 8, 1992

## Emil Haury, 88, Anthropologist Who Studied American Southwest

By ERIC PACE

Emil W. Haury, an archeologist and anthropologist who was influential in the study of the prehistory of the American Southwest, died Saturday at his home in Tucson, Ariz. He was 88 years old.

He had suffered from a heart ailment for three months, said his secretary, Carol A. Gifford.

Dr. Haury (pronounced HOW-ree) was a professor of anthropology at the University of Arizona from 1937 until his retirement in 1980, and headed its anthropology department from 1937 to 1964. He was also the director of the Arizona State Museum, in Tucson, from 1938 to 1964.

### Identified Indian Cultures

Through excavations, scientific analysis and writings, he was instrumental in identifying and defining the prehistoric Mogollon Indian culture that flourished for several centuries before A.D. 1000 in what is now eastern Arizona and western New Mexico.

That farming culture was characterized by houses that were partly dug into the soil and by what scientists call brownware pottery.

In 1964 and 1965, Dr. Haury led an expedition that expanded scientists' knowledge of the development of another prehistoric culture, the Hohokam culture, which prevailed for a millennium, until about A.D. 1400, in the desert basins of what is now central and southern Arizona.

He also helped to shape Federal policy on the preservation of archeological remains on Government land. From 1957 to 1975 he was a member of the Committee for the Recovery of Archeological Remains, a panel advising Government agencies like the National Park Service and the Bureau of Land Management.

He was born in Newton, Kan., and earned bachelor's and master's degrees from the University of Arizona in 1927 and 1928 and a doctorate from Harvard University in 1934.

His books included "The Hohokam: Desert Farmers and Craftsmen, Excavations at Snaketown,



1964-65" (University of Arizona Press, 1976).

He was married in 1928 to Hulda E. Penner, who died in 1987.

Dr. Haury is survived by his second wife, the former Agnese N. Lindley, to whom he was married in 1990; two sons, Allan, of Annapolis, Md., and Loren, of Del Mar, Calif., and four grandchildren.

Photo: Emil W. Haury examining a stone sculpture of a horned toad, circa A.D. 700-900, from the Hohokam culture of the American Southwest. (University of Arizona)

## BALLCOURTS AND CERAMICS: THE CASE FOR HOHOKAM MARKETPLACES IN THE ARIZONA DESERT

David R. Abbott, Alexa M. Smith, and Emiliano Gallaga

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*During the middle Sedentary period (ca. A.D. 1000–1070) in the deserts of southern and central Arizona, crowds from near and far regularly gathered at the centers of Hohokam villages to participate in ritual ballcourt festivities. These events were ideal venues for barter and exchange, leading some theorists to hypothesize that periodic marketplaces were associated with the ritual ballgames. Recent ceramic provenance and vessel-form evidence from the Phoenix basin have shown that the production of decorated and utilitarian pots was highly concentrated during this time and large numbers of bowls and jars were evenly distributed to far flung consumers. These findings have supported the marketplace hypothesis, suggesting that an efficient and reliable mechanism was available for moving large numbers of commodities across the region. The high volume of ceramic transactions, however, seems to have placed the Hohokam case beyond the capabilities of nascent marketplaces documented from ethnohistoric and ethnographic evidence. In this paper, we support the idea that marketplace barter was a central component of the Hohokam economy by presenting new ceramic data from the lower Salt River valley, which temporally links the demise of the ballcourt ceremonialism with a transformation in the organization of pottery production and distribution. We then examine some unusual circumstances pertaining to the Hohokam regional system that may help to explain how consumers could have so heavily depended on a network of horizontally organized, periodic marketplaces for basic necessities like earthenware containers.*

*Durante el periodo Sedentario medio (1000–1070 d.C) en los desiertos del centro y sur de Arizona, multitudes de cerca y lejos se juntaban regularmente en los centros de las villas Hohokam para participar en las festividades rituales de los juegos de pelota. Estos eventos eran lugares ideales para regatear e intercambiar, llevando a hipotetizar a algunos teóricos que la realización periódica de mercados estaba asociada con los rituales de los juegos de pelota. Recientes investigaciones de proveniencia cerámica y evidencia de forma-de-vasija de la cuenca de Phoenix, han mostrado que la producción de vasijas decoradas y utilitarias estaba concentrada principalmente durante el periodo Sedentario medio y un gran número de cuencos y ollas fueron distribuidas equitativamente a consumidores lejanos. Estas investigaciones dan soporte a la hipótesis del mercado, sugiriendo que un eficiente y confiable mecanismo estaba en uso para mover un gran número de comodidades a través de la región. Sin embargo, el alto volumen de transacciones cerámicas, parecen haber puesto el caso Hohokam muy por encima de las capacidades de los incipientes mercados documentados mediante la evidencia etnohistórica y etnográfica. En este artículo, apoyamos la idea de que el regateo en los mercados fue un componente central de la economía Hohokam presentando nueva evidencia e información cerámica del Valle bajo del Río Salado, que temporalmente se conecta con la debacle ceremonial de los juegos de pelota con la transformación en la organización y distribución cerámica. Posteriormente examinamos algunas circunstancias inusuales concernientes al sistema regional Hohokam que pueden ayudar a explicar como los consumidores pudieron depender tanto de una red organizada horizontal y periódicamente en mercados para cubrir necesidades básicas como recipientes de barro.*

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**A**rchaeologists conceptualize the Hohokam regional system as a set of geographically separate but interacting prehistoric communities spread across a vast regional territory and dependent on one another through the exchange of goods and services (Crown and Judge, eds. 1991; Wilcox 1979). During the middle Sedentary period

(ca. A.D. 1000–1070), when the regional system had expanded to its largest extent, it encompassed some 80,000 km<sup>2</sup> that included most of southern and central Arizona (Doyel 1991a:247). One manifestation of the system's integration was a dense network of ballcourts, whose limits largely demarcated the regional system boundaries and whose

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presence implied a shared set of religious beliefs across the region, which provided a basis for social and economic interaction (e.g., Wilcox 1991a; Wilcox and Sternberg 1983). At last count, 238 ballcourts at 194 sites have been identified (Marshall 2001:120).

Crowds of spectators and participants in the ritual ballgames presumably gathered from near and far, providing an ideal venue for barter and exchange. Indeed, theorists have long suspected that ballcourt festivities were conduits for the movement of various commodities, leading them to hypothesize that the large gatherings afforded the opportunity for trade fairs and incipient markets (e.g., Bayman 2002; Doyel 1979, 1985; Haury 1976:78; Heidke 2000; Wilcox 1991a; Wilcox and Sternberg 1983:213). In this paper, we explain how recent ceramic evidence has supported this idea. The pottery data suggest that there must have been a reliable and efficient mechanism during the eleventh century for distributing large numbers of clay containers from concentrated production sources. We concur with those theorists who suggest that periodic marketplaces associated with ritual ballgames are good candidates for explaining the distribution pattern. However, the ceramic findings also imply a level of dependence on marketplace barter for basic necessities, like earthenware containers, that is greater than typically associated with nascent marketplaces. Concerned by the imperfect fit between the Hohokam evidence and extant models drawn from ethnohistoric and ethnographic evidence, we asked ourselves if the marketplace hypothesis for the Hohokam is supportable. We have responded with additional ceramic information that temporally links the demise of the Hohokam ballcourts with a transformation in the organization of pottery production and distribution. Finally, we consider some unusual circumstances that characterized the Hohokam regional system and offer some tentative propositions, which, if correct, imply that the variability among emergent economies, like that of the Hohokam, exceeds the prevalent models of nascent marketing networks.

### The Hohokam Regional System

The Hohokam are best known for their hydraulic infrastructure of ditches and cultivated fields, some

of the largest and most impressive irrigation works of the prehistoric New World. At several locations along both sides of the lower Salt and middle Gila Rivers (known collectively as the Phoenix basin), the desert farmers maintained a centuries-old pattern of constructing intake facilities to draw water from the river channel into hundreds of kilometers of main and distribution canals that delivered the flow to tens of thousands of hectares planted in corn, beans, squash, and cotton (e.g., J. Howard 1991, 1993; Hunt et al. 2005). As Omar Turney (1929) noted, the hydraulic layout in each river valley was divided into canal systems, each of which consisted of canals with a common headgate location and the irrigated farmlands and settlements spread out along the canal routes. Clearly, the farmers in each canal system cooperated with one another to operate and maintain their irrigation facilities. In the lower Salt River valley, there were four major irrigation units—Canal Systems 1 and 2, the Scottsdale Canal System, and the Lehi Canal System—as well as several smaller and unnamed systems (Figure 1).

The densely inhabited and irrigated lowlands in the Phoenix basin constituted the heartland or core of the Hohokam regional system. Probably near the beginning of the ninth century, the first Hohokam ballcourts were constructed there. These large, oval-shaped features were flat-bottomed excavations with prepared floors and sidewalls that continued up onto the surrounding embankments. Emil Haury (1937a) was the first to propose that these earthen constructions were ballcourts, where a version of the Mesoamerican ballgame was played. He cited similarities in various attributes, including high parallel embankments that flanked a playing alley within which three markers, one in the center and one at each end were placed (see also Wilcox 1991b:103). Haury (1937b) also documented that rubber balls, probably made from *guayule*, a plant native to the Chihuahuan Desert, were present in the Hohokam territory.

Some of the largest of the Hohokam ballcourts were built along the middle Gila River at Snake-town (Haury 1937a) and Grewe (Marshall 2001) and had embankments that stood 2.5 m above the surrounding terrain and stretched around an area more than 60 m long and 33 m wide (crest to crest). Doyel (1991b:249) has estimated that as many as 500 spectators could have been seated on

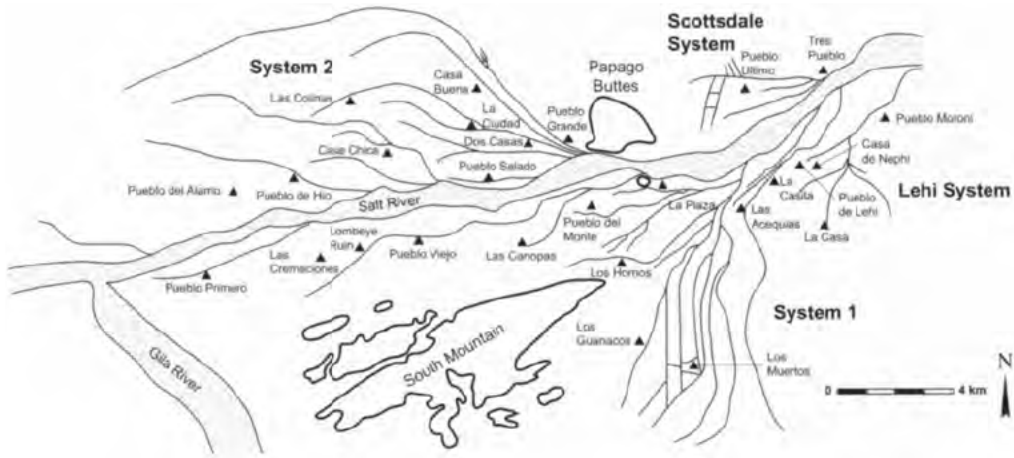


Figure 1. Canal Systems and major Hohokam settlements in the lower Salt River valley (based on information in Howard and Huckleberry 1991:Figure 1.1).

the berms in stadium-like fashion to watch the game below.

During subsequent centuries, the network of ballcourts in southern and central Arizona was expanded greatly, as mostly courts of a smaller type were built on the edges of the central plazas in nearly every village in the Hohokam territory. During the middle Sedentary period (A.D. 1000–1070), when the network had grown to its greatest extent, the densest distribution remained in the Phoenix basin, but more widely spaced lines of courts paralleled the water courses that extended in all directions from the central clusters (Figure 2). These lines reached into various ecological zones, including non-Hohokam lands inhabited by the Sinagua, Cohonina, and middle Verde cultural groups in and around the Flagstaff and Prescott areas (Wilcox 1999; Wilcox et al. 1996).

The irrigated valleys were highly productive agriculturally but were poor in natural resources. In contrast, the surrounding uplands to the north, east, and south, and the desert lowlands to the west were just the opposite: marginal agriculturally but environmentally diverse and rich in natural resources. Not surprisingly then, raw materials and finished products made from obsidian, turquoise, argillite, galena, steatite, serpentine, and shell, as well as manos, metates, tabular knives, wild vegetables and fruits, large-bodied game, and probably hides were imported from the outlying areas to the villages lining the banks of the Salt and Gila rivers. Painted red-on-buff ceramics and probably

agricultural surpluses including cotton moved in the opposite directions (e.g., Doelle 1980; Doyel 1991a; Gasser and Kwiatkowski 1991; Teague 1998). Most Southwestern archaeologists agree that the ballcourt gatherings facilitated the transfer of the rich diversity of goods from various ecological districts across considerable distances. This connection between ballcourts and regional exchange has become a central topic of research and is considered by many analysts to be of the utmost significance for comprehending Hohokam prehistory (e.g., Crown and Judge, eds. 1991).

Previous work has established that the assortment of trade goods was impressive, although with a closer look we see that the mix of material culture varied from one end of the regional system to the other. The variation implies that the network lacked an overarching, centralized control (e.g., redistribution from a central place) that regulated the exchange transactions and other associated activities (Bayman 2002:70; Crown 1991:402–403). Instead, the network's decentralized structure was a patchwork of communities, horizontally tied together for the benefits afforded by the far-reaching interaction (e.g., Crown 1991; Wilcox 1979). The Hohokam present researchers with a case study that can inform on how large quantities of goods can be transferred in the absence of overarching political unity.

Beyond that general configuration, there are various but overlapping ideas about how the ballcourt network and the movement of goods through it

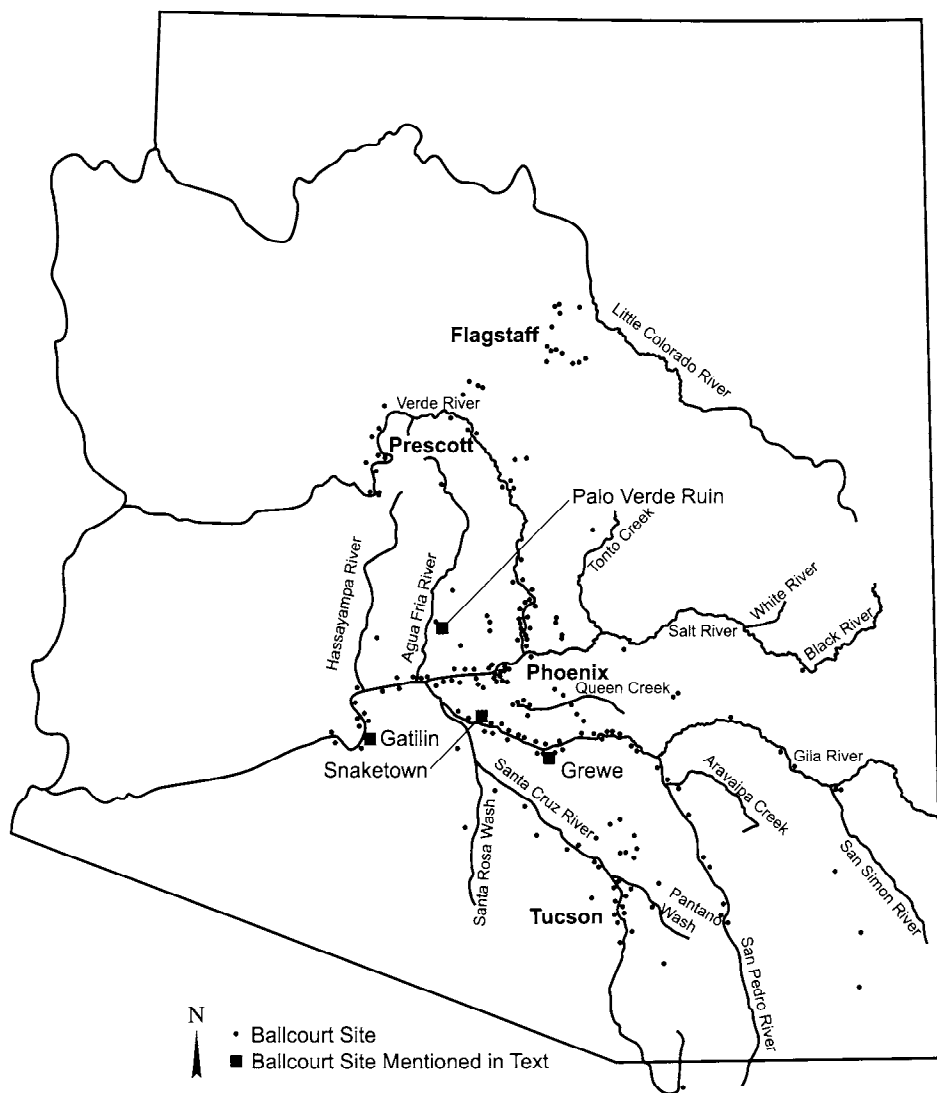


Figure 2. Distribution of Ballcourts in Arizona (based on information in Marshall 2001:Figure J.1.).

should be characterized. In one of the best developed of these models, Wilcox conceptualizes the ballcourt ceremonialism and some of the associated exchanges as embedded in social arrangements and ritual obligations. He proposed that the ballcourt events facilitated the circulation of exotics and other goods among emergent local leaders, who used the commodities to build and maintain a constituency (Wilcox 1991b:123–124). He presented evidence that the ballgames were calendrically timed (Wilcox 1991b:115–122), and suggested that:

[T]he obligations to produce goods and services for ceremonies, when harnessed to a scheduled round of ceremonial events among a set of nearby communities would have created periodic pools of goods and the motivations to carry them to another place as gifts or presentations in a continuing series of reciprocal exchanges [Wilcox and Sternberg 1983:213].

In addition, he also posited the existence of regional trade fairs associated with ballgames to supplement exchanges contingent on kinship connections (Wilcox 1991b:123–124).

Doyel (1979, 1981:58, 1985, 1991a, 1991b:252) has offered an economic perspective. He has also proposed that trade fairs or incipient markets accompanied the ballgames, emphasizing that people of all social statuses enjoyed full and direct participation in the exchange of goods. By this reckoning, the games themselves were clearly ritual affairs. Under a ceremonial umbrella, however, bargaining and barter of a purely economic nature took place. Periodic meetings, where large gatherings form for ritual performances, inevitably facilitate secular intercourse as well, which, as Renfrew (2001:19, 22) notes, can sometimes include periodic markets. Recent advances in the Hohokam ceramic chronology, pottery-provenance research, and subsequent findings concerning the organization of ceramic production and distribution during the middle part of the Sedentary period have strongly supported the marketplace idea.

#### **Wallace's Refinements of the Red-On-Buffer Typology**

The most important work for building the Hohokam chronology since Haury's (1937c, 1976) eminent studies at Snaketown is Wallace's (2001, 2004) recent typological refinements of the red-on-buff ceramics made along the middle Gila River. Using a rigorously designed, fine-scale, temporal seriation of the painted designs and vessel forms, Wallace modeled the rise and fall of decorative traditions, leading to temporal subdivisions of Haury's pottery types and objective criteria for assigning individual ceramics to the more precise temporal categories. Important for our presentation is the four-part division of Sacaton Red-on-buff, the type that Haury defined to represent the Sacaton phase, which is equivalent to the Sedentary period. Wallace has been able to divide the type into Early Sacaton, Middle Sacaton 1, Middle Sacaton 2, and Late Sacaton Red-on-buff. In effect, what had been a single pottery category representing a 200-year block of prehistory has been split into four types, each associated with a relatively short interval of time. In the application of Wallace's refined typology, some decorated sherds can be pinned down to a specific type (e.g., Late Sacaton Red-on-buff), whereas others are sometimes assigned to categories that encompass a small and continuous range of new types. One example is "Early Sacaton to

Middle Sacaton 2 Red-on-buff." There can be many such combinations with different degrees of temporal precision.

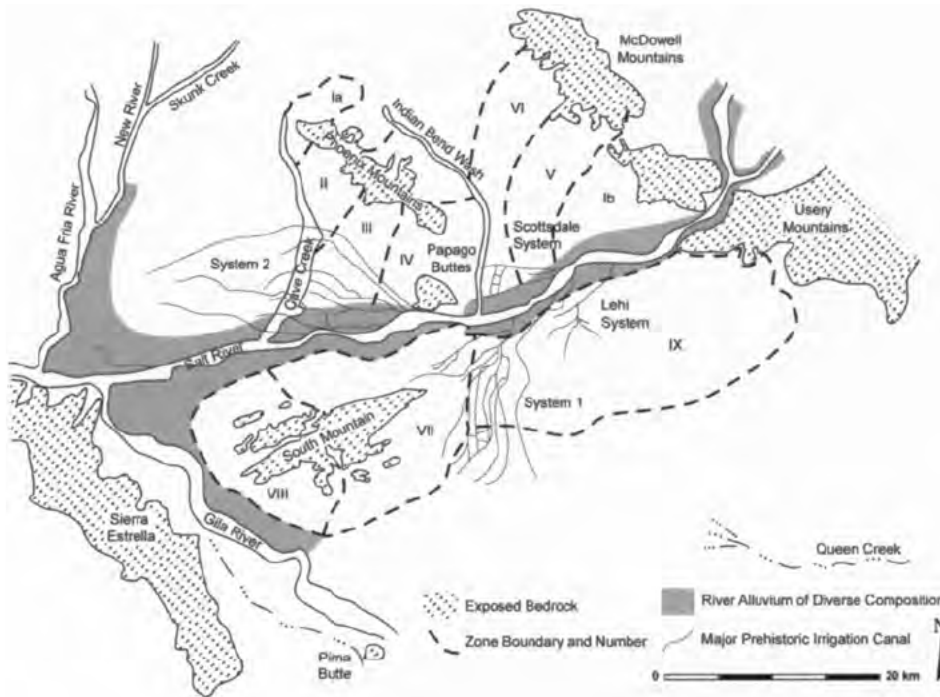
#### **Pottery Provenance**

Also in recent years, a significant advancement has been achieved in the analysis of Hohokam pottery from the lower Salt and middle Gila River valleys. Previous work had noted mineralogical variability in the temper of Hohokam pots and suggested a provenance relationship between temper varieties and production sources (Abbott 1983, 1988; Doyel and Elson 1985; Lane 1989; Weaver 1973). New compositional and geological studies, begun at Pueblo Grande (Abbott 1994, 2000; Abbott and Schaller 1994; Schaller 1994) and continued elsewhere (Abbott 1993, 1995, 2001a; Abbott and Love 2001; Miksa 1995, 2001; Miksa et al. 2004), have subsequently extended and refined the documentation of temper variation, codified it in terms of geological zones, and demonstrated that the prehistoric artisans relied on the raw materials that were nearest at hand (Figure 3). Consequently, temper type has been shown to be an excellent indicator of production source.

Because the temper types are mineralogically distinctive, they are distinguishable with just a standard binocular microscope, making it possible to determine the provenance of individual ceramics quickly and inexpensively. As a result, tens of thousands of ceramics have been linked to spatially narrow production sources, and pottery exchanges have been traced with remarkable precision. The movement of earthenware vessels between inhabitants who lived as little as 5 km apart is now recognized, demonstrating that large numbers of clay containers changed hands. By tracing these ceramic exchanges, the organization of pottery manufacture, the spatial and temporal patterns of pottery distribution, and the social and economic relationships implied by the ceramic data are being reconstructed with unprecedented detail (e.g., Abbott 1993, 2000, 2003; Abbott and Walsh-Anduze 1995; Walsh-Anduze 1996).

#### **Concentrated Production**

Pottery was not made in most villages of the lower Salt River valley during the middle part of the



**Figure 3. Zones of sand and rock types in the lower Salt River valley: Ia = basalt, Phoenix Mountains; Ib = basalt, Fountain Hills; II = phyllite; III = Squaw Peak Schist; IV = Camelback Granite; V = quartzite; VI = quartzite and schist; VII = South Mountain Granodiorite; VIII = Estrella Gneiss; IX = Utery Mountains sand (based on information in Abbott 2000:Figure 5.1).**

Sedentary period. Instead, more than 90 percent of the bowls and jars in the valley households could be accounted for by the output of artisans residing in only five pottery source areas. Three of these sources existed in the lower Salt River valley and two others were present along the middle Gila River to the south.

The first production source, associated with phyllite temper, has been pinpointed at Las Colinas, a sprawling settlement at the terminal end of Canal System 2 (see Figure 1). On the western edge of the site, thick layers of well-sorted clay were repeatedly accumulated in and mined from two huge settling basins (approximately 10 m in diameter and 5 m deep) into which canal water with suspended sediments had been diverted and allowed to dry (Nials and Fish 1988). The levigated clay was ideal for fabricating thousands of medium- and large-sized plain-ware jars (probably used for cooking and storage) and lesser numbers of plain-ware bowls, which were distributed throughout Canal System 2 and the Scottsdale Canal System.

The second and third supply zones were located on the south side of the Salt River. The two halves of South Mountain were the bedrock origins of two distinctive sands (South Mountain Granodiorite and Estrella Gneiss; see Figure 3). Local artisans used the sand types to produce large, wide-orifice, thick-walled ollas, which possibly functioned as water coolers. These vessels were widely traded across the lower Salt River valley, including to Las Colinas, where jars of this shape and size were not made. Because two discrete sources for these pots can be discriminated by their temper, we have inferred that at least two groups of potters labored to make them. We have no knowledge, however, of precisely where and at how many places in the South Mountain vicinity these producers were located.

Manufacturers of plain-ware containers also worked in the middle Gila River valley, supplying nearly all of the medium- and large-size jars and some bowls to the Phoenix-area households on the south side of the Salt River. Many of these Gila

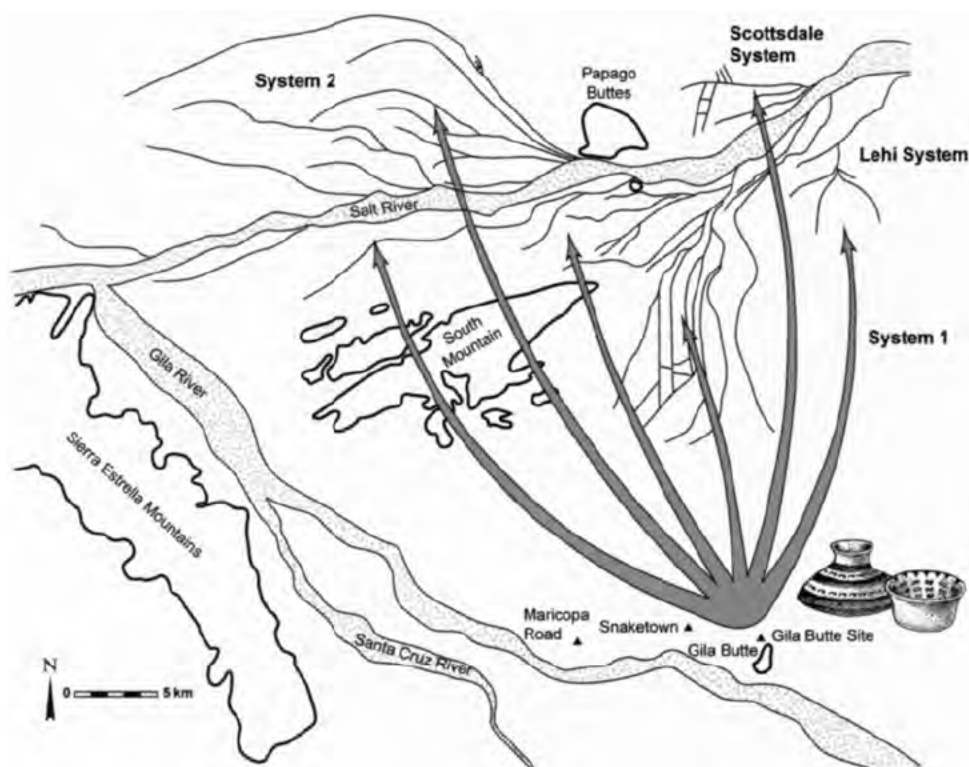


Figure 4. Distribution of Red-on-buff Jars and Bowls during the Middle Sedentary Period.

River imports were likewise transported to the residents of the Scottsdale Canal System. In effect, the middle Gila plain-ware makers supplied the communities on the south side of the Salt River with the same vessel forms made at Las Colinas, which were distributed to the settlements on the north side of the river. Only in the Scottsdale Canal System do we find a significant overlap of the plain wares from Las Colinas and the middle Gila River valley. The middle Gila ceramics were tempered with coarse-grained mica schist, which outcrops at several bedrock exposures that encircle the valley and exist along Queen Creek, a short distance to the north. Consequently, we do not know the extent to which plain-ware production was concentrated in that southern part of the Phoenix basin.

Finally, those potters specializing in red-on-buff bowls and small jars were also situated along the middle Gila River at Snaketown and probably elsewhere in that vicinity (Figure 4). Haury's (1976) excavations at Snaketown unearthed the facilities, tools, and raw materials for pottery manufacture in a work area near the center of the site. Experiments

with those raw materials demonstrated that they were intended for buff-ware manufacture (Abbott and Love 2001). Analogous evidence has been reported from the Maricopa Road site, a few kilometers to the west of Snaketown (Lascaux and Raveslout 1993), and extreme densities of buff-ware pieces are known from the surface of the Gila Butte site, suggesting buff-ware production there, about 4 km east of Snaketown (Rafferty 1982).

Nearly all of the bowls in use in the lower Salt River valley during the middle Sedentary period were decorated forms, and the small red-on-buff jars complemented the larger plain-ware containers in size and aperture diameter, with little overlap. The buff-ware pots were also tempered with coarse-grained mica schist, but approximately half the decorated ceramics that reached the lower Salt River valley also contained a sand component. Extensive geological analysis of the sands in the middle Gila River valley has yielded a petrofacies model that demarcates several sand-composition zones (Miksa 2001; Miksa et al. 2004). Recent analyses of the sand fraction in several hundred



Sedentary period buff-ware sherds recovered from various sites along the lower Salt River have tentatively shown that most of these specimens contained sand from the Snaketown area (Abbott et al. 2007). These findings suggested that those middle Gila potters who supplied painted pots to the Salt River communities were mostly concentrated at and around Snaketown, on the north bank of the Gila River.

Despite this concentration, a standard set of red-on-buff vessel forms was uniformly disseminated from the middle Gila River region to domestic units throughout the lower Salt River valley. During the middle Sedentary period, buff-ware sherds consistently accounted for about 20 percent of the total ceramic assemblages in all parts of the Phoenix area. Moreover, the ratios of decorated bowls to decorated jars and the relative numbers of red-on-buff bowls of particular sizes were repeated from each location in the lower Salt River valley to the next (Abbott et al. 2001).

We now recognize that ceramic production during the middle Sedentary period was organized across an expansive territory so that artisan groups, sometimes separated from one another by one or two days' travel, each fabricated a restricted set of wares and vessel forms that often functionally complemented the containers manufactured by the other potter groups. In this way, each Salt River household was dependent on multiple and often distant producers for the full complement of its domestic pottery inventory. This concentration of production could not have been more dissimilar from the pattern documented for the subsequent early Classic period (ca. A.D. 1100–1300), when a full range of vessel forms was produced by local potters throughout the lower Salt River valley (Abbott 1993, 1995, 2000, 2003). This shift implied a radically reduced scale of production during the later time period with a greater emphasis on self sufficiency and less dependence on distant suppliers for basic domestic needs.

### **Economic Implications**

The ceramic results have at least four obvious implications for how to conceptualize the middle Sedentary period economy. First, where production was concentrated for one kind of commodity (i.e., the pots), it stands to reason that other kinds of goods

were made by specialists for broad scale exchange. We define "specialist producers" as those artisans who practiced their craft, at least in part, to supply their wares beyond their own households to external consumers. Specialized production and exchange have been proposed for several commodity types, although the supporting data are not as well-developed as they are for the ceramics (e.g., shell jewelry [A. Howard 1993], projectile points [Hoffman 1997], manos and metates [Hoffman et al. 1985], tabular knives [Bernard-Shaw 1983], axes [Doyel 1991a], and some kinds of plant foods and fibers [Fish et al. 1992; Gasser and Kwiatkowski 1991; Hutira 1989; Teague 1998]).<sup>1</sup> The one-way flow of pottery from the middle Gila River potters to the communities along the lower Salt River also implied that large quantities of other goods were moved in the opposite direction. At Grewe, in the heart of the middle Gila area (see Figure 1), it was recently estimated that a paltry .03 percent of the pottery (i.e., 3 sherds per 10,000) originated in the lower Salt River valley (Abbott 2001b:265). In contrast, probably thousands of pots each year, roughly accounting for half of all ceramics along the lower Salt River, were imported from the middle Gila sources.<sup>2</sup>

Second, when considering the huge numbers of consumers relative to the much smaller number of pottery suppliers, we recognize that the clay pots must have been distributed beyond the limits of kinship networks and other social ties. Artisans must have manufactured some of their wares for people they did not know. For instance, the uniform distribution of a standard set of red-on-buff ceramics over a large territory (Abbott et al. 2001) clearly differed from expectations for down-the-line transactions typically associated with reciprocal kin-based exchange. Presumably, the trade in other commodities also transcended the connections in the social field.

Third, the ceramic results imply that the Sedentary period was marked by an efficient and reliable mechanism for commodity distribution. One idea to consider was a political economy articulated by dominating elites (e.g., Earle 1997:70–75; Feinman et al. 1984:169; Johnson and Earle 2000), but the available evidence offers little support. In such economies, an obligatory production of surplus goods and labor was paid to a central figure for financing the activities of governing institutions.

This mechanism of accumulation and reapportionment probably does not explain the distribution of Hohokam pottery. In other cultural settings, elites had little interest in a monopoly control over domestic pottery production and distribution (Frankenstein and Rowlands 1978; Fry 1980; Rice 1987), probably because it would have been especially difficult to attain. Cheaply made utilitarian items that could be and often were manufactured across wide areas were not the stuff from which political hierarchies were built (Costin 1991:11; cf. Earle 1987).

For the Hohokam, an administrative control over pottery making probably would have been impossible because the clays and temper for fabricating pots were some of the few raw materials for crafts production that were widespread in the valley lowlands (see Abbott 2000; Abbott and Love 2001; Miksa 2001). The knowledge and skill to utilize these materials were probably easy to acquire as well, as witnessed during the Classic period when pots were made in all sections of the lower Salt River valley (Abbott 2000). Moreover, we find no evidence for stockpiling at redistributive central places during the Sedentary period. In fact, as discussed above, we know of production during the Sedentary period outside the most politically prominent villages (e.g., large headgate villages that may have controlled water distribution through the canals), which contradicts expectations for administrators interested in controlling manufacture by locating it in administrative centers.

Fourth, we can reject the idea that pottery production was regulated as part of a tribute economy. Costin (1991:11) has noted that the output of independent specialists was usually governed by the general principles of supply and demand, where fabrication and transportation costs served to regulate distribution from makers to consumers. She also noted, however, that politics and taxation sometimes influenced their activities to fulfill their obligations. In the case of pottery production at Las Colinas, we could entertain the possibility that the local artisans supplied cooking and storage jars to the other villages in their canal system as tribute or in exchange for assured water deliveries to their fields at the tail end of the irrigation works. Las Colinas, however, not only supplied Canal System 2 with utilitarian vessels but also partially filled the household inventories in the Scottsdale Canal

System. The Scottsdale villages imported the same vessel forms from the middle Gila plain-ware suppliers as well. In fact, the Scottsdale System was the one portion of the lower Salt River valley where a significant overlap existed for the distribution of both the Las Colinas and middle Gila plain-ware ceramics, and it was the place within the supply areas of both producer groups that was furthest from the source. In the Scottsdale area, both potter groups incurred their greatest transportation costs, and presumably they directly competed with one another in that vicinity (Abbott 2001c). From the perspective of the Scottsdale Canal System, the pottery production at Las Colinas and along the middle Gila appeared to have been an economic undertaking governed by the forces of supply and demand rather than the dictates of a controlling central authority. Moreover, production as tribute poorly explains the massive import of clay containers from the middle Gila throughout the lower Salt River valley. Political hegemony that influenced the distribution of large numbers of clay containers at an intervalley scale during the Sedentary period seems farfetched.

### Marketplace Hypothesis

A likely candidate for the mechanism that facilitated commodity distribution was periodic marketplaces associated with the ritual ballgames. As noted above, this idea is not new. But what is new concerns the great quantities of materials that possibly changed hands via market exchange. Marketplace barter has important advantages from both the perspectives of supply and of distribution. Markets offer ideal conditions for producers by minimizing their transportation costs when multiple buyers assemble in one place (Alden 1982:86–88; Belshaw 1965; Stine 1962). We can imagine Hohokam potters in the middle Gila River valley packing up loads of their wares, walking one or two days to ballcourt events in the lower Salt River valley, while eager buyers anticipated these merchants' arrival. Many kinds of artisans can also be attracted to a single marketplace thereby concentrating a great variety of goods at a particular location (Hassig 1982; Hirth 1998).

On the distribution side, a supplier's wares can reach sparsely settled, low-demand areas when buyers are drawn from the countryside to a mar-

ketplace (Hassig 1982). This process creates a homogenizing effect on the distribution of goods produced in limited areas (Hirth 1998), exactly like the uniform distribution of Hohokam red-on-buff pottery in the lower Salt River valley during the middle Sedentary period (Abbott et al. 2001). Finally, participants in market exchange require no prior kinship relationship or other social tie in order to transact with one another (Carrasco 1983; Hirth 1998). As noted above, barter between strangers almost certainly characterized the distribution of Hohokam ceramics.

At this juncture, we should clearly state that the Hohokam did not initiate a market-dominated economy, such as those in industrialized nations, where all members of the society acquire their livelihood by selling something (including their labor) to the market. Instead, the Hohokam possibly operated what Bohannon and Dalton (1962:7–9) have called “peripheral markets” within a multicentric economy. Distinct transactional spheres were probably extant among the Hohokam, each distinguished by different material items and services, different principles of exchange, and different moral values (e.g., Abbott 2000:133–140). One of those transactional spheres may have been marketplace exchange in which the forces of supply and demand dominated. In other spheres, “the movement of material goods in reciprocative [sic] and redistributive transactions cannot be understood outside the context of the social situation of which they [formed] an integral part” (Bohannon and Dalton 1962:4).

Ceramic bowls and jars were basic necessities of Hohokam life, yet households across the lower Salt River valley did not make their own pots. Instead, each family depended on multiple pottery suppliers, often situated considerable distances away. As such, the clay containers lead us to an interesting conundrum. The ceramic data, on the one hand, imply that there must have been a reliable and efficient mechanism for distribution, thus supporting the marketplace idea. On the other hand, if basic necessities were indeed distributed via marketplace barter, there must have been a heavy dependence on those kinds of transactions, which seems inconsistent with expectations associated with extant models of nascent marketplaces.

Nascent marketing systems, often called market rings, include uniformly distributed marketplaces where trade at each location is periodic and

scheduled to offset with marketing days at other nearby sites. Different commodities are available more or less equivalently at each location, where barter is horizontal, without oversight from some overarching, vertically structured institution. Market rings everywhere are composed of mostly local people, who are small-scale and part-time suppliers, serving only a single center or a single market ring (Bromley et al. 1975; Hodder 1962; Smith 1974). Their production decisions are little influenced by the markets, which are simply outlets for occasional surpluses of crafts and foodstuffs. For these reasons, consumers are unable to obtain necessities in market rings with regularity or certainty (Smith 1976:39–44).

Market rings are rooted in a set of economic conditions, namely direct participation of small-scale producers, horizontal organization, and a considerable degree of local self-sufficiency. The conditions imply a low dependence on market exchange and a poorly developed division of labor. In contrast, what we find in the Hohokam case is an advanced division of labor evident by transactions of products that could have been, but were not, produced by self-sufficient households (cf. Blanton 1983:53; Forman and Riegelhaupt 1970; Smith 1974, 1976) and a scale and efficiency of market distribution that exceeded expectations for periodic, horizontally organized market rings.

The poor fit between the Hohokam case and other market rings causes us concern, to which we respond with new information. Our new findings will not settle the issue, but they do link ballcourt ceremonialism and the organization of ceramic production and distribution more closely than had been accomplished before, thereby adding a new measure of support to the proposition that the ritual ballgames were associated with marketplaces.

### Supporting The Marketplace Hypothesis

Our results are based on Wallace’s (2001, 2004) refinements to the Hohokam ceramic chronology and on precise controls over pottery provenance. Southwestern archaeologists generally agree that most if not all of the Hohokam ballcourts had fallen into ruin by the Classic period, and the ceramic provenance data from the Classic period in the lower Salt River valley also imply that pottery production had reverted to the local manufacture of a

full range of vessel forms by that time. The question that we posed was whether or not those two developments were linked synchronously.

We begin with a review of the evidence that the ballcourt network collapsed rather suddenly, probably near the end of the middle Sedentary period. We then present new evidence from Las Colinas to support that claim. Then, using ceramic percentages and provenance data from Las Colinas and elsewhere, we show that the organization of pottery production and distribution changed considerably, precisely at the time that the ballcourts were abandoned.

### *Collapse of the Ballcourt Network*

The first application of Wallace's refinements to the red-on-buff typology immediately yielded significant results. Even before Wallace's study appeared in print, his typological criteria were applied to the Sedentary period assemblage at Palo Verde Ruin, located in the upland zone north of the Phoenix basin and approximately 35 km from the Salt River (see Figure 2). The Palo Verde analysis demonstrated that part of a string of single-family farmsteads, paralleling the west bank of the New River, existed on the eastern margin of the site during the early part of the Sedentary period. Then, quite suddenly, a large Hohokam village, complete with courtyard groups of pithouses clustered into residence units with associated cemeteries, was constructed around a central plaza and ballcourt during the middle portion of the Sacaton phase. The ballcourt village was short-lived, being abandoned prior to the inception of Late Sacaton Red-on-buff (Abbott 2002a). Without Wallace's typology, we would have never discerned this rapid transformation of the site structure in the middle of the Sedentary period. In addition, an abundance of tree-ring dated intrusive ceramics and a large suite of absolute dates tentatively indicated that the middle Sedentary ballcourt village was established around A.D. 1010–1020 and securely dated the site's abandonment by A.D. 1070 (Abbott 2002a).

A chronological reassessment (Abbott 2002b) of the ceramic data from various small sites previously investigated along the New River by Doyel and Elson (eds., 1985) implied that the ballcourt village at Palo Verde Ruin represented an aggregation of local inhabitants. The absolute dating supported Wilcox's (1999) hypothesis for the

expansion of the regional ballcourt network, when the Palo Verde ballcourt became an intermediary node in a rapidly expanding ceremonial and exchange network. It helped to link the Hohokam core area with other ethnic groups in the middle Verde, Cohonina, and Sinagua culture areas to the north (cf. Wilcox et al. 1996). The abandonment of Palo Verde Ruin by A.D. 1070 implied the loss of those northern connections.

Doyel (2000) has also described a major disruption of the Hohokam regional system beginning at A.D. 1075, which corresponded with the abandonment of Snaketown based on the presence and absence of tree-ring-dated intrusive ceramic types (Doyel 1993). In addition to the abandonment of the two ballcourts at Snaketown, Doyel pointed out that the ballcourts at Gatlin and Pueblo Grande (see Figure 2) were also abandoned at about the same time, suggesting to him that that ballcourt network had disintegrated around A.D. 1075 and no longer functioned as a key element of horizontal social integration. Doelle and Wallace (1991:319–321) have also suggested a ballcourt collapse in the Tucson Basin where there were no settlements whose occupations were spatially focused on a ballcourt by the beginning of the Late Rincon phase, probably dating to around A.D. 1100 (Henry Wallace, personal communication 2003)—an idea supported by Heidke (1996:62). To these instances, we can now add the demise of the Palo Verde Ruin ballcourt at A.D. 1070. Admittedly, only a handful of Hohokam ballcourts have been excavated and even fewer courts are well-dated, but the available evidence does suggest that the ballcourt network was in rapid decline, if not totally collapsed, by the end of middle Sacaton times, around A.D. 1070.

### *Dating the Ballcourt at Las Colinas*

During the excavations at Las Colinas in the early 1980s, the field crew encountered a ballcourt filled with dense deposits of soil and cultural debris that included an abundant quantity of ceramic pieces. Below the upper trash fill, they removed a lower stratum in which few artifacts were present. Based on our application of Wallace's refined buff-ware types, we suggest that the upper stratum accumulated during the late part of the Sedentary period, indicating that the court was abandoned and partially filled prior to that time (Table 1). Among the

Table 1. Temporally Diagnostic Buff Ware Sherds in the Las Colinas Ballcourt and Associated Pits.

Feature	E Sacaton- M Sac 1	E Sacaton- M Sac 2	Middle Sacaton 1	Middle Sacaton 1/2	pre-Late Sacaton	Late Sacaton	Late Sacaton/ Casa Grande
Ballcourt (upper stratum)		1	1	4	4	1	2
4024 (intrusive pit)	1	2			1	1	
4025 (possible intrusive pit)				3		1	
4029 (possible intrusive pit)				1	4		
4178 (pit in ballcourt floor)					1		

few buff-ware specimens saved from the lower deposits, none could be placed in a temporally diagnostic category.

In addition, a large trash pit (Feature 4024) intruded the ballcourt fill and two other pits (Features 4025 and 4028) probably intruded the court's embankment, which was not preserved on the historic surface (see Gregory 1988a:273). All three pits contained decorated ceramics that indicated the features were filled during or after Late Sacaton times (see Table 1). Feature 4178 was a sherd-lined pit that in contrast probably was coeval with the ballcourt's use, possibly marking the division between the playing floor and the northern end court (see Gregory 1988a:272–273). The sherd lining was composed, in part, of decorated bowl sherds, one of which we identified as pre-Late Sacaton. An abandonment date during the middle Sacaton 2 interval seemed likely for the ballcourt, which, interestingly, precisely agreed with Teague's (1988:56) assessment, published in the Las Colinas project report. Based on the presence of red-slipped sherds in the upper stratum and their absence in the lower stratum of the ballcourt fill, Teague suggested that the court was abandoned before the late end of the Sedentary period.

#### *Dating the Reorganization of Pottery Production*

Previous evidence has shown that the supply of buff-ware vessels from the middle Gila River valley declined during the Sedentary period from a high of roughly 20 percent of the total ceramic assemblage to a low of about 5 percent in the Classic period assemblages. Moreover, that decline has been characterized as a reduction in the manufacture of painted bowls. The earlier work at Las Colinas established that an increase in plain-ware bowls replaced the shortfall in buff-ware forms during the Sedentary period (Abbott 1988). We have now recognized that the shift occurred during the Mid-

dle Sacaton 2 times and that the decline in buff-ware percentages was not a gradual and protracted decline but a one-time interruption of the buff-ware supply. Importantly, the timing of that interruption precisely corresponded to the demise of the ballcourt.

We evaluated the sherd counts for each feature, which allowed us to assign some features to a specific temporal category (e.g., Middle Sacaton 2) or to a slightly longer temporal interval (e.g., Middle Sacaton 2/Late Sacaton). In addition, there were numerous instances where the ceramic set included specifically dated sherds that together represented three or more temporal units (e.g., an assemblage containing a Middle Sacaton 1 sherd, a Middle Sacaton 2 sherd, and a Late Sacaton sherd). We interpreted these cases as features with temporally mixed deposits.

Using the data published in the Las Colinas project report (Gregory 1988b), we then calculated the percentage of buff-ware ceramics for each of the features in our sample (see Table 2). When we excluded the temporally mixed assemblages and plotted the features by buff-ware percent, we got an unexpected result (Figure 5). Instead of a continuous decline over time, there seemed to be two somewhat variable groups, with a distinct gap in the distribution of buff-ware percentages, between 12 and 17.5 percent. This gap was a result to which we assigned considerable significance. We suggest that it represented a disruption in the supply of red-on-buff containers at Las Colinas. Small relative frequencies of decorated sherds existed in all of the Middle Sacaton 2/Late Sacaton features and all of the Late Sacaton assemblages. In contrast, all of the Middle Sacaton 1 and all but one of the Middle Sacaton 1/2 features contained more than 17.5 percent buff ware. The one exception was Feature 4029, from which five temporally diagnostic sherds were collected: four cases classified as pre-Late Sacaton and one piece that was either a Middle

Table 2. Ceramic Data from Contexts at Las Colinas.

Feature	Buff %	Plain Ware Percent					Total	
		Local <sup>a</sup>	South Mt. <sup>b</sup>	Middle Gila R. <sup>c</sup>	Canal System 2 <sup>d</sup>	Scottsdale <sup>e</sup>		Other <sup>f</sup>
<i>Early Sacaton/Middle Sacaton 1</i>								
4254	22.3	46.9	38.8	2.0	2.0	0.0	10.2	49
<i>Middle Sacaton 1</i>								
4001	25.4	34.0	50.9	9.4	0.0	0.0	5.7	53
4122	18.7	58.0	30.0	4.0	0.0	0.0	8.0	50
4124	17.8	52.7	14.5	0.0	1.8	0.0	30.9	55
4125	22.7	62.0	16.0	0.0	0.0	0.0	22.0	50
4179	21.1	53.8	23.1	7.7	2.6	0.0	12.8	39
4262	27.9	48.0	40.0	4.0	0.0	0.0	8.0	50
5066	28.1	43.1	33.3	7.8	2.0	0.0	13.7	51
5103	17.5	51.0	19.6	3.9	0.0	0.0	3.9	51
7089	19.8	.	.	.	.	.	.	.
<i>Middle Sacaton 1/2</i>								
4000	21.1	37.7	43.4	7.5	0.0	0.0	11.3	53
4029	7.8	62.7	13.7	0.0	5.9	3.9	13.7	51
4178	21.3	70.0	20.0	5.0	0.0	0.0	5.0	20
4253	20.2	43.1	35.3	7.8	2.0	0.0	11.8	51
5314	18.2	50.0	38.2	5.9	2.9	0.0	2.9	34
7021	18.7	42.0	34.0	4.0	6.0	0.0	14.0	50
7023	18.6	66.7	18.5	3.7	0.0	0.0	11.1	54
<i>Middle Sacaton 2</i>								
4091	7.5	83.3	10.4	0.0	4.2	0.0	2.1	48
4215	10.7	53.1	24.5	4.1	2.0	2.0	14.3	49
5034	19.9	56.9	27.5	2.0	0.0	0.0	13.7	51
5073	9.2	26.4	15.1	5.7	22.6	0.0	30.2	53
5116	11.7	66.0	13.2	0.0	9.4	1.9	9.4	53
5126	18.5	63.5	21.2	5.8	0.0	0.0	9.6	52
<i>Middle Sacaton 2/Late Sacaton</i>								
4025	8.1	60.8	27.5	2.0	9.8	0.0	0.0	51
4150	9.5	64.0	18.0	0.0	6.0	0.0	12.0	50
4280	7.6	35.3	13.7	5.9	7.8	5.9	31.4	51
<i>Late Sacaton</i>								
4019	11.2	51.0	8.2	4.1	20.4	2.0	14.3	49
4060	8.6	64.7	11.8	5.9	0.0	0.0	17.6	51
4250	9.5	64.3	10.7	1.8	16.1	0.0	7.1	56
4273	11.2	42.0	14.0	8.0	10.0	2.0	24.0	50
5038	11.1	36.0	10.0	6.0	34.0	6.0	8.0	50
5074	10.5	23.1	46.2	0.0	11.5	7.7	11.5	42

<sup>a</sup>phyllite<sup>b</sup>South Mountain Granodiorite, Estrella Gneiss<sup>c</sup>coarse-grained mica schist<sup>d</sup>Camelback Granite, Squaw Peak Schist<sup>e</sup>quartzite, quartzite and schist<sup>f</sup>other schist, unidentified.

