CLERK OF THE SUPERIOR COURT
FILED
OCT 25 2023 3:51pm
I. Jimenez, Deputy

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) Arizona Water Company

Mailing Address 3805 N. Black Canyon Hwy.
Phoenix, AZ 85015

Telephone No. 602-240-6860

Statement of Claimant No. 39- 49731; 46778-46781; 46783; 174598

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

Please see Attachment A.

CERTIFICATE OF SERVICE

On this 25th day of October, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.

Meghan H. Grabel
Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed) Meghan Grabel,

Mailing Address of Representative c/o Osborn Maledon

2929 North Central Avenue, 20th Floor Phoenix, Arizona 85012-2793

Telephone Number of Representative 602-640-9399

Attachment A

Meghan H. Grabel, No. 021362
Elias J. Ancharski, No. 035590
OSBORN MALEDON, P.A.
2929 North Central Avenue, 20th Floor
Phoenix, Arizona 85012-2793
(602) 640-9000
mgrabel@omlaw.com
eancharski@omlaw.com

Attorneys for Arizona Water Company

IN THE SUPERIOR COURT FOR THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN RE THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	Civil Nos. No. W-1, W-2, W-3, and W-4 (Consolidated) Case No. W1-106 **ARIZONA WATER COMPANY'S OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** (Special Master Sherri L. Zendri)

Contested Case Name: *In re Subflow Technical Report, Verde River Watershed*

DESCRIPTIVE SUMMARY: Arizona Water Company submits objections to the Subflow Zone Delineation Report for the Remainder of the Verde River Watershed.

NUMBER OF PAGES: 3

DATE OF FILING: October 25, 2023

Arizona Water Company ("Arizona Water") hereby submits objections to Arizona Department of Water Resources' ("ADWR's") April 28, 2023 *Subflow Zone Delineation Report for the Remainder of the Verde River Watershed* ("Subflow Report"). Arizona Water appreciates ADWR's work on the Subflow Report but respectfully objects to the delineation of the subflow zone near Watson Lake, Sullivan Lake, and Granite Basin Lake reservoirs. Special Master Zendri recently ruled on this exact issue as it relates to the Horseshoe and Bartlett Reservoirs in the Verde

Mainstem and Sycamore Canyon Subwatershed. *See Order Granting Partial Summary Judgement re Objections to Subflow Delineation Report for Verde Mainstem and Sycamore Canyon Watershed* filed on October 24, 2023 ("Order"). For the reasons discussed therein, ADWR is required "to use predevelopment conditions for mapping the Verde subwatershed subflow zone." *Order* at 9. The subflow zone may not extend beyond the saturated floodplain Holocene alluvium, and ADWR is required to base its delineation of the subflow zone for a particular watershed on the "predevelopment conditions" for that watershed.

Therefore, Arizona Water objects to ADWR's Subflow Report to the extent that the proposed subflow zone exceeds the predevelopment floodplain Holocene alluvium. Arizona Water's objection encourages ADWR to update the Subflow Report to ensure a legally defensible subflow report on which to base appropriable claims in the Verde River Watershed.

RESPECTFULLY SUBMITTED this 25th day of October, 2023.

OSBORN MALEDON, P.A.

By Meghan H. Grabel

Meghan H. Grabel
Elias J. Ancharski
2929 North Central Avenue, 20th Floor
Phoenix, Arizona 85012-2793
Attorneys for Arizona Water Company

ORIGINAL of the foregoing hand-delivered for filing this 25th day of October, 2023 to:

Clerk of the Superior Court
Maricopa County
Attn: Water Case
601 W Jackson St
Phoenix AZ 85003

COPY of the foregoing hand-delivered this 25th day of October, 2023 to:

Sherri L. Zendri
Special Master
Central Court Building, Suite 3A
201 West Jefferson Street
Phoenix, Arizona 85003-2205

COPY of the foregoing mailed this 25th day of October, 2023 to:

All parties on the *In re Subflow Technical Report, Verde River Watershed W1-1-6* Court Approved Mailing List dated October 19, 2023

By Patricia D. Palmer

CLERK OF THE SUPERIOR COURT
FILED
OCT 25 2023 3:46p.m
I. Jimenez Deputy

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) Arizona State Land Department

Mailing Address 1616 W. Adams St.
Phoenix, AZ 85007

Telephone No. (602) 542-4631

Statement of Claimant No. 39- 50400, et al.

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

*See Attachment "A"

CERTIFICATE OF SERVICE

On this 25th day of October, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.

Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed) Carrie J. Brennan, Asst. Attorney General

Mailing Address of Representative 2004 N. Central Ave.
Phoenix, AZ 85004

Telephone Number of Representative (602) 542-7782

KRISTIN K. MAYES
Attorney General
(Firm State Bar No. 14000)
David F. Jacobs, SBA #018807
Carrie J. Brennan, SBA #018250
Kevin P. Crestin, SBA #033341
Assistant Attorneys General
Natural Resources Section
2005 N. Central Avenue
Phoenix, Arizona 85004
Telephone: 602.542.7782
Fax: 602.542.4084
NaturalResources@azag.gov

Attorneys for Arizona State Land Department

SUPERIOR COURT OF ARIZONA

COUNTY OF MARICOPA

IN RE THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	Contested Case No. W1-106 Case No.: W-1, W-2, W-3, W-4 (Consolidated)(Gila) **ATTACHMENT "A" TO THE ARIZONA STATE LAND DEPARTMENT'S OBJECTIONS TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED**

CONTESTED CASE NAME:	*In re Subflow Technical Report, Verde River Watershed*
HSR INVOLVED:	None Issued Yet
DESCRIPTIVE SUMMARY:	Attachment "A" to ASLD's Objections to the Subflow Zone Delineation Report for the Remainder of the Verde River Watershed.
DATE OF FILING:	October 25, 2023

NUMBER OF PAGES: 4

Pursuant to this Court's Order, the Arizona Department of Water Resources ("ADWR") filed its Subflow Technical Report for the Remainder of the Verde River Watershed on ("Report") on April 28, 2023.

The Arizona State Land Department ("ASLD") as a claimant in the watershed submits the following objections to ADWR's Report below. By filing these objections, ASLD reserves the right to participate in the determination of all future issues related to the subflow zone delineation report and hydrographic survey report for the Verde River Watershed.

In its November 27, 2017, Order, this Court directed ADWR to "determine the subflow zone based on conditions existing in the earliest year or during a 'range of years immediately prior to regular, discernable diversion or depletion of stream flows resulting from human activity' for which reliable and reasonably complete data exists." *See* Order, dated September 27, 2017, at 4 (quoting Judge Ballinger's Order, dated September 5, 2005, Contested Case W1-103, at 21). ADWR acknowledges this directive in its Report. *See* Report at 7, 9.

In its Report, ADWR describes the process used to determine the delineation of the subflow zone. *Id.* at 10. Specifically, ADWR states that the subflow zone was determined by combining the Historic Composite Active Floodplain ("HCAF") with the floodplain Holocene alluvium ("FHA") boundary. *Id.*

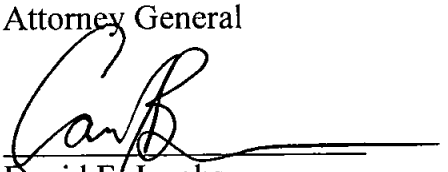
With regard to the reservoir associated with Watson Lake, ADWR chose to map the HCAF to the high-water mark in aerial imagery. *Id.* at pdf 321, Appendix E, Map 37 of 42, Subflow Delineation Map Sheet, Granite Creek Miles 20–29. ADWR concluded that the maximum fill of reservoirs were to be included within the HCAF, expanding the subflow zone to the high-water mark of man-made reservoirs.

ASLD objects to ADWR's establishment of a subflow zone around the man-made reservoir at Watson Lake as violative of the Court's 2017 Order directing ADWR to assume predevelopment conditions in its delineation of the subflow zone. ADWR's current delineation of a subflow zone including the maximum fill of the man-made reservoirs is too broad and should have been mapped to the predevelopment floodplain Holocene alluvium.

This objection is supported by the Court's Order dated October 24, 2023, granting partial summary judgment with regard to ADWR's mapping of the subflow delineation for the Verde Mainstem and Sycamore Canyon Watershed and ordering ADWR to amend its Mainstem Report relating to reaches in the vicinity of Horseshoe and Bartlett lakes.

RESPECTFULLY SUBMITTED this 25th day of October, 2023.

Kristin K. Mayes
Attorney General



David F. Jacobs
Carrie J. Brennan
Kevin P. Crestin
Assistant Attorneys General
Attorneys for Arizona State Land Department

CERTIFICATE OF SERVICE

ORIGINAL of the foregoing was sent via hand delivery this 25th day of October, 2023, to:

Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

COPIES of the foregoing were deposited for mailing this 25th day of October, 2023, upon all parties on the court-approved mailing list for *In re Subflow Technical Report, Verde River Watershed* (as of October 19, 2023).

By _____
Karina Bernal

11626535

CLERK OF THE SUPERIOR COURT
FILED
OCT 26 2023 2:58pm
I. Jimenez, Deputy

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) Chino Grande, L.L.C., a Missouri limited liability company

Mailing Address 2698 Moonridge Circle
Prescott, Arizona 86303-6764

Telephone No. Private. Please contact objector's representative.

Statement of Claimant No. 39- Numerous, including but not limited to 39-44586; 39-44604; 39-44605; 39-44606, etc. See Exhibit 1 to Attachment "A" for a complete list.

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

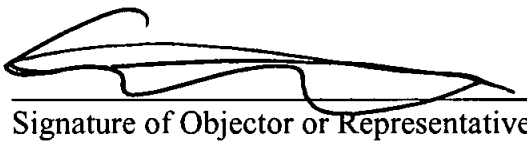
See Attachment "A."

CERTIFICATE OF SERVICE

On this 26th day of October, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.



Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed) Carlos D. Ronstadt (SBN# 006468)

Mailing Address of Representative The Law Office of Carlos D. Ronstadt, PLLC
7000 North 16th Street, Suite 120, No. 510 Phoenix, Arizona 85020

Telephone Number of Representative 602-799-0755

Carlos D. Ronstadt (SBN# 006468)
The Law Office of Carlos D. Ronstadt, PLLC
7000 North 16th Street, Suite 120, No. 510
Phoenix, Arizona 85020-5547
Telephone: (602) 799-0755 (Direct)
E-mail: carlos@carlosronstadt.com

Attorney for Chino Grande, L.L.C.

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR MARICOPA COUNTY

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Contested Case No. W1-106 ATTACHMENT "A" TO CHINO GRANDE'S OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED Special Master Sherri Zendri

OBJECTOR

Name: Chino Grande, L.L.C., a Missouri limited liability company

Mailing Address: c/o The Law Office of Carlos D. Ronstadt, PLLC
7000 N. 16th Street, Suite 120, No. 510
Phoenix, Arizona 85020

Telephone No.: (602) 799-0755

Statement of Claimant No.: Numerous, including but not limited to: 39-44586; 39-44604; 39-44605; 39-44606; 39-44610; 39-44613; 39-44614; 39-44618; 39-44627; 39-44630; 39-44631; 39-44632; 39-140153; 39-140155; 39-140161; 39-140162; 39-140163; 39-140164; 39-140165; 39-140166; 39-140175—See Exhibit 1 for a complete list.

STATEMENT OF OBJECTION

1. Chino Grande, L.L.C. ("Chino Grande") is a Missouri limited liability company that

owns approximately 28,500 acres in the Big Chino Valley, approximately 15 miles northwest of Paulden, Yavapai County, Arizona. Chino Grande's acreage is in the Big Chino sub-watershed of the Verde River watershed.

2. At this time, Chino Grande does not intend to provide technical or legal comments on the Technical Report captioned "Subflow Zone Delineation for the Remainder of the Verde River Watershed," prepared by the Arizona Department of Water Resources ("ADWR"), and dated April of 2023

3. Chino Grande generally agrees with ADWR's delineation of the subflow zone in the vicinity of Paulden, as depicted on Map 35 of Appendix E to the Technical Report.

4. Chino Grande reserves the right to comment on the objections or comments submitted by other parties in this matter, including such party's evidence and testimony, as may be presented to the Court.

5. Chino Grande further reserves the right to comment or object to ADWR's or any other party's methodology for determining whether water withdrawn from wells located outside the subflow zone should be subject to this proceeding.

DATED this 26th day of October, 2023.

THE LAW OFFICE OF CARLOS D. RONSTADT, PLLC

By: _____

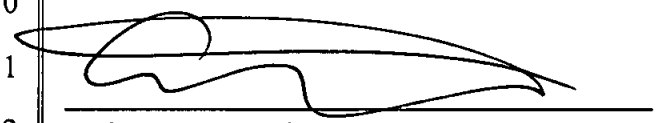
Carlos D. Ronstadt
7000 North 16th Street, Suite 120, No. 510
Phoenix, Arizona 85020-5547
Attorney for Chino Grande, L.L.C.

CERTIFICATE OF SERVICE

ORIGINAL and two copies of the foregoing HAND DELIVERED this 26th day of October, 2023 for filing with:

Clerk of the Maricopa County Superior Court
ATTN: Water Case
601 W. Jefferson Street
Phoenix, Arizona 85003

COPY of the foregoing sent via first class mail This 26th day of October, 2023 to those parties who appear on the Court-Approved Mailing List for this matter.



Carlos D. Ronstadt

EXHIBIT 1

ATTACHMENT "A" TO CHINO GRANDE'S OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED

Statements of Claimant

39-140150	39-140170	39-44595	39-44616
39-140151	39-140171	39-44596	39-44617
39-140152	39-140172	39-44597	39-44618
39-140153	39-140173	39-44598	39-44619
39-140154	39-140174	39-44599	
39-140155	39-140175	39-44600	39-44620
39-140156	39-140176	39-44601	39-44621
39-140157	39-140177	39-44602	39-44622
39-140158	39-140178	39-44603	39-44623
39-140159	39-140179	39-44604	39-44624
39-140160	39-140180	39-44605	39-44625
39-140161	39-140181	39-44606	39-44626
39-140162	39-140182	39-44607	39-44627
39-140163	39-141938	39-44608	39-44628
39-140164	39-44586	39-44608	39-44629
39-140165	39-44587	39-44609	39-44630
39-140166	39-44588	39-44610	39-44631
39-140167	39-44589	39-44611	39-44632
39-140168	39-44590	39-44612	
39-140169	39-44591	39-44613	
	39-44592	39-44614	
	39-44593	39-44615	
	39-44594		

OFFICE OF THE CITY ATTORNEY
Julie M. Kriegh, City Attorney
State Bar No. 021175
200 West Washington, Suite 1300
Phoenix, Arizona 85003-1611
Telephone (602) 262-6761
law.civil.minute.entries@phoenix.gov

CHARLES L. CAHOY, Assistant City Attorney
State Bar No. 010801
charles.cahoy@phoenix.gov

ATTORNEYS FOR THE CITY OF PHOENIX

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

IN RE: THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE

Case Nos.: W-1, W-2, W-3, and W-4 (Consolidated) (Gila)

Contested Case No. W1-106

CITY OF PHOENIX'S OBJECTION TO THE TECHNICAL REPORT—SUBFLOW DELINEATION FOR THE REMAINDER OF THE VERDE RIVER WATERSHED

(Assigned to the Hon. Scott Blaney)

(Referred to Special Master Sherri L. Zendri)

CONTESTED CASE NAME: *In re Subflow Technical Report, Verde River Watershed*, Contested Case No. W1-106.

DESCRIPTIVE SUMMARY: The City of Phoenix ("Phoenix") submits its Objection to the Technical Report—Subflow Delineation for the Remainder of the Verde River Watershed.

STATEMENT OF CLAIMANT NOS.: Phoenix 39-07-7927, 39-05-50153 through 39-05-50155, inclusive, and 39-L8-37666 through 39-L8-37691, inclusive.

NUMBER OF PAGES: 5.

DATE OF FILING: October 27, 2023.

OFFICE OF THE CITY ATTORNEY
200 W. WASHINGTON, SUITE 1300
PHOENIX, ARIZONA 85003-1611

In April, 2023, the Arizona Department of Water Resources ("ADWR") filed its Technical Report—Subflow Zone Delineation for the Remainder of the Verde River Watershed ("Subflow Report"). In accordance with the July 30, 2021, Order of the Special Master, the City of Phoenix ("City" or "Phoenix") submits its Objection to the Subflow Report ("Objection").

The City's Objection to the Subflow Report is limited to ADWR's determination that the Big Chino Wash would not be included in the report as a perennial or intermittent stream or one that falls within the "ephemeral stream exception" for which a subflow zone must be delineated.[1] *See* Subflow Report, at pp. 12-13.

ADWR's analysis of the Big Chino Wash is less than clear. ADWR begins by explaining the stream classification methodology by which ADWR made determinations within the Verde River watershed of which streams were perennial, intermittent or within the ephemeral stream exception. ADWR explains that they compiled various classification maps, reviewed riparian vegetation, and examined aerial photography for the "apparent presence of Holocene alluvium." *Id.* at 12. The Subflow Report then provides a list of tributaries that met the criteria as established by ADWR.

ADWR then singles out the Big Chino Wash by stating that it does not meet the evaluation criteria, siting a report by Mr. Mark Holmes. It is unexplained, however, whether ADWR's stream classification methodology, as it was applied to other tributaries in the Verde River watershed, was applied to the Big Chino Wash. If the stream classification methodology was applied to the Big Chino, ADWR offers no explanation as to which of the

[1] The City will not review the entire history of the development of Arizona subflow jurisprudence. Suffice it to say that Special Master Harris's Order for Production of a Subflow Delineation Technical Report for the Verde River Watershed, November 27, 2017, ordered ADWR to "develop a map of and a technical report regarding the subflow zone of the perennial and intermittent streams in the Verde River Watershed" as well as "ephemeral reaches of perennial and intermittent streams if: (1) anthropological surface water diversions or groundwater pumping caused that portion of the perennial or intermittent stream to become ephemeral; and (2) a saturated zone exists beneath the ephemeral reach that is connected to the saturated zone beneath the adjoining perennial or intermittent reaches." 11/27/2017 Order, p. 2. The ephemeral reaches described in the 11/27/2017 Order are known as the "ephemeral stream exception." *See* Subflow Report, p. 11.

OFFICE OF THE CITY ATTORNEY
200 W. WASHINGTON, SUITE 1300
PHOENIX, ARIZONA 85003-1611

evaluation criteria was lacking. Instead, the Subflow Report incorporates the findings of the Holmes report, leading to an assumption that it was the Holmes report, and not the stream classification methodology used for other streams, that led ADWR to omit the Big Chino Wash from those tributaries of the Verde River for which a subflow zone will be delineated.

This seemingly disparate treatment of the Big Chino Wash in the Subflow Report is sufficient in itself to cause concern about the Report's conclusion as to the Big Chino Wash. Further troubling, however, is that ADWR seemingly relied solely on the Holmes report for its determination that the Big Chino Wash has always been ephemeral.[2] Other studies reach different conclusions. *See, eg.*, "Geologic Framework of Aquifer Units and Ground-Water Flowpaths, Verde River Headwaters, North-Central Arizona," edited by Laurie Wirt, Ed DeWitt, and V.E. Langenheim, USGS Open-File Report 2004-1411-A, Ch. A, p. A16.[3] Indeed, certain of ADWR's own publications refer to the Big Chino Wash as intermittent. *See* "Water Level Changes in Big Chino Sub-Basin, Arizona, 1999-2009," Arizona Department of Water Resources, Sept. 2009.[4]

The City is not asserting that the Wirt report or ADWR's Water Level Changes map is more or less reliable than the Holmes report. The City has not subjected any of them to a review by a technical expert.[5] The City simply is raising the issue of why the Holmes report was deemed reliable by ADWR and no other reports or studies were considered. If scientific literature was used to determine that there would be no subflow delineation for the Big Chino

[2] Similarly, ADWR relies on a single report by Mr. Mark Nicholls to conclude that there is no current or historic hydraulic connection between the Big Chino Wash's groundwater and surface water systems. *See* Subflow Report, p. 13. Again, use of a single study or report is troubling. If ADWR conducted a more thorough investigation, it is not documented in the Subflow Report.

[3] "Big Chino Wash presently is ephemeral throughout its entire length, but there is evidence that some reaches may have been intermittent or perennial prior to agricultural development." https://pubs.usgs.gov/of/2004/1411/ .

[4] Big Chino Wash denoted on map as an "Intermittent Stream." https://new.azwater.gov/sites/default/files/WLCMSReportNo.4_BigChino2009.pdf.

[5] The Salt River Project has had the Holmes report reviewed by Mr. Jon Ford, and Mr. Ford has raised numerous issue regarding the reliability of Mr. Holmes' conclusions. *See* Salt River Project's Attachment "A" to Objections to the Subflow Zone Delineation for the Remainder of the Verde River Watershed, filed October 27, 2023, at Section I.C.

OFFICE OF THE CITY ATTORNEY
200 W. WASHINGTON, SUITE 1300
PHOENIX, ARIZONA 85003-1611

Wash, instead of the stream classification methodology that was used for other streams in the Verde River watershed, then the ADWR review of that literature should have been more robust and should not have relied on a solitary report. As the Subflow Report currently reads, ADWR's conclusion that the Big Chino Wash is not perennial, intermittent, or within the ephemeral exception, is suspect and unsupported.

For these reasons, Phoenix requests that the Court order ADWR to review and expand its analysis of the Big Chino Wash in the Subflow Report, to analyze all evidence of predevelopment conditions on the Big Chino, including, at a minimum, the same type of analysis that it applied to other streams, to explain the results of that analysis, and if a review of scientific literature is warranted, to do a more thorough review of reliable sources.

Respectfully submitted this 27th day of October, 2023.

Julie M Kriegh, City Attorney

By _____

CHARLES L. CAHOY
Assistant City Attorney
200 West Washington, Suite 1300
Phoenix, Arizona 85003-1611
Attorney for the City of Phoenix

OFFICE OF THE CITY ATTORNEY
200 W. WASHINGTON, SUITE 1300
PHOENIX, ARIZONA 85003-1611

ORIGINAL of the foregoing hand-delivered
for filing this 27th day of October, 2023, with:

Clerk of the Superior Court
Maricopa County
Attn: Water Case
601 West Jackson Street
Phoenix, Arizona 85003

AND COPY hand-delivered this
27th day of October, 2023, to:

Sherri L. Zendri
Special Master
Central Court Building, Ste. 3A
201 West Jefferson
Phoenix, AZ 85003-2205

Arizona Department of Water Resources
Legal Division
Kimberly P. Parks
1110 W. Washington, Ste. 310
Phoenix, AZ 85007

COPIES of the foregoing sent
via first-class mail this 27th day
of October, 2023, to all parties
on the Court-Approved Mailing Lists
for Contested Case W1-106, dated 10/19/2023

By: K. Torres
CLC:kt_:2404921_1.DOC

OFFICE OF THE CITY ATTORNEY
200 W. WASHINGTON, SUITE 1300
PHOENIX, ARIZONA 85003-1611

FENNEMORE CRAIG, P.C.
Sean T. Hood (No. 022789)
2394 E. Camelback Road
Suite 600
Phoenix, Arizona 85016
Telephone: (602) 916-5000
Email: shood@fennemorelaw.com

Attorneys for Freeport Minerals Corporation

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

IN RE: THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE,	W-1, W-2, W-3 and W-4 (Consolidated) Contested Case No. W1-106 **FREEPORT MINERALS CORPORATION'S OBJECTIONS TO ADWR'S APRIL 2023 SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER SUBWATERSHED** (Before Special Master Sherri L. Zendri)

CONTESTED CASE: *In re Subflow Technical Report, Verde River Watershed*

DESCRIPTIVE SUMMARY: Freeport Minerals Corporation objects to ADWR's April 2023 Subflow Zone Delineation Report for the Remainder of the Verde River Subwatershed.

NUMBER OF PAGES: 3

DATE OF FILING: October 27, 2023

Pursuant to the Special Master's order dated July 30, 2021, Freeport Minerals Corporation ("Freeport") hereby submits its objections ("Objections") to the Arizona Department of Water Resources' ("Department" or "ADWR") April 2023 *Subflow Zone Delineation Report for the Remainder of the Verde River Subwatershed* ("Report").

These Objections are supported by the *Declaration of Rich Burtell on ADWR's April 2023 Subflow Zone Delineation Report for The Remainder of the Verde River Watershed* ("Declaration"), which is attached as **Exhibit 1** and incorporated herein in its entirety.

With respect to the mapping associated with Watson Lake (*see* Declaration § III.), ADWR's delineation of subflow zones in the areas of artificial impoundments – based on post-development, artificial lake levels – has now been conclusively rejected by the Court. *See Order Granting Partial Summary Judgement Re Objections To Subflow Delineation Report For Verde Mainstem And Sycamore Canyon Subwatershed*, signed by Special Master Zendri on October 24, 2023 and filed in Contested Case No. W1-106 ("Order").

ADWR's delineation in the area of Watson Lake is erroneous for the same reasons that the delineation in the areas of Horseshoe Reservoir and Bartlett Reservoir was erroneous. As is required for the reservoirs, for Watson Lake, ADWR should "conduct an active channel and historical composite active floodplain analysis and determine the lateral extent of the saturated floodplain Holocene alluvium according to predevelopment conditions." Order at 12.

The Declaration outlines sources of information that ADWR might find useful for purposes of identifying the lateral extent of the floodplain Holocene alluvium. Declaration at ¶¶ 18-22.

Freeport expressly reserves the right to participate in every phase of these proceedings, including, without limitation, in connection with objections raised by other parties.

RESPECTFULLY SUBMITTED this 27th day of October, 2023.

FENNEMORE CRAIG, P.C.

By _____
Sean T. Hood
Attorneys for Freeport Minerals Corporation

ORIGINAL of the foregoing filed this 27th day of October, 2023 with:

Clerk of Maricopa County Superior Court
Attn: Water Case
601 West Jackson Street
Phoenix, Arizona 85003-2205

COPY hand-delivered this 27th day of October, 2023 to:

Sherri L. Zendri
Special Master
Central Court Building, Ste 3A
201 West Jefferson
Phoenix, AZ 85003-2205

COPY mailed this 27th day of October, 2023 to all persons appearing on the court-approved mailing list for Contested Case No. W1-106, dated October 19, 2023

_____
3031 6975

EXHIBIT 1

DECLARATION OF RICH BURTELL ON ADWR's APRIL 2023 SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED

In re The General Adjudication of the Gila River System and Source

October 2023

Prepared for:
Freeport Minerals Corporation
333 North Central Avenue
Phoenix, AZ 85004

Prepared by:
Plateau Resources LLC
4016 East Jojoba Road
Phoenix, AZ 85044

DECLARATION OF RICH BURTELL ON ADWR's APRIL 2023 SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED

I. BACKGROUND

1. I am a Registered Geologist (AZ No. 33746) and Principal at Plateau Resources, LLC ("Plateau") with degrees in hydrology and geology.

2. Before founding Plateau in February 2011, I worked at the Arizona Department of Water Resources ("ADWR" or "Department") for twelve years. While at ADWR, I managed the Adjudications Section and, as manager of that section, was involved with delineating subflow zones in the San Pedro River Watershed. During this period, I also oversaw surface geologic mapping by the Arizona Geologic Survey ("AZGS") along the Verde River and its major tributaries on behalf of the Department.

3. My education, experience, and expertise are detailed in my resume, included here as **Attachment A**.

4. I have been asked by Freeport Minerals Corporation ("Freeport") to review ADWR's April 2023 *Subflow Zone Delineation Report for the Remainder of the Verde River Subwatershed* ("2023 Subflow Technical Report"). The Department prepared its report in accordance with November 27, 2017 and July 30, 2021 orders from Special Master Harris ("2017 Order" and "2021 Order", respectively). The Special Master further ordered that objections to the 2023 Subflow Technical Report be filed by October 27, 2023.

5. This declaration provides my comments and recommendations regarding the 2023 Subflow Technical Report, focusing on the methodologies used by ADWR to characterize streamflow conditions and map the extent of Floodplain Holocene Alluvium (FHA).

6. In preparing this declaration, I reviewed: (a) the 2023 Subflow Technical Report and its supporting documentation; (b) the 2017 Order and 2021 Order; (c) historic geologic and survey maps of the Watson Lake area along Granite Creek; and (d) ADWR's December 2021 *Subflow Delineation Report for the Verde River Mainstem and Sycamore Canyon Subwatershed* ("2021 Subflow Technical Report"). If additional information becomes available between now and future subflow proceedings, I reserve the right to revise or supplement the opinions in this declaration accordingly.

7. The remainder of this declaration is organized into three sections – Classifying Streamflow Conditions (Section II); Mapping FHA Associated with Watson Lake (Section III); and, Summary (Section IV).

II. CLASSIFYING STREAMFLOW CONDITIONS

8. In her 2017 Order, Special Master Harris instructed ADWR to map subflow zones adjacent to perennial and intermittent streams in the Verde River Watershed, including:

> *(E)phemeral reaches of perennial and intermittent streams if (1) anthropogenic surface water diversions or groundwater pumping caused that portion of the perennial or intermittent stream to become ephemeral; and (2) a saturated zone exists beneath the ephemeral reach that is connected to the saturated zone beneath the adjoining perennial or intermittent reaches.*

9. In Section 3 of the 2023 Subflow Technical Report, ADWR states that it "consulted various sources to determine the class of each stream." As per footnote 34 on page 11, those sources included (a) Brown et al. (1981), (b) Freethey et al. (1986), (c) TNC (2010), and (d) Turner and List (2007).

10. ADWR further states on page 12 of Section 3 that it "delineated a proposed subflow zone within the Verde River Watershed for any area listed in Figure 6 containing perennial or intermittent flow". However, review of the figure suggests that the Department also considered perennial and intermittent stream segments from the "Water Atlas", which presumably refers to ADWR's Arizona Water Atlas. Furthermore, Figure 6 does not show stream data from either TNC (2010) or Turner and List (2007) although the Department indicates that both sources were consulted.

11. Plateau recommends that ADWR clarify which data sources it ultimately relied on to identify perennial and intermittent stream reaches for its 2023 Subflow Technical Report, and describe how it addressed potential discrepancies between those sources.

III. MAPPING FHA ASSOCIATED WITH WATSON LAKE

12. In Section 5.1.1 of the 2023 Subflow Technical Report, ADWR describes three variations in how it mapped FHA in the Verde River Watershed that differ from the methodology it used for the San Pedro River Watershed. The Department's third variation ("Lakes and Reservoirs") is of concern to Plateau:

> *The lakes and reservoirs within the Verde River watershed required different mapping than previously seen in the San Pedro watershed due to their comparative sizes and geology... Lakes and reservoirs were included in the FHA mapping, even though they are manmade water features... The existence of surface water paired with the detailed geologic mapping completed by AZGS suggests that subflow could exist under these water features. Thus, the inclusion of these features captures the potential presence of appropriable subflow. According to the criteria listed in the 2017 Order, bedrock areas should be omitted from the subflow zone as setbacks cannot be applied to bedrock... Therefore, bedrock areas were omitted from the subflow zone along the lakes and reservoirs mapped for this report resulting in mapped water elevations that do not encompass the entirety of certain reservoirs. This determination was based on the geologic maps provided by AZGS* [Arizona Geological Survey].

13. Plateau does not believe that ADWR properly applied this variation when delineating a subflow zone for Watson Lake.

14. As shown on FHA Delineation Map Sheet 37 in Appendix C of the 2023 Subflow Technical Report, Watson Lake is located along Granite Creek and primarily within Sections 13 and 24 of Township 14 North ("T14N"), Range 2 West ("R2W"). According to T.A. Hayden's 1940 report *Irrigation on Upper Verde River Watershed from Surface Waters*, the dam for 'Lake Watson' was completed in 1915 and, the following year, about 2,000 acres were reportedly irrigated by its owner, the Chino Mutual Water User's Association (pp. 23 and 79).

