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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, W-4 (Consolidated)  
Contested Case No. WI-103

**ORDER DETERMINING THE  
VERTICAL BOUNDARY OF THE  
SUBFLOW ZONE**

CONTESTED CASE NAME: *In re San Pedro Subflow Technical Report.*  
HSR INVOLVED: San Pedro River Watershed Hydrographic Survey Report.  
DESCRIPTIVE SUMMARY: For purposes of developing a groundwater model to test whether the cone of depression developed by a well located outside the lateral boundaries of the subflow zone has intersected the subflow zone and is pumping subflow, the vertical boundary of the subflow zone is the lower physical boundary of the floodplain alluvium.  
NUMBER OF PAGES: 16  
DATE OF FILING: August 30, 2021

1 At issue in this case is the legal definition of the vertical extent of the subflow zone for  
2 purposes of the Subflow Depletion test. The issue arises from the Arizona Supreme Court's  
3 discussion about the Arizona Department of Water Resources's development of a test to apply to  
4 wells located outside the subflow zone to ascertain whether these wells are pumping subflow. *In*  
5 *re Gen. Adjudication of All Rights to Use Water in Gila River Sys. & Source*, 198 Ariz. 330, 9  
6 P.3d 1069 (2000) (*Gila IV*); *In re Gen. Adjudication of All Rights to Use Water in the Gila River*  
7 *Sys. & Source*, 175 Ariz. 382, 857 P.2d 1236 (1993) (*Gila II*).

8 The following parties participated in this proceeding: ASARCO LLC, Arizona Public  
9 Service Company, the Arizona State Land Department, BHP Copper, Inc., Freeport Minerals  
10 Corporation, Pueblo Del Sol Water Company, Salt River Project, and the Cities of Avondale,  
11 Mesa, Phoenix, Sierra Vista and Tempe (collectively, the "Stipulating Parties"), the Gila River  
12 Indian Community, the San Carlos Apache Tribe, and the United States. The Arizona Department  
13 of Water Resources also appeared and called witnesses to testify during a short evidentiary  
14 hearing on February 22-23, 2021. The parties called four witnesses, who are experts in the fields  
15 of hydrology and groundwater modeling. On June 30, 2021, the parties submitted post-trial  
16 briefs. In addition to briefing the substantive question that was the subject of the hearing, the  
17 post-trial briefs included arguments on other procedural and substantive arguments.  
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#### 21 **A. Standing**

22 In its post-trial brief, the United States contends that the Stipulating Parties lack standing  
23 to participate in a proceeding involving the development of the subflow depletion test to be  
24 applied to wells in the San Pedro Watershed. Under Arizona law, standing does not constitute a  
25 jurisdictional issue. *Sears v. Hull*, 192 Ariz. 65, 71, ¶ 24, 961 P.2d 1013, 1019 (1998) ("Because  
26 our state constitution does not contain a 'case or controversy' provision analogous to that of the  
27 federal constitution, we are not constitutionally constrained to decline jurisdiction based on lack  
28

1 of standing.”). Challenges to standing present the court with questions of judicial restraint and  
2 whether judicial economy and administration will be promoted by allowing the challenged party  
3 to appear. *Armory Park Neighborhood Ass'n v. Episcopal Cmty. Services in Arizona*, 148 Ariz. 1,  
4 6, 712 P.2d 914, 919 (1985); *Chambers v. United Farm Workers Org. Comm., AFL-CIO*, 25 Ariz.  
5 App. 104, 106, 541 P.2d 567, 569 (1975). Standing requires that each party possess a legitimate  
6 interest in the outcome of the litigation. *See also Monroe v. Arizona Acreage LLC*, 246 Ariz. 557,  
7 565, ¶ 31, 443 P.3d 954, 962 (App. 2019), review denied (Oct. 23, 2019).

9 Unlike many cases involving a limited number of parties and issues, this proceeding is part  
10 of a general stream adjudication under Title 45 of the Arizona Revised States that will determine  
11 the rights of all persons to use the waters of a river system and source. A.R.S. § 45–252(A).  
12 “River system and source” includes “all water appropriable under [A.R.S.] § 45–141 and all water  
13 subject to claims