Sacaton 1 or a Middle Sacaton 2 Red-on-buff sherd. Based on the low percentage of buff-ware, we strongly suspect that this feature actually dated to the Middle Sacaton 2 interval. Finally, the Middle

Sacaton 2 features straddled the gap, with four cases to the left and two cases to the right, suggesting that the disruption in buff-ware supply occurred during that temporal span.

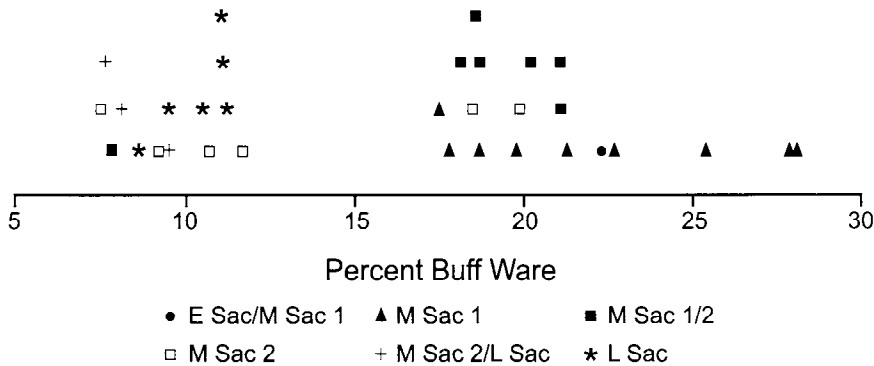


Figure 5. Buff Ware Percentages in Features of Different Time Intervals at Las Colinas.

Consequently, the disruption in buff-ware supplies from the middle Gila River valley transpired at Las Colinas exactly at the time the Las Colinas ballcourt was abandoned and when the regional ballcourt network is now thought to have been in rapid decline. As we discuss next, those events were coeval with a reorganization of plain-ware production as well.

#### *Las Colinas Plain Ware*

We began with the plain-ware sherds at Las Colinas recovered from the 31 Preclassic structures and pits that were either coeval with the ballcourt's use or postdated it.<sup>3</sup> From each of these features, we randomly selected about 50 plain-ware sherds and carefully reviewed each sherd set to eliminate pieces from the same vessel (see Table 2). Locally made cases contained crushed phyllite fragments. The ceramics made in the central and eastern portions of Canal System 2 were tempered with Squaw Peak Schist and Camelback Granite, respectively. Those specimens made in the Scottsdale Canal System contained a quartzite-rich sand or a sand of mixed quartzite and schist. Other cases included those tempers representing production in the two South Mountain areas (South Mountain Granodiorite, Estrella Gneiss), manufacture along the middle Gila River valley (coarse-grained mica schist), and a few cases with undifferentiated tempering material.

For our analysis, the percentages of plain ware with either Squaw Peak Schist, Camelback Granite, quartzite, or quartzite and schist in each feature was of interest because ceramics with these "eastern" temper types were not made in the lower Salt

River valley during the middle Sedentary period. As discussed above, nearly all of the ceramics in use in the valley during the middle Sedentary period were made either at Las Colinas, in the South Mountain area, or along the middle Gila River. In contrast, bowls and jars were produced in abundance throughout the valley during the Classic period, including the upper reaches of Canal System 2 and the Scottsdale Canal System, and were commonly exchanged among the valley inhabitants at that time (see Abbott 1995, 2000). We wanted to know when the "eastern-tempered" varieties from the central and eastern portions of Canal System 2 and the Scottsdale Canal System were first imported to Las Colinas, which presumably was the time when plain-ware production became localized across the region.

Not surprisingly, we found only tiny amounts of the eastern-tempered varieties in the middle Sedentary contexts coeval with the ballcourt. In contrast, the contexts that postdated the ballcourt typically contained considerably greater percentages of these ceramics (Figure 6). Based on the imports received by people living at the western end of Canal System 2, it appeared that just at the time that the ballcourt at Las Colinas was abandoned and the supply of red-on-buff pottery from producers far to the south rapidly declined, local production of plain-ware bowls and jars began throughout the lower Salt River valley.

#### *Pueblo Grande Plain Ware*

A similar result was obtained from the plain-ware pottery at Pueblo Grande. Recent excavations there by Soil Systems, Inc. (Abbott, ed. 2003), at the

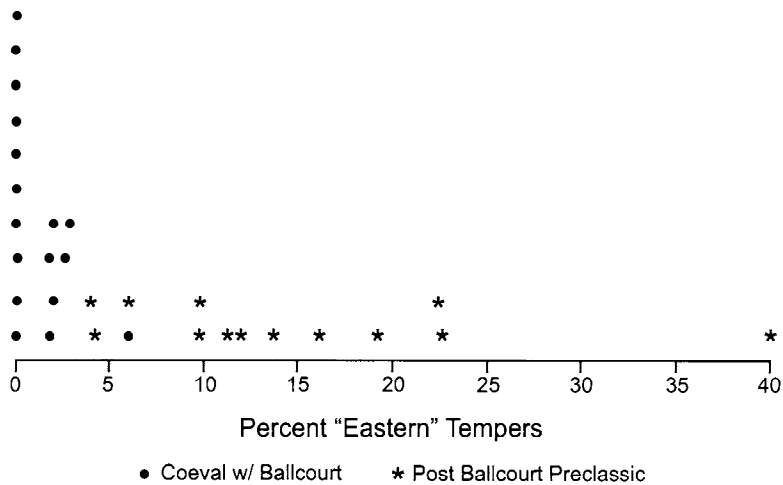


Figure 6. Percentages of Plain Ware Ceramics with "Eastern" Tempers in Features at Las Colinas.

eastern end of Canal System 2, uncovered 11 late Sedentary period structures, all containing late Sacaton phase ceramic assemblages (Abbott et al. 1994). The locally made plain ware contained granite-derived sands, which were abundant in the Classic period contexts at Pueblo Grande (Abbott 2000). As indicated in Table 3, they were also abundant at Pueblo Grande during the late Sedentary period, indicating that local production began in the Pueblo Grande vicinity just after the ballcourt system collapsed near the end of the middle Sedentary period. Also in the late Sedentary period structures were large quantities of Squaw Peak Schist-tempered plain ware from the central portion of Canal System 2, where plain-ware production was rare or absent prior to the late Sedentary period (see Table 3).

#### *Los Hornos Plain Ware*

Finally, we turned to two late Sedentary and eight middle Sedentary assemblages at Los Hornos, which we identified using Wallace's refined buff-ware typology. These features were excavated by Arizona State University (Wilcox et al. 1990) and SWCA, Inc., (Chenault et al., ed. 1993). The number of plain-ware sherds was few in each feature, and all pieces clearly from different vessels were included in our analysis.

Los Hornos was situated near the eastern end of South Mountain and in Canal System 1, on the south side of the Salt River. The reader will recall

that the villagers on the south side, including those residing at Los Hornos, received much of their plain-ware pottery from the middle Gila River valley during the middle Sedentary period when the ballcourt network was at its height. The middle Gila wares were tempered with copious amounts of the glittery coarse-grained mica schist. In the eight middle Sedentary period assemblages in our sample, the mica schist-tempered pottery accounted for half or more of the plain-ware specimens (Table 4). In the two later contexts, which presumably corresponded to the time after the ballcourt collapse, the middle Gila River imports dropped substantially. In order to adjust for the shortfall, local artisans ramped up their own production of plain-ware pots (i.e., South Mountain Granodiorite temper), just as their counterparts had done elsewhere throughout the valley.

#### *Summary*

Our results have indicated that the collapse of the Hohokam ballcourt network was synchronous with the dissolution of a regionally organized division of labor for the manufacture and distribution of clay containers in the Phoenix basin. Prior to the collapse, during the middle Sedentary period, artisans who made a narrow range of vessel forms and labored to supply the households of the lower Salt River valley were highly concentrated in only five production zones. Thousands of pots were probably traded and exchanged each year. They included



Table 3. Ceramic Data from Late Sedentary Contexts at Pueblo Grande.

Feature	Buff %	Plain Ware Percent				Total
		Local <sup>a</sup>	Central Canal System 2 <sup>b</sup>	Western Canal System 2 <sup>c</sup>	Other <sup>d</sup>	
591	5.7	30.3	37.8	19.7	12.2	360
614	9.0	35.7	28.6	22.6	13.1	168
687	7.6	23.4	37.2	30.9	8.5	94
710	1.3	34.7	21.8	21.2	23.3	170
780	7.7	19.1	29.4	23.5	28.0	68
786	9.0	47.1	17.6	17.6	17.7	51
2027	7.3	21.5	15.0	49.6	13.9	274
2032	4.7	33.2	24.9	33.7	9.2	193
2099	11.9	23.8	35.6	18.0	22.6	239
2233	7.0	45.2	19.3	20.7	14.8	135
2786	6.0	22.4	23.2	42.4	12.0	125

<sup>a</sup>Camelback Granite, arkosic sand with minor Squaw Peak Schist

<sup>b</sup>Squaw Peak Schist

<sup>c</sup>phyllite

<sup>d</sup>South Mountain Granodiorite, Estrella Gneiss, quartzite, quartzite and schist, coarse-grained mica schist, unidentified.

large quantities of red-painted bowls and small jars, distributed throughout the valley from production localities on the north side of the Gila River, and thousands more plain-ware jars delivered to Salt River communities on the south side of the river from producers to the south. But as the ballcourts at Las Colinas, Palo Verde Ruin, Snaketown, Gatlin, across the Tucson basin, and elsewhere fell into ruins, probably around A.D. 1070, buff-ware supplies to the Salt River households were abruptly reduced. At Los Hornos and probably elsewhere on the south side of the Salt River, the coarse-grained mica schist-tempered plain wares from the middle Gila region were also cut, as local potters filled the local demands by fabricating a full range of vessel forms to replace the formerly imported decorated and plain-ware containers. In Canal System 2, across the river from Los Hornos, red-on-buff supplies were also severely diminished as local ceramic production in all parts of that area was begun anew.

We suggest that the underpinnings of the economy, replete with marketplaces and concentrated production, were lost, including (1) a moral authority that promoted cooperation across the region, guaranteed the peace of the market, and facilitated barter and trade among strangers; (2) regional-scale integration that fostered the flow of information about supply and demand at distant places; and (3) a dense and well-organized network of interaction that minimized transportation costs. As indicated

by the analysis of Classic period ceramics (e.g., Abbott 2000; Abbott and Walsh-Anduze 1995), pockets of specialized production were reestablished during that time, but never to the impressive scale associated with the ballcourts of the middle Sedentary period.<sup>4</sup>

### Some Tentative Propositions

Now that we have added new evidence to support the Hohokam marketplace hypothesis, we return to the problem of reconciling the specifics of the Hohokam case with expectations for nascent market rings. Economic anthropologists and cultural geographers have long noted that market exchange occurs sporadically in all kinds of societies. Various forms and scales of market systems create different conditions for market participation for both suppliers and consumers (Bohannon and Bohannon 1968; Bohannon and Dalton 1962; Brumfiel 1980; Haggert et al. 1977:157; Plattner 1975, 1985, 1989; Smith 1976:51). In the Hohokam case, theorists have suggested that a system of market rings was in place, where market days were timed in accordance with a calendrical schedule of ballcourt events. As the name implies, market rings are characterized by relatively local, noncentralized, overlapping markets that are more or less equivalent for meeting local needs. Commodities flow horizontally, rather than vertically through a settlement hierarchy and without constraint by political bound-

Table 4. Ceramic Data from Contexts at Los Hornos.

Feature	Excavator	Plain Ware Percent				Total
		Middle Gila R. <sup>a</sup>	Local <sup>b</sup>	Western South Mountains <sup>c</sup>	Other <sup>d</sup>	
<i>Middle Sacaton 1/2</i>						
12	ASU	70.5	16.4	11.5	1.6	61
15	ASU	55.5	28.6	6.3	9.5	63
16	ASU	47.8	37.7	7.2	7.2	69
146	ASU	50.0	25.0	17.6	7.4	68
157	ASU	48.2	17.2	20.7	13.8	29
172	ASU	87.5	0.0	0.0	12.5	8
485	ASU	68.7	13.2	10.5	5.2	38
10	SWCA	50.0	0.0	25.0	25.0	4
<i>Late Sacaton</i>						
174	ASU	32.4	37.8	2.7	27.0	37
176	ASU	15.6	59.4	3.1	21.8	32

<sup>a</sup>coarse-grained mica schist

<sup>b</sup>South Mountain Granodiorite

<sup>c</sup>Estrella Gneiss

<sup>d</sup>phyllite, Squaw Peak Schist, unidentified.

aries. Both producers and consumers have access to multiple markets, and their regular visits are due as much to social reasons as to economic concerns.

Noncentralized overlapping marketing systems tend to be characterized by weakly specialized economies in which marketplace barter has little influence on the organization of production. Dependence on the markets is minimal. And without a developed market hierarchy, economic interaction tends to rapidly decline with distance. Goods are transported over short distances, and decisions about production are little effected by the conditions of supply and demand in other localities. In these ways, the Hohokam circumstances match poorly with the expectations for market rings. Specialized production accounted for nearly all of the pottery in use in the lower Salt River valley during the middle Sedentary period, there was a heavy dependence on the market for acquiring basic necessities like clay containers, and a considerable degree of articulation was evident among distantly separated artisans who responded to one another's production and distribution decisions. These traits are typically associated with more hierarchically organized market arrangements (e.g., Alden 1982; Bromley et al. 1975; Brumfiel 1980; Hirth 1998; Smith 1974, 1976).

Do Hohokam marketplaces make sense? We have argued that there is mounting evidence to indicate that they did exist and played a larger part in the Hohokam economy than previously recognized.

But to defend that proposition, we have had to diverge from current thinking about the modest extent to which market rings can integrate a regional economy. We make no claim that we thoroughly and completely understand how that should be so, but we can offer some observations and suggestions.

We posit that several important circumstances were combined during the middle Sedentary period in the Hohokam territory to foster a noncentralized overlapping marketing system on which the dependence for a variety of goods, including some basic necessities, was considerable. These circumstances included (1) widely accepted religious beliefs that promoted cooperation across an expansive territory, (2) large-scale irrigation infrastructure capable of surplus production, (3) benign environmental conditions that fostered regional interaction, and (4) ecological diversity that encouraged specialized production.

We start with a simple fact: one or more ballcourts stood near the center of just about every moderate to large-sized Hohokam settlement during the middle Sedentary period. The ballcourt ceremonies probably drew people together from near and far and must have been commonly celebrated throughout the Hohokam territory. In a palpable sense, cooperation was writ large across the desert landscape with the construction and use of ballcourts at nearly every place of consequence in the Hohokam world.

If true, the Hohokam regional system, by virtue of the density and frequency of the ballcourt-related events, may have been characterized by considerable connectivity that promoted a broad-scale economic integration based on moral authority rather than on a hierarchically organized political economy of power relations. We postulate that the hindrances to regional exchange and other forms of intercommunity interaction were met by extending the moral economy of kinship with a shared consciousness of religious identity (Rappaport 1971, 1984; Yoffee 1994). As suggested by Yoffee (1994:353), similar patterns may have been common in the Southwest where centralization remained weak even though social and religious institutions integrated relatively large geographic regions (see also Renfrew 2001:21). Among the Hohokam, commodities and the information about demand and prices may have efficiently flowed horizontally, thereby minimizing the risk of selling at distant markets and rewarding the efficiencies of concentrated production.

The coupling of favorable environmental conditions and large-scale irrigation may have also been a crucial part of the middle Sedenatry period case. Graybill's (1989) tree-ring-based reconstruction of the streamflow history in the Salt River demonstrated that the waterway was a dependable benefactor of the Hohokam economy, providing a steady and predictable source of irrigation water. In turn, the irrigation agriculture sustained large and geographically stable populations, allowing them to enter into long-term relationships with one another and with surrounding populations. The Sedentary period, in particular, was a salubrious interval for the Hohokam, during which both the irrigation infrastructure and the ballcourt network were expanded. And it seems to have been part of a wider pattern. As noted by LeBlanc (1999:195–196), the A.D. 900–1150 interval was an exceptional time of peace and cultural florescence across the Southwest that coincided with warming climatic conditions. At that time, a wide range of habitats was farmed—leading to a period of raised carrying capacity, little stress on resources, and little incentive for warfare. It is certainly not happenstance that the expansion of the ballcourt network and probably its associated marketplace exchange coincided with a time of favorable environmental conditions and dampened hostilities.

Another crucial factor to consider is the ecological diversity in the Hohokam region and its potential relationship to specialized production. Numerous ethnographic cases have shown that economic specialization can thrive in politically simple societies (Cobb 1993). In the absence of a political hierarchy, but in the presence of a reliable mechanism for exchange, increases in productivity via specialized production for regional scale distribution can be stimulated in at least two ways. Both of them are dependent on pronounced inequalities in the availability of natural and agricultural resources associated with ecological heterogeneity.

The first is surplus production for the purpose of buffering against agricultural shortages (food and cotton). It is interesting to note that the known suppliers of decorated ceramics, the craftspersons at and near Snaketown, were situated at the downstream end of the middle Gila River valley, in one of the last canal systems in line to take water from the river channel. Similarly, Las Colinas was located at the tail end of Canal System 2. When the first Las Colinas inhabitants established themselves there, they immediately began supplying the rest of their irrigation cooperative and the people in the Scottsdale Canal System with cooking pots, storage jars, and plain bowls. Perhaps, as is common cross-culturally among intensive cultivators who have excess labor and insufficient arable land and/or water (e.g., Arnold 1985; Netting 1990:43; Rice 1987:195; Stark 1991:72), agricultural disadvantages due to relative location in the Phoenix basin stimulated pottery production for exchange at those locations.

Second, one need only look at the maps of Hohokam canal systems, and especially the irrigation infrastructure on the broad valley floor surrounding the lower Salt River (see Figure 1), to appreciate the prehistoric potential for agricultural surpluses. As noted above, that potential probably varied with locality, but, at the regional scale, agricultural capacity was considerably greater in the irrigated river valleys than elsewhere. One idea is that raw cotton fiber, thread, or cloth, functioned as a medium of exchange to facilitate the barter among suppliers of different commodities (e.g., Schele and Freidel 1990:92–93; Wilcox 1987). Without some type of general currency, only traders who were interested in each others' wares would

successfully execute a transaction. If cotton production was literally a cash crop and agricultural products were key components of the interaction network, then perhaps we should conceptualize the hydraulic infrastructure of the lower Salt River valley as a centrally located economic engine that powered the regional system. In the presence of an efficient mechanism for trade, the regular availability of agricultural surpluses may have whetted the appetite of regional demand, whereby the widely desirable agricultural products of the irrigated valleys were exchanged for the relatively abundant natural resources present in the desert lowlands and the upland zones surrounding the Phoenix basin. Geographical variability and the related resource inequities, when matched with the high connectivity engendered by the widespread acceptance of religious beliefs, the regular participation in the ballcourt ceremonialism, and favorable environmental conditions may help to explain the association between a network of periodic marketplaces and a specialized economy integrated at a regional scale.

### Conclusion

Evidence has been growing in recent years that the manufacture of plain-ware and red-on-buff pots during the middle Sedentary period was highly concentrated and that large numbers of those containers were widely distributed to consumers across the Phoenix basin. Interestingly, those arrangements were in effect at a time when the Hohokam ballcourt network had reached its greatest extent, in terms of the number of settlements with ballcourts and the territory over which those ballcourt villages were distributed. Archaeologists have long speculated that because the ballgames probably drew crowds from near and far, the events were also ideal venues for the exchange of goods. The ceramic data certainly support that idea, and, in fact, the heavy volume of pottery transactions implies that periodic marketplaces served a more substantial role in the Hohokam economy than previously thought. In support of that hypothesis, we have presented new ceramic data from Las Colinas and elsewhere, which demonstrated a temporal connection among the Las Colinas ballcourt, possibly the demise of the ballcourt network in general, and a radical reorganization of the production and dis-

tribution of clay containers in the Phoenix basin.

The new and previous evidence, however, have confronted us with a conundrum. The Hohokam ballgames are thought to have been associated with horizontally organized market rings, which, as observed elsewhere, supply consumers with basic necessities only unreliably and without regularity. However, Hohokam marketplaces may have been heavily relied upon by specialized producers and consumers alike for the distribution of goods, including some basic necessities. We have suggested that several unusual circumstances may collectively clarify how the Hohokam economy exceeded the dependence on marketplace barter typically associated with nascent marketing systems. Those circumstances included (1) widely accepted religious beliefs that promoted cooperation, consensus, social stability, and the peace of the marketplace; (2) a large-scale irrigation infrastructure capable of surplus agricultural production; (3) a benign environmental regime that reinforced the cooperative spirit of the ballcourt ceremonialism and fostered the geographically expansive and horizontally integrated social, religious, and economic network across which commodities and information freely flowed; and (4) a diverse ecological landscape in which the availability of various and important resources were disproportionately distributed and, when coupled with social and environmental stability, led to "reliable dependencies" among populations. Clearly, our tentative model has not explained the development of a region-size economy that included market rings. Less ambitiously, we have simply attempted to enumerate some, but not all, of the necessary conditions for the unusual coexistence of a periodic and horizontally structured marketplace network with a high dependence on market transactions for the supply of commodities, including some basic necessities like pottery.

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## Notes

1. Most scholars who study the Hohokam would agree that the Sedentary period specialists were part-time artisans, and, following Feinman (1999; Feinman and Nicholas 2000), would concur that the craft activities were generally located in household contexts.

2. Obviously, this estimate will depend, in part, on how many people lived in the lower Salt River valley at any one time during the Sedentary period, which is a topic of much debate. Nevertheless, a rough idea of the production and distribution scales can be achieved with a few assumptions. If we accept the conservative estimate that only 4,000 people were present in the lower Salt River valley during the Sedentary period (Doelle 1995), and if we assume that each resident required one new pot per year, then 4,000 new pots were produced annually for the Salt River households. If half of them were made at middle Gila locations, then 2,000 vessels were transported from the Gila to the Salt River communities each year. In contrast, if we accept Craig's (2001) more liberal population estimates, then, perhaps, 8,000 pots or more were imported each year to the lower Salt River valley from the middle Gila producers. Assuming higher consumption rates would, of course, yield still higher estimates. For instance, Judge (1989:231) estimates a rate of pottery consumption in domestic contexts in Chaco Canyon that was three times higher.

3. The plain-ware ceramics from Feature 7089 could not be located for analysis.

4. It is also interesting that during the Sedentary period most of the domestic labor for crafts was devoted in particular households to a predominant product rather than to multi-crafting (Mills 2000:314). These production decisions may have relied on the regional-scale integration and reduced transportation costs of the markets. In contrast, during the Classic period, when the economy was characterized by more localized exchange networks, the craft activities of individual households were often more diverse (Crown and Fish 1996; Mills 2000).

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## Integrating Recreational Boating Considerations Into Stream Channel Modification & Design Projects

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## 1 | Introduction

Stream channels are modified to meet a wide range of social and ecological goals. Many small-scale projects that involve adding wood and rock to rivers and their banks are aimed at improving fish habitat or protecting riparian property. Other projects are much larger in scale, such as those aimed at restoring a functional river channel in sites previously impacted by dams, mining, development, or other industrial-scale impacts.

Many of the rivers where these projects are carried out attract significant recreational use. Anglers ply virtually all waters in the United States, and each year kayakers and canoeists descend virtually every stream, including those that even rarely have enough water to float a kayak. Adults and kids alike often take a swim in rivers, or simply walk along them and take in the vistas of flowing water. This diverse recreational use is a vital component of the quality of life and economies of many communities.

While most stream modification projects have well-defined primary ecological or engineering goals, this paper offers advice for integrating (often secondary) recreational goals into project design and implementation. Integrating recreational goals and safety into projects can foster public support for projects, encourage recreational use and stewardship, and reduce the likelihood of avoidable accidents.

This paper aims to offer stream modification practitioners simple advice on how to create projects that meet their primary objectives while ensuring the projects are relatively low-risk and enjoyable for people descending the stream in canoes, kayaks, and rafts. Since swimming is an unavoidable component of paddling rivers, the recommendations in this paper will also provide safety benefits not only for paddlers, but also for hikers, anglers, and other recreationists that intentionally or accidentally swim in a project area. This paper offers no guarantees of public safety, but rather common sense practices for lowering recreational risks based on recreational experience.

This paper is intended for use by anyone planning to add or remove material (typically rock and wood) from a stream, or otherwise change a stream's shape or function. Applicable projects include stream restoration or enhancement projects, road and infrastructure projects that encroach on stream channels, and flood clean-up and prevention efforts.



**Figure 1.1** | *Virtually all streams are enjoyed by paddlers, anglers, and other recreationists, even small intermittent streams.*

## 2 | Consultation and Review

While this guide is intended to give channel designers a working knowledge of recreational considerations, this knowledge is no substitute for consulting with the recreation community. Recreationists, many of whom are knowledgeable and often deeply concerned with a specific river or regional rivers, can offer valuable insight into channel design projects. The importance and value of outreach to the recreation community can't be overstated. Recreationists can confirm the types and amounts of existing and potential use, can highlight existing features of importance, and can offer input on the safety and desirability of designs throughout the design and construction process. Recreationists – who typically appreciate complex and healthy rivers – can also provide media, political, and volunteer support for well-designed projects.

To find appropriate recreationists for consultation, it is recommended that at a minimum regional paddling and angling clubs and businesses are contacted. American Whitewater can provide assistance with making these contacts as needed, and Trout Unlimited is also an excellent resource for coldwater streams.

## 3 | Channel Design and Recreational Risk

Paddling rivers, like all activities, carries some level of inherent risk. These risks are determined by the features in the streambed, the volume of flow, the recreational activity, and the skill and equipment of the recreationists. People choose to expose themselves to calculated risks based on their knowledge of those risks and the anticipated rewards of the endeavor. Risks are calculated based on a foundation of experience with other rapids and rivers.

This foundational knowledge is based primarily on past experience navigating logs, rocks, meanders, and other river features that were arranged by the natural forces of the river into generally predictable patterns. Based on the public expectation that rivers and specific river features will follow natural patterns, channel design that mimics natural patterns can enhance public safety.

With this said, natural rivers possess features that range from physically impossible to survive to features that are so compelling people will travel thousands of miles to experience them. This paper describes the full spectrum of natural features, from death-trap to recreational-treasure, and offers advice on how to avoid the former and create the latter, while still meeting the project's primary objectives. Successful channel designs will incorporate features that range from benign to extremely appealing to recreationists, while creating no unnecessary objective hazards.

## 4 | Recreational Hazards and Associated Features

Paddlers move down rivers in small groups, stopping occasionally in eddies and pools to rest, regroup, and peer downstream. Often, by “eddy-hopping” down the river, paddlers can see enough of the rapids downstream to pick their route. Paddlers call this “boat scouting.” When faced with a horizon line or blind corner, paddlers typically catch an eddy, and walk down the shore to scout the rapid prior to running it. Sometimes they won't like what they see and they will either choose an easy route if one exists, or portage around the rapid on shore.

All the while, paddlers are visually scanning the river for three things, which are, in order of decreasing priority: hazards to be avoided, a safe and personally navigable route, and fun to be had. It is important for channel designers to understand and recognize the features and factors that result in hazards, reasonable passage, and fun. The following table describes river features that are objective hazards (e.g. especially and clearly hazardous features) that paddlers actively avoid. Anglers, swimmers, novice floaters and some other river recreationists may be less expert at recognizing these river hazards, however these features are similarly hazardous to all recreationists that find themselves moving downstream in the flow, with or without a boat beneath them.

It should be noted that these risks increase in severity with gradient (channel slope) and water velocity. Objective hazards in low gradient streams however still pose a risk – it is astounding how much force even slow currents can exert on a paddler or swimmer entrapped by sharp or undercut rocks, wood, or debris.

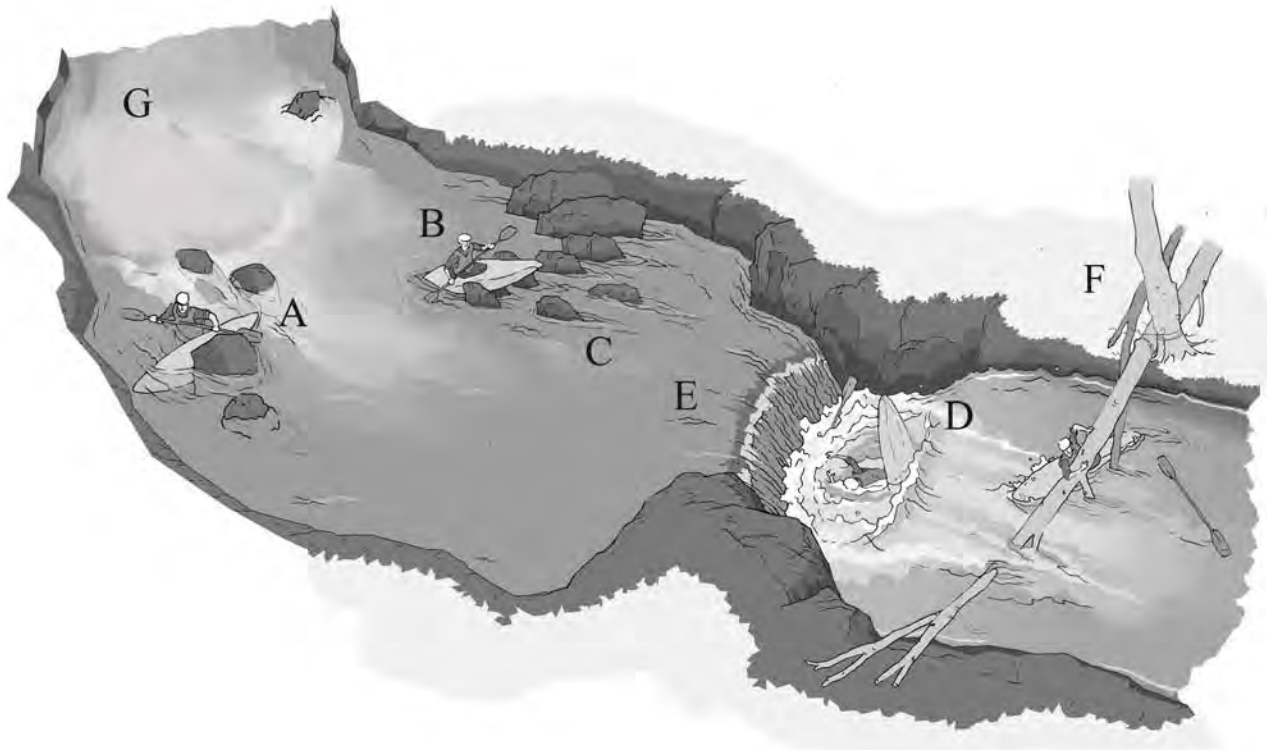
While the objective hazards described above and the desirable features to follow this section are relatively easy to define regardless of where they occur, the factors that make a rapid personally navigable for paddlers are a bit more complicated and subjective. The best way to consider this issue is by using the International Scale of River Difficulty (see Appendix 1), which describes in some detail the level of challenge and complexity associated with individual rapids. Channel designers should seek to create the same classification of rapids that existed in the river reach prior to disturbance. Ideally, remnant features will give significant clues to the structure of the historic river bed. If no historical information is available, reference reaches with similar channel slope, substrate size, and flow should be used. Lastly, there may be recreational (e.g. social) goals that arise in the scoping and permitting process for a channel design project that may also be considered.



Figure 4.1 | Objective Hazards and their Associated Recreational Concerns

HAZARDOUS FEATURE	RECREATIONAL CONCERN
A. Rocks or wood with water flowing under them	<b>Entrapment:</b> Individual undercut rocks, porous rock combinations, single logs, or log accumulations are highly likely to entrap, above or below water, a paddler or swimmer encountering them.
B. Rocks or wood vertically oriented and in swift current	<b>Entrapment and/or Impact:</b> If a person or boat washes up against a vertically oriented rock or log in swift current their boat or body may be pinned, at times under water.
C. Sharp rocks in swift current	<b>Impact and Entrapment:</b> Sharp rocks can break boats, injure swimmers, and are more likely to pin a boat or person underwater.
D. Large symmetrical hydraulics (holes) difficult or impossible to move through or escape	<b>Flush Drowning, Injury, or Gear Loss:</b> Large holes can hold boats and/or swimmers. Swimmers may drown in the hole or may be exhausted and encounter problems as they flush downstream. Shoulder injuries are common. Gear loss is common upon swimming.
E. Drops or swift current with obstructions immediately downstream	<b>Impact and Entrapment:</b> Paddlers may careen (e.g. "piton") into rocks or logs immediately below drops with their boats, which can result in injury. Vertical pins or other forms of entrapment are possible. Swimmers may be pinned or injured.
F. Cable, rope, chain, rebar, metal debris, or any man-made structure	<b>Entrapment:</b> Rope and cable are extremely capable of trapping a swimmer under water. Wooden and metal structures can entrap paddlers like A-C above, a function exacerbated by a snagging hazard associated with nails, bolts, etc.
G. Long sections of rapids with no visible eddies	<b>Flush Drowning or Objective Hazards Beyond Sight Distance:</b> A lack of eddies or pools deny swimmers shore access, which can lead to flush drowning. It can also deny paddlers the ability to eddy out above an objective hazard (e.g. A-F above).

Figure 4.2 depicts each of these dangerous river features. | Objective hazards described in Figure 4.1 are illustrated below in Figure 4.2: undercut rocks (A), vertical rocks (B), sharp rocks (C), symmetrical keeper hydraulics (D), obstructed drops (E), cabled and/or spanning logs not in contact with the substrate (F,A), and long rapids lacking eddies (inferred at G).



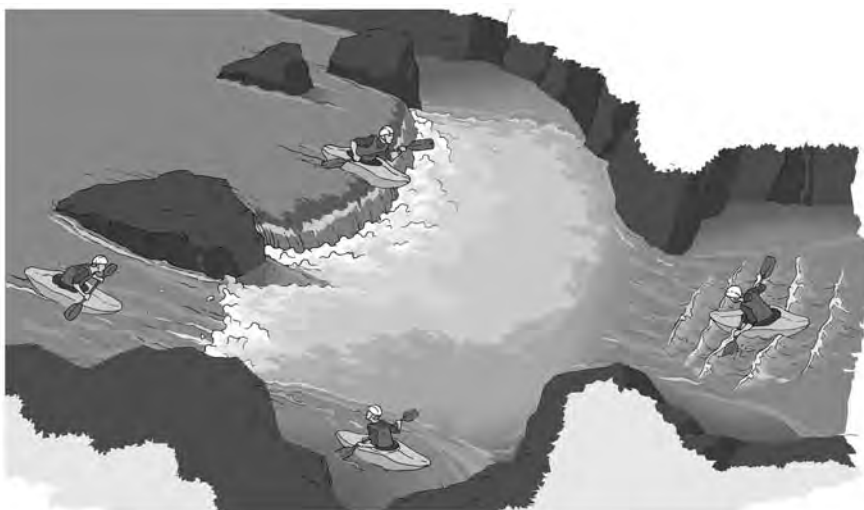
## 5 | Recreational Boating Goals and Associated Features

Of course, navigating a river reach is about more than safely passing from point A to point B. Along the way, paddlers often encounter rapids and features that dish out aesthetic, thrilling, and fun descents. Paddlers seek rapids that have “clean lines” (a “line” is a route) through rapids that lack shallow rocks and objective hazards. They seek features that provide opportunities to perform specific techniques that are fun and challenging, like catching eddies, boofing drops (i.e. ramping with speed to land flat), punching holes, surfing, etc. Rapids that feature textbook opportunities for these maneuvers have high value to the paddling public.

Figure 5.1. | *Desirable Features and Their Recreational Attributes*

DESIRABLE FEATURE	RECREATIONAL ATTRIBUTE
A. Deep pools between rapids	Resting and rescue for paddlers. Low risk fishing and swimming.
B. Vertical drops of any height with a relatively sharp 90 degree lip.	Paddlers can “boof” such drops resulting in a flat landing. Flat landings help paddlers avoid the hydraulic and any underwater hazards at the base of the drop, and are fun.
C. Drops with lateral eddies immediately adjacent and downstream of the lip, and with rounded rocks forming the edge of the lip.	Paddlers can also “boof” into eddies, using either lateral rocks at the lip or pillows of water next to such rocks as a ramp to provide lift, resulting in short freefall and a flat landing in the eddy.
D. Waves	Waves are formed by compression of flow, gradient, and bed roughness and/or entry into a deep pool. They are fun to paddle over, and waves of specific shapes and sizes can be surfed by kayakers, just like stationary ocean waves.
E. Holes (also called hydraulics)	Holes are formed by water flowing fast over a downward sloping rock, creating surface backwash. The backwash of most holes can be safely “punched” through by paddlers, providing excitement and challenge. Some holes form highly desirable freestyle surfing opportunities. Such holes generally have lateral eddies, gently sloping lead-ins (<30 degrees), and deep water immediately beneath and downstream of them.
F. Eddies	Eddies are calm or upstream flowing areas downstream of objects. They provide rest, safety, and added complexity for paddlers. They also provide good fish habitat and thus good angling. Ensuring that rapids have eddies throughout them and below makes rapids recreationally better.
G. Slides	Sloping water slides less than 30 degrees of any height are fun for paddlers, offering fast flow and typically a hydraulic to punch through. Asymmetries and lateral eddies improve safety and enjoyment.
H. Slots	Several large rocks at the lip of a drop of any height form “slots” where water pours between them and over the drop. Multiple and diverse routes occur which paddlers enjoy.

Figure 5.2 depicts a river channel with each of the eight desirable features described above. | *Desirable paddling features described in Figure 5.1 are illustrated in Figure 5.2: The top paddler is boofing a vertical drop over a hole with low retentive power, into a deep pool. The top paddler could have gone farther to his left into a lateral eddy. The left paddler is running a slide through a slot, and will need to punch through the mildly retentive hole just downstream. The lower paddler is resting and setting safety in an eddy. The right paddler is surfing a wave with lateral eddies next to it.*



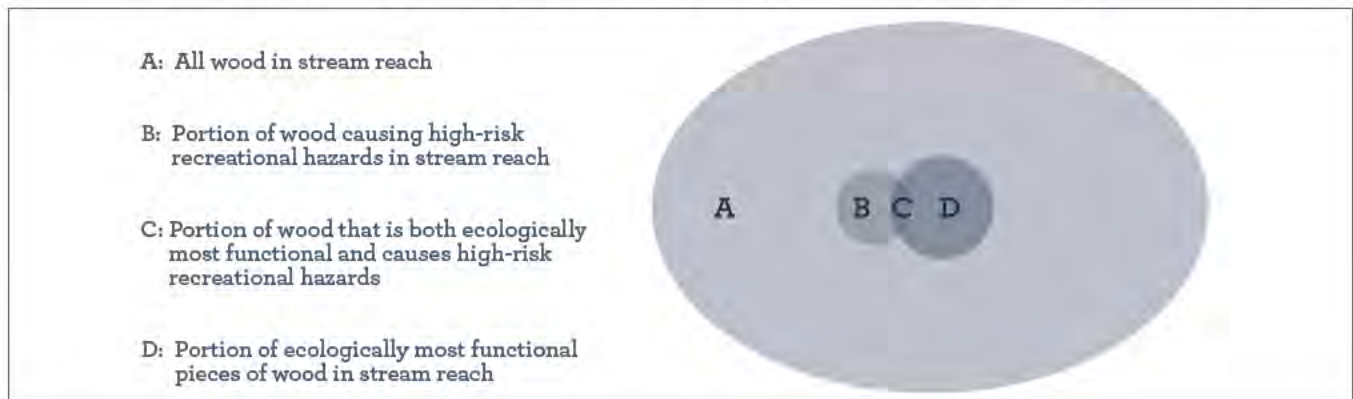
## 6 | Wood Structure Guideline

Wood poses a significant hazard for people paddling or swimming in the flow of a river. People and boats can become pinned against logs in even slow current, can become entrapped between a log and the substrate, can become snagged on branches, or become entrapped in log jams. Not only can this happen – it often does. According to American Whitewater’s paddling accident database<sup>1</sup> and associated reports, wood is among the leading factors contributing to paddling deaths.

The chance of a person being injured or killed by an artificial log structure can be reduced through understanding the specific risks of logs and how to minimize and mitigate them. Not all wood orientations are equally dangerous – in fact orientations range from totally benign to impossible to survive. On medium-sized and larger whitewater rivers in particular, the majority of natural wood orientations and locations are recreationally passable, and relatively low risk. Just as the recreational risk of a wood piece or accumulation exists on a spectrum, so too does the ecological and geomorphological value. This relationship is described in Figure 6.1. Successful channel design projects will select wood orientations and locations that meet primary ecological and geomorphological goals while avoiding the creation of objective hazards.

The following design considerations describe the relative recreational risk associated with specific aspects of wood orientation and location.

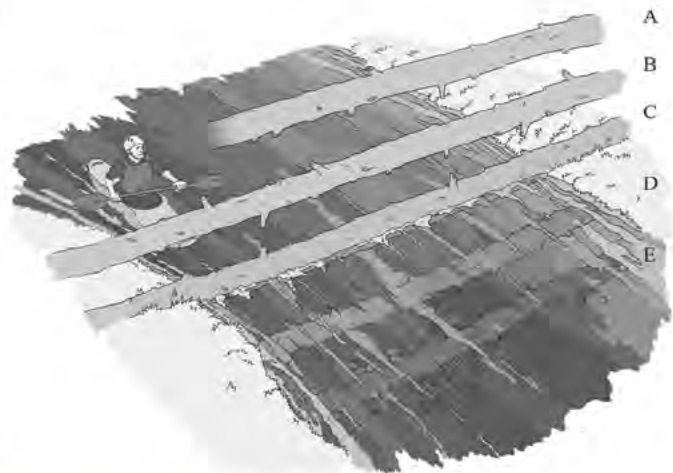
**Figure 6.1** | Diagram showing that a subset of natural wood in a stream has disproportionately high ecological value, that another subset creates objective recreational hazards, and that there is a small amount of overlap. Scale of relationship is estimated.



- **Log Height:** Logs of varying heights relative to both the streambed and the water surface pose specific recreational risks and impacts. If a log is high enough above the water (3 feet for kayaks, 6 feet for rafts) it can be safely ducked under (A), and if it is in consistent contact with the streambed (E) it can be safely paddled or swam over. Logs just above the water (B) or at water level (C) require portage. Logs at or below the water’s surface but above the substrate (D) can be paddled over but can entrap swimmers. Log structures in contact with the streambed (especially in channel areas with swift current) have relatively small risks of causing entrapment or other recreational hazards compared with logs suspended in the water column

- **Percent Channel Spanned:** Logs not in contact with the streambed that span the entire stream channel are more dangerous than similar partially spanning logs. Partially spanning logs of various heights can often be safely paddled or swam around, especially if they are obvious from upstream and have a clear route past them.

- **Branching:** Branches pose a serious risk of snagging paddlers and swimmers, and trapping them in or under the water. Branches also severely complicate paddling routes over or even around logs. Removing branches from logs placed in streams will minimize these risks and benefit recreationists. Simply removing branches from a sufficient length of a log allows paddlers to avoid portage by opening up safe passage. This practice should allow at least a six foot gap for canoes and kayaks (more in fast or complex current). Be sure to cut branches flush with the tree bole to avoid creating a severe snagging and entrapment hazard for swimmers.



**Figure 6.2.** | The height of logs effects whether paddlers or swimmers can duck under (A) or float over (D, E) them – or whether they pose a severe entrapment hazard (B, C, D).

<sup>1</sup> <http://www.americanwhitewater.org/content/Accident/view>



- **Number of Logs:** The risks associated with each structure will generally increase with the number of logs. A single log is typically less likely to entrap a paddler than a structure containing two or more logs. Spanning accumulations of multiple logs almost always require portage and can pose significant risks to paddlers and swimmers by creating siphons, sieves, and other entrapment hazards (see Figure 6.3). The only recreational benefit of structures with more logs is that they are more likely to be highly visible and obvious to paddlers, and may slow the approaching current. Just like single logs, relatively low-risk log accumulations are: not fully spanning, not in strong current, highly visible from upstream eddies, easily portaged if necessary.



Figure 6.3 | Log accumulations like this natural one in Idaho typically require portage and can be high risk.

- **Visibility:** Avoid placing higher-risk log structures on or just downstream of corners or immediately downstream of significant drops to enhance paddlers’ ability to see them and react accordingly. Highly visible structures are easier to avoid or safely navigate.

- **Portage Opportunities:** Placing logs in locations that allow for shore-based portage reduces risks. Portage requires an eddy upstream of, and within clear sight of, the log. One or more eddies immediately upstream of the log is especially valuable for safety and portage. Portage also requires a stream-bank that is not too steep to traverse and ideally an eddy just downstream from which to launch.

- **Location in the Reach:** Placing logs in rapids and other areas of swift current (versus lower gradient or slower reaches/locations) is more likely to create a high risk feature.

- **Anchoring:** The use of cable, rope, rebar, or other artificial anchoring materials is likely to create extreme entrapment hazards if and when the feature/log is moved by the river. If feature stability is a design objective, embedding logs or weighting them with natural materials will more safely promote stability.

Figure 6.4 | Wood Consideration Summary

CONSIDERATION	LOWER RISK	HIGHER RISK
Height	High or Low	In Water Column
% Spanning	Smaller %	Larger %
Branches	Fewer	More
Visibility	Easier to See	Harder to See
# of Logs	Fewer	More
Portage	Easier	More Difficult
Location	Lower Gradient	Steeper
Anchoring	More Natural	More Artificial

Wood is a valuable stream restoration tool, especially in impaired, relatively low-gradient stream reaches with unnaturally low wood volumes. As wood shifts and moves through and within a stream ecosystem, it can form high risk features. However, channel designers have a large suite of options for utilizing wood in orientations and locations that are *relatively* low risk for paddlers and other recreationists. Plunge pools can be created by spanning branchless logs in full contact with the streambed, eddies can be formed by partially spanning logs in contact with the streambed or highly visible log accumulations, and complex overhead cover can be formed by highly visible log jams that are partially spanning (preferred) or even full spanning with a portage option (if needed). In short, incorporating low-risk elements described in this section can partially or fully mitigate unavoidable high-risk aspects of features.





Figure 6.5 | Example of high-risk wood, Colorado.



Figure 6.6 | Example of low-risk wood, Idaho.

**High-Risk Wood Example:** The photograph in Figure 6.5 was taken of two trees placed in a river specifically to pose a risk to paddlers. The perpetrators did an excellent job. The logs exemplify hazardous log structures because they 1) are right at the water's surface and close enough to the substrate to entrap paddlers, 2) are fully spanning the channel, 3) have sharp branches above and presumably below the water, 4) are less visible because they are on a bend in the river, 5) have no eddies upstream to facilitate portage, 6) act together to exacerbate risk, and 7) are in swift rapids, exacerbating the risks due to high water velocities. Additionally, they have destroyed the recreational value of the rapid.

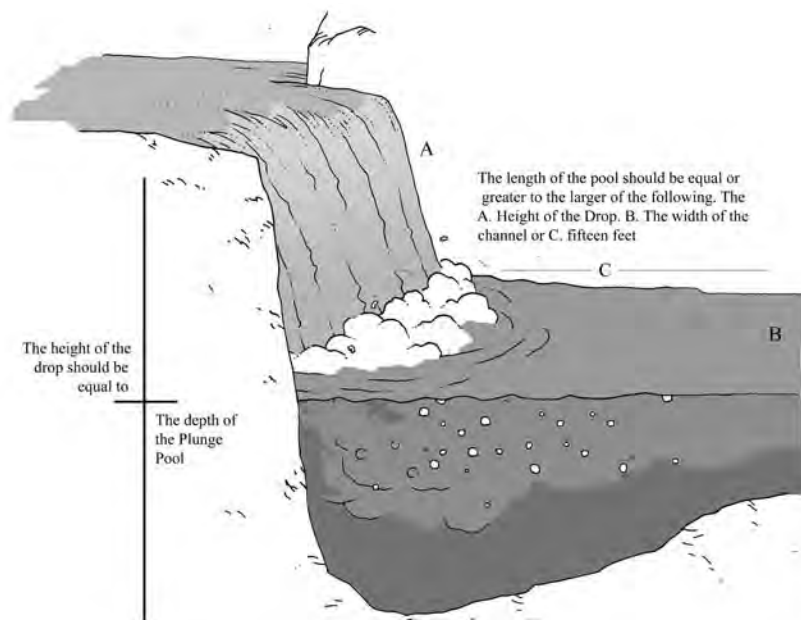
**Low Risk Wood Example:** Figure 6.6 represents a piece of wood that functions both ecologically and recreationally. Note that the log is 1) in constant contact with the substrate, 2) free of branches, 3) not quite fully spanning, 4) in a relatively low gradient reach, 5) obvious from upstream, and 6) a single log rather than an accumulation of several logs.