15. AZGS provides the following description of current, surface geologic conditions in the vicinity of Watson Lake:

> *Upper Granite Creek flows through a landscape composed of Tertiary sedimentary and volcanic rocks capped by younger basalt flows. Downstream, Granite Creek has been dammed to form Watson Lake at the southern margin of the Proterozoic Granite Dells. Middle reaches of Granite Creek flow through a narrow canyon within the Granite Dells and then a dissected terrain of late Miocene to Pliocene basin fill deposits... Holocene alluvium upstream of the Granite Dells fills the wide valley bottom with multiple terrace levels up to 1,600 ft across. Downstream, Holocene sediment is submerged below Watson Lake... Granite Creek then flows through a narrow box canyon within the Granite Dells and Holocene alluvium is confined to the flat bottom which is <50 ft wide in some areas. Holocene and Pleistocene Granite Creek deposits are more extensive downstream of the Dells.* (Cook, 2022, p.17).

No mention is made by AZGS of how it determined the extent of granite bedrock beneath Watson Lake. Indeed, AZGS utilized a mapping symbol in this area to indicate that the geology underlying the lake was "obscured by standing water." (Cook, 2022, p.41).

16. It is evident from the preceding paragraph, as well as Map Sheet 37 in Appendix E of the 2023 Subflow Technical Report, that ADWR's subflow zone for Watson Lake is primarily based on an artificial lake level, not the underlying surface geology. In Plateau's opinion, this delineation is therefore inconsistent with the 2017 Order. More specifically, the Special Master reminded ADWR in that order that subflow zones "will remain as narrow as the saturated floodplain Holocene alluvium." Apparently, little to no effort was made by ADWR or AZGS to examine geologic conditions in the area before Watson Lake filled, or to identify non-FHA materials below the lake after that time.

17. It is also Plateau's opinion that ADWR's subflow zone delineation for Watson Lake is inconsistent with Judge Goodfarb's June 1994 order. In that order, Judge Goodfarb concludes that the "weight of the evidence points to the saturated floodplain Holocene alluvium as the most credible 'subflow' zone. Its lateral and vertical limits have existed for some 10,000 or more years. It has far more stability of location than any other proposal..." (p.58) Clearly, water levels in Watson Lake are not natural and may change in the future depending on sedimentation rates, reservoir operating criteria, and climatic conditions.

18. Plateau identified two sources of information that it believes could assist in determining the approximate extent of non-FHA material within the Department's subflow zone for Watson Lake – (a) the original, General Land Office ("GLO") township survey and (b) an early surface geology map of the region.

19. In August 1871, S.W. Foreman surveyed the exterior and subdivision lines of T14N, R2W on behalf of the GLO. Official and unofficial maps from his survey illustrate the occurrence of granite boulders beneath the current surface of Watson Lake. In addition, his field notes describe the local width of Granite Creek and its floodplain along the section lines that were surveyed. For reference, a copy of Foreman's survey maps and notes are provided in **Attachment B**.

20. Over 30 years later, in 1902 and 1903, the U.S. Geological Survey ("USGS") formally surveyed the topography of the Jerome quadrangle, which covers present-day Watson Lake. Recall from above that the lake's dam was not completed until 1915, so this initial topographic survey also predates the lake. Using that early topography as his base, Waldemar Lindgren of the USGS later published a geologic map for the quadrangle based on earlier mapping by the Arizona Bureau of Mines.

21. Review of Lindgren's geology map indicates that most of the northern and middle portions of Watson Lake are underlain by granite bedrock, with only a narrow strip of Holocene alluvium running through it. On the other hand, much of the southern portion of the lake is underlain by alluvium from the creek and a tributary. **Attachment C** provides a copy of Lindgren's map and associated pages from his 1926 report.

22. Plateau believes a more precise delineation of geologic conditions beneath Watson Lake can be obtained by georeferencing Lindgren's map and comparing it to more recent, post-lake geology maps and aerial imagery. Early channel and floodplain widths surveyed by Foreman should also be incorporated into the analysis.

23. Lastly, Plateau does not agree with the Department's justification for delineating subflow zones adjacent to impoundments based on artificial lake levels. As ADWR describes in its 2021 Subflow Technical Report for Bartlett and Horseshoe reservoirs, located along the lower Verde River:

> *The* [Historic Composite Active Floodplain] *boundary was set at the high water mark in order to capture all potential appropriable water within the reservoir.*

But if that was acceptable, then ADWR should have also mapped a subflow zone for Willow Creek Reservoir in its 2023 Subflow Technical Report.

24. Willow Creek Reservoir is currently owned by the City of Prescott and located less than a mile northwest of Watson Lake. Hayden (1940, pp. 22 and 79) reported that the capacity of this reservoir was approximately 6,000 acre-feet, compared to 4,800 acre-feet for Watson Lake. Nevertheless, even though it contains potentially more appropriable water than nearby Watson Lake, the Department does not delineate a subflow zone for Willow Creek Reservoir. That inconsistently highlights the problem in relying on recent water levels to delineate subflow zones adjacent to impoundments.

IV. SUMMARY

25. It is uncertain which data sources ADWR relied on to classify streamflow conditions within the watershed. Plateau recommends that the Department clearly identify those sources and explain how it resolved potential discrepancies between them.

26. ADWR's delineation of a subflow zone for Watson Lake is based on an artificial lake level. In Plateau's opinion, that delineation is inconsistent with Special Master Harris' 2017 Order and the June 1994 subflow order of Judge Goodfarb, and should be based on something more stable, namely surface geologic conditions.

27. Plateau identified an early land survey and an early geology map of the lake site before its dam was completed in 1915. It recommends that ADWR and/or AZGS review these documents and use them to remove non-FHA from the subflow zone delineated for this area.

I declare under penalty of perjury that the foregoing is true and correct.

Executed on this 24th day of October 2023.

RICH BURTELL

ATTACHMENTS

ATTACHMENT A

Resume for Rich Burtell

RICHARD THOMAS BURTELL
4016 East Jojoba Road
Phoenix, Arizona 85044
602-327-7486
plateauresources@gmail.com

EDUCATION

- M.S. Hydrology, University of Arizona (1989)
- B.S. Geology, University of Pittsburgh (1986)

CERTIFICATION

- Registered Geologist, Arizona (No. 33746)

SUMMARY

Mr. Burtell is an environmental scientist with over 30 years of project and management experience. Areas of expertise include water rights and demand analyses; evaluation of surface and ground water resources; environmental compliance; contaminant hydrology; collection and analysis of environmental data including water, soil and rock samples; stream navigability and geomorphology assessments; remote sensing; and investigation of mine, fuel and waste storage facilities. Management duties have included supervision of staff and consultants, project planning and coordination, report preparation, and litigation support.

EMPLOYMENT

- Plateau Resources LLC
  Principal and Owner
  Phoenix, AZ (2011-Present)
- Arizona Department of Water Resources
  Manager, Adjudications and Tech Support
  Phoenix, Arizona (1999-2011)
- Golden Environmental Management
  Senior Project Manager
  Tempe, Arizona (1998-1999)
- Montgomery Watson
  Supervising Hydrologist/ Geochemist
  Arizona and Colorado (1992-1998)
- Golder Associates Inc.
  Project Hydrologist/Geochemist
  Denver, Colorado (1990-1992)
- U.S. Geological Survey
  Staff Hydrologist/Geochemist
  Orlando, Florida (1989-1990)
- Phelps Dodge Inc.
  Hydrogeologist – Summer Intern
  Morenci, Arizona (1987)

CONTINUING EDUCATION/TRAINING

- Water Management Modeling with GoldSim (Arizona Hydrological Society, 2022)
- Springs Inventory and Assessment (Springs Stewardship Institute, 2018)
- Water Quality Sampling and Processing (USGS, 2017)
- Stream Restoration Design Techniques (DTW & Associates, 2016)
- Water Well and Pump Performance (American Ground Water Trust, 2013)
- Mine Geochemistry and Hydrology (EPA, 2013)
- Section 404 and GW Plume Workshops (Arizona Hydrological Society, 2012)
- Stream Restoration (Water Management Group, 2011)

October 2023

EXPERIENCE

Project

- Evaluation of ground and surface water resources including aquifer testing, model development and review and GW/SW interactions
- Water rights analysis and legal review
- Stormwater, Section 404, and mine exploration permits
- Preparation of Environmental Impact Statements and Aquifer Protection Permits
- Water demand determinations for agricultural, municipal, industrial, and riparian uses
- Phase I/II Environmental Site Assessments
- Remote sensing and surface mapping
- Contaminant hydrology and transport/ geochemical modeling
- Characterization of fuel and solid/ hazardous waste facilities
- Collection and analysis of hydrologic, geologic and water quality data

Management

- Supervision of environmental staff (up to 15 geologists, hydrologists, GIS analysts and administrative assistants) and consultants
- Project planning and scheduling
- Proposal and report preparation including document publication
- Coordination with interdisciplinary teams, stakeholders and regulators
- Litigation support (expert testimony, technical advisor to court, and settlement negotiations)
- Third party and peer review
- Budget development and control

COMMITTEES

- AZ Water Resources Development Commission (served on Water Supply and Demand Committee)
- Western Navajo-Hopi Water Supply (Kyl) Study
- Upper San Pedro Partnership (served on Technical Advisory Committee)

AWARDS/HONORS

- Arizona Department of Water Resources
  - Supervisor of the year
  - Section of the year
  - Team and individual special achievement
- University of Arizona
  - Meritorious performance as teaching assistant
- University of Pittsburgh
  - Representative of graduating class
  - Tarr Award, Sigma Gamma Epsilon
  - Summa cum laude

PROFESSIONAL ORGANIZATIONS

- Arizona Geological Society
- Arizona Hydrological Society
- Arizona Riparian Council
- Arizona Water Well Association
- Society for Mining, Metallurgy & Exploration
- National Ground Water Association

VOLUNTEERING

- Wet-dry mapping, Agua Fria National Monument

PUBLICATIONS/REPORTS SINCE 2006

- *Declaration on ADWR's 2023 Subflow Delineation Report for Tributaries in the Verde River Watershed* (2023)
- *Analysis of Potential Effects from Well Pumpage on Drainages in the Copper Creek Project Area during Redhawk's Exploration Drilling Program near Mammoth, Arizona* (2023)
- *Estimated Well Pumpage in Cuyama Basin by Duncan Family Farms, 2010-2021* (2023)
- *Quality of Ak-Chin Indian Community Water Sources* (2022)
- *Declaration on ADWR's 2022 Subflow Delineation Report for the Verde River Watershed* (2022)
- *Supplemental Hydrogeologic Analysis for the Red Mountain Mine in Mesa, Arizona* (2021)
- *Appropriation of Water Diverted from Wells in the San Pedro River Watershed* (2020)
- *Analysis of Baca Float's Protest of Application to Appropriate* (2020)
- *Hydrogeologic Assessment of the Red Mountain Mine, Mesa, Arizona* (2020)
- *Land Ownership Analysis for Parcel 222-04-002, Mohave County, Arizona* (2018)
- *Evaluation of Skull Valley Ranch Wells as a Water Supply for the Kirkland Mine* (2018)
- *January and April 2018 Declarations for SPRNCA Contested Case* (2018)
- *Hydrologic and Water Rights Analysis of SPRNCA Federal Reserved Rights Claims* (2016)
- *Hydrologic Analysis of RCWA Federal Reserved Right Claims* (2016)
- *Declaration on ADWR's April 2016 Progress Report Concerning Cone of Depression Tests for the San Pedro River Watershed* (2016)
- *Evaluation of Water Needs and Sources at Fort Huachuca* (2015)
- *Declarations on ADWR's 2015 Subflow Delineation Reports for the San Pedro River Watershed* (2015)
- *Declaration on the Non-Navigability of the Upper Salt River at and prior to Statehood* (2015)
- *Declaration on the Non-Navigability of the Verde River at and prior to Statehood* (2014)
- *Declaration on ADWR's 2014 Subflow Delineation Report for the San Pedro River Watershed* (2014)
- *Declaration on the Non-Navigability of the Upper Gila River at and prior to Statehood* (2014)
- *Water Demand and Conservation Assessment for the Town of Camp Verde* (2014)
- *Hydrologic Review of BLM's Federal Reserved Right Claims for Aravaipa Canyon Wilderness Area* (2013)
- *Declaration on the Non-Navigability of the Santa Cruz River at and prior to Statehood* (2013)
- *Declaration on the Non-Navigability of the San Pedro River at and prior to Statehood* (2013)
- *Unmetered Residential and Non-residential Well Use in the Sierra Vista Subwatershed* (2013)
- *Findings on the Relationship between Plaintiff's Water Pipeline and the Pyle Irrigation Ditch, Bonita Creek, AZ* (2012)
- *Estimated Water Demand and Conservation Potential of Domestic Wells in the Sierra Vista Subwatershed, Arizona* (2012)
- *Water Supply Options and Potential at the Fancher Mill Site* (2011)
- *Assessing Water Supply Vulnerability in a Water Scarce State: The Arizona Water Sustainability Evaluation* (prepared with Kelly Lacroix and Linda Stitzer and presented at the XIV World Water Congress, 2011)
- *Multi-Sector General Stormwater Permit Applications for the Ajo, Carlota, Fancher and Zonia Mines, Arizona* (2011)
- *Response to Comments and Objections Filed on ADWR's June 2009 Subflow Zone Delineation Report for the San Pedro River Watershed* (2011)
- *Land Ownership Within the San Pedro Riparian National Conservation Area* (2010)
- *Mapping of Holocene River Alluvium along the Verde River, Central Arizona* (prepared in cooperation with the Arizona Geological Survey, 2010)
- *Arizona Water Atlas, Volumes 1 through 8* (2006-2010)
- *Catalog of Non-Exempt Registered Wells, Zuni Indian Water Rights Settlement* (2009)
- *Subflow Zone Delineation Report for the San Pedro River Watershed* (2009)
- *Preliminary Hydrographic Survey Report for the Hopi Indian Reservation* (2008)

PUBLICATIONS/REPORT SINCE 2006 (continued)

- *Identification of Irrigated Lands in the Gila River Maintenance Area* (2008)
- *Review of the Settlement of Public Water Reserve No. 107 Claims in the San Pedro River Watershed* (2007)
- *Technical Assessment of the Tohono O'odham Nation, Gila River Indian Community, and Zuni Indian Tribe Water Rights Settlements* (2006)

RECENT AND CURRENT PROJECTS

- Aquifer Protection Permit for a marble quarry near Dragoon, AZ (Alpha Calcit Arizona Ltd.)
- Aquifer testing, well siting, and ground-water quality analysis for the proposed Fancher gold mill near Salome, AZ (Luxcor Gold)
- De minimis water use evaluation and analysis of potential impacts on surface water availability in the Verde River Watershed, AZ (confidential client)
- Exploration permit for the Idaho gold placer claim near Prescott Valley, AZ (various investors)
- Historic irrigation analysis for ranch along the upper San Pedro River, AZ (confidential client)
- Floodwater inspection for a residential property in Phoenix, AZ (confidential client)
- Geochemical and water supply analysis for municipal water supply near Grand Canyon National Park, AZ (confidential client)
- Geochemical characterization of impacted waters and storm water, and 404 permitting for the Zonia copper mine near Prescott, AZ (Redstone Resources Corporation)
- Geochemical characterization of water supplies for an irrigation district in Pinal County, AZ (MSIDD)
- Geomorphic and hydrologic evaluation of the Colorado River near Bullhead City, AZ (Arizona Series 5)
- Geomorphic and hydrologic evaluation of the Colorado River near Yuma, AZ (confidential client)
- Groundwater resource evaluation for a proposed industrial minerals mine near Kirkland, AZ (Kirkland Mining Company)
- Groundwater resource evaluation and water rights research for a proposed development near Payson, AZ (confidential client)
- Hydrologic analysis of a recreational lake in Sun City, AZ (Dawn Lake HOA)
- Hydrogeologic and well permitting support for reclamation of the St. Anthony uranium mine, NM (Pueblo of Laguna)
- Hydrogeologic and geochemical investigation for a gravel mine in Phoenix, AZ (Red Mountain Mine)
- Hydrogeologic assessment and water rights due diligence analysis for an agricultural property near Yuma, AZ (confidential client)
- Hydrogeologic investigation and well impact analysis for mineral exploration area near Mammoth, AZ (Redhawk Copper, Inc)
- Irrigated acreage and well registration analysis for two small irrigators along the Upper Gila River, AZ (Franklin Irrigation District)
- Litigation of Bonita Creek water rights issues near Payson, AZ (various plaintiffs)
- Navigability assessment of major intrastate streams, AZ including expert testimony (Freeport Minerals Corporation)
- Review of federal reserved right claims for Aravaipa Canyon Wilderness Area, Fort Huachuca, Redfield Canyon Wilderness Area, and the San Pedro Riparian National Conservation Area, AZ including expert testimony (Freeport Minerals Corporation)
- Review of documentation supporting EPA's proposed rule regarding Waters of the U.S. (confidential client)
- Springs investigation along Oak Creek, AZ (confidential client)
- Subflow litigation support for the Gila General Stream Adjudication, AZ (Freeport Minerals Corporation)

RECENT AND CURRENT PROJECTS (continued)

- Subflow analysis for an investment property along the Gila River, AZ (confidential client)
- Surface water impacts analysis for the Trench Camp Project near Patagonia, AZ (Arizona Minerals Inc.)
- Surface water impact analyses from upstream well pumpage by two ranches and an irrigation district along the San Pedro River, AZ (confidential clients)
- Traditional Navigable Water analysis for a reach of the Santa Cruz River, AZ (Rosemont Copper Company)
- Various state and federal water rights analyses, AZ (confidential client)
- Water rights analysis for a proposed placer mine along the Agua Fria River, AZ (confidential client)
- Water rights analysis related to the Huachuca City consolidated contested case, Gila River General Stream Adjudications (ASARCO LLC)
- Water rights analysis for a town in northeastern AZ (confidential client)
- Water rights analysis for an irrigation district in Phoenix area, AZ (Roosevelt Irrigation District)
- Water rights analysis for a large ranch owner along the upper San Pedro River, AZ (confidential client)
- Water rights analysis for a small ranch owner along the lower San Pedro River, AZ (confidential client)
- Water rights analysis for two developers along the upper San Pedro River, AZ (confidential client)
- Water rights analysis for a developer along the Verde River, AZ (confidential client)
- Water rights analysis for two residential subdivisions along Oak Creek, AZ (confidential clients)
- Water rights analysis for various landowners along Oak Creek near Cornville, AZ (confidential clients)
- Water rights analysis for an investment property in Salt Lake City, UT (confidential client)
- Water rights analysis and litigation support for an irrigation district in southern AZ (confidential client)
- Water rights due diligence and hydrogeologic support for a nursery expansion in central AZ (confidential client)
- Water rights and geochemical analysis for a small ranch owner along Oak Creek, AZ (confidential client)
- Water rights research for a mining property in southern AZ (confidential client)
- Water rights research for a developer in Sedona, AZ (confidential client)
- Water rights research for a small ranch along Spring Creek near Cornville, AZ (confidential client)
- Water rights research for a small ranch in Chino Valley, AZ (confidential client)
- Water rights research for a ranch along the Babocomari River, AZ (confidential client)
- Water rights review for a ranch near Page Springs, AZ (confidential client)
- Water rights support for the Hermosa Project, AZ (Arizona Minerals Inc)
- Water rights support and subflow zone analysis for a copper mine within the Salt River Watershed, AZ (confidential client)
- Water rights settlement support, NM (Pueblo of Laguna)
- Water supply evaluation of the Arctic Ice and Water company, AZ (various investors)
- Water recharge analysis for the Camp Verde area, AZ (LS Stitzer Consulting LLC)
- Water use evaluation for the town of Camp Verde, AZ (Western Resource Advocates)
- Water use evaluation and analysis of conservation potential for domestic wells in the Sierra Vista Subwatershed, AZ (City of Sierra Vista and Western Resource Advocates)
- Water use evaluation and review of regional hydrogeologic conditions for a commercial vegetable farm in the Central Valley, CA (Duncan Family Farms)
- Well use evaluation for communities in the Verde Valley, AZ (Western Resource Advocates)
- WOTUS and Section 404 analysis for a small ranch near Pine, AZ (confidential client)

DEPOSITION AND TRIAL TESTIMONY DURING PAST FOUR YEARS

- January 2023 – deposition in *Ak-Chin Indian Community v. Maricopa Stanfield Irrigation* (United States District Court, District of Arizona)
- April 2021 – trial in *Town of Huachuca Contested Case No. W1-11-0245* (Gila River Adjudication)
- February 2021 – deposition in *Town of Huachuca Contested Case No. W1-11-0245* (Gila River Adjudication)
- November 2019 – trial in *State of Arizona v. Series 5, CV2017-015782* (Maricopa County Superior Court)
- March 2019 – trial in *SPRNCA Contested Case No. W1-11-232* (Gila River Adjudication)
- February 2019 – deposition in *State of Arizona v. Series 5, CV2017-015782* (Maricopa County Superior Court)

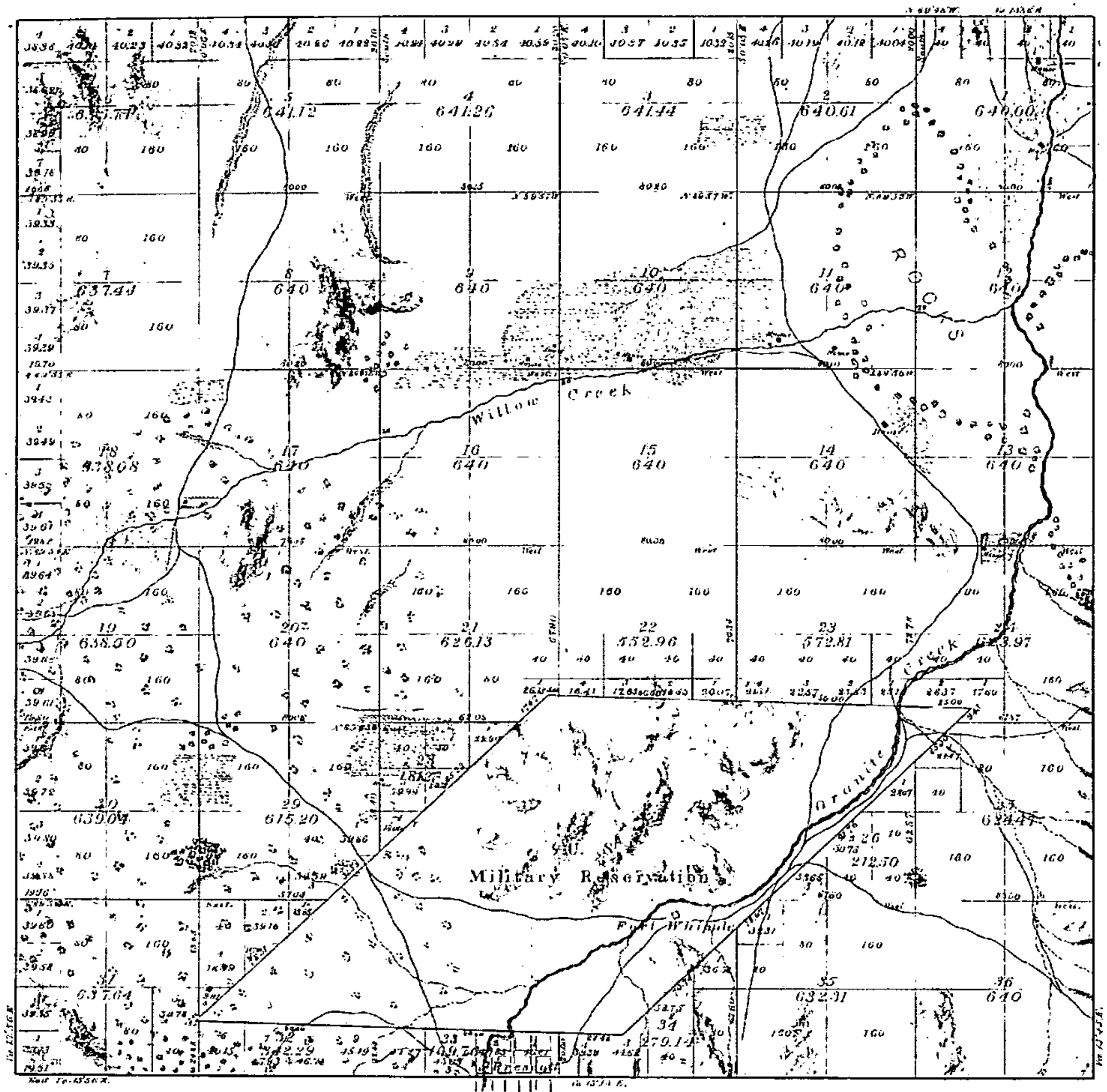
ATTACHMENT B

Original Township Survey Maps and Notes

TOWNSHIP Nº 14 NORTH RANGE Nº 2 WEST

GILA AND SALT RIVER MERIDIAN

OFFICIALLY FILED 11-7-1871



Subdivision lines run at a Variation of 13°45' East.

Surveys Designated	By Whom Surveyed	Date of Contract	Amount of Surveys	When Surveyed
Township lines	J. W. Freeman	Aug 29 1871	23 ms 78 chs 07 lks	Aug 2-9 1871
Subdivisions	do	do	59 ms 19 chs 29 lks	Aug 16-23 1871

Amt. of Public lands surveyed	20,145.71	acres
" " land in Reservation	2,888.00	"
Total	23,033.71	

The above Map of Township Nº 14 North of Range Nº 2 West of the Gila and Salt River Meridian, is strictly conformable to the field notes of the survey thereof on file in this Office which have been examined and approved.

Surveyor General's Office
Tucson Arizona October 20. 1871

[illegible]
Surv. Genl.

No. 1038

Field Notes

of the Survey of the Sub-
division lines of Township
[illegible] Ranges 2 & 3 W.
of the Fifth Principal
Meridian
in Oregon.

Executed by Freeman Dep. Sur.
under contract of May 29th 1[illegible]
Commenced Aug 16 "
Completed " 29 "

No. 1038

BOOK 1038

Preliminary Oaths of Assistants.

I, do solemnly swear that I will well and truly perform the duties of Compassman, according to instructions given me, and to the best of my skill and ability.

Subscribed and sworn to before me, this day of 187

U. S. Deputy Surveyor.

We, Joseph Hamel and S. L. Harris do solemnly swear that we will faithfully execute the duties of Chain Carriers; that we will level the chain upon uneven

ground, and plumb the tally pins, whether by sticking or dropping the same; that we will report the true distance to all notable objects, and the true length of all lines, that we will assist in measuring, to the best of our skill and ability.

Joseph P. Pence
J. L. Hand

Subscribed and sworn to before me, this 10th day of June 1871.

J. C. McCaffry
[illegible]
Notary Public

18

BOOK 1033

We, James Daly & Geo. W. Carr

do solemnly swear that we will well and truly perform the duties of Appraisers & Glassmen according to instructions given us, and to the best of our skill and ability.

James Daly

Geo. W. Carr

Subscribed and sworn the before me, this 10 day of June 1871

J. O. McCaffrey

~~U. S. Deputy Marshal~~ Notary Public

BOOK 1038

Field Notes

of

the Subdivision Lines of

Township 14 North Range 2 West

Gila and Salt River Meridian

Arizona Territory.

By S. A. Tremaul

Deputy Surveyor

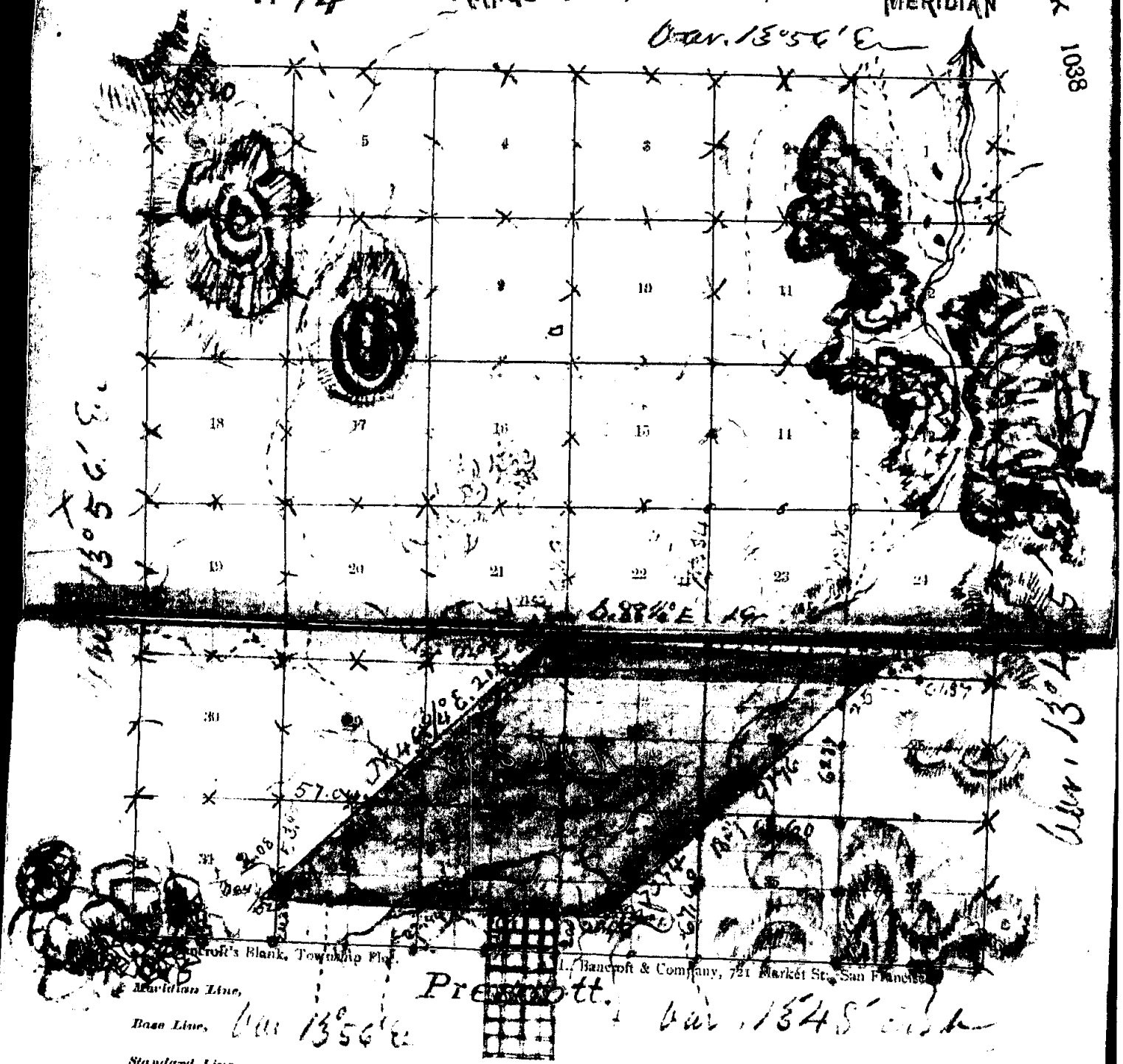
Under his contract of

Survey commenced

Survey completed

TOWNSHIP 14 N. RANGE 2 West, MERIDIAN

Var. 13°56' E



H. H. Bancroft's Blank, Township Plat.

H. H. Bancroft & Company, 721 Market St., San Francisco.

Prescott.