## 7 | Rock Structure Guidelines

The vast majority of natural rapids are formed by bedrock and boulders, and most provide relatively safe and enjoyable recreational passage. The reason for this is that water, in carving and creating a path for itself, also typically creates a viable path for paddlers and swimmers. Similarly, the physics of water often creates deep recovery pools between rapids. Following the patterns and rules of natural rapids can reduce sheer stress, increase stability of the feature, and significantly improve public safety. Below are some basic considerations for constructing features out of rocks.

- **Recovery Pools Between Rapids:** Providing relatively deep pools between rock features allow recreationists to swim to shore if needed. The pool below any drop structure (vertical or sliding) should be free of obstructions, as well as at least as deep as the drop is high, and at least 15 feet long or as long as the height of the drop, whichever is greater (see Figure 7.1). This ensures a paddler can paddle safely over the drop without hitting the bottom, and fish can likely pass in both directions.

Figure 7.1 | Recovery pools between drops can provide safe passage and resting for paddlers and fish alike.



- **Eddies in Rapids:** Staging eddies immediately upstream of a rapid are helpful for boat scouting, shore scouting or portaging. Eddies in and immediately below a rapid are helpful for creating a good route, for resting, for setting safety for others, or for accessing the shore in the case of a swim or mishap. Eddies can be create throughout rapids using large boulders or bank protrusions. Eddies immediately adjacent to the base of drops will help avoid the creation of an inescapable hydraulic.
- **Navigable Routes Through Rapids:** Boulders and drop structures placed in such a way that affords a route downstream for paddlers will lower risk. This route can be convoluted, but should exist.
- **Low Risk Drop Lip Shapes (Overhead View):** The shape of a drop, as seen from overhead, is a determining factor of its safety for all recreationists (See Figure 7.2). Dangerous hydraulics can be created by symmetrical drops, such as those with straight lips (top edge that water flows over) either horizontal, diagonal to the flow, or arched with the upstream part of the arch in the center of the drop. Making drop lips irregular but not jagged, and making any arched shapes extend downstream in the center lowers risk.
- **Low Risk Drop Angles (Side View):** Relatively low risk drop structures either have a vertical drop (B) or gently sloping slide (D). Severely overhanging drops (A) and steep sliding drops (C) are relatively high risk because they can have a dangerous recirculation (Letters refer to Figure 7.3). Introducing overhead or cross sectional asymmetry into any design will generally reduce the severity of the hydraulic formed by a feature. Sharp 90 degree lips of drops are typically safer than curved/rounded lips because they create a weaker hydraulic and provide for “boofing” opportunities.
- **Round and/or Smooth Rock:** Sharp rocks can damage boats, injure and entrap swimmers, and erratically accelerate flows. Using round rock will enhance recreational safety.
- **No Underwater Gaps and Overhangs:** Underwater gaps between rocks create a sieve or siphon that can entrap recreationists and equipment underwater. Ensuring that all rocks are buried so that they are either flat or sloping from the substrate towards their center/top (half sphere or gumdrop shape) will reduce the chance of creating a sieve. Placing rocks either touching and filled (so no water goes between them) or at least one meter apart will promote safe passage. Placing undercut (overhanging) rocks in any river or stream will create objective hazards.

Figure 7.2 | Drop lip shape is a defining feature of drop safety (overhead view)

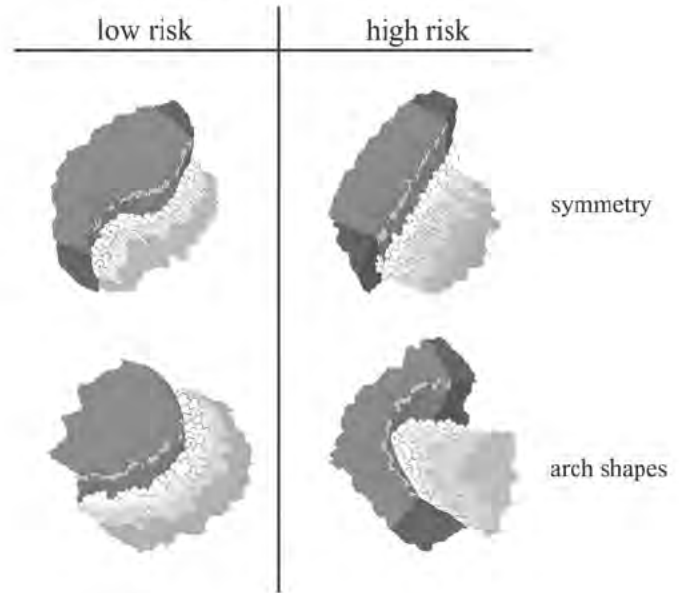
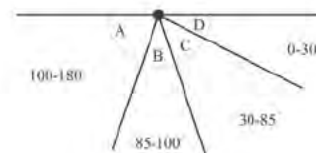
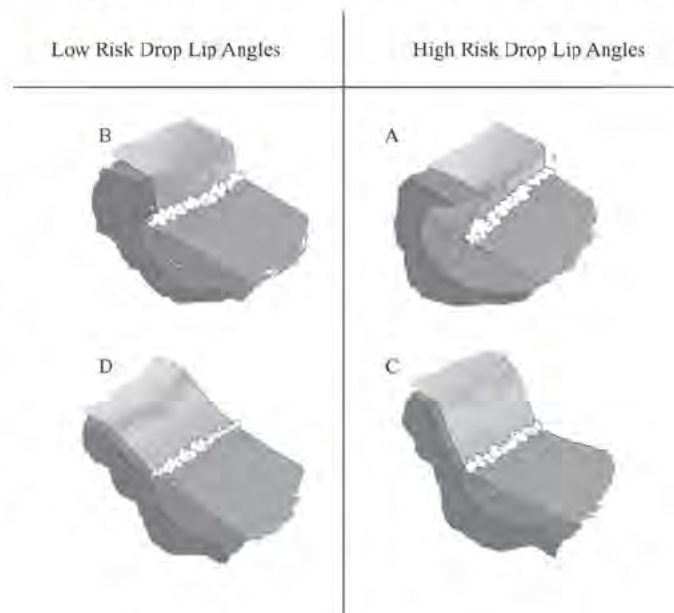


Figure 7.3 | Drop angle is another defining feature of drop safety (side view)



## 8 | General Recreational Considerations

There are a number of general considerations that affect recreational use of rivers, whether moving a single rock or creating an entirely new river channel. Channel designers are encouraged to integrate each of these considerations into all projects.

### A. Protecting and Utilizing Natural Structures

All instream channel work should protect natural structure (bedrock, boulders, and native riparian vegetation) in the existing or new streambed area. Many examples exist of projects that needlessly destroyed or modified treasured natural rapids and other river features, rendering them more dangerous and less valuable (See Figure 8.1). Never move or remove natural boulders or bedrock in a natural river without significant consultation with the recreation community.

### B. Anchoring and Stability

Rivers are inherently dynamic systems and every structure placed in a stream will one day be disassembled and moved by the stream. This process should be a fundamental component of the design. Structures should be viewed as temporary, and be designed to accelerate or guide natural processes which will eventually take over. Generally, using natural materials that are consistent with those already in the watershed will ensure that the rock, wood, and/or other elements of the structure are transported and re-deposited in a natural pattern with natural ecological, geomorphological, and recreational effects.

To lower risks, channel designers should avoid the use of steel cables or rope if at all possible. Cable and rope is among the most dangerous foreign material in any river or stream. Cable and rope pose a severe and often undetectable risk of entrapment when they are in or across moving water. Rebar is also a common stabilization material that can snag and entrap, or severely injure recreationists. Use of rebar is not recommended for this reason, and wooden dowels or stakes may better serve the same purpose. Mortar, grout, or other concrete materials can effectively be used to decrease the flow moving through otherwise porous structures and increase their stability. This material is likely to break down into a natural-like substance and is in many cases a viable stabilization material for rock structures.

### C. Aesthetics

Many rivers are actively managed for their aesthetic values, whether it be through zoning regulations in suburban and rural areas or through protective management of rivers on federal lands. This management is based on the fact that a large subset of the public derives great pleasure from simply looking at a natural river scene, and paddlers, anglers, swimmers are no exception.

Regardless of any special designation, rivers belong to all citizens and should be managed accordingly. Channel design elements that appear artificial can have detrimental aesthetic impacts that can last for a generation or more. As with other aspects of channel design, mimicking natural features can significantly improve the aesthetics of any channel design project. The following are a few channel design components that should be considered.

- Use native materials including rock of similar color, shape, and size as native rock. Use native plant species.
- Arrange logs, rocks, root-wads and other structures in naturally common patterns. As examples, while dozens of root-wads buried in a meander bend may prevent erosion, and many back-to-back symmetrical log plunge pools may offer good adult fish holding habitat, these patterns rarely if ever naturally occur and should be avoided (See Figure 8.2).



*Figure 8.1 | In 2011, following flood damage, boulders were removed from Vermont's popular New Haven River and used in road stabilization. The resulting reduction in stream complexity impacts paddlers, fish, and downstream landowners.*



*Figure 8.2 | These root wads were installed on the Kenai River in Alaska to prevent erosion. The result is a structure that looks overly symmetrical and obviously man-made, detracting from the natural scenery.*

- Ensure that all non-native erosion prevention materials biodegrade in a reasonably short timeframe that is commensurate with the anticipated recovery of natural analogs, like riparian shrubs.
- Avoid repeating symmetrical patterns, such as identical meanders, rock veins, or log structures. Seek complexity and diversity in and between structures.

Considering these design components will garner greater public support for projects, reduce the social footprint of projects, and may also have ancillary ecological and geomorphological benefits. Importantly, channel designers have a responsibility to all members of the public to design channels that look, feel, and act naturally.

#### D. Ecology and Geomorphology

It is beyond the scope of this paper to provide a robust review of ecological and geomorphological considerations of channel design, however some mention of the shared considerations is merited. Native plants and animals evolved in essentially the same naturally complex and dynamic stream environment that paddlers, anglers, and other recreationists have learned to safely enjoy. Generally, channel designs that mimic natural streams will benefit the ecology of the stream – and they will be consistent with natural geomorphology. Of the universe of natural features that designers can choose to mimic, this paper describes and recommends the selection of the significant subset that is relatively low risk for all river recreationists and desirable to paddlers.

It is important to recognize that wood features provide significantly more ecological value in stream reaches with fine substrate (sand – small cobble) than in reaches with large substrate like boulders and bedrock. In low-gradient, fine-substrate reaches wood can be used to add significant habitat complexity for fish and other aquatic organisms. Wood, which is itself a highly mobile type of substrate, most often naturally settles in lower gradient reaches with fine substrate. Boulder and bedrock channels however generally have ample complexity and stability, and are typically higher gradient sediment (and wood) transport zones. Adding wood to high gradient boulder and bedrock streams will pose a greater recreational risk, a likelihood of mobility of the wood, and will offer relatively little habitat value. For these reasons it is recommended that wood structures be favored in low-gradient small-substrate reaches and rock structures be favored in high-gradient large-substrate reaches to meet channel design goals.

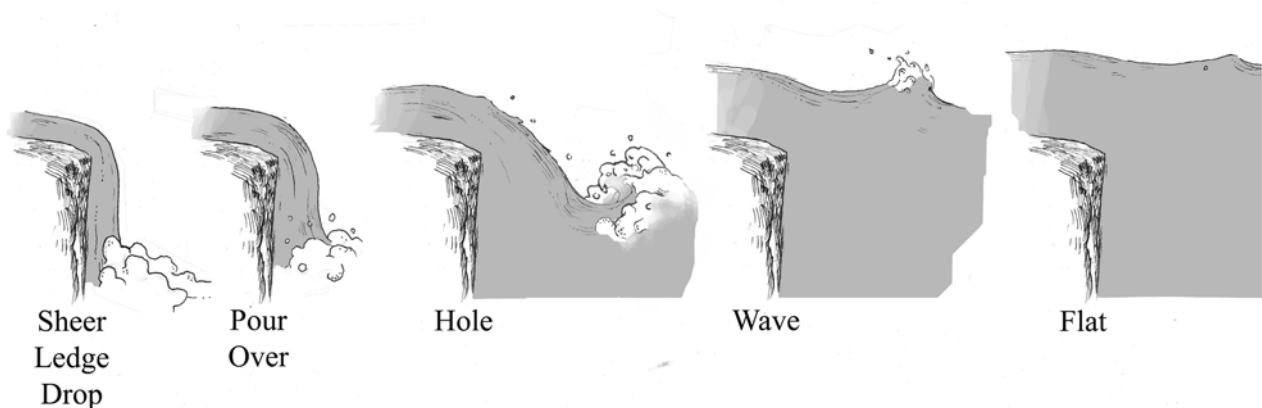
#### E. Water Levels

Paddling, angling, swimming, and other forms of river recreation are flow dependent. Rivers typically have specific flow ranges that are unacceptable, acceptable, and optimal for these forms of recreation. For paddling, the lowest flows are often too rocky to be navigable, moderate low flows are acceptable, medium flows are optimal, high flows are acceptable, and very highest flows are often unacceptable. Of course what constitutes “low”, “medium,” and “high,” are unique to each river and to a lesser extent to each paddler. Anglers and swimmers typically prefer flows at or near base flow.

Channel designers should ensure that river features do not pose unnecessary or excessive risk at the range of flows preferred by recreationists. For paddling flow preferences, designers should consult with guidebooks and resources like the American Whitewater online Whitewater Rivers Inventory.<sup>2</sup> Generally, channels should be recreationally functional at all flows between the average annual low flow and the average annual peak flow, but this varies widely by reach.

The recreational characteristics of a rock or log will change with water levels in a predictable pattern (See Figure 8.3). Following the rock and log feature design recommendations in this paper will help ensure that features do not create severe hazards within the range of common recreation flows.

*Figure 8.3 | Hydraulic features and their recreational attributes change as flows rise (low flow at left to high flow at right)*



<sup>2</sup> <http://www.americanwhitewater.org/content/River/view/>

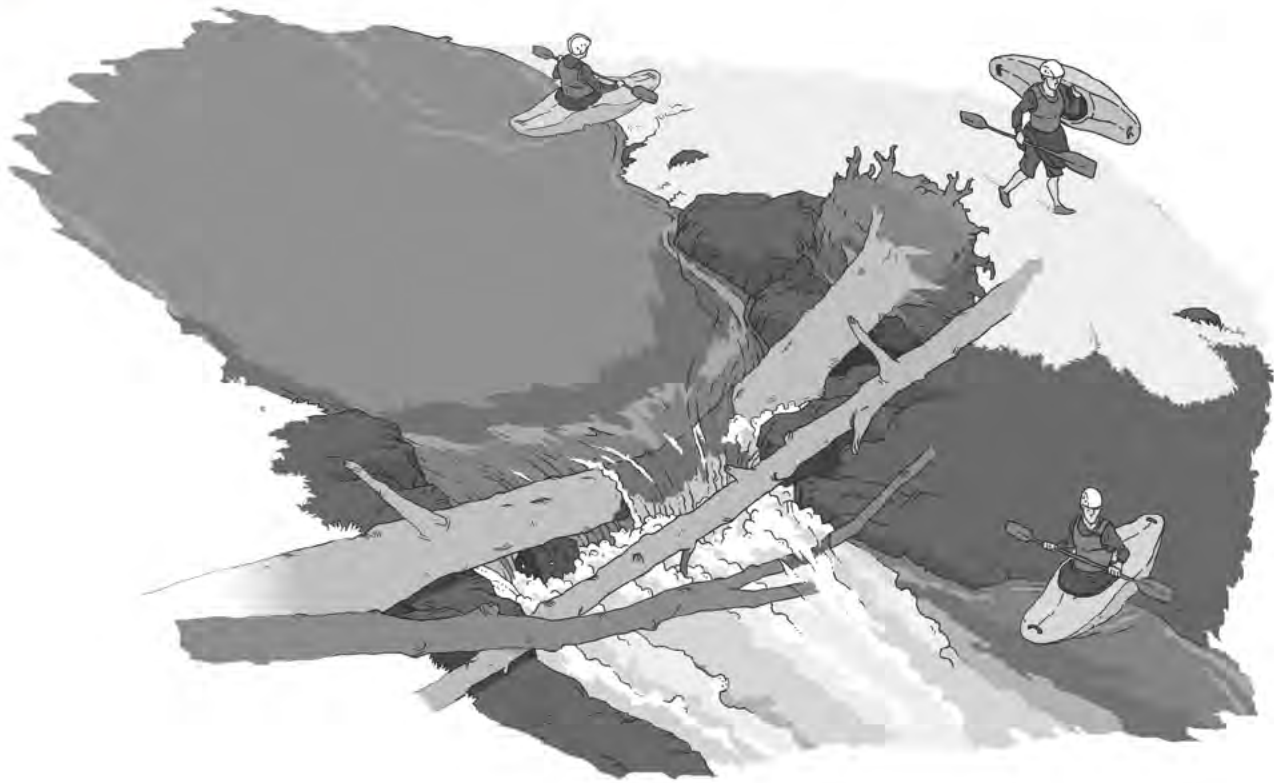
#### F. Recreational Use Considerations:

It is recommended that channel designers conduct basic research on the historic, adjacent, and most likely recreational uses of the project river reach, and design the reach accordingly. Designs should first and foremost aim to restore similar features to the low-risk features naturally occurring in the reach. As a secondary consideration, designs should seek recreational consistency. For example, if the design reach is in the middle of a popular Class II whitewater river, it would be appropriate to design Class II rather than Class V rapids in the reach. It may be inappropriate to install features that require mandatory portage or pose severe risks on a river popular with paddlers, especially if the river receives significant rafting use (since rafts are difficult to portage). Designers should consult with river managers, guidebooks and online resources like the American Whitewater online Whitewater Rivers Inventory to assess recreational use.

#### G. Mitigation

There is no geomorphological or ecological need that requires the construction of a feature that is a mandatory portage for paddlers. Paddlers regularly and safely paddle drops of staggering heights and rapids of astounding complexity. With this said, if a designer chooses to create a feature that paddlers may wish to portage, it is important to mitigate the recreational impacts of the feature. To do so, design the feature to 1) be obvious and visible from upstream, 2) have a reasonable take-out eddy upstream and within sight of the feature, 3) have a viable portage route, and 4) have a reasonable eddy to launch from immediately downstream of the feature (See Figure 8.4).

*Figure 8.4 | Unavoidable high risk channel structures can and should be mitigated by providing safe and obvious portage opportunities*



## 9 | Summary: Putting It All Together:

Natural rivers provide a full suite of ecological habitat, geomorphological processes, and recreational values. Stream channel designers can provide these same values by selecting specific natural feature locations and orientations that: 1) minimize objective hazards, and 2) maximize or at least integrate recreational values.

Figure 9.1 highlights a river channel that is unnecessarily full of objective hazards. Channel designers can meet the same project goals without creating these objective hazards. To avoid creating objective hazards, consider the following rules of thumb.

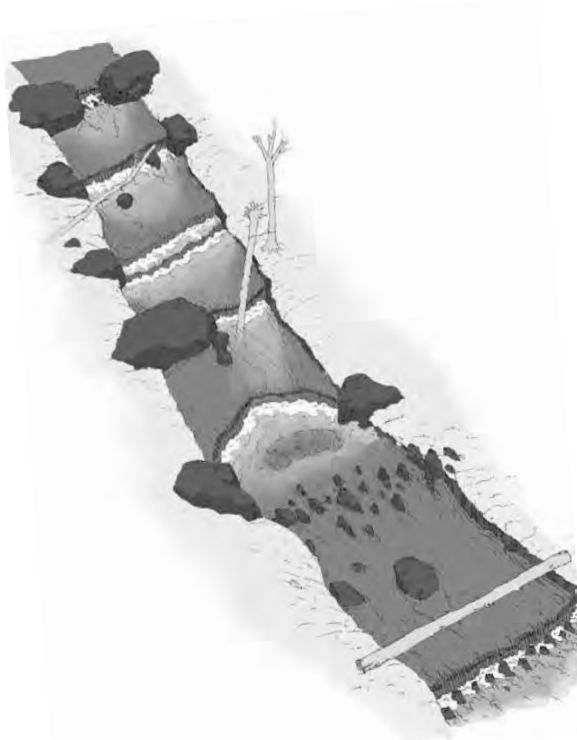
- Water flowing under rocks or wood is high-risk.
- Water flowing swiftly into anything vertically oriented or porous is high-risk.
- Cable, rope, and rebar are high-risk.
- Sharp rocks are high-risk.
- Drops with obstructions immediately downstream are high-risk.
- Anything geomorphologically unnatural is likely high-risk.
- Symmetrical drops can be high-risk, especially if they are steeply sloped or have a rounded lip.

Figure 9.2 highlights a recreationally valuable river channel. To create a recreationally valuable river channel follow these rules of thumb.

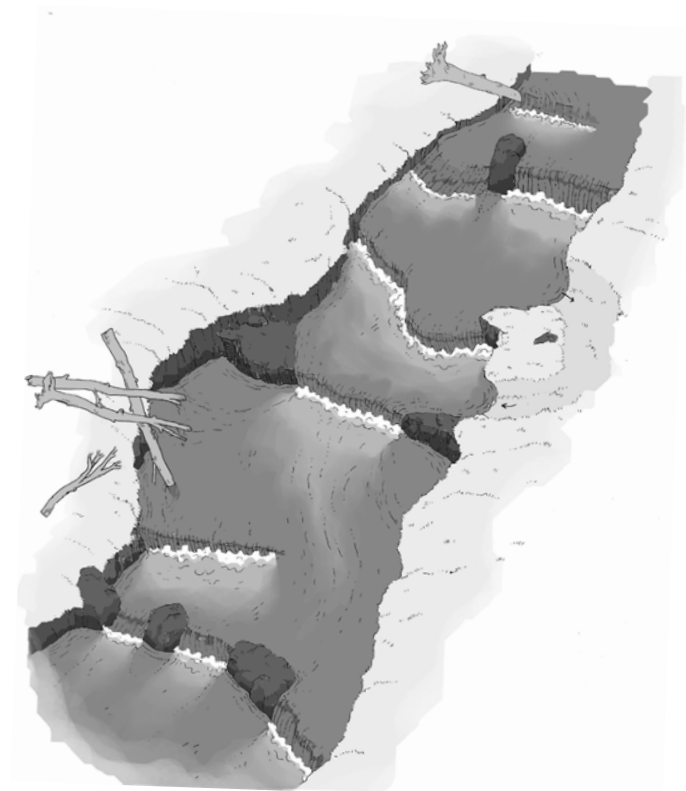
- Create no objective hazards.
- Separate rapids and drops with deep pools.
- Create eddies before, within, and after rapids.
- Make all drops asymmetrical and either vertical or less than 30 degree slope, landing in deep pools, with lateral eddies adjacent to their base.
- Design a level of complexity (i.e. whitewater difficulty) that is historically accurate and/or consistent with reference reaches.
- Ensure any potential portages are obvious and possible.

## 10 | Conclusions:

Virtually all rivers and streams that you can't jump across at high water are enjoyed by the public through paddling, angling, swimming and/or sightseeing. Integrating recreational considerations into all channel design and modification projects can ensure that these recreational experiences remain high quality and reasonably safe.



*Figure 9.1 | A poorly designed channel with many objective hazards.*



*Figure 9.2 | A well-designed channel with many low-risk and desirable features.*

**About American Whitewater:** *Founded in 1954, American Whitewater's mission is to protect and restore our nation's whitewater resources and to enhance opportunities to enjoy them safely. Our members are predominantly conservation-oriented whitewater kayakers, canoeists, and rafters. Our river stewardship program focuses on restoring rivers impacted by hydropower dams, protecting free flowing rivers from environmental harm, and ensuring that river management supports sustainable river recreation. This paper was written to guide the restoration of Washington State's Sullivan Creek, on which American Whitewater negotiated a dam removal.*

**About The Author:** *Kevin Colburn received a B.S. in environmental studies from the University of North Carolina at Asheville with an emphasis in restoration ecology in 1994. He received a M.S. in Environmental Studies from the University of Montana in 2001, following the completion of a thesis focused on the role that wood can play in restoring habitat and flow complexity to impacted streams. Since 2001 he has worked for American Whitewater on a variety of river stewardship projects. He has written articles on wood in rivers and in 2007 he presented a talk on the topic at a River Management Society conference.*

**About the Illustrator:** *Chad Lewis is an illustrator and avid kayaker based out of central Virginia. He completed his fine arts degree at James Madison University and continued to study illustration at Kent State University. Currently he works as a freelance illustrator and fine artist. Other samples of his work can be seen at: <http://www.facebook.com/chadlewisart>*

**Disclaimer:** *This paper has undergone informal peer review from gracious stream modification practitioners, a river safety expert, and river management specialists. It was crafted to share the collective knowledge of the whitewater paddling community regarding river safety with river modification practitioners. It is the author's intention to offer no direct advice to stream modification practitioners on what they should or should not do – but rather to share an opinion on the relative paddling risks and other values associated with various features. This paper is not intended to constitute engineering, construction, geomorphology, hydrology, or any other type of advice, and should not be construed as such. This paper is for informational purposes only. This paper was written as a guide for the restoration of Sullivan Creek, in Northeastern Washington.*

## Appendix 1: International Scale of Difficulty

### Class I Rapids

Fast moving water with riffles and small waves. Few obstructions, all obvious and easily missed with little training. Risk to swimmers is slight; self-rescue is easy.

### Class II Rapids: Novice

Straightforward rapids with wide, clear channels which are evident without scouting. Occasional maneuvering may be required, but rocks and medium-sized waves are easily missed by trained paddlers. Swimmers are seldom injured and group assistance, while helpful, is seldom needed. Rapids that are at the upper end of this difficulty range are designated "Class II+".

### Class III: Intermediate

Rapids with moderate, irregular waves which may be difficult to avoid and which can swamp an open canoe. Complex maneuvers in fast current and good boat control in tight passages or around ledges are often required; large waves or strainers may be present but are easily avoided. Strong eddies and powerful current effects can be found, particularly on large-volume rivers. Scouting is advisable for inexperienced parties. Injuries while swimming are rare; self-rescue is usually easy, but group assistance may be required to avoid long swims. Rapids that are at the lower or upper end of this difficulty range are designated "Class III-" or "Class III+" respectively.

### Class IV: Advanced

Intense, powerful but predictable rapids requiring precise boat handling in turbulent water. Depending on the character of the river, it may feature large, unavoidable waves and holes or constricted passages demanding fast maneuvers under pressure. A fast, reliable eddy turn may be needed to initiate maneuvers, scout rapids, or rest. Rapids may require "must" moves above dangerous hazards. Scouting may be necessary the first time down. Risk of injury to swimmers is moderate to high, and water conditions may make self-rescue difficult. Group assistance for rescue is often essential, but requires practiced skills. A strong eskimo roll is highly recommended. Rapids that are at the lower or upper end of this difficulty range are designated "Class IV-" or "Class IV+" respectively.

### Class V: Expert

Extremely long, obstructed, or very violent rapids which expose a paddler to added risk. Drops may contain large, unavoidable waves and holes or steep, congested chutes with complex, demanding routes. Rapids may continue for long distances between pools, demanding a high level of fitness. What eddies exist may be small, turbulent, or difficult to reach. At the high end of the scale, several of these factors may be combined. Scouting is recommended but may be difficult. Swims are dangerous, and rescue is often difficult even for experts. A very reliable eskimo roll, proper equipment, extensive experience, and practiced rescue skills are essential. Because of the large range of difficulty that exists beyond Class IV, Class 5 is an open-ended, multiple-level scale designated by class 5.0, 5.1, 5.2, etc... each of these levels is an order of magnitude more difficult than the last. Example: increasing difficulty from Class 5.0 to Class 5.1 is a similar order of magnitude as increasing from Class IV to Class 5.0.

### Class VI: Extreme and Exploratory Rapids

These runs have almost never been attempted and often exemplify the extremes of difficulty, unpredictability and danger. The consequences of errors are very severe and rescue may be impossible. For teams of experts only, at favorable water levels, after close personal inspection and taking all precautions. After a Class VI rapid has been run many times, its rating may be changed to an appropriate Class 5.x rating.



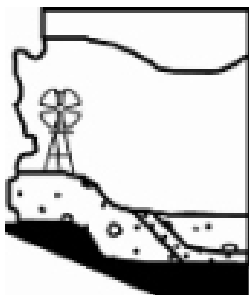
# Proceedings

of the

## 2009 Annual Water Symposium

August 30 – September 2, 2009

Westin Kierland Resort & Spa, Scottsdale, Arizona



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Arizona Hydrological Society

American Institute of Hydrology



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## ANNUAL VIRGIN FLOWS IN CENTRAL ARIZONA

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### ABSTRACT

When approaching many questions of water resource planning it is useful to determine the virgin flow. This is the flow that would have occurred but for the activities of humanity. By combining statistical methods with early studies of annual virgin flow, a recreation of the annual virgin flows of the Gila River at Gillespie Dam, the Salt River at Granit Reef, and the Gila River at Kelvin was created for the period 1889 through 1977. The methodology uses upstream gaging stations with minimal disturbance to correlate statistical relationships that estimate virgin flows. The resulting equations are:

- 1) Annual Virgin Flow of the Gila River at Gillespie Dam (acre-feet/yr) =  $[1.1967 \times \text{Flow of Verde River below Bartlett Dam (adjusted for reservoir storage)}] + [1.4041 \times \text{Flow of Salt River below Roosevelt Dam (adjusted for reservoir storage)}] + [0.9277 \times \text{San Francisco River at Clifton}] + [9.6840 \times \text{Rillito Creek near Tucson}] - 322.254$
- 2) Annual Virgin Flow of the Salt River at Granite Reef (acre-feet/yr) =  $[1.1362 \times (\text{combined inflows})] - 13225$
- 3) Annual Virgin Flow of the Gila River at Kelvin (acre-feet/yr) =  $281,597 - (1.10 \times \text{Granite Reef}) + (1.09 \times \text{Gillespie})$ .

**Key words:** Gila River, Salt River, Arizona, Virgin Flow

### HISTORIC ESTIMATES OF AVERAGE VIRGIN FLOW

Three locations are examined to determine the annual virgin flows in Central Arizona. These are: The Gila River at Gillespie Dam; the Salt River at Granite Reef, and the Gila River at Kelvin. This study relies primarily on USGS gage records and three studies: The White and Blue Books by the U.S. Bureau of Reclamation (BOR) and the U.S. Geological Survey (USGS) extrapolative of dendrochronological data.

#### The White Book

The BOR in November 1952 published the "Report on Water Supply of the Lower Colorado River Basin".<sup>1</sup> This report was initially bound in a white cover and is known in the BOR as the "White Book." Supplements to the "White Book" were published in November 1953<sup>2</sup> and again in October 1963.<sup>3</sup> In this report, all three sections will be referred to collectively as the "White Book". In addition to the "White Book", eight file boxes of supporting materials were also compiled by the BOR but not published. These data have been reviewed by Gookin Hydrology, PLC to aid in their understanding of the "White Book".

The "White Book" represents approximately 15 man-years of work and is the most comprehensive study ever made concerning the virgin flows in the Lower Colorado River Basin.<sup>4</sup> The extent to which human activity in the watersheds of the Lower Colorado River Basin has progressively altered the natural flow of the river was studied in greater detail in the "White Book" than at any time before or since. The "White Book," though not perfect, is the best study available. The "White Book" does not address a few basic changes in the watershed. The most major change not considered is the changes of the types of vegetation on the watershed due to historic over-grazing.

The "White Book" procedure for computing the virgin flow consisted of: 1) evaluating and quantifying the net depletion due to human activities and 2) algebraically adding that net depletion to the historically recorded flow. The sum of all human-caused depletions of water from the stream minus the sum of all of the human-caused replenishments to the stream equals the net depletion.

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<sup>1</sup> United States Bureau of Reclamation, 1952.

<sup>2</sup> United States Bureau of Reclamation, 1953.

<sup>3</sup> United States Bureau of Reclamation, 1963.

<sup>4</sup> Personal Communication with William Scudder Gookin, Sr.

## The Blue Book

An earlier document that attempted to quantify virgin flow was the "Blue Book". The "Blue Book" was published by the United States Department of Interior in July 1947 and is entitled "The Colorado River, 'A Natural Menace Becomes A National Resource'".<sup>5</sup> The description of virgin flow calculations is contained in Appendix I to that report. Although not specifically referenced, it appears that the "Blue Book" analysis was based on the procedures set forth in a report by the Bureau of Reclamation in 1934.<sup>6</sup>

The procedure used in the "Blue Book" to calculate virgin flow can be summarized as follows<sup>7</sup>

- Extend the recorded flow of the Salt River at Granite Reef and the Gila River at Kelvin.
- Estimate the unmeasured inflows below the gaging stations at Granite Reef and Kelvin.
- Adjust the records of the Salt and Gila Rivers for reservoir effects and upstream depletions.

Channel losses for the Salt River through the Phoenix metropolitan area and the Gila River through the Gila River Indian Reservation area were computed based on records for the reach below Gillespie Dam. The result showed the estimated virgin flow. The "Blue Book" contains much less detail than the "White Book". The "Blue Book" provides some data for the period prior to 1914 going back as far as 1897. The entire period of record contained in the "Blue Book" is 1897-1943. The Debler Report extends the records back to 1895.<sup>8</sup>

## Dendrochronology Studies

Two reports are of primary significance to the Gila River system. A 1981 report prepared for the Army Corps of Engineers by Lawrence P. Smith<sup>9</sup> concentrated on reconstruction of the history of the streamflow for the Salt River at Roosevelt Dam and the winter flow of the Verde River below Tangle Creek. An article by Meko and Graybill<sup>10</sup> reconstructs the virgin flow for the Gila River at the head of the Safford Valley.

Dendrochronological studies did not provide virgin flow estimates at Gillespie, Kelvin, or the Salt River at Granite Reef. However, the USGS took these data and extrapolated the virgin flow at Kelvin and Granite Reef Dam from the information in the tree ring studies. The conclusion was that the virgin flow at Granite Reef was 1,250,000 AC-FT<sup>11</sup> and the virgin flow at Kelvin was 500,000 AC-FT.<sup>12</sup> These determinations of virgin flow confirm the computations of the White and Blue Books.

## Comparison of Virgin Flow Estimates

We choose to rely primarily on the "White Book" due to its greater detail as the basis for our study, recognizing that the "White Book" does not cover the entire period of record and techniques to adjust for that are necessary. This will be handled in our discussion of annual flows.

Several management and technical factors limit the computation of virgin flow. Management limitations include time, manpower, and financial resources. Technical limitations include availability of pertinent and continuous data, applicable research, and the knowledge and experience of the investigators. The "White Book" is the most comprehensive effort to date to determine virgin flows of Arizona's major river systems. The "White Book" involved dozens of investigators working over a period of five years. Even with that effort, certain factors were not evaluated in the preparation of the "White Book". These factors included are the destruction of the beaver and the alteration of the watershed runoff characteristics by human (mis)management. The two most important of these effects are the suppression of fire and the massive overgrazing of the 1890s and 1900s.

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<sup>5</sup> United States Bureau of Reclamation, 1947.

<sup>6</sup> Debler, E. B., 1957.

<sup>7</sup> United States Bureau of Reclamation, 1947.

<sup>8</sup> Debler, E. B., 1957.

<sup>9</sup> Smith, L. P., 1981.

<sup>10</sup> American Water Resources Association, 1995, 605-616.

<sup>11</sup> Thomsen, B. W. and Porcello, J. J., 1991. 32.

<sup>12</sup> Thomsen, B. W. and Eychaner, J. H., 1989, 31.

## EXTENDING ESTIMATES OF ANNUAL VIRGIN FLOWS

### Choosing the Period

The climate in this area is not a constant phenomenon. Over time, it has varied. Along with the changes in climate, there have been concomitant changes in the vegetative patterns. Both of these affect runoff. Selecting different periods of record can yield different estimates of virgin flow. In order to minimize this bias, we have made the virgin flow analysis for the maximum concurrent period of record that we could, rather than relying on average flows.

The first step in determining the annual flow is selecting the period of record. Most detailed data are only available back to the 1900's. The "Blue Book", the War Department Reports<sup>13</sup>, and measurements from gaging stations on the Salt River near the present Roosevelt Dam provide some data back to the late 1880's. The "Blue Book" along with exhibits in *Arizona v. California*<sup>14</sup> provides data back to 1895. Examination of the historic records reconstructed by the War Department and the records at Roosevelt Dam show that the years 1892, 1893, and 1894 were very dry. 1891 had a wet winter. 1890 was fairly wet, as was 1889 and many years prior. The War Department's reconstruction of Gila River flows back to 1867<sup>5</sup> shows that the 22 years prior to 1889 was very wet and would not have restricted development. We decided to start with 1889 as the first year for which we have data.

The availability of records of development appears to decline after 1958. Periodic specific data are available that allow some reconstruction of human activities in more modern times. After the late 1970's, the availability of data begins to decline due to the imposition of privacy restrictions, the lack of reporting of specific data on cropping and the shift of the emphasis of hydrology from water quantity to water quality. The historic flow records show that 1978 through 1995 was exceptionally wet except for the year 1990.<sup>16</sup> Any development that had been successful from 1889 through 1977 would be assured an ample water supply from 1978 to the present. Therefore, to limit the data reconstruction needed, the study was brought forward through 1977, thereby providing a continuous record of 89 years. The period includes the severe drought of the 1950s and the severe drought of the 1890s and early 1900s.

The next step was to compare the annual virgin flow estimated in the "White Book" with the "Blue Book". The "White Book" estimates virgin flow for water years. The "Blue Book" estimates virgin flow for calendar years. We compared the annual virgin flows at Gillespie Dam estimated by these two sources. Despite the use of calendar years and water years, there is a good correlation between the annual virgin flows estimated in the "White Book" and the "Blue Book". This is demonstrated by comparing the cumulative flow of the "Blue Book" to the cumulative flow of the "White Book" for the period of concurrent record. This effectively eliminates the impact of using the different types of years. If either underlying methodology had been fundamentally different, a cumulative difference would have appeared.

### Choice of Streamflow Data over Rain-Gage Data

The method is to relate to the flows at the gaging stations to other occurrences within the watershed to extend the record forward and backward. The two sources of records are long-term rain gauge records and long-term stream gage records for relatively undeveloped areas. Long-term stream gage records provide a better area-wide indicator of climatic events.

The process of analyzing and tabulating precipitation data is difficult. The unique climatic and topical characteristics of the Gila River watershed area cause extreme variability between local climates. An obvious dissimilarity exists between desert and mountain regions, whose local features and climates differ substantially, despite their geographical proximity.

The spatial variability of rainfall in the watershed region makes it difficult to ascertain rainfall totals with certainty. The number and placement of gauges and other measuring devices becomes important in the attempt to minimize statistical error. The drainage area for Gillespie Dam encompasses 49,626 square miles. There are only a few dozen long-term rain gauge stations within or near the watershed. Studies of the National Engineering Handbook #4 (NEH-4)<sup>17</sup> have shown that there is a

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<sup>13</sup> United States Engineering Office 1941; United States Engineering Office 1945a; United States Engineering Office 1945b.

<sup>14</sup> Debler, E. B., 1957.

<sup>15</sup> United States Engineering Office 1941, 54-55.

<sup>16</sup> Gila River Water Commissioner Annual Reports. 1935 to present.

<sup>17</sup> United States Soil Conservation Service, 1972.

significant amount of variation in rainfall.

Studies performed in the Walnut Gulch Watershed in southeastern Arizona by the Soil Conservation Service (SCS), determined the rain gauge necessary to acquire adequate information for an accurate depiction of rainfall distributions. The study concluded that rain gauges should be placed at 1,000 ft. intervals to accurately describe thunderstorm rainfall. The SCS study stated that for purposes of streamflow prediction, a lower density of rain gauges could be utilized and suggested one central rain gauge for every 120 acres. The SCS stated that three evenly spaced rain gauges per square mile probably would be sufficient. In correlating rainfall events, the SCS study determined that the expected correlation between rain gauges dropped to zero when they were placed 12,000 feet apart.<sup>18</sup> These criteria indicate that some 150,000 rain gauges, evenly spaced, would be necessary for a proper study of the relevant Gila River watershed above Gillespie Dam. This is not a real world scenario. In the heavily instrumented and studied 50-square mile Walnut Gulch Experimental Watershed, only 92 recording rain gauges were installed.<sup>19</sup> It is not surprising, that statistical analyses and correlations may, at times, show a low degree of correlation between the readings. We add to this the inherent error of measurement of streamflow.

This does not mean that the use of rain gauges to predict streamflows will not work even when the rain gauge density is small. While a rain gauge may only give a partial picture for any one storm, it provides a better picture for longer periods. Whenever possible, long-term records should be utilized to determine basic trends and relationships and minimize the “noise” from the error.

Despite the inherent problems of using rainfall stations, in many cases, rain gauge data and their correlations can be quite useful. The War Department successfully utilized rain gauges to reconstruct portions of the historic flows of the Gila River and some of its tributaries.<sup>20</sup>

Gookin Hydrology, PLC feels that the use of stream gages generally constitutes a better source for analysis of water supply than do rain gauge records. A stream gage gives data concerning a much larger area than does a rain gauge. Therefore, we examined the USGS records, records available to us from Salt River Project, and other studies to find the gages that had minimal upstream disturbances and a long period of record.

#### Selecting Streamflow for Flow Computation at the Gila River at Gillespie Dam

The first criteria for picking stream gages is that the gage has a long period of record. From USGS survey data,<sup>19</sup> stream gages that had an extended period of record were selected. The second criteria was to find gages that have not been significantly influenced by man. The ratio of the average flow to the 1978 developed acreage reported in the USGS survey data was computed. That ratio indicates the upstream development. A large ratio means a large amount of water and few human activities and indicates a good gage to consider for the analysis. Thirteen gages had ratios above ten. The Gila River near Blue Creek gage and the Gila River near Red Rock gage are very close to each other. The records of Blue Creek were used to supplement the records of Red Rock where Red Rock records were missing. Additionally, the sites were examined to determine if the records could be extended back to the 1800s and forward to the 1970s. Eight gaging sites met these criteria and were used as potential indices for computing virgin flow:

- Verde River below Bartlett Dam
- Salt River near Roosevelt Dam
- Tonto Creek near Roosevelt Dam
- Gila River near Red Rock
- San Francisco River at Clifton
- San Carlos River near Peridot
- San Pedro River at Charleston
- Rilitto Creek near Tucson

The Salt River and Tonto Creek gages were combined into one gage since some of the earlier records only recorded the combined flow of the Salt River at Roosevelt Dam. Adding data from the two gages approximated the flow of the Salt River

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<sup>18</sup> United States Soil Conservation Service, 1972.

<sup>19</sup> Hickock, 1969.

<sup>20</sup> United States Engineering Office 1941.

at Roosevelt Dam. This gives us seven indicators. In some cases, additions or extrapolations were necessary to complete the record. The record was generated as follows.

Data for the Verde River below Bartlett Dam are published by the USGS for the period 1889 to 1938. Data for the period 1939 to 1977 were taken from the Verde River below Bartlett Dam corrected for changes in reservoir contents as published in the Appendices to the report on Tree Rings by Smith.<sup>21</sup>

The flow of the Salt River at Roosevelt Dam is based on USGS data for the period 1888 to 1907, 1911, and 1912. The period 1913 through 1977 was computed by adding the Tonto Creek above Roosevelt Dam to the Salt River near Roosevelt. The data for 1908, 1909, and 1910 were taken from the Salt River Project's graphs of river flows. The data on these graphs are presented in calendar years rather than water years. The monthly bars on the graphs were measured and the calendar year data was adjusted by the difference in the bar heights for October, November and December to convert the data to water years.

Data for the Gila River near Red Rock for the period 1889 to 1912 (except for 1906 and 1909) came from the 1941 War Department Report.<sup>22</sup> The other data were published by the USGS. Data for the period 1956 to 1962 was computed by running a regression analysis comparing the flows at Blue Creek with the flows at Red Rock. The result shows a high correlation. The regression equation was used to convert Blue Creek USGS data into Red Rock data.

Data for the other gage sites are based on the War Department series reports through 1940<sup>3</sup> or until actual USGS gaging data are available and then USGS gaging data from that point forward.

## ANALYSIS

Regression analyses were performed for estimating virgin flows the three study locations.

### Gila River at Gillespie Dam

A regression analysis was performed comparing the seven gages to the virgin flows of the Gila River at Gillespie Dam. A correlation matrix was prepared to determine how the various ages correlated to the Gila River at Gillespie Dam and how they correlated with one another. The first run of the regression analysis gave a 99 percent correlation coefficient. However, the "t-test" values raised questions as to how much input several of the gages contributed to the final relationship. The most questionable gage was the San Pedro River at Charleston. The "t-test" showed only 44 percent degree of certainty that the San Pedro gage related to the computer virgin flow at Gillespie Dam. Therefore, the San Pedro gage was eliminated from the regression analysis.

This does not mean that the San Pedro flows are unrelated to the flows at Gillespie Dam. The flows are interrelated. But, in a statistical analysis with numerous variables, if some variables have similar variations, the prediction of one variable masks the contribution of the second variable.

A second regression analysis leaving out the San Pedro gage showed a 99 plus percent correlation. None of the gages had poor certainties but three of the gages were marginal, Gila River at Red Rock, San Francisco River at Clifton, and San Carlos River at Peridot. Of these three gages, the poorest certainty was with the San Carlos River gage.

The San Carlos River gage at Peridot was deleted and the analysis recomputed. The correlation was still over 99 percent. The "t-test" showed a 96 percent degree of certainty that the Gila River at Red Rock gage was related to the estimated virgin flow of the Gila River at Gillespie Dam. The "t-test" showed a 98 percent degree of certainty that the San Francisco River at Clifton gage was related to the estimated virgin flow of the Gila River at Gillespie Dam. The San Francisco River at Clifton gage and the Gila River at Red Rock gage are related to each other with an 80 percent correlation. Some of the lack of correlation is due to their relative duplicity. The Gila River at Red Rock gage was eliminated because its data were less dependable.

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<sup>21</sup> Smith, L. P., 1981. 95-96.

<sup>22</sup> United States Engineering Office 1941.

<sup>23</sup> United States Engineering Office 1941; United States Engineering Office, 1945a, United States Engineering Office 1945b.

The remaining four gages, the Verde River below Bartlett Dam, Salt River near Roosevelt Dam, San Francisco at Clifton, and Rillito Creek at Tucson all had certainties of greater than 99 percent. The correlation coefficient was 99 percent. The t-test showed statistical certainties of 100.0000% for all variables except the San Francisco which was 99.0395%.

This is an outstanding result and the regression analysis was adopted as computed. The records from these four gages were used to extend the analysis forward and backward. The analysis was made against the period of record in the “White Book”. As an independent check, the analysis was compared to the “White Book” and to the “Blue Book”, both on year by year basis and on a cumulative basis. In both cases, the accuracy of the derived equation in modeling the virgin flows of the Gila River at Gillespie Dam was outstanding. The resulting equation to determine the annual virgin flow at Gillespie Dam is:

$$\begin{aligned} \text{Estimated Annual Virgin Flow at the Gila River at Granite Reef (acre-ft/yr)} = & \\ & 1.1967 \times \text{Flow of Verde River below Bartlett Dam (adjusted for reservoir storage)} \\ & + 1.4041 \times \text{Flow of Salt River below Roosevelt Dam (adjusted for reservoir storage)} \\ & + 0.9277 \times \text{San Francisco River at Clifton} \\ & + 9.6840 \times \text{Rillito Creek near Tucson} \\ & - 322.254 \end{aligned}$$

### Salt River at Granite Reef

The only source of annual data for the virgin flow at Granite Reef is the “Blue Book”. To expand that estimate for the period of record, Gookin Hydrology, PLC looked at three major components to the Salt River system. The major components are: the Verde River below Bartlett Dam (adjusted for storage changes); Tonto Creek near Roosevelt Dam; and the Salt River near Roosevelt Dam. The historic flows at these three points for the Salt River system averaged 1,331,800 AC-FT/YR for 1914-45.<sup>24</sup> To estimate the flows for the Salt River at Granite Reef, Gookin Hydrology, PLC prepared a regression analysis comparing the three historic flows to the virgin flow for Granite Reef as calculated by the “Blue Book.”<sup>25</sup> The coefficient of correlation in this analysis was 92 percent. The “t-test” showed virtual certainty (100.0000%) in the calculation. The regression equation that was generated is:

$$\text{Estimated Annual Virgin Flow at the Salt River at Granite Reef (acre-ft/yr)} = 1.1362 \times (\text{combined inflows}) - 13225$$

### Gila River at Kelvin

Gookin Hydrology, PLC found that a good result could be achieved by taking the annual virgin flow at Gillespie and the annual virgin flow at Granite Reef (which can be approximated with Roosevelt, Tonto Creek, and the Verde) and performing a regression analysis against the virgin flow at Kelvin. A correlation coefficient of 96 percent was found and the “t-test” showed near certainty for the coefficient value. The computed equation is:

$$\text{Estimated Annual Virgin Flow at the Gila River at Kelvin (acre-ft/yr)} = 281,597 - (1.10 \times \text{Granite Reef}) + (1.09 \times \text{Gillespie})$$

The multipliers for Gillespie and Granite Reef were near to the value one. This caused us to question whether we should just take a value of Gillespie minus Granite Reef and compare it directly to Kelvin rather than using the individual terms. In all previous analyses, the “t-test” was used to determine if the multiplier was significantly different than zero. In this case, it is obvious that Granite Reef flows should be subtracted from the Gillespie flow in order to arrive at a variable that more closely approximates the Kelvin flow. In order to determine if the regression equation had contributed anything over and above that hypothesis, we ran manual “t-tests” to determine whether the multipliers are significantly different than one. In each case, there was approximately a 90 percent level of certainty that the multiplier was different than one. Gookin Hydrology, PLC adopted this equation given the certainty on the individual multipliers and the high degree of correlation. t.

## CONCLUSION

The ability to extend the record of virgin flows provides for a better data base when allocating water resources between differing and competing resources. This analysis shows the ability to compute the annual virgin flows for a longer period that includes the worst droughts of history.

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<sup>24</sup> United States Bureau of Reclamation, 1952, 161.

<sup>25</sup> United States Bureau of Reclamation, 1947, 284-85.



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TABLE 1 Estimated Virgin Flow (AF)			
Water Year	Salt River @ Granite Reef	Gila River @ Gillespie	Gila River @ Kelvin
1889	2,073,634	2,526,774	754,783
1890	2,437,218	2,814,911	668,910
1891	4,315,697	5,260,042	1,267,776
1892	337,520	176,090	102,263
1893	786,546	726,110	207,857

TABLE 1 Estimated Virgin Flow (AF)

Water Year	Salt River @ Granite Reef	Gila River @ Gillespie	Gila River @ Kelvin
1894	488,975	323,824	96,693
1895	1,707,550	1,722,235	280,529
1896	860,286	829,362	239,287
1897	1,556,890	1,916,087	657,553
1898	616,571	561,602	215,516
1899	509,768	366,211	120,023
1900	298,094	83,110	44,284
1901	900,848	820,708	185,235
1902	451,254	258,067	66,511
1903	758,368	661,374	168,289
1904	578,622	422,684	105,839
1905	4,904,249	7,637,268	3,211,545
1906	2,956,461	3,865,625	1,243,021
1907	2,413,698	3,345,989	1,273,657
1908	1,694,118	2,038,635	640,180
1909	2,182,130	2,400,173	497,442
1910	1,004,578	899,125	156,607
1911	1,650,854	1,872,069	506,214
1912	1,125,247	1,255,485	412,304
1913	877,669	840,894	232,736
1914	1,038,555	1,071,589	307,218
1915	3,001,000	5,300,892	2,758,469
1916	4,372,507	6,046,621	2,062,656
1917	1,929,450	2,244,908	606,152
1918	1,003,560	987,780	254,361
1919	1,729,138	2,233,364	813,912
1920	3,572,168	4,307,460	1,047,344
1921	959,362	1,257,884	597,393
1922	1,658,807	1,667,394	274,369
1923	1,293,064	1,315,005	292,582
1924	1,636,083	1,835,116	482,182
1925	999,356	907,956	171,977
1926	1,463,040	1,525,038	334,544
1927	2,006,371	2,176,320	446,778
1928	704,399	585,548	145,006
1929	966,861	1,125,932	445,316
1930	891,417	912,312	295,458
1931	1,171,150	1,277,414	385,714
1932	2,519,365	3,007,693	788,681
1933	774,048	718,409	213,210

TABLE 1 Estimated Virgin Flow (AF)

Water Year	Salt River @ Granite Reef	Gila River @ Gillespie	Gila River @ Kelvin
1934	463,638	316,680	116,776
1935	1,517,691	1,699,015	464,064
1936	1,098,660	1,114,757	288,155
1937	2,113,969	2,345,162	512,458
1938	935,161	850,461	179,922
1939	678,494	605,870	195,652
1940	588,847	531,818	213,546
1941	3,942,342	4,921,758	1,309,738
1942	997,311	1,016,874	292,947
1943	990,721	933,782	209,626
1944	944,705	846,222	164,803
1945	1,075,595	1,062,289	256,338
1946	607,708	474,360	130,171
1947	583,621	453,382	133,801
1948	803,135	704,405	165,951
1949	1,519,509	1,731,555	497,532
1950	505,337	368,486	127,376
1951	544,649	387,142	104,468
1952	2,301,214	2,636,892	624,474
1953	545,217	381,572	97,771
1954	762,459	756,056	266,994
1955	546,694	496,716	221,653
1956	390,240	182,252	50,988
1957	886,645	842,627	224,751
1958	1,427,477	1,697,931	562,118
1959	514,767	412,265	164,722
1960	1,718,344	1,994,604	565,537
1961	374,219	195,919	83,508
1962	1,241,822	1,417,381	460,539
1963	686,901	687,136	274,984
1964	605,550	551,984	217,155
1965	1,697,892	1,754,358	326,166
1966	2,189,867	3,035,926	1,181,903
1967	700,877	636,999	204,961
1968	1,811,512	2,279,692	773,798
1969	1,177,285	1,122,606	210,224
1970	690,992	610,028	186,436
1971	408,873	307,044	166,514
1972	777,002	738,143	231,470
1973	3,975,405	5,066,600	1,431,246

TABLE 1 Estimated Virgin Flow (AF)			
Water Year	Salt River @ Granite Reef	Gila River @ Gillespie	Gila River @ Kelvin
1974	441,596	246,851	64,909
1975	1,047,872	1,085,203	311,809
1976	627,854	557,617	198,760
1977	1,222,888	1,069,608	102,293

**PREHISTORIC IRRIGATION IN ARIZONA.\***

BY F. W. HODGE.

In none of the extensive archeologic remains of southern Arizona are the industry, perseverance, and degree of advancement of a large pueblo population more faithfully illustrated than in the many works of irrigation that abound in the valleys and on the mountain slopes of this section. Prior to the prosecution of systematic archeologic investigation in this region, it was generally believed that, aside from the employment of catch-basins or rude reservoirs formed at the bases of mountain arroyos, artificial irrigation was not practiced by ancient pueblo builders, and that the existing pueblo tribes derived from the early Spanish missionaries or conquistadores their knowledge of conducting the water from the streams to their fields. In the valleys of the Salado and Gila, in southern Arizona, however, casual observation is sufficient to demonstrate that the ancient inhabitants engaged in agriculture by artificial irrigation to a vast extent.

The arable area of the valley of the Salado comprises about 450,000 acres, a tract almost equally divided by the river. No obstacle is encountered in irrigating the land lying south of the stream for a distance of ten miles, but greater difficulty attended the conducting of water to the northern area by reason of the greater slope of the land, which necessitated the establishment of headworks much farther up the river. This difficulty modern ranchmen have overcome by the construction of the Arizona canal, which traverses a distance of forty-one miles from east to west, and has a capacity of 40,000 miners' inches, sufficient to irrigate 50,000 acres, or over 27 per cent. of the 182,000 acres now reclaimed by the nine irrigating canals of the valley. This latter area is less than one-half the lands redeemable by the waters of the lower Rio Salado.

Judging from the remains of extensive ancient works of irrigation, many of which may still be seen passing through tracts cultivated

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\* From notes made in 1887-'88 while the author was a member of the Hemenway Archeological Expedition, operating in the Southwest under the directorship of Mr. Frank Hamilton Cushing.

to-day as well as across densely wooded stretches considerably beyond the present non-irrigated area, it is safe to say that the principal canals constructed and used by the ancient inhabitants of the Salado valley controlled the irrigation of at least 250,000 acres, even without considering the economical methods employed by a primitive people in all its undertakings.

The mode of canal construction employed by these pueblo builders was another indication of their patience and industry. Their canals are models for the modern farmer to imitate; yet they could have been dug in no conceivable manner save by the laborious process of hand excavation with stone or wooden implements, the earth being borne away by means of blankets, baskets, or rude litters. Notwithstanding this, the outlines of at least a hundred and fifty miles of ancient main irrigating ditches may be readily traced, some of which meander southward from the river a distance of fourteen miles.

In following the courses of these canals their depressions may more readily be seen in the dense mesquite forests, where protection is afforded against the drifting sand. On more open ground their routes are generally entirely effaced, lines of stones alone remaining to mark their sites. These stones were the implements once used, broken, and cast aside upon the banks, as well as concretions grotesquely eroded by the river stream and deposited by the natives along the banks as "tamers of the waters." Similar concretions or huacas, according to the description by Mr. Cushing in his article on "Zuñi Breadstuffs," are placed by the Zuñis along the courses of hill-streams near their main pueblo and along the ditches of Pescado and Ojo Caliente, in order, presumably, to direct the waters of the rainy season from the hillsides to the thirsty fields, and to prevent the overflow of their acequias. It is interesting to note that in no instance were these concretions found to have been used as implements, although many of them are admirably adapted to such purposes; a fact further attesting their sacred character.

In the progress of the investigations of the Hemenway Expedition in the Salado valley, under the directorship of Mr. Cushing, excavation was undertaken at a point along the course of one of the principal supply canals of the ancient Pueblo de Los Muertos, near one of the thirty-six large communal structures which formed this now ruined city, and extended for a distance of about thirty feet. The depth of the bed beneath the original banks was found

to be about seven feet. Unlike ordinary irrigation ditches, these were constructed in such a manner as to control to some extent the depth of the current as well as to prevent waste through seepage. The bed of the canal was about four feet wide, but the sides broadened in their ascent to within about four feet of the bank, where a "bench" three feet in width on each side of the canal had been made. From these benches the banks continued, broadening until they reached the brinks, which were about thirty feet wide. Thus a main ditch consisted, so to speak, of one water-course within another; so that if at any time a small current of water only could be supplied at the headgate, owing, perhaps, to drouth, the lower and narrower ditch was doubtless always filled sufficiently to supply the towns beyond, while during the rainy season the upper and much broader portion of the great canal would readily accommodate all surplus waters.

The bottom and sides of the irrigating ditch which was opened, as well as those of a branch of it excavated to the southwest of the ruined-house cluster alluded to, were found to be exceedingly hard, evidently having been tamped while moist, and then, perhaps, roughly plastered with adobe clay. The extreme hardness of the canal lining may be accounted for by the supposition that, instead of burning the dense underbrush for the sole purpose of destroying it, the natives gathered it into their moist canal beds, where it was burned to harden the newly plastered lining. Very little silt was found in the beds of the irrigating ditches, a fact exhibiting either the care taken of them or showing that a current of considerable strength was flowing at the time of the abandonment of the pueblo.

A few rods south of the canal excavation referred to, the canal was observed, from the course of the chipping stones and concretions or "water-tamers" along its banks, to decrease in width and branch off into two canals, each at an angle of about  $45^{\circ}$  from the trunk acequia. Excavation at this point showed a number of post-holes on the outer banks of the two branches, as well as at the angle formed by their juncture, attesting the former existence of a head-gate for cutting off or supplying at pleasure the farm lands and house groups to the southward.

The only specimens collected from the canal excavation were a few potsherds, quite a large quantity of cottonwood pollen comparatively well preserved, a few small fresh-water univalves, and the remains of a bundle of fagots or reeds that had apparently floated

down with the current. The finding of these last-mentioned remains suggested the possibility of the irrigating canals having also been used in conducting a rude system of navigation by means of *balsas* or cane rafts, in transporting boulders and other material from the river to be manufactured into cutting and chipping tools, etc. It was also observed that all the unfinished stone implements found at Los Muertos (except the lamelliform tools of shale or slate, such as knives and hoes), whether of diorite, granite, or sandstone, were smoothly water-worn, and consequently the products of the river-bed nine or ten miles distant, and were not conveyed from the Maricopa mountains, situated only about five miles to the westward.

The existence of these thousands of water-worn tool-stones and the absence of the ill-shaped fragments of basalt from the mountains, however, is not advanced as evidence that navigation existed among these people. River cobbles are much better adapted for fashioning into implements than the rough stones found on the slopes of the basaltic Maricopa range, previously mentioned as the rock deposit nearest to the Los Muertos ruins. Therefore, notwithstanding that the difference in distance from Los Muertos to the river and to these mountains is fully four miles, river boulders would doubtless have been procured in preference to the clumsy natural chippings from the mountains, even if the facilities for a system of water transportation were lacking. It would, therefore, not necessarily be an indication of particular advancement on the part of these people if they did construct rude craft as a means of water communication from the river to their pueblos. In fact, having exercised their ingenuity to such an extent as is exhibited by their canal construction, one would expect this next step as a matter of course, particularly where the extreme necessity for such navigation, however primitive, had arisen.

It was noted that nearly all the pueblos encountered throughout the Salado valley were situated, not near the river, as would seem more likely by reason of the convenience of such a location to stone, cottonwood timber, rushes, osiers, and other river products, but nearer the ends of the canals, where the slope of the land prevented further irrigation without the necessity of overcoming obstacles beyond the skill of such a people. In each of these cases, with but a single exception, it was observed that the tracts lying between the towns and the river were devoid of vestiges of previous pueblo set-



tlement, but, as indicated by the ramifications of the lesser canals, bore evidence of having been under cultivation.

The location of the towns usually at the farthest possible distance from the river would of itself seem to demonstrate the independence of their builders toward the source of water supply and deposits of raw material. Again, countless bowlders or cobbles were unearthed at each of the pueblos excavated, which clearly exhibited faults in chipping or flaking, and had apparently been rejected as unfit for use. Had the natives been without ready means of transportation, this rough or primary chipping of the stones would most probably have been done at or near the river rather than at the places where they were to be used, ten or twelve miles away, to which point they must necessarily be conveyed by hand.

The great distance to which these ancient canals were extended in order to utilize all the available land through which their waters coursed, the depth which they were dug, and the care taken to prevent waste by seepage, are not the only evidences of the indomitable energy of these ancient agriculturists. At the group of ruins near the Mormon settlement of Mesa City, eastward from Tempe, in Maricopa county, remains of an extensive irrigation system may be seen. Here, more than at any other point in the valley, is demonstrated the degree of skill attained. In the original excavation of the canal referred to a hill of indurated tuff was encountered, beyond which a large tract of fertile land lies. This knoll or mound of concrete was partly encircled by the irrigating ditch in order to preserve the proper incline of the canal bed, and to accomplish this it was necessary to excavate through this indurated deposit with implements of stone, a work necessarily attended with inconceivable difficulty and requiring a great length of time.

Several years ago, when the Mormons first settled at Mesa City and began the irrigation and cultivation of the fertile plain about them, they utilized this ancient canal bed for a considerable distance, including that portion encircling the knoll of volcanic tuff mentioned. The writer has been informed by one of the founders of this settlement and builders of the Mesa canal, which is nine miles in length, that the saving to them by using the ancient canal was from \$20,000 to \$25,000. To use the words of my informant: "The old canal was utilized for fully three miles to great advantage, and from one to two miles with but little benefit." In other words, one-half the modern canal occupies the ancient bed.

A number of writers, mainly in the public press, have given expression to opinion in regard to irrigation in the Salado valley by means of water stored in catchment-basins or *represas*, constructed on the various mountain slopes, in addition to irrigation by the canal system. Great stress has been laid upon this supposed irrigation by means of reservoirs in order to give color to the theory, entertained by some, of a prehistoric population in the Salado valley much more vast than possibly could have existed. Had this means of storage of rainwater for irrigation been practiced by the natives of a region so bountifully supplied with water as the Salado valley, the fact that a teeming population dwelt upon and cultivated the lands within its limits would be undeniable; but this cannot be proved to be the case, although a very large population, as Indian populations go, doubtless did occupy the greater portion of the lower valleys of both the Salado and Gila, as is shown by the extensive irrigation operations once engaged in.

Reservoirs at the mouths of mountain washes for holding in reserve rainwater for the irrigation of the lands which, on account of their elevation, could not be redeemed by the canals, are not found in the valley of the Salado. While most of the valley lands were once covered by a network of irrigating ditches, yet there were tracts capable of redemption over which it appears water was never conducted, and which could have been reclaimed by merely extending the canals, before *represas* were resorted to for irrigating the inferior land about the mountain bases.

Receptacles for the storage of rainwater occur in this region, their remains being found in many parts of the area of the lower Gila drainage, but it is safe to say that they were not constructed because of a lack of sufficient land irrigable by canals, as the low, level tracts in both the Salado and Gila valleys showing no evidence of former tillage will testify. The population of an agricultural tribe cannot well be estimated by the extent of its habitat, particularly in the arid region, but by the amount of land actually cultivated. For instance, the Zuni reserve embraces a tract over thirty miles in length, and while a large portion of it is capable of redemption and cultivation by the present water-supply, only a comparatively small quantity is tilled. Were the population of this tribe estimated by the area which embraces the scattering patches of cultivated land from Nutria to Ojo Caliente, it would reach many thousands, whereas it is but 1,600. It would appear,

therefore, that the number of inhabitants of the now dead pueblos of this region has been figured on an erroneous basis.

It seems reasonable to presume that in an arid territory like our Southwest, where so many of the streams are intermittent, the valleys of the larger streams were first occupied, and, as the population increased, the lands drained by their lesser affluents were next settled upon. As the pueblos of the Gila, as shown by their ruins, were generally larger than those of the Salado or Verde, and the irrigating canals of the former more extensive than those of its tributaries, it is not improbable that these hillside reservoirs or catchment-basins were built previously to the construction of the irrigation ditches, at a time when the population was small. Should this prove to be the case, the occurrence of these hillside reservoirs may be accounted for, since their construction might be undertaken with much less expenditure of labor and skill than the building of an irrigation canal would entail, and at the same time the wants of a small population would be supplied.

In tracing the routes once pursued by many of the canals, great depressions—the sites of ancient reservoirs—are observable. The remains of one of these reservoirs, nearly a mile long by about half a mile wide, occur on the open plain at the terminus of one of the main canals that formed the source of water-supply of Los Muertos, and about three miles southwest therefrom. It is possible that this great depression was, in part at least, a natural sink, deepened by artificial means to serve more fully the purposes of a storage basin of surplus waters from the Los Muertos irrigating system. Every cluster of communal structures in Los Muertos was supplied with a reservoir on a smaller scale than the one just mentioned, a single canal forming both its inlet and outlet. Sometimes a lesser communal dwelling shared with a neighboring structure in the water supply from a single storage basin.

Doubtless the largest reservoir within the limits of Los Muertos was that lying directly west of the ruined communal dwelling designated XIV and extending almost to its walls. A trench run through the lesser diameter of this reservoir showed its original depth to have been about fifteen feet. This artificial basin was elliptical, measured about 200 feet in length by fully 100 feet in width, and, like the canals, had apparently been tamped and burned. The bed and sides of this reservoir were covered by a thick stratum of silt.

The existence of the remains of so many extensive irrigation

works scarring the broad, level valley of the Salado seems sufficient to prove the contemporaneous occupancy of the pueblos formerly within its limits, for had a village been built and for some reason abandoned by one community, it would scarcely be in keeping with the Indian's idea of economy for subsequent settlers not to utilize the enormous labor already expended in gathering building material and digging ditches and reservoirs. While the population of these pueblo settlements was undoubtedly large, it would be unreasonable to estimate the number of inhabitants of the dozen distinct ancient pueblo settlements formerly in the valley of the Rio Salado at from 200,000 to 300,000. This, however, has been done.

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THE CITIZENSHIP PRIZES.—Since the formal announcement of these was made in the last number of the ANTHROPOLOGIST one of the prizes has been increased and the limiting conditions have been extended.

There are now offered a first prize of \$150 and a second of \$75, to be awarded to the best two statements of the elements that go to make the most useful citizen of the United States, regardless of occupation. These prizes are open to competitors of all countries.

Each essay should be type-written or printed, should not exceed 3,000 words, and be submitted by November 1, 1893. The essays will become the property of the Anthropological Society of Washington, and may be published in the AMERICAN ANTHROPOLOGIST (with due credit to authors) at the option of the Board of Managers.

Each essay should bear a pseudonym or number and should be accompanied by a sealed envelope bearing the same pseudonym or number, and containing the name and address of the competitor; and the competitors' identity shall not in any way be made known to the examiners in accordance with whose findings the awards shall be made. There shall be five examiners, of whom at least one and not more than two shall be members of the Society.

It is suggested that the subject be treated scientifically, and considered from the standpoints of general anthropology, personal characteristics and habits, and of ethics.

Correspondence should be addressed to Mr. WESTON FLINT, 1101 K Street N. W., Washington, D. C.

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# TRAILS, ROCK FEATURES AND HOMESTEADING IN THE GILA BEND AREA

A Report on the State Route 85  
Gila Bend To Buckeye  
Archaeological Project

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*Untitled mural by Emil Pedro for the exhibit He'kugam V:og,  
Huhugam Heritage Center, Gila River Indian Community.*

*Cover:* Ryan Stone, archaeologist for the Cultural Resource Management Program, Gila River Indian Community, recording a trail in the Maricopa Mountains near State Route 85.

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**TRAILS RESEARCH IN THE GILA BEND AREA**

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J. Andrew Darling and B. Sunday Eiselt

**INTRODUCTION**

Human beings travel to survive. They travel for food, to visit relatives, to trade, or to make war. Trails are the physical manifestation of routine travel. In recent years, projects such as Route 66, the *Camino Real*, and the Spanish or Santa Fe Trails have memorialized historic routes of travel, which shaped a developing nation. But, what was Native American infrastructure like before the arrival of Euro-Americans?

*He'kugam Vo:g* is a Pima phrase meaning Ancient Trail. The arid southwest provides us with a unique natural landscape where trail segments, some as old as 10,000 years, are still visible on the desert surface. In connection with data recovery efforts sponsored by the Arizona Department of Transportation (ADOT), the Cultural Resource Management Program of the Gila River Indian Community examined a 30 percent sample of the 47 sites along SR 85 near Gila Bend exhibiting one or more trail segments.

Viewing trails as Native infrastructure is a theme that appeals to concepts of how communities function as collections of interconnecting ideological and material systems. Knowledge of trails—not just of where people were but how they got there—provides an important dimension for understanding the location and distribution of sacred sites and settlements. It also provides insights into the regular flow of resources (energy and information) among traditional communities. These data can be used to structure new research questions about the historic and prehistoric past.

Ultimately, trail studies will provide a greater understanding of how human beings traveled in the past. This includes the variety of journeys undertaken such as routine trips to gather resources, trips between settlements, and ceremonial journeys to gather special resources such as salt or shells, to worship, or to make war.

**PROCESSUAL ASPECTS OF TRAILS**

Trails are the product of human beings repeatedly traveling across preexisting game trails, natural corridors between resource areas (such as water sources), or along purposefully constructed or established routes of travel. Many trails are created through repeated usage. Other trails are designed and constructed. In some instances trails exhibit characteristics of casual clearing of stones and debris by travelers and intentional or formalized engineering. Geographic and environmental considerations also determine the location, appearance, and duration of trails.

Trails serve as a guide or facility for structuring the movement of people, baggage, and livestock from one location to another. As such they record the movement of individuals across geographic space. Most trails were used repeatedly for long periods of time by differing ethnic groups, and for a variety of functions requiring mobility. These functions might include seasonal mobility, trade, resource acquisition, religious observances, warfare, or other unrelated social obligations.



Becker and Altschul (2003:33–38) present a number of themes that outline certain basic processual aspects of trails research. These include Settlement Pattern and Trail Use, Trade, Territorial Boundaries, and Trail Systems. Each of these themes considers the ways in which economic, sociopolitical, and religious behavior may relate to the structure and use of trail systems over time. The most basic fact underlying all of these behaviors is that mobility or travel is **not** random. Repeated actions in the social and natural landscape produce trails, which remain visible on stable desert ground surfaces. Trail networks evolve in tandem with other aspects of a society's infrastructure or the ways that information, material culture, and people circulate and interact.

## TYPOLOGICAL ASPECTS OF TRAILS

Classification schemes serve to describe and organize information about trails. These can be used to establish relationships between individual trail segments, interconnected trail networks, individual settlements, and settlement systems. Trail typologies normally organize specific trail types in terms of their function, chronology or history, and/or physical characteristics.

Stein (1994:37) provides a typology for historic trails as a guide for managing historic properties. She identifies nine different trail types:

1. Native American Trails
2. Spanish Period Trails and Roads
3. Mexican Period Trails and Roads
4. U.S. Government Trails and Roads of the Early American Period
5. Mormon Trails and Roads
6. Stagecoach, Freight, and Toll Roads
7. Stock Trails
8. Early Automotive Routes
9. Other Historic Trails and Transportation Corridors

Stein's classification scheme favors chronology and function over physical properties, although she does associate certain trail characteristics with specific transport facilities, such as foot traffic, livestock, wagons or automobiles. Stein's typology is useful for identifying and organizing information on trails in historical documents. As she notes, many historically documented trails no longer exist and therefore cannot be considered eligible for the National Register of Historic Places.<sup>3</sup>

Other typologies also serve to describe the physical characteristics and putative function of prehistoric or historic trails as they occur in the field. Outmoded classification schemes utilize familiar categories including hunting trail, war path, and trade trail (Jones 1967:5). Becker and Altschul (2003:28–30) provide a functional scheme based on three trail types—trackways, minor trails, and major trails. We will present a classification scheme that is similar but focuses on the mode of travel (as a human behavior) rather than the trail itself. As noted by Becker and Altschul, among others, the disadvantage of any trail typology is that any one trail could have carried many different kinds of traffic. By focusing on travel in relation to general theories of human mobility, the process becomes one of human decision-making with reference to which trails would best serve the purpose of the trip. This approach acknowledges that certain trails may be used exclusively for certain kinds of travel whereas most trails are multi-functional and the features and artifacts found along them represent a wide range of activities.

<sup>3</sup>The physical integrity of a trail is critical for evaluation of a trail's eligibility status including its location, associations, and other materials.

Network analysis offers some compelling avenues for research (see for example Helbing, Keltsch and Molnár 1997, see also Becker and Altschul 2003:38) and incorporates human decision making in models of trail evolution. These studies suggest that trail networks initiate simply as the most direct route between two destinations. As preferred routes of travel become part of the knowledge base of pedestrians they will make small detours to access preferred routes. In time mature trail networks may acquire a configuration that reflects a compromise between constraints of preference (reflecting social and functional choices by travelers) and spatial efficiency. Furthermore, what underlies effective modeling of trail network evolution is the realization that individual travelers receive and process information (or knowledge) as they travel (see for example Kelly 1995:150; Rockman and Steel 2003). Thus, the act of travel goes beyond the simple act of getting from place to place. While research on trail network evolution is beyond the scope of the current study, the unusual degree of trail preservation along SR 85 may provide an opportunity for research in the future.

### **TRAILS RESEARCH ALONG SR 85**

Trails research was conducted along SR 85 to address two primary research questions:

- 1) What kinds of features and artifacts co-occur with trail sites?
- 2) Where do the trails go?

Native American trails are as much represented by the trail itself as the artifacts and features scattered along it. These commonly include rock cairns/rock piles, trail markers, shrines, hearths, campsites, and linear artifact scatters (Breternitz 1975; Brown and Stone 1982; Harmon and Beyer 1995; Rodgers 1976, Rogers n.d. [notes on file San Diego Museum of Man], 1966; Stone 1986, 1991; Woodall 1995). Woodall (1995:13–14) notes that the most frequently observed feature adjacent to trails were rock clusters. Rock clusters/piles could represent roasting pits, hearths, or trail markers. Rock piles may also represent trail shrines as noted by Treutlein (1949:228); cited in Ezell 1961:78–79). Ezell (1961:79) noted this trait on a San Dieguito shrine identified in the saddle of the Buckeye Hills northeast of Gila Bend and a similar shrine in the saddle of Gila Butte along the Gila River.

The second question addresses the origin and destination of trails in relation to their characteristics including associated artifacts and features. Prehistoric and historic indigenous trails can be classified in terms of the types of travel conducted along them. This includes travel between settlements (Type I), travel from a settlement to a resource area (Type II), and ritualized travel, from a settlement to a particular location for a specific social-ceremonial function (Type III). As discussed above, the relationship of types or modes of travel will be considered in more detail in relation to the archaeological record of trails in the Gila Bend area.

### **TRAILS RESEARCH METHODOLOGY**

Trail research followed two phases:

- I. Background research and review of the trails records of Malcolm Rogers at the San Diego Museum of Man
- II. Field Survey along SR 85.

Background research included extensive use of Malcolm Rogers' survey records, located at the San Diego Museum of Man, to contextualize the historic and prehistoric trail networks maintained by the O'odham (Pima) and Pee Posh (Maricopa) Tribes. These data provide important views of how local trail systems are integrated into extra-local networks of travel. Oral histories, creation stories,

and other accounts further document the manner in which trails are used. Rogers recorded over 6000 sites, ceramic and preceramic, during several field seasons between 1928 and 1960. Regrettably only a small number of reports were produced, none of which provide a synthesis of over 20 volumes of notes resulting from his regional survey and extensive research (McGuire 1982:440).

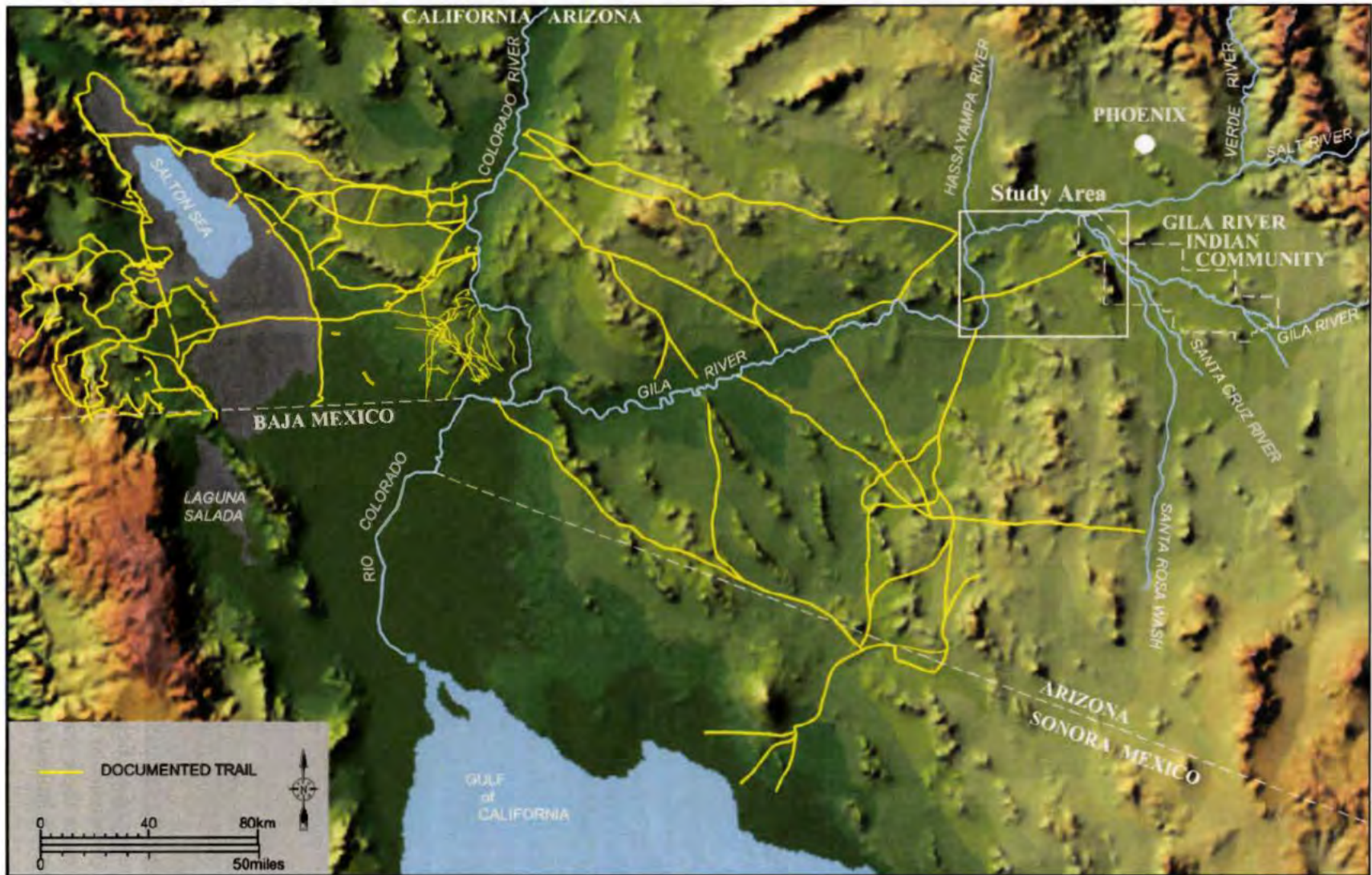
We were particularly interested in records related to Rogers' thorough mapping and recording of trails in southwestern Arizona, since further studies of this important data set would help place the SR-85 trails in a regional context. Combined with the research of Stein (1994), Pendleton (1986), Von Werlhof (1988), and Hayden (1965, 1967, 1972), historical accounts of trail use (e.g. Manje 1971; Sedelmeyer 1955), ethnographies describing trail use (e.g. Bean 1974; Jett 2001; Laird 1976) and finally synthetic studies of trail systems (e.g. Davis 1961; Johnston and Johnston 1957; Sample 1950), a clear picture of trail use and Native American infrastructure emerges which incorporates the Gila Bend and extends throughout the arid Southwest (Figure 12.1).

As part of the ADOT archaeological project along SR 85, Arizona State University collaborated with the Gila River Indian Community, Cultural Resource Management Program, in their on-going Traditional Cultural Properties Research project funded by the Pima-Maricopa Irrigation Project and the National Park Service. The immediate goal was to identify previously recorded trails and map them beyond the existing SR 85 right-of-way. A 30 percent sample of 14 sites out of the 47 sites with trail segments reported by Harmon and Beyer (1994) was selected for visual examination in the field. Selection was based on three priorities designated in the research plan. First, survey was conducted to verify the continuation and integrity of the trail as a long linear archaeological feature on the landscape and to distinguish it from other animal trails or recently created vehicle tracks. Second, sites were selected in strategic locations along major routes of travel connecting the Gila Bend region with other known or suspected historic and prehistoric indigenous routes of travel. Third, trails in the vicinity of the Butterfield Stage Route were examined to determine the relationship between them and this long-standing historic Euro-American road.

Field recording focused on following the trails out of the previously recorded site boundaries away from the SR 85 right-of-way in an easterly or westerly direction, or roughly perpendicular to the north-south trending highway. In general, no trails along the bajada of the Gila Bend Valley were shown to travel north-south (a few short north-south tracks were used by cattle). Field crews consisted of 2–4 persons and trail locations were mapped using a GPS unit. Approximately three weeks were spent documenting trails in the field. Intact trail segments could exceed a kilometer in length and waypoints were taken regularly at 50-meter intervals or less when specific features along the trail were identified. Field notes were taken at each waypoint describing the character of the trail, artifacts or features, and where possible, a width measurement was made. Digital photography was used to record specific details of the trails and associated features.

## TRAIL IDENTIFICATION

Trails consist of segments, which in turn are composed of one or more tracks or linear artifact scatters. Tracks are the walking surface or the physical representation of the trail on the ground. A track normally consists of a cleared linear area approximately 40–60 centimeters wide with a central walking surface that may be compacted slightly, lowered a few centimeters below ground surface with occasional slight lateral berms or stone-lining marking the edge of the track. In many cases well-used trails may be represented by more than one parallel track. At other times trails may only appear as linear vegetation changes resulting from the accumulation of moisture in the worn walking



**Figure 12.1. Map showing indigenous trails recorded by Malcolm Rodgers.**

surface. Tracks occasionally became erosion channels and were downcut sometimes as much as 10–20 cm. The occurrence of multiple tracks is not considered evidence of braiding or branching as the individual parallel tracks of prehistoric trails do not tend to cross back and forth. Instead, these may represent varying chronological stages of a continuously used trail. Each trail segment was of varying length and characteristics and was numbered in the order of its discovery. Segments recorded in the field were mapped and associated with each other to form trails based on field observations and their location.

Trail recording generally focused on attributes useful for testing the validity of a prehistoric or historic trail observed in the field. These included the following (see also Becker and Altschul 2003:46–47 for a similar series of attributes):

1. width, variability in width
2. depth of trail
3. presence of parallel trails or multiple tracks
4. presence or absence of desert pavement
5. compaction in the trail
6. presence of a berm
7. rock border
8. vegetation patterns
9. branching or fading (particularly at the endpoints of a trail segment)
10. location on the geomorphic landscape
11. use or reuse by animals or humans

Trail integrity varied along its length and was subject to natural or geomorphic processes that would greatly modify its appearance including erosion, cross-cutting animal tracks and vegetation cover. Contextual elements include associated features, artifacts, and geomorphology, which were critical for verifying that a trail was generated by humans rather than other domestic or wild animals. In certain cases the only evidence for a trail segment consisted of a linear artifact scatter, which connected visible trail segments or tracks on the ground surface. In these instances, the track or pathway had been entirely removed by erosion or other disturbance.

Waters (this volume) has demonstrated the association of prehistoric trail segments with relic or older geomorphic surfaces. Archaeological survey and geomorphic mapping along the roadway corridor reveals a distinctive pattern of where trails appear and where they do not. Stable Pleistocene alluvial fans are the most likely location for encountering trails and nearly all of them in the project area exhibit probable trails (Figure 12.2). Fragile desert pavement surfaces preserve the effects of regular foot traffic along a trail (Hayden 1965). Artifacts or other features placed along these trails also will not be removed by subsequent erosion.

Historic roads and animal trails at times can be confused with prehistoric trails. In cases where suspected trails cross active Holocene alluvial surfaces and archaeological features or artifacts were not present, it often resulted that these trails led to a modern cattle tank or corral facility for domestic animals. Becker and Altschul (2003:17–18) point out that cattle in particular tend to take a longer, more circuitous route avoiding steep slopes while ascending and a more direct route while descending. They go on to suggest that unlike cattle and burros, it may be more efficient energetically for humans to ascend steep slopes directly, even to the point where the grade requires the cutting of artificial steps (2003:19–20). “Ascent Trails” are a common form of trail often seen rising perpendicular to the slope of small buttes or similar isolated physiographic desert features. In many cases these trails lead to an exposed bedrock promontory that provides a commanding view serving as a lookout and/or rock art site.

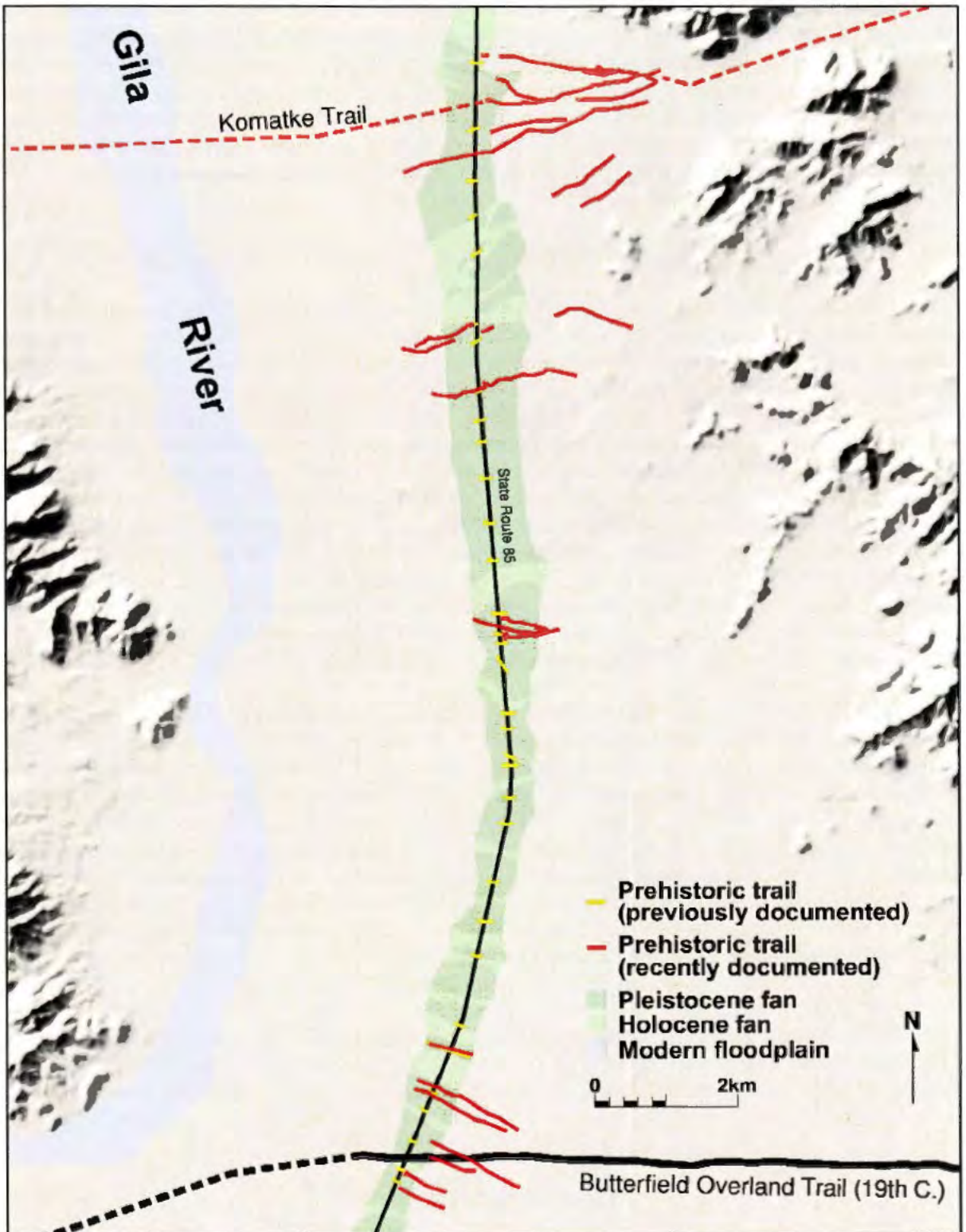


Figure 12.2. Map showing study area trails in relation to geomorphic landforms.

Historic or modern roads also tend to obscure prehistoric trails or in some instances mimic them. However, like animal trails many roads tended to cross-cut both recent and older geomorphic surfaces. Even in the case of the Butterfield stage route, which has been out of use for more than 100 years, the road follows a direct line across both recent arroyo bottoms and older terraces, unlike older indigenous trails found on relic Pleistocene surfaces. It was also observed that roads and trails might coincide in the same location. This is not surprising since the preferred route of travel in the past may continue to be preferred today. In these instances, trails might be found paralleling historic or modern roads and two tracks.

## RESULTS OF TRAIL SURVEY ALONG SR 85

A total of 39 trail segments representing 30.3 km of prehistoric and historic indigenous trail directly associated with sites along SR-85 were recorded as part of data recovery. Most trail segments could be linked with other segments to form what were identified as trails. In many cases these linkages were assumed and were not visible on the ground, whereas other direct connections between segments were observed as trail branching. An additional 9.08 km of linear distance may be added to the total distance covered by trail segments to account for these linkages for a total of 39.83 km of trail observed within the Gila Bend portion of the Gila River Valley. Finally, the Oyadaibuic-Komatke Trail is a prehistoric and historical period trail which extends from east of the Estrella Mountains to as far as the painted rocks area beyond the Gila bend, passing through passes in the Estrella Mountains, the Maricopa Mountains east of SR-85, and the Gila Bend Mountains, immediately west of SR-85 across the Gila River. Portions of this trail were observed in each location. Adding the 3.7 km of this trail observed in the Estrellas as well as the 35.41 km of intervening sections of the trail that must have existed in the now eroded valley bottoms yields a grand total of 78.94 km (49 mi) of indigenous trail considered as part of this study.

Trail characteristics and features along trails are an important part of this research. Features observed include linear sherd and lithic scatters, trail markers, trail shrines, rock art (petroglyph boulders and panels), stone circles, and pot-rests. The trails themselves can be linear segments or multiple tracks across the desert landscape, which in some cases are constructed or are the byproduct of constant use for hundreds of years. Other trails may only be seen as long linear scatters of artifacts. A characteristic of many trails in the study area is the prevalence of white quartz or feldspar nodules made into trail markers or lining the trail. Some scholars have remarked on the sacred significance of quartz (Ezzo and Altschul 1993; Rogers 1976; and Stone 1991). However, O'odham (Pima) tradition also records that quartz served to illuminate trails on moonlit nights or when torches were used for night-time travel. An historical account describes one trail as a "river of torches" due to the prevalence of burned-out torches observed along its length (Sedelmayr 1955).

Trail segments appeared as sets representing individual trails or groups of trails crossing the Gila Bend Valley and beyond (Figure 12.3). To describe each individual trail segment would go beyond the scope of this chapter. Each of the eight groups or segment sets will be described below with respect to its particular characteristics. These will be summarized in a discussion that follows.

## TRAIL SEGMENT SETS

### Segment Set 1

Segment Set 1 consisted of 11 trail segments originating at sites AZ T:14:92-93 in the SR-85 right-of-way. Selected segments were identified and mapped to establish the pattern of trails crossing

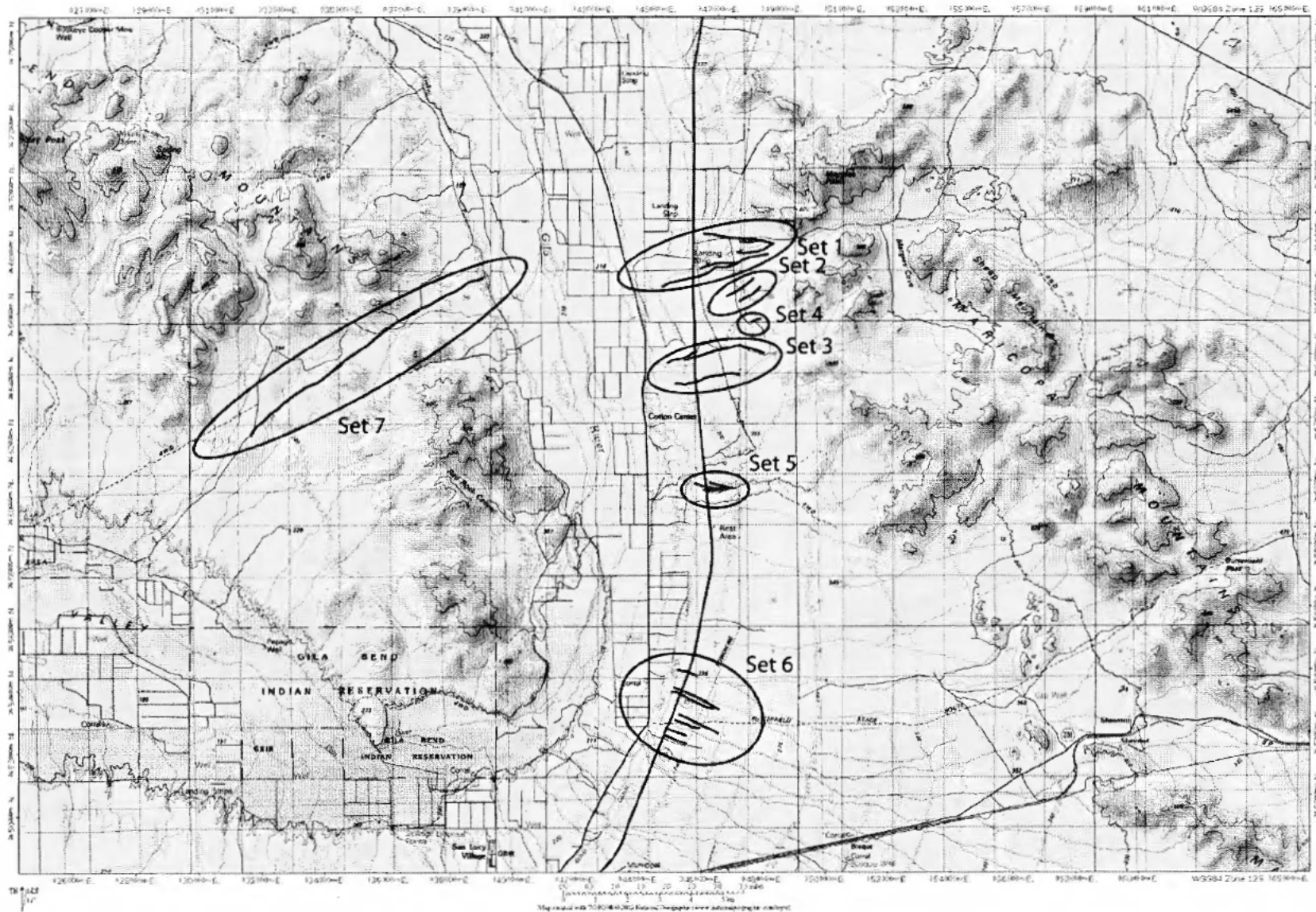


Figure 12.3. Map showing recorded trail segment sets 1 to 7.



this area. Trails were shown to cross the freeway in an east/northeast to west/southwest direction oriented to a pass in the Maricopa Mountains (Figure 12.4). As will be discussed below this complex of trails represents a portion of the Oyadaibuic-Komatke Trail with branching or fanning out towards the west from the pass to access prehistoric and historic sites in the Gila Bend Valley.

Trail features in Segment Set 1 were numerous and included extensive linear artifact scatters consisting of mixed lithic and ceramic artifacts along visible trail segments. Ceramics included primarily non-diagnostic plain or buff pottery, although a minor amount of red-slipped wares and red-on-buff sherds were observed. In all cases, sherds appeared in concentrations many apparently representing potbreaks or drops. Pottery fragments were exclusively from jars and no obvious bowl sherds were observed.

Lithics along the trail consisted of mainly tested river cobbles transported up from the valley bottoms or alluvial terraces. Many of these fall into the category of primary flake tools as described by Haury (1976) for the Hohokam but may pertain to other periods. Quartz and feldspar scatter and shatter along the trail was common and trail segments passed a number of natural outcrops. Even though this material did occur naturally, its occurrence along visible trail segments and in formal features beside the trails seemed to indicate intentional placement.

An unusual shell artifact consisted of an unmodified *glycymeris* shell that was found approximately one meter off a well-defined track (Figure 12.5).

Formal features along Segment Set 1 included rock piles or concentrations, rock circles (Figure 12.6), small cairn like features, and trail markers. Sherd and quartz concentrations tended to associate with these features, which occasionally occurred at trail branches.

Trail segments were of variable length and integrity on the ground. However, the majority of trails were visible as tracks compacted 1–3 centimeters below the surrounding desert pavement (Figure 12.7). Trail width ranged from 39.1–54.3 cm with occasional berms along the side of the trail due to heavy use. Parallel tracks were common, although trails may diminish to differential vegetation growth in tracks and linear artifact scatter only. Visible tracks were confined to an elevation range of 887.2–960.8 feet above sea level (ft asl) characteristic of the Pleistocene terrace/bajada environment where trails are most visible.