Meridian Line,

Base Line,

Standard Line,

Township Lines,

Section Line,

Meander Lines,

Office Work,

Ranch Lines Re-surveyed,

BOOK 1038

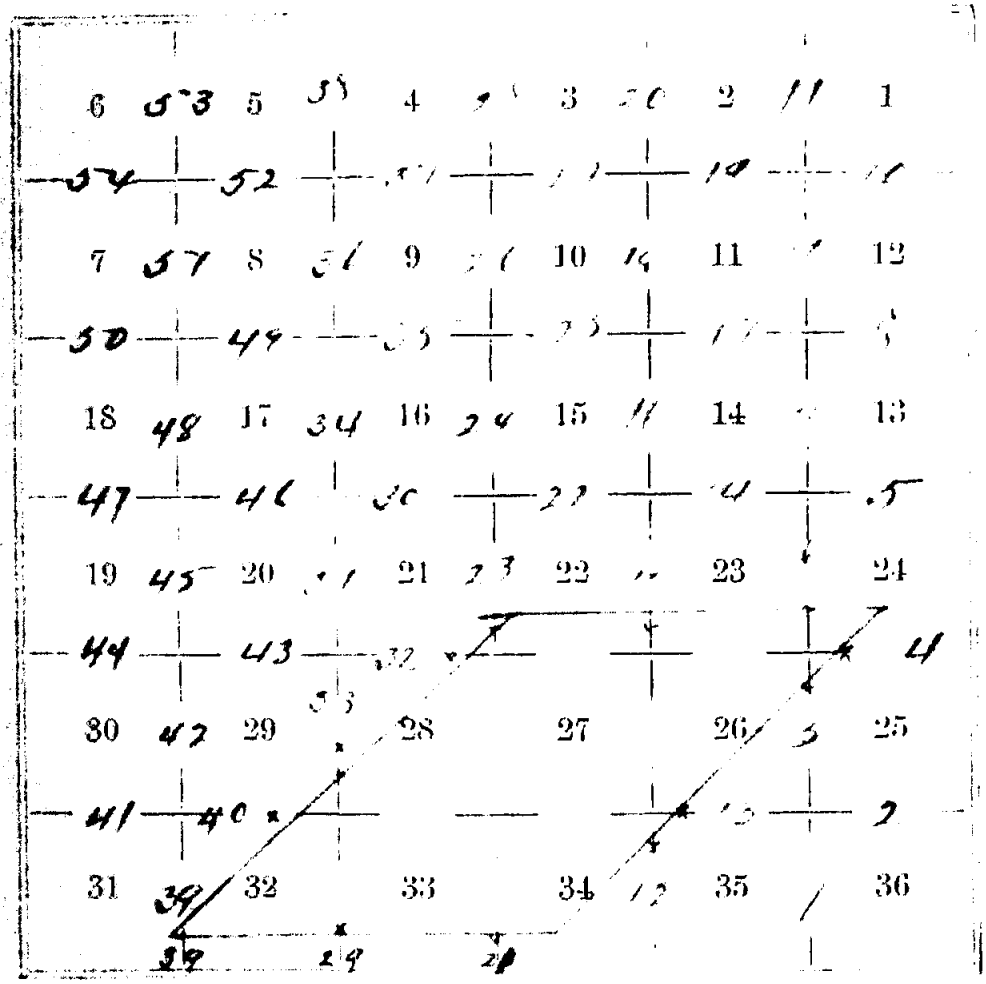
BOOK 1038

Index for T. 14N., R. 3W. on Page 58

(1)

BOOK 1038

Township 14 N. R. 2 W.



988h5mm9-01

No. 1038 Book 1033 E

Township 14 North Range 2 West.

Gila & Salt River Meridian

Run [illegible] from the corner to sections 1. 2. 35 and 36. on the south boundary of the Township. - Area —.

North between sections 35 and 36.

Var. 13° 45' East.

(as the east boundary, as run by myself.)

40.00 Set a [illegible] section corner. Post on a mound and fill as per instructions. Hollow near.

5.00 Road bears east and west.

50.00 Set a stone 14 x 10 x 10 inches on a stone mound as per instructions, for the corner to sections 25. 26. 35 and 36.

No trees near.

Land, north slopes of north ends of hills.

Soil 2nd rate. No timber.

Part brush on spots.

BOOK 1038

Township 14 North. Range 2 West.

Gila and Salt River Meridian.

East. on Random line. between
sections 25 and 36.
Var 13° 45' East.
(as per east township boundary)

40.00 Set a temporary 1/4 section
corner Post.

63.00 Roads leave north and south.

65.00 Dry creek. 5 links wide runs north.

80.00 Intersect the east boundary line
at the corner to sections 25. 36.
30 & 31. — from which corner, a tree
West. on true line between sections 25 & 36.
var 13° 45' East.

40.00 Set a 1/4 section corner Post with
mounds and pits as per instructions
No trees near.

80.00 The corner to sections 25. 36. 35 & 36.
Land; rolling, low hills.
Soil 2nd rate
No timber

Township 14 North. Range 2 West.

Okla'a Salt River Meridian—

N. North. between sections 25 and 26.

Var. 13° 45' East.

10.00 Round knoll. 50 feet high.

40.00 Okla'a sections corner stone 18 x 10 x 10 inches as per instructions.—from which a Pine 10 inches diameter bears north 10° East 20 links distant.

No other trees near.

42.87 Intersect the east boundary of the Fort Whipple U. S. Military Reservation and set a post as per instructions for the corner to fractional sections 25 and 26.—from which the north east corner Post, marked U.S.M.R. No. 2., bears north 46 3/4° East., 34.43 chains distant.

Land rolling. soil 2nd rate

No timber.

Township 14 North. Range 2 West.

Gila & Salt River Meridian

Y. From the corner to sections 24. 25. 19 & 30
on the east boundary as the line will reach
the Military Reservation in less than 80
chains. W. runs.
West. on true line between sections 24 & 25.
Var. 13° 45' East

2.00 Road bears north east and south west.
2.00 Ravine runs north west.
40.00 Set a 1/1 section corner Post in a
mound and pits as per instructions.
No trees near.

1.87 Intersect the east boundary of the
U. S. Military Reservation and set
a Post as per instructions for the
corner to fractional sections 24 & 25
from which the north east corner No. 2.
of the Reservation bears north 46 3/4°
East. 9.43 chs. distant.
Land rolling. Soil 2nd rate. No timber.

BOOK 1038

Township 11 North Range 2 West
City of Salt River Meridian

Ls From the corner to sections 13.24.18 & 19. on the east boundary line. I run West on true line between sections 13 & 24
var. 13° 45' East

10.00 Leave rocks and enter bottom land.
20.00 Granite creek, 4 chains wide and runs north east. -- enter cornfield
10.00 Set a 1/4 section corner stone 14 x 10 x 8 inches in a mound and pits as per instructions. No trees near.
9.00 House 8 0 links south of line.
0.38 Fence bears north & south and leave cornfield.
1.00 Road bears north and south.
60.00 Ascending grounds.
80.00 Set a stone 14 x 10 x 8 inches as per instructions for corner to sections 13.14.23 & 24. No trees near.
Land nearly levels. Soil 1st rate
No timber.

C. BOOK 1038

Township 14 North. Range 2 West
Gila and Salt River Meridian

Chs	South. between sections 23 & 24. Var. 13° 45' East.
40.00	Set a 1/4 section corner stone 16 x 10 x 10 inches in a stone mound as per construction. No trees near.
45.00	Road bears north east and south west.
58.00	Granite creek runs north west.
62.00	Right bank of granite creek and enter cornfields.
92.78	Intersect the north boundary of the U. S. Military (Reservation) and set a post as per instructions for the corner to fractional sections 23 & 24. from which, the north east corner post No. 2. of U. S. Military Reservation bears south 88° 46' East, 25 chains distant. Land, rolling and level. Soil 1st rate. No timber

Township 14 North. Range 3 West.

Cla: and Salt River Meridian

No From the corner to sections 13. 14. 23rd 24.
Runs.
North. between sections 13 and 14.

Var. 13° 45' East.

27.00 Enter level land. bears north west & south east.
36.00 Road. bears north west and south east
37.00 Fence bears north west and south east.
and enter cornfields.
40.00 Set a 4" section corner Post. w[illegible] a mound
and Pits as per instructions. — No trees near.
House bears north west. 2.11 chains distant.
61.00 Leave cornfield. and enter rocks.

80.00 Set a stone 18 x 10 x 8 inches as per instructions
basin. for this corner to sections 11. 12. 13 and 14.

No trees near.

Land level.
Soil 1st rate. excepting the last 19 chains
rocky and worthless.

No timber.

Township 14 North. Range 2 West.

Gila & Salt River Meridian

	The East. on random line. between sections 12 & 13. Var. 13° 45' East
40.00	Set temporary 1/4 section corner Post.
12.00	Cross Creek in a rocky canon. 2 chains wide. runs north.
10.00	Intersect the east boundary at the corner to sections 12. 13. 7 & 18. from which corner. I mark — West. on true line between sections 12 & 13. Var. 13° 45' East.
40.00	Set a 1/4 section corner Post in a stone mound as per instructions. No trees near.
10.00	The corner to sections 11. 12. 13 & 14. Land covered with massive granite boulders. No soil. No timber.

Township 14 North. Range 2 West.
Principal Base (Fort Ross Meridian)
(N. North. between sections 11 and 12).
var. 13° 45' East.

26.00 Hollow creek. 20 links wide east.

40.00 Set a "G" section corner Post. in a stone mound. as per instructions.
No trees near.

80.00 Set a stone 14 x 8 x 8 inches as per instructions for the corner to sections.
1. 2. 11 and 12.
No trees near.

Lands rocky with massive granite rocks.
No soils and no timber.

July 24th 1871.

10 BOOK 1038

Township 1st North. Range 2 West
Utah and Salt River Meridian

No East, on random line, between sections 1 and 12.
var 13° 45' East—

27.00 Leave north and enter cultivated.

40.00 Set a temporary 1/4 section corner Post.

57.00 Grande creek 2 chains wide runs north.

80.00 Intersect the east boundary at the
corner to sections 1, 12. 6 and 7.
from which corner, I run —
West, on true line between sections 1 and 12.
var. 13° 45' East—

40.00 Set a 1/4 section corner Post, cir a
mound and pits as per instructions.
No trees near.

80.00 The corner to sections 1. 2. 11. 12.

Land level.
Soil 1st and 3rd rate
No timber.

Township 14 North. Range 2 West
Principal Salt River Meridian

On the North on random line between sections 1 and 2.
var. 13° 45' East

40.00 Leave rocks and set a temporary 1/4 section
corner Post. Line of rocks bears north
west and south east.

4.00 Road bears ~~north~~ South west and ~~south~~ North east.

80.00 Intersect the north boundary line
at the corner to sections 1. 2. 35 and 36.
from which corner I mark. —
South. on true line between sections 1 and 2.
var. 13° 45' East.

40.00 Set a 1/4 section corner Post in stone
mound and Pits.
An Oak. 6 in. diam. bears west 25 links distant
do . 6. " " " north 49° west. 43 links distant

80.00 The corner to sections 1. 2. 11 and 12.

Sand level and rolling
Soil 1st and 3rd rate. No timber.

12 BOOK 1038

Township 14 North, Range 2 West
Gila and Salt River Meridian

	The North, between sections 34 and 35.
	var. 13° 45' East.
40.00	Set a ¼ section corner Post on a mound and Pits as per instructions.
	No trees near.
67.60	Intersect the east boundary line of the military reservation and set a Post as per instructions for the corner to fractional sections 34 & 35 and from which the southeast corner Post marked U.S.M.R. No. 1., bears south 46¾° West., 70.74 chains distant.
	Land sloping to the north.
	Soil 2nd rate. No timber.

Township 12 North. Range 2. West
Utah Salt Lake Meridian

Ch. From the corner to sections 25. 26. 35 & 36. I run —
West. between sections 26 & 35.
var. 13° 45' East.

19.00 Road runs north west and south east.
33.00 Ascend. point of hill. north & south.
40.00 Set a 1/4 section corner Post in a mound and pits as per instructions
No trees near.
48.00 Pass of hill 100 feet high. bears north and south
64.00 Base of same.
67.00 Road bears north and south.
67.60 Intersect the east boundary of the Military Reservation and set a Post as per instructions. for the corner to fractional sections 26 & 35. and from which the corner to fractional sections 34 & 35. bears south 46 3/4 E. 18.07 chains distant.
Land rolling. Soil 1st rate. No timber.

BOOK 1038

Township 14 North Range 2 West
Gila & Salt River Meridian

Commences at the corner to sections
13. 14. 23 & 24. I run —
West on true line between sections 14 & 23.
Var. 13° 45' East

40.00 Set a 1/4 section corner Post ai
a mound and pits as per instructions.
No trees near.

80.00 Set a post in a mound and pits
as per instructions, for the corner
to sections 14. 15. 22. & 23.
No trees near.

Land rolling. Soil 2nd rate.
No timber.

BOOK 1038

Township 14 North. Range 2 West—
Gila and Salt River Meridian.

1/10 From the corner to sections
14, 13, 22 and 23. I run
South. between sections 22 and 23.
var. 13° 45' East.
40.00 Dist. to 1/4 section corner Post with
a mound and pits as per instructions.
No trees near.

No. 34 Intersect the north line of the
Military Reservation and set a post
as per instructions, for the corner
to fractional sections 22 and 23.
and from which the corner to
fractional sections 23 and 24 bears
south 88 1/4° East. 81 chains distant.

Land rolling.
Soil 2nd rate
No timber.

BOOK 1038

Township 14 North. Range 2 West.
Principal Salt River Meridian
No. North. between sections 14 and 15
Var. 13° 45' East

17.00 Descending ground.
40.00 Set a 14 section corner stone
18 x 10 x 10 inches in a stone mound
as per instructions.
No bees near.
43.00 Enter level land bears east and west.

80.00 Set a stone 24 x 16 x 8 inches in
a mound and pits as per
instructions for the corner
to sections 10. 11. 14 and 15.
No bees near.

Land rolling and thin level.
Rock 2d and 1st rate
No timber.

Township 14 North. Range 2 West
Gila and Salt River Meridian.

The East. on a Random line between sections
11 and 14.

Var 13° 45' East

110.00 Set a temporary 1/4 section corner post.
42.00 Road bears north east and south east.
43.00 A house 10 links north of line.
51.00 Cuts two Granite boulders. bears north and south.
80.10 Intersect the north and south line 9 links
south of the corner to sections 11. 12. 13 & 14.
from which corner I run
South 89° 56' West. on true line between
sections 11 and 14.
Var. 13° 45' East
40.05 Set a 1/4 section corner stone 16 x 12 x 8
inches as per instructions. No trees near.
80.10 The corner to sections 10. 11. 14 & 15.

Land level. Soil 1st and 2nd rate.
No timber.

July 21st 1871

BOOK 1038

Township 11 North, Range 2 West -

Principal and Salt River Meridian

This line North, between sections 10 and 11.

Var. 13° 45' East -

7.50 Road bears east and west.

8.00 Miller creek 40 links wide runs east.

10.00 Enter cornfield, bears east and west and a house and barn 15 chains east of line.

10.00 Set a 4" section corner stone 18 x 14 x 8 inches as per instructions. No trees near.

54.30 Leave cornfield, bears east and west.

55.00 Hay road bears northeast and southwest.

80.00 Set a stone 14 x 10 x 6 inches as per instructions, for the corner to sections 2. 3. 10 and 11. No trees near.

Land level. Soil 1st rate

No timber.

BOOK 1038

No. 1038

Township 14 North, Range 2 West
Ute and Salt River Meridian

No East. on a random line between sections 2 and 11.
Var. 13° 45' East.

13.25 Road bears north and south
20.00 do. do. do.
40.00 Set a temporary 1/4 section corner post.
45.30 Granite boulders, bears north and south.
80.08 Intersect the north and south line.
18 links north of the corner to sections
1. 2. 11 and 12. from which corner a pine
10 in. dia bears S 89° 52' West. on true line between
sections 2 and 11.
Var 13° 45' East.
40.04 Set a 1/4 section corner stone 18 x 10 x 10
inches as per instructions No trees near.
80.08 The corner to sections 2. 3. 10 and 11

Sandy loam. Soil 1st rate, except
the east half, which is granite
boulders. No timber

BOOK 1038

Township 14 North. Range 2 West.
Utah 6th Principal Meridian
The North, on random line between sections 2 & 3.
Var 13° 45' East—
20.00 Enter creek, bears east and west.
35.00 Leave same, bears north east and south west.
40.00 Set a temporary 1/4 sections corner Post.
80.15 Intersect the north boundary line 12 links
East of the corner to sections 2. 3. 34 & 35.
from which corner I run
South. 0° 05' East. on true line between
sections 2 and 3.
Var. 13° 45' East—
40.15 Set a 1/4 sections corner Post in a mound
and Pits as per instructions. No trees near.

80.15 The corner to sections 2. 3. 10 & 11.

Land level. Soil 1st rate
No timber.

Town. 14 North. Range 2 West
Gila and Salt River Meridian

(N. North. between sections 33 & 34.
Var. 13° 45' East.

5.40 Road runs east and west.

20.00 Intersects the south boundary of the U. S. Military Reservation and set a post as per instructions for the corner to fractional sections 33 & 34. and from which the south east corner of said reservation bears south 88 1/4° East. 28.48 links distant.

The south line of the Reservation is also the north boundary of the town of Prescott and several valuable houses are inside the boundaries of said Reservation.

BOOK 1038

(2) Township 14 North, Range 2 West
Salt Lake, Salt River Meridian.

Jno. From the corner to sections 14. 15.
22, and 23, S. 89 E.
40.84 on true line between sections 15 & 22.
Var. 13° 45' East.

40.00 Set a ½ section corner post in a mound
and pits as per instructions.
No trees near.

30.00 Set a post in mound and pits
as per instructions for the corner
to sections 15. 16. 21 and 22.
No trees near.

Land, rolling table lands
Soil 2° rate. Good grass
No timber.

BOOK 1038

Township 14 North. Range 2 West.

Salt Lake (Principal Meridian)

N. South. on true line between sections 21 & 22.

Var. 13° 45' East —

40.00 Set a ¼ section corner Post in a mound and pits as per instructions.

No trees near.

67.90 Intersect the north boundary line of the Military Reservation and set a Post as per instructions for the corner to fractional sections 21 and 22. and from which the north west corner No. 3. of the Reservation bears north 88¼° West 5 chains distant

Land. rolling

Soil 2nd rate.

No timber.

July 22nd 1871.

BOOK 1038

Township 11 North, Range 2 West
Boise Salt River Meridian.

(No) North. between sections 15 and 16.
Var. 13° 45' East

40.00 Set a M. section corner stone 18 x 8 x 6
inches as per instructions. No trees near.
74.80 Willow creek 30 links wide runs East (dry)

80.00 Set a Post in a mound and pits as
per instructions for the corner to sections
9. 10. 15 and 16., from which.
a Double Ash 18 inches diameter bears south
3° East. 200 links distant.
a Black Walnut. 10 inches diameter bears
south 10° west. 175 links distant.
No other tree near.
a house bears north 10° west. 15 chains dist.
Land rolling. Soil 2° and 1st. rate.
No timber, except a few scalling
trees on the creek.

Surveyed in 14 North. Range 2 West.

Utah 6th Principal Meridian

North East. on random line between sections 10 and 15.

Var. 13° 45' East

32.00 A house 3 chains north of line.

40.00 Set a temporary 1/4 sections corner Post.
A house bears north. 65 links distant.

41.00 Willow Creek, 50 links wide runs north east.

65.00 Leave cultivated lands, north east and south west.

80.00 Intersect the north and south line at the corner to sections 10. 11. 14 and 15.
from which corner. I found—
West. on true line between sections 10 & 15.
Var. 13° 45' East.

40.00 Set a 1/4 sections corner stone 14 x 10 x 8 inches in stone mound as per instructions
No trees near.

80.00 The corner to sections 9. 10. 15 and 16.
Land level. Soil 1st. rate
No timber.

BOOK 1038

Township 11 North. Range 2 West
Utah and Salt Lake Meridian

Thro' North, between sections 9 and 10.
Var. 13° 45' East

20.00 A house 1 chain west of line.
39.00 Leave cultivated land.
40.00 Set a section corner post in mound
and pits as per instructions
No trees near.

80.00 Set a post in a mound and pits
as per instructions for the corner to
sections 3. 4. 9. and 10.
No trees near.
Land level and rolling
Soil 1st rate. No timber.

BOOK 1038

Township 14 North, Range 2 West
Utah and Salt Lake Meridian

The East. on a random line between sections
3 & 10.

Var 13° 45' East.

40.00 Set a temporary 1/4 section corner Post.

80.20 Intersect the north and south line
6 links north of the corner to sections
2. 3. 10 and 11. from which corner I run.

N. 89° 57' West. on true line between sections
3 & 10.

Var. 13° 45' East.

40.10 Set a 1/4 section corner Post. in a
mound and pits as per instructions
No trees near.

80.20 The corner to sections 3. 4. 9 and 10.

Land level. Soil 1st. rate
No timber.

BOOK 1038

(102)

Township 14 North. Range 2 East
Gila and Salt River Meridian

The North, on a random line between
sections 3 & 4

Var. 13° 45' East

40.00 Set a temporary 1/4 section corner post.

80.20 Intersect the north boundary, 11 links
East of the corner to sections 3. 4.
33 & 34. from which corner I raise.
South. 0°5' East. on true line between
sections 3 & 4.

Var. 13° 45' East.

40.20 Set a 1/4 section corner post on
a mound and pit as per witness
trees. No trees near.

80.20 The corner to sections 3. 4. 9 & 10.

Land gently rolling.
Soil 1st rate for grass.
No timber.

Township 14 North. Range 2 West
Gila and Salt River Meridian

North. between sections 32 and 33.
Var. 13° 45' East

6.00 Road runs northeast and southwest.
18.00 Creek 10 links wide runs northeast.
22.44 Intersect the south boundary of the Military Reservation, and set a post as per instructions for the fractional sections 32 and 33, and from which the corner to fractional sections 33 and 34 bears south 88 ¼° East, 80 chains distant.

Sand a little rolling and stony — granite boulders.
Soil good.
Timber. Pine. Juniper and Oak.

BOOK 1038

(30)

Township 14 North. Range 2 West
Gila and Salt River Meridian

(No) From the corner to sections 15. 16.
21 & 22. I run:—
West. on true line between sections
16 & 21.

Var. 13° 45' East

40.00 Set a 1/4 section corner post ei a
mound and pits as per instructions.
No trees near.

80.00 A Juniper tree. 10 inches diameter
and marked as per instructions
for the corner to sections
16. 17. 20 & 21.
No other trees near.
Land, rolling. grassy low hills.
Soil 1st rate.
Some scattering Pine and
Juniper trees and Oak brush.

Township 14 North, Range 2 West
Gila and Salt River Meridian

Commences South, between sections 20 and 21
Var 13° 45' East.

21.00 Road runs north east.

40.00 Set a 1/4 section corner Post in a mound and pits as per instructions. a Pitch Pine 8 inches diameter bears north 48 links distant.
No other trees near.

74.50 Old road runs east.

78.00 Fence east and west and enters cornfield.

80.00 Set a post in mound and pits as per instructions for the corner 21, 21, 28 and 29.
No trees near.
Land rolling. Soil 1st and 2nd rate.
Scattering Pine timber and Oak brush.

July 24th 1871.

Township 14 North. Range 2 West.
Gila and Salt River Meridian
Ariz.

From the corner to sections 20. 21
28 & 29. I run—
East. on true line between sections 21 & 28.
Var 13° 45' East.

32.00 Leave cornfield. bears north and south.
40.00 Set a 1/4 section corner post in a
mound. and pits as per instructions.
No bees near.
62.08 Intersect the west boundary line
of the Military Reservation and
set a Post as per instructions
for the corner to fractional sections
21 & 28 and. from which the north
west corner No. 3. of the Reservation
bears North 46 3/4° East. 17.87 chains distant.

Land rolling and good grass.
Soil 2° rate
Timber. Pine and Juniper.

BOOK 1038

Township 14 North. Range 2 West
Gila and Salt River Meridian

Chs. From the corner to sections
20. 21. 28 & 29. I run
South. between sections 28 & 29.
Var. 13° 45' East

4.40 Fence and leave corn field - East & West.
25.00 House 0.0 lks east of line.
40.00 Set a 1/4 section corner post in a
mound and pits as per instructions.
No trees near.
58.40 Intersect the west boundary line
of the Military Reservation and
set a post as per instructions
for the corner to fractional sections
28 & 29. from which the corner
to fractional sections 21 & 28
bears North 46 3/4 East. 85.22 chains
distant.
Land gently rolling.
Soil good.
Some scattering Pine and Juniper.

BOOK 1038

Township 14 North. Range 2 West.
Gila and Salt River Meridian.
The North, between sections 16 and 17.
Var. 13° 45' East.

20.00 Pass timber and enter rocky land.
28.00 Ravine runs north east.
40.00 Set a 1/4 section corner post in a stone mound as for ordinations.
No trees near.
48.00 Willow Creek 20 links wide runs east.
80.00 Set a stone 18 x 10 x 8 inches in a stone mound as for ordinations for the corner to sections 8. 9. 16 and 17.
No trees near.
Land rolling and stony.
Soil good.
Some scattering Pine and Juniper.

Township 11 North, Range 2 West.

Utah and Salt Lake Meridian.

	East, on random line between sections 9 and 16. Var. 13° 45' East.
12.00	Enter cultivated, bears north east and south west.
40.00	Set a temporary ¼ section corner post.
80.00	Intersect the north and south line at the corner to sections 9. 10. 15 & 16. from which corner I run. — West. between sections 9 and 16. Var. 13° 45' East.
40.00	Set a ¼ section corner stone 16 x 10 x 6 inches as per instructions. No trees near. A stone bears north east 6 chains distant.
80.00	The corner to sections 8. 9. 16. & 17.

Land level. Soil 1st rate.

No timber.

Township 14 North. Range 2. West—
Kiowa and Salt River Meridian

14 Km. North, between sections 8 and 9.
Var. 13° 45' East—

75.00 Bluff bears east and west 150 feet high
40.00 Base of bluff and set a 1/4 section
corner stone 16 x 10 x 8 inches in a
stone mound, as per instructions.
No trees near.
51.00 Ravine runs north east.
50.00 Set a stone 14 x 14 x 14 inches as per
instructions for the corner to sections
4. 5. 8 and 9. from which.
a Juniper 24 inches diameter, bears
North 40° west. 136 links distant,
No other trees near.
Land rolling. Soil good for grass.
No timber

Township 14 North. Range 2 West
Gila and Salt River Meridian

Chs. Each, on a random line between sections 4 and 9.
Var. 13° 45' East

Chs. Set a temporary 1/4 section corner post.

Chs. Intersect the north and south line 7 links north of the corner to sections 3. 4. 9 and 10. from which corner I run.

North. 89° 57' West. on true line between sections 4 & 9.
Var. 13° 45' East

0.07 Set a 1/4 section corner post with a mound and pits as for existing. No trees near.

0.15 The corner to sections 4. 5. 8 and 9.

Land level. Soil 2nd rate
No timber.

BOOK 1038

Township 11 North. Range 2 West—
Gila and Salt River Meridian

Chs North on a random line between
sections 4 and 5.

Var. 13° 45' East.

31.00 Flat ravine runs north east.
40.00 Set a temporary 1/4 section corner post.
80.10 Intersect the north boundary line
at the corner to sections 4. 5. 32 and 33.
from which corner I run ——
South. on true line between
sections 4 and 5.

Var 13° 45' East

40.10 Set a 1/4 section corner post in
a mound and pits as per instruc-
tions. No trees near.
80.10 The corner to sections 4. 5. 8 and 9.
Land gently rolling.
Soil 2° rate. No timber.

July 25th 1871.

Townships 11 North, Range 2 West.

Gila and Salt River Meridian

North, between sections 31 and 32.

Var. 13° 45' East.

4.88 Intersect the South Boundary of the Military Reservation and set a post as per instructions, from which the south west corner of said Reservation bears North 88 1/4° west. 1.52 chains distant.

4.25 Intersect the north west boundary line of said Reservation and set a post as per instructions from which the south west corner of the Reservation (No 4) bears south 46 3/4° west. 2.08 chains distant.

10.00 Set a post in a mound and pits as per instructions, for 1/4 section corner. No trees near.

10.00 Set a stone 18 x 10 x 8 inches, as per instructions for the corner to sections 29. 30. 31 & 32. No trees near.

Land rolling & stony. Soil 2nd rate. Some Pine and Juniper timber.

BOOK 1038

Township 11 North. Range 2 West
Willamette Third Principal Meridian

(No (Chs. on true line between sections 29 & 32
Var 13° 45' East.

40.00 Set a 4x4 section corner stone
16 x 10 x 6 inches as per instructions
No trees near.

5-7.04 Intersect the north west ~~corner~~ boundary of
the Military Reservation and
set a post as per instructions for
the corner to fractional sections
29 and 32. from which the post
on this line between sections
31 and 32. bears south 46 3/4°
West. 78. 31 chains distant.

Land gently rolling and
granite boulders.
Soil good.
Scattering Pine and Juniper.

BOOK 1038

Township 1 N. North. Range 2 West
Gila and Salt River Meridian

West. on a random line between sections
30 and 31.

Var. 13°45' East

40.00 Set a temporary 1/4 section corner. Post.

79.96 Intersect the West boundary 19 link
South from the corner to sections
25, 36, 30 and 31., from which corner
I mean.

South. 89°52' East. on true line between
sections 30. and 31.

Var 13°45' East

39.96 Set a 1/4 section corner stone 16 x 8
x 6 inches, as per instructions.

No trees near.

79.96 The corner to sections 29. 30. 31 & 32.

Sand, rolling and stony.
Soil good.
Scattering Pines, Juniper and Oak.

BOOK 1038

Township 14 North, Range 2 West
Boise and Salt River Meridian

Chs. North between sections 29 and 30.
Var. 13° 45' East

9.00 Pine runs north east.
11.00 Large granite boulders 50 feet high.
28.00 Same granite boulders.
40.00 Set a 1/4 section corner post as per
instructions, from which
an Oak 6 in. diam. bears north 4° east, 26 links distant.
do. 6 " " " south 13 " "
42.00 Enter cultivated land, bears east and west.
66.50 Leave same and rocky ground east and west.
75.00 Leave rocks, bears east and west.
79.00 Road bears west and south east.
80.00 Set a stone 18 x 8 x 8 inches as per
instructions for the corner to sections
19. 20. 29 and 30. - from which
a Pine 24 in. diam. bears north 81° East 64 links dist.
an Oak 10 " " " south 54° East 100 " "
no other trees near.
a House bears south east 50 links distant.
Land rolling and level, Soil 2nd rate.
Pine and Oak Timber.

Township 11 North. Range 2 West
Utah and Salt River Meridian

The East. on random line between sections 20 & 29.
Var. 13° 45' East

8.00 Road bears north and south east.
10.00 Enter rocky lands.
40.00 Set a temporary 1/4 section corner Post.
80.16 Subtract the north and south line 16 links
north of the corner to sections 20. 21.
28 & 29. from which corner I saw.
North. 89° 53' West. on true line between
sections 20 & 29.
Var. 13° 45' East
40.03 Set a 1/4 section corner Post in a
stone mound as per instructions.
No trees near.
80.16 The corner to sections 19. 20. 29 & 30
Land rolling and stony.
Soil 3rd rate.
Scattering timber.

BOOK 1038

Township 14 North Range 2 West
Gila and Salt River Meridian

The West. on random line between sections 19 & 30.
Var. 13° 45' East.

3.50 Road north west and south east.
29.00 Same road south west and north east.
40.00 Set a temporary 1/4 section corner post.
43.00 Road bears north west & south east.
61.00 Ravine runs north.
69.00 Round Knoll 50 feet high.
79.80 Intersect the west boundary line at the corner to sections 19. 30. 24 & 25.
from which corner I run. —
East. on true line between sections 19 & 30.
Var. 13° 45' East

39.80 Set a 1/4 section corner post as ten existence-
tions. from which. —
A Pine 16. in. diam. bears south 37° East. 56 links dist.
do 16. " " " north 44° east. 71 " "

79.80 The corner to sections 19. 20. 29 & 30.
Land rolling. Soil good.
Timber (Pine Juniper and Oak).

Township 14 North. Range 2 West
Gila and Salt River Meridian

N. North, between sections 19 & 20.
Var. 13° 45' East

40.00 Set a 1/4 section corner stone 16 x 10 x 4 inches, as per instructions. from which
A Pine 14 inches diameter bears west 58 links distant.
An Oak 6 inches diameter bears north 43° East. 31 links distant.

75.00 Road north east and south east

80.00 Set a stone 20 x 16 x 12 inches in a stone mound as per instructions for the corner to sections 17. 18. 19 & 20. from which
a Pine 24 in. diam. bears north 70° east. 100 link dist.
an Oak 8. " " north 82° west. 19 " "
No other trees near.
Land, rolling and stony.
Soil 2° rate.
Timber. Pine. Juniper and Oak.

BOOK 1038

Township 14 North. Range 2 West
Utah and Salt Lake Meridian

No. East. on random line between sections 17 and 20.
Var. 13° 45' East

8.00 Begin ascent of hill, bears north and south
19.75 Top of same, bears north and south. 75 feet high.
31.50 Bottom of hill bears north and south.
40.00 Set a temporary 1/4 section corner post.
63.00 Ravine runs north east.
79.88 Intersect the corner to sections
16. 17. 20 and 21. from which corner I run,
West. on true line between sections 17 and 20.
Var. 13° 45' East
39.94 Set a 1/4 section corner stone 16 x 10 x 6
inches as per instructions. No trees near.
79.88 The corner to sections 17. 18. 19 & 20.

Land broken and rolling.
Soil good for grass.
Some scattering Pine and Oak.

June 22.
July 26th 1871

Township 14 North. Range 2 West.

Utah and Salt Lake Meridian.

On West. on a random line between sections 18 and 19.

Var. 13° 45' East.

9.50 Road bears north and south.

12.25 Fence bears north and south and onto cornfield.

40.00 Set a temporary 1/4 section corner post.

44.00 Yellow Creek 30 links wide runs north.

61.00 Leave cornfield bears southwest and northeast.

79.82 Intersect the west boundary line 14 links north of the corner to sections 18. 19. 13 and 24. from which corner I run. —

North 89° 54' East. on true line between sections 18 and 19.

Var. 13° 45' East.

39.82 Set a 1/4 section corner post and a mound and pits as per instructions.

A Pine 8 in. diam. bears south, 32 links distant.

79.82 The corner to sections 17, 18, 19 and 20. No other trees near. Land level. Soil 1st rate

Pine. Juniper and Oak timber.

BOOK 1038

Township 11 North. Range 2 West.

Gila and Salt River Meridian

(No. North. between sections 17 and 18.

Var. 13° 45' East.

15.00 Willow creek 40 links wide, runs north east.

21.90 Brush fence runs east and west.

And a fence 10 chains West of line.

40.00 Set a "1/4 section" corner stone 20 x 10 x 10 inches as per instructions.

An Oak 10 in. diam. bears north 10° east. 25 links dist.

A Pine 6 " " " north 7° west 26 " "

41.70 Road bears north east and south west.

48.00 Ravine runs south east.

63.00 Enter cornfield, bears east and west and leave timber.

71.00 Leave cornfield.

80.00 Set a stone 16 x 14 x 10 inches as per instructions for the corner to sections 7. 8. 17 and 18.

No trees near.

Land rolling. Soil 1st and 2nd rate

Pine and Oak timber on first half mile.

Township 1 North. Range 2 West

Gila and Salt River Meridian

Chs East. on a random line between sections
8 and 17.

Var 13° 45' East

13.00 Road bears north and south.

25.00 Begin steep ascent of hill.

40.00 Set a temporary 1/4 section corner post
and descend.

70.00 Foot of hill and enter rock flat.

80.20 Intersect the north and south line
9 links north of the corner. to sections
8. 9. 16 and 17. from which corner I run,
North 89° 56' West, on true line between
sections 8 and 17.

Var. 13° 45' East

40.10 Set a 1/4 section corner stone 14 x 10 x 8
inches in stone mound as per
instructions. No trees near.

80.20 The corner to sections 7. 8. 17 and 18.
Land broken. Soil Good
No timber.

BOOK 1038

Township 12 North. Range 2 West
Gila and Salt River Meridian
No. West. on a random line between sections
7 and 18.

Var. 13° 45' East

40.00 Set a temporary 1/4 section corner post.
79.70 Intersect the west boundary line
17 links south of the corner to sections
7. 18. 12 and 13, from which corner, I run.
South 89° 53' East - on true line between
sections 7 and 18
Var 13° 45' East.
39.70 Set a stone 18 x 8 x 4 inches in a
stone mound as per instructions
No trees near.
79.70 The corner to sections 7. 8. 17 & 18.

Land south slope of hill.
Soil 2nd rate. No timber.

Township No. North. Range 2 West
Gila and Salt River Meridian
Ariz. North. between sections 7 and 8.
Var. 13° 45' East.

40.00 Set a "U" section corner stone 16 x 10 x 10 inches as per instructions
No trees near.

80.00 Set a stone 30 x 12 x 10 inches in a stone mound as per instruction for the corner to sections
5. 6. 7 and 8.
No trees near.
Land rolling.
Soil 2nd rate.
No timber.

BOOK 1038

Township 14 North. Range 2 West
Gila and Salt River Meridian

North East on a random line between sections 5 and 8.
Var. 13° 45' East.

10.00 Pecos runs north
38.50 Road runs north and south
40.00 Set a temporary 1/4 section corner post on top of hill, 100 feet high, bears north & south.
74.00 Pecos runs north.
80.00 Intersect the north & south line at the corner to sections 4. 5. 8. and 9. from which corner, I run. —
WEST. on true line between sections 5 and 8.
Var. 13° 45' East
40.00 Set a 1/4 section corner stone 14 x 10 x 6 inches as per instructions.
No trees near.
80.00 The corner to sections 5. 6. 7 and 8.

Land rolling. Soil Loam
No timber.

ECQK 1038

Township 14 North. Range 2 West —
Gila and Salt River Meridian
(Turn with page)

The North, on a random line between sections
5 and 6.

Var. 13° 45' East.

40.00 Set a temporary 1/4 section corner post.

80.18 Intersect the north boundary line
14 links east of the corner to sections
5. 6. 31 and 32. from which corner I run
South 0° 6' East. on true line between
sections 5 and 6.

Var 13° 45' East.

40.18 Set a 1/4 section corner post on a
mound and pits as per instructions
No trees near.

80.18 The corner to sections 5. 6. 7 and 8

Sand gently rolling.
Soil 1st. and 2nd rate.
No timber

BOOK 1038

Township 11 North. Range 2 West
Gila and Salt River Meridian
Ino * West. on a random line between sections
6 and 7.
Var. 13° 45' East.
33.00 Began to ascend.
40.00 Set a temporary 1/4 section corner post.
79.66 Intersect the west boundary line
11 links south of the corner to
sections 6. 7. 1 and 12. from which
corner I run.
South 89° 55' East. on true line between
sections 6 and 7.
Var. 13° 45' East
39.66 Set a 1/4 section corner stone 16x11x6
inches as per instructions.
No trees near.
79.66 The corner to sections 5. 6. 7 and 8.

Land steep east slope and stony.
Soil poor. No timber.
July 27th 1871

BOOK 1038

General Description

This Township has some good agricultural lands and all of it is good grazing land.

There is some good timber in the south west corner, and part of the town of Prescott is in section No 33 of this township.

Granite Creek runs through the midst of this township and usually affords a living stream of good water.

S. M. Freeman.

Deputy Surveyor.

BOOK 1038

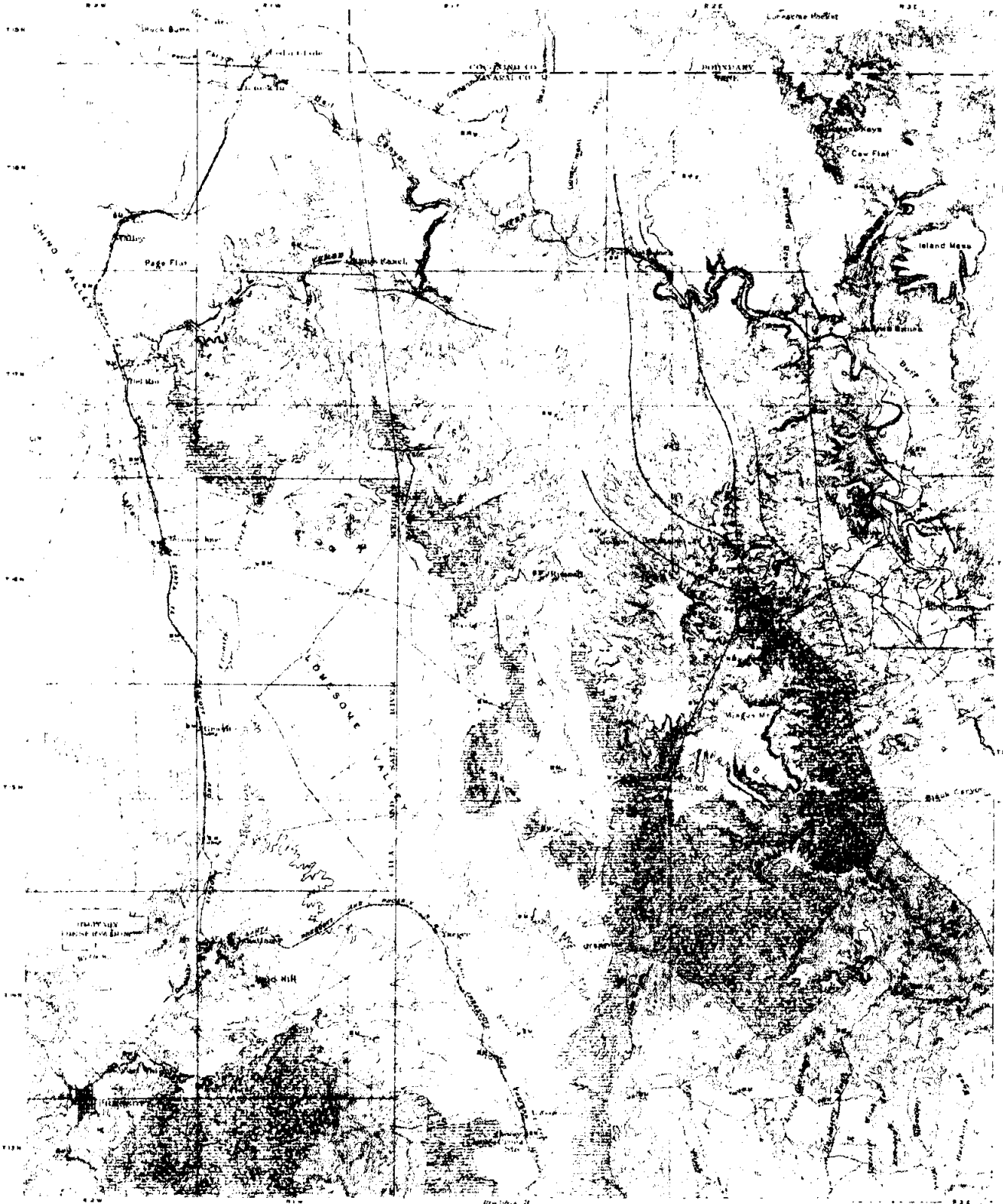
Surveyor General's Office
Tucson A.T.
October 20th 1871

The foregoing field Notes of the Survey of the Subdivisional lines of Township 14 N. Range 2 W. of the Gila & Salt River Base and Meridian line in the Territory of Arizona, executed by Sylvester Fireman Jr. Deputy Surveyor, under his contract dated May 29th 1871, having been critically examined the necessary corrections and explanations made, the said field notes and the Survey they describe are hereby approved.

John Wasson
U.S. Surveyor General
for Arizona

ATTACHMENT C

Early Surface Geology Map



EXPLANATION

SEDIMENTARY ROCKS

Qf — Alluvium and terrace sand and gravel — QUATERNARY

Tvs — Verde formation — TERTIARY

CDL — Kaibab limestone and Coconino sandstone (Permian); Supai formation (Permian and Pennsylvanian); Redwall limestone (Mississippian and older limestone (Devonian at least in part); and Tapeats sandstone (Cambrian) — PALEOZOIC

Ay — Yavapai schist — ALGONKIAN

IGNEOUS ROCKS

Tv — Volcanic flows and tuffs — TERTIARY

bg — Bradshaw granite — PROBABLY ALGONKIAN

Faults

Mine

Prospect

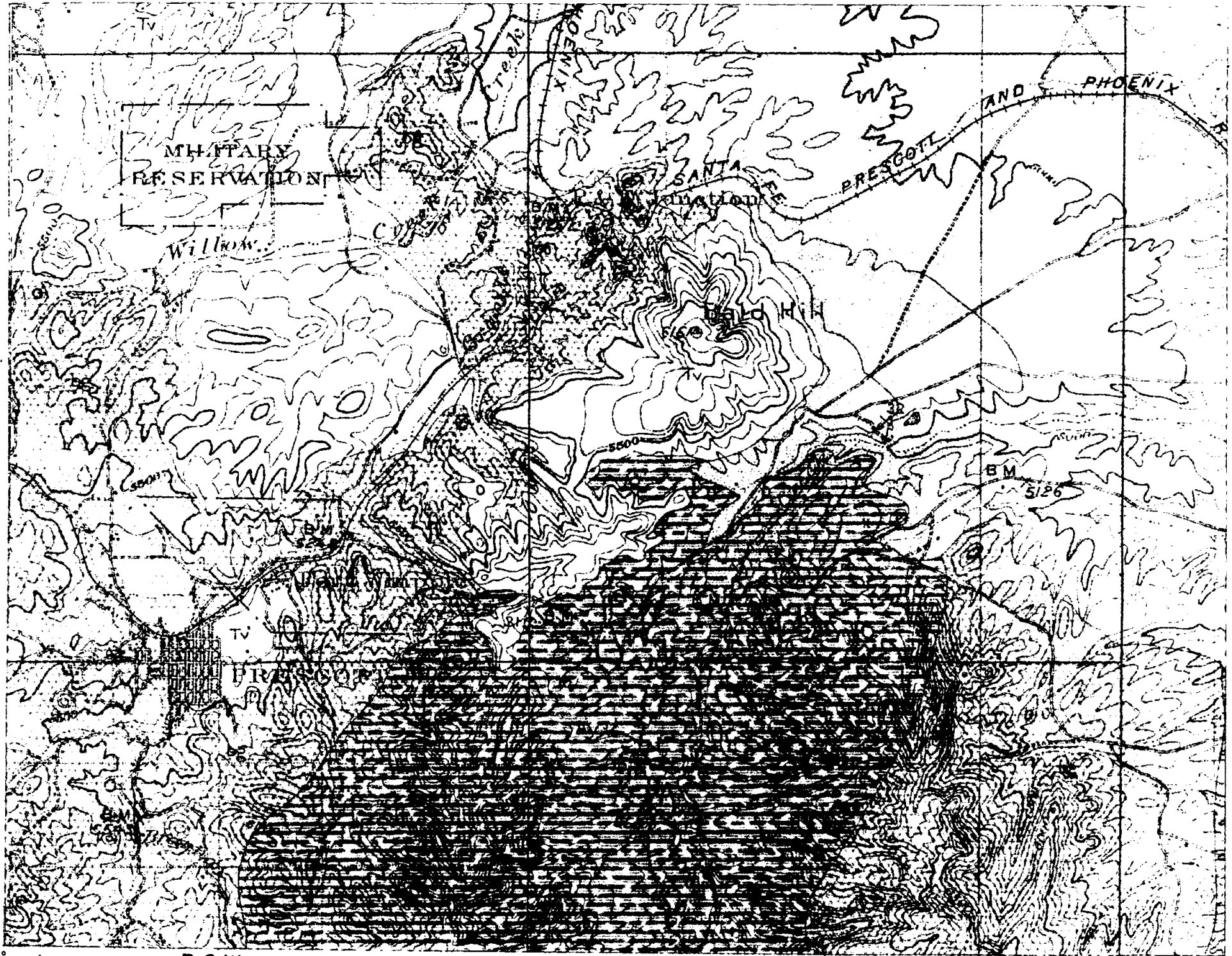
Placer

LIST OF MINES

1. United Verde
2. United Verde Extension
3. Verde Central
4. Hawkins Consols
5. Calumet Jerome
6. Jerome
7. Verde Combination
8. Jones Monitor
9. Copper Chief
10. Iron
11. Grand Island
12. Jerome Verde
13. Hull
14. Arizona and Arkansas
15. West U. V.
16. Tuzigoot
17. Butterfly Pup
18. Mingus
19. Big Lode
20. Yavapai County
21. Kenneth Verde
22. Eagle
23. Copper
24. Pilot
25. Lucky Boy
26. Independence
27. Pollock
28. Copper prospects
29. Gold prospects
30. Bell prospect
31. Gold placers
32. Bellevue

GEOLOGIC MAP OF THE JEROME QUADRANGLE, ARIZONA

1929



E. M. Douglas, Geographer in charge

DEPARTMENT OF THE INTERIOR
Hubert Work, Secretary

U. S. GEOLOGICAL SURVEY
George Otis Smith, Director

Bulletin 782

ORE DEPOSITS OF THE JEROME AND BRADSHAW MOUNTAINS QUADRANGLES, ARIZONA

BY

WALDEMAR LINDGREN

WITH STATISTICAL NOTES BY

V. C. HEIKES

WASHINGTON
GOVERNMENT PRINTING OFFICE
1926

CONTENTS

ILLUSTRATIONS

68508—26——2

ORE DEPOSITS OF THE JEROME AND BRADSHAW MOUNTAINS QUADRANGLES, ARIZONA

By WALDEMAR LINDGREN

INTRODUCTION

In the summer of 1922, at the request of the Director of the United States Geological Survey, I undertook an examination of the ore deposits in the Jerome and Bradshaw Mountains quadrangles, Ariz. (See fig. 1.) The object of this work was not a detailed investigation of each deposit but rather a coordination and classification of the occurrences and an attempt to ascertain their origin and economic importance. Almost all the deposits occur in pre-Cambrian rocks or in rocks that are not readily differentiated from the pre-Cambrian. In the northern part of the Jerome quadrangle there are large areas of almost horizontal Paleozoic beds, and in both quadrangles there are also large areas of lava flows of Tertiary age. Finally there are wide spaces occupied by Tertiary tuff and limestone, or by Tertiary and Quaternary wash filling the valleys between the mountain ranges. But all these rocks except the pre-Cambrian are practically barren of ore deposits, and the problem therefore narrowed itself to an examination of the pre-Cambrian areas. This task was greatly facilitated by the careful work of Jaggar and Palache, set forth in the Bradshaw Mountains folio,[1] in which the southern quadrangle of the two under present consideration is mapped geologically and described, and which also includes a comprehensive though brief discussion of the mineral deposits. There is no published geologic map of the Jerome quadrangle, but I had the opportunity through the courtesy of Dr. G. M. Butler, Director of the Arizona Bureau of Mines, to use a manuscript map of this area prepared for the State by Mr. L. E. Reber, jr., and Mr. Olaf Jenkins.

It would have been desirable to include the Congress quadrangle, to the west, in this reconnaissance, but the time and funds available did not permit this work. The topographic maps of the two quadrangles examined are of conspicuous excellence and reflect great

[1] Jaggar, T. A., jr., and Palache, Charles, U. S. Geol. Survey Geol. Atlas, Bradshaw Mountains folio (No. 126), 1905.

credit on Messrs. Matthes, Bannon, Dunnington, Evans, and Stiles, who surveyed the areas. The geologic map of the Jerome quadrangle accompanying this bulletin (pl. 1) has been compiled from the sources above indicated. The geologic map of the Bradshaw Mountains quadrangle, which forms Plate 2, has been taken from the Bradshaw Mountains folio. For assistance in the field I am indebted to Mr. A. B. Colwell, of Jerome, and for help in the study of ores to Dr. H. C. Boydell, of Cambridge, Mass.

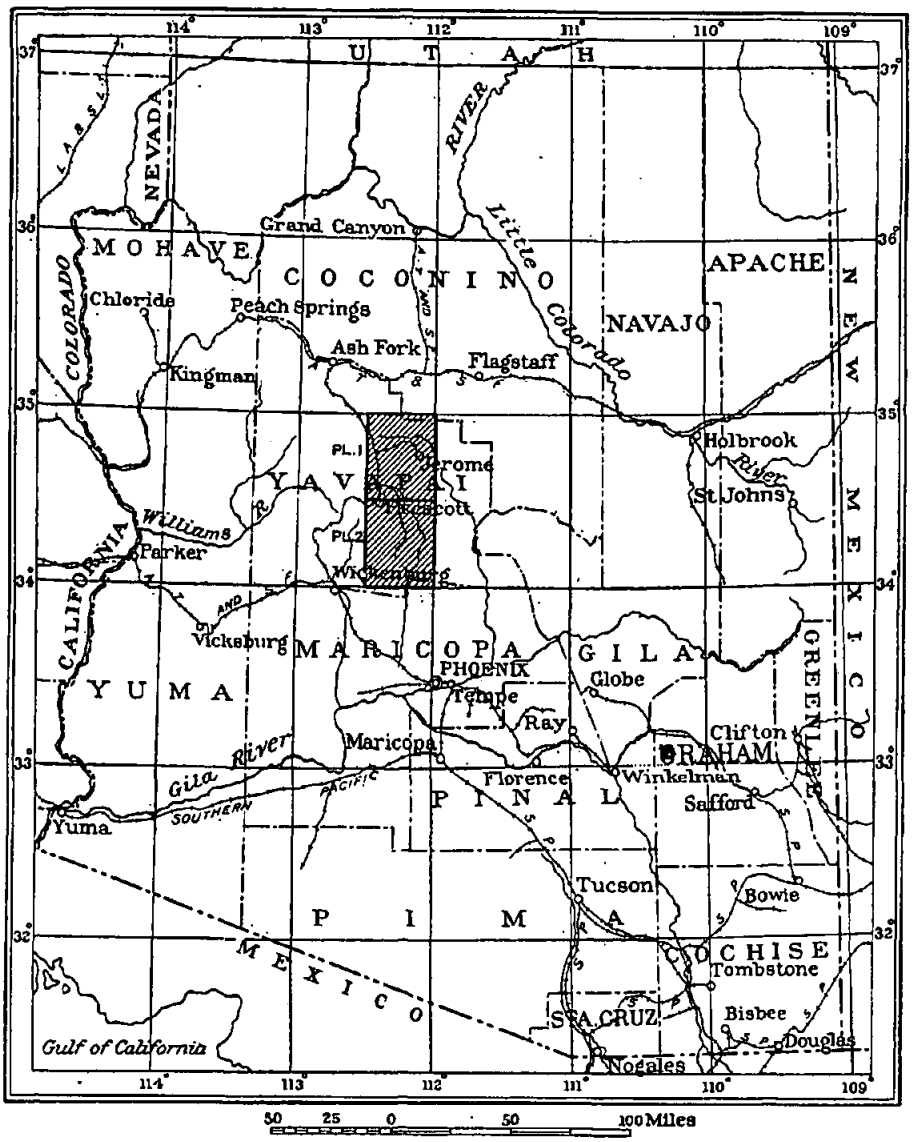


FIGURE 1.—Index map of Arizona showing location of region examined

HISTORY OF MINING

At an early date, about 1863, the Bradshaw Mountains were invaded by gold-seeking placer miners from California. They found some gold deposits of value along Hassayampa River and Lynx Creek and at other places, but compared to those of California the

of the Bradshaw Mountains quadrangle are the Red Picacho, White Picacho, Blue Tank, and Black Rock districts. The Black Rock district includes a number of gold and silver mines, some of which have been more or less productive. The Walnut Grove district, a short distance west of Copperopolis, includes a great number of small properties and some placer ground. The Copper Basin district, west of Prescott, has a fairly large output of copper and some molybdenum to its credit. The Weaver and Martinez districts, still farther west contain, respectively, the Octave and Congress mines, which have been large producers from gold quartz veins but are now idle. In the extreme western part of the county lies the Harcuvar district, and in the northwest corner the Ochocomo and Eureka districts. The Eureka contains the Bagdad mine, which has a large copper deposit far distant from rail communication and is not extensively operated.

GENERAL GEOLOGY

PHYSIOGRAPHY

The area here described is approximately 70 miles long from north to south and 28 miles wide and lies between parallels 34° and 35° and meridians 112° and 112° 30′. The altitude ranges from 1,900 feet at the most southerly point of Agua Fria River to 7,971 feet on the summit of Mount Union, in the Bradshaw Mountains.

According to Ransome, Arizona may be divided into three physiographic provinces trending northwest—the plateau region of flat-lying Paleozoic sediments; the mountain region, an area of irregular mountain masses, lying southwest of the plateau; and the desert region of short ranges trending north or northwest and separated by wide stretches of desert plains. The limit between plateau and mountain is sharply marked by recessed cliffs of horizontal Paleozoic beds, which are prominent in the landscape and are known as "the breaks." From northwest to southeast there are in succession many such breaks, beginning on Colorado River with the Grand Wash Cliffs, which are succeeded in turn by Music Mountain, by the Verde breaks, in the area here discussed, and by Mogollon Mesa, farther southeast.

The area considered in this paper extends across the Verde breaks and includes a part of the mountain region. It presents many physiographic problems of the first magnitude, which can only be briefly touched upon.

We have to deal with comparatively few units, already referred to on page 1. The flat-lying Paleozoic beds occupy the larger part of the northeastern section of the Jerome quadrangle. They rest

on the peneplaned surface of the pre-Cambrian, and their thickness, from the basal beds (Cambrian) to the top of the Coconino sandstone (Permian), amounts to 2,500 feet. Gradually thinned out by erosion, the southern outliers rest on pre-Cambrian granite in the south end of the Black Hills.

Strong fault lines of recent date mark the eastern slope of the Black Hills—in fact, the Verde fault, with a throw of at least 1,700 feet—can be traced continuously across the whole northeastern part of the Jerome quadrangle far into the plateau province. It is scarcely to be doubted that other older faults outlined the western slope of the Black Hills and all four sides of the Bradshaw Mountains. The plateau province is thus adjoined by a series of pre-Cambrian fault blocks, and few areas offer as good an opportunity to investigate the relation of mountain to plateau.

The top of the plateau attains 6,000 feet in the northeast corner of the Jerome quadrangle. The mountain region includes two main masses—the Black Hills and the Bradshaw Mountains. The Black Hills consist of an irregular orographic block capped in part by flat Paleozoic beds and Tertiary lavas, trending north-northwest for about 20 miles and 8 to 12 miles wide. This block is doubtless outlined by faulting and merges on the north into the flat plateau rocks. On the east it is delimited by the deep Verde Valley, filled by late Tertiary deposits; on the west by the higher plains of Lonesome Valley.

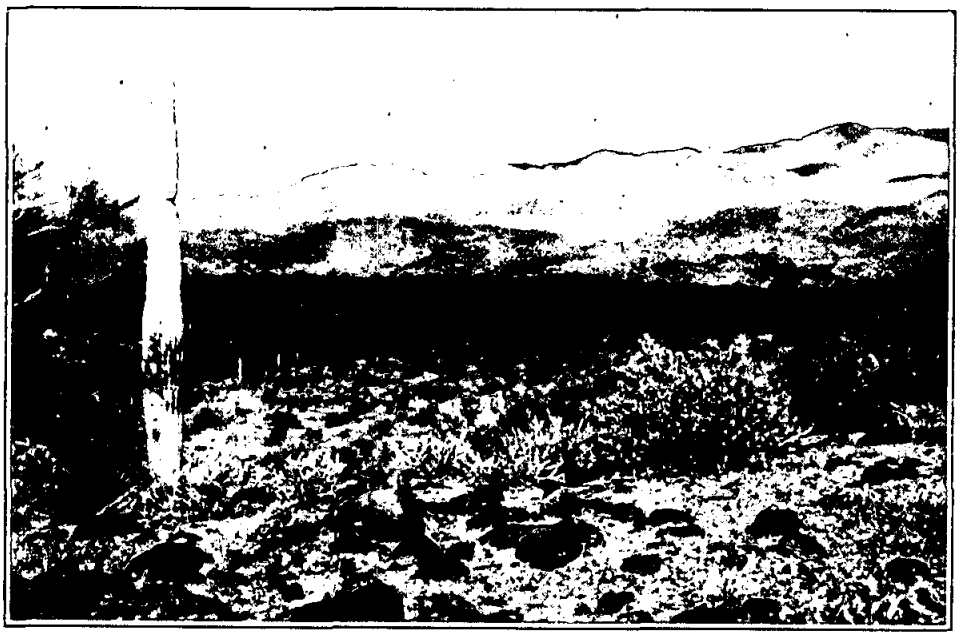
South of this range rises the irregular block of the Bradshaw Mountains, occupying about the whole of the Bradshaw Mountains quadrangle. (See pl. 3, *B*.) Essentially these mountains are a series of broad ridges trending north or north-northwest and dissected by a vast number of valleys and gulches that generally drain southward. At the south end of the quadrangle the ridges dip below the lava flows of the lower Agua Fria River, and the topography of the low-lying pre-Cambrian rocks becomes an intricately dissected landscape of irregular ridges and sharp points or "picachos."

The drainage is southward toward Gila River, by Hassayampa, Agua Fria, and Verde Rivers. The Hassayampa drains the western edge of the Bradshaw Mountains quadrangle, and the Agua Fria the central part. Stream capture effected by the active southward drainage is much in evidence. Thus the Agua Fria has captured the drainage of Lonesome Valley, and the Verde through a sharply incised canyon has captured streams draining much of the plateau region in the northern part of the Jerome quadrangle.

The Tertiary lavas (see pl. 3, *A*) occupy scattered areas on the plateau in the north and also much of the eastern half of the

A. SILVER MOUNTAIN, LOOKING EAST FROM HILL NEAR COPPEROPOLIS

Characteristic schist topography. Tertiary volcanic rocks at left, horizontally bedded



B. BRADSHAW MOUNTAINS, LOOKING NORTHEAST FROM POINT NEAR GODDARD'S RANCH

Mountains composed of Bradshaw granite; basaltic agglomerate in the foreground

Bradshaw Mountains, which drops off sharply from the pre-Cambrian ridges of the western half. In the latter region they form a dissected plateau with a surface altitude of about 4,000 feet. The advent of the late Tertiary lava flows modified the drainage to a considerable extent. Thus probably the whole of the lower Agua Fria was laid out along a new course over the flows in the eastern part of the Bradshaw Mountains quadrangle. But in the main the drainage far antedates the flows.

PALEOZOIC SEDIMENTS

The series of flat Paleozoic sandstones and limestones as exposed in the northeast corner of the Jerome quadrangle has a thickness of about 2,500 feet. The approximate succession as recorded by Ransome,[3] with changes in age assignment to accord with present classification, is as follows:

Section of Paleozoic formations in Jerome quadrangle

	Feet
Coconino sandstone (Permian)	500±
Supai formation (Permian (?) and Pennsylvanian)	1,000±
Redwall limestone (?) (Mississippian)	250
Limestones (Devonian, at least in part)	500
Tapeats ("Tonto") sandstone (Cambrian)[4]	80
Great unconformity.	
Pre-Cambrian.	2,330

These beds are in full view from points near Jerome on the upper slopes of the Black Hills, across the Verde Valley, and present a wonderful geologic panorama. The Tapeats sandstone forms a narrow brown band rarely to be observed from a distance. The Devonian beds are pale yellow and gray; above them rests the white Redwall limestone, and this in turn is covered by the Supai sandstones, which gleam brilliantly red when illumined by the rays of the setting sun. The level top of the plateau in the extreme corner of the quadrangle is surmounted by a narrow dark fringe of the pine forests, and the slopes below are bare and sculptured by erosion into a series of salients and recesses, with battlements and towers alternating with gentler slopes.