The most overwhelming pattern exhibited by Segment Set 1 was its obvious convergence on the pass in the Maricopa Mountains to the east. All trail branching was to the west as the trails leaving the pass fan out to settlements with locations below the interface of the bajadas and lower floodplain. The convergence pattern approximates a 50 percent reduction in visible trails or a decrease from five or six trails at the SR-85 right-of-way to approximately three trails in closest proximity to the pass. Unfortunately, this pattern could not be carried out further below the bajada where the active floodplain has removed any signs of prehistoric trails. Likewise, erosion off the flanks of the Maricopa Mountains has buried the trails as they proceed into the pass.

## Segment Set 2

Segment Set 2 consisted of only two probable trails (see Figure 12.4). With similar configuration as those trails in Segment Set 1, these trails also likely represent branches off the Oyadaibuic-Komatke Trail as it proceed to the west from the Maricopa Mountain Pass. Although rather distantly offset to the east, these two trails may have at one time passed through site AZ T:14:90 located at the SR 85 right-of-way.

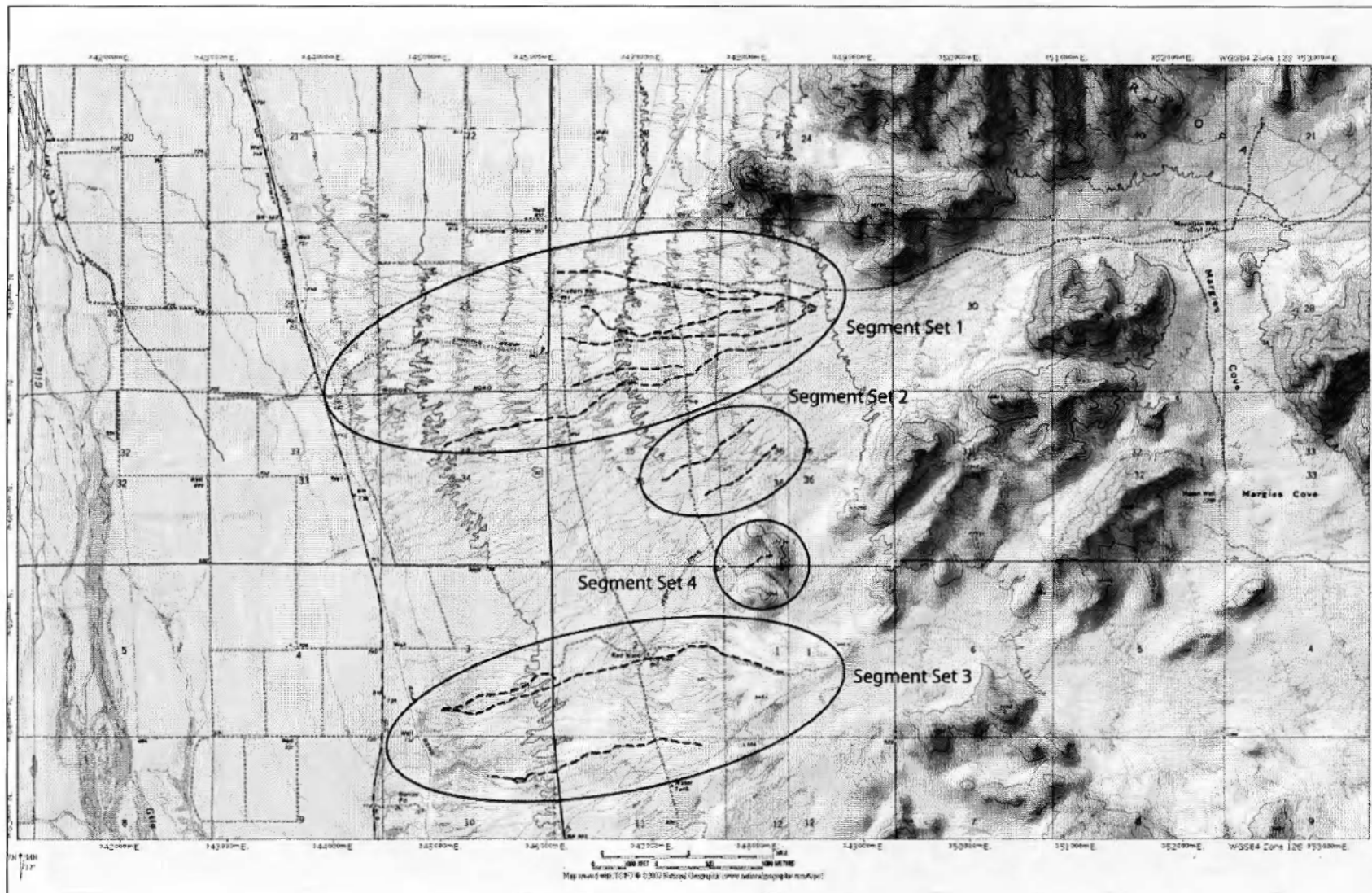


Figure 12.4. Map showing recorded trail segment sets 1 to 4.



Figure 12.5. *Glycymeris* shell associated with trail.

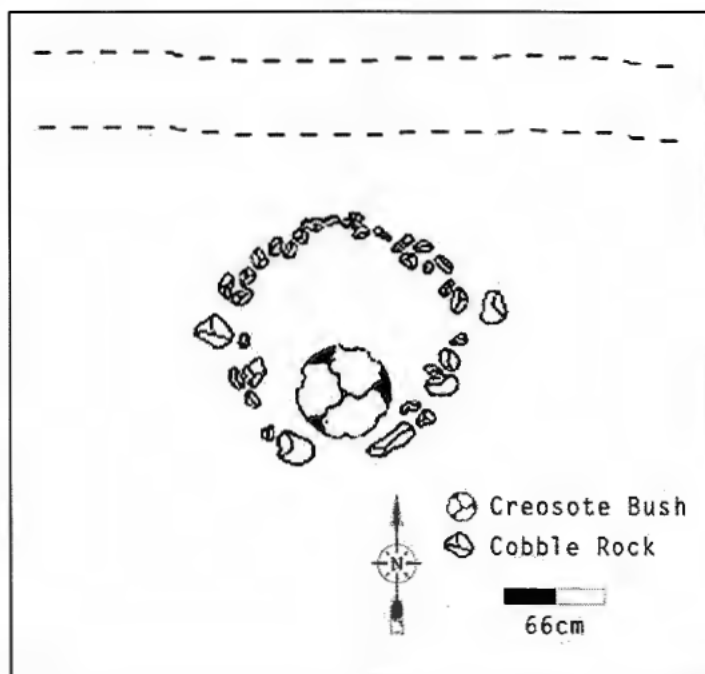


Figure 12.6. Trail TL1-2, Feature 1, rock ring.



**Figure 12.7.** Two photographs showing branching and parallel tracks as part of a typical trail.

Artifact remains along the trail consisted primarily of non-diagnostic buff, plain, and redware body sherds concentrated into pot drops. Some lithics occur consisting of tested rhyolite river cobbles but quartz and feldspar is less common. Trail characteristics include parallel tracks and well-defined trail segments averaging 35.4 cm in width. Elevation of the trails ranged from 937 to 946 ft. asl. The southernmost trail is obscured in part by recent cattle traffic to access low spots where grass was observed. No formal features or rock concentrations were observed along these trail segments.

### Segment Set 3

Segment Set 3 consisted of six trail segments representing two trails. These segments cross SR-85 and appear to associate with sites AZ T:14:86 and AZ T:14:88 located in the right-of-way. Located south of Sets 1 and 2, Segment Set 3 follows a similar east/northeast to west/southwest orientation and may represent a subsidiary route into the Maricopa Mountain pass that passes through a small side canyon identified as Margies Cove (see Figure 12.4).

The northern of the two trails is most similar to the trails described in Segment Sets 1 and 2 consisting of parallel tracks, abundant sherd and lithic scatters, and up to ten formal rock features including rock rings, rock concentrations, and possible trail markers. One petroglyph boulder, as well as chipping stations utilizing locally occurring basalt-rhyolite, was noted as the trail passes to the east toward the base of the mountains. Trail width ranged from 33 to 35 cm, and trail segments were clearly visible as tracks with well defined walking surfaces. Elevation of this trail ranged from 761–926 ft. asl.

The southern trail in this segment set was distinctive. Unlike the trail to the north, no ceramic artifacts were encountered, although lithic remains were abundant. A total of nine petroglyph boulders were observed with figures consisting mainly of abstract concentric circles (Figure 12.8). Most of the lithics were found in three chipping stations located either side of the trail in which all stages of lithic reduction were represented, utilizing naturally occurring basalt or other volcanics. Four additional features consisting of rock concentrations were noted. Quartz is also less abundant along this trail but appears in association with rock features. As with previous trails, parallel tracks were observed with well defined walking surfaces and edges. Average elevation of this trail was 812.8 ft. asl and trail width averaged 33.4 cm.

### Segment Set 4

Trail Segment Set 4 represents a single "ascent" trail located on the west side of a small butte located between Trail Segment Sets 1–2 and 3 (see Figure 12.4). This trail was observed from a distance but on closer inspection appears to conform to a naturally occurring vein of granite or gneiss. While there is some doubt as to the validity of this trail, a width measurement of 30 cm was obtained. Elevation change ranged from 850 ft. asl at the trail's base to 1018 ft. asl at the summit. Like other ascent trails in the region, this trail approaches the slope at a perpendicular angle and ascends directly without meandering. No artifacts were observed along the trail or on the summit, although a naturally occurring quartz outcrop is present. Two features, a rock concentration and a circular stone structure were observed. The circular feature built of granite boulders is approximately one meter in diameter and about 15 meters from the possible ascent trail (Figure 12.9). Similar features have been observed in the Gila River Indian Community and are described as possible lookouts.

### Segment Set 5

Trail Segment Set 5 consists of five trail segments making up three converging trails (Figure 12.10). These trails are oriented east–west, crossing SR 85 and are associated with sites AZ T:14:79-80.



**Figure 12.8. Boulder petroglyph associated with trail.**

Average elevation ranges from 750–780 ft asl and the individual tracks are highly variable in their integrity and visibility. In general, trail width ranged from 29–35 cm. Ceramic artifacts were non-diagnostic and were concentrated in only a few potdrops. Lithic scatter was more common throughout, although three chipping stations exhibiting all stages of reduction were found along the eastern portion of the trail going towards the mountains. Tested river cobbles appear to have been more common along the western portion of the trails. Four features included rock piles or concentrations and three petroglyph boulders were observed.

### **Segment Set 6**

Segment Set 6 consists of nine trail segments forming eight parallel trails oriented east/southeast to west/northwest (Figure 12.11). Observation of these trails was conducted to establish their relationship with the Butterfield Stage Route, which passes on an east-west trajectory across these clearly earlier trails. These trails are associated with sites recorded along SR 85 including AZ T:14:28, AZ T:14:61-62, AZ T:14:64 and AZ Z:2:54-55.

These trails are very uniform in their characteristics. Average elevation ranges from 770–786 ft asl and average width ranges 35–45.7 cm. Artifact assemblage is dominated by ceramics, while lithics are few and consist of isolated flaked river cobbles primarily. Two worked fragments of *glycymeris* shell were encountered. Quartz or feldspar is largely absent. There are no features present although artifact distribution is continuous and follows the clearly visible trails. Parallel tracks were observed sporadically.



**Figure 12.9. Circular feature associated with ascent trail.**

Two of the trails were shown to cross the Butterfield stage route which cuts through the preexisting indigenous trail visible on either side of the road. The stage route is a visible cut up to 30 cm or more beneath ground surface with visible berms to either side. At each location where the trails crossed the stage line, historic solder seam, and hole-in-top cans were observed.

### **Segment Set 7**

Segment Set 7 consists of a continuation of the Oyadaibuic-Komatke Trail through a pass in the Gila Bend Mountains into the painted rocks area (Figure 12.12). Actual visible segments were short, located at either end of the segment set with a 6 km segment assumed to connect the two. The trail is oriented northeast-southwest. The northwest portion rises out of the Gila Bend Valley onto the narrow bajada and enters the pass. A later wagon road or two-track dating to the early part of the last century partially obscures the trail. Average elevation on the eastern portion of the trail is 750.1 ft asl, whereas on the western end the elevation is 837.6 ft. asl, where the trail has already crossed the uppermost portion of the pass and is descending into the painted rocks area. Average width of the trail, where visible, was 35 cm.

Artifact presence is much less than other trails but consists of non-diagnostic ceramics and lithic scatters. Where the trail originates, in proximity to the Gila River floodplain, a ground stone mano

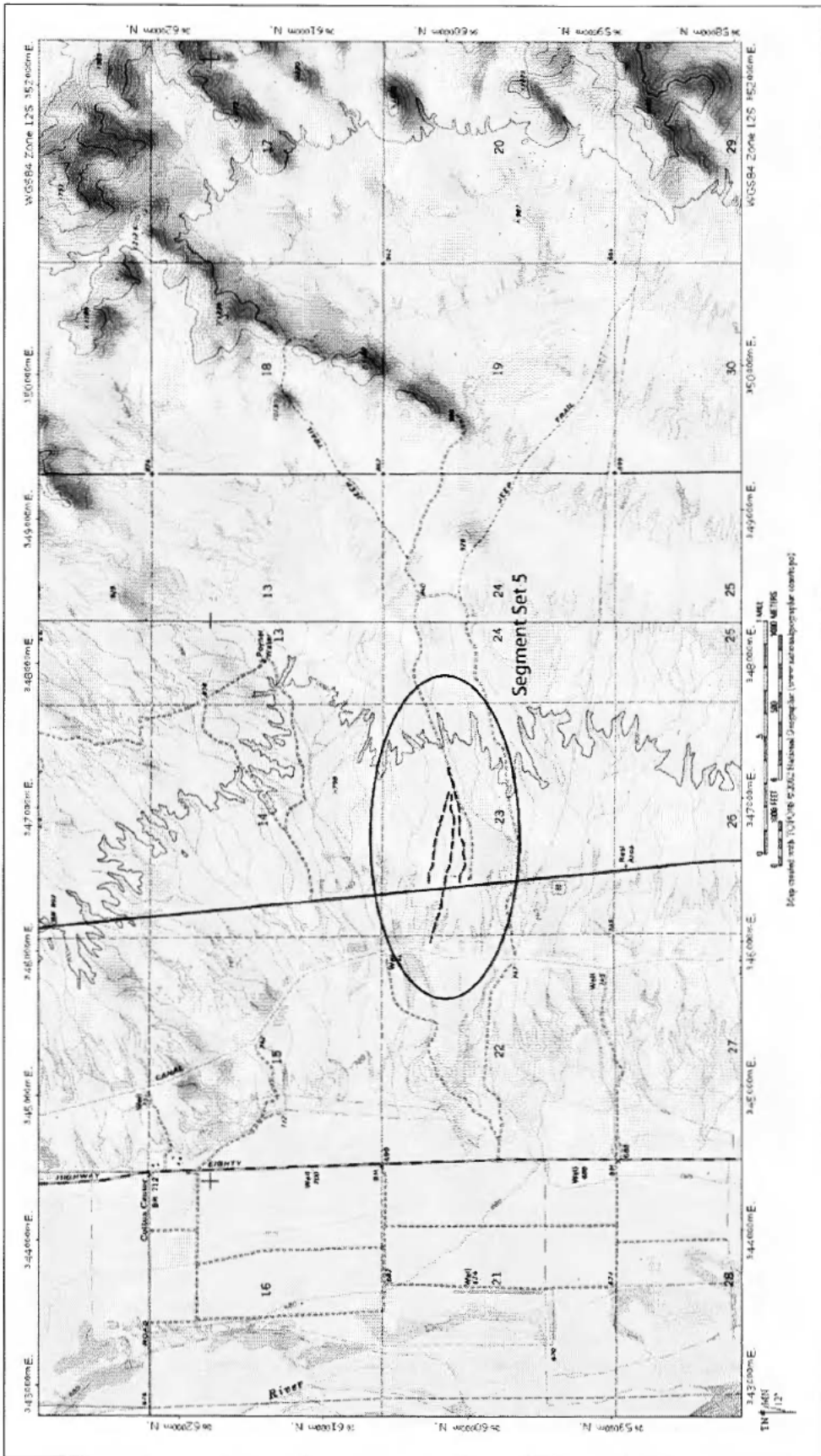


Figure 12.10. Map of trail segment 5.



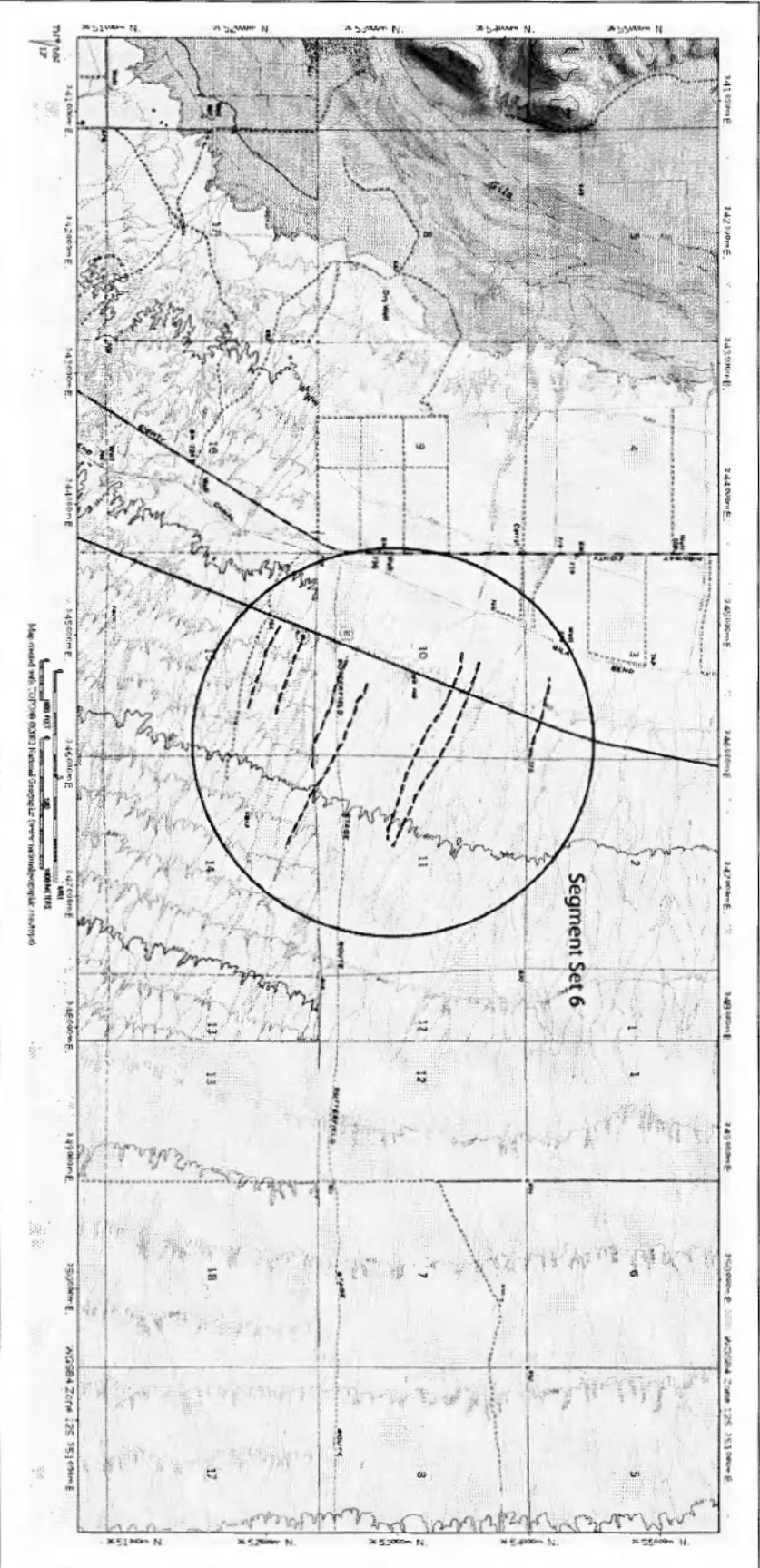


Figure 12.11. Map of trail segment 6.

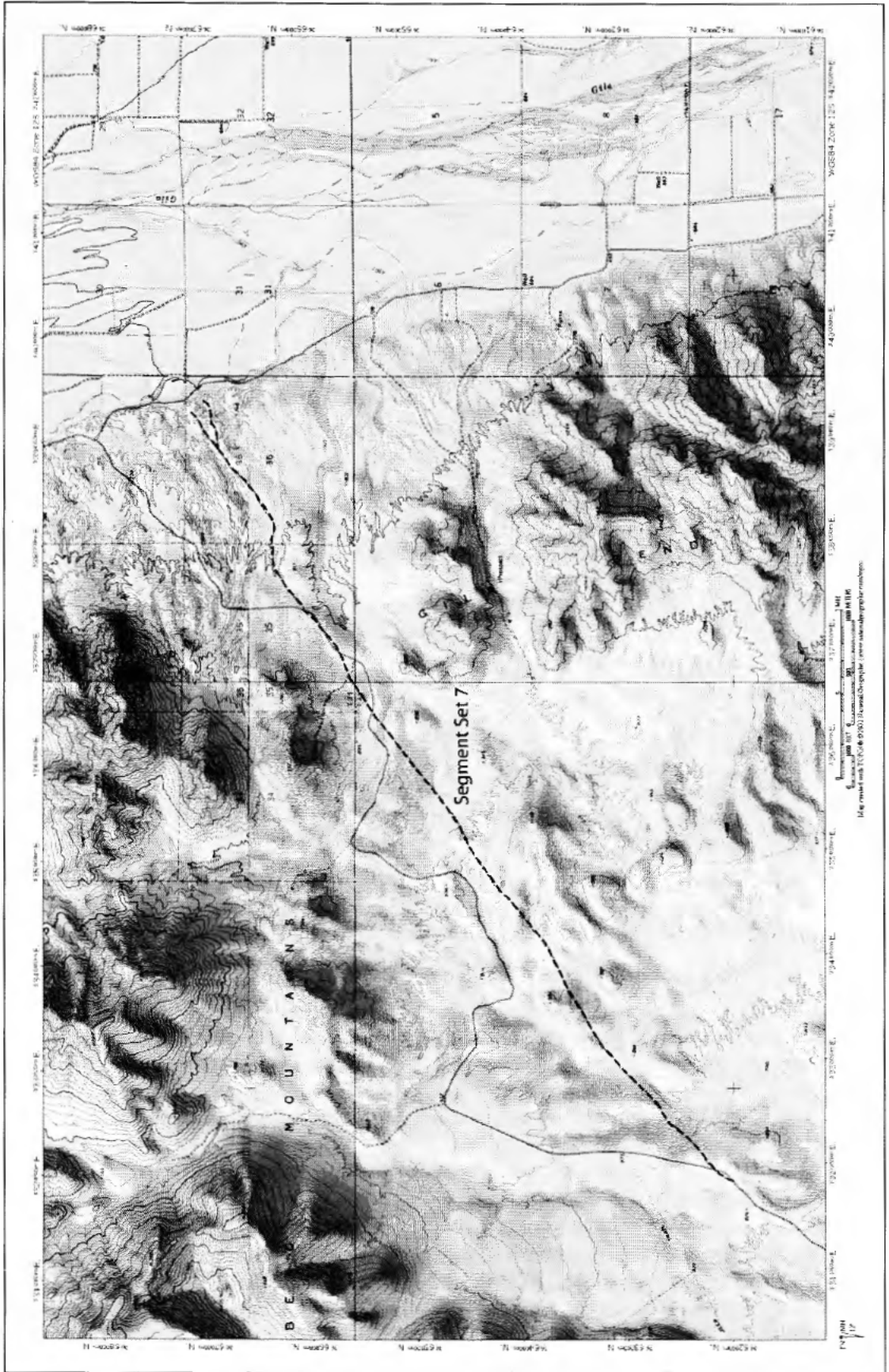


Figure 12.12. Map of trail segment 7.

fragment and red-on-buff ceramics were observed. Further along the trail, lithic artifacts tended to exhibit higher amounts of desert varnish, similar to artifacts found in Colorado or Mojave Desert environments. Formal features were also less common than on the Gila Bend Valley but were more discrete and included two quartz trail markers (Figure 12.13). The westernmost portion of the trail was reminiscent of Colorado Desert trails marked by a clear track with occasional ceramics.

### Segment Set 8

Trail Segment Set 8 is 3.72 km. in length and is the easternmost documented section of the Oyadaibuic-Komatke Trail, which crosses the Estrella Mountains from the Rainbow Valley on the west to the Middle Gila Valley on the east (Figure 12.14). This trail is indicated primarily by a long linear artifact scatter dominated by Hohokam pottery jars of plain, buff, and red-on-buff wares and some lithics. Occasional trail segments were visible but have mainly washed out. When measurable, trail width ranged between 30 and 40 cm. Elevation change was dramatic from the trail's starting point on the west at 1350 ft asl to 2400 ft asl at the summit and a descent to 1835 ft asl at the limit the trail could be followed to the east.

In spite of the ephemeral nature of the trail segments, the artifact scatter clearly links a series of rock art panels or petroglyph sites, cairns (some of them modern), and shrines as well as passing by quartz outcrops which were evidently mined for material scatter along the trails. Probable shrines are large and formal with one shrine located below the trail summit represented by a large natural stone column with preclassic Hohokam cache vessels broken at its base (Figure 12.15). A split in the column also had a small stone shelf placed in it presumably to receive offerings. Rock rings and possible campsites were evident at the base of the Estrella Pass on the western side.

### SUMMARY

Trail survey in connection with SR 85 data recovery in the Gila Bend Valley confirmed the existence and integrity of numerous unusually well preserved trails initially identified by surveys in the highway's right-of-way. The sheer quantity of trails seems attributable to the stability of Pleistocene terraces located on the bajada on the east side of the valley. As was shown through the current survey, it is likely that many more trail segments or individual tracks also may exist than was actually sampled by the earlier survey of SR 85.

The large number of trails on the bajada may also be attributed in part to the pattern by which trails enter from outside the valley into the Gila Bend. As trails emerge from mountain passes, they fan out or branch before descending off the bajada. These branches or secondary trails leave the passes and head toward village settlements scattered along the upper edge of the Gila River floodplain. The distance between trail segments is smallest on the bajada, nearest their branch points from the main trails, resulting in a high density of trail segments near gateways or passes into the next valley. In this way, mountain passes act as nodes or convergence points for numerous trails extending throughout the valley.

This pattern contrasts with Segment Set 6, which crosses the Butterfield Stage Line. In this area the trails exhibit a distinctly different orientation and direction. Trails on the bajada are parallel and show no tendency to converge on a main trail or pass. The pattern of these trails may be attributed to unobstructed travel. In contrast the Stage Line tends to crosscut existing ridges and may be characteristic of travel using domestic animals and wheeled conveyances.



**Figure 12.13. Quartz trail marker.**

Other trails are oriented less to inter-regional travel and seem to access particular bajada resource areas. This may be true of Segment Sets 3 and 5, where trails appear to approach usable lithic raw material sources. The occurrence of petroglyph boulders and fewer ceramics may be indicative of chronological differences or a different set of activities or behaviors associated with these trails. Further in-field analysis of these features is necessary to make these determinations. However, the lower density of artifacts, particularly ceramics, also suggests a lower level of traffic.

Level of traffic seems to be a good deal higher along Segment Sets 1 and 8, which are situated along the Oyadaibuic–Komatke Trail. Here, the regular occurrence of multiple parallel tracks, converging and branching trails, and numerous features suggest higher usage. Artifact abundance is higher and the consistent loss of jars, presumably used as transport vessels, and occasional special items, or raw material, such as shell indicate use over a long period. Furthermore, probable establishment of trail shrines and the use of quartz to mark the trail seem to prevail over evidence of resource extraction along the trail. This further supports the hypothesis that these trails were used for inter-regional travel. Uncertainty and the dangers associated with major thoroughfares most likely elicited different sorts of behaviors from travelers as opposed to individuals who used trails to gather resources.

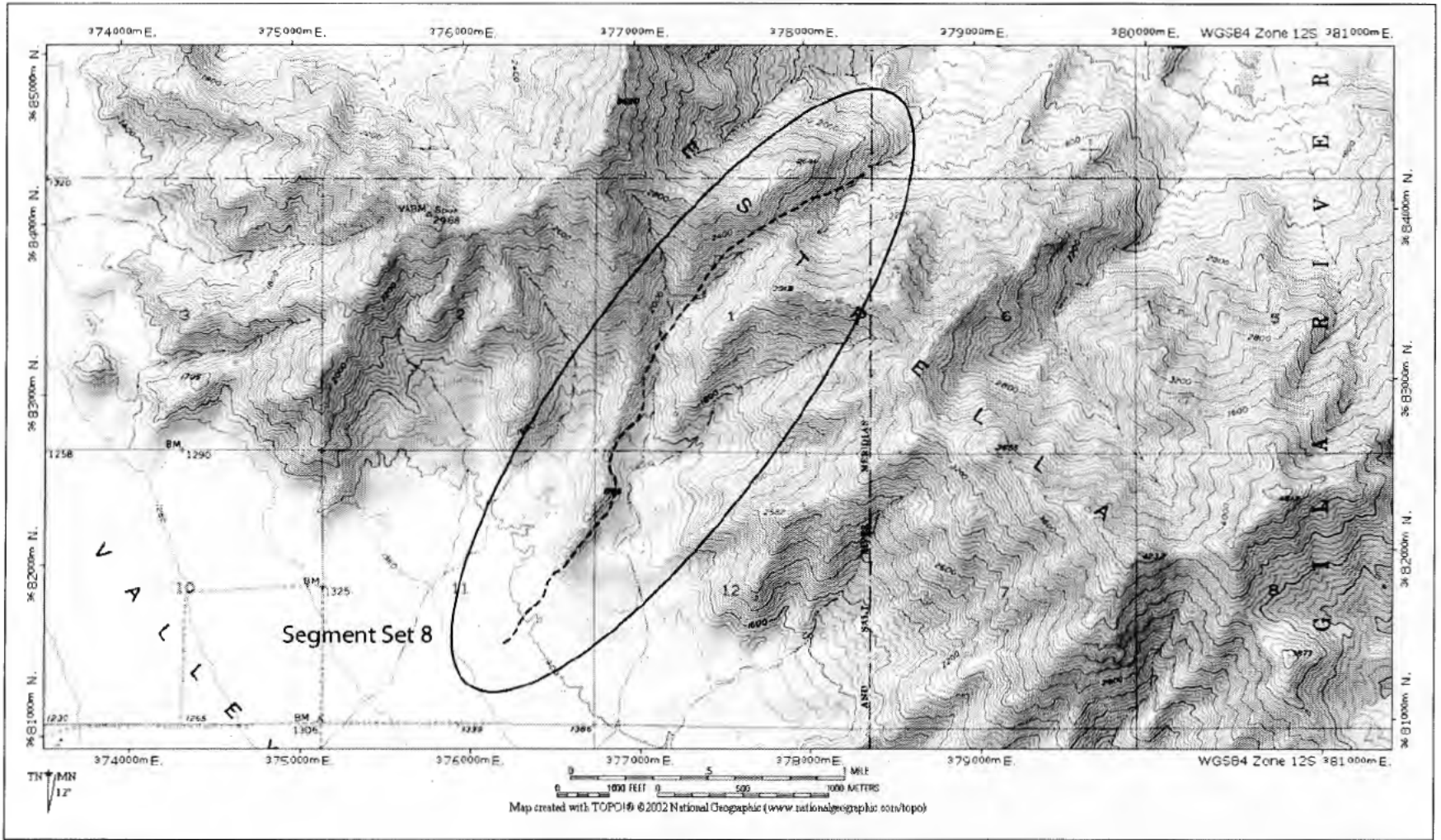


Figure 12.14. Map of trail segment set 8.



**Figure 12.15. Shrine.**

### **ANALYZING TRAIL NETWORKS**

Analysis of trail systems is tied to studies of space and how sociocultural systems use it. Continuous space allows for straight-line connections between fixed locations or settlements. However, in the real world, space is discrete. Movement is constrained by physical features, social factors, or other elements in the landscape. As a result, networks of roads or trails determine or exhibit the ways in which energy and information flow between settlements (Gorenflo 1991). Travel or types of travel along these trails reflect the behavioral aspects of movement. As noted in the introduction to this chapter, trails may be used for many different kinds of travel. Thus, it is likely that the artifacts and features along trails are the combined residue of a variety of travelers who used them.

Contextual studies of trails, particularly their location and situation in a trail network may help to narrow down the range of travel types exhibited along them. Preliminary analysis of trails and a review of the Rogers record of trails in the Arid Southwest reveal that many inter-valley routes of travel cross-cut major drainage systems rather than paralleling river courses or streams (see Figure 12.1). As illustrated in this study all the trails examined were located on the bajada and therefore were trails to access bajada resources or to reach inter-regional routes of travel. The Oyadaibuic-Komatke Trail, for example, crosses three mountain passes and connects settlement areas in three river valleys along the Gila River.

This may be modeled in terms of modes of travel (Figure 12.16). Movement along Type I trails between zones of settlement (Zone A) through hinterlands (Zone B) characterizes intra-regional travel patterns. Type II trails provide access to resources and materials outside settlements. Movement along Type I trails consists of travel from zones of security (Zone A) to areas where loss of life and possessions increases (Zone B). Higher amounts of artifacts especially broken pottery jars as well as shrines, rock art, and other features in Zone B attest to the dangers of travel between settled areas particularly mountainous zones. Desert travel may be equally dangerous due to the lack of water. Along the Gila River drainage this may not be as much of an issue. However as shown by the trail record amassed by Malcolm Rogers, zones of security may consist of wells or water sources separated by large stretches of waterless desert (Zone B).

Type III trails are routes utilized for ritualized travel including salt journeys, warfare, pilgrimages, etc. Unlike Type I trails, Type III trails may bypass local settlements as travelers leave familiar landscapes or homelands for distant lands. Rituals of preparation as well as cleansing or purification upon their return are activities required of the traveler. Type III trails may be highly specialized and recapitulate itineraries stipulated in stories of historical events or songs.

## **HISTORICAL CONTEXT OF TRAILS AND THE TRAILS OF GILA BEND**

As Ezell (1968) once noted, from the time of their first entry into the Desert Southwest to the end of the Mexican Period, it is likely that no European ever blazed a new trail across the desert and that all routes of travel were based on preexisting Indian trail networks. With increasing usage by Europeans, descriptions of these trails became available. In time, several major routes were recognized as significant ethnohistoric routes of travel including the Mohave Trail, the Coco-Maricopa Trail, the Yuma Trail, the Camino del Diablo, and the Gila Trail, among others. One such trail, the Oyadaibui-Komatke Trail, was described by Fr. Eusebio Francisco Kino and Captain Juan Mateo Manje in 1699. Its circuitous route across mountain passes proved less advantageous to explorers with horses and wagons and subsequently this route was forgotten, while other trails became enshrined in the annals of exploration. Nineteenth and twentieth century historians and archaeologists later confused this route with a route that followed the old Gila Trail or what became the Butterfield Stage Route. Data recovery along SR-85 has helped to clarify the historical record and relocate this important indigenous trail connecting the Gila Bend and Middle Gila River Valleys.

### **The Oyadaibuic – Komatke Trail**

In the winter of 1699, while on an exploration trip to investigate the peninsularity of the once-believed island of Lower California, the Spanish explorers, Fr. Eusebio Francisco Kino and Captain Juan Mateo Manje, reluctantly turned their party back from the Colorado River, well short of their intended goal. They headed east, and several days later, they proceeded around the first curve of the

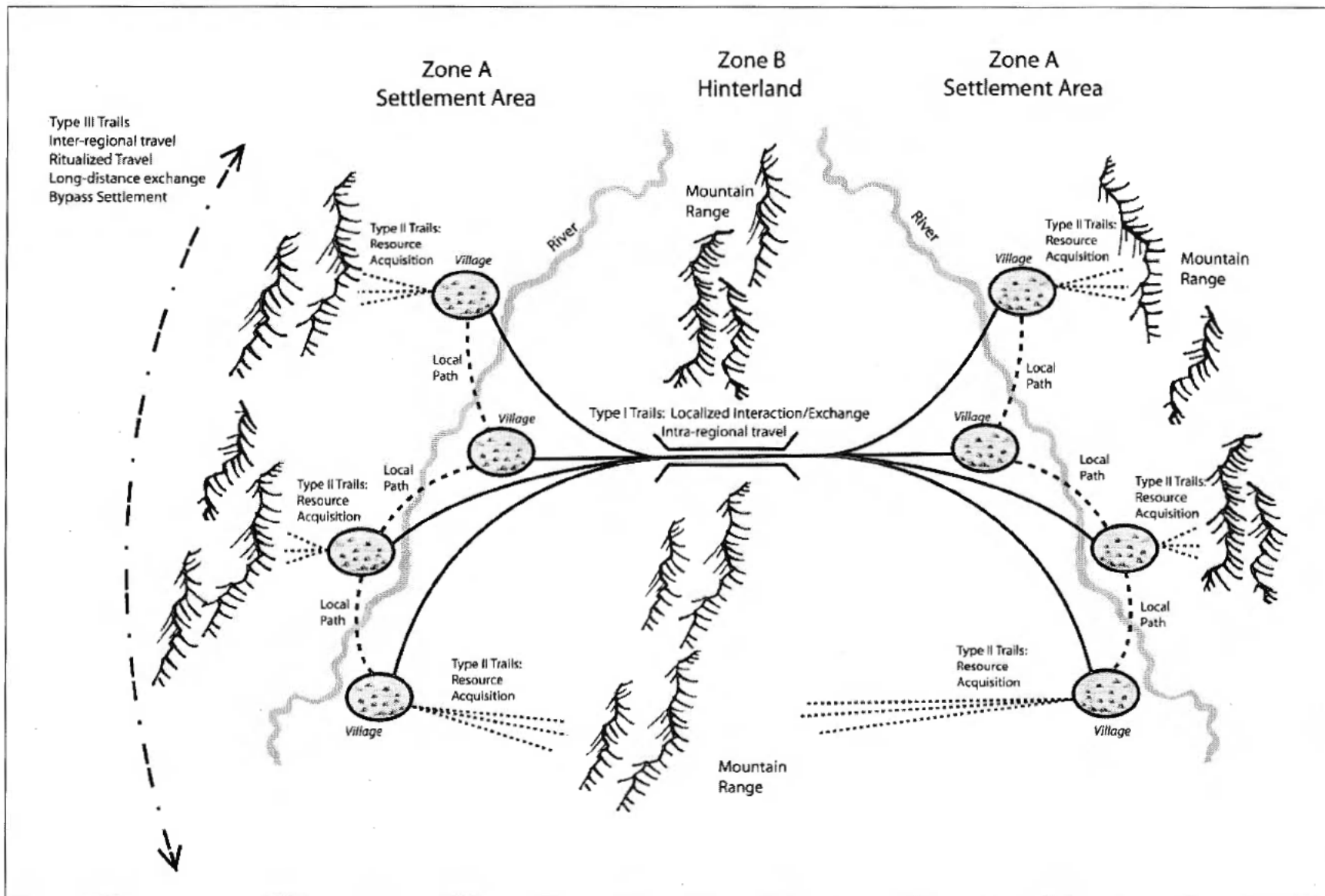


Figure 12.16. Behavioral model of trails and travel.



great bend of the Gila River. The explorers arrived at the O'odham (Pima) village of San Felipe y Santiago de Oyadoibuise (Oxibahibuiss) located approximately half way along the length of the large S-curve made by the river. Here they were greeted by as many as 132 Opa and Pima Indians (Manje reports a total of 150 adult males, having neglected to count the women and children).

Seeking a short-cut across the bend, the explorers and three Pima guides left the village after mass on Sunday, March 1, 1699. They headed east along a trail through the north Maricopa Mountains. After a ride of 11 leagues (36 kilometers) across the Rainbow Valley, the group stopped for the night at a small, unnamed ranchería, where pasturage and a small well were located. The following morning, the explorers continued their journey ascending 1000 feet along a narrow trail to the spine of the Estrella Mountains. Here a low pass offered an easy descent into the Middle Gila River Valley, the heartland of the Akimel O'odham (River People) and their ancestors the Huhugam (Hohokam).

From the summit of the Estrella Mountains, Kino and Manje observed the confluence of the Salt and Gila Rivers. Following the trail into the fertile valley, their guides led them to a Pima village, which they named San Barlolomé del Comac (Komatke or *Komatki*). Having passed two days and approximately 48 kilometers along the Komatke Trail, they were greeted by 200 inhabitants, some of whom recognized them from previous exploratory trips to villages located further upstream.

Manje's account of this trip across the Maricopa and Estrella ranges is detailed and may be found in two sources—his journal of the fifth expedition undertaken with Kino from February 7 to March 14, 1699 (Burrus 1971:223–248) and Manje's memoir, *Luz de Tierra Incógnita*, which was written in 1716 (Karns 1954). Karns translation of the latter work, under the title *Unknown Arizona and Sonora, 1693–1721*, provides a nearly exact duplicate of Manje's original journal account. This description is provided below (the Spanish original of which is provided in a footnote).<sup>4</sup>

On March 1, with guides furnished by the Indians, we left the river and turned left. We traveled east through rock-ribbed and arid hills, and after having gone 11 leagues, we camped for the night near a well of water, and a plain covered with pasture.

On the 2<sup>nd</sup>, traveling east and climbing to the top of a small mountain, which the guides pointed out to us, we could see plainly the Verde River which takes its rise in the land of the Apaches, running northeast to southeast, with a grove of trees along its banks. It is joined by another salty river, running northeast to southeast, with a grove of trees along

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<sup>4</sup> En primero de marzo, con guías que nos dieron, dejando el río a la izquierda, por una gran vuelta que da, caminamos, al oriente, por entre ceros pedregosos y estériles; y, a 11 leguas andadas, dormimos en un pozo y llano de buen pasto.

En 2, prosiguiendo al oriente y trasmontando el puerto de una sierrecilla, de la cumbre nos enseñaron los guías, que vimos patentemente, el río Verde que nace en la tierra de los apaches y corre de nordeste a sudueste, poblado de ancha y frondosa arboleda, ya florida, que lo guarnece; y, juntándosele otro río salobre de oriente a poniente, ya juntos, desaguan en este grande, cuya junta también vimos. Dijeron le llaman Verde, por pasar por una sierra de muchas vetas de piedras verdes, azules, y otros colores.

No sabemos si será ésta la Sierra Azul de que hay tradición de haber visto infinidad de minas de oro y plata, de que sacaron mucha ley respecto al poco metal que llevaron, y ensayaron en el Nuevo México, a los principios de su pacificación, y no pudieron volver más, recelosos los pacificadores de que no se sublevasen los pueblos, como cristianidad nueva; y, habiendo pasado año, solo quedó la noticia de la Sierra Azul, rica de plata, sin haber hoy quien dé razón de ella.

Bajando de la cumbre al río, 3 leguas distante de la junta, y 13, de donde salimos, dormimos en una ranchería de pimas que intitulamos San Bartolomé del Comac, con 200 personas, dóciles y afables; y de fértiles tierras. Recibieron nos con júbilo y se les intimó el conocimiento de Dios; y bautizaron a 3 párvulos. [Manje (1699) in Burrus 1971: 400–401]

its banks. It is joined by another salty, river running from east to west, and the two merging together flow into this Río Grande River, the junction of which we were able to see. They told us its name was Verde and it flows by a mountain streaked with several veins of green, blue and variegated colored stones. We do not know if this could be the Blue Mountain range of which a tale is told to the effect that innumerable gold and silver mines, very rich and of high grade character of ore, have been discovered. The conquerors of New Mexico at the time, when they came to this place, took some ore to be refined; but they never returned. As the years passed only the tradition of the Blue Mountain, rich in silver, remained. However, no one could give its exact location.

Coming down from the hill to the river, three leagues distance from the junction, and 13 leagues from where we started on that day, we camped for the night in a Pima settlement, which we called San Bartolomé del Comac. It contained 200 peaceful and courteous Indians who welcomed us gladly. They were told about God, and three children were baptized. There are good fertile lands here. [Manje 1716 (Karns, trans. 1954:122-123)]

### **An Historical Controversy**

Little did Kino or his companions realize that based on ceramic artifacts encountered 300 years later, they were traversing a trail used continuously by the Pima and the Hohokam and potentially earlier populations. Ironically, the actual location of the route followed by Kino and his companions on March 1<sup>st</sup> and 2<sup>nd</sup>, 1699, also appears to have been misidentified repeatedly by historians and archaeologists; first by Bolton (1919), and subsequently by Karns (1954), Schroeder (1961) and Burrus (1971).

Based on Kino and Manje's accounts, these scholars identified the village of San Felipe y Santiago de Oyadoibuisse (Oxibahibuisse), at the southwest end of the Gila Bend in roughly the same location as the village of El Tutto or Aritutac, later identified by Ezell (1961, 1963:7). As Bolton and other scholars proposed, the explorers would have followed a route roughly approximating the later Butterfield Overland Trail, pioneered after 1850 (Figure 12.17). In 1699, this route would have brought the exploring party around the south end of the Estrella Mountain range, requiring that they pass several villages in the vicinity of Pima Butte (including Hueso Parado) without notice. From this location they would have had to travel north to Komatke, only to reverse their direction to continue on their journey. As Ezell proposes, the location of the village of Oxibahibuisse, midway along the north-south portion of the Gila Bend, concurs with Kino and Manje's description. This includes the presence of wells at the unidentified village still used into the twentieth century, as well as the panoramic view of the Salt-Gila River Valley, which would not have been visible on the misidentified route located too far to the south.

Period artifacts have not been found during archaeological survey of the Komatke Trail, which might verify the explorers' accounts. However, the Kino-Manje record serves to accomplish more by drawing attention to the centuries-old route of travel that communicated the Middle Gila River Valley with the Gila Bend and into the Painted Rocks Reservoir area to the west. Field identification of portions of the trail in passes in the Estrella Mountains, the Maricopa Mountains, and the Gila Bend Mountains provides sufficient evidence that this route extended from the central Hohokam region, dominated by such archaeological sites as Snaketown, to its western periphery. During the Historic Period, the trail communicated between Yuman (Patayan) areas along the river inhabited by the Cocamaricopa, the Opa (including Pima and Opa living in mixed villages in the Gila Bend), the Maricopa, and the Pima. Unusual preservation of the trails west of the Maricopa Mountains reveals extensive branching as the main Komatke Trail split into numerous smaller trails accessing villages along the length of the valley at Gila Bend.

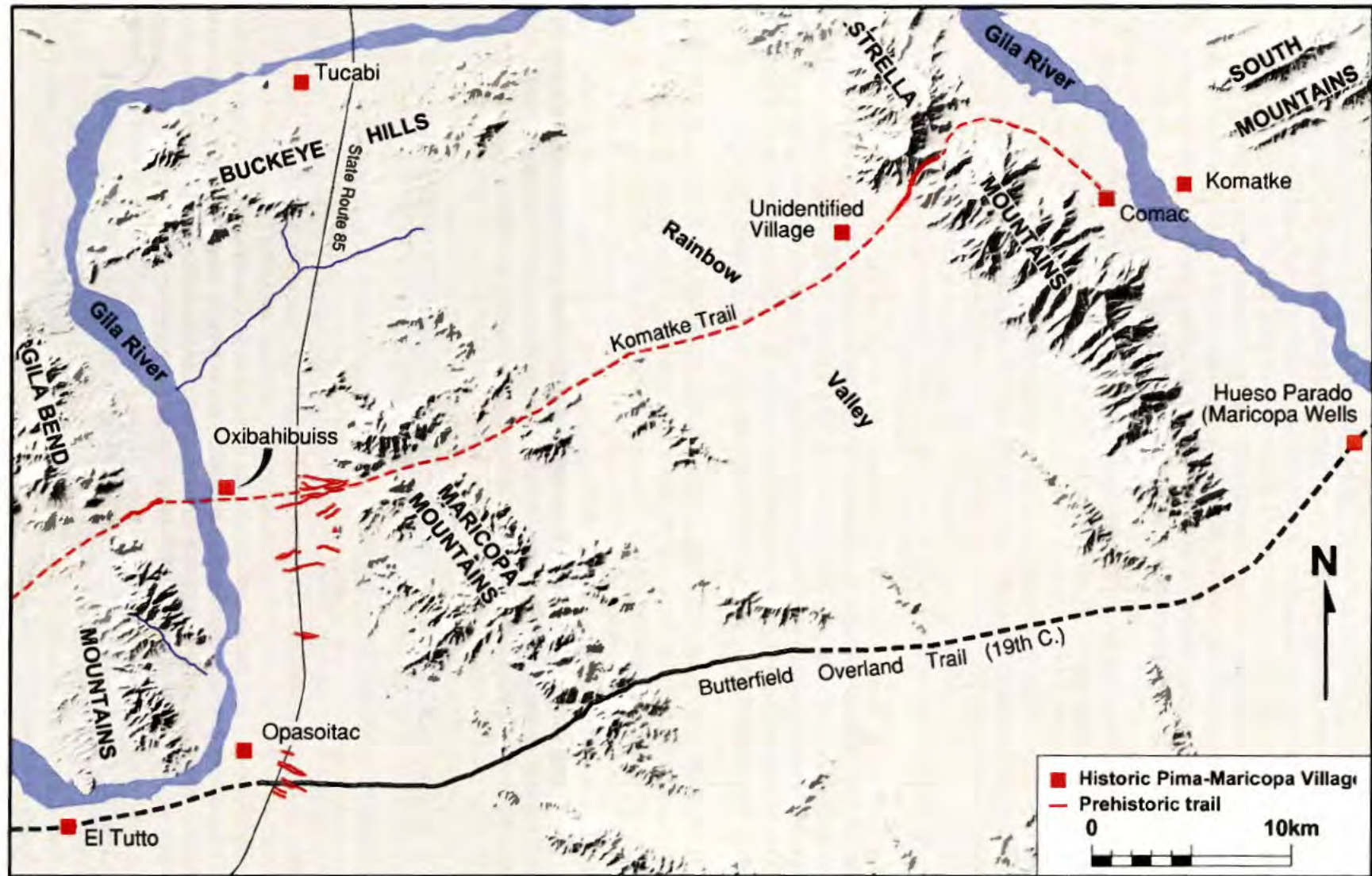


Figure 12.17. Oyodoibuic-Komatke Trail and the Butterfield Overland Trail.