This section is materially thinner than those obtained along the Grand Canyon; at Tovar the strata measure 3,600 feet up to the top of the Coconino. The Devonian, however, which is represented in the Grand Canyon by 100 feet or less of Temple Butte limestone,

[3] Ransome, F. L., Some Paleozoic sections in Arizona and their correlation: U. S. Geol. Survey Prof. Paper 98, pp. 159–162, pl. 25, 1916.

[4] The basal quartzite at Jerome has not been definitely identified as the Tapeats (Cambrian) formation.

appears to be thicker here, although some of the 500 feet of limestone so classified may not be of Devonian age. Both sections agree in that they are relatively thin compared with the 30,000 feet of Paleozoic beds in eastern Nevada. Furthermore, both sections in Arizona, though apparently conformable, include several unconformities, so that there are many gaps in the succession.

The region here described is part of a large positive element of the crust, which in general has tended to rise. It is not a part of any geosyncline.

PRE-PALEOZOIC PENEPLAIN

The Paleozoic beds were laid down on a surface peneplaned by long erosion. As the sea advanced it destroyed any surface débris that might have accumulated, and a basal sandstone or fine conglomerate was laid down, first known as the "Tonto" sandstone and determined as Cambrian in several sections. Along the Grand Canyon these beds are several hundred feet thick and are overlain by 200 or 300 feet of Cambrian shale. In the Jerome section the "Tonto" (now called Tapeats) sandstone averages only 50 feet and, indeed, in places thins out almost entirely. It is overlain by a slight thickness of shale, which may represent the Bright Angel shale of the Grand Canyon section, and above this is the so-called Devonian limestone. The age of the sandstone at Jerome has not been proved, but it looks like the Tapeats sandstone of the Grand Canyon area, which contains Cambrian fossils. Just north of Lonesome Valley the Tapeats (?) is again exposed, and here it appears to be somewhat thicker than at Jerome.

We may assume, then, that the Cambrian sea advanced southward, transgressing over the pre-Cambrian peneplain, which gradually rose in this direction. Whether the Paleozoic beds up to the top of the Coconino sandstone covered the whole of these two quadrangles is a question open to discussion. The lowest Supai red beds form the uppermost part of the Paleozoic section in the Black Hills and directly underlie the Tertiary basalt.

RELATION OF THE PLATEAU PROVINCE TO THE MOUNTAIN REGION

The pre-Cambrian peneplain now lies at an altitude of 3,400 feet in the Bright Angel and Vishnu quadrangles of the Grand Canyon region. In the Shinumo quadrangle,[5] adjoining the Bright Angel on the west, the same horizon lies at 2,400 to 3,400 feet, the contact being very irregular in spots, though comparatively level as a whole.

[5] Noble, L. F., The Shinumo quadrangle, Grand Canyon district, Ariz.: U. S. Geol. Survey Bull. 549, 1914.

Southwest of Ash Fork, on the main line of the Atchison, Topeka & Santa Fe Railway, we find the same peneplain at an altitude of 4,800 feet. This is about 65 miles south of the Grand Canyon. About 25 miles farther south the base of the Tapeats crops out along Verde River at altitudes of 4,400, 4,200, 3,700, and 3,600 feet; the lowest figure was obtained at Packard's ranch, 6 miles north of Clarkdale. About 8 miles farther south, at the north edge of Lonesome Valley, the same basal plane lies considerably higher, at 5,200 to 5,300 feet. Still farther south, on the west side of the Black Hills, we find it at 6,000 to 6,400 feet, and at the south end of the hills, near Cherry, at 5,600 feet. On the east side of the Black Hills the Tapeats rests on the pre-Cambrian at 6,000 feet, but just east of the Verde fault, as shown in the Edith shaft of the United Verde Extension mine, it is thrown down to 4,230 feet.

In the Verde Valley, at the smelters of Clarkdale and Clemenceau, borings through the white lake beds of the Verde formation have encountered the pre-Cambrian at a depth of 1,200 feet,[6] or an altitude of 2,000 feet. Evidently there is here a deep depression in the pre-Cambrian surface, but it may possibly be due to more intense erosion of the pre-Cambrian beds in this particular area rather than to faulting.

To sum up, it appears that the position of the top of the pre-Cambrian is abnormally high in the Black Hills and abnormally low in the Verde Valley.

It would seem at first glance that the cliffs that mark the edge of the plateau province and stand up above the surrounding country indicate an uplift of the plateau. This is not so, however. Along the Grand Wash Cliffs runs a deep fault along which the country to the east has been relatively thrown down, and points in the Kingman and Hualpai ranges, to the southwest, stand high above the Tapeats horizon. W. T. Lee[7] interprets the structure in this area, southwest of Music Mountain, to the effect that the southwest side has been broken up into eastward-tilted fault blocks, from which an enormous erosion has removed the Paleozoic blocks. According to Ransome,[8]

> South of Ash Fork the continuity of the plateau escarpment is interrupted by flows of basalt that poured down from the plateau to the valley of the Verde, forming a slope that has been utilized by the Santa Fe, Prescott & Phoenix Railway between Ash Fork and Jerome Junction.

East of this slope the escarpment again begins, forming the "Verde breaks," already referred to as visible from Jerome.

---

[6] Finlay, J. R., The Jerome district of Arizona: Eng. and Min. Jour., vol. 106, Sept. 28 and Oct. 5, 1918.

[7] Lee, W. T., Geologic reconnaissance of a part of western Arizona: U. S. Geol. Survey Bull. 352, 1908.

[8] Ransome, F. L., op. cit., p. 134.

All this is interpreted as follows: Between the Grand Canyon and the upper Verde Valley the pre-Cambrian peneplain is fairly uniform, ranging from 3,600 to 4,800 feet in altitude over a distance of 100 miles. The Black Hills form an uplifted block, perhaps slightly tilted, separated by an obscure fault line from Lonesome Valley and by a well-marked fault, the Verde fault, from the depressed block on the west side of the Verde Valley. The Verde fault is later than the basalt and the Verde beds and is therefore of very late Tertiary or post-Tertiary age. It trends north-northwest and breaks into the plateau country where it crosses the upper canyon of the Verde. The downthrow amounts to 1,700 feet, and the fault has several branches, according to the mapping by Jenkins and Reber. Near the base of the slope in the vicinity of Clarkdale there is probably another parallel fault of unknown magnitude. In the block or "horst" of the Black Hills the base of the Tapeats lies abnormally high—that is, from 5,300 to 6,400 feet above the sea. The conclusion is that the block of the Black Hills has been lifted or tilted, and at the same time there has been a downward movement of a block underlying the Verde Valley. The effect is a relative depression of the edge of the plateau.

It is likely that there are other block faults, probably of earlier formation. Almost certainly one runs from north to south dividing the lava-flooded eastern part of the Bradshaw Mountains quadrangle from the higher mountainous region of the western half. The highest altitudes in this quadrangle lie between 7,000 and 8,000 feet. It is clear that if Paleozoic rocks rested on top of these highlands they would have attained a height at least equivalent to a present altitude of 10,000 feet. On any supposition the mountain province has risen relatively to the edge of the plateau. Actually, I think, the Paleozoic beds thinned out very much toward the south, and the Bradshaw highlands may never have been covered.

Supporting evidence for this suggestion is found in the following considerations: There are in the Bradshaw Mountains several stocks of granodiorite, some of them several miles in diameter, which are believed to be of Mesozoic age. Their present exposures reach an altitude of 7,500 feet and could hardly have been less than 3,000 feet below the Mesozoic surface. That surface may have been formed by flat Paleozoic beds or by the partly eroded pre-Cambrian peneplain. Furthermore, the Bradshaw Mountains are intersected by one of the most remarkable systems of dikes in the world, which reach at least 7,500 feet in altitude and which must have penetrated to the surface and produced volcanic flows of vast extent. Of these flows there are now no traces. This system of rhyolite dikes is genetically con-

nected with veins of epithermal to mesothermal type, most probably formed at depths not less than 3,000 feet.

All in all, I see no escape from the conclusion that the present exposures in the Bradshaw Mountains are about 3,000 feet or more below the pre-Cambrian erosion surface and that at the end of Paleozoic time these mountains projected as a vast dome above the edges of the transgressing sediments.

The only alternative would be to assume strong faulting or deformation between the Black Hills and the Bradshaw Mountains, which may have changed their relative elevations. Some such faulting may have occurred but is probably not sufficient to explain the absence of Paleozoic strata in the Bradshaw Mountains.

POST-PALEOZOIC EROSION

An enormous erosion intervened in the northern part of the mountain province between the deposition of the Kaibab limestone and the next notable event—the outpouring of the Tertiary basalt and allied rocks. The basalt rests on the Supai formation only in the northeast corner of the Jerome quadrangle and the northern part of the Black Hills. Elsewhere it rests mostly on the Devonian limestone or the Tapeats sandstone, or, as in parts of the Black Hills and over the whole of the Bradshaw Mountains, on the pre-Cambrian rocks.

The second period of erosion was postbasaltic and post-Tertiary. It also was of tremendous extent. It included the excavation of the main Verde Valley, both sides of the uplifted fault block of the Black Hills, and the whole upper Verde River above Packard's ranch and the trenching of the Bradshaw Mountains by deep canyons, which are best measured around Bigbug Mesa. It included the cutting of the new canyon of the Agua Fria and its capture of Lonesome Valley; also the capture by Verde River of its whole upper drainage system in the northern part of the Jerome quadrangle. Rarely can such vast physiographic changes be observed.

VOLCANIC FLOWS

Though the Tertiary flows were well scattered over the whole area (see pls. 1 and 2), they were not of great thickness, probably nowhere more than 700 or 800 feet, and as a rule much thinner. In the Jerome quadrangle they consist mainly of basalt, but in the Bradshaw Mountains there are also some andesite and rhyolite and much mixed volcanic agglomerate. Feeders such as necks and dikes are to be seen in many places, but no volcanoes or craters remain. The age of the flows, according to Robinson's determination in the San Franciscan field, is believed to be Pliocene.

The main flows descended toward Lonesome Valley and the Black Hills from the plateau in the vicinity of Flagstaff and Bill Williams Mountain. Another vast flow covered the depression in the east half of the Bradshaw Mountains quadrangle and no doubt followed the Tertiary equivalent of Agua Fria River. Still another line of flows may be observed along the western margin of the same quadrangle and may be considered as filling a branch of the Tertiary equivalent of the Hassayampa.

VERDE FORMATION

The main Verde Valley is now filled to a depth of at least 1,500 feet by the white lake beds which Reber[9] and Jenkins[10] have called the Verde formation. The valley from Packard's ranch down to a point beyond the limits of the Jerome quadrangle may have been outlined by the pre-basalt erosion, but in late Tertiary or Quaternary time dislocations parallel to the edge of the plateau caused it to sink like a deep graben. The whole of Verde River is therefore a comparatively late development. The lake beds rest on the faulted blocks. On Plate 1 the Verde formation is classified as Pliocene, but it may be of Pleistocene age.

LATEST FORMATIONS

The most recent formations include certain low river terraces and alluvial deposits in the Verde and Lonesome valleys.

PRE-CAMBRIAN ROCKS

GENERAL FEATURES

The pre-Cambrian rocks occupy large areas in the southwestern half of Arizona. They emerge from under the flat Paleozoic rocks of the plateau province along the diagonal line of "the breaks," as is well illustrated in the northeastern part of the Jerome quadrangle. South of this line they appear in nearly every mountain range from Clifton, Globe, and Bisbee to Kingman, Yuma, and Parker. Toward the north these rocks are not exposed for long distances except where they are laid bare in the narrow trench of the canyon of Colorado River.

W. P. Blake,[11] when Territorial geologist of Arizona, first described them in 1883. Since then they have been investigated by

[9] Reber, L. E., jr., Geology and ore deposits of the Jerome district: Am. Inst. Min. and Met. Eng. Trans., vol. 66, pp. 8–11, 1922. Adopts Jenkins's proposed name Verde formation.

[10] Jenkins, O. P., Verde River lake beds near Clarkdale, Ariz.: Am. Jour. Sci., 5th ser., vol. 5, pp. 65–81, 1923.

[11] Blake, W. P., Geology of the Silver King mine: Eng. and Min. Jour., vol. 35, pp. 238–239, 1883; also in the reports of the Governor of Arizona, 1896–1899, particularly in report for 1899, p. 139.

many geologists, particularly by Jaggar and Palache [12] in the Bradshaw Mountains; by Ransome [13] at Ray, Miami, and Bisbee and in the Mazatzal Mountains; by Lindgren [14] at Clifton; by Schrader [15] and Bancroft [16] in the western part of the State adjoining Colorado River; by Bryan [17] and Ross [18] in southwestern Arizona.

The pre-Cambrian rocks of Arizona may be divided as follows:

Grand Canyon series: Algonkian, probably of the same age as the Belt series of Montana and Idaho. Bedded sediments. Not definitely recognized except in Grand Canyon.

Mazatzal and other quartzites: Probably late pre-Cambrian.

Dike intrusions: Diorite porphyry (Jerome), diabase porphyry (Blue Bell mine). Latest pre-Cambrian. Not schistose.

Granites: Large widely distributed masses of intrusive normal granite with more or less pegmatite. In the region here described it is called the Bradshaw granite. In places gneissoid.

Diorite, "quartz porphyry," and monzonite: Smaller masses intrusive in schist and probably a facies of the granite.

Schists: Highly compressed, intruded by the granites. They are known as the Pinal schist at Globe, Ray, Clifton, and Bisbee, where they are predominantly of sedimentary origin. Near granites they are metamorphosed and may contain andalusite, sillimanite, and staurolite. They are known as the Yavapai schist in the Bradshaw Mountains quadrangle, where they are in large part also of sedimentary origin. They are known as the Vishnu schist in the Grand Canyon, where they unconformably underlie the Grand Canyon series. There is no reason to doubt that in the main these schists represent the same formation. The name "Arizonian schist" would, in my opinion, suit all these occurrences very well.

The schists are the earliest known pre-Cambrian rocks, though the occurrence in them of conglomerates made up of granite, quartzite, and other rocks would indicate that there existed an older series from which they were derived. At present all the granite with which they are in contact is intrusive.

The pre-Cambrian also includes certain flat-bedded sediments, consisting of slate, quartzite, limestone, and amphibolite, found near Parker on Colorado River and in the Harcuvar Range. They rest on older gneissoid and granitic rocks, and their correlation is

---

[12] Jaggar, T. A., jr., and Palache, Charles, U. S. Geol. Survey Geol. Atlas, Bradshaw Mountains folio (No. 126), 1905.

[13] Ransome, F. L., Geology of the Globe copper district: U. S. Geol. Survey Prof. Paper 12, 1903; Geology and ore deposits of the Bisbee quadrangle, Ariz.: Prof. Paper 21, 1904; The copper deposits of Ray and Miami, Ariz.: Prof. Paper 115, 1919; Quicksilver deposits of the Mazatzal Range, Ariz.: Bull. 620, pp. 111–128, 1916.

[14] Lindgren, Waldemar, The copper deposits of the Clifton-Morenci district, Ariz.: U. S. Geol. Survey Prof. Paper 43, 1905.

[15] Schrader, F. C., Mineral deposits of the Cerbat Range, Black Mountains, and Grand Wash Cliffs, Mohave County, Ariz.: U. S. Geol. Survey Bull. 397, 1909.

[16] Bancroft, Howland, Reconnaissance of the ore deposits in northern Yuma County, Ariz.: U. S. Geol. Survey Bull. 451, 1911.

[17] Bryan, Kirk, Erosion and sedimentation in the Papago country, Ariz.: U. S. Geol. Survey Bull. 730, pp. 19–90, 1922.

[18] Ross, C. P., Geology of the lower Gila region, Ariz.; U. S. Geol. Survey Prof. Paper 120, pp. 183–197, 1922.

not known. They are not identical with the Yavapai schist nor with the Grand Canyon series, and they are not intruded by granite. In this region the underlying granite is much more gneissoid than elsewhere. Whether or not it is of the age of the Bradshaw granite it uncertain.

DIKE INTRUSIONS

Dikes intruded at just about the end of the pre-Cambrian period of mineralization and probably of the age of the Bradshaw granite have been found in several places but are of small extent. At Jerome they are narrow, strike east, and seem to be related to diorite porphyry. They are greatly decomposed and cut across the diorite, schist, and pyritic deposits. The persistent dike that cuts across the Blue Bell mine is a panidiomorphic dike rock with labradorite, augite, brown hornblende, and a little sericite and chlorite. Possibly it is later than the pre-Cambrian.

BRADSHAW GRANITE

The typical rock of the Bradshaw granite is white, of coarse to medium grain, and forms large rounded outcrops of yellowish-gray color. It is uniform over large areas and is rarely gneissoid, though evidence of strain is commonly observed in thin sections. In color it differs from the pre-Cambrian granite at other places—that at Clifton, for instance, which is dark reddish. It everywhere contains quartz, orthoclase, and microcline, and in places perthite, with some plagioclase, which may be zoned, and which is generally an oligoclase-albite. The dark constituents are scarce and consist of biotite and rare hornblende. The accessories are apatite and zircon, but there is no titanite. A type locality is in the vicinity of Prescott. Reddish varieties occur in places, but differ little in composition from the normal type. Here and there the rock is porphyritic, having larger microcline crystals. Jaggar and Palache, in the folio already cited, give a partial analysis of granite from Crooks Canyon, as follows: Silica, 74.62 per cent; lime, 1.06; potash, 3.90; soda, 3.99. They say: "Pegmatitic facies are extremely abundant in the great southern stock, particularly along the eastern contact, where extensive areas, practically all of pegmatite, are found." The vicinity of the Tiptop mine well illustrates this statement. Many of the pegmatite dikes contain tourmaline.

The granite in the southern part of the Jerome quadrangle is normal, but in Lonesome Valley, in the Coyote Hills, and also at the north side of the same valley there are many smaller masses of medium-grained granite poor in mica, some of it pegmatitic and of a yellowish to reddish color. In many places these masses are mixed with included masses of schist.

DIORITE AND MONZONITE

The smaller masses of diorite in the Bradshaw Mountains quadrangle are fully described by Jaggar and Palache. They show a very hard and dark medium-grained rock, which may be regarded as a facies of the granite or at least a closely allied intrusive. The smaller masses of diorite at Jerome and the dikes at the Shea mine, south of Jerome, and the Yaeger mine, on the west side of the Black Hills, are similar and are more fully described on pages 57, 92, and 98.

The gneissoid monzonite of Battle Flat is also fully described in Folio 126 and is probably of about the same age.

YAVAPAI SCHIST

BRADSHAW MOUNTAINS QUADRANGLE

The schists, which occupy large areas in the Bradshaw Mountains quadrangle, with a general northerly trend, were named the Yavapai schist by Jaggar and Palache. They continue northward into the Jerome quadrangle, though here the exposures are much smaller.

The formation is described as follows by the authors cited:

> Chiefly phyllite, mica schist, and hornblende schist, with limestone lenses, quartzite, and siliceous schist lenses. * * * Within the schist areas are conglomerate and sandstone bands and lenses, and zones of intense metamorphism where the rocks are amphibolitic and contain epidote, garnet, zoisite, tourmaline, andalusite, and mica in various amounts. [There are also lenses containing much magnetite.] The typical phyllite as developed in the great body of Yavapai schist which occupies the northern half of the center of the quadrangle is a finely foliated blue or silvery schist consisting chiefly of quartz and the form of muscovite mica known as sericite. The foliation is pronounced, but the surfaces of the partings are not plane, so that nowhere are truly cleavable slates found. The rock consists largely of interlocking quartz grains, producing a mosaic, the sericite being woven in between the grains or forming layers wrapped about individual grains. Occasionally single large rounded grains of quartz are seen, their edges granulated. Plagioclase, calcite, epidote, zoisite, pyrite, and magnetite are often found in scattered grains.

The rocks are interpreted as a recrystallized and metamorphosed sedimentary series, and the conclusion is confirmed by the occurrence of lenses of quartzite, conglomerate, and, more rarely, limestone. Certain rare facies of the schist, however, contain so much feldspar in crystal form that a local derivation of the schist from granite porphyry or some such rock seems likely.

The hornblende schists are a varied assortment. They include amphibolites of doubtful derivation, some diabasic rocks, and some schists in which the hornblende seems to be derived by contact metamorphism. Near the granite staurolite, andalusite, and tourmaline appear.

The schists have been altered by regional metamorphism and extreme compression, but also to a considerable extent by the contact-metamorphic action of intrusive granite. The total thickness of the formation is in doubt. An estimate based on sections is from 5,000 to 7,000 feet.

The preceding paragraphs summarize the conclusions of Jaggar and Palache. My own studies are far less extensive than theirs, but included detailed examinations in each of the mining districts, and the general results are set forth as follows:

The first impression given by any typical section is that of very monotonous silvery-white schists, the outcrops looking very much alike. An inspection of mine workings, however, soon shows that this appearance is deceptive, for although a great variety of rocks present this appearance on the surface, the fresh rocks below vary greatly and are greenish, dark green, and brown from biotite mica. The pure sericite schists do not predominate. The quartzite lenses are very characteristic, especially in the central part of the Bradshaw Mountains quadrangle. I should say the predominating variety is chloritic mica schist, in part doubtless of sedimentary origin. There are also small lenses of limestone, usually only a few feet thick and, on the whole, very rare. Banded magnetites occur in many places. Some of them, as those near Copper Mountain, are red jasperoids, very similar to those of Lake Superior.

The amphibolites and allied greenstones are more abundant than the map in the folio cited would indicate. In small part they may owe their origin to contact metamorphism, but most of them are schistose and altered basic igneous rocks, probably effusive. Agglomerates with a dip differing from that of the normal schistosity are present—for instance, at the Binghampton mine, near Stoddard. A large part of the schists west of Wolf Creek, in the northwestern part of the quadrangle, have this origin.

Most prominent, however, are the schistose rhyolites or rhyolite porphyries; they are present in abundance in most of the districts examined, and where they have been pressed are almost indistinguishable from the normal chloritic schists. I suspect that the large quartz grains of which Jaggar and Palache speak are really deformed phenocrysts. Practically all the rocks at the Binghampton mine are of this character. They occur also at the Blue Bell mine, in the Black Canyon, and at many other places, but in all these places real sediments are also present.

It would be fair to say, it is believed, that the Yavapai schist comprises a series of sedimentary beds with a large amount of interbedded, supracrustal igneous rocks and tuffs. To what extent the series contains intrusive rocks is difficult to say; they are undoubt-

edly present here and there and have been made schistose with the rest. I would not dare to assign a definite thickness to the series.

This mainly supracrustal series was closely folded and appressed and subjected to regional metamorphism. The intrusion of the granite tends to follow the schistosity, so that great bands of schist are embedded in the granite with a general northerly direction. The effects of contact metamorphism are strongly marked. Next to the granite coarse schists appear with andalusite and staurolite, and in places probably also some amphibolite. Farther away brown mica seems to be the predominating mineral. In a few places, as at the Rainbow mine, in the Turkey Creek district, there are masses of epidote and garnet with pyrite, which seem to be contact-metamorphosed limestones. The effects may extend for a mile, or even several miles, from the contact. Tourmaline developed frequently, a mineral characteristic of granitic emanations. The tourmaline found in the schist is, indeed, invariably later than the regional metamorphism.

JEROME QUADRANGLE

The southwesterly area of Yavapai schist between Prescott and Dewey is greatly injected with granite, which in places is rudely gneissoid. The injection along the western border of this area is so extensive that it is difficult in places to separate the two formations. Near the granite the rocks are mainly amphibolites, black and lustrous, as at the Bullwhacker mine, but farther east, at the bridge across Lynx Creek, there are fissile slates and cherty beds intruded by granite.

A long north-south belt about 1 mile wide of fissile, almost vertical schists continues northward from the Bradshaw Mountains quadrangle and is well exposed on the Cherry Creek road, at the Shylock mine, at the Yaeger mine, and finally in a narrow strip below the Tapeats sandstone on the west side of the Black Hills. Where the road from Dewey to Cherry Creek crosses this belt from west to east it consists first of brown and red volcanic agglomerate, followed by purple schists and finally by a belt 500 feet wide of the usual chlorite-sericite schist, all members striking N. 20° E. and standing about vertical. Below the Shylock mine the same fissile schists appear, adjoined on the east by greenstone schists and granite. Similar conditions are found below the Yaeger mine.

In Lonesome Valley, north of the wagon road to Jerome, rises a complex of low hills that consist in part of a massive light-colored reddish or yellowish granite poor in dark minerals and rather fine-grained. In places the rocks show schistose structure; the granite injects numerous patches of strongly altered schist. Similar rocks are found in the northern foothills of Lonesome Valley, but within a short distance to the north the pre-Cambrian rocks are covered by

the Paleozoic sediments. In Yaeger Canyon on the road to Jerome the greenstone series consists of fine-grained tuffs with interbedded masses of fragmental greenstone, the series dipping 45° E. and having the usual schistosity superimposed.

In the Jerome district and adjacent parts of the Black Hills the Yavapai schist has a distinctly differing facies. The greenstones are rudely schistose, rarely fissile, and in several places show bedding by gently dipping layers of volcanic agglomerate. In the northern part of the district, about the town of Jerome, there is much rhyolite schist, usually light colored and poor in chlorite; some of it is almost massive, the schistosity varying sharply in intensity. The rhyolite is in part clearly intrusive into the greenstone, but some of it may possibly consist of supracrustal flows. The areas of this rock are irregular, and in places it is intimately interlocked with the greenstone schist. The strike of the schistosity is generally north-northeast, but is subject to sharp variations.

In the southern part of the district fine-grained granitic rocks are found, also intrusive in the greenstone schists. Reber thinks that there may be transitions between the aplitic granite and the rhyolite porphyry, but I do not believe that this is proved. It seems more likely that the porphyry antedates the granite, which I believe is to be correlated with the Bradshaw granite.

The smaller areas and dikes of diorite at the United Verde, Shea, and Yaeger mines are probably also to be considered as facies of the Bradshaw granite. Masses and streaks of clay slate, quartzite, banded chert, and other clearly sedimentary rocks are interbedded in the schists near Jerome, particularly near the United Verde mine. It is believed that they are earlier than or contemporaneous with the supracrustal volcanic rocks that make up the larger part of the greenstone series.

CORRELATION

There seems to be no reason why the rocks near Jerome should be separated from the Yavapai schist. They are predominantly volcanic and largely supracrustal, but if it is admitted that the same schists in the Bradshaw Mountains also contain large amounts of such rocks any distinction seems futile. I believe that all these schists, including the Pinal schist and the schists in the Mazatzal Mountains and at many other localities in central Arizona, are of approximately the same age, and that Blake's name "Arizonian" would be eminently suitable for them as a whole. In detail they differ greatly: some are almost entirely sedimentary; others contain many different kinds of igneous schistose rocks. It is hopeless to separate them except locally. From this series should be excluded the distinctly later intrusive rocks such as the diorite, the

Bradshaw granite, and other granites, which on the whole present a much more massive appearance.

ROCKS OF DOUBTFUL AGE

GRANODIORITE (QUARTZ DIORITE)

Jaggar and Palache called attention to certain bodies of quartz diorite in the Bradshaw Mountains quadrangle which differ strikingly from the other intrusive rocks here present. There are four areas of these rocks forming rounded intrusive masses at most a few miles wide. They are the Groom Creek, Walker, McCabe, and Crown King areas. These rocks are conceded to be the youngest among the intrusive masses in the quadrangle. There are no rocks of this appearance in the Jerome quadrangle.

The typical quartz diorite is a medium-grained light-gray rock of granitic appearance, composed predominantly of snow-white triclinic feldspar, together with more or less interstitial quartz and a variable amount of hornblende and biotite, the latter sometimes wholly replacing the hornblende. The rock is noticeably free from banded or gneissic structures, and, as shown by microscopic study, its constituents are free from evidence of unusual strain. * * * Its most marked characteristic in the field is the way in which it weathers into spheroidal forms. * * * Its outcrops always occupy basins [with sandy disintegrated soil]. * * * The quartz diorite is known to be the youngest plutonic intrusive in the region [because it shows intrusive contacts with all the known pre-Cambrian rocks].

It is medium to coarse grained, with hypidiomorphic texture. Both hornblende and biotite are usually present and show a tendency to crystal form. Oligoclase feldspar is the dominant mineral. Quartz, orthoclase, and microcline fill the interstices between oligoclase and ferromagnesium silicates. Titanite is always present, with some magnetite, apatite, and zircon.

Two partial analyses given by Jaggar and Palache are reproduced in the following table (Nos. 1 and 2). The composition is that of a granodiorite rather than a quartz diorite. In 1922 a preliminary analysis (No. 3) was made of an apparently typical specimen collected by me at the Sheldon mine in the Walker district. The microscopic features correspond well with those given above, except that there seems to be a larger amount of orthoclase.

Partial analyses of granodioritic rocks

	1	2	3		1	2	3
SiO_2	63.22	64.23	65.74	Na_2O	4.32	4.90	3.37
Al_2O_3	------	------	16.76	K_2O	2.53	2.44	3.55
Fe_2O_3	------	------	3.99	Loss on ignition	------	------	.99
MgO	------	------	1.70				
CaO	4.46	4.07	3.78		------	------	99.88

1, 2. Jaggar, T. A., jr., and Palache, Charles, op. cit., p. 5. Analyst not stated.
3. Analyst, Helen Vassar.

According to the quantitative system the first two analyses indicate a tonalose and the third corresponds to an adamellose. Which of these represents the average composition of the intrusive rock must be left an open question.

The pre-Cambrian of Arizona contains few if any rocks of this composition, but the rock agrees closely with the intrusives of Jurassic or later age which are so abundant in the western coast region of North America. The probability is strong that these masses were intruded in Cretaceous or early Tertiary time.

BASIC DIKE ROCKS

Basic dike rocks are not abundant in these quadrangles. There are some diorite dikes, closely affiliated with the pre-Cambrian diorite. Dikes of diabase are found at several places. Dike rocks of camptonite were observed by Jaggar and Palache at Battle Flat, at the Creek mine (near Goodwin), near Alexandra, at the Crooks mine, and in Crooks Canyon.

There is no direct evidence of the age of these dikes, but it is believed that they may well be Cretaceous or younger.

DIKES OF RHYOLITE PORPHYRY

Dikes of acidic rocks are very common. Many of aplite and more of pegmatite are associated with the Bradshaw granite. There are also dikes of granite that is not aplitic, as at the head of Bear Creek and Peck Canyon, which are probably related to the granodiorite.

The most abundant dikes are those of rhyolite porphyry. They are of late origin compared to the other rocks of the pre-Cambrian complex, and they intersect the granodiorite, which is believed to be of Cretaceous or later age. They occur chiefly in the western part of the Bradshaw Mountains quadrangle. Some of them can be traced for several miles. They usually strike north-northeast, roughly following the strike of the Yavapai schist. From the south the first ones are seen north of Copperopolis, also near the Tiptop mine and the Simpson ranch; the main belt continues northward across the granodiorite of the Crown King district, and the dikes are found along Peck Canyon and at Turkey Creek. They are very abundant in the Hassayampa district, near Mount Union and in the Tillie Starbuck, Senator, and N. C. 4 mines; also near Walker; and they continue northwestward across Hassayampa River into the Congress quadrangle and up to the Copper Basin district. They are intrusive in all the pre-Cambrian schists. The dikes are rarely more than 50 feet in width.

The rock is dull white, locally porous, and usually more or less decomposed. It shows small quartz and feldspar phenocrysts, also biotite, in a gray fine-grained or flinty groundmass. Generally it is strongly altered by the development of sericite and calcite. None of these rocks can be mistaken for the rhyolite porphyry at Jerome or elsewhere in the Yavapai schist. A comparatively fresh dike near Turkey Creek station shows fine embayed quartz phenocrysts and partly altered crystals of orthoclase, with a little brown biotite, in a micropoikilitic groundmass of quartz and short feldspar laths, probably plagioclase.

The dike at the south portal of the Poland tunnel is a dull, light-gray, fine-grained rock with phenocrysts of feldspar. In thin section it shows many large and small crystals of feldspar, many of orthoclase but some of andesine. There are also muscovite foils, pseudomorphic after biotite. The groundmass is microcrystalline and consists of quartz and feldspar. Much sericite and calcite indicate strong alteration. Entirely similar to this is a dike from the summit of the road to the Mount Union mine from Prescott.

Another dike observed near the Tiptop shaft, in the Tiptop district, is a dull-white rock with a few phenocrysts of orthoclase, which in thin section prove to be strongly sericitized. The groundmass is microcrystalline and consists of quartz and orthoclase, the latter likewise much sericitized. There are also pseudomorphs of muscovite after biotite.

Different from this is the wide dike at the Springfield mine, in the Crown King district, which intersects granodiorite. This dike consists of a coarse porphyry with very abundant phenocrysts of quartz, orthoclase, and oligoclase-andesine in a rather coarse holocrystalline groundmass of quartz and orthoclase. The quartz phenocrysts contain plentiful large fluid inclusions with bubbles and colorless cubes, probably of an alkaline chloride. A similar rock is the porphyry at Copper Basin, 12 miles west of Prescott.

Two analyses were made, both of more or less altered dike rocks, as follows:

Analyses of acidic porphyries

[Analyst, Helen Vassar]

	1	2		1	2
SiO_2	71.20	65.83	Na_2O	0.05	2.84
Al_2O_3	17.57	15.76	K_2O	5.92	4.15
Fe_2O_3	1.50	2.51	Loss on ignition	2.86	5.41
CaO	.37	3.16			
MgO	.21	.79		99.68	100.45

1. Tiptop mine.
2. South portal of Poland tunnel.

The rocks are greatly altered; it is clear, however, that the rock from the Tiptop mine is a rhyolite porphyry and that from the Poland tunnel approaches much more closely a trachytic composition.

The acidic dike rocks are most intimately connected with the later mineralization of the Bradshaw Mountains quadrangle. The evidence of that mineralization points definitely to lesser depths and lesser temperatures than those prevailing in the mineralization that followed the intrusion of the Bradshaw granite. It is concluded that the dikes were introduced after the region had undergone a great deal of erosion. It is also certain that the dikes are much later than the Bradshaw granite. As they are also later than the granodiorite we may tentatively conclude that they were intruded in Cretaceous or Tertiary time.

I have not seen the thick dike of rhyolite porphyry in the New River Mountains, described by Jaggar and Palache. It is situated in the extreme southeast corner of the quadrangle, and they state that it differs but little from the [Tertiary] rhyolite flows of the same vicinity. No ore deposits have been discovered near by.

On the map (pl. 2) the quartz diorite and the rhyolite porphyry dikes are indicated as "probably Algonkian." This was the view of Jaggar and Palache.

ORE DEPOSITS

MINERALS OF THE ORE DEPOSITS

The deposits of this region are not remarkable for variety and beauty of minerals. Only 51 species have been identified.

Quartz.—As usual, quartz is the most abundant gangue mineral. In the pre-Cambrian veins the quartz has a glassy appearance and forms a coarse granular mass. Druses and vugs as well as comb structure are absent. Locally, as near the Monarch mine, in the Black Hills, large crystals are found, but these occurrences rather indicate a transition to pegmatite. In much of the rock the grains are extremely crushed, as indicated by their optical character, and full of fluid inclusions, with moving bubbles which do not disappear on gentle heating. They are, therefore, not fluid carbon dioxide.

The quartz in the pyritic replacement deposits is of finer grain and less crushed than in the veins just described.

In the later (post-Cambrian) veins the quartz is milky white and shows little optical deformation. Druses, vugs, and comb structure are characteristically present. The crystals are small, the largest individuals observed, in the Tiptop mine, reaching only 2 or 3 inches in length in the comb aggregates.

ORIG.

CLERK OF THE SUPERIOR COURT
FILED
SEP 20 2023 10:30a.m.
A. Marrufo, Deputy

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) Sandy DuBois

Mailing Address 3975 Scarlett Dr.
Prescott, AZ 86305

Telephone No. 928-776-4441

Statement of Claimant No. 39-142402 AND 39-142401

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

I am objecting to the statement that my wells are part of the Verde River Watershed.

CERTIFICATE OF SERVICE

On this 18 day of September, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.

Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed)_____

Mailing Address of Representative_____

Telephone Number of Representative_____

SANDY DUBOIS
3975 W. SCARLETT DR.
PRESCOTT, AZ 86305

9/15/23

Clerk of the Maricopa Superior Court
ATTN: Water Case
601 W. Jackson Street
Phoenix, Az 85003

Dear Sir,

My well company, McGee Well Drilling & Pumps, was just here doing annual maintenance on our wells & I asked him about your notice of publication.

He stated that I am not part of the Verde River watershed and that my water comes from the south-west ground water from an extinct volcano near Granite Mountain.

I hope this helps. They certainly know this area as they have been serving this area for a long time.

Thank You,

Sandy DuBois

CLERK OF THE SUPERIOR COURT
FILED
OCT 27 2023 10:44 A.M.
A. Marrufo, Deputy

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) Salt River Project (see attachment A for full name of objector)

Mailing Address c/o Salmon, Lewis & Weldon, PLC
2850 E. Camelback Rd., Ste 200, Phoenix, AZ 85016

Telephone No. (602) 801-9060

Statement of Claimant No. 39- numerous. See attachment A.

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

See Attachment A

CERTIFICATE OF SERVICE

On this 27th day of October, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.

Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed) Lucas Shaw

Mailing Address of Representative c/o Salmon, Lewis & Weldon, PLC
2850 E. Camelback Rd., Suite 200, Phoenix, AZ 85016

Telephone Number of Representative (602) 801-9060

John B. Weldon, Jr., 003701
Mark A. McGinnis, 013958
Michael K. Foy, 032736
Katrina L. Wilkinson, 037195
SALMON, LEWIS & WELDON, P.L.C.
2850 East Camelback Road, Suite 200
Phoenix, Arizona 85016
(602) 801-9060
jbw@slwplc.com
mam@slwplc.com
mkf@slwplc.com
klw@slwplc.com

Attorneys for Salt River Project Agricultural Improvement and Power District and Salt River Valley Water Users' Association

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

IN RE: THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	No. W-1 (Salt) No. W-2 (Verde) No. W-3 (Upper Gila) No. W-4 (San Pedro) Contested Case No. W1-106 **ATTACHMENT "A" TO SALT RIVER PROJECT'S OBJECTIONS TO THE SUBFLOW ZONE DELINEATION FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** (Assigned to the Hon. Scott Blaney) (Referred to Special Master Sherri L. Zendri)

Contested Case Name: *In re Subflow Technical Report, Verde River Watershed.*

Descriptive Summary: SRP submits its objections to the Arizona Department of Water Resources' April 28, 2023 Technical Report re Subflow Zone Delineation for the Remainder of the Verde River Watershed.

Statement of Claimant Nos.: 39-05-50053 through -50055; 39-07-1040, -1041, -1206, -1207, -1998, -11951 through -11955; 39-11-1976, -1977, -1978, -2217, -2219 through -2223, -2225, -4844 through -4846, -17557; 39-L8-35152, -35157, -35158, -35212,

-35213, -35216 through -35218, -132301 through -132309, and -133295.

Date of Filing: October 27, 2023.

Number of Pages: 15 + 29 (attachments) = 44.

On April 28, 2023, the Arizona Department of Water Resources ("ADWR") filed its Technical Report re Subflow Zone Delineation for the Remainder of the Verde River Watershed ("Tributaries Report"). Pursuant to the Special Master's Order dated July 30, 2021, the Salt River Valley Water Users' Association and the Salt River Project Agricultural Improvement and Power District (collectively, "SRP") hereby submit their objections to the Tributaries Report.

As a general matter, SRP concurs with the delineation presented in the Tributaries Report with the exception of the discrete issues that are identified in these Objections. SRP retained an expert hydrologist to review the Tributaries Report (Jon Ford of LRE Water), and Mr. Ford's analysis confirmed that ADWR generally has developed and accurately applied an appropriate methodology for delineating the lateral extent of the subflow zone. Accordingly, SRP's objections to the Tributaries Report are intended to address only three discrete issues rather than to broadly critique ADWR's methodologies or conclusions. An overview of the technical bases for SRP's objections on these three issues is provided in the Affidavit of Jon Ford, attached hereto as **Exhibit 1**.[1] The three grounds on which SRP objects to the Tributaries Report are as follows:

1. ADWR improperly failed to delineate the subflow zone for at least two watercourses (Big Chino Wash and Patridge Creek) that included reaches that were intermittent under predevelopment conditions and delineated a subflow zone for only a

[1] Mr. Ford's affidavit is not intended to provide a comprehensive recitation of his opinions regarding the Tributaries Report, nor is it intended to address any objections that other parties might raise. SRP expressly reserves its right to disclose additional affidavits, reports, or memoranda from Mr. Ford or other experts in any subsequent proceedings in this case, including for purposes of supporting SRP's objections or rebutting objections that other parties may submit to the Tributaries Report.

portion of Williamson Valley Wash even though it was intermittent in its entirety under predevelopment conditions. These watercourses include a subflow zone as a matter of law even if they are currently ephemeral. *See* Section I, *infra*.

2. The watercourses that are analyzed in the Tributaries Report include at least four surface reservoirs (Watson Lake, Sullivan Lake, Granite Basin Lake, and Willow Creek Reservoir) that did not exist under predevelopment conditions. ADWR improperly delineated the subflow zone for the area impacted by these reservoirs based on post-development rather than predevelopment conditions. *See* Section II, *infra*.

3. For numerous tributaries, ADWR appears to have arbitrarily stopped its subflow delineation at a specific point along the tributary even though (a) intermittent or perennial reaches of the tributary extend farther upstream and (b) there is no evidence that the saturated floodplain Holocene alluvium ("SFHA") does not also continue farther upstream. *See* Section III, *infra*.

I. Failure to Delineate a Subflow Zone for Big Chino Wash and Partridge Creek and Improper Partial Delineation for Williamson Valley Wash

The Tributaries Report does not include a subflow zone delineation for Big Chino Wash (the "Big Chino") or for Patridge Creek and includes a subflow zone for only a portion of Williamson Valley Wash, based on the apparent conclusion that these watercourses are ephemeral. ADWR is required to evaluate streams under their predevelopment conditions for purposes of its subflow analysis. *See* Section I(A), *infra*. A wide body of evidence establishes that portions of the Big Chino and Partridge Creek, and the entirety of Williamson Valley Wash, were intermittent under predevelopment conditions. *See* Section I(B), *infra*. ADWR opted to ignore this evidence and to instead rely upon reports that were provided to ADWR by participants to this Adjudication that have a vested interest in seeing that these watercourses do not have a subflow zone. *See* Section I(C), *infra*. ADWR erred in doing so, and SRP objects to ADWR's error. The Court should direct ADWR to map a proposed subflow delineation for these historically intermittent streams.

A. The "Ephemeral Stream Exception"

In *Gila IV*,[2] the Supreme Court of Arizona considered whether the Adjudication Court "properly determined what underground water constitutes 'subflow' of a surface stream, thus making it appropriable . . . ." 198 Ariz. at 333. The Adjudication Court's order had determined, among other things, that subflow requires a saturated geologic unit and that subflow must "be a part of the surrounding floodplain of the stream basin." *Id.* at 337. That floodplain "must be the alluvial plain of a perennial or intermittent stream and *not* an ephemeral stream . . . ." *Id.* (cleaned up). Thus, this Court concluded that "[a] 'subflow' zone is adjacent [to] and beneath a perennial or intermittent stream and not an ephemeral stream." *Id.* at 338. The Supreme Court affirmed this Court's order "in all respects." *Id.* at 344.

The order that the Supreme Court affirmed in *Gila IV* recognized that the determination of whether a watercourse is ephemeral, for purposes of subflow analysis, includes a temporal element under which a currently ephemeral stream may include a subflow zone if it is ephemeral due to "adjacent surface water diversion or groundwater pumping." *See* Order, at 35 (June 30, 1994) ("Goodfarb Order"). In its subsequent 2005 Subflow Order,[3] the Adjudication Court elaborated upon this exception to the exclusion of ephemeral streams (the "ephemeral stream exception"). That exception applies to "streams that would legitimately be categorized as ephemeral, but only because of the effect of surface water diversions or groundwater pumping." *Id.* at 23. The Court offered the following explanation of the exception:

> The exception requires, in effect, that these streams be considered in a predevelopment state. That is, if one assumes away the effects of diversions and pumping, would the subject streams share the characteristics of an adjacent intermittent or perennial stream? If the answer is "yes," they can be included

---

[2] *In re Gen. Adjudication of All Rts. to Use Water in Gila River Sys. & Source*, 198 Ariz. 330 (2000) ("*Gila IV*").

[3] *See* Order Re: Report of the Special Master on the Arizona Department of Water Resources' Subflow Technical Report, San Pedro River Watershed and Motion for Approval of Report, Case No. W1-103 (Sept. 28, 2005) ("2005 Subflow Order").

> within the subflow zone due to their predevelopment attributes. Instead of an admonition to use only current conditions, the ephemeral stream exception is evidence that the Goodfarb Order contemplated that ADWR would outline the subflow zone without having to be concerned that human generated water diversions or depletions might artificially divest jurisdiction over water right claims this Court is charged with adjudicating.

Id. at 23-24. Accordingly, a stream lacks a subflow zone only if that stream was ephemeral during the "predevelopment state" that preceded modern surface diversions and pumping. *See id.*

The Special Master recognized the "predevelopment state" principle when ordering ADWR to begin preparing a delineation report in the Verde Watershed.[4] In the Verde Subflow Order, the Special Master directed ADWR to prepare a technical report for perennial and intermittent streams in the Verde River Watershed. *Id.* at 2. However, the Special Master specifically directed ADWR to include "the subflow zone of ephemeral reaches of perennial and intermittent streams if: (1) anthropological surface water diversions or groundwater pumping caused that portion of the perennial or intermittent stream to become ephemeral; and (2) a saturated zone exists beneath the ephemeral reach that is connected to the saturated zone beneath the adjoining perennial or intermittent reaches." *Id.* The Verde Subflow Order "clearly requires ADWR to use predevelopment conditions for mapping the Verde subwatershed subflow zone." *See* Order Granting Partial Summary Judgment re Objections to Subflow Delineation Report for Verde Mainstem and Sycamore Canyon, Case No. W1-106, at 9 (Oct. 24, 2023) ("Mainstem MSJ Order"). In addition to ephemeral reaches of streams that are otherwise perennial or intermittent, the "ephemeral stream exception" also applies to watercourses that are now entirely ephemeral due to post-development human impacts. *See, e.g.*, Minute Entry, Case No. W1-103, at 2 (Jan. 22, 2002) (Ballinger, J.) (directing ADWR to develop a method for including in its subflow delineation "streams that

---

[4] *See* Order for Production of a Subflow Zone Delineation Technical Report for the Verde River Watershed, Case No. W1-106 (Nov. 27, 2017) ("Verde Subflow Order").

historically contained perennial or intermittent flows, but which now are ephemeral due to development and other human initiated actions"); 2005 Subflow Order, at 23 (stating that the ephemeral stream exception applies to "streams that would legitimately be categorized as ephemeral, but only because of the effect of surface water diversions or groundwater pumping" and explaining that "[t]he exception requires, in effect, that these streams be considered in a predevelopment state.").

B. The Lower Portions of the Big Chino and Partridge Creek, and all of Williamson Valley Wash, Were Intermittent Under Predevelopment Conditions.

Jon Ford analyzed a portion of the drainage basin of the Big Chino, including its major tributaries, to determine whether ADWR erred by not delineating a subflow zone in that area. *See* Ex. 1, ¶ 19. Mr. Ford determined that a wide body of historical evidence demonstrates that the Big Chino below Partridge Creek, the lowermost portion of Partridge Creek, and all of Willamson Valley Wash were intermittent, rather than ephemeral, under predevelopment conditions.[5] *See id.*, ¶¶ 31-41. For purposes of this analysis, Mr. Ford applied the definitions of "perennial," "intermittent," and "ephemeral" streams that have been adopted by the Adjudication Court. *See id.*, ¶¶ 21-21(c) (citing Goodfarb Order). Mr. Ford also determined that there is SFHA associated with the Big Chino and Partridge Creek and that a saturated zone historically has existed along the Big Chino at and below Partridge Creek that connected to the headwaters of the Verde River. *See id.*, ¶ 23.

Mr. Ford determined that settlement in the area of the Big Chino first began to occur around 1870. Ex. 1, ¶ 26. The settlers initially relied upon direct diversions, and by about 1890 they had supplemented those direct diversions by shallow wells. *Id.* Around 1930,

---

[5] Subsequent references herein to the Big Chino and Partridge Creek refer to the portion of the Big Chino below Partridge Creek and the lowermost portion of Partridge Creek, respectively. SRP does not dispute that the portion of the Big Chino above Partridge Creek and the upper portion of Partridge Creek were likely ephemeral under predevelopment conditions.

larger and deeper wells became widespread in the area, and by about 1950 those wells caused the water table to decline in both the basin fill and the floodplain alluvium. *Id.*, ¶ 27. This eventually transformed the Big Chino from an intermittent stream to an ephemeral stream. *Id.* Though not reflective of true predevelopment conditions, evidence regarding conditions during the period between approximately 1870 and approximately 1950 nevertheless is useful for analyzing predevelopment conditions because the hydrologic alteration was less significant than during modern conditions.[6] *Id.*, ¶ 26. In addition, several relatively recent studies have retrospectively analyzed predevelopment hydrological conditions in the Big Chino area, and these studies also provide useful insight into predevelopment conditions.

As Mr. Ford describes in his affidavit, the relevant evidence demonstrates that the Big Chino, Partridge Creek, and all of Williamson Valley Wash were intermittent, and not ephemeral, under predevelopment conditions. That evidence includes (1) concentrations of archaeological sites along the Big Chino and Williamson Valley Wash (Ex. 1, ¶ 31); (2) historic newspaper articles that provide a contemporaneous account of the early development of the Big Chino Sub-basin during the period from approximately 1881 through 1912 (*id.*, ¶ 34); (3) homestead patents and notices of appropriation in the vicinity of the Big Chino and Partridge Creek (*id.*, ¶ 35); (4) Statements of Claimant and Statements of Claim that identify the Big Chino as the source of water supply (*id.*, ¶ 36); (5) an affidavit filed in litigation involving claimed water rights to the Big Chino in which the affiant describes streamflow conditions in the 1920s (*id.*, ¶ 37); (6) aerial photographs from 1940 that document, among other things, surface flow for the length of the Big Chino and Williamson Valley Wash and underground water discharging into these watercourses (*id.*, ¶ 38); (7) topographic maps prepared by the United States Geological Survey ("USGS") in 1892, 1905, 1923, 1947, and 1954 that identify the Big Chino and Williamson Valley Wash as intermittent by using the

[6] For purposes of evaluating predevelopment conditions, the Adjudication Court has directed that "ADWR should take a practical approach and adopt the earliest predevelopment timeframe for which accurate and reliable data is available." 2005 Subflow Order, at 21.

USGS mapping symbol for an intermittent stream (*id.*, ¶ 39); and (8) evidence that the Big Chino floodplain historically and currently is covered in blue gramma grass, which has been documented to have roots up to two meters deep (*id.*, ¶ 40). Based on these lines of evidence, Mr. Ford concluded that the Big Chino, Partridge Creek, and Williamson Valley Wash were intermittent under predevelopment conditions and that they have since become ephemeral due to pumping and diversions. *Id.*, ¶¶ 27, 41.

In addition to evaluating whether the Big Chino was historically intermittent, Mr. Ford also concluded that there is SFHA associated with the Big Chino, Partridge Creek, and Williamson Valley Wash. *See* Ex. 1, ¶ 23. Mr. Ford concluded that geological mapping that has already been performed demonstrates that, to the extent mapped to date, SFHA is present along the Big Chino and that SFHA would also exist beneath the additional reaches of the Big Chino that have not yet been mapped. *See id.*, ¶ 30. Vegetation patterns and photographic evidence of underground water discharging to the Big Chino further support this conclusion. *Id.*, ¶¶ 38, 40. His conclusion is also supported by the shallow underground water levels that historically existed, and continue to exist, along the Big Chino. *See id.*, ¶¶ 34, 40, 44, 48, 68. This evidence led Mr. Ford to conclude that a saturated zone historically existed along the Big Chino that connected to the headwaters of the Verde River. *Id.*, ¶ 23.

C. ADWR's Incorrect Conclusions Regarding the Big Chino Were Based on Flawed Work by Participants in the Adjudication with a Vested Interest in Ensuring that no Subflow Zone is Delineated for the Big Chino.

ADWR serves as "technical advisor to the trial court." *In re Gen. Adjudication of All Rts. to Use Water in Gila River Sys. & Source*, 175 Ariz. 382, 385 n.3 (1993). ADWR's duties in that advisory role are largely prescribed by statute. *See* A.R.S. § 45-256(A). Those statutory duties include "[i]dentify[ing] the hydrological boundaries of the river system and source," as it has attempted to do in the Tributaries Report. *Id.* § 45-256(A)(1). Reports issued by ADWR, such as the Tributaries Report, "will be made after an investigation of facts

and will contain factual analysis." *United States v. Superior Court*, 144 Ariz. 265, 280 (1985).

SRP submitted a public records request to ADWR, requesting the documents upon which ADWR relied to determine that the Big Chino was ephemeral under predevelopment conditions. The documents produced by ADWR in response to that request, in addition to the Tributaries Report itself, indicate that ADWR did not conduct a thorough and objective factual investigation and analysis of the Big Chino under predevelopment conditions. Instead, ADWR determined that the Big Chino did not qualify for the ephemeral stream exception based entirely on investigations conducted by Mark Holmes, LLC and by Mark Nicholls of Haley & Aldrich, Inc. *See, e.g.*, Tributaries Report, § 3.2. The report by Mark Holmes LLC ("Holmes Report") was prepared at the direction of the City of Prescott and the Town of Chino Valley, and the report by Mark Nicholls ("Nicholls Report") was prepared on behalf of the Town of Prescott Valley. *See* Ex. 1, ¶ 43. Prescott, Prescott Valley, and Chino Valley are all parties to this case with vested interests in avoiding a subflow zone delineation for the Big Chino.

In addition to being prepared at the direction of interested parties, the methodology, analysis, and conclusions presented in the Holmes and Nicholls Reports are unreliable. ADWR cites the Holmes Report for the proposition that "[p]redevelopment hydrologic observations of Big Chino Wash indicate that the stream has always been ephemeral." Tributaries Report, at 12 (citing Holmes Report, at 5). However, the various sources upon which the Holmes Report relied for its conclusion are either irrelevant, misinterpreted, or demonstrate that the Big Chino was intermittent under predevelopment conditions. *See* Ex. 1, ¶ 54. Mr. Holmes stated that the purpose of his analysis was to determine "whether the Big Chino Wash was ephemeral or perennial in nature," but this determination (even if made correctly) failed to answer the relevant question, which is whether the Big Chino was perennial **or** intermittent under predevelopment conditions. *Id.*, ¶ 55. Mr. Holmes' failure to analyze whether the Big Chino historically was an intermittent stream appears to stem largely

from his consistent misinterpretation of USGS mapping. *Id.*, ¶ 56. Specifically, Mr. Holmes repeatedly claimed that historic USGS maps identified the Big Chino as ephemeral when it actually mapped the Big Chino using its standard symbol for an intermittent stream. *See id.*

The second overarching error in Mr. Holmes' analysis is that he failed to analyze the Big Chino under predevelopment conditions and instead focused primarily upon recent studies that are not indicative of predevelopment conditions. *See* Ex. 1, ¶ 57. The relatively few older documents that Mr. Holmes cited do not support his conclusions, and he ignored wide bodies of historic evidence that establish that the Big Chino was intermittent under predevelopment conditions. *See id.*, ¶ 60; Section I(B), *supra.* Mr. Holmes also ignored that the recent studies that analyzed predevelopment conditions of the Big Chino actually concluded that it was historically intermittent, rather than supporting Mr. Holmes' conclusion that it was ephemeral. *See id.*, ¶ 59. In sum, Mr. Holmes did not have any basis for his conclusion that the Big Chino has always been an ephemeral stream, and ADWR's reliance upon the Holmes Report for its Big Chino analysis was not in compliance with the legal requirements for applying the ephemeral stream exception.

ADWR also erred by relying upon the Nicholls Report for the proposition that "Big Chino Wash does not currently, nor historically, have any indication of a hydraulic connection between its groundwater and surface water systems." Tributaries Report, at 12-13 & n.40. There is a historic hydraulic connection between the Big Chino's underground and surface water systems. *See* Ex. 1, ¶¶ 23, 30, 34, 38, 40, 44, 48, 68. ADWR's conclusion as to whether there is "currently" a hydraulic connection is irrelevant. *See* 2005 Subflow Order, at 23; Mainstem MSJ Order, at 7-9. The ephemeral stream "exception requires, in effect, that these streams be considered in a predevelopment state. That is, if one assumes away the effects of diversions and pumping, would the subject streams share the characteristics of an adjacent intermittent or perennial stream? If the answer is 'yes,' they can be included within the subflow zone due to their predevelopment attributes." 2005 Subflow Order, at 23. An evaluation of current hydrological conditions does not "assume[ ] away the effects of

diversions and pumping," but instead incorporates those effects into ADWR's analysis of whether the ephemeral stream exception applies.

The primary focus of the Nicholls Report was an improper analysis of rather recent hydraulic conditions rather than the historic hydraulic connection between surface water and underground water along the Big Chino. *See* Ex. 1, ¶¶ 64-65, 68-69. But even this recent evidence does not support Mr. Nicholls' conclusions. For example, Mr. Nicholls relied upon recent underground water elevation data from 36 wells near the Big Chino, but half of those wells have a shallow depth to water of between 8.1 and 23 feet below land surface. Those wells represent the SFHA or basin fill wells that are hydraulically connected to the SFHA, and water elevation data supports the current existence of a hydraulic connection between the Big Chino's underground and surface water systems. *See id.*, ¶ 68. Thus, the Nicholls Report demonstrated that, in spite of the surface and groundwater development that has occurred since 1870, there remains a hydraulic connection between surface water and underground water along the Big Chino. *Id.* The relatively few pieces of evidence that Mr. Nicholls cited from the predevelopment or early development periods also did not support his conclusion regarding the alleged lack of a hydraulic connection. *See id.*, ¶¶ 66-67.

ADWR's decision to rely solely upon the flawed and irrelevant analysis presented in the Holmes and Nicholls Reports is especially puzzling when viewed alongside the language of the Tributaries Report, which identifies a methodology that ADWR purports to apply when evaluating whether to delineate a subflow zone for a particular watercourse. *See* Tributaries Report, at 12 Fig. 6; Ex. 1, ¶ 42. Under that methodology, ADWR will consider a stream to be something other than ephemeral if (1) the stream is identified as non-ephemeral on one of three specific maps; (2) there is riparian vegetation; and (3) Holocene alluvium is present based upon aerial photography. *See* Ex. 1, ¶¶ 42(a)-(c). The Big Chino is mapped as non-ephemeral on two of the three maps upon which ADWR purports to rely, there is no evidence to suggest that the Big Chino lacks riparian vegetation, and geologic mapping of the Big Chino documents the existence of Holocene alluvium adjacent to the Big Chino, as well as

Partridge Creek and Williamson Valley Wash. *See id.*, ¶¶ 43-49. Therefore, even though the methodology described in the Tributaries Report improperly omits multiple lines of relevant evidence (*see* Section I(B), *supra*), ADWR would have concluded that the Big Chino and the lower portion of Partridge Creek were intermittent under predevelopment conditions if it had applied its own methodology rather than improperly relying upon the Holmes and Nicholls Reports. *See id.*, ¶ 50.

II. Post-Development Reservoirs.

The Tributaries Report covers four surface reservoirs (Watson Lake, Sullivan Lake, Granite Basin Lake, and Willow Creek Reservoir) that did not exist under predevelopment conditions. ADWR recognized that these lakes "are manmade water features" but nevertheless included them in the subflow delineation. Tributaries Report, at 23. ADWR's proposed delineation for these reservoirs generally tracks the modern water line of these manmade lakes rather than the boundaries of the SFHA that existed prior to their construction. *See* Ex. 1, ¶¶ 71-72.

The Adjudication Court has previously addressed the time period that should be used to delineate the lateral extent of the subflow zone. *See* 2005 Subflow Order, at 18-24. In particular, "a proper analysis of subflow require[s] consideration of stream conditions 'prior to widespread diversion and depletion of Arizona's stream flows.'" *Id.* at 20-21 (quoting Minute Entry, Case No. W1-103, at 2 (Jan. 22, 2002) (Ballinger, J.)). The focus on "predevelopment conditions" exists to ensure that ADWR "outline[s] the sublow zone without having to be concerned that human generated water diversions or depletions might artificially divest jurisdiction over water right claims this Court is charged with adjudicating." *Id.* at 24. Consistent with this prior ruling from the Adjudication Court, Special Master Harris directed ADWR to "determine the subflow zone based on conditions existing in the earliest year or during 'a range of years immediately prior to regular, discernable diversion or depletion of stream flows resulting from human activity' for which reliably and reasonably complete data is available." *See* Verde Subflow Order, at 4 (quoting 2005 Subflow Order).

Further, Special Master Zendri recently confirmed that the predevelopment conditions analysis requires that the subflow delineation for stream reaches that now include post-development reservoirs or impoundments must be based on stream conditions prior to the construction of those impoundments. *See* Mainstem MSJ Order, at 7-9.

ADWR attempts to avoid the predevelopment conditions requirement by contending that it is required to use predevelopment conditions only for determining whether a watercourse has a subflow zone and not for actually delineating the subflow zone. Tributaries Report, at 23. However, as noted above, the Adjudication Court, Special Master Harris, and Special Master Zendri have made clear that the predevelopment conditions standard requires the entire process for determining the subflow zone to be based on predevelopment conditions.[7] Thus, ADWR erred as a matter of law by delineating the subflow zone around these manmade reservoirs based on modern conditions.

III. Upstream Limit on Tributaries Delineation

"The subflow zone is defined as the saturated floodplain Holocene alluvium." *Gila IV*, 198 Ariz. at 344. The subflow zone must be "adjacent to and beneath a perennial or intermittent stream." *Id.* at 338 (cleaned up). In numerous instances in the Tributaries Report, ADWR failed to delineate a proposed subflow zone for the full intermittent or perennial extent of a stream and instead stopped its delineation even though additional intermittent or perennial reaches continued farther upstream. *See* Ex. 1, ¶¶ 73-77. For several of these streams, the National Hydrography Dataset or USGS topographic maps confirm that perennial or intermittent reaches continue further upstream. *Id.*, ¶ 77. The point at which

[7] SRP explained in detail ADWR's obligation to use predevelopment conditions for the entirety of its subflow analysis in two prior filings in this proceeding, both of which SRP incorporates herein by reference. *See* Motion for Summary Judgment re Objections to Subflow Zone Delineation Report for Verde Mainstem and Sycamore Canyon Subwatershed, Case No. W1-106 (June 15, 2023); Reply to ADWR's Comments on Motion for Summary Judgment re Objections to Subflow Zone Delineation Report for Verde Mainstem and Sycamore Canyon Subwatershed, W1-106 (August 7, 2023). Further, this precise issue was conclusively decided in the Mainstem MSJ Order.