## CONCLUSION

The previous analysis reveals several useful observations about understanding trails:

1. Trails are regionally extensive archaeological features that cannot be fully understood without mapping and study well outside standard project areas (areas of potential effect) or road right-of-ways.
2. Recent advances in remote sensing and low elevation imaging (not available to this project) may be useful for identifying and mapping trails, and can be used in the design of research prior to entry into the field. These may provide data for hypothesis generation and network analysis testable through targeted data recovery efforts. We feel that emphasizing the behavioral aspects of different modes of travel in relation to decision-making processes will provide a productive avenue for research over previous typological studies.
3. The unusual preservation of trails in the Gila Bend provides a rare opportunity to understand travel as a cultural behavior and its relationship to indigenous infrastructures that existed long before Europeans entered on the scene. Clearly other areas up and down the Gila River maintained similarly complex, if not more complex trail networks, no longer visible today. Further work in the Gila Bend Valley is warranted to document this unusual and highly fragile cultural resource.
4. Much of the literature on indigenous trails and trail networks is dominated by European accounts reflecting the early explorers' reliance on Native Americans as guides and sources of information on local landscapes. The co-opting of Native American infrastructures and dramatic reshaping of them into stage lines and mail routes is a little understood process by which preexisting structures of information and communication were transformed. This has resulted in a not insignificant bias in the historical literature on trails in which only the preeminent trails used by Europeans continue to be recognized while the thousands of kilometers of Native American trails have been lost.

IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF UTAH

CENTRAL DIVISION

FILED  
U. S. DISTRICT COURT  
DISTRICT OF UTAH

UNITED STATES OF AMERICA, )

Plaintiff, )

vs )

STATE OF UTAH, GEORGE D. )

FEHR, EARL E. FEHR, JOE )

LYON, JR., and UNITED WESTERN )

MINERALS COMPANY, A Corporation, )

Defendants. )

No. C-137-59

DEC 16 1960

FINDINGS OF FACT  
AND  
CONCLUSIONS OF LAW

*Wayne Christy*  
CLERK

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The above entitled matter came regularly before the Honorable Willis W. Ritter, Chief Judge, sitting without a jury, for trial on June 6 through June 10 and June 15 through June 17, 1960. The cause was thereafter on October 10, 1960 argued at length to the Court by counsel for the respective parties. The United States of America was represented in each instance by C. Nelson Day, Assistant United States Attorney, and the defendants were represented by Grant H. Bagley, Clifford L. Ashton, Donald E. Schwinn and Frank J. Allen, all Special Assistant Attorneys General of the State of Utah. At the trial evidence both documentary and oral was offered to and received by the Court.

The Court now being fully advised in the premises makes the following

FINDINGS OF FACT

1. This is a civil action brought by the United States of America and the jurisdiction of this Court is invoked under Title 28, Section 1345, United States Code.

2. The action is brought by the United States of America for the purpose of quieting title in itself in and to the bed of that portion of the San Juan River within San Juan County, State of Utah from the Utah-Colorado boundary line downstream to the mouth of Chinle Creek a distance of approximately 55 miles, subject only to: (1) The rights of the Navajo Tribe of Indians under the Executive Order of May 17, 1884, 1 Kapp. 876, the Executive Orders of March 10, 1905 and May 15, 1905, 3 Kapp. 690, and the Act of March 1, 1933, 47 Stat. 1418; (2) The rights of anyone claiming through or under

the Navajo Tribe of Indians; and (3) The rights, if any, of anyone other than the United States of America arising through ownership of lands riparian to or abutting upon said portion of the river.

3. The defendant State of Utah has appeared in the action claiming ownership of the said portion of the bed of the San Juan River, subject only to mineral leases issued by it to the other defendants. The said other defendants George D. Fehr, Earl E. Fehr, Joe Lyon, Jr., and United Western Minerals Company appeared in the matter claiming to be the owners of and the lessees in mineral leases covering the said portion of the bed of the San Juan River duly issued by the State of Utah.

4. The claim of the defendant State of Utah and the other defendants, its said lessees, is based upon their contention that title to the said portion of the bed of the San Juan River vested in the State of Utah upon the said State becoming one of the United States of America and by reason of the "navigable" character of the said river at said time and place, the term "navigable" being within the legal meaning and definition of the term as applicable to a determination of the question of whether or not state title attaches to river bed lands within the several states.

5. The plaintiff United States of America acquired from the Republic of Mexico by the Treaty of Guadalupe Hidalgo of February 2, 1848, 9 Stat. 922, fee simple title to lands within the State of Utah, including all of the bed of the San Juan River from the Utah-Colorado boundary to its confluence with the Colorado River and all lands riparian thereto.

6. Pursuant to the general law of the land and under and by virtue of the provisions of the Act of Congress dated July 16, 1894, 28 Stat. 107, usually referred to as the Utah Enabling Act, the State of Utah became one of the United States of America on January 4, 1896 by Presidential proclamation of that day, 29 Stat. 876.

7. The United States Supreme Court in the case of United States v. Utah, No. 14 Original, decided April 13, 1931, reported at 283 U. S. 64, 51 Supreme Court 438, 75 L. Ed. 844, determined and adjudicated that the San Juan River in Utah from Chinle Creek downstream to its mouth where it joins the Colorado River, a distance of approximately 133 miles, was not a "navigable" stream and that, therefore, the State of Utah as sovereign had no right, title,

interest or estate in the bed of such portion of the San Juan River and that title to the bed of such portion of the San Juan River was vested in the United States except as to lands theretofore granted, and the State of Utah was forever enjoined from asserting any claim to said river bed adverse to the United States of America or its grantees and from in any manner or way interfering with the use, occupation, possession or enjoyment thereof by the United States or its grantees. Said decision also determined and adjudicated that the Green River from immediately below the mouth of the San Rafael River to the mouth of the Green River, and the Grand River (now part of the Colorado River) from Castle Creek to the junction of the Green and Grand Rivers, were "navigable".

8. In the area in controversy in this action, the San Juan River has a substantially uniform rate of fall or gradient of slightly more than seven feet per mile. Downstream from Chinle Creek to its mouth, the San Juan River also has an average rate of fall or gradient of slightly more than seven feet per mile. The 133 mile downstream segment of the San Juan River, previously held to be non-navigable, includes a segment of 48.73 miles (from river mile 21.64 to river mile 70.37) which has an average and practically uniform gradient of 5.46 feet per mile unbroken by any rapids and where the river flows in a single well defined channel except for approximately 4 miles at about river miles 53 to 57 where the river sometimes has a braided channel. Except for this approximate 4 mile stretch, the said 133 mile downstream segment of the San Juan River runs in a single well defined channel, substantially all of the way between deep canyon walls.

9. In the area in controversy herein, the San Juan River flows through a broad, sandy, flood plain which is from 1,000 to 5,000 feet wide and which is encased between rocky cliffs or steep slopes. By reason of the flat and sandy nature of the flood plain, the irregular flow and the gradient or rate of fall, the river is constantly shifting its channels. On many occasions the river has moved its channels over one-half mile in a very short period. The washing and cutting action of the river did not occur in any one year or other particular period but is a continuous action of the river. The river in this area runs in a single channel for only short distances but generally has braided channels and the river runs for

most of the 55 miles in controversy and for most of the time in from two to many channels at the same time with such channels constantly shifting. This braided characteristic of the river over the entire 55 mile stretch in controversy herein presents a continuing and insurmountable obstacle to navigation as none of the several channels presents an adequate or continuous channel for the passage of boats. The testimony, and particularly the defendants' testimony, showed considerable difficulty in this regard even at high stages of water and in modern shallow-draft small rubber rafts and small plastic glass motorboats.

10. In the area in controversy here, the San Juan River has an extremely irregular flow, on a number of occasions running dry and in flood stage running at a recorded high of 70,000 cubic feet per second in 1927, with the flood occurring in the year 1911 estimated as high as 150,000 cubic feet per second. The flow is generally low for most months of the year, running less than 1,000 c.f.s, with the big runoff occurring during the snowmelt period from about April into June. The flow of the river during the snowmelt runoff period ordinarily includes most of the total flow of the stream during the year. Aside from the snowmelt runoff period in the spring, there are a considerable number of flash floods on the river ordinarily occurring during the late summer months and the fall months, although there are flash floods at other times of the year also. While the stream has a long time average rate of flow of 3,000 cubic feet per second, the flow of the San Juan River runs at 1,000 c.f.s, or less during 60.9% of the time or more than 7 months out of each year. It runs at 2,000 c.f.s. or less during 72.3% of the time or almost 9 months each year. It runs at 3,000 c.f.s. or more during only 18.4% of the time and this is not a consecutive period, but represents the aggregate of high water periods resulting from spring runoff and other flood conditions resulting from storms. The river runs at 500 c.f.s. or less during 22% of the time, a longer period than that during which the river flows at or in excess of the long time average rate of flow.

11. There was a marked change in the conditions of the flood plain of the river in the area in controversy herein as a result of a big flood in the year 1884, which flood washed out the small Mormon community of Montezuma at Montezuma Creek and also came up into Bluff City washing out much of the bottom lands in that area. There were recurrent marked changes in the conditions of the flood plain of the river in the area in controversy herein as a result of the big flood of 1911 and as a result of the big flood of 1927 which was recorded



at 70,000 c.f.s. These big floods and even larger ones have occurred at irregular intervals on the San Juan River in the past. In the San Juan River segment in controversy herein, the prevalence of quicksand conditions is dangerous to animals and persons unfamiliar with it.

12. The San Juan River with approximately one-half the runoff of the Green River and approximately one-third the runoff of the Colorado River above its junction with the Green carries a total sediment load of twice that of either the Green or Colorado in the areas determined to be "navigable" in the said former case. The degree of concentration of sediment in the San Juan during flood periods is between five and six times greater than that of either the Green or Colorado in said areas. The high sediment content in the San Juan River water gives rise to sand waves, while none are noted on the Green or Colorado in said areas. These sand waves reach a height of up to 12 feet or more according to one of the defendants' witnesses. The silt and sand in the San Juan River water would render its use in steam boilers impracticable and the sand waves present an additional and dangerous obstacle to use of the river by small boats.

13. The San Juan River drainage area near Bluff exceeds 23,000 square miles and is about the same as that of the Colorado River above Cisco, Utah and about one-half of that of the Green River above Green River, Utah. The San Juan River long time annual runoff is about one-half that of the Green and about one-third that of the Colorado in the said "navigable" areas. The San Juan River has little sustained flow during non-snowmelt period, with zero flows recorded, while the Green and Colorado in said areas have relatively large sustained flows.

14. The flow of the San Juan River is much more variable than the Green or Colorado in said areas.

15. The average slope of the San Juan River in the area in controversy exceeds seven feet per mile in contrast to 1.17 feet per mile on the Green River from the San Rafael down to its mouth and 1.63 feet per mile on the Colorado River from Castle Creek downstream to its junction with the Green River. The San Juan River in the area in controversy has an unstable channel throughout, in contrast with relatively stable channels on the Green and the Colorado Rivers in the areas above noted. A medium rise in stage on the San Juan River in the area in controversy herein would flood approximately an additional 330 acres of shifting bottom lands per mile of length compared to only 2.7 acres for the Colorado and 1.4 for the Green in the areas above noted. The characteristics of the San Juan River in the area in controversy permit an

increase in volume of flow to spread out over the wide flat flood plain without an appreciable rise in depth, while the Green and Colorado in the areas noted flow in stable banks where an increase in flow results in a corresponding increase in depth of water. The characteristics of the San Juan River in the area in controversy are such that the stream flow is very rapid for relatively shallow depths. This condition persists at low stages and high stages of water. The velocity of the San Juan River in the area in controversy is consistently and considerably higher, and its depth is consistently and considerably lower than that of the Green River and Colorado River in the respective areas noted.

16. The records of the Geological Survey, Department of The Interior, show the annual discharge in acre feet at the mouth of the San Juan River as being 2,080,000 for the year 1895, 1,530,000 for the year 1896, with a mean annual discharge from 1915 through 1950 of 2,174,500 acre feet at the Bluff, Utah station.

17. The San Juan River has not changed its general characteristics as noted in these findings during the time in which white men have been in the area. In the area in controversy herein, this has been since 1879 when "Mormon" pioneers settled at Bluff and at Montezuma Creek.

18. On the various occasions when the river has run dry, the fish died in pools causing a great stench and the Indians found it necessary to dig in the river bed to secure water for their animals and themselves. One of the witnesses, Fletcher B. Hammond, testified that in the year 1896 he dammed the entire flow of the San Juan River at Bluff by using a team of horses and a scraper. Another witness, Otto J. Zahn, testified that in about 1904 he diverted the entire flow of the San Juan River by simply using a hand shovel. This was at his mining camp about 60 miles below Bluff.

19. The climate of the San Juan River country is "spotted". The river rises in Southeastern Colorado, flows into New Mexico, back into Colorado at a point approximately one or two miles east of the corners of Utah, Colorado, New Mexico and Arizona and thence into Utah approximately one mile north of such four corners. It then meanders through Utah in a general westerly direction for approximately 188 miles to join the Colorado River. Through most of its distance it flows through typically Southwestern United States desert country. The region is arid and even if the rainfall was evenly distributed the average result would be small and might be largely counter-

balanced by evaporation during the dry hot days of summer. The most significant feature of the rainfall in the desert area is the violence of the showers. Most rains are short lived, widely spaced, torrential downpours. The precipitation for a month or even two months may be the result of a single storm that lasts only half an hour and covers only a few miles.

20. The Indians who resided in the area of the San Juan River in Utah were Navajos. They have made no use of the river except as a source of water for personal use and as drinking water for their livestock. They, of course, did cross the river, usually on foot or horseback, although during high water periods on occasion they used small homemade boats for this ferry purpose.

21. The white people who came into Southeastern Utah as settlers attempted to use the river in a very limited way for irrigation of some of the bottom lands along the stream. These attempts at irrigation were particularly unsuccessful in that the river filled the small irrigation ditches with silt, cut them out entirely or moved away from the diversion points. The river in flood washed out much of the bottom lands, carried away the settlers' homes, haystacks and livestock and in general was more of a hindrance than a help, except as a source for drinking water. There were a number of trading posts established from the Four Corners area downstream along the San Juan River and the traders usually kept small skiffs or rowboats to enable the Indians and others who came to trade to cross the river during high water. These boats were many times washed away downstream but it was a simple matter to build another.

22. There was a gold rush along the San Juan River in about 1892 and 1893 during which time several hundred persons came into the San Juan country in Utah in search of gold. Almost all of them came overland by foot, by horse or burro, or by wagon, although the evidence showed that possibly 3 or 4 came downstream in small rowboats on the San Juan River to Bluff. Most of the mining activity on the San Juan River was of placer type and was carried on below Chinle Creek. Most of the miners and prospectors who came into the area came through Bluff and went downstream overland from there. Bluff is approximately 12 miles upstream on the San Juan River from Chinle Creek. ~~Some~~ small, rowboat type flat-bottomed boats were constructed in

Bluff and used to carry some of the prospectors with small amounts of supplies, bedrolls, etc. downstream. The use of the San Juan River above Chinle Creek by these small rowboats was not different or greater than the use of the river by such small rowboats downstream from Chinle Creek. Most of the prospectors went downstream on horseback, by burro or wagon, and most supplies were taken downstream in this manner. A few of the miners and prospectors, as above indicated, went downstream in these small rowboats; none of them ever came upstream in a boat.

23. Some years after the gold rush, above referred to, there was some oil prospecting in the San Juan River country in Southeastern Utah and again a number of persons came into the area in connection with this oil prospecting. All machinery and equipment, as well as supplies, used in this activity were transported into the area by freight wagon. As above indicated, the country is typical desert country, and at the time of the gold rush and the oil activity above referred to the area was very primitive, with roads almost non-existent and with trails hand carved from the rocky canyon areas.

24. During the past 20 years, there has been a very limited use of the San Juan River by two or three so-called "river runners" who have generally used small, rubber, pontoon type boats in transporting a relatively few passengers downstream on the San Juan River for "thrill" purposes. Most of this "river running" has been from Bluff, Utah downstream past Chinle Creek to Mexican Hat, Utah, a total distance of approximately 31 miles, approximately 19 miles of which are downstream from Chinle Creek. A very small amount of such "river running" has been from the Four Corners down to Bluff with a slightly larger amount from Mexican Hat down to the mouth of the San Juan River. None of such "river running" has been upstream.

25. In connection with preparation for the present law suit, there were several boat trips on the San Juan River in the area in controversy in small, rubber, pontoon type and small flat bottom type boats drawing only a few inches of water. One or two of the said boats were powered by both inboard and outboard motors which required a depth of up to 24 inches for the propellor and shaft. These particular boats went both up and downstream in parts or segments of the area in controversy herein when the stream flow was in excess of 4,000 c.f.s. One of these boats made two trips upstream and one boat made one trip upstream. Neither of the upstream trips was for the full

distance from Chinle Creek to the Four Corners. There were only two occasions when upstream travel was attempted when the river flow was under 4,000 c.f.s. and on each of these occasions, the upstream travel was only for 3 or 4 miles. The persons engaging in making these trips both up and downstream, encountered sandbars, rocks, braided channels and other obstacles requiring them to stop, get out of their boats and pull them off the obstructions, turn their boats around and try other channels, and similar actions. The modern rubber pontoon-type boats and the modern small flat bottomed plastic-glass and aluminum boats and the modern high-powered inboard and outboard motors used in making the trips referred to in this paragraph were unknown in 1896.

26. At low stages, the San Juan River in the area in controversy herein has insufficient water to permit the passage of any but small, rowboat type boats or small rubber rafts and then only downstream with no commercial load and with considerable difficulty. At high stages the San Juan River in the area in controversy herein becomes torrential, cutting and tearing its banks, swiftly changing channels, carrying excessive debris and an extremely high sediment load. The high stages of water persist for only relatively short period of time each year, and the river current is then too swift and too dangerous as well as too uncertain to permit any use of the river for commercial navigation. These same conditions existed in 1896 and have persisted since that time.

27. Except as herein noted there has never been any attempt to carry passengers and there has never been any attempt, either successful or unsuccessful, to carry on freighting on the San Juan River in the area in controversy herein.

28. In 1896, the year Utah was admitted into the United States of America as a state, there was considerable commerce on the various rivers of the United States, which commerce was then usually and ordinarily accomplished by means of the sternwheel and sidewheel type steam engine boat. The boats usually and ordinarily carried the passengers and freight on the boat itself. The boilers, engines, beams, sternwheels, sidewheels, and other equipment, including the necessary cord wood fuel were all heavy, cumbersome and occupied a large part of the boat's carrying capacity. There was no evidence that any type of steam boat or any craft at all, except small skiffs or rowboats, were ever used on the San Juan River in the area in controversy. By reason of the lack of sustained flow, the shifting sandbars, the shifting and unstable channel, the comparatively steep slope and the other features

of the San Juan River in the area in controversy, as above set forth, it would have been impossible to navigate a boat of any substantial size or such as would have been suitable for carrying passengers or freight in the then ordinary and customary mode of travel on water at the time Utah became a state.

29. The San Juan River in the area in controversy herein on January 4, 1896 was not used and never has been used, and was not then susceptible of use and never has been susceptible of use in its ordinary condition as a highway of commerce over which trade and travel was or might have been conducted in the customary mode of trade and travel on water. In its natural and ordinary condition it did not and never has afforded a channel for useful commerce. The San Juan River in the area in controversy herein as a matter of fact on January 4, 1896, was not, ever since has not been, and is not now a "navigable" stream.

From the above and foregoing Findings Of Fact, the Court now makes the following

#### CONCLUSIONS OF LAW

1. The plaintiff United States of America acquired from the Republic of Mexico by the Treaty of Guadalupe Hidalgo of February 2, 1848, 9 Stat. 922, fee simple title to lands within the State of Utah, including all of the bed of the San Juan River from the Utah-Colorado boundary to its confluence with the Colorado River and all lands riparian thereto.

2. Pursuant to the general law of the land and under and by virtue of the provisions of the Act of Congress dated July 16, 1894, 28 Stat. 107, usually referred to as the Utah Enabling Act, the State of Utah became one of the United States of America on January 4, 1896 by Presidential proclamation of that day, 29 Stat. 876.

3. The San Juan River in the area in controversy herein on January 4, 1896 was not susceptible of use and never has been susceptible of use in its ordinary condition as a highway of commerce over which trade and travel was or might have been conducted in the customary mode of trade and travel on water. In its natural and ordinary condition, it did not afford and never has afforded a channel for useful commerce.

4. The San Juan River between the Utah-Colorado boundary and Chinle Creek, all in San Juan County, State of Utah, on the date of Utah's statehood, January 4, 1896, was not a "navigable" water within the legal meaning and definition of the term "navigable" as applicable to a determination of the

question of whether or not state title attaches to river bed lands within the several states.

5. Title to the said river bed is vested in the United States of America subject only to (1) the rights of the Navajo Tribe of Indians under the Executive Order of May 17, 1884, 1 Kapp. 876, the Executive Orders of March 10, 1905 and May 15, 1905, 3 Kapp. 690, and the Act of March 1, 1933, 47 Stat. 1418; (2) the rights of anyone claiming through or under the Navajo Tribe of Indians; and (3) the rights, if any, of anyone other than the United States of America, arising through ownership of lands riparian to or abutting upon said portion of the river; and the State of Utah and the other defendants herein, its lessees, have no right, title, interest or estate in and to said river bed, and should be forever enjoined from asserting any estate, right, title or interest in or to said river bed, or any part thereof, adverse to the United States of America, or its grantees, and from in any manner or way disturbing or interfering with the possession, use and enjoyment thereof by the United States of America or its grantees.

6. The United States of America is entitled to its costs herein.

Let Judgment Be Entered Accordingly.

DATED this *14* day of *December*, 1960.

*Willis W. Ritter*

WILLIS W. RITTER  
Chief Judge

*Filed Dec. 15, 1960. ✓*

*3*

IN THE UNITED STATES DISTRICT COURT FOR THE DISTRICT OF UTAH  
CENTRAL DIVISION

UNITED STATES OF AMERICA,	)	
	)	
Plaintiff,	)	No. C-137-59
	)	
vs	)	JUDGMENT AND DECREE
	)	
STATE OF UTAH, GEORGE D.	)	
FEHR, EARL E. FEHR, JOE	)	
LYON, JR., and UNITED WESTERN	)	
MINERALS COMPANY, A Corporation,	)	
	)	
Defendant.	)	

FILED  
U. S. DISTRICT COURT  
DISTRICT OF UTAH

DEC 15 1960

*Wagon Chittiman*

CLERK

The above entitled matter came regularly before the Honorable Willis W. Ritter, Chief Judge, sitting without a jury, for trial on June 6 through June 10 and June 15 through June 17, 1960. The cause was thereafter on October 10, 1960 argued at length to the Court by counsel for the respective parties. The United States of America was represented in each instance by C. Nelson Day, Assistant United States Attorney, and the defendants were represented by Grant H. Bagley, Clifford L. Ashton, Donald E. Schwinn and Frank J. Allen, all Special Assistant Attorneys General of the State of Utah. At the trial evidence both documentary and oral was offered to and received by the Court, and the Court being fully advised in the premises, and having made and entered its Findings Of Fact And Conclusions Of Law and having ordered judgment entered pursuant thereto; now, therefore,

It is hereby ORDERED, ADJUDGED and DECREED that the United States of America is the owner in fee simple and entitled to the exclusive possession of the bed of that portion of the San Juan River within San Juan County, State of Utah from the Utah-Colorado boundary downstream to the mouth of Chinle Creek, a distance of approximately 55 miles, subject only to: (1) the rights of the Navajo Tribe of Indians under the Executive Order of May 17, 1884, 1 Kapp. 876, the Executive Orders of March 10, 1905 and May 15, 1905, 3 Kapp. 690, and the Act of March 1, 1933, 47 Stat. 1418; (2) the

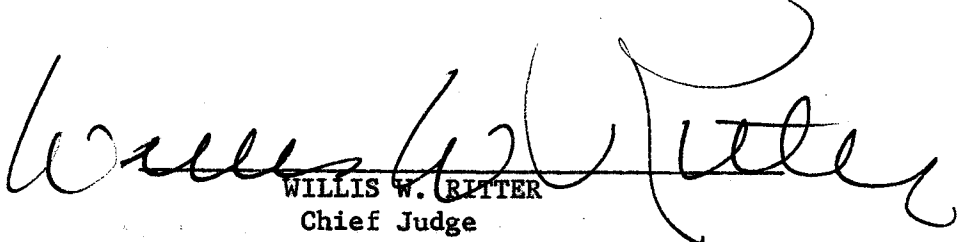


rights of anyone claiming through or under the Navajo Tribe of Indians; and (3) the rights, if any, of anyone other than the United States of America arising through ownership of lands riparian to or abutting upon said portion of the river. The State of Utah and the other defendants, its lessees, have no right, title, interest or estate in or to said river bed and any claim or claims of the defendants, or any of them, in and to the said river bed adverse to the plaintiff, are without right or basis in law and in fact.

It is hereby ORDERED, ADJUDGED and DECREED that the State of Utah and the other defendants, its said lessees, are forever enjoined and restrained from in any manner or way disturbing or interfering with the use, occupation, possession or enjoyment of said river bed lands by the United States of America or its grantees, and the said defendants and each of them are forever enjoined from asserting any right, title, interest or estate in and to said river bed lands or any part thereof adverse to the United States of America or its grantees.

It is further ORDERED, ADJUDGED and DECREED that the plaintiff recover its costs in this matter.

DATED this 14 <sup>December</sup> day of ~~November~~, 1960.

  
WILLIS W. RITTER  
Chief Judge

Clerk's Note: Notation of entry of Judgment made in civil docket on December 15, 1960, in accordance with Rule 79 of Rules of Civil Procedure.

✓  
Entered Dec. 15, 1960. ✓  
03"

On and after April 2, 1874, and until otherwise notified, R. C. Brown is authorized to transact any and all necessary business connected with the business and editorial departments of THE ARIZONA CITIZEN.

CLIMATE AND HEALTH.

We made brief mention in our last week's issue of our belief in the value of this climate for the restoration of consumptives or persons afflicted with bronchitis. Since that time The Mesilla News has come to us with a long communication upon the same subject, written by Judge Knapp.

In choosing a home for your consumptive, do not mind the average height of the thermometer, or its variations, do not trouble yourself about the mean rainfall; do not be scientific at all but find out by somebody's journal how many days were fine enough to go out forenoon and afternoon; that is the test you require; and by that you may be confidently guided.

Arizona when tried by the above test will be found equal to any spot on the globe. The article written by Judge Knapp is ably written and shows that he has made a very thorough examination of the subject not only from practical observation but by studying the opinions of eminent physicians.

Not wishing to detract one word he has said in favor of that locality. We are of the opinion that the great belt of country lying adjacent to the 32d parallel of latitude and extending from the Rio Grande on the east to the Colorado river on the west will be found equally beneficial for consumptives.

The subject is too important to discuss it from any selfish stand-point. It is true that if the tens of thousands who are now traveling with a view of finding some locality where life would be prolonged, should find from experience that this country is superior to all others, as we believe they would, it would be of vast pecuniary advantage to our people.

Under the management of Major Randall and Agent Roberts, these Apaches have become the most faithful and best behaved Apaches in Arizona. They cheerfully cooperate with our soldiers and give valuable aid in bringing to terms the hostile Apaches.

The White Mountain Apaches. Under the management of Major Randall and Agent Roberts, these Apaches have become the most faithful and best behaved Apaches in Arizona.

Gold in New York, 113%. Greenbacks in San Francisco, 87 1/2%.

WASHINGTON, April 15.—In the Senate to-day, the Judiciary Committee reported back Sumner's Civil Rights bill with a recommendation of its passage.

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PRESCOTT AND VICINITY. Prescott, April 14.—Lieut. Engan, 12th Infantry, arrived here on 13th. Lieut. Woodson, 3th Cavalry, wife and child left here for Tucson this morning.

MARICOPA WELLS. MARICOPA, April 17.—John T. Gifford, telegraph operator at Stanwix, came very near being drowned on the 15th inst.

YUMA, April 17.—Major Brown arrived from Tucson yesterday about noon. Gen. Carr is expected here to-day.

PHOENIX, April 16.—Daniel Toomey and Paul Handel were killed by Indians yesterday while on the way from McDowell to Phoenix.

WICKENBURG, April 16.—Messrs. Heald and Marion, Lieut. Woodson and family arrived at this place last evening.

SAN FRANCISCO. SAN FRANCISCO, April 14.—U. S. revenue steamer Lincoln was sold to-day for \$25,000 to Goodall, Nelson & Perkins.

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NASHVILLE, April 15.—The Cumberland River rising rapidly—great damage is reported.

ARKANSAS. Little Rock, April 16.—Joseph Brooks, candidate to have been elected Governor, took oath of office yesterday before Justice McClure, and then took possession of State-house, ejecting Gov. Baxter.

LONDON, April 15.—A fearful explosion took place in a coal mine yesterday; forty-six bodies have already been taken out.

CHIRICAHUA INDIAN AGENCY. April 15, 1874. EDITOR CITIZEN—I have just taken four horses from a party of Indians on this reservation, which have been stolen within a few days from somewhere in the vicinity of the Patagonia mines.

Mr. Pearce informs us that the company owning the rich copper mine in Silver Mountain district, have made arrangements to erect a furnace to smelt the ore, and in a few weeks they expect to have it in operation.

Messrs. Tully, Ochoa & Co. have about twenty tons of ore from this mine now on the road to Yuma and we hope soon to see back freight teams all loaded with rich ores.

Messrs. Leatherwood, Bartlett and Hewitt have some good miners working on their mine in the Sierrita district.

Prospecting parties are constantly leaving town for the mountains and the new discoveries and rich specimens that are coming in, indicate that the opinion of those who have been most sanguine of the mineral wealth of the Territory, will be more than realized.

It is the opinion that the few hostile Apaches left have all crossed to the south side of the Gila, and until they are routed by the military that are now after them, our people should be very cautious.

BY A MAN, BY PROFESSION A COOK, a situation at a Post, Rancho or Family in the vicinity of Tucson. Would prefer situation near Gila or Salt river.

AT THE REQUEST OF A LARGE number of friends throughout the Territory, I hereby announce to the people of Arizona that I will be an Independent People's Candidate for Delegate to Congress, at the ensuing election.

McDONALD & CO., Forwarding Merchants, In Fire Proof Building, Cor. K and 6th Streets, San Diego, Cal.

Goodall, Nelson & Perkins' Line of Steamships, Running from San Francisco to San Diego and Way Ports.

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TULLY, OCHOA & CO., THE OLD AND LONG ESTABLISHED commercial house of

TULLY, OCHOA & CO., NEW AND COMPLETE STOCK of Goods from the Great Eastern and Western Markets

DRY GOODS, CLOTHING, HARDWARE, QUEENSWARE, GLASSWARE, WINES AND LIQUORS, TOBACCO, CIGARS, &c., &c.

FOR TRAINS. LEATHER, SADDLES, CHAINS, WHIPS, AXELS, HUBS, SPOKES and RIMS; MULE and HORSE SHOES and NAILS, and in fact everything required for OUTFITTING TRAINS.

Our stock has been selected with great care by one of the firm of most EXTENSIVE EXPERIENCE

and with especial reference to the requirements of THIS MARKET. We are confident we meet the necessities of our customers at REASONABLE RATES as any house in the Territory.

To examine our stock and PRICE our goods, will be to purchase. TULLY, OCHOA & CO.

Trader's Store in APACHE PASS and CAMP BOWIE, Arizona Territory.

Supplies kept for travelers going East or West, as well as GOODS for ALL, and at fair rates. TULLY, OCHOA & CO. November 1, 1873.

E. N. FISH, Tucson, A. T. S. SILVERBERG, San Francisco.

WHOLESALE AND RETAIL DEALERS IN GENERAL MERCHANDISE, TUCSON, A. T.

Are constantly receiving large and complete assortments of goods, consisting of GROCERIES & PROVISIONS

DRY GOODS, CLOTHING, HATS and CAPS, BOOTS and SHOES, FANCY GOODS and STATIONERY, QUEENSWARE, HARDWARE and CUTLERY, LEATHER, HARNES, FARMING TOOLS and GRAIN SACKS, And the choicest brands of WINES, LIQUORS, TOBACCOES, AND CIGARS.

All of which we offer at unprecedently LOW PRICES FOR CASH

Give us a call and be convinced that our goods are of the best quality and as cheap as can be bought of any house in the Territory.

PINE LUMBER and SHINGLES for sale. BARLEY and CORN, In any quantity, at lowest possible rates.

W. B. HELLINGS, C. D. VEIL, EDWARD E. HELLINGS.

SALT RIVER VALLEY FLOURING MILL, SALT RIVER VALLEY, ARIZONA.

OUR MILL NOW BEING IN FULL operation, we are prepared to furnish the market with a quality of Flour, which we guarantee far superior to any manufactured in the Territory, and fully equal to the very best imported from California.

Three Qualities of Flour, In 25, 50, and 100-Pound Sacks GRAHAM FLOUR, BRAN, CORN-MEAL, SEMITILLA and CRACKED WHEAT.

A liberal discount will be made on regular rates to merchants and others purchasing large quantities.

AGENTS: W. B. HOOPER & Co., Yuma. GIDEON CORNELL, Prescott. J. H. PIERSON, Wickenburg. BARNETT & BLOCK, Phoenix. JAMES A. MOORE, Maricopa Wells. E. N. FISH & Co., Florence. E. N. FISH & Co., Tucson. W. B. HELLINGS & CO., East Phoenix, Arizona. Dec. 6, 1873

FLOUR! FLOUR!! HAVING PUT IN FINE RUNNING order the

EAGLE STEAM FLOURING MILL, In Tucson, I am prepared to fill orders for CHOICE FLOUR

WHOLESALE AND RETAIL. Patrimage Sold. Please call at the Mill and Examine my make of Flour and Prices. July 19. JAMES LEE.

Tucson Feed Stable, Lower end of Main street.

HAVING FITTED UP THE LAIR, Corral formerly occupied by Hinds and Hooker,

I am now prepared to Board stock by the Day, Week or Month at rates to suit the times.

Teamsters, Travelers and Farmers will find a Good, Large Corral and Plenty of the Best of Hay, Grain and Water.

Give me a Call. B. D. FAIRBANKS, Tucson, February 14, 1874.

E. N. FISH, Tucson. S. SILVERBERG, San Francisco. JOE COLLINGWOOD, Florence.

E. N. FISH and CO., MAIN ST., FLORENCE. Wholesale and Retail Dealers in

GENERAL MERCHANDISE. HAVE constantly on hand a large and well selected stock of DRY GOODS, CLOTHING, BOOTS and SHOES, GROCERIES, PROVISIONS, LIQUORS, CIGARS and TOBACCO, HARDWARE, etc., which we will sell at the VERY LOWEST prices.

We have, also, HAY and GRAIN, constantly on hand to supply the public.

JOHN H. ARCHIBALD, Dealer in

GENERAL MERCHANDISE, WEST SIDE MAIN STREET, Tucson, - - - Arizona. October 11, 1873.

DAVIS & KELSON, CONGRESS STREET, TUCSON, MANUFACTURERS and DEALERS

TIN, BRASS AND SHEET IRON WARE; Also STOVES of the BEST patterns. EVERY DESCRIPTION

Tin, Sheet-Iron Ware and Stoves is sold on terms to suit the times. Orders solicited and promptly filled.

Connected with the above establishment is a special department for the REPAIR AND CLEANING

WATCHES, CLOCKS, Etc., Etc. STENCIL WORK solicited and executed to suit customers.

All work warranted as represented. W. B. HELLINGS, C. D. VEIL, EDWARD E. HELLINGS.

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WANTED—SEVERAL FAITHFUL MEN OR women to travel for responsible established house in Arizona. Salary \$75, payable \$15 weekly and expenses. Position permanent. References. Enclose self-addressed stamped envelope. The National Star Building, Chicago.

V. C. MARTIN, Editor and Proprietor

Chief Justice Truesdale has gone on the bench in Phoenix.

It is announced that Governor McCord will institute libel proceedings against the New York World.

It is a toss up between Tom Watson and Eugene Debs as to which can get a new political party on the road first.

Governor Franklin and Attorney General Wilson have not purchased tickets yet to go to Ash Fork to welcome Governor McCord on his arrival.

In sizing up the work of congress it should not be forgotten that the republicans are not a majority in the senate; otherwise some things would have been a little different.

Hon. Geo. Christ has been appointed surveyor general of Arizona. Col. Christ has been one of the most active and zealous workers for the success of the republican party that we have in Arizona.

The man who thinks that the future success of the republican party depends upon who gets one or one hundred federal offices, should take something to strengthen his thinking apparatus.

By no means the least likeable trait in the make up of President McKinley is his love and honor for his aged mother. Long may she continue to live and take pride in the honorable career of such a son.

"The hand that rocks the cradle not only rules the world, but rules this country from the hearthstone."—Fourth of July speech of Hon. Benjamin Butterworth.

Judge Baker's decision, in the water case at Phoenix, is displeasing to both sides. A judge usually pleases one side in deciding a case, but in this instance both are dissatisfied.

The hot wave seems to have gone into camp in Arizona. While its presence is somewhat uncomfortable, it is not attended with such fatalities as it has been in the east.

President McKinley's decision to modify the partisan and absurd extensions of the civil service rules made by Mr. Cleveland is in line with real civil service reform.

The gunpowder route to eternity was patronized as well as usual, or a little better, this year. Those who failed to make connection will find the gasoline route quick and effective.

Russia has served notice on the Sultan to keep off the grass, or in other words that unless Turkish troops immediately evacuate Thessaly, Russia will send her troops across the Turkish frontier. All the powers except England have consented to this arrangement.

The English government has ordered a censorship over the press in India. It is claimed that one or two assassinations and several riots have occurred on account of articles published in native papers. The alleged seditious publications that promoted the riots, and which are still keeping Calcutta and other places in ferment, simply charge the British troops with outraging or violating the honesty of native women, and of insulting the religious feelings of the Hindus and Mohammedans.

The city council is doing a wise act in causing a complete investigation of the country surrounding Prescott with a view of ascertaining the very best possible site for a water system. Prescott stands badly in need of such a system, in fact it is essential to its growth, and it is all important that when a decision is made it may be the very best possible, and one which gives the best assurance of permanency.

A dispatch from Paris says the inquiry at an American embassy there has elicited a confirmation of the rumor that the governments of Spain and Japan have arranged an offensive alliance against the United States. The terms of the understanding, which is for the mutual protection of Cuba and Hawaii, provide that in the event of an active, aggressive movement on the part of the United States tending toward interference in Cuban affairs or persistence in the annexation of the Hawaiian Islands, both Spain and Japan shall declare war simultaneously against the United States, and shall make hostile demonstrations along both the Atlantic and Pacific coast line of that country.

Richmond, Virginia, has been making a move to induce the next meeting of the national encampment of the G. A. R. to be held there. There, however, appears to be a serious obstacle in the way of the success of this movement. Whether correctly or not, it is said that at the last grand army encampment a resolution was adopted declaring that hereafter the body would not meet in any city in which the hotels would not entertain the colored members. This the hostilities have never done in Richmond and will hardly be likely to do. If this resolution was adopted by the G. A. R. convention it leaves Richmond and all other southern cities out of the race.

CONFIRMATION OF GOVERNOR McCORD.

The friends of Governor M. H. McCord who are legion, are naturally jubilant over the happy outcome of the fight made against him for the position of chief executive, while his enemies are naturally correspondingly dejected and crest fallen.

The fight waged on him has been of such a nature that it finds no parallel in the history of politics in the nation. It has been bitter and relentless and yet every accusation, every charge, and every affidavit introduced has been manfully met and disproven.

Governor McCord has won a host of friends to his side by the dignified and manly bearing which he has maintained through it all. Men who were indifferent, and others who were inclined to oppose him simply because he was assailed, when they saw the manly dignified manner of the man, under such trying circumstances, were won to him.

A guilty man, one who was guilty of the acts charged against him could never have passed through the ordeal he did without giving vent to the feelings possessed by the ordinary mortal. He never permitted the violent assaults to disturb his equanimity or the serenity of his temper.

The JOURNAL-MINER has believed from the first that the charges were ungrounded. It believed in his integrity and believes so still. His future acts as governor will demonstrate whether his friends have misplaced their confidence in the man, or whether his enemies were right. He has it in his power to further put his assailants to shame and we have faith that his official acts will be of such a character as to do this.

The vote whereby he was confirmed, as reported in the Phoenix papers was 57 to 8 instead of 28 to 18, as reported in the special to the JOURNAL-MINER on Saturday.

THE YOUNGER BROTHERS' CASE.

The Minnesota state board of pardons is now in session, considering the question of a commutation of sentence, or pardon, of the notorious murderers and outlaws, the Younger brothers. One man who is interesting for these outlaws, cited an instance, on their behalf, where they refused to kill a man whom they might just as well have murdered as not. This man is Sheriff Barton, of Rice county, Minnesota, and it is said he spoke earnestly in favor of a pardon. The circumstance related by him is as follows:

He said he had charge of the Youngers just after the raid for two months, and found them to be truthful in every thing. When the party were near Mankato after the raid, they came across a farmer who was made to show them the roads by which they could avoid the town. After the farmer had showed them the right road, Pitts insisted that he be shot, claiming that he would certainly betray their whereabouts, and the result would be their capture. Cole Younger had objected to killing the farmer, and it was finally left to Bob Younger to decide what should be done. Bob Younger sided with his brother Cole and the farmer was allowed to go.

Sheriff Barton said Cole Younger had told him this the day following the capture, and a day or so later, when the farmer visited the jail, the statement had been verified before the man was admitted to see the prisoner.

Now really was not that a magnanimous act? The bandits were fresh from Northfield with their hands reeking in the blood of a murdered cashier. A poor farmer happens in their way and gives them information whereby they may be able to elude the officers. They fail to kill him after receiving kindly words from his lips, and now this is set up as an incident in favor of their pardon. To what length will maudlin sentiment for worthless murderers be carried?

The Younger brothers should be thankful for the miscarriage of justice which today permits them to be alive at all. Had justice been meted out to them as they deserve their worthless carcasses would years ago have been eaten by worms, and today nothing would be left of them but a memory of their crimes.

INEQUALITIES OF TAXATION.

The mayor has sent a message to the city council, recommending some radical changes in the matter of taxation, for the alleged purpose of equalizing taxation. His idea of equalizing taxation, according to his message, is "that an arbitrary annual tax of two dollars be levied on each lot for the purpose of maintaining public lighting and water works, as such works add equally to the value of the improved and unimproved lots." A \$2.00 tax on a \$10.00 lot on the outskirts of town, the same as on a \$5,000 lot in the business portion of town, evidently expresses His Honor's idea of equalizing taxation. It is probably true that the intrinsic value of the earth composing the \$10.00 lot is as great as that of the \$5,000 lot, the increased value of the latter arising from its special adaptability to certain uses in business.

The idea that the poor laboring man, who purchases a cheap lot in the suburbs of the town, and erects thereon a humble cottage to shelter himself and family, and thus avoid paying rent, should be taxed as much for his lot as the capitalist who draws a monthly rental of \$50 or \$100 per month from his lot in the business part of town, and lives in ease and luxury from the income of his realty holdings, will strike the average citizen as being a somewhat novel one in correcting inequalities in taxation.

If we understand aright the

recommendation of the mayor, this arbitrary tax is to be in addition to the regular ad valorem tax levied. While not a lawyer, as a plain every day citizen, this proposition at first sight strikes us as being double taxation, hence its liability to run up against a legal snag.

His Honor also recommends "that a street tax of two dollars per annum be levied on each male resident of the city between the ages of 21 and 60 years, as a special street tax." The mayor is treading on dangerous ground in this recommendation, as if such a tax should be levied, it would place him on the tax paying list, a position he has not occupied for several years.

This proposition, though, is not a bad one, and the money thus collected could certainly be expended to good advantage in improving the streets. The only suggestion the JOURNAL-MINER has to offer to it is that the mayor be exempt from its provisions.

Bryan is campaigning in Oregon now. He has been in the field now for over a year, and still holds out as fresh as a daisy.

The senate committee has agreed to report favorably on the Hawaiian annexation treaty without any amendment.

Senator Mark Hanna has been given a room in the White House, in order that he may escape from office holders.

The gentlemen who would be glad of Mr. Quay's retirement were a little premature in their rejoicing. He will serve at least one more term in the Senate unless death prevents.

Jerry Simpson is entirely too pessimistic. He certainly hasn't found the struggle for life a harder one than did Americans of revolutionary days, and he will find it difficult to point out any one who has.

Col. C. F. Crocker, first vice president of the Southern Pacific Company, died at his residence in San Mateo on Saturday night, after an illness of only eight days. Deceased was an exceptionally bright man and a good railroad official. He was only forty-two years old.

Speaking of the confirmation of McCord the Washington Times says: "Today ended the most stubbornly contested case ever before the senate. There was absolutely nothing against McCord, yet senatorial curiosity could not be overcome. McCord won his case by straight forward manly conduct and the prompt refutation of any charge."

The convention of Republican League Clubs is in session at Detroit, Michigan. At its session on Thursday, a motion was adopted that the plank in the platform urging the passage of discriminating duty as an act for the protection of American shipping in foreign trade be sent to the president and congress. Omaha was selected for the next convention of the Republican League.

The Phoenix Gazette says that the tax levy in that county has remained at \$2.50 for twelve years, yet in that time the assessment roll has climbed from \$1,500,000 to \$9,000,000, and the only thing the county has got to show for the expenditure of the money is a rickety old jail. It then asks, "what an earth becomes of the additional revenues collected on this increased tax roll?"

A correspondent of the Chicago Journal of Commerce, writing of Arizona, says that he saw in the Salt River valley a steam dredging scow, such as is used in deepening rivers and harbors for navigation, voyaging slowly and steadily through a wide strip of arid desert. It was started landward from Salt River and was excavating its own channel ahead, the river waters following and floating it as it advanced. But the work done was not, in fact, the making of a new channel, but the digging out of an old one, the irrigating canal made by a civilized people that lived and flourished and departed before recorded American history began. It is really astonishing the different effects the different grades of whiskey produce on a man's mind. Now, if that Chicago man had been at home, the same "jag" that enabled him to see a steam mud scow navigating the arid deserts of the Salt River valley, would have pictured itself to him simply as an air ship.

HE WAS CAPTURED.

In the Brazilian hotels men are employed to do the chamber work, and they are prone to rush into the bed rooms of the guests when occasion requires without knocking. A prim little Yankee "schoolmarm" visiting Rio de Janeiro was much annoyed at this custom, and, after mildly protesting several times without effect, she said severely to the boy who did the work in her room: "Juan, be good enough to open the door of my room without knocking. If you do it again, I shall certainly report you to the office. Why, I might be dressing!" "No danger of that, senora," responded Juan in his best English; "before I come in I always look me through the keyhole."—San Francisco Argonaut.

The Alaska fever has broken out bad in Prescott. Out of a score or two of people who have it in a more or less serious form two had it so bad that they left on this morning's train for the frozen, gold laden shores of Alaska. They were Geo. Merwin and Tom Turner, and they intend to try and get through to the new gold fields before winter.

H. A. Eastman, a Chicago capitalist, and S. E. Fuller, have just returned from a visit to Spanton.

MINING INTELLIGENCE

Weekly Collection of News Nuggets From Our Mining Camps of Interest to Miners.

What Prospectors and Miners are Doing to Increase the World's Supply of Precious Metals.

Miss M. M. Hutchinson has deeded the Sulphure mining claim to Mrs. S. C. Hutchinson for \$1,000.

On Saturday a steamer arrived at Seattle from St. Michaels having on board a ton of gold.

Specimens of rich gold ore from from a claim owned by Tom Shultz can be seen on exhibition in Geo. H. Cook's jewelry store.

A deed has been filed for record from Sam Foran to John Riley for three-eighths of the Jim Crow mining claim, in Big Bug district.

The August number of The Engineering Magazine (New York and London) will contain an illustrated article on "The Mineral Resources of Arizona," written by Thomas Tonga, of Denver.

The Monte Cristo mine on Groom creek continues to hold its own both in the quality and quantity of ore with development work. Assays of ore taken from the bottom of the shaft gave a value of \$267 in gold and \$99.87 in silver.

The Swallow mining company of Castle rock are overhauling their mill at Briggs and will start it up soon on a steady run. Mr. Gray, one of the owners, is personally supervising the work and states that the outlook is very gratifying.

W. H. Bank, mention of whose arrival in this section was recently made, left yesterday for Harqua Hala with samples of ore from a mine near Prescott, which he thinks of purchasing. The assayer of the company represented by Mr. Bank resides in Harqua Hala.

Supt. E. Randolph, Eugene S. Ives and R. J. Dunne have secured control of the King of Arizona mines and a stock company has been organized with Mr. Randolph as president. These mines are known as the Gleason mines, situated about fifty miles northeast of Yuma—Citizen.

A deed was filed for record today from F. E. George to E. Webb, trustee, of Wichita, Kansas, for the Goddard mining claim, located in Black Rock district, the consideration named being \$1,000.

Stories of fabulously rich mines have been received from Alaska. Passengers who arrived in San Francisco July 16 from that country, were loaded down with gold, eleven of them having from \$3,000 to \$175,000 each.

The Herald reports five carloads of machinery at Phoenix for the Arizona oxyc company. It says that the machinery is to be located in the oxyc quarries at once and set up as soon as possible, when the work of working the product of those quarries will be actively engaged in.

A lot of very rich ore from the Etta mine is on exhibition at James Shirley's office on Gurley street. The ore was taken out from a depth of over 200 feet and free gold can be seen sticking out from it on all sides. The specimens on exhibition are to the thousands of dollars per ton.

A deed was filed for record today from Mrs. S. E. Newland, of Phoenix, to Mrs. Anna Wisdom, for an undivided one half of the Eureka mining claim, in Weaver mining district, the consideration being \$1,500. Another deed from John Webber conveys title to Mrs. Wisdom to the Independence mining claim, in Peeples valley, for \$75.

Two car loads of machinery have arrived for the oxyc company, and the first shipment by wagon was made today. The machinery consists of boiler and engine, steam derrick, saws and other appliances for the convenient handling and polishing of the oxyc. The operation of the property promises to become a great industry.