ADWR opted not to continue farther upstream appears to have been driven by the location where the Arizona Geological Survey ("AZGS") stopped its mapping. However, in addition to not corresponding to the full perennial or intermittent extent of the stream, the AZGS stopping points for these reaches generally occur at locations that show no apparent changes in geomorphologic controls or vegetation. *Id.*, ¶¶ 75-76. Thus, there is no evidence or reason to believe that the SFHA ends at ADWR's proposed cutoff point rather than continuing into the intermittent or perennial reaches of these watercourses that are situated farther upstream. *Id.*, ¶ 75. By failing to include the full extent of intermittent and perennial tributaries, ADWR has failed to fully delineate the SFHA for the tributaries in the Verde Watershed. This does not comply with *Gila IV*.

IV. Conclusion

For the foregoing reasons, SRP requests that the Court direct ADWR to file a supplement to its Tributaries Report. In that supplement, ADWR should be required to (1) delineate a subflow zone for the portions of the Big Chino and Partridge Creek discussed above (*see* Note 5, *supra*) and all of Williamson Valley Wash; (2) delineate the subflow zone for locations now inundated by post-development reservoirs based on the extent of SFHA under predevelopment conditions; and (3) obtain and provide geological mapping for the full extent of intermittent or perennial tributaries and delineate a subflow zone for the full reaches of those tributaries.

DATED this 27th day of October, 2023.

SALMON, LEWIS & WELDON, P.L.C.

By: _____

John B. Weldon, Jr.
Mark A. McGinnis
Michael K. Foy
Katrina L. Wilkinson
2850 East Camelback Road, Suite 200
Phoenix, Arizona 85016
Attorneys for SRP

ORIGINAL of the foregoing hand-delivered this 27th day of October, 2023 to:

Clerk of the Superior Court
Maricopa County
Attn: Water Case
601 West Jackson Street
Phoenix, AZ 85003

AND COPY hand-delivered this 27th day of October, 2023 to:

Sherri L. Zendri
Special Master
Central Court Building, Ste. 3A
201 West Jefferson
Phoenix, AZ 85003-2205

Arizona Department of Water Resources
Legal Division
Kimberly R. Parks
Karen J. Nielsen
1110 W. Washington Street, Suite 310
Phoenix, AZ 85007

AND COPY mailed to all persons appearing on the Court-approved mailing list in Case No. W1-106, dated October 19, 2023.

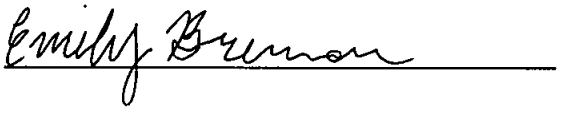


EXHIBIT 1

AFFIDAVIT OF JON R. FORD

STATE OF COLORADO)
) ss
County of Denver)

JON R. FORD, being first duly sworn, upon his oath deposes and says:

Professional Background

1. I am a Project Manager in the Denver, Colorado firm of LRE Water, LLC ("LRE"). I have been with LRE since 1986. Prior to that time, I worked in various roles as a geologist and geophysicist in Colorado from 1972 to 1986. Among other things, I served as President and Senior Coal and Petroleum Geologist for Resource Technology Corporation in Denver from 1981 to 1985. I was Vice President and Senior Ground Water Geologist for Willard Owens Associates, Inc., in Wheat Ridge, Colorado from 1972 to 1977.

2. I received bachelor's degrees in Geological Engineering and Geophysical Engineering from the Colorado School of Mines in 1972. In addition, I have over 50 years of experience working in the geology and groundwater hydrology field in Colorado, Arizona, and other parts of the West.

3. I am a Registered Professional Engineer in Colorado and a Registered Professional Geological Engineer in Arizona.

4. I am a member of various professional groups, including the Arizona Hydrological Society, the Colorado Ground Water Association, and the American Council of Engineering Companies of Colorado.

Purpose of Affidavit

5. I am familiar with issues relating to groundwater and subflow in Arizona, in part as a result of my several decades of prior work for the Salt River Valley Water Users' Association and the Salt River Project Agricultural Improvement and Power District (collectively, "SRP") in the Gila River Adjudication and on other matters.

6. I have reviewed a copy of the April 28, 2023 technical report submitted to the Maricopa County Superior Court in the Gila River Adjudication ("Adjudication Court") by the Arizona Department of Water Resources ("ADWR") relating to the determination of the lateral extent of the subflow zone along the tributaries of the Verde River in the Verde River Watershed. That report is entitled "Subflow Zone Delineation Report for the Remainder of the Verde River Watershed" ("Tributaries Report"). My review of the Tributaries Report included all tables, figures, and appendices. The purpose of this affidavit is to present a general summary of my review of the Tributaries Report. This affidavit is not intended to necessarily present all of my specific technical opinions regarding the Tributaries Report, nor is it intended to address opinions or critiques that other parties might submit regarding the Tributaries Report.

7. The statements contained in this Affidavit are made based upon my own personal knowledge and upon work performed by me or by the LRE staff under my direct supervision.

Subflow Experience

8. I served as a consulting groundwater hydrology expert on behalf of SRP in the 1987 proceedings before Judge Goodfarb regarding the interaction of groundwater and surface water, which resulted in the Arizona Supreme Court's opinion in *In re General Adjudication of All Rights to Use Water in the Gila River System and Source*, 175 Ariz. 382, 857 P.2d 1236 (1993) ("*Gila II*").

9. I also served as a consulting groundwater hydrology expert for SRP in the subsequent proceedings before Judge Goodfarb regarding "subflow," which resulted in the Arizona Supreme Court's opinion in *In re the General Adjudication of All Rights to Use Water in the Gila River System and Source*, 198 Ariz. 330, 9 P.3d 1060 (2000) ("*Gila IV*").

10. I served as SRP's groundwater hydrology expert in proceedings regarding the Subflow Zone Delineation Report that ADWR prepared in 2009 for the San Pedro Watershed, including providing testimony at the evidentiary hearing that was held in August and September of 2015 regarding ADWR's proposed delineation.

11. I served as SRP's groundwater hydrology expert in proceedings regarding the cone of depression test to be applied for purposes of determining the extent of the Adjudication Court's jurisdiction, including providing testimony at the evidentiary hearing that was held in March 2018 for purposes of determining the appropriate cone of depression test.

12. I also am serving as SRP's groundwater hydrology expert in the ongoing proceedings to develop a "depletion test" to determine the extent to which wells located outside of the subflow zone are withdrawing appropriable water.

13. I served as a testifying groundwater hydrology expert for SRP in the evidentiary hearing held before Special Master Harris in February 2021 with respect to the delineation of the vertical boundaries of the subflow zone in the San Pedro Watershed for purposes of depletion modeling.

14. I reviewed and submitted an affidavit regarding a prior technical report prepared by ADWR in 2021 in which it proposed a subflow delineation for the mainstem of the Verde River.

15. Based on my work in these proceedings and my training and education, I have developed, in addition to my knowledge of groundwater and geology, an extensive knowledge of the technical aspects of the tests and methodologies that are used to delineate subflow zones on Arizona streams in a manner that complies with *Gila II*, *Gila IV*, and the orders issued by the Adjudication Court to implement those decisions.

Opinions re Tributaries Report

16. I am familiar with the orders that Special Master Harris has issued with respect to the delineation of the subflow zone in the Verde Watershed, including the November 27, 2017 "Order for Production of a Subflow Zone Delineation Technical Report for the Verde River Watershed"; the minute entry filed March 4, 2020; and the July 30, 2021 "Order Granting Request for Extension in Part and Denying Request in Part and Order Setting Schedule."

17. The focus of my review of the Tributaries Report was determining (1) whether ADWR employed a technically sound and reliable methodology for delineating

the subflow zone, and (2) whether ADWR accurately and reasonably applied its methodology.

18. I generally agree with ADWR's approach to delineating the subflow zone within the area covered by the Tributaries Report. As set forth below, I identified certain defects in ADWR's methodology and conclusions presented in the Tributaries Report. My opinion is that, in order for the Tributaries Report to be technically sound and defensible, the Tributaries Report must be updated to address these errors. Other than the errors described below, it is my professional opinion that ADWR has developed procedures to comply with *Gila II*, *Gila IV*, and the Adjudication Court's prior rulings with respect to the delineation of the subflow zone.

Failure to Delineate a Subflow Zone for the Big Chino, Lower Partridge Creek, and the Entirety of Williamson Valley Wash

Scope of my Analysis

19. I reviewed the Tributaries Report to determine whether ADWR failed to delineate a proposed subflow zone along watercourses that should properly include a subflow zone. As part of this process, I analyzed a portion of the drainage basin of the Big Chino Wash ("Big Chino"), including its major tributaries, to determine whether ADWR erred by not delineating a subflow zone in that area. The study area that I focused upon generally includes the Big Chino and its tributaries at and downstream of the confluence of the Big Chino and Partridge Creek ("Study Area"). The Study Area includes Williamson Valley Wash. I am not offering an opinion in this matter on whether ADWR should have delineated a proposed subflow zone for the Big Chino upstream of Partridge Creek. My opinion also is limited to the lowermost portion of Partridge Creek.

20. It is my understanding that the Adjudication Court has determined that "the subflow zone may only be comprised of areas related to perennial and intermittent streams" and that "[n]o ephemeral streams may be included." Order re Report of the Special Master on ADWR's Subflow Technical Report, San Pedro River Watershed, at 23 (Sept. 28, 2005) ("2005 Subflow Order"). I further understand that a determination of whether a stream is ephemeral, for these purposes, requires "consideration of stream

conditions prior to widespread diversion and depletion of Arizona's stream flows." *Id.* at 20-21. Therefore, a focus of my analysis was determining whether the Big Chino and its tributaries were ephemeral under conditions prior to significant development that affected streamflows (i.e., under predevelopment conditions). As set forth below, my conclusion is that the Big Chino and the lowermost portion of Partridge Creek were intermittent, rather than ephemeral, under predevelopment conditions.

21. For purposes of my analysis, I applied the definitions of perennial, intermittent, and ephemeral streams that were adopted by the Adjudication Court in 1994. *See* Order (June 30, 1994) ("Goodfarb Order"). Those definitions are as follows:

a. "Perennial streams discharge water continuously through the year. Their source of supply is normally comprised of both direct runoff from precipitation events or snow melt, and baseflow derived from the discharge of groundwater into the stream."

b. "Intermittent streams discharge water for long periods of time, but seasonally. For example, an intermittent stream may flow all winter, every winter, but never flow continuously during the summer. During seasons when base flow is maintained, groundwater is contributing to the stream. During seasons of discontinuous streamflow, natural and cultural losses may be greater than the contribution from groundwater, resulting in a losing stream. Or, the amount of groundwater discharge itself may have decreased due to natural or cultural uses."

c. "Ephemeral streams discharge water only in response to precipitation events or snowmelt, and do not have a baseflow component at any time of the year; they flow out sporadically. The groundwater system and surface water system do not establish a hydraulic connection in these systems."

22. Under these definitions, the difference between an intermittent stream and an ephemeral stream is whether or not groundwater contributes to flow. In other words, a stream is intermittent if during periods of flow, there is a hydraulic connection between

the surface flows and the shallow water table beneath the floodplain. If the water table in the floodplain is higher than the elevation of the stream water surface, it follows that underground water is flowing toward and discharging to the stream and contributing baseflow to the stream and the two systems are in hydraulic connection. A stream under these circumstances is, by definition, intermittent or perennial rather than ephemeral.

23. I also evaluated whether there is saturated floodplain Holocene alluvium ("SFHA") associated with the Big Chino and Partridge Creek and concluded that SFHA was present under predevelopment conditions and, for the most part, continues to be present along these watercourses. I also concluded that a saturated zone historically has existed along the Big Chino that connected to the headwaters of the Verde River and that such saturated zone has continued up into the lowermost portion of Partridge Creek. Such a saturated zone also is historically present along the entirety of Williamson Valley Wash.

Overview of the Study Area

24. The most detailed publication of the hydrogeology of the Big Chino Sub-basin is United States Geological Survey ("USGS") Open-File Report 2004-1411, Chapters A-G (Wirt, et al.). The oldest rocks in the area are metamorphic rocks of Precambrian age (1+ billion years old). Because of their low permeability, groundwater generally passes through them slowly. The area also includes Paleozoic (540 to 250 million years old) limestone and dolomite rock units. These rocks have very low permeability similar to the Precambrian rocks, except where they have been uplifted and extensively fractured by the uplift. The area also includes Tertiary (70 to 3 million years old) basin fill that is composed of sand, silt, clay, and gravel that is semi-consolidated. The basin fill accumulated in areas that were down dropped and filled with sediment eroded from the mountains as they were uplifted during the Laramide Orogeny (mountain building episode 80 to 70 million years ago). The basin fill is moderately permeable and allows groundwater to easily pass through it. In places, the basin fill is 2000 or more feet thick. It is the major aquifer in the region.

25. The area also includes floodplain Holocene (12,500 years old or less) alluvium. The floodplain alluvium is composed of very permeable unconsolidated sand, silt, clay, and gravel. It is the most permeable unit in the area. Where the streams underlain by this unit were either perennial or intermittent during predevelopment time, its lateral limits define the lateral limits of a subflow zone (i.e., the SFHA).

26. Settlers first entered the Study Area in the 1870s. For purposes of my analysis, I consider the predevelopment period to be the period prior to the 1870s. I also evaluated the period between the settlement of the Study Area and the development of high capacity well pumps (1870-1930). Starting in the 1870s, the settlers began diverting the surface water of the Big Chino for livestock watering and growing feed for the livestock. By 1890, shallow wells into the floodplain alluvium had been installed. Though not reflective of true predevelopment conditions, evidence regarding conditions during this period nevertheless is useful for analyzing predevelopment conditions because the hydrologic alteration was less significant during that period than under modern conditions.

27. I consider the modern period to be after approximately 1930. This period is less useful for ascertaining predevelopment conditions because it occurred after the advent of large-scale pumping that radically altered predevelopment hydrology. Once deep well pumps were available in the 1930s, irrigation using water produced from primarily the basin fill aquifer of the Big Chino Sub-basin began. From approximately 1950 to the present, surface water diversions and withdrawals of water from wells penetrating the basin fill increasingly intercepted and consumed water that had previously discharged from the basin. These diversions and withdrawals caused the water table to decline in both the basin fill and the floodplain alluvium so that over the years, the Big Chino became an ephemeral stream. A similar situation occurred on lower Walnut Creek, Little Chino Creek, and portions of Williamson Valley Wash.

28. In addition to impacts directly caused by humans, streamflows in the Study Area also have been impacted by precipitation patterns.

29. Historically, some of the underground water discharged into the floodplain Holocene alluvial aquifer of the Big Chino flowed southeast until it ultimately discharged as surface water at the confluence of the Big Chino and Little Chino Creek (original headwaters of the Verde River). Another portion remained in the basin fill aquifer and flowed southeast until it also discharged as surface water to the Verde River also at the confluence of the Big Chino and Little Chino Creek. The remaining portion of the underground water flowing in the basin fill and Paleozoic aquifers flowed southeast to the vicinity of Paulden. From there, the water in the basin fill flowed into the highly fractured Paleozoic aquifer and eventually flowed to the Verde River, where it discharged as the Upper Verde Springs.

30. Geologic maps of the Paulden (Ferguson, et al., 2012), Chino Valley North (Gotee, et al., 2010), and Wineglass Ranch (Pearthree and Ferguson, 2012) quadrangles as well as Quarternary Alluvium mapping (DeWitt et al, 2008) demonstrate that, to the extent mapped to date, SFHA is present along the Big Chino. If the Arizona Geological Survey ("AZGS") were to map the remainder of the floodplain alluvium of the Big Chino, it is almost certain that the remaining sections of the Big Chino would have SFHA associated with them.

Evidence re Historic Conditions

31. There is a high concentration of archaeological sites along the Big Chino and Williamson Valley Wash, which suggests that sufficient water was available from these two streams to provide irrigation water for growing crops to meet the needs of the Native groups who occupied these areas from about 900 to 1300 AD. This is a most reliable indicator that the Big Chino and Williamson Valley Wash were intermittent streams during predevelopment conditions.

32. The only documentation of the predevelopment period is an 1856 account of the Whipple Expedition (1853-54), which was sent west to identify a railway route near the thirty-fifth parallel. The expedition crossed the Big Chino on January 16, 1854, near the mouth of Patridge Creek. The Big Chino was observed to be dry on that occasion, but the crossing occurred at the far northern end of the Study Area during the

winter when it was cold and snowy. Consequently, the fact that the Big Chino was dry on that one day in the winter is to be expected for a predevelopment intermittent stream. Given the hydrology of the Study Area, it is improbable that the intermittent Big Chino would be flowing during any particular day that time of year. In my opinion, the Whipple expedition observation that the Big Chino was dry is not useful in determining whether the flow in the Big Chino was intermittent or ephemeral under predevelopment conditions.

33. The United States General Land Office ("GLO") contracted surveyors who surveyed the township boundaries of most of the townships along the Big Chino during the fall and late winter of 1871 and 1872. The surveying of the interior sections of the townships was completed five years later in the late winter and spring of 1877. The interior section surveys included both the surveying and the erection of section corner monuments. The surveyors' notes do not mention observing any live springs or streams. A review of the GLO surveys along the Big Chino indicates that the symbols used to identify streams varied from map-to-map and are inconsistent. It also shows that the township line surveys and the section line surveys were done in the fall, winter, and early spring at various times between 1871 and 1877, when there was a low probability that flow from an intermittent watercourse would be encountered during any particular day. Further, various inconsistencies appear in the notes, including, most notably, that the summary "general description" does not mention observing crossing the predevelopment perennial Little Chino Creek or the perennial Verde River at the confluence of the Big Chino and Little Chino Wash. From this analysis, it is my opinion that the township survey maps are unreliable for the purposes of characterizing whether or not the Big Chino was intermittent under predevelopment conditions.

34. I reviewed historic newspaper articles that provide a contemporaneous account of the early development of the Big Chino Sub-basin during the period from approximately 1881 through 1912. These articles detail the installation of direct diversions from the Big Chino and the installation of shallow and rudimentary wells to take advantage of the very shallow underground water table in the vicinity of the Big

Chino, where water was generally only a few feet below land surface. The common theme of these articles is that there was enough surface water available to encourage settlers to homestead the area and sufficient shallow underground water was available in the floodplain alluvium of the Big Chino to warrant installation of shallow wells. It was prudent for the settlers to seek to satisfy their water needs by installing shallow wells to supplement whatever intermittent surface water supplies were available. In my opinion, the depth to water reported in these articles reliably demonstrates that the water table of the predevelopment floodplain alluvium was at or above the channel bottom of the Big Chino and therefore was providing baseflow to the Big Chino. The articles also are a reliable indicator that the Big Chino was an intermittent stream under predevelopment conditions. The reliability of the articles is underscored by the fact that they are purposeful observations that occur over time at multiple locations.

35. I reviewed homestead patents and notices of appropriation in the vicinity of the Big Chino and Partridge Creek. These documents reflect that early settlers were actively developing the available surface water for irrigation in the Study Area through diversion dams, storage reservoirs, and canals between 1887 and 1929. The settlers were irrigating pastures and growing crops between 1875 and 1938. The settlers likely would not have invested the labor and money or taken the risk of failure over this lengthy period if they thought that the Big Chino and Partridge Creek were ephemeral streams. The homestead patents and notices of appropriation are a most reliable data source in that they are purposeful long-term observations at multiple locations by multiple observers. They demonstrate that the Big Chino and Partridge Creek were intermittent streams under predevelopment conditions.

36. There are numerous Statements of Claimant or Statements of Claim within the Study Area that identify the Big Chino as the source of water supply. These water rights filings consist of claims for surface water diversions from the Big Chino, a spring producing from within the lateral limits of the approximate Big Chino SFHA, wells producing from aquifers within the lateral limits of the approximate Big Chino SFHA, and wells producing from the basin fill aquifer outside of the lateral limits of the

approximate Big Chino SFHA. The Statements of Claimant and Statements of Claim include claimed priority dates during the early development period of the Big Chino, and therefore provide a reliable indication that the Big Chino was intermittent during this period.

37. One of the Statements of Claimant that I reviewed (39-27026) includes an affidavit that Barbara Fritsche filed in litigation involving claimed water rights to the Big Chino in which she describes streamflow conditions in the Big Chino during the period between 1920 and 1926. Ms. Fritsche's account confirms that the Big Chino flowed year-round during this period. Because her year-round flow observation is consistent with climate data and is both purposeful and long-term, that sworn affidavit is a reliable indicator that the Big Chino was an intermittent stream under predevelopment conditions.

38. The earliest known set of aerial photographs that provide coverage of the Big Chino and Williamson Valley Wash were taken in October 1940. These photographs show (1) there is surface flow for the length of the Big Chino and Williamson Valley Washes; (2) there are multiple places where underground water is discharging to the Big Chino, which means that the SFHA was fully saturated and that the water table was essentially at the ground surface; (3) a clearly demarcated area of vegetation (native grasses) appears adjacent to the stream channel of both the Big Chino and Williamson Valley Wash, which indicates the approximate lateral extent of the SFHA. In my opinion, these aerial photographs show that both the Big Chino and Williamson Valley Wash were still intermittent streams with underground baseflow in 1940.

39. Numerous topographic maps prepared by the USGS cover the Study Area. These maps are a valuable tool to assess the predevelopment flow conditions of the Big Chino. The earliest USGS map was prepared in 1892. That map identifies the lower portion of the Big Chino as perennial. In addition to the 1892 USGS map, I reviewed more recent USGS maps, including maps from 1905, 1923, 1947, and 1954. These maps further confirm that the Big Chino and Williamson Valley Wash historically were intermittent by using the USGS mapping symbol for an intermittent stream (a blue dash and three dots). USGS has consistently used that symbol since approximately 1885 to

denote intermittent streams. USGS has repeatedly published instructions identifying that as the standard symbol for intermittent streams, including in 1903, 1918, and 1928. Moreover, the USGS instructions reflect that correctly identifying stream type along with other types of hydrologic and geologic information was a clear and purposeful function of the topographers. In contrast to intermittent streams, ephemeral streams typically have been omitted from USGS mapping. Considerable skill and time (months) were required to make the early topographic maps, such as the 1892 map that includes the Big Chino.

40. Riparian vegetation is one of the indicators of both a floodplain and a shallow water table beneath it. My understanding is that the Goodfarb Order notes that "riparian plants directly draw off and diminish the surface flow of adjacent streams" and explains that a "riparian area" means "a geographically delineated area with distinct resource values, that is characterized by deep-rooted plant species that depend on having roots in the water table or its capillary zone and that occurs within or adjacent to a natural perennial or intermittent stream channel or within or adjacent to a lake, pond or marsh bed maintained primarily by natural water sources." Goodfarb Order, at 54. Therefore, my opinion is that the presence of riparian vegetation is a useful tool to aid in identifying the lateral limits of the subflow zone of both perennial and intermittent streams. Some cottonwoods exist along the Big Chino, indicating the presence of a shallow water table beneath the Big Chino floodplain. The absence of additional riparian trees does not indicate an historically ephemeral stream or the absence of a subflow zone because, in many cases, riparian vegetation is absent due to post-development diversions and depletions. Moreover, some intermittent or perennial streams did not have woody riparian vegetation even under predevelopment conditions (e.g., the Hereford reach of the San Pedro River). Further, the floodplain (where it has not been disturbed by farming) is covered with dense native blue gramma grass, which has been documented to have roots up to two meters deep. A 1932 photograph taken adjacent to the Big Chino floodplain shows dense native grasses covering the floodplain. The floodplain is a few feet lower in elevation than the adjacent terrace area that does not include dense native grasses. I also reviewed aerial photographs and satellite imagery that indicate that vegetation is present

in the immediate vicinity of the Big Chino to a greater extent than it is in the surrounding area.

41. Based on the lines of evidence described above, it is my opinion that, within the Study Area, the Big Chino, Partridge Creek, and Williamson Valley Wash were intermittent under predevelopment conditions, and that each of these watercourses historically had a hydraulic connection between their groundwater and surface water systems. However, diversions of surface water (1870 to present) and withdrawals from wells completed in all three of the aquifers (approximately 1930 to present) lowered the elevation of the water table in the SFHA so that it is now below the bottom of the Big Chino and caused the Big Chino to change from an intermittent stream under predevelopment conditions to an ephemeral stream today.

ADWR's Methodologies for Evaluating Predevelopment Conditions

42. The Tributaries Report does not provide a detailed description of the methodology ADWR used to classify streams as perennial, intermittent, or ephemeral. Based on language that appears on page 12 of the Tributaries Report and the information presented in Figure 6 of the Tributaries Report, it appears that ADWR required each of the following criteria in order for it to consider a stream to be something other than ephemeral:

a. A perennial stream reach on at least one of the following published maps: (1) Freethey and Anderson, Plate 1, 1986 "Predevelopment Hydrologic Conditions of the Alluvial Basin of Arizona and Adjacent parts of California and New Mexico"; (2) Brown and Carmony, 1981 "Drainage Map of Arizona Showing Perennial Streams and Some Important Wetlands"; and (3) ADWR Water Atlas 5, "Figure 5.5.5 Verde River basin Perennial /Intermittent streams and Major Springs."

b. Riparian vegetation along the streams.

c. The presence of Holocene alluvium identifiable from aerial photography.

43. ADWR determined that, within the Study Area, Little Chino Creek, portions of Williamson Valley Wash (Tributaries Report Maps 35 and 38), Mint Wash (Tributaries Report Maps 38 and 39) and portions of Upper Walnut Creek (Tributaries Report Map 40) met the above criteria and have a subflow zone. Apparently, ADWR concluded that all of the Big Chino, all of Partridge Creek, and portions of Williamson Valley Wash do not have subflow zone because they are excluded from the Tributaries Report Maps 1-42. Regarding the Big Chino specifically, ADWR determined that it "did not meet the evaluation criteria." Tributaries Report, at 12. This vague statement appears to indicate that ADWR concluded that the Big Chino Wash was not a perennial or intermittent stream under predevelopment conditions. However, ADWR did not follow its own stream classification methodology as listed above for the Big Chino. Instead, ADWR relied upon (1) a November 2021 report by Mark Holmes LLC entitled "Historical Documents and Evidence Supporting the Predevelopment State of the Big Chino Wash, Big Chino Subbasin, Upper Verde River, Gila River Watershed, Yavapai County, Arizona" ("Holmes Report"); and (2) a May 2022 report by Mark Nicholls, R.G. of Haley & Aldrich, Inc., entitled "Transmittal of Data and Information Describing Hydrologic Connections in Big Chino Wash, Yavapai and Coconino Counties, Arizona ("Nicholls Report"). The Holmes Report was prepared for the City of Prescott and the Town of Chino Valley, and the Nicholls Report was prepared for the Town of Prescott Valley. As set forth below, neither of these reports has technical merit or supports ADWR's conclusions.

44. With respect to the three maps upon which ADWR purports to rely, Plate 1 from Freethey and Anderson (1986) shows that groundwater flows from the upland areas around the Big Chino Sub-basin towards the Big Chino and then down the valley parallel to the Big Chino. This indicates a shallow water table beneath the Big Chino that discharges to the Verde River. Plate 1 also shows a perennial stream reach along Williamson Valley Wash that is different from that shown on the ADWR map (2023). It also shows intermittent reaches for the Big Chino, Partridge Creek, Mint Wash, Granite Creek, and Walnut Creek. Thus, Plate 1 does not support ADWR's apparent

determination that the Big Chino and Partridge Creek were ephemeral under predevelopment conditions and also does not support the limited extent of ADWR's delineation for Williamson Valley Wash. In my opinion, Plate 1 is a reliable source of information regarding the predevelopment conditions in the area it depicts, and that plate supports the conclusion that some or all reaches of these watercourses were at least intermittent under predevelopment conditions.

45. With respect to Brown and Carmony (1981), the map uses a specific symbol for ephemeral streams. None of the streams in the Big Chino Sub-basin are shown as ephemeral on that map. The Brown and Carmony map shows intermittent streams for the Big Chino, Partridge Creek, Williamson Valley Wash, Mint Wash, Pine Creek, Walnut Creek, and other streams. Therefore, the Brown and Carmony map does not support ADWR's apparent determination that the Big Chino and Partridge Creek were ephemeral under predevelopment conditions.

46. With respect to the ADWR Water Atlas 5, the relevant figure (Figure 5.5.5) does not purport to show predevelopment perennial or intermittent streams and instead only shows current stream flow conditions. Because this map shows current conditions and not predevelopment conditions, it is not useful for evaluating predevelopment conditions.

47. In sum, of the three maps that ADWR purported to consider, two are directly contrary to ADWR's conclusions, and one is irrelevant.

48. Although not specifically discussed in the Tributaries Report, ADWR apparently used the modern-day presence of riparian vegetation as an indicator of the presence of a shallow water table in the SFHA under both present and predevelopment conditions. As explained above, the floodplain adjacent to the Big Chino includes some cottonwoods even to this day. Native grasses are present in the Study Area and were present under predevelopment conditions. Those grasses are more abundant in the area immediately adjacent to the Big Chino. Therefore, to the extent that ADWR determined that the Big Chino lacked riparian vegetation under either predevelopment or current conditions, it appears that ADWR lacked sufficient evidence to support that conclusion.

49. Had ADWR completed aerial photograph analysis, considered the geologic mapping of the floodplain Holocene alluvium completed by the AZGS to date (DGM-80, 90 and 91) within the Study Area and the geologic mapping by Dewitt, et al. (2008) of the USGS that demonstrate the presence of floodplain Holocene alluvium associated with the Big Chino, Partridge Creek, and Williamson Valley Wash, ADWR would have concluded that a subflow zone is present along the Big Chino, a portion of Partridge Creek, and the entirety of Williamson Valley Wash.

50. In my opinion, the analysis that ADWR purports to apply is overly narrow and omits multiple lines of relevant evidence. As described in detail above, that evidence conclusively establishes that the Big Chino and Partridge Creek were intermittent under predevelopment conditions. Despite these flaws in ADWR's methodology, had ADWR followed its own methodology rather than relying upon Holmes (2021) and Nicholls (2022), it would have concluded that both the Big Chino and the lower portion of Partridge Creek were intermittent streams under predevelopment conditions and that they both do in fact have a subflow zone. Under the ADWR criteria, Williamson Valley Wash was an intermittent stream to a greater extent than mapped by ADWR under predevelopment conditions. Consequently, its subflow zone has not yet been fully mapped. Additionally, both Walnut Creek and Pine Creek should be further evaluated for the presence of subflow zones.

51. I reviewed an undated draft ADWR document entitled "Why Big Chino Wash was not selected for mapping by AZGS." In that document, ADWR states that "a stream reach must meet at least two of the following four criteria" in order to be mapped by AZGS for potential delineation of a subflow zone. Those four criteria, along with my opinions on the application of those criteria, are as follows:

a. "*The reach appears on at least one of four maps of current and past intermittent and perennial streams (TNC 2010, Turner & List 2007, Brown et al. 1981, Freethey & Anderson 1986).*" As discussed above, the Big Chino appears as an intermittent stream on both Freethey and Anderson, Plate 1 (1986) and Brown and Carmony (1981). Therefore, Criterion 1 is met.

b. "*An alluvial channel is present as interpreted from aerial imagery or topographic map evidence of channel and terrace morphology.*" According to the mapping performed by the AZGS (DGM-80, 90 and 91), the Big Chino has an alluvial channel as well as channel and terrace morphology. Therefore, Criterion 2 is met.

c. "*Riparian vegetation is present as interpreted from aerial imagery or Normalized Difference Vegetation Index (NDVI) derived from remotely sensed data.*" The Big Chino has some cottonwood. NDVI and aerial imagery reflects that native grasses are more abundant in the area immediately adjacent to the stream channel where the water table is comparatively shallow. Therefore, ADWR lacked an adequate basis for concluding that Criterion 3 is not met.

d. "*Evidence of historic water use exists, such as water right claims, or diversion structures observed on aerial imagery.*" As described above, there is abundant evidence of historic water use from the Big Chino in the form of land patents, notices of appropriation, statements of claimant, statements of claim, and water storage/diversion structures. Therefore, Criterion 4 is met.