Mr. McNulty, partner of G. C. Waddell in a mining claim seven miles south of town brought in some very rich samples of ore from that mine on Saturday. It was struck in a new shaft within about ten feet of the surface. It goes about \$100 in gold and carries a good percentage of lead and is a fine concentrating ore. The mine is being worked under lease at present.

The Phoenix Herald reports the discovery of another lost mine, but fails to state its location, further than in the indefinite location of the southwestern part of the territory. Like all discoverers of lost mines, the discoverer of this one traveled for days on the desert without water, depending entirely on cactus juice to quench their thirst. They were compelled to return without thoroughly investigating the value of their find.

Thomas Sedgwick, a mining prospector, is reported to have recently made one of the richest gold strikes ever made in Sonora, in the mountains near the headwaters of the Yaqui river. The news of the wonderful find has spread throughout the state and hundreds of prospectors are going to the new camp. Many claims have already been filed and a number of other rich strikes are reported. The new district is a considerable distance from railroad transportation and is in the Yaqui Indian country.

The Sun Dance company while prospecting for water, near the bed of the Hassayampa river, and close to their mines, yesterday struck a strong flow of water at a depth of five feet from the surface. The water came in so rapidly that it steam jet throwing at the rate of 50,000 gallons of water per day failed to make any impression on it or to lower it in the least. It is estimated that not less than 100,000 gallons per day can be obtained from it, which will give an ample supply to run the mill day and night and have a surplus of thousands of gallons per day left.

Word reached here yesterday that J. C. Henry, of this valley, who is mining in the vicinity of Walnut Grove, in Yavapai county, has struck

a ledge of cinabar. If this turns out to be a fact, and quick silver ore is found in sufficient quantities to work, it is one of the most important mining discoveries ever made in Arizona. From time to time in the past, reports have come in of discoveries of tin ore, aluminum, cinabar; but they have proved to be mistakes on being analyzed; it is sincerely hoped that Mr. Henry has found all that he thinks he has. Large quantities of quick silver ore, and it comes almost entirely from the New Almaden quick silver mines, Santa Clara county, and the Johnstown and Knoxville quick silver mines, in Lake county, California, the most prominent and successful quick silver mines in the United States. The discovery of a new supply of that metal in Arizona would be a boon to miners, especially in the southwest, and it would be better than a gold mine to the discoverer.—Herald.

California has a gold excitement now, too. A telegram from Redding says: "Authentic reports from Harrison Gulch, just received, substantiate the rumor that an extensive gold discovery has been made at Hall city, Trinity county, during the past week. It is now believed by many that the mother lode of the untold wealth supposed to exist somewhere in that rich mineral section had been found, and enthusiasm is rife among many prospectors who look for the opportunity of staking out good claims. The rock is of white and black variety and is freely impregnated with lime. The formation runs northwest and southeast from Tehama to Del Norte, and has been followed by its outcroppings for many miles. It is even clearer that the same thing is found in Colusa county, 200 miles south-east. The formation lies between a dyke of lime, several hundred feet wide on the north, and a porphyritic combination 200 feet wide on the south. By many experienced miners it is believed that a mother lode of inestimable wealth has been discovered. Hall city and Harrison Gulch have developed numerous rich mines during the past fourteen months, and the general direction of the ledges led many to believe that the mother lode existed there, and would some day be discovered.

R. H. Paul, ex United States marshal and former sheriff of Pima county, for more than two years has been the employer of the Southern Pacific company and engaged in boring for coal in the Gila river, nine miles above Solomonville. It has puzzled a good many people to understand why the Southern Pacific company should select a locality in prospect for coal where there are no surface croppings and where previously there had been no suspicion of coal existing. The theory upon which the company bases its expectations of finding coal is this: The Deer Creek coal fields lie fifty miles west. Proceeding east into New Mexico coal is found in the miles west of Silver city and still farther east, two miles from the Rio Grande river, are valuable coal deposits owned by Senator Steve Elkins and others, and which have been prospected to a depth of about 300 feet. All of these several occurrences of coal are situated on a well defined belt, the geological formation being identical and continuous, and the site selected by the Southern Pacific company to carry on operations is upon this belt, and where, if they are successful in finding coal, it will be at a considerable depth. In prospecting this work they have encountered difficulties unforeseen and boring was suspended last December. There is nothing, however, to discourage the hope of ultimately striking coal, and Mr. Paul is only awaiting the arrival of an experienced man from New York to take charge of the work to resume boring.—Ex.

The Associated Press, through its San Francisco agent, has received a letter from Alaska from H. A. Stanley, president of the Binghamton, N. Y., Herald, telling of the wonderful gold discoveries of Alaska. Mr. Stanley wrote from Saint Michael's Island, Yukon mining region. Writing under date of June 30, he says: "The richest gold strike the world has ever known was made in the Clondyke region last August and September, but the news did not get even to Circle City until December 15, when there was a great stampede over the 300 miles intervening between there and the newer fields. On August 12, George Cormack made the first gold strike on Bonanza creek, and on August 19 seven claims were filed in that region. Those who made the 300 miles first, struck it richest. Of all the 200 claims staked out on Bonanza and El Dorado creeks not one has proved a blank. Equally rich claims were made June 6 to 10 on Dominion creek, and the surface indications are that those are as rich as any of the others. The largest nugget yet found was picked up by Bert Huddeson on Claim No. 6 on the Bonanza, and was worth \$257. Next in size was one found by J. Clemons on Indian creek, worth \$231. The last four pans Clemons took out were worth \$2,000 and one went \$775. Bigger pockets have been struck in other regions, but nowhere on earth has so rich a general find been made as in this section. In all about seventy-five lucky miners have reached St. Michael's. Some brought but a portion of their clean up, preferring to invest other portions in mines they know to be rich. Among the most lucky are J. J. Clemons of Los Angeles, who has cleaned up about \$175,000; he brought out \$50,000 and invested the rest. Prof. T. C. Lippy, of Seattle, brought out about \$50,000, and has \$150,000 in sight, and now claims his mine is worth \$500,000 or more; Wm. Stanley, of Seattle, who cleaned up \$112,000; Clarence Berry, \$110,000; Henry Anderson, \$55,000; Frank Keller, \$50,000; T. Kelly, \$33,000; W. K. Sloane, of Nansimo, B. C., \$85,000, and at least thirty more who will not talk, but keep guard over their treasure in their staterooms. There are at least twenty men more bringing from \$10,000 to \$20,000. All this gold and more to come is the clean up of last winter's work. It must all come out via St. Michael's and the bulk of supplies must go in that way. The two great transportation companies pushing in supplies are the Northern American Trading and Transportation Company and the Alaska Commercial Company."

NEWS NOTES AND COMMENTS.

Theodore Schmidt, a real estate broker of Chicago, has failed for \$700,000.

The coal miners' strike is increasing.

The famous Broad Moor Casino, a one hundred thousand dollar resort near Colorado Springs, has been burned to the ground.

A Los Angeles telegram says: A strong company of local capitalists was hastily formed here today to see to it that the Alaska gold fields. They will raise \$2,000 for each man sent. E. E. Delano, an old mining man in charge of the party, will probably outfit at Seattle. They will start this week.

Lieutenant R. E. Peery and party sailed for North Greenland from Boston on Monday. They are fully equipped for a long voyage on board the steam sailing bark Hope. They expect to establish a settlement at Remota, a northern point in Greenland, which shall be used as the base of supplies for an expedition in search of the north pole in 1898.

J. E. Pruett, deputy assessor and tax collector of San Jose, Cal., for many years, shot and killed himself under circumstances which tend to belie the belief that he committed suicide. He has made no settlement for the current year and was to have done so on Monday. His books are missing from his office and it is not known how much he owes. The books will be exported.

John Bradbury and wife both say they are happy and glad. They will forget the past, and seek happiness out of the future.

A young New York lawyer, who saved two young men from jail, was knocked down and robbed by them.

The Kansas wheat crop is estimated at 60,000,000 bushels.

Two thousand people have left New York for the Clondyke country.

The new gold fields are said to be located in British territory and not in Alaska.

The Winner

of one of those \$100 prizes got her yellow tickets in this way:

- 1. By using the tea herself.
2. By asking some friends who use the tea to give her their tickets.
3. By inducing some friends to try the tea and give her their tickets.

One of her friends kept a boarding house, and sent her lots of tickets.

Have n't you some friend who keeps a boarding house or a restaurant, or who has influence in some hospital or other public institution? They need good tea there.

Rules of contest in large advertisement about first and middle of the month. A A

\$100 Reward \$100.

The readers of this paper will be pleased to learn that there is at least one dreaded disease that science has been able to cure in all its stages, and that is Catarrh. Hall's Catarrh Cure is the only positive cure known to the medical fraternity. Catarrh being a constitutional disease, requires a constitutional treatment. Hall's Catarrh Cure is taken internally, acting directly upon the blood and mucous surfaces of the system, thereby destroying the foundation of the disease, and giving the patient strength by building up the constitution and assisting nature in doing its work.

The proprietors have so much faith in its curative powers, that they offer One Hundred Dollars for any case that it fails to cure. Send for list of testimonials. Address, F. J. Cheney & Co., Toledo, O. Sold by Druggists, 75c. Hall's Family Pills are the best.

District Court Proceedings.

Monday, July 19.—Mrs. Mary Wall vs. J. Phillips, jr.; leave grantable plaintiff to file amended complaint herein making the Gold Bug Mining company a party defendant. Anna C. Gustafson vs. Lars E. Gustafson; judgment for plaintiff. The oath of office as judge was administered to R. E. Sloan and he took his seat on the bench as presiding judge and Hon. J. J. Hawkins retired. Joseph Dougherty vs. Daniel O'Boyle; case placed on the calendar and default entered. W. C. Bashford vs. John Wood; case placed on calendar.

Apropos of the production here tomorrow evening of Sir Puffin, it may be mentioned incidentally that J. M. Wilson, manager of the Columbia opera company, is an Oriental himself, by initiation, being a Noble in the order of Mystic Shriners. Everybody who belongs to this mystic order is supposed to have crossed the trackless desert on the hurricane deck of a camel.

NOTICE FOR BIDS!!!

THE UNITED VERDE COMPANY at Jerome, Arizona, will receive bids for 10,000 TO 15,000 PEELED STULLS

Straight, of good sound timber. Diameter at small end to be 9 inches, 10 inches and 11 inches. Stulls to be 16 feet in length. Same to be delivered at Jerome Junction or at Davis Station on line of U. V. & P. Ry Bids will be received until August 17th, 1897. The company reserves the right to reject any or all bids. UNITED VERDE COPPER CO. 1-11-97

Advertisement for Blackwell's Genuine BULL DURHAM Smoking Tobacco. Includes image of a pack and text: 'This is the very best Smoking Tobacco made. You will find one coupon inside each 2 ounce pack and two coupons inside each 4 ounce bag. Buy a bag, read the coupon and see how to get your share of \$25,000 in prizes.'

Advertisement for NO-TO-BAC GUARANTEED TOBACCO CURE. Text: 'Over 1,000,000 boxes sold. \$20.00 cures prove the power to destroy the desire for tobacco in any form. No-to-bac is the greatest nerve-food in the world. Many gain 10 pounds in 30 days and it never fails to make the weak impotent man strong, vigorous and manly. Just try it a day and you will be convinced. We expect you to believe what we say. For a name is an absolutely guaranteed cure for tobacco and opium habit. Address: T. B. SELLING & BROS., Chicago or New York. For Sale and Guaranteed by J. N. McCANLESS.'

Advertisement for Bicycles. Text: 'Two Fine Wheels! CHEAP Ladies' and Gents! GEO. H. COOK, JEWELER, PRESCOTT, ARIZONA.'

Advertisement for Good Ones! HANAN & SON'S CELEBRATED SHOES. Text: 'Do You Wear Shoes? Do You Wear Good Shoes? If You Do Not Now is the Time to buy Good Ones! AT THE PRICE OF CHEAP ONES. For this week we will place on sale our entire line of HANAN & SON'S CELEBRATED SHOES. At the price you have been paying for Shoes of vastly inferior make and quality. The \$6.50 Calf Shoes we will sell for \$4.00. The \$6.50 Patent Leather Vici Kids we will sell for \$4.25. Don't fail to take advantage of this tempting offer. We have a few \$2.50 shoes that we will close out at \$1.25. Ask to see them.'

Advertisement for On Wednesday, July 21, 1897. WE WILL HOLD A BARGAIN SALE OF SILK! Look at These Bargain Prices. A Fair Quality of China Silk, all Colors, at 20c a yard. A Nice Broadcut Silk, 75c and 80c quality at 40c a yard. A \$1.25 Quality Summer Silk, at 50c a yard. A \$1.50 Quality Summer Silk, at 75c a yard. A \$2.00 Quality Summer Silk, at 1.00 a yard. And all our COLORED SILK will be offered at like reductions in price.

Advertisement for M. Goldwater & Bro. The Best Always. Includes image of a man and text: 'FRANK M. MURPHY, President. MORRIS GOLDWATER, Vice President and Cashier. WALTER C. BRANSON, Secy. Cashier. THE PRESCOTT NATIONAL BANK. Paid up Capital, \$100,000. Surplus and Undivided Profits, \$25,000. FRANK M. MURPHY, DIRECTORS. MORRIS GOLDWATER, J. L. FISHER, R. N. FREDERICK, W. C. BASHFORD, D. M. PERRY, JOHN C. BERNDSON. A General Banking Business Transacted. Drafts Drawn on all the Principal Cities of the United States and Foreign Countries. Money Sent by Telegraph. Gold Dust and Bullion Bought. Exchange Papers Taken Care of Without Charge. Collections Made on Favorable Terms and Promptly Remitted for. We Solicit Your Business, Which will Have Careful Attention. AND... FOUNDRY Machine Shop. Castings of all Kinds in Iron or Brass. Machine repairing a specialty. MILL and MINING MACHINERY. P. O. Box 458. PHOENIX, ARIZONA. STANDARD IRON WORKS.'

# Arizona Republican's Editorial Page

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THURSDAY MORNING, MARCH 5, 1914

We must demand the highest order of integrity and ability in our public men who are to grapple with these new problems.  
—Theodore Roosevelt.

**The Somers System at Tucson**

A protest has been filed by the principal property owners of Tucson against the installation of the Somers system there, and a petition has been presented to the board of supervisors to make no appropriation to defray in part the expenses of its application. The city council of Tucson has already refused to hear any part of the expense. The chief and, so far as we have heard, the only objection to the installation of the system there is that it is not to be applied to all the towns in the state, notably Clifton and Morenci.

This objection must be based upon the assumption that the assessments under the Somers system will be higher. That is not necessarily the case, and is not theoretically the case at all, since it is the purpose of the state tax commission to see that the property in all towns, by whatever system employed, shall be assessed at its full cash value. If the purpose is carried out, the valuation of property as between towns shall be equalized. The Somers system is intended to equalize the valuation of property among the property owners of the same towns and not to leave assessments to the caprice or favoritism of local assessors and boards of equalization.

Thus city, the coming of the Somers system has been welcomed by all who have given attention to the subject of scientific assessments. We believe the members of the Maricopa County Non-Partisan Taxpayers' League, those resident in the city, almost to a man favored its introduction, and since its operation, so far as it has gone, are more strongly in favor of it than before. It has already been discovered that some property has hitherto escaped taxation; that some property has not borne its full share of taxation, notably, property held for speculative purposes, depending for its value upon the development of the property in its immediate vicinity.

It will be found, we suppose, when the valuations have been finally determined, that some property will be assessed at a lower figure than it was last year, and some at a higher figure, but in neither case will the figures be the result of guess work, but of scientific calculation, in which the property owners themselves, to a large extent, have concurred. Those whose taxes this year will be heavier than they were last year may regret the increased outlay, but their peace of mind will not be further embittered by the reflection that they are the victims of injustice.

For many years complaint has been heard from Tucson that some of its citizens, the wealthier ones, have been touched too lightly by the taxing authorities; that more than his share of the burden has been borne by the small property owner, who was without influence or recourse. He is the man whom the Somers system is designed to protect.

The system will be applied to Tucson, despite protests, but if it should not be, Tucson as a town would still have to bear its full share of the burden, for the state board will attend to that, whatever the local city and county assessors and boards of equalization may do. But the state board, while it can work justice as between towns, cannot insure justice, or even attempt it, between the property owners of the same town. It is for that the Somers system has been invoked, and not, as some suppose, to raise a greater amount of money than is needed for the conduct of government.

**Mars on Our Watershed**

"The north polar snowcap of Mars is melting," according to a dispatch from the Flagstaff observatory. Now, if that snowcap were only on the Salt River watershed, the Roosevelt Dam would soon be running over and we would have some millions of acre feet to spare. The Salt River would be a navigable stream compared with which the paternal Mississippi would be a murmuring rivulet. And why should we not pre-empt and lay claim to Mars as a part of our watershed? Flagstaff is in the watershed, and Mars is within the jurisdiction of Flagstaff, the center from which all news relating to Mars and the Martians is distributed to the peoples of the earth. The silence of scientists everywhere else gives consent to our claim of sovereignty over that planet. If any section of the earth has a right to appropriate the flood waters of Mars, certainly we within the Salt River watershed have that right.

There was a time when we were inhibited by federal law from appropriating flood waters from any source. We had to content ourselves with the natural flow, which we appropriated over and over again. The records of the recorder's office of this county show a total appropriation of such a natural flow of the Salt River that if it really existed would be in such volume that it would make the lordly

Amazon appear to be merely a long and tortuous damp streak.

But that federal inhibition disappeared when Arizona was admitted to statehood, and we are at liberty to appropriate any thing not already appropriated. We refer this matter for further action to our fellow citizen, Professor Percival Lowell, custodian of Mars.

**A Belated Apology**

We made some mention the other day of the acquittal at Clifton of a woman, on trial for the murder of her father, who, though she was married, had forbidden her to roam the streets at night, and remonstrated with her and was threatening to chastise her when she disobeyed his injunction. We hinted at the time that here was a miscarriage of justice, our opinion being based in part upon the fact that the man had been shot in the back, usually an awkward circumstance in the vicinity of which to build up a plea of self-defense, as was done in this case.

But, regarding the wound in the back of the murdered man, we learn from the Copper Era "apparently, the attorneys for the defense did not attach great importance to this testimony, they referring in their arguments to it as being entirely possible that Mrs. Gould did fire at her father's back in her great fear and excitement occasioned by his attack, and that she could not be responsible for the place of entrance of the bullets."

This seems to be, after all, only a variation of the long-established doctrine that when a woman throws at a hen in the back yard and hits the child of a neighbor two doors away, she is not responsible. Her elongated clavicle is responsible for the mishap. The fault, if any, in the case of the Clifton homicide, seems to lay with the manufacturers of the revolver which, presumably, like most of its kind, had a straight barrel, so that a bullet projected from it would proceed in a straight line, modified only by the trajectory, until it was stopped by some object of sufficient resistance. If the barrel of the revolver had been given a proper curvature, and we have heard of such construction to permit hunters to shoot around corners at elusive game, the defendant, even though her father's back was turned toward her, might with unwomanly aim have shot him in the breast.

In this view of the case, we are inclined to the belief that her attorneys were right in not "attaching much importance" to the point of ingress of the bullet, since their client had made use of the only weapon that the manufacturers had provided for her. Our strictures upon the jury in this case were made without a full consideration of the facts that have since been brought to our notice. We gave undue weight to what at the time seemed a matter of "great importance." We offer a belated apology at the earliest moment.

The inquiry by a member of the congressional committee engaged in investigating the Michigan mining troubles as to the salary of General Manager McNaughton of the Calumet & Hecla seems improper. One thing is certain. Whatever his salary may be, it is not more than the directors of the company believe he is worth to them. McNaughton rose to his position from the ranks, and at every stage he proved to the mine owners that he was worthy of a better place at better pay. Owners of mines do not pay fancy salaries for fun or with the idea of unburdening themselves of their profits.

The wife of the San Francisco sheriff is suing him for a divorce and threatening to institute a movement for his recall from office. She is not animated by any ill feeling in the latter proceeding, but she believes she has had a better opportunity to know of his unfitness for the office than outsiders. But as a recaller she is short-sighted. A divorced husband deprived by the recall of his salary may not be prepared to comply with an order to pay alimony.

In the case of a clash of authority between Carranza and Villa, it would not be difficult to forecast the result. Villa has the army and whatever prestige has been gained by the revolution. He has obscured Carranza whenever he chose to do so and has shoved him to the front when that suited his purpose better.

**FAMOUS SHORT POEMS**

Printed in connection with the work done in the English department of the Phoenix Union High School.—Conducted by Prof. I. Colodny.

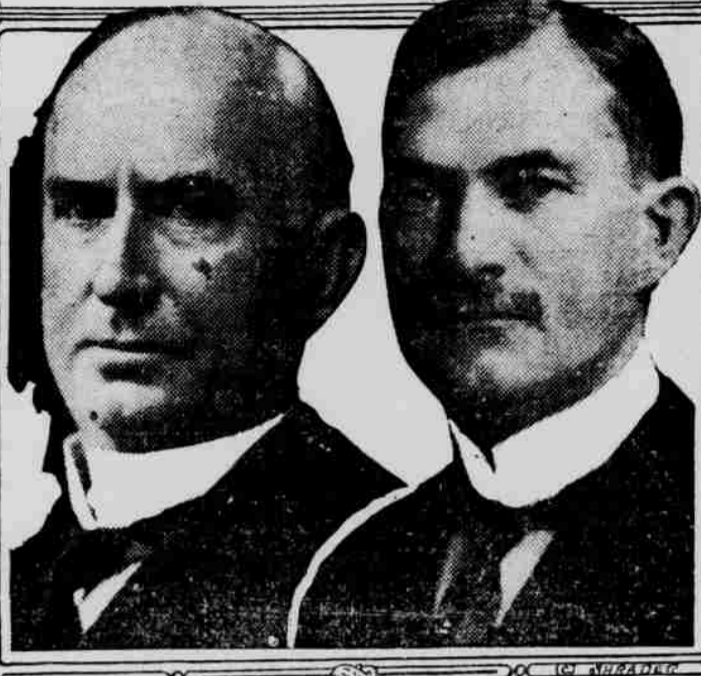
**—Crossing the Bar**  
Sunset and evening star,  
And one clear call for me!  
And may there be no moaning of the bar,  
When I put out to sea;  
But such tide as moving seems asleep,  
Too full for sound and foam,  
When that which drew from out the boundless deep,  
Turns again home.  
Twilight and evening bell,  
And after that the dark!  
And may there be no sadness of farewell,  
When I embark;

For though from out our bourne of time and place  
The flood may bear me far,  
I hope to see my Pilot face to face  
When I have cross'd the bar.  
—Alfred Tennyson.  
1809-1892.

**A NEW LINE OF SPORT SLANG**

I found my eyes jowling on the cage, but she awoke, mantled and roused a little, after which I let her bowse. Hooded, with jesses, leash, and bells in perfect order, I took her on the fist and so to the fields. It was evident that she was in parak, for her sails, mails and train ruffled eagerly, and her petty singles spasmodically contracted so that her talons gripped the glove hard. A rock appeared and I flew her at it. It was too far off and escaped, but it was a marvel to see Lady wait on, discover another quarry, chase it, throwing up cleverly, and finally bind to it with a lightning stoop. She was depluming it when I was able to make it easily.—Outing Magazine.

**HOT CAMPAIGN FOR SENATORSHIP IN ARKANSAS; CANDIDATES BITTER ENEMIES**



Senator James P. Clarke (left) and Judge William F. Kirby.

James P. Clarke, U. S. senator from Arkansas for the last eleven years, and president pro-tem of the senate, is now engaged in a contest for re-election. His opponent is William F. Kirby, associate justice of the Arkansas supreme court, who has held the post of attorney general and was an unsuccessful candidate a few years ago for the nomination for governor. The contest is becoming very bitter and the candidates do not speak as they pass by.

**Sidewalk Sketches**  
BY HOWARD L. RANN

**THE ULTIMATE CONSUMER**

The ultimate consumer is a pigeon-toed producer of pinched pennies entirely surrounded by congressional hot air. He is usually portrayed in the pleasing role of the goat. Whenever a politician sets out to cop a certificate of election, he wags a forbidding forefinger and a bunch of chin whiskers in the direction of the ultimate consumer and the dead is done. One of the most improving sights in this materialistic age is that of a pure-hearted candidate for office waving the red flag of \$8 sugar before a crowd of ultimate consumers with pop eyes and a general thirst. The hope of this republic is in the open-mouthed patriot who backs up against the Stars and Stripes and strings the ultimate consumer until he can't tell the wool schedule from the Leaning Tower of Pisa. Every man is an ultimate consumer until he mortgages his home for a green runabout and a full-dress suit, after which he becomes a bloated magnate and quits asking the price of store eggs. The man who can make \$12 a week reach around the appetites of twelve corn-fed children with a maw like a hot-air furnace is the real ultimate consumer, and he makes the average captain of industry look as cheap as a bow-legged tinier in court costume.

**PLAYGROUNDS FOR A MILLION CHILDREN**  
(New York Times)

That a million children may be given year-round playgrounds this year—a man prominent in public life has offered \$10,000 on condition that four other men or women give the Playground and Recreation Association of America like amounts, and thus make up a fund of \$50,000.

On the basis of the campaign conducted last year by the Playground and Recreation Association of America this \$50,000 will result in providing year-round playgrounds for at least one million children now compelled to play in the streets.

Less than eight million of the thirty million children in the United States now have year-round playgrounds.

Among the leaders in the Playground and Recreation Association of America are: Joseph Lee, Boston; Charles W. Eliot, Cambridge; Henry P. Davison, New York; John H. Finley, Albany.

The office of the association is in the Metropolitan building, New York City. Henry P. Davison is raising funds for the association in New York City.

**CAUSES OF TIDAL WAVES**

The tidal wave which devastated the island of Sokuira, in one of the provinces of Japan, is not the first disaster of this kind which the mikado's empire has suffered. In July, 1896, a great tidal wave swept along the coast of the island of Yezo for nearly 200 miles. Towns were ruined, fertile fields were laid waste. Twenty-seven thousand persons were killed, 3290 wounded and 9213 houses were washed away or wrecked. More than 60,000 persons were made destitute. Iwate prefecture suffered worse, as more than 23,000 of the dead lived in that province.

The Japanese papers of the time were busy constructing theories as to the cause of the sudden eruption had taken place far out in the Pacific ocean. Another theory was that a huge cave-in occurred in the southern part of what is known as the "Great Deep," stretching more than 700 miles northwest and eastward.

The term tidal wave is erroneously applied to almost any unexpected wave that inundates the sea coast or the shore of a great lake. These waves are rarely if ever due to the tides, since the real tidal wave is a phenomenon admitting of exact calculation and prediction; but they may be traced usually to some distant earthquake or violent storm.

When an earthquake occurs beneath the sea the vertical movements of the sea bed generate a great wave which is propagated outward from the center of the shock and reaches the land after the arrival of the earth wave. In the open sea this wave is so broad that it cannot be perceived; but when it reaches shallow water near the shore it rushes forward as an immense breaker, sometimes sixty feet or more high, and overwhelming everything in its course.

The sandy beach deposits and loose boulders are swept away, while inland the surface is strewn with debris. The velocity of these great sea waves is greater than the ordinary waves raised by the wind. A submarine earthquake near the coast of Japan in 1854 gave rise to sea waves which tra-

**There are 750,000 men and women in New York under 35, most of them under 20, who are not married and, as far as appearances go, do not intend to get married.**

Go into any theater in any large American city, and note the rows of young women sitting together and the corresponding groups of men. Why are they not coupled off, as in the smaller cities? Simply because the modern girl has developed an extravagance that the young man refuses to stand for. She must have a \$2 seat; she expects a box of American beauties with it; if the weather is bad, a taxi is required; and if her escort does not take her to a lobster palace after the show, he is regarded as a "cheap one."

And the same thing goes on after marriage, even if the husband's salary is small. He must go on working, of course, but she is to be beneficent a lady. She must have her maid, her laundress, her dressmaker, and she frets because she has no auto. And when the poor devil at the desk begins to show a waning enthusiasm over married life, she suspects that there is another woman in the case! —Thomas Van Buren in Leslie's.

**UNFAIR DEAL**

Hikely—Would you lend Dobson \$5?  
Skippe—No, I wouldn't!  
Hikely—Why not?  
Skippe—Why, I owe the cuss ten—it would be just like giving it to him!

**SALOONS NEAR THE STATION**

Saloon men are trying to get a bunch of saloons around the new Union Station in Kansas City. With a few "run" holes in and adjoining the magnificent new station, it could be easily made as rotten and unpleasant a place as the old station. The finest buildings in the world can be ruined without any trouble by what you put in and around them.

**Plain Speech**  
By WALT MASON

Old Ebenezer Jimson Jinks takes pride in saying what he thinks. "I do not mince my words," says he, "but speak my mind out, bold and free; and if I do not like a gent, I make it plainly evident; I air my views to beat the band, and people know just where I stand." He takes a foolish pride, methinks, does Ebenezer Jimson Jinks, in being rude and rough of speech, but few regard him as a peach. He keeps his neighbors hot and sore, and they denounce him as a bore. "We'd pay the freight," they often say, "if he would only move away!" And people dodge him on the street; they hate to hear old Jinks repeat "his honest views" on this and that, which views are spoken through his hat. When he steps up to join a crowd, you'd think a cold and clammy shroud had fallen on that bunch of men, who all disperse, to meet again when there's no Jinks to give the blues expounding "his straightforward views." If you would have a grist of friends you'll bear in mind that friendship ends, and cordial feeling slinks behind, when you begin to "speak your mind."

**LAND VALUES ARE INSURED BY THE**

**Roosevelt Dam**

Land titles are insured by the  
**Phoenix Title and Trust Co.**  
18 North First Avenue  
"A Modern Trust Company"  
Resources \$165,000

versed the whole breadth of the Pacific at a rate of about 370 miles an hour. At Simoda, Japan, the waves were thirty feet high, while at San Diego, Cal., they measured only six inches. Such an earthquake wave near the coast of Peru, once lifted a gunboat of the United States navy and landed it a mile inland.

The report of Cullio was inundated only the other day by a tidal wave, accompanied by an earthquake lasting fifty-five seconds. The naval school at La Junta and some of the hotels were flooded. A tidal and earthquake wave a few years ago in Ecuador did much damage. Across the Pacific from Ecuador, in Hawaii, the same disturbance was felt, accompanied by a great earthquake wave which did little damage. A hundred miles of beach towns and summer homes from Long Beach to Santa Barbara showed the effects last December of high tide combined with great swells which swept the Southern California coast. But Japan always seems to have been the worst sufferer from these phenomena.—Kansas City Star.

**Your Business**

Can be handled more smoothly and every transaction attended to with system and dispatch, when you make use of the services rendered by the Phoenix National Bank. You have a safe place for your funds; you can pay for purchases and expenses by check, and are assured of every accommodation in keeping with sound banking. You are cordially invited to confer with our officers regarding your banking needs.

**The Phoenix National Bank**  
"UNITED STATES DEPOSITORY"

Upwards of 7000 people do business with this bank. The people's confidence is shown by these figures.

We invite your banking business.

**THE VALLEY BANK**  
of Phoenix, Arizona

**Home Builders**  
Issue  
**Gold Notes**  
Drawing  
6% INTEREST.  
May be withdrawn on demand.  
**Assets \$535,000.00**  
Funds idle temporarily can earn something.  
Put your dollars to work.

**Home Builders**  
127 N. Central Ave.

Land values are insured by the  
**Roosevelt Dam**

Land titles are insured by the  
**Phoenix Title and Trust Co.**  
18 North First Avenue  
"A Modern Trust Company"  
Resources \$165,000

**Your Business**

Can be handled more smoothly and every transaction attended to with system and dispatch, when you make use of the services rendered by the Phoenix National Bank. You have a safe place for your funds; you can pay for purchases and expenses by check, and are assured of every accommodation in keeping with sound banking. You are cordially invited to confer with our officers regarding your banking needs.

**The Phoenix National Bank**  
"UNITED STATES DEPOSITORY"

# MESA DEPARTMENT

CHAS. F. JONES, Manager

## Eczema—A Germ Disease Can Now Be Cured.

The Medical profession is all agreed that ECZEMA is a germ disease, but the thing that has baffled them is to find some remedy that will get to the germs and destroy them.

Zemo, the clean, external treatment has solved this difficulty by drawing the germs to the surface of the skin and destroying the germ life that causes the disease. The whole method of treatment and cured by ZEMO is explained in an interesting book on the subject issued by the makers of ZEMO. It tells how to cure eczema at home of Eczema, Blackheads, Pimples, Dandruff, and all diseases of the skin and scalp. Call at Elvey & Hulst's Drug Store for Booklet and learn more about this clean, simple remedy that is now recognized the standard treatment for all diseases of the skin and scalp.

## COME TO MESA

where they have assured water supply, excellent soil.

Land within reach of all, \$50 and up, in tracts to suit on small payments down; 4000 acres you can choose from.

For full information see

## Jesse F. Kelly

Agent, Mesa, Ariz.,  
Or E. J. BENNITT & CO.,  
Phoenix, Arizona.

"SEE US FIRST"  
The Wilbur Realty Co.  
"Everything in Real Estate."  
Mesa, Arizona.

PAINTING  
We Do Anything from a South-western Sunset to a Barnyard Fence.  
Buggy and Sign Painting a Specialty.  
MESA PAINT SHOP.

String Beans, Apricots, Peas and Green Trading Stamps at  
Openshaw & Johnson.

ALHAMBRA HOTEL  
Mrs. Edgar Demrick, Proprietor.  
The only first-class hotel and dining room in town.

LARGE SAMPLE ROOM  
Bus Meets All Trains.  
MESA, ARIZONA

Keep your eye on this space.  
CRESCENT DRUG STORE.

Dr. Tom Young  
Veterinary  
Inquire at Crescent Drug Store.

If It's CANDY  
You want, go to GROVER'S

## An Iceless Fountain

AN EXPERT MIXER  
TRUE FRUIT SYRUPS—  
THE BEST ICE CREAM AND  
SODA WATERS.

WHERE?  
AT EVERYBODY'S

MESA CITY BANK  
Established 1893  
We will be pleased to serve you.

# WATER ROUTE TO ROOSEVELT

## Accomplishment of Two Mesa Voyagers

## VIA CANALS IN ROWBOAT

## Another Story of Two Men Not Including the Dog. The Route is Not Yet Recommended for General Travel

The first trip ever made from Roosevelt to Mesa by way of boat was that of yesterday when Roy Thorpe and James Crawford arrived in Mesa by way of the Mesa canal, having made the entire journey from the dam site by means of an ordinary row boat.

The original idea of the voyagers in making the trip was to enjoy the sensations of going over a route that is seldom frequented and also attempting a feat which has never yet been accomplished. It is understood that at least two parties have made the trip by boat from Roosevelt to Granite Reef, but the making of the entire trip by water from Roosevelt to Mesa is a record.

The row boat which was used throughout the journey was in a very dilapidated condition at the end of the trip. Before the start was made three bottoms had been placed in the craft and one of these had been worn through by the constant friction with the boulders and sands found in shallow waters. Many times the men were compelled to lift their craft from the water and carry it over obstacles and at other times had to haul it along the banks.

After leaving Granite Reef the boat was placed in the south side canal and followed it until the division gates were reached yesterday about noon. The remainder of the trip was made by way of the Mesa canal.

One incident of the trip was that just prior to leaving Roosevelt one of the men exchanged a faithful dog to which he had become attached, for a puppy. The idea being that the older dog would be entirely too heavy for the craft. The dog, which was left at Roosevelt, in some manner chewed the rope in two with which he was tied and followed his master the entire distance, arriving at Granite Reef but a few hours after the boatmen had left. Those who understand the Salt river will recognize that the feat performed by the dog is even greater than that by the men. Coming through Box canyon necessitated the animal swimming for a considerable distance, while the falls this side of Mormon Flat would offer many obstacles. The men are well pleased with their adventure, but have no serious intention of attempting to go into competition with the stage company, nor did they attempt to break any speed regulations.

ADVICE TO MOTHERS—Mrs. Winslow's Soothing Syrup should always be used for Children's Teething. It soothes the child, softens the gums, allays all pain, cures wind colic and is the best remedy for Diarrhoea. Twenty-five cents a bottle.

NEW SCENERY IS ORDERED.  
E. R. Hout, representing the Comet Scenery company of Kansas City, arrived in Mesa Sunday and yesterday closed a contract with the Mesa opera house management for a new equipment of scenery throughout. Those who have seen the idea to be carried out in the new scenery effect are loud in their praises, claiming that it is as beautiful as anything they have ever inspected in the way of theatrical paraphernalia. The new curtain shows a mountain scene and advertisements of local business firms will be prominently displayed.

IT is pure!  
That is the one thing about Ivory Soap that is of paramount importance.

It floats; it is economical; it is available for use not only in the bath and toilet, but also for fine laundry purposes—these things are important; but after all they are secondary to the one great fact that Ivory Soap is pure soap; and nothing else.

Ivory Soap  
99 1/2 Per Cent. Pure

## ORANGE TREES FOR VALLEY GROWERS

A Mesa Nursery Which Will Supply Enough.

Within three years Mesa nurseries will be able to supply Washington navel orange trees to all orchardists in the Salt river valley. J. J. Frazer and Bert Winger have upwards of 50,000 young trees already set in nursery rows which will be ready for budding next fall. They also have a seed bed with enough young trees started to supply a good many acres with orange trees.

H. S. Rideout, a practical nurseryman from Whittier, California, yesterday closed a deal with John Horne whereby he is to lease twenty acres one mile east of town and just south of the Walton Patterson ranch which he will utilize as a nursery and which will also be partly set to blackberries. Mr. Horne owned a five-acre tract on which the house is located and in addition purchased fifteen acres from Charles Peterson which is to make up the twenty acres.

Mr. Rideout came here for the purpose of setting out the Frazer-Winger stock and at that time became so impressed with the idea of starting a nursery that he has remained to investigate conditions thoroughly, with the above results. It is a practical orange grower and may be depended upon to promote the industry throughout this section. He will not only set out several thousand young trees, but will plant several pounds of seed. He will set out five acres to blackberries which within two years will be in full bearing. The blackberries alone will mean a new industry for Mesa from a shipping standpoint.

Trying to Save His Life.  
When we say that Sixine Pills are responsible for many a happy person in this world today we are not exaggerating a bit. There is no tonic builder equal to Sixine Pills. Show me a person who cannot be restored to strength and steady nerves with Sixine Pills and I will show you that it will not cost you a cent to try them, for they are guaranteed. Price, \$1 a box, 6 boxes \$5. Sold by Elvey & Hulst, where they sell all the principal remedies and do not substitute.

Plans and furniture handled by competent men. Phone Main 16, Lightning Delivery.

## MR. ORME INSPECTING BRIDGES AND POLITICS

Fences as Well as Roads on the South Side.

Supervisor John P. Orme and Howard S. Reed of the reclamation service were Mesa visitors yesterday. Mr. Reed came on his usual semi-weekly trip and Mr. Orme accompanied him for the purpose of inspecting roads and bridges in the capacity of supervisor and also for the purpose of conferring with the landowners in his capacity of president of the water users' association. However, while the supervisor was looking over the roads and bridges he was looking over the political fences.

LEAVES FOR COAST.  
Alonso Burdig, who for the past two years has been a resident of Mesa, left yesterday evening for Los Angeles, where he will probably make his home. It is the intention of Mr. Burdig to remain on the coast for the summer at least. He, however, reserves the right to have it known that there is a possibility that he will return to Arizona in the fall.

Chamberlain's Cough Remedy is sold on a guarantee that if you are not satisfied after using two-thirds of a bottle according to directions, your money will be refunded. It is up to you to try. Sold by all dealers.

SHIPMENT OF SHEEP.  
The Shangler Sheep company yesterday shipped sixteen hundred head of sheep to the Kansas City market. W. A. Trent, Frank Dykes and Mr. Barton accompanied the shipment.

BOND WAS FORFEITED.  
Willis Cooper yesterday forfeited a \$10 cash bond in police court for failing to put in an appearance when his case was called wherein he was charged with a disturbance of the peace. It is alleged that Cooper created a disturbance at the Mesa hotel Saturday evening while under the influence of liquor.

RETURNED FROM COAST.  
Dr. A. J. Chamber returned yesterday from a few days' trip to Los Angeles.

NEW DRUGGIST.  
W. A. Davis has arrived from Tucson and taken a position as pharmacist at the Crescent drug store, made vacant by the resignation of William Marlar. Mr. Davis has been in Iowa originally, but the past few months has been in Tucson. Prior to that time he was a resident of New Mexico.

A BROKEN ANKLE.  
Mrs. Dave Wallace, living immediately northeast of town, is suffering the fracture of the bones in her ankle as the result of trying to save a kitten from being trampled upon. Mrs. Wallace had started to go into the house Sunday night and was about to enter a doorway where some kittens were sleeping. She apparently remembered

## Happy, Happy, Use Tiz

A Marvel for Sore Feet. Acts Right Off.



Sore Feet? Never After Using TIZ—

Good-bye sore feet, aching feet, swollen feet, sweaty feet, smelling feet, tired feet.

Good-bye corns, callouses and bunions and raw spots.

You've never tried anything like TIZ before for your feet. It is different from anything ever before sold.

It acts at once and makes the feet feel remarkably fresh and sore-proof. TIZ is not a powder. Powders and other foot remedies clog up the pores. TIZ draws out all poisonous exudations which bring on soreness of the feet, and is the only remedy that does. TIZ cleans out every pore and glorifies the feet—your feet.

You'll never limp again or draw up your face in pain, and you'll forget about your corns, bunions and callouses. You'll feel like a new person.

If you don't find all this true after trying a box of TIZ, you can get your money right back.

TIZ is for sale at all druggists at 25 cents per box, or it will be sent you direct if you wish from Walter Luther Dodge & Co., Chicago, Ill. Recommended and sold by A. L. Boehmer.

That the kittens were in danger after she had started to make the step and in trying to swing about stepped sideways with the results mentioned above. The injured limb was given medical attention yesterday and while no serious complications are liable to result, the injury is nevertheless very painful and the cause of considerable annoyance.

## LOOKING OVER CANTALOUPE FIELDS.

M. M. Cox and son Roy arrived from Whittier, California, yesterday morning for the purpose of looking after the cantaloupe shipments from this place. Mr. Cox has been for a number of years the representative of H. Woods & Co., and annually he comes to this place for the purpose of looking after the shipping of the melons.

RETURNS FROM NEBRASKA.  
Evans Elvett, who was called to Nebraska two weeks ago by the sad news of the representative of H. Woods & Co., has returned to Mesa and is again at his desk with the Shattuck-Nimmo company.

## FIRST MEAL WITH GAS.

The family of M. H. Best cooked their first meal with gas yesterday morning and in all probability it was the first meal ever cooked by means of the fuel in Mesa. The stove was connected up Sunday so that the fuel was utilized as soon as it was turned into the mains.

## RAIN AT ROOSEVELT.

A slight shower was reported at Roosevelt Sunday afternoon. Yesterday, however, when the wetness fell stingily throughout the Mesa section the sun was reported to be shining brightly in the vicinity of the reservoir.

## A VITAL POINT.

The most delicate part of a baby is its bowels. Every ailment that it suffers with attacks the bowels also endangering in most cases the life of the infant. McGee's Baby Elixir cures diarrhoea, dysentery and all derangements of the stomach and bowels. Sold by Elvey & Hulst.

## RETURNS TO MESA.

W. H. Miller returned to Mesa yesterday after over a year's absence in Stevenson, Oregon. It will be remembered that Mr. Miller came here nearly two years ago from Oklahoma and later purchased the John Phillips ranch south of town. He later sold this property to Frank Barkley and moved with his family to Oregon. He has discovered that the Oregon country is not the location that he was seeking and he has returned thoroughly satisfied that the Salt river valley is his good home.

## CHARGED WITH GRAPE THEFT.

Manuel Payanes and Guadalupe Payanes, his wife, were yesterday arrested on a complaint sworn out by Dr. J. B. Nelson, charging them with stealing grapes from his vineyard north of the city limits. The defendants contend that they did not enter the vineyard and steal grapes, but that they did appropriate a few bunches from a vine that grew rather temptingly close to the roadway. The grapes are just ripening at the present time and quite a number of petty thefts have been mentioned. The case was postponed from yesterday morning, so that more evidence could be collected.

## NEWS NOTES.

J. E. LeBaron has accepted a position with the A. & B. Grocery company as clerk.

Ed. Shattuck returned to Phoenix yesterday morning after spending Sunday with his father at this place.

J. A. Beek has arrived in the city from California and will be located south of town at the transformer station No. 1.

C. T. Hirst, a well known real estate man of Phoenix, was a Mesa business visitor yesterday.

# FIRST RAIN IN MONTHS

## A Refreshing Shower Fell Yesterday Morning

## TEMPE A FAVORED SPOT

## For the Shower Did Not Settle the Dust East and South of Town—A Heavy Downpour For a Short Time

After one of the longest dry spells that the valley has experienced in some years, a refreshing shower fell here yesterday forenoon. It was not such an awful rain, though for a few moments it was a soaker, but it was enough to nicely settle the dust for the time being and it cooled the air off immensely. The night before there were a few sprinkles and during the night it rained just enough to drive outdoor sleepers inside. The rain yesterday morning was accompanied by a couple of terrific claps of thunder.

Tempe seemed to get the best of the shower. As far south of town as the date orchard, the dust was hardly settled while east of town, conditions were scarcely any rain. That was a fortunate circumstance for there are thousands of acres of grain south of town, some of it in the stack but more or less still in the shock or uncut and a hard rain would do it much damage. There is an unfortunate shortage of threshers in this section this season and much of the grain that should by this time be in the warehouse is still in the field.

There used to be an old adage in this country to the effect that it always rains between San Juan's day and Fourth of July. That proved to be the case here. The rain yesterday looked very heavy to the north and northeast and it is to be hoped that it was as heavy as it looked to be. A lovely rain in the range now will be a godsend to the cattlemen.

## PAINTER-JACOBSEN QUIET HOME WEDDING

The Bride and Groom Took the Evening Train for Maricopa.

One who was present at the wedding of Miss Alberta Painter to Chris Jacobsen contributes the following account of it:  
The home of Mr. and Mrs. William Painter was the scene of a quiet but most beautiful and artistic wedding Sunday afternoon when their daughter, Miss Alberta, and Christian Jacobsen were married.

Rev. Seaborn Critchfield of the M. E. church, South, performed the ceremony in a most impressive manner. Only the family and most intimate friends of the contracting party were privileged to witness the ceremony, the sweet simplicity of which struck the guests most forcibly.  
To the strains of the Lohegrin wedding march most beautifully rendered by Miss Blanche Cummins, the bridal party entered the parlor and took their places beneath an arch of dainty feathery foliage from which was suspended the proverbial wedding veil, a lovely creation of white and green.

The bride was attired in an exquisite lingerie gown and carried bride's roses. The groom wore the regulation wedding suit. The maid of honor, Miss Nellie Harris, was attired in blue. Roy Painter was best man.

After the ceremony the bridal party led the way to the lawn where every thing had been arranged for the guests to enjoy delicious refreshments, for which Mrs. Painter is famous, and which were served in a graceful manner by Misses Juanita Painter, Blanche Cummins and Lena Nielsen. A striking feature of the refreshments was the serving of the bride's cake, which even the most critical must acknowledge was perfect both as to the quality of the cake and the manner of decoration, which was quite unusual in its way—and something that must be seen to be appreciated. The bride and groom were each served a slice and then slipped away to don her going-away gown of pongee, which was most becoming. The groom wore a perfectly tailored suit of grey for travel. The guests in a body accompanied them to the station to wish them all possible pleasure on their extended wedding tour through California to terminate in a lengthy stay at the beach.

The wedding gifts were beautiful as well as elegant. The silver, cut glass, and exquisitely embroidered linen, dainty drawn work and other articles which all brides appreciate and love so well, were arranged so as to display their artistic beauty.

Mr. Jacobsen is a gentleman of sterling worth, a prosperous ranch-

## Protect Yourself!

AT SODA FOUNTAINS OR ELSEWHERE

Get the Original and Genuine HORLICK'S MALTED MILK

"Others are Imitations" The Food Drink for All Ages RICH MILK, MALT GRAIN EXTRACT, IN POWDER

Not in any Milk Trust Insist on "HORLICK'S" Take a package home

## Goodwin OPERA HOUSE

Wednesday evening.

Vaudeville and Moving Pictures

FRIDAY NIGHT

Opening of the New Airdome

Followed by a dance in the opera house.

Prices 15c and 25c.

## South Side Realty Company

R. J. SCHWEPPE, President.

INVESTMENT. TEMPE, ARIZ.

If you want a small ranch...SEE ME

If you want a large ranch...SEE ME

If you want loans or insurance.....SEE ME

R. A. WINDES, Tempe.

## M. Ellingson & Sons

Dealers in hay and grain, seed grain, seed oats, feed

oats, roled barley, alfalfa seed, grain bags, etc.

Temp.

## AUTO SUPPLIES AND REPAIRING

Repair department guaranteed.

J. A. AHLQUIST & CO.

## OLIVE HOTEL

Comfortable Rooms Reasonable Prices

TEMPE.

## Try An—EGG MALTED MILK

At Our Iceless Fountain

HARMER'S DRUG STORE.

We still have a nice line of

Cut Glass

Hand Painted China, Silverware and many novelties at reduced prices.

GOODWIN NOVELTY STORE.

## Go in Style

If you are going away for the summer, you must

Arizona Mercantile Co.

## YOU WILL ENJOY A

DINNER AT THE

CASA LOMA

TEMPE TODAY

The River Crossing is Fine For Machine

## SHOES! SHOES!

Just received a large shipment of the celebrated Hamilton-Brown Shoes. Shoes for the whole family, from the soft sole infant's shoe to the old folks' comfort.

Come in and see our swell line of Ladies' and Gents' Oxfords—this season's latest styles.

W. LUKIN'S CASH STORE

# Attention Mining Men.

We carry mining supplies and will be pleased to submit figures on ore cars, ore buckets, blasting machines, powder, fuse, caps, electric fuses, black-smith coal, candles, drill steel, and in fact on anything that you may need in the mining line. Give us the opportunity and we know we can interest you.

And by the way, speaking of mining, we want you to see the sample of gold ore in our west window. This is from the Relief Gold Mine, which is within twenty-three miles of Phoenix. It is a fine sample of ore, and will give you an idea of what there is in the mines of Arizona. Don't fail to see it. Remember it is in the West Window.

## EZRA W. THAYER

127-133 E. Adams St.

124-126 E. Washington St.

REMEMBER THE FIRST ANNUAL TERRITORIAL FAIR AT PHOENIX DECEMBER 25 TO 30, NINETEEN HUNDRED AND FIVE

**DR. D. M'SWEGAN** has returned from Europe with the radio-active remedies. He tells disease by the microscope and gives free examination at the Occidental Hotel, opposite postoffice.

**MISS TROWBRIDGE PAINTINGS.** The exhibit of Arizona views, painted by Miss Trowbridge, which is to be shown later at the fair, will be displayed for a short time in the window of the store formerly occupied by Plank the latter, next the Phoenix National bank. Orders received at Ford hotel.

### THE PRICE FIXED ON THE CANALS

But the Finding of Appraising Board is Not Disclosed.

The board of engineers of the reclamation service, which has been engaged since a week ago last Monday in appraising the property of the Arizona Water company, finished their Arizona Water company, finished their presumed it was forwarded this morning to the interior department. A copy of the report would be a very interesting thing to publish, a fact that seemed to be fully appreciated by the engineers, who were careful not to leave a copy of it lying round where a reporter could get hold of it. This was not disappointing, however, for no air castles had been built in anticipation.

Engineer Chandler left on last night's

Wholesome and sweet, nature's own product, Donofrio's Crystallized Cactus Candy.

M. & P. train for his home in California and Engineers Hill, Wisner, and Sanders, accompanied by their wives and Engineer Grunsky, left for Mesa City. This morning they will continue their journey toward Roosevelt, going as far as Fish creek and finishing the trip Sunday morning.

Mr. Fowler, who has been commissioned by the board of governors to go to Washington, will not leave until Sunday morning, instead of this morning, as originally planned. Mr. Fowler, who has been ill for several days, though much improved, is not yet able to leave her room, or was not yesterday, and he has decided to stay here a day longer. No time will be lost for the reason that he can still get to Washington by the time the report of the engineers is before the officials for consideration, which in the natural order of things would not be before next Friday or Saturday.

Mr. Fowler and Engineer Grunsky returned yesterday morning from Mesa City, where they spent the night before after a very hard day's work in sightseeing and inspection, traveling about sixty-five miles. They spent Wednesday looking over the western part of the valley and traveling about forty miles, so that Engineer Grunsky has driven over more than a hundred miles of the irrigation district during his short visit and has secured a very good general idea of what is going on. He says he has been greatly impressed with the country and with its possibilities with the completion of the storage reservoir.

Thursday's trip was devoted mainly to an inspection of diversion facilities and a hasty view of the irrigated section south of Mesa City. Starting about 8 o'clock Thursday morning, with Messrs. Fowler, McDermott, and McClung, the drive was first to the Consolidated head, then to the Tempe bridges, where an idea was gained of the height of the water in the recent flood and the damage to the bridges and canals, with a long-distance view of the upper end of the Appropriators' canal. Returning to the old mound on the Crosscut, they went north to power house No. 2 and the falls, inspecting all these properties, then via Ingleside to power house No. 1 and on to the Arizona head, looking over the wreck of the Arizona dam and the proposed site of the new diversion dam. Immediately after luncheon they started down the river in a boat toward the head of the Consolidated canal. They found the Salt river a poor stream for navigation, however, and in the voyage a mile they were shipwrecked twice, though with loss of life or property. In the first incident

the boat went on a rock in a rapid and the next time stuck on a sandbar. On one occasion it threatened to turn over, but was righted with a little difficulty. They finally made a landing a little above the Consolidated head and after a walk of perhaps a mile met Dr. Chandler, who drove them to Mesa, changed horses, and then drove them several miles south to his pumping plant and various other south side ranches. They returned to Mesa late in the evening and came on to Phoenix yesterday morning.

### AMUSEMENTS

"A Deserted Bride" pleased the audience in attendance at the Dorris opera house last night. The specialties were new and entertaining and new motion pictures contributed to the enjoyment of the evening.

This afternoon and tonight "A Wise Woman" will be given by popular request. Many who witnessed the bill are desirous of seeing it again. When the show let out Tuesday evening the boys in the gallery were whistling the catchy selections, the balcony folk were chuckling over the funny speeches and the folks down stairs had the smile that tells of inward mirth. 180 laughs a minute is the usual record of "A Wise Woman" but that number is often far exceeded.

This afternoon a special bargain matinee will be given. Prices for children 10c, for adults 25c.

The Ethel Tucker company close their successful week's engagement tonight when they will produce the sensational comedy drama entitled, "Deadwood Dick," at the Hardwick theater. A special matinee and children's matinee will be given this afternoon at 2:30 when the highly amusing cartoon comedy, "Foxy Grandpa" will be given at popular prices. Children 10c, adults 25c.

Tom Morrow, business manager for Jules Murry's theatrical attractions, numbering among which are Mme. Modjeska, "The Marriage of Kitty," Louis Morrison, Paul Gilmore and Creston Clark, is in Phoenix, making arrangements to bring to this city what will probably prove to be one of the best theatrical performances of the local season.

"The Marriage of Kitty" is the title of the play to be presented at the Dorris theater, and Alice Johnson, who so ably portrayed the character of the charming widow in "A Friend of the Family," in this city two seasons ago, is the bright, particular star of the engagement. Miss Johnson needs but little introduction to the theater goers of Phoenix. Her magnificent work in "A Friend of the Family" remains still fresh in their minds. Notwithstanding the fact that it has been two years since she appeared here, even the patrons of the theater in this city who have not seen her, are well acquainted with her name and will look forward to her coming with much interest.

Miss Johnson's play, "The Marriage of Kitty" is especially fitted to her. It is a society comedy, and though her admirers in this city know her to be an emotional actress of infinite charm, it will please them to know that she appears to better advantage in the lighter role, the simple statement of which fact is sufficient to secure a large interest in her production and secure a good patronage.

"The Marriage of Kitty" is, in a way, a simple play while it is at the same time one of the happiest conceptions of the dramatic title ever seen in this country. After a long season in England it was chosen by Charles Frohman, one of the best known managers in America, to open his season at the Empire theater in New York City, with Miss Marie Tempest playing the part of Kitty.

His judgment was faultless in its selection was demonstrated by the generous patronage accorded it, and the unlimited praise of the press and public in that city. It contains not a semblance of a moral problem; offers no room for deep or serious thought; but with the simple aid of the countless happily conceived situations, happy phrases and the most lovable character in the world, causing a smile one minute, a laugh the next, and a tug at the heart strings a third; it clears the cobwebs out of the mind and sends all who have seen it home in the best humor in the world, with good will in their hearts to all and especially Kitty.

Miss Johnson will present "The Marriage of Kitty," with a full complement of scenery necessary to the production, and a company of merit seldom introduced outside of New York City at the Dorris theater Monday and Tuesday, December 11th and 12th.

Col. W. C. Breckenridge of Tucson, Pima county's territorial fair commissioner, spent yesterday in Phoenix, and during the day visited the fair ground. He left last night for Tucson.

E. A. Packard returned to the city yesterday morning after a visit to his property in Cochise county.

Mrs. W. C. Trueman and Mrs. T. G. Oils accompanied by Willie Reid of Los Angeles spent Thursday night and yesterday as guests of the Kingsburys at Tempe.

There were yesterday registered as guests of the Ford: Leslie Long, Amboy, Ill.; T. M. Bannon, Cheyenne, Wyo.; A. W. Anve, Forester, Wis.; Mr. and Mrs. Joe La Chance, Williams; Geo. R. Caldwell, Denver; J. W. Lewis, and O. T. Lowe, Albuquerque, N. M.; C. J. Babcock, Los Angeles; F. H. Cartwell, Santa Ana; H. J. Howell, Douglas; W. E. Hill, The Dalles, Ore.; and Grant Marks, Bishop.

W. S. Goldworthy, general agent of the S. F. P. & F. road, was a part of yesterday confined to his home suffering a slight illness. His many friends hope for his speedy recovery.

J. F. Kelly of Mesa, was yesterday a business visitor in Phoenix.

Sheriff Tom Willis of Pinal county, was yesterday in the city. During the afternoon he visited the capitol building and was in conference with the live stock officials.

William E. Montgomery, an engineer at the Pima training school, left yesterday morning for Topeka, Kas., his home.

### PERSONAL.

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## Christmas Neckwear

It matters not how many Christmas gifts a man may receive he will always be expecting something very handsome in the way of



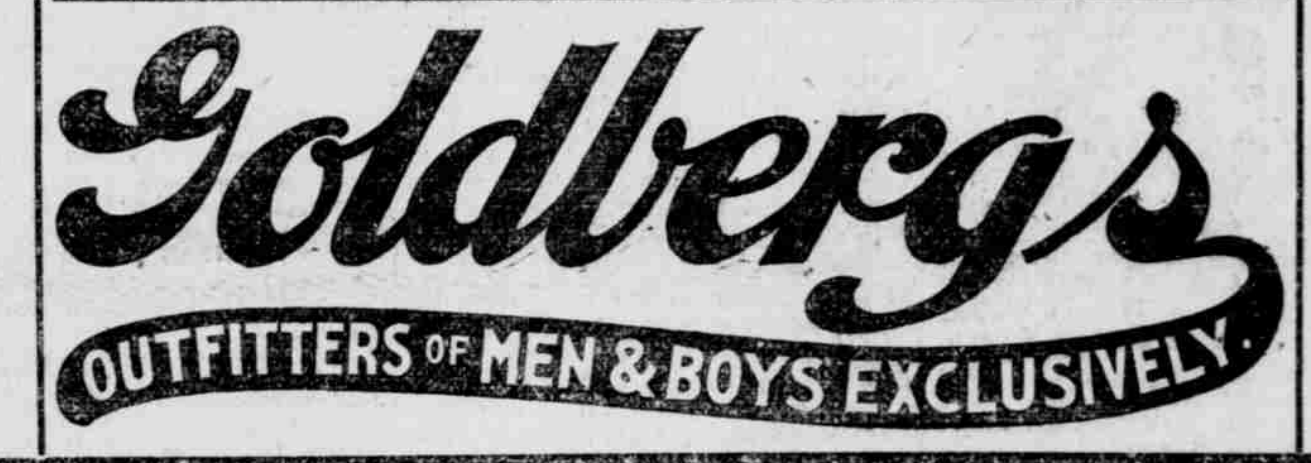
### A CHRISTMAS TIE

Don't disappoint him. We have a beautiful line of CHRISTMAS NECKWEAR, in every shape and style that is correct. Many of the silks and shapes are confined to us in this locality and cannot be found elsewhere. We have the choicest creations of the

### Leading Neckwear Makers

There is only one place to buy Choice Neckwear, and that is our store. He'll be sure to like his Tie if it comes from here, for we lead the town in Neckwear.

Picked Patterns in Neckwear Silks. Choice, Handsome, Reasonable, Unusual Neckwear.



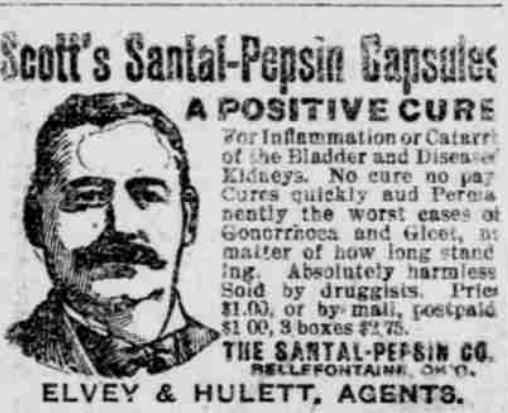
Shell Oysters, Fish, Lobsters Steaks and Chops

AT Ford Hotel Bar

—AND— Grill Room



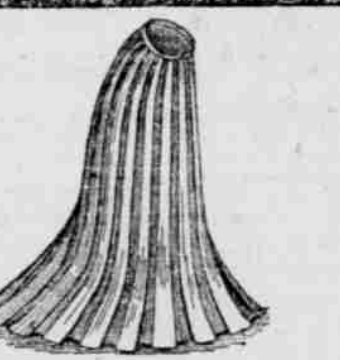
One Pair of Eyes to a lifetime so don't neglect or abuse them. Should they trouble you consult us. SWIKERATH BROS., 21 E. Washington St. (Upstairs.) P. S. Formerly located at 7 W. Adams St.



ELVEY & HULETT, AGENTS.

### Ruby Bread for Health and Wealth

Immaculately pure and from best selected wheat Ruby Flour is a tonic in itself. That every lady in Arizona may prove this, the Phoenix Flour Mills offers three prizes, \$25, \$15, \$10 for best bread exhibited at coming fair (Dec. 25 to 30.) Bake up with Ruby Flour—All grocers sell it.



### New Novelties

In the gored Sun-Burst skirts. Write or phone for information. Straight plaiting. Buttons made to order. Latest designs in pinking and new novelties in stamping.

The New York Dress Plaiting Co. 330 N. First Ave. Phoenix, Ariz. Phone Red 44.

### ANHEUSER Chop House and Grill Room

Open day and night. Main entrance on Center street. CHARLEY LEE, CHARLEY SAM, Prop.

### WALTER HILL CO.

Only Exclusive Wholesale Fruit and Produce House in Arizona. Write for Quotations. Special Attention Paid to Mining Camps. PHOENIX and PRESCOTT, BOOST THE FAIR.

WE ARE RECEIVING NEW CROP ARIZONA ORANGES LEMONS GRAPE FRUIT APPLES PEACHES PEARS

Fruit Grown in ARIZONA is a Guarantee as to QUALITY.

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E. S. WAKELIN GROCER CO.

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A discount that is worth while on every thing in that line you buy from

**THE BEAR DRUG STORE**  
C. S. Clopton, Prop.

The City Hall is Opposite Our Store.  
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Nothing Succeeds Like Success

**DR. HIBBARD** IS KNOWN THROUGHOUT THE SOUTHWEST AS A **Leading Specialist** IN CHRONIC DISEASES

He has the confidence and patronage of the leading business men and most prominent citizens of Arizona. The Doctor's a graduate of Harvard Medical College. Was formerly a member of the Rhode Island and Colorado State Medical Societies, and United States Physician at Las Vegas. Health is wealth—Economy to be well. Are you suffering from some chronic affection? Are you weak, sick and unable to perform the ordinary duties of life? If so, beware of patent medicines, inexperienced and unskilled physicians. Dr. Hibbard employs none but rational and scientific methods—he uses no injurious drugs in removing the poisonous effects of BLOOD AND PRIVATE WEAKNESS from the system. SEXUAL WEAKNESS with all its baneful effects, positively cured by the latest and best remedies. Chronic, nervous, blood, kidney, urinary, bladder and special disease treated in a strictly up-to-date manner.

Hibbard Building, 26-28 South 2nd Ave., Phoenix, Arizona. Consultation free. Hours 10 to 12; 1 to 3, and 6 to 7. Address all communications. **SKILLFUL SUCCESSFUL**

*D. Hibbard*

RELIABLE PROGRESSIVE

**Specials in Our Tailor-Made Suits**

\$25.00 SUITS ..... \$20.00  
\$20.00 SUITS ..... \$16.50  
\$15.00 SUITS ..... \$12.50

The new and nobby effects in long, tight fitting, eton, box effects. Come early and secure first choice.

**STEINS**

### New Suit Cases

Among the great array of Christmas presents you will find none more appropriate or acceptable for the average person, than a good leather suit case.

The new ones that we have just opened up are made of solid leather in various shades and range in size from the small case for women's use to the immense telescopic suit case for the man who does a lot of traveling and likes to do so in comfortable, clean linen, etc.

Ask to see these new cases at the leather goods section.

### Special Today

Children's cashmere hose in white, light blue and black, all sizes, regularly 25c and 35c a pair. Today 20c a pair.

Near the entrance today you'll find a remnant box full of odds and ends in children's vests and pants some worth as high as 75c a garment. All sizes. Your choice today

**25c**

### Men's Bath Robes

Ever wake up these chilly mornings and dread the cold, cold walk to your morning tub? You wouldn't if you owned one of these handsome warm new bath robes that we have here, as they are full of solid comfort and besides are very reasonable in price.

No chill blast of winter air can penetrate one and for a man who lives by the way and therefore likes to be perfectly comfortable at all times a bath robe is an actual necessity. All sizes and a good assortment of colors to choose from. Perhaps one would be appreciated as a Christmas gift by some one even if you don't need one yourself.









SUBSCRIPTION RATES: One copy, one year, \$3.00; six months, \$1.80; three months, \$1.00.

LOCAL ITEMS: Mr. L. K. Drain will begin to receive for sale to-day. Mr. C. Colby, of the Reynert mine, in town this week.

Mr. Geo. W. Small was in from River a few days this week. Mr. James Korman was in from the H. A. Deane on Wednesday.

Seventeen year old Brandy at Weed, for medicinal purposes. Mr. J. H. Thoroughman, of Galata, visited Florence this week.

Mr. Richard Jennings and his mother returned from De Noon on Thursday. Mr. J. M. Quiggle commenced boring water at the Atlas mine last Saturday.

Mr. F. B. Maldonado, of W. C. Smith Co., took a trip to Casa Grande this week. Messrs. P. W. Meyers, G. W. Myers and John Beato are in town from De Noon.

Mr. D. S. Thomas, formerly President of the Florence canal, visited Florence this week. The repairs to the Vekol mill are nearly all completed and it will start up again on the first of May.

Mr. Oscar Buckalew of Tucson, spent several days in Florence this week, the last of Mr. J. M. Ochoa. The stock yards of the Columbia Company and Mr. W. D. Harrington are in to-day's Enterprise.

Howell Hinds, assayer of the Vekol, is in the hospital at Tucson, as a result of an injured hand. Edge Geo. G. Berry, of Tombstone, is a few days in Florence this week on a return from a visit to Globe.

C. F. Palmer returned yesterday on his visit to the east, looking as if his trip had agreed with him. James Green, one of the owners of the Combination mine, at the Vekol, is in town for a little rest and recuperation.

W. W. Porter cleared the dock at the District Court on Saturday and left for Globe to hold court in Gila. W. Kersey, of Los Angeles, visited Florence this week and looked country adjacent to the Florida.

Supervisor Arthur Macy, of Silver King, is in town a portion of the week attending a session of the Board of Supervisors. D. Henry's new brick building is a coat of plastering on it. Mr. Frank Malone is in the town.

Some of the supervisors are doing some work in Florence to be done for the public. Milton and Kentfield returned from surveying trip Saturday evening and Sunday in Florence. They were in town on Monday.

An circus will give performance on Sunday night on the Vekol. They give a very creditable display to crowded houses. A sample of Dudleyville, in the Vekol, is making final proof before the District Court on Saturday on the San Pedro.

The mining camps to be opened at Casa Grande quite a number, and its prospects are bright and flourishing. A large and flourishing mining camp is being opened to the front as a great advantage. It also possesses great advantages as a fruit and agricultural country.—Tombstone Prospector.

Mr. Geo. L. Hood, secretary of the Democratic Central Committee of Pinal county, was in town Thursday, on his way to Globe where he has a case before the District Court.

Mr. J. M. Megson, who has been through a siege of sickness in Casa Grande, was in town with his freight team this week, apparently enjoying his usual good health again.

Mr. S. P. Mehan, formerly foreman of the Vekol, is now in charge of a force of men sinking a 100-foot shaft on the Wall Street mine, in the Jack Rabbit district, owned by Mr. Lucien E. Walker.

The board of supervisors has ordered the opening of Eleventh street, from Pinal to East streets. This is a continuation of the street south of Mr. W. R. Stone's residence through the alfalfa field north of the old cemetery.

Messrs. Spinas and Jas. Keenan, of the Owl Heads, took a band of five, fat cattle to Tucson this week for shipment to California. They will ship two carloads. All the cattle at the Owl Heads are fat and in prime condition and they ought to command a good price in the California market.

Mr. A. L. Pogue, of Richmond, Ind., is in Florence, and has become interested in the Florence Canal. Mr. Pogue is a thoroughly enterprising capitalist and aside from his connection with this great irrigation scheme he will acquire property interests in Florence.

Mayor W. E. Stevens, of Tucson, is a gentleman of wonderful enterprise and public spirit, and in many of the public improvements he has pushed to completion he has been rewarded by having to put his hands into his own pocket to fully carry them out. The ancient pugilist ought to do better by his efficient officials.

Mr. W. J. Bley returned on Wednesday from Casa Grande, where he has been engaged in erecting the oil tank for the Silver King mining company. Work is temporarily suspended on the tank pending the arrival of timbers needed in its construction. In the meantime Mr. Bley is at work finishing up his new residence in this place.

Mr. Samuel Hughes is certainly one of the most enterprising citizens of Tucson. He has, in conjunction with Captain Millmore, built a canal sixteen feet wide on the front, and developed sufficient water to irrigate several thousand acres of land north of that city. They also own the land and purpose disposing of it in small holdings of 80 acres and less, for fruit culture. Their enterprise will be worth a great deal of money to Tucson.

Dr. F. C. Mueller, of Chicago, who has been operating the Ruiseno mine, at El Plomo, Sonora, for the past four years, was in Casa Grande a few days ago. The property has a ten-stamp mill and a roasting furnace, which are run occasionally as the requirements of the development work demand. It is a good silver property so far as shown and promises to yield handsome returns.

Mrs. Chas. R. Drake, of Tucson, died at her home in that city last Sunday afternoon, after an illness of two weeks, dating from the birth of her youngest child. She was but 23 years of age and leaves a sorrowing husband and seven young children, to mourn her untimely death. The many warm friends of the family in Florence tender their sincere condolences to the bereaved family in their terrible affliction.

Dr. J. L. Wortman and Mr. Sylvester Baxter, of the Hemenway expedition, were in town last Saturday and called at the ENTERPRISE office. They are now engaged in making a thorough investigation of the system of water reservoirs connected by the prehistoric people of this valley and are making some very interesting discoveries. Mr. Sylvester Baxter was formerly connected with the Boston Herald and is still a correspondent of that paper.

A very pleasant picnic party visited the headgate of the Florence canal last Sunday and spent the day under the great trees at that delightful spot. Among the number were Mrs. G. H. Oury, Mrs. A. T. Colton, Mrs. Kentfield, Mrs. Wrasen, Miss Fannie Bartleson, Miss Hattie Elbell, Miss Genevieve Oury, Miss Maggie Brash, Messrs. Julian Laughlin, J. W. Ramella, A. T. Colton, W. L. Pucagey, H. V. Jackson and W. Wood Porter.

Seventeen year old Brandy at Weed, for medicinal purposes. If the broken hearted mourner of cherished idols that have been taken away from earth forever, could but read the plan of a kind and watchful Providence, the seeming chastisement inflicted might bring tears of joy and thanksgiving rather than of woe and lamentation. It is natural for mortals to sorrow for loved ones whom God, in His boundless wisdom, has taken, but in the midst of the deep affliction comes the consoling faith that all His acts are good, and we are blind to the manner in which His tenderest mercies are shown.

Such are the thoughts vividly inspired by the sad bereavement of Mr. and Mrs. Geo. W. Campbell, whose little son Robert, the pride and hope of a happy household, was so suddenly called away last Monday, and his health and happiness, to the immortal life beyond. The circumstances were as follows: On Monday afternoon, Mrs. Campbell and her two children started across the Alamo Amarilla canal near their residence, to gather flowers that grow in profusion in the fields adjacent. While crossing the foot bridge spanning the canal, little Robbie, in some unaccountable manner, fell headlong into the swift current, very muddy water. Mrs. Campbell at once jumped in after him and caught him by the clothes only to be herself borne down by the swift running water and lose her grasp of the child. Strangled and blinded by the muddy water, she struggled to again reach her child, but all her efforts were unavailing. The current bore him rapidly away and he soon disappeared entirely. The frantic mother, nearly exhausted, then tried to save herself and caught hold of a barbed wire fence beneath which the current was sweeping her, and lacerated her hands trying in dragging herself out on to the bank where she lay faint. Not more than ten minutes elapsed before the body of the child was recovered, but life was extinct, and it is believed his neck was dislocated by his first fall headlong into the stream. The funeral was held at the family residence the same evening, and was largely attended.

Little Robert was twenty months old lacking two days, and was a bright, handsome and healthy lad, of exceedingly rare promise, and his death in such a calamitous manner occasioned universal sorrow in Florence.

Sheriff Jere Fryer received a telegram on Thursday, the 18th instant, from his wife at Fremont, Nebraska, conveying the very sad intelligence of the death of his daughter, Emma Pauline Fryer, which occurred at that place early on the same morning. Mrs. Fryer was returning home from a visit to Michigan for the child's health, and when Fremont was reached little Emma was prostrated with paralysis and soon afterwards expired.

She was born in San Francisco, Cal., on the 15th day of November, 1881, and at the time of her death was 6 years, 5 months and 3 days old. The sincere sympathies of a very large circle of friends in Pinal county are with the afflicted parents in their sad bereavement, and many a former playmate in Florence will miss little Emma.

Draw & Bamrick are the mail contractors to Silver King and Pinal. The best stock and quickest time made.

**A Fine Copper Mine.** The Lake Shore copper mine, in the Jack Rabbit country, owned by Messrs. Geo. Aitchison and M. P. Frant, is one of the most promising and extensive properties of the kind in the Territory. It is located twenty-five miles from Casa Grande and has wood and water sufficient for mining and smelting purposes for years to come. The ore is found in a contact of magnesian limestone and is free smelting ore. The Clifton copper mines in Graham county are in similar formation and their value reaches to a very high figure. The ledge strikes to the east and at shaft No. 1, where the discovery of the ore was first made upon a very small exposed surface, the shaft of 25 feet is all in the ore body, the ore being principally red oxide of copper. The slate formation is on the east side and extends all through the Santa Rosa mountains, while the west side is lime. For about 75 feet south of shaft No. 1 the ground has been stripped, showing the continuation of the ore body, which averages 12 1/2 per cent copper. Shaft No. 2 is down 45 feet, all in ore, with a drift to the west 30 feet and a drift to the south 20 feet, both in ore. All the ground is removed from the mine and nothing but ore is being taken out. The ore body has been shown, south of shaft No. 1, by actual measurement to be 110 feet wide.

Between shafts 1 and 2 another shaft was sunk of the line of the two shafts 15 feet, showing splendid oxide ore. A prospect shaft fifty feet south of No. 2 also shows a large body of ore. Shaft No. 3 is down 110 feet, of which 20 feet was through cement and 40 feet through a slate formation and strata of ore were encountered for 50 feet when the regular ore body was seen. Shaft No. 2 to the west was run 30 feet in ore, and drift No. 1 was run 45 feet, also in ore. Shaft No. 4 went through the same formation for 45 feet when ore was struck. It has a drift west of 50 feet showing ore. Its distance from shaft No. 3 is about 200 feet.

On the north end of the Lake Shore is a shaft down fifty feet, and indications of the ore body can be seen. This is 150 feet from the end of the claim. Boulders of ore taken from the mine, when exposed to the air for a time, crumble away by atmospheric action, showing the self-fluxing qualities. On the south extension of the Lake Shore, is a claim belonging to C. S. Sawyer, with a shaft 31 feet deep, showing a continuation of the ore body. This was sunk to demonstrate the theory of the ore beyond the limits of the Lake Shore claim. The same character of ore was found in the shaft, which is about 100 feet south of the south end of the Lake Shore claim. There is a drift of 30 feet in the bottom of the shaft, with streaks of ore. It is believed the main ore body lies to the west of this shaft.

**Another Canal Enterprise.** Mr. Julian Laughlin and his associates have acquired the controlling interest in Montezuma Canal which heads a short distance below the Florence canal and is already built a distance of five miles and has heretofore irrigated but a few hundred acres of land. A new company is to be organized to extend the canal and enlarge its capacity. Mr. Laughlin says it is the intention of his company to abandon the present line of the canal and construct a new one about eighteen feet wide on the bottom. Work will begin within a month and it is their intention to construct at least twenty-five miles of the canal this summer to a point where the individual members of the company will own about six thousand acres of land which they propose bringing under cultivation next fall.

The people of Florence extend a welcome to every enterprise that is calculated to advance the material interests of the town and adjacent country, and particularly the development of means to extend a water supply over the lands that are worthless without it, and it is their hope that a spirit of harmony will exist among those engaged in bringing about the great transformation that will follow the building of these important water conduits.

**We Mean Business.** We aim to supply all the wants of a discriminating public, in our line, and with a full stock of choice goods in every department we expect to satisfy every customer. Our prices are as low as goods can be sold for in this market, even under the strongest competition, and our patrons derive the full benefit of our unexampled facilities in purchasing in large quantities. All weak is a comparison of our goods and prices. Orders by mail from adjacent towns and camps will be carefully attended to.

**W. C. SMITH & Co.** Supt A. H. Elliott, of the Queen of Sheba mining company, has removed his family from Casa Grande, to a new place, which occurred at that place early on the same morning. Mrs. Fryer was returning home from a visit to Michigan for the child's health, and when Fremont was reached little Emma was prostrated with paralysis and soon afterwards expired.

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Draw & Bamrick are the mail contractors to Silver King and Pinal. The best stock and quickest time made.

**District Court.** W. W. PORTER, Associate Justice. Thursday, April 12th. James Brash vs N. White—Judgment for plaintiff for \$8.50. N. White vs James Brash—Judgment for plaintiff for \$1 and each party pay his own costs. Mary E. Bailey vs Stephen M. Bailey—Tried and taken under advisement by the court. G. Wheat vs Jas. Douglas et al—Dismissed. J. P. Slavan vs W. C. Smith—continued till next term. J. W. Morgan et al vs Geo. N. Fletcher—Motion for new trial dismissed. Jose Gonzales vs Ramon Duron—ordered that testimony when taken be submitted to the court during term time. H. B. Summers vs Henry Schoshusen—Judgment for plaintiff. I. D. Putman vs C. D. Putman et al—The court allowed one per cent commission on amount in controversy held by him.

**SATURDAY, April 14th.** F. B. Maldonado allowed \$20 for his services as interpreter. W. L. Pinney allowed \$30 for his services as stenographer. G. H. Oury allowed \$30 for defense of indigent prisoners. K. M. French vs Chas. G. French—Referred to the clerk of the court to take further testimony. M. E. Bailey vs S. M. Bailey—Referred to the clerk of the court to take further testimony. C. G. Lewis vs Gussie P. Hickey—Ordered that plaintiff pay \$20 costs for continuing suit within two weeks or case will be dismissed. C. D. Putman vs M. Kennedy et al—Appeal bond fixed in sum of \$1000. Doran, Admr, vs J. C. Loss—Defendant allowed 30 days to prepare statement of facts. Adjourned till May 23d 1888.

**The Central Silver.** The following shows the developments made in the Central Silver Mining Company's properties up to the present time: Shaft No. 1 is down 95 feet, with cross-cut No. 1 in 19 feet south of shaft, with levels run 20 feet and 21 feet respectively, all in ore. Cross-cut No. 2, was made seventy feet south of shaft with the object of cutting the south vein. The vein was met and ore from the crosscut to the bottom of the shaft is from 6 to 14 feet thick, with three feet of ore in the bottom of the shaft and increasing with depth. Shaft No. 2 is down 126 feet, sunk on the ore all the way. The ore will average 15 inches from top to the bottom of the shaft and no break occurs from top to bottom. Shaft No. 3 is down 130 feet, sunk on the vein. There is 3 feet of vein matter and ore in the bottom; cross-cut No. 1 is in 35 feet to the hanging wall. Cross-cut No. 2 is in 15 feet at the 130 level, penetrating the vein matter. Levels will be run at each 100 feet. Sixteen men are now employed on this mine.

The North Star is the first west extension of the Silver Reef mine, and considerable work has been done on this claim. The showing is very good for a valuable mine. Mr. J. L. Sullivan is its owner and he is sanguine of the good future that his mine possesses.

**To the Democrats of Pinal County.** The Chairman of the Territorial Democratic Committee, has made a call for a Democratic convention to convene at Phoenix, on the 7th day of May, 1888, for the purpose of selecting two delegates and two alternates to the National Democratic Convention, to be held at St. Louis, Missouri, on the 5th day of June, 1888, and requests that the several counties of the Territory will hold convention, under direction of the chairman of their respective county central committees for the purpose of electing delegates to the said Phoenix convention.

Now, therefore, you are hereby notified that a county convention will be held in the town of Florence, on Saturday, the 28th day of April, 1888, for the purpose of electing four delegates to represent Pinal county in the said Phoenix convention. And you are further notified that the following is the apportionment for delegates to said county convention, viz:

Table with 2 columns: Precinct Name and Number of Delegates. Includes Florence Precinct (4), Silver King (3), Casa Grande (3), Dudleyville (1), American Flag (1), Owl Head (1), Ray Camp (1), Maricopa (1), Riverside (1), Mesaville (1), Whitlock (1), Picocho (1), Sacton (1), Vekol (1).

It is expected that each precinct will be represented in said county convention by a full delegation and will avoid as much as possible representation by proxies. CHARLES RAFF, Chairman of Committee.

**Notice to Republicans.** A mass meeting of the Republicans of Pinal county will be held in the Court House in Florence, April 21, 1888, at 2 p. m., when nine delegates will be selected to represent Pinal county in the National Republican Convention, called to meet in Phoenix April 25th for the purpose of choosing two delegates to the Republican National Convention to be held in Chicago, June 19th.

By order of the Republican county committee. W. E. GUILD, Chairman. R. E. SLOAN, Secretary.

**Hotel Arrivals.** The following are among recent arrivals at the Florence Hotel: W. S. McFarland, San Francisco; Geo. G. Berry, Tombstone; R. W. Kersey, Los Angeles; J. H. Thoroughman, Galata, Colorado; M. Corbett, Quijotoa; N. F. Salzer, Ft. Apache; G. W. Small, Riverside; A. Macy, Silver King; A. L. Pogue, Richmond Ind.; L. O. Adams, Silver King; W. J. Bley, Casa Grande; M. H. Derris, Mammoth; D. S. Thomas, Carlisle, Mo.; J. Gottvald, Tombstone; H. A. Tausig, San Francisco; Geo. Westfall, Reymert; B. B. De Nure, Geo. R. Morse, Montezuma.

**Mowing Machines.** The celebrated Osborne Mowing Machines for sale at W. C. Smith & Co. They will be sold at very low prices.

**Stage Fare and Time of Departure.** Leaves Florence for Casa Grande at 12 noon. Fare \$3; round trip \$5. For Pinal, 1 p. m. Fare \$4; Silver King, \$5.

Seventeen year old Brandy at Weed, for medicinal purposes.

**Board Supervisors.** (Official.) OFFICE BOARD OF SUPERVISORS OF PINAL COUNTY, FLORENCE, APRIL 2, 1888. Board met in regular session. Present Chairman T. D. Hammond, Supervisors D. C. Stevens, A. Macy and Wm. E. Guild, Clerk. Minutes of last meeting read and approved.

**The Money in Good Cattle.** As near as the matter can be reduced to figures, it is estimated that there is one registered animal of the bovine race in this country of 280 all kinds. There is no means of knowing, even approximately, how many there are pure bred but unregistered, or how many contain sufficient good blood to give them character as grades. Yet, even making the most liberal allowance for these facts remains patent that the business of "breeding up" has so far made its impression upon a very small percentage of cattle of the United States. It hardly seems likely, in view of all this, that work of introducing good blood will be overdone—that is, if prosecuted quiet, sensible, way, without extravagant booms and extravagant crazes of the kind.

The County Treasurer filed his quarterly statement. The Board counted the money in the treasury and found the same as follows: County General fund, 91 41; County Consolidated fund, 895 28; County School fund, 5875 29; " Road fund, 173 36; " School dist. No. 1 interest fund, 802 18; County School dist. No. 1 sink fund, 91 05; Territorial general fund, 6 91; " School fund, " Fund bonds, interest fund, " Insane asylum fund, " Normal school fund, Total \$79,000.00.

The above amount being correct the Board turned money back to treasurer taking receipt therefor. That Mr. A. T. Colton, contractor for building bridge across the Florence canal, at the head of Main street, having agreed to immediately put certain specified additional bolts in the floor beams of the said bridge, the said bridge be accepted by this Board and a warrant be drawn in his favor for \$600 on the general fund.

It appearing to the Board that Henry M. Loud of Oscoda, Michigan, having offered \$213 for the property assessed to the Ray Copper Company, consisting of smelter, machinery and building at Riverside and sold for delinquent taxes of 1886 for \$177 57 and advertised for sale by this Board, it is hereby ordered that the property be sold and a deed executed to Henry M. Loud.

On motion a rebate of \$27 was ordered paid to P. R. Brady on property assessed to J. N. Walker being S. & block 123, Florence, such original assessment being evidently excessive a warrant was ordered drawn on the General fund.

On motion a rebate of \$8.64 was ordered paid to B. H. DeArmitt for erroneous assessed property for 1887, and the Clerk instructed to draw a warrant on the general fund for the same.

On motion a rebate of \$300.70 was ordered paid to J. D. Walker on erroneous assessed property for 1887, and the Clerk was instructed to draw a warrant on the General fund.

On motion the proposition of J. C. Harris, to paint the bridge across the Florence canal with two coats of iron paint for \$22, was accepted. Work to be approved by the Board before payment.

Petition of citizens of De Noon, asking for new road district taken up, and a new road district established, to be known as District No. 7, county road in said district to consist of the new travelled road from Nicholas ranch via Reymert mine and mill and Willow Springs to intersection of the Florence and Pinal road north of Florence, and W. H. Merritt was appointed road overseer of the said district, and the Clerk was instructed to notify him of his appointment and for him to file a bond in the sum of one thousand dollars.

On motion W. W. Porter was allowed an additional \$50 per term for expenses. On motion the following accounts against the County were audited and the Clerk was instructed to draw warrants on the Treasurer in payment of same.

Table with 2 columns: Name and Amount. Includes McNeil & Hammond, mds (15 75), P. R. Brady, rent of Hospital (90 00), L. K. Rags, boarding prisoners (133 60), Wm Harvey, County Physician (160 00), Thos. F. Weed, drugs (30 55), J. C. Harris, work on C. H. (5 00), J. M. Ochoa, m'd'se (15 00), Juan Aveneto, m'd'se (13 50), R. E. Sloan, District Atty's fees (102 00), B. F. Michas, m'd'se (112 00), J. B. Hartles, transporting prisoner (110 55), C. W. Lemson, County Surveyor (30 00), W. C. Smith, purchased account (8 00), R. L. Rogger, burying pauper (13 00), Ed Lanoue, County Hospital (492 00), The Bancroft Co, Stationery (205 50), Bien & Atkinson, coffin for pauper (12 00), Isor (falloway, int. fee (2 50), Levi Ruggles, Probate Judge's salary and fees (123 95).

Table with 2 columns: Name and Amount. Includes Wm. E. Guild, Clerk Board of Supervisors salary and expressage (221 65), Levi Ruggles, stationery (21 25), Geo. R. Finch, work on road (193 00), W. P. Davis, purchased account (74 00), Estevan Ramirez, work on road (116 80), Hartford Banking Co., purchased acc (130 18), P. C. Warner, work on road (105 00), C. W. Culver, " (209 80).

On motion the Board adjourned until tomorrow at 8 a. m. Attest T. D. HAMMOND, Wm. E. GUILD, Chairman, Clerk.

**OFFICE BOARD OF SUPERVISORS OF PINAL COUNTY, FLORENCE, APRIL 3d, 1888.** The Board met pursuant to adjournment. Present Chairman T. D. Hammond, Supervisors D. C. Stevens and Wm. E. Guild, Clerk. Absent, Supervisor A. Macy. On motion the following accounts against Pinal county were allowed and the Clerk instructed to draw warrants on the county treasury for the amount.

Table with 2 columns: Name and Amount. Includes W. W. Porter, expenses, 1st term of Court, 1888 (150 00), C. M. Marshall, J. P. fees (27 00), Jere Fryer, Sheriff's fees (765 70), J. P. Slavan, constable fees (16 25), F. Boscha, Constable fees (106 00), J. Miller, J. P. fees (21 25), Elmo Reymert, int. fees (5 00), W. H. Benson, J. P. fees (42 90).

Table with 2 columns: Name and Amount. Includes D. C. Stevens, mileage and per diem (18 20), T. D. Hammond " (42 00), E. Lanoue, clothes to indigent sick (3 00), The Probate Judge audited the accounts of the Supervisors as follows: T. D. Hammond, mileage and per diem (42 00), D. C. Stevens, mileage and per diem (18 20).

On motion the Board adjourned until April 10, 1888. Attest T. D. HAMMOND, Wm. E. GUILD, Chairman, Clerk.

**OFFICE BOARD SUPERVISORS OF PINAL COUNTY, A. T., APRIL 10, 1888.** The Board met pursuant to adjournment. Present Chairman T. D. Hammond, Supervisor D. C. Stevens and Wm. E. Guild, Clerk. Absent Supervisor A. Macy. On motion the awarding of contract to build a culvert at McCallan's well on the Casa

Grande road was taken up and discussed and laid over until next meeting. The board of W. H. Merritt, road overseer, received and approved. On motion the Board adjourned until Monday, April 16th, 1888. Attest T. D. HAMMOND, Wm. E. GUILD, Chairman, Clerk.

**Executive Department.** To all whom these presents may come, greeting. Whereas, I am informed that Willis Brown was brutally murdered, in Pinal county, Arizona, at a place called East side of Eandler's Ranch situated about one and one quarter miles from Picocho station, S. P. R., on the night of the 29th day of December, A. D. 1887.

Now, therefore, I, C. Meyer Zulick, Governor of the Territory of Arizona, by virtue of the authority in me vested, do hereby offer and proclaim a reward of five hundred dollars, \$500, for the arrest and conviction of the person or persons committing said murder. In witness whereof, I have set my hand, and caused the Great Seal of the Territory to be hereunto affixed.

[Seal] Done at Prescott, the Capital, this seventeenth day of March, A. D. 1888. By the Governor, Wm. C. FOSTER, Secy of Territory. C. MEYER ZULICK, Acting Secy of Territory.

**Governor's Proclamation.** EXECUTIVE DEPARTMENT, TREASURY OF ARIZONA, Office of the Governor. To all to whom these presents may come, greeting. Whereas, I am informed that Cyrus Grille, the Superintendent of the Vulture mine, and his guards, John Johnson and Charles Doolittle were brutally murdered by some unknown person or persons, about eighteen miles from Vulture, and near Nigger Wells, Maricopa county, Arizona, on the night of the 19th instant, while en route to Phoenix.

Now, therefore, I, C. Meyer Zulick, Governor of the Territory of Arizona, by virtue of authority in me vested, do hereby offer and proclaim a reward of five hundred dollars (\$500) for the arrest and conviction of the person or persons committing said murder. In witness whereof I have set my hand and caused the Great Seal of the Territory to be hereunto affixed.

[Seal] Done at Prescott, the Capital, the 21st day of March, A. D. 1888. By the Governor, Wm. C. FOSTER, Secy of Territory. C. MEYER ZULICK, Acting Secy of Territory.

**Notice of Desert Land Proof.** U. S. LAND OFFICE, TUCSON, ARIZONA, Feb. 29, 1888. Notice is hereby given that Lucien Swingle of Dudleyville, Arizona, has filed a claim of intention to make proof on his desert land claim No. 431, for the N. E. 1/4 of N. E. 1/4 section 7, T. 6, S. 16, R. 16 E. before the clerk of the U. S. District Court at Florence, Arizona, on Wednesday, the 18th day of April, 1888.

He names the following witnesses to prove the complete irrigation and reclamation of said land: Charles G. Dell, Dudleyville, Swingle's Peter Young, Henry Schochusen, all of Dudleyville, Arizona. A. D. DUFF, Register.

**Summons.** In the District Court of the Second Judicial District, of the Territory of Arizona, in and for the county of Pinal. Elijah Bowen, Plaintiff vs Charlotte Bowen, defendant. Action brought in the District Court of the Second Judicial District of the Territory of Arizona, in and for the county of Pinal, and the complaint filed in the said county of Pinal, in the office of the Clerk of said District Court.

The Territory of Arizona sends greeting to Charlotte Bowen, Defendant. You are hereby required to appear in an action brought in the District Court of the Second Judicial District of the Territory of Arizona, in and for the county of Pinal, and to answer the complaint filed in the said county of Pinal (exclusive of the day of service) after the service on you of this summons (if served within this county) or if served out of this county, out in this district, within twenty days; otherwise, within thirty days, if served by publication within twenty days after the completion thereof, or judgment by default will be taken against you according to the prayer of said complaint.

Given under my hand and seal of the District Court of the Territory of Arizona, in and for the county of Pinal, and the complaint filed in the said county of Pinal, in the office of the Clerk of said District Court, this 19th day of March in the year of our Lord one thousand eight hundred and eighty-eight. W. WOOD PORTER, Clerk. SLOAN & STONE, Atty for plaintiff.

**Notice of Pre-emption Proof.** [Declaratory Statement No. —] U. S. LAND OFFICE, TUCSON, ARIZONA, April 3, 1888. Notice is hereby given that the following named settler has filed notice of his intention to make final proof in support of his claim, and that said proof will be made before the Clerk of the U. S. District Court at Florence, Arizona, on Tuesday, the 22nd day of May, 1888, viz: Jose Maria Guayudanal of Florence, Arizona, for the S. W. 1/4 Section 29, T. 4, S. 16, R. 16 E.

He names the following witnesses to prove his continuous residence upon, and cultivation of, said land viz.: B. H. DeArmitt, Charles Trunkner, Milton Ward and Estevan Ramirez all of Florence, Arizona. A. D. DUFF, Register.

**Desert Land Final Proof.** U. S. LAND OFFICE, TUCSON, ARIZONA, April 3, 1888. Notice is hereby given that the following named settler has filed notice of his intention to make final proof in support of his claim, and that said proof will be made before the Clerk of the U. S. District Court at Florence, Arizona, on Tuesday, the 22nd day of May, 1888, viz: Jose Maria Guayudanal of Florence, Arizona, for the S. W. 1/4 Section 29, T. 4, S. 16, R. 16 E.

He names the following witnesses to prove his continuous residence upon, and cultivation of, said land viz.: B. H. DeArmitt, Charles Trunkner, Milton Ward and Estevan Ramirez all of Florence, Arizona. A. D. DUFF, Register.

**Notice of Forfeiture.** Notice is hereby given to Chas. B. Walser and James Simpson, their administrators, or those claiming under them, that the undersigned has performed the annual assessment work for the year 1887 on the New Jersey mine, in Owl Head mining district, Pinal county, Arizona, amounting to One Hundred Dollars, and you are hereby notified that unless each of you pay your proportion of the same to wit, \$25 each of you, within ninety days after the first publication of this notice, your interests in said mine will be forfeited to the undersigned, according to law, and you will also pay for this advertisement. Tucson, April 5th, 1888. JOSEPH GOLDTRIEB

**Notice to Creditors.** Estate of George Emmel, deceased. Notice is hereby given by the undersigned administrator of the estate of George Emmel, deceased, to the creditors of all persons having claims against the said deceased to exhibit them with the necessary vouchers, within in four months after the first publication of this notice to the said administrator, at his office in Pinal county, Arizona Territory, at the residence of the undersigned. Tucson, April 13th, A. D. 1888.

**KENGLA, WAER & WENGLA, TANNERS.** Corner Congress & Main streets—Opposite P. O., Tucson. MANUFACTURERS OF: Leather Saddles and Harness, Saddle-Trees of all Kinds, CARRIAGE TRIMMERS, AND IMPORTERS OF: Bits, Spurs, Whips, Horse-Clothing. All our work is hand sewed. The public is respectfully invited to call and examine our stock and prices.





## Supplemental References

### November 2015

- “Black Canyon AZ/Arizona Territory Stagecoach Routes” Posted on September 17, 2012. Trips Into History/Historic Sites.  
<http://tripsintohistory.com/2012/09/17/black-canyon-az-arizona-territory-stagecoach-routes/>
- “Canal Era, 1825-1860.” United States – Canals 1825-1860 (Latin American Studies.org) The University of Texas at Austin. Perry Castañeda Library Map Collection. Historical Map Web Sites.  
[https://www.lib.utexas.edu/maps/map\\_sites/hist\\_sites.html](https://www.lib.utexas.edu/maps/map_sites/hist_sites.html) scroll way, way down to United States: Historical Maps section
- “Cars and Parts Described. The Biddle Murray Truck.” *The Motor Way*. Vol. XVI, No. 1. (January 3, 1904). Chicago, IL. Page 24.  
<https://books.google.com/books?id=w0YfAQAAMAAJ&pg=PP28&lpg=PP28&dq=freight+horse+drawn+wagon+cost+ton+mile&source=bl&ots=FTI6ReHA-&sig=FCExWPMuz96cs2xVj071jLXChdQ&hl=en&sa=X&ved=0CB0Q6AEwAGoVChMIh7b4p4r4yAIVV-NjCh3eSwa0#v=onepage&q=freight%20horse%20drawn>
- “The Realm of the Commercial Car. Cutting Down Transportation Costs.” *Motor Age*. Vol. XXV, No. 2. (January 8, 1914). Page 62.  
[https://books.google.com/books?id=BTwfAQAAMAAJ&pg=RA1-PA62&lpg=RA1-PA62&dq=freight+horse+drawn+wagon+cost+ton+mile&source=bl&ots=F9Vz0nj6\\_J&sig=G-9u60a8CT7OajFDBcZDtkI-2AE&hl=en&sa=X&ved=0CCgQ6AEwA2oVChMIh7b4p4r4yAIVV-NjCh3eSwa0#v=onepage&q=freight%20horse](https://books.google.com/books?id=BTwfAQAAMAAJ&pg=RA1-PA62&lpg=RA1-PA62&dq=freight+horse+drawn+wagon+cost+ton+mile&source=bl&ots=F9Vz0nj6_J&sig=G-9u60a8CT7OajFDBcZDtkI-2AE&hl=en&sa=X&ved=0CCgQ6AEwA2oVChMIh7b4p4r4yAIVV-NjCh3eSwa0#v=onepage&q=freight%20horse)