52. Even assuming that ADWR's methodology is otherwise valid—which, as explained above, it is not because it omits relevant evidence—all four of the ADWR criteria are actually met. Therefore, ADWR erred by excluding the Big Chino from the areas it selected for mapping by AZGS and erred by not delineating a subflow zone for the Big Chino, lower Partridge Creek, and the additional portions of Williamson Valley Wash that were intermittent under predevelopment conditions. ADWR also might have erred by omitting Walnut Creek and Pine Creek from the AZGS analysis.

ADWR's Reliance Upon Holmes Report

53. In the Tributaries Report, ADWR cites the Holmes Report for the proposition that "[p]redevelopment hydrologic observations of Big Chino Wash indicate that the stream has always been ephemeral." Tributaries Report, at 12 (citing Holmes Report, at 5). ADWR further opines that the Holmes Report "provides an overwhelming amount of predevelopment documents that describe the Big Chino Wash as an ephemeral

wash with water flowing in it only during heavy precipitation events." *Id.* at 12 n.39 (internal quotation marks omitted).

54. It is my professional opinion that each of the supposedly "overwhelming amount of predevelopment documents" that are discussed in the Holmes Report are either irrelevant, misinterpreted, or supportive of my conclusion that the Big Chino was intermittent under predevelopment conditions.

55. Mr. Holmes states that the purpose of his analysis was to determine "whether the Big Chino Wash was ephemeral or perennial in nature." The false dichotomy that Holmes presents between ephemeral and perennial streams ignores that there is a third type of stream (intermittent) that is neither perennial nor ephemeral and for which a subflow zone exists. Thus, the conclusion that the Big Chino was not "perennial" fails to answer the relevant question, which is whether the Big Chino was perennial **or** intermittent under predevelopment conditions.

56. Mr. Holmes' failure to analyze whether the Big Chino historically was an intermittent stream appears to stem largely from his consistent misinterpretation of USGS mapping. Mr. Holmes repeatedly misinterprets the USGS symbols for intermittent and ephemeral streams. USGS uses a blue dash and three-dot symbol on its maps to indicate intermittent flow conditions and not ephemeral conditions, as Mr. Holmes appears to assume. Although Mr. Holmes incorrectly used the topographic maps and reached an erroneous conclusion, they are a valuable tool to assess the predevelopment flow conditions of the Big Chino. The 1892 Prescott topographic map shows perennial flow in the lower portion of the Big Chino. As documented by Laurie Wirt in USGS Open-File Report 2004-1411-A through G, the Big Chino is shown in the 1947 USGS topographic map as a solid blue line indicating a perennial reach existed for a portion of the Big Chino at the time of the publication of the map and that the water table at the time was at the Big Chino stream elevation. Other reaches of the Big Chino are shown as intermittent in the 1947 map. A 1954 Army Mapping Service regional scale map shows an intermittent Big Chino. Mr. Holmes discusses his analysis of USGS topographic maps on pages 13 through 30, which includes Figures 7 through 21. Throughout this

discussion, he erroneously refers to streams that are mapped as intermittent as being ephemeral. Further, the maps he evaluated spanned the period from 1905 through 2012, with only the map published in 1905 being within the pre-1930 early development period on the Big Chino. The earliest of the other maps he reviewed is 1947. Mr. Holmes discusses the 1981 Brown and Carmony map, which as discussed above, distinguishes between intermittent and ephemeral streams and identifies the Big Chino as intermittent. He makes the same error again calling the Big Chino ephemeral when it is mapped as intermittent.

57. In addition to the failure to analyze whether the Big Chino was historically intermittent, a second fundamental problem with the analysis presented in the Holmes Report is its failure to analyze predevelopment conditions on the Big Chino. Most of the materials cited in the Holmes Report relate to streamflows in the Big Chino during the most recent decades and are not indicative of predevelopment conditions. Examples of these materials that address only modern streamflow conditions, if at all, include: ADWR Water Atlas (2005); Riley (2011); Neary, et al. (2012); Pawlowski (2012); Neary (2012); Pawlowski (2013); Kennedy, et al. (2019); Macy (2019); Beisner (2020); Pearthree (1993); Pearthree (1996); Ford (2007); Wirt and Hjalmarson (2000); Wirt, et al. (2002); and Blasch, et al. (2005). Shaw (2006) concludes that the Big Chino was dry at Partridge Creek at the time of the winter crossing by Whipple in 1854 but, as explained above, that does not provide evidence that the Big Chino was not historically intermittent.

58. Mr. Holmes also improperly relies on a supposed lack of riparian vegetation along the Big Chino based on aerial photography from 1969. He ignores that the lack of riparian vegetation was caused by post-development pumping that caused marked declines in underground water levels in the area depicted. He also ignores that, even today, cottonwoods and grasses are present in portions of the Big Chino floodplain.

59. Mr. Holmes states that there have been numerous recent investigations that indicate that the Big Chino has <u>always</u> been ephemeral. That is false. More recent investigations of the Big Chino's predevelopment conditions have identified the Big Chino as historically intermittent. Specifically, the Big Chino appears as an intermittent

stream on both Freethey and Anderson, Plate 1 (1986) and Brown and Carmony (1981), both of which analyzed historic Big Chino stream conditions. Likewise, Krieger (1965) states that, at the time of her report, the Big Chino was an intermittent stream and not an ephemeral stream. Ewing, et al. (1994) also states that the Big Chino was an intermittent stream at the time of that study. Mr. Holmes cites email correspondence with Don Pool for the proposition that modeling of predevelopment conditions showed "no perennial stream observed within the Big Chino Wash." Since my staff and I cannot presently access that private update, and based on the large body of predevelopment materials I have reviewed, I must conclude that it is unreliable until such time as I and my staff can complete a review of the updated model. Further, even if accurate, the statement attributed to Pool is consistent with my opinion that the Big Chino was historically intermittent.

60. Holmes cites relatively few documents that address conditions in the Big Chino older than the last approximately fifty years. The documents he does cite do not support his conclusions. Mr. Holmes purports to analyze conditions during the latter half of the 19th Century, but his conclusions regarding this period stem almost entirely from the Whipple Report, which (as noted above) is based on a single observation and is not indicative of historically intermittent flows. Mr. Holmes neglects other relevant evidence from this period, such as the 1892 Prescott topographic map that shows perennial flow in the lower portion of the Big Chino. Mr. Holmes cites the supposed existence of earthen dams constructed on the Big Chino during the first decade of the 20th Century as support for the proposition that the Big Chino was not historically perennial. Mr. Holmes overstates the number of these dams and the certainty of the evidence regarding their construction dates and, further, fails to demonstrate that the existence of these dams would be inconsistent with perennial flows, much less intermittent flows. Mr. Holmes also attempts to support his conclusions with accounts of construction of Sullivan Dam in the 1930s, but those accounts do not show predevelopment conditions because (1) there had been 60 years of water development for agricultural purposes that diverted intermittent and perennial flow upstream in the Big Chino Sub-basin utilizing many

dams; and (2) Upper Verde Springs, and not the Sullivan Lake area, is the discharge point for most of the underground water discharging from the much bigger Big Chino Sub-basin. Mr. Holmes also cites the fact that Prescott did not identify the Big Chino as a potential source during a water supply study that occurred in or around 1946 as evidence that the Big Chino did not have perennial flow in 1946. It is doubtful that stream conditions in 1946 were indicative of predevelopment conditions and, even if they were, Mr. Holmes' interpretation of the study is consistent with the existence of intermittent stream conditions in 1946.

61. In sum, Mr. Holmes does not have any basis for his conclusion that the Big Chino has always been an ephemeral stream. Actually, the Big Chino was an intermittent stream under predevelopment conditions. It currently is an ephemeral stream as a consequence of the development of surface and groundwater in the Big Chino Sub-basin. Therefore, ADWR's reliance upon the Holmes Report to conclude that the Big Chino was ephemeral under predevelopment conditions was misplaced.

ADWR's Reliance Upon the Nicholls Report

62. Aside from the Holmes Report, the only other document that ADWR cites to justify its decision not to delineate a subflow zone for the Big Chino is the Nicholls Report. ADWR cites the Nicholls Report for the proposition that "Big Chino Wash does not currently, nor historically, have any indication of a hydraulic connection between its groundwater and surface water systems." Tributaries Report, at 12-13 & n.40.

63. Though it is a legal issue on which I am not opining in this matter, my understanding is that ADWR's decision to address whether the Big Chino "currently" has a hydraulic connection between surface water and groundwater is in error. The issue is whether the so-called "ephemeral stream exception" applies in the case of the Big Chino, and "[t]he exception requires, in effect, that these streams be considered in a predevelopment state. That is, if one assumes away the effects of diversions and pumping, would the subject streams share the characteristics of an adjacent intermittent or perennial stream? If the answer is 'yes,' they can be included within the subflow zone due to their predevelopment attributes." 2005 Subflow Order, at 23. An evaluation of

current hydrological conditions does not "assume[ ] away the effects of diversions and pumping," but instead incorrectly incorporates those effects into ADWR's analysis of whether the ephemeral stream exception applies.

64. As to whether the Big Chino "historically" has "any indication of a hydraulic connection between its groundwater and surface water systems," the Nicholls Report provides only minimal relevant data because it focuses primarily on relatively recent conditions rather than predevelopment conditions.

65. Mr. Nicholls analyzed the flow conditions in the Big Chino by dividing them into three time periods: Predevelopment, early development, and current. It is unclear what years he included in each time period, but it appears that the predevelopment period is prior to 1855, the early development period is 1914 to 1940, and the current/modern period is 1953 to present.

66. For the predevelopment period, the Nicholls Report relies exclusively on a summary of the 1854 Whipple expedition, which (as explained above) documents only a single instance in which the Big Chino was not flowing in January of that particular year. The lack of streamflows during a single day in January does not indicate the absence of a hydraulic connection between the Big Chino's groundwater and surface water systems. The Big Chino has a floodplain that is typically at least .25 miles wide. The floodplain is underlain by unconsolidated permeable sediments that absorb the water discharging from the Big Chino tributaries.

67. For the "early development period," the Nicholls Report relies upon the purported lack of any mention of irrigation systems in the Big Chino area in a 1914 Irrigation Survey by Hancock and a 1940 Irrigation Survey by Hayden. However, the purpose of both the Hayden and Hancock surveys was to evaluate if and how more water could be available to the Salt River Project. Thus, they were focused on irrigation systems that diverted water from perennial streams into irrigation systems that included a diversion canal that delivered water to multiple farms under the canal. They were less interested in individual canals that diverted water to a single farm. As described in detail above, extensive agricultural and irrigation development occurred in the Big Chino Sub-

basin during the era that I have classified as the early development period (1870-1930). Mr. Nicholls also includes four undated photographs of the construction of the Sullivan Lake Dam in the late 1930s that seem to show an absence of flow in the Verde River at the dam site during construction. These photographs contradict two photographs from Holmes (2021, Figures 5 and 6) and two photographs from Wirt (2004, Figure A7) that show flow in the Verde River at the Sullivan Lake dam site. The most probable explanations for the absence of flow in the photographs Mr. Nicholls relies upon are (1) the Nicholls photographs are at the incorrect angle to show the flow; (2) the flow was being routed outside of the limits of the photograph; or (3) at times, during construction a temporary upstream earthen dam was used to prevent flow at the dam while construction proceeded. Mr. Nicholls includes three aerial photographs from October 7 and 31, 1940 that cover portions of the Big Chino, but Mr. Nicholls does not offer any conclusions regarding these three photographs.

68. For the "current" period, Mr. Nicholls relies upon Groundwater Site Inventory ("GWSI") information for the 36 wells that he states are within 500 feet of the Big Chino. In addition to my general criticism that Mr. Nicholls is relying upon modern data to perform what should be a predevelopment conditions analysis, I have several specific criticisms about Mr. Nicholls' approach. First, he does not provide the coordinates for the channel locations on the Big Chino that he used to calculate the elevation difference between each well and the Big Chino. Second, he does not explain his methodology for determining which points on the Big Chino he used to apply the 500-foot criteria. Third, using the data in Mr. Nicholls Table 1, there are 18 wells that have a minimum depth to water of between 8.1 and 23 feet below land surface, and those wells with shallow depths to water represent the SFHA or basin fill wells that are hydraulically connected to the SFHA. The other wells likely represent parts of the basin fill aquifer that are poorly connected to the SFHA. Thus, Mr. Nicholls' data supports, rather than contradicts, the current existence of a hydraulic connection between the groundwater and surface water systems along the Big Chino. The first measurement of the depth to water for the 18 SFHA wells ranges from 1953 to 2004, which is decades

after widespread development occurred in the Big Chino Sub-basin. Thus, the Nicholls Report demonstrates that, in spite of the surface and groundwater development that has occurred since 1870, there remains a hydraulic connection between surface water and groundwater along the Big Chino.

69. Mr. Nicholls also relies upon the purported lack of discharging springs in the vicinity of the Big Chino to claim that there is no hydraulic connection between surface water and groundwater. Springs are not the only indicator of groundwater-supported surface systems. A more reliable indicator is a potentiometric surface map like Freethey and Anderson's Plate 1 (1986), which (as noted above) shows that groundwater flows down-gradient from the upland recharge areas to the Big Chino. Therefore, the discussion regarding springs is not useful or reliable for assessing the predevelopment flow conditions of the Big Chino and does not even show whether there currently is a hydraulic connection between surface water and groundwater along the Big Chino.

70. In sum, Mr. Nicholls does not provide an opinion regarding the predevelopment flow conditions of the Big Chino, nor does his analysis provide a basis for any conclusion other than (1) the Big Chino was an intermittent stream under predevelopment conditions, (2) a hydraulic connection historically existed between surface water and groundwater in the vicinity of the Big Chino, and (3) that connection continues to exist. Therefore, ADWR's reliance upon the Nicholls Report to evaluate the current or historic hydraulic connection between the Big Chino's groundwater and surface water systems was erroneous.

Inclusion of Post-Development Reservoirs

71. ADWR delineated the subflow zone in the vicinity of manmade reservoirs differently by including the full extent of the reservoirs within the subflow zone, based upon its interpretation of the following statement: "The Court intended for predevelopment conditions to be considered for classifying perennial, intermittent, and ephemeral streams, but did not indicate such conditions should influence the mapping of FHA [floodplain Holocene alluvium] nor HCAF [historic composite active floodplain]." Tributaries Report, at 23. While this is a legal issue, it is my understanding that SRP has

taken the position that ADWR should have delineated the subflow zone based upon predevelopment conditions.

72. Regarding Sullivan Lake, the ADWR delineation of the subflow zone is equivalent to what it would have been under predevelopment conditions. The extent of SFHA that ADWR mapped does not exceed the extent of the SFHA under predevelopment conditions. For Watson Lake, Willow Creek Reservoir, and Granite Basin Lake, ADWR's proposed delineation based upon current lake levels conflicts with the extent of SFHA that existed under predevelopment conditions.

Insufficiently Delineated Subflow Zone on Several Tributaries

73. My colleague at LRE, Dave Colvin, PG, PMP, analyzed whether ADWR's proposed delineation included the full extent of the subflow zone for each of the tributaries in which it proposed a subflow zone. Mr. Colvin is a hydrogeologist with over 20 years of relevant experience, including extensive groundwater modeling experience. He is a licensed Professional Geologist in Arizona, Texas, Idaho, Wyoming, and Kansas. I reviewed Mr. Colvin's work and concur in his analysis and conclusions.

74. In the Tributaries Report, ADWR summarizes the legal rulings related to the definition of subflow and describes the delineation of the subflow zone adjacent to perennial and intermittent streams as follows:

> In general, the subflow zone is delineated by combining the Historic Composite Active Floodplain ("HCAF") with the FHA boundary, which includes setbacks as directed by the Court. The FHA boundary is delineated based on the geologic mapping provided by AZGS. The HCAF is created by mapping the extent of active floodplains over several decades and compositing the layers together in the Geographic Information System ("GIS") mapping program, ArcGIS. Setbacks are applied to the FHA before it is then composited with the HCAF boundary to create the final subflow zone.

Tributaries Report, at 10. ADWR further explained that it used the following three-step process to delineate the boundary of the SFHA:

Step 1: Identify the FHA boundary where FHA is deposited directly against pre-Holocene bounding topography.

Step 2: Identify the FHA boundary where tributary erosion and sediment deposition is significant.

Step 3: Identify the FHA boundary where river erosion and sediment deposition are the predominant geomorphologic processes.

Tributaries Report, at 17-18.

75. Errors in the subflow delineation presented in the Tributaries Report occur where ADWR's proposed subflow zone delineation is terminated at the end point of geologic mapping performed by AZGS without regard to whether the cutoff point for that mapping represents the upstream end of the perennial or intermittent portion of the watercourse or the end of the SFHA. In most cases, ADWR's reason for termination is listed as Step 3, which is where "river erosion and sediment deposition are the predominant geomorphologic processes." Tributaries Report, at 18. This occurs in ADWR's mapping of numerous tributary creeks, including Camp Creek, Dry Beaver Creek, Ellison Creek, Granite Creek, Lime Creek, Little Chino Wash, Pine Creek, Red Creek, Red Tank Draw, Spring Creek, Sycamore Wash, Walker Creek, Walnut Creek, Weber Creek, Willow Valley, Williamson Valley Wash, West Fork Oak Creek, and Wet Bottom Creek. Aerial photography and AZGS's mapping show no apparent changes in geomorphologic controls or vegetation in the areas near the cutoff points. ADWR appears to have terminated the subflow delineation at those points strictly because that is where the AZGS geologic mapping stopped. This does not follow the prescribed process for subflow zone delineation. If ADWR's Step 3 is the rationale for upstream termination of subflow zone mapping in these watercourses, the geologic maps must be extended a distance further upstream sufficient to demonstrate that the termination of the subflow zone is coincident with the termination of the SFHA.

76. Documents and communication records indicate that AZGS could not field map the full extent of some tributary valleys due to difficult travel and safety concerns.

AZGS indicated that, in such instances, "[t]hese streams were mapped remotely using a combination of aerial photo interpretation, high-resolution topographic data, and field observations from nearby analogous streams." It is unclear where AZGS had to rely on desktop mapping in locations where it had planned to conduct field mapping, or where subflow zone mapping was terminated because of access issues. Areas affected by this include Willow Valley, Wet Bottom Creek, Clover Creek, and Deadman Creek. The subflow zone mapping of Clover Creek and Deadman Creek is acceptable and demonstrates that accessibility challenges in the field need not prevent an appropriate delineation.

77. For some of the tributaries, the subflow zone delineation presented in the Tributaries Report was terminated because the sources upon which ADWR relied did not show perennial or intermittent streams mapped further upstream. In some cases, the National Hydrography Dataset and/or USGS topographic maps indicate that perennial or intermittent streams continue further upstream. These are industry standard stream mapping references and should be included in subflow mapping considerations. These sources track current stream flows rather than predevelopment stream conditions. However, current creek flow patterns are almost universally drier than predevelopment conditions in Arizona, absent artificial water augmentation, which is not present on any of these streams. Therefore, the presence of current intermittent or perennial flows provides strong evidence that flows also were intermittent or perennial under predevelopment conditions. For those predevelopment perennial and intermittent tributaries that have since been impacted by water supply development, they are likely to have transitioned towards less regular flows. Subflow mapping issues related to stream flow characterization exist for Alder Creek, Apache Creek, Camp Creek, Ellison Creek, Houston Creek, Lime Creek, Little Chino Wash, Pine Creek, Pumphouse Wash, Red Creek, Red Tank Draw, Spring Creek, Sycamore Wash, Tangle Creek, Walnut Creek, Weber Creek, Willow Valley, and West Fork Oak Creek.

JON R. FORD

SUBSCRIBED AND SWORN TO before me by Jon R. Ford this 24th day of October, 2023.

Notary Public

My Commission Expires:

2024-07-29

BUNNY VICTORIA BEERS
Notary Public
State of Colorado
Notary ID # 20164028823
My Commission Expires 07-29-2024

MONTGOMERY & INTERPRETER, PLC
Susan B. Montgomery, AZ Bar No. 020595
Robyn L. Interpreter, AZ Bar No. 020864
3301 E. Thunderbird Rd.
Phoenix, AZ 85032
Phone: (480) 513-6825
Fax: (480) 513-6948
smontgomery@milawaz.com
rinterpreter@milawaz.com
Attorneys for the Yavapai-Apache Nation

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

IN RE THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	No. W-1 (Salt) No. W-2 (Verde) No. W-3 (Upper Gila) No. W-4 (San Pedro) Contested Case W1-106 **NOTICE OF FILING OBJECTIONS TO THE ARIZONA DEPARTMENT OF WATER RESOURCES' SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** (Referred to Special Master Sherri Zendri)

CONTESTED CASE NAME:	*In re Subflow Technical Report, Verde River Watershed*
DESCRIPTIVE SUMMARY:	The Yavapai-Apache Nation provides notice of filing their objections to the Arizona Department of Water Resources' Subflow Delineation Report for the Remainder of the Verde River Watershed
STATEMENTS OF CLAIMANT:	Yavapai-Apache Nation No. 39-50059, United States No. 39-54025 for the Yavapai-Apache Nation

NUMBER OF PAGES: 11 pages (including Attachments)

DATE OF FILING: October 27, 2023

The Yavapai-Apache Nation hereby provides notice that on October 27, 2023, they served on all parties on the court-approved mailing list their objections to the Arizona Department of Water Resources' Subflow Delineation Report for the Remainder of the Verde River Watershed filed April 28, 2023.

RESPECTFULLY SUBMITTED this 27th day of October, 2023.

MONTGOMERY & INTERPRETER, PLC

By: Robyn L. Interpreter for
Susan B. Montgomery, Esq.
Robyn L. Interpreter, Esq.
Attorneys for the Yavapai-Apache Nation

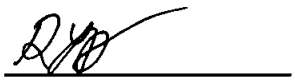
ORIGINAL AND TWO COPIES of the foregoing hand-delivered this 27th day of October, 2023, to:

Clerk of the Superior Court
Maricopa County Superior Court
Attn: Water Case
601 W. Jackson St.
Phoenix, AZ 85003

COPY of the foregoing hand-delivered this 27th day of October, 2023, to:

Sherri L. Zendri
Special Master
Central Court Building, Ste. 3A
201 W. Jefferson St.
Phoenix, AZ 85003-2205

AND COPIES of the foregoing sent via U.S. Mail this 27th day of October, 2023 to all persons appearing on the CAML for Case No. W1-106 dated October 11, 2023.



IN THE SUPERIOR COURT OF THE STATE OF ARIZONA
IN AND FOR THE COUNTY OF MARICOPA

IN THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	W-1 (Salt) W-2 (Verde) W-3 (Upper Gila) W-4 (San Pedro) (Consolidated) Case No. W1-106 **OBJECTION TO THE SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** Special Master Sherri Zendri

OBJECTOR

Name (printed) The Yavapai-Apache Nation

Mailing Address c/o Montgomery & Interpreter, PLC

3301 E. Thunderbird Rd. Phoenix, Arizona 85032

Telephone No. (480) 513-6825

Statement of Claimant No. 39- Numerous. See Attachment.

STATEMENT OF OBJECTION

Please reference the portion of the report to which you are objecting, explain the reasons for the objection below (or in a separate attachment), and complete the next page.

See Attachment.

CERTIFICATE OF SERVICE

On this 27th day of October, 2023, I certify that the original Objection and two copies were sent by first class mail, or hand delivered, to:

Via First Class Mail or Hand Delivery:
Clerk of the Maricopa Superior Court
Attn: Water Case
601 W. Jackson Street
Phoenix, Arizona 85003

If you mail your objection to the court, please allow additional time for mailing, so that your objection will be received by the court by **October 27, 2023**.

Signature of Objector or Representative

If this objection is being submitted by a Representative of the Objector, please provide the following information below or by attachment:

Name of Representative (printed) Susan B. Montgomery and Robyn L. Interpreter

Mailing Address of Representative c/o Montgomery & Interpreter, PLC

3301 E. Thunderbird Rd. Phoenix, Arizona 85032

Telephone Number of Representative (480) 513-6825

MONTGOMERY & INTERPRETER, PLC
Susan B. Montgomery, AZ Bar No. 020595
Robyn L. Interpreter, AZ Bar No. 020864
3301 E. Thunderbird Rd.
Phoenix, AZ 85032
Phone: (480) 513-6825
Fax: (480) 513-6948
smontgomery@milawaz.com
rinterpreter@milawaz.com
Attorneys for the Yavapai-Apache Nation

IN THE SUPERIOR COURT OF THE STATE OF ARIZONA

IN AND FOR THE COUNTY OF MARICOPA

IN RE THE GENERAL ADJUDICATION OF ALL RIGHTS TO USE WATER IN THE GILA RIVER SYSTEM AND SOURCE	No. W-1 (Salt) No. W-2 (Verde) No. W-3 (Upper Gila) No. W-4 (San Pedro) Contested Case W1-106 **YAVAPAI-APACHE NATION'S OBJECTIONS TO THE ARIZONA DEPARTMENT OF WATER RESOURCES' SUBFLOW ZONE DELINEATION REPORT FOR THE REMAINDER OF THE VERDE RIVER WATERSHED** (Referred to Special Master Sherri Zendri)

CONTESTED CASE NAME:	*In re Subflow Technical Report, Verde River Watershed*
DESCRIPTIVE SUMMARY:	The Yavapai-Apache Nation provides notice of filing their objections to the Arizona Department of Water Resources' Subflow Zone Delineation Report for the Remainder of the Verde River Watershed

STATEMENTS OF CLAIMANT:	Yavapai-Apache Nation No. 39-50059, United States No. 39-54025 for the Yavapai-Apache Nation
NUMBER OF PAGES:	6 pages
DATE OF FILING:	October 27, 2023

On April 28, 2023, the Arizona Department of Water Resources (ADWR) filed its Subflow Zone Delineation Report for the Remainder of the Verde River Watershed involving the tributaries to the Verde River (Tributaries Report) [1] pursuant to the Court's Order dated July 30, 2021.[2] The Yavapai-Apache Nation (Nation) submits its Objections to the Tributaries Report here.

INTRODUCTION

The Nation agrees with much of the findings and analysis set forth in ADWR's Tributaries Report. However, the Nation objects to the Tributaries Report on three important points, as described below. In support of the Nation's Objections, the Nation joins in and adopts here (as if set forth in full) the legal arguments and factual assertions set forth in Salt River Project's Objections to the Subflow Zone Delineation Report for the Remainder of the Verde Watershed, *In re Subflow Technical Report, Verde River Watershed*, dated October 27, 2023 (SRP Objections), including the affidavit of SRP's

[1] ADWR Technical Report: Subflow Zone Delineation For the Remainder of the Verde River Watershed, *In re the General Adjudication of the Gila River System and Source*, April 2023.

[2] Order Granting Request for Extension of Time in Part and Denying Request in Part and Order Setting Schedule, *In re Subflow Technical Report, Verde River Watershed,* July 30, 2021.

technical expert, Jon Ford, which is attached to SRP's Objections as Exhibit 1 (Ford Affidavit).

Objection 1

ADWR failed to delineate the subflow zone for Big Chino Wash and Partridge Creek, even though portions of Big Chino and Partridge Creek were at least intermittent under predevelopment conditions. See Ford Affidavit, ¶¶ 20, 23, 41, 50. In addition, ADWR included only a partial delineation of the subflow zone for Williamson Wash, when the facts available to ADWR demonstrate it was at least intermittent under predevelopment conditions. *See* Ford Affidavit, ¶¶ 31, 38-41, 43-45, 49. In sum, each of these watercourses include a subflow zone as a matter of law, even if they are ephemeral today. *See* Order Re: Report of the Special Master on the Arizona Department of Water Resources' Subflow Technical Report, San Pedro River Watershed and Motion for Approval of Report, Case No. W1-103 (Sept. 28, 2005).[3]

In addition, the Nation objects to ADWR's decision to rely on biased information in its Tributaries Report. Specifically, ADWR determined that the Big Chino did not qualify for the ephemeral stream exception based on investigations conducted by Mark Holmes, LLC and by Mark Nicholls of Haley & Aldrich, Inc. *See, e.g.,* Tributaries Report, § 3.2. The report by Mark Holmes LLC (Holmes Report) was prepared at the direction of the City of Prescott and the Town of Chino Valley, and the report by Mark Nicholls (Nicholls Report) was prepared on behalf of the Town of Prescott Valley. *See*

[3] *See also In re Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source*, 198 Ariz. 330 (2000) (*Gila IV*).

Ford Affidavit, ¶ 43. Prescott, Prescott Valley, and Chino Valley are all parties to this case with vested interests in avoiding a subflow zone delineation for the Big Chino and ADWR's strong reliance on these interested parties' experts is biased and should be rejected. Finally, as noted more fully in the SRP Objections, in addition to being prepared at the direction of interested parties, the methodology, analysis, and conclusions presented in the Holmes and Nicholls Reports are also unreliable. For the foregoing summarized reasons, the Nation objects to ADWR's failure to delineate a subflow zone for portions of the Big Chino Wash and Partridge Creek, and the entirety of Williamson Wash.

Objection 2

The watercourses analyzed in the ADWR's Tributary Report include four surface reservoirs (Watson Lake, Sullivan Lake, Granite Basin Lake, and Willow Creek Reservoir) which did not exist under pre-development conditions. This is contrary to the clear requirements for delineating the subflow zone and the direction of the Adjudication Court.[4] ADWR's decision to delineate the subflow zone for the area impacted by these reservoirs using post-development (not pre-development) conditions, as more fully detailed in SRP's Objections and the Ford Affidavit, should be rejected. The Nation accordingly objects to the subflow zone delineation of these surface reservoirs.

---

[4] *See* Order Re: Report of the Special Master on the Arizona Department of Water Resources' Subflow Technical Report, San Pedro River Watershed and Motion for Approval of Report, Case No. W1-103 at pages 18-24 (Sept. 28, 2005). *See also* Minute Entry, Case No. W1-103 at page 2 (Jan. 22, 2022). *See also* Order for Production of a Subflow Zone Delineation Technical Report for the Verde River Watershed, Case No. W1-106 at page 4 (Nov. 27, 2017).

Objection 3

For numerous tributaries evaluated in ADWR's Technical Report, it is unclear why ADWR terminated its subflow delineation at a specific point within each tributary. As more fully explained in the SRP Objections and Ford Affidavit, *see* Ford Affidavit, ¶¶ 73-77, ADWR's decision to terminate its subflow delineation appears to be arbitrary, since the termination points occur in areas with no apparent changes in geomorphology or vegetation. In several instances, ADWR's termination point also does not correspond with the actual start or stopping point of the perennial or intermittent reach of the tributary and there is no evidence that the saturated floodplain Holocene alluvium does not also continue farther upstream. Accordingly, the Nation therefore objects to ADWR's failure to fully delineate the saturated floodplain Holocene alluvium for all the tributaries in the Verde Watershed.

RESPECTFULLY SUBMITTED this 27th day of October, 2023.

MONTGOMERY & INTERPRETER, PLC

By: Robyn L. Interpreter for
Susan B. Montgomery, Esq.
Robyn L. Interpreter, Esq.
Attorneys for the Yavapai-Apache Nation

ORIGINAL AND TWO COPIES of the foregoing hand-delivered this 27th day of October, 2023, to:

Clerk of the Superior Court
Maricopa County Superior Court
Attn: Water Case
601 W. Jackson St.
Phoenix, AZ 85003

COPY of the foregoing hand-delivered this 27th day of October, 2023, to:

Sherri L. Zendri
Special Master
Central Court Building, Ste. 3A
201 W. Jefferson St.
Phoenix, AZ 85003-2205

AND COPIES of the foregoing sent via U.S. Mail this 27th day of October, 2023 to all persons appearing on the CAML for Case No. W1-106 dated October 11, 2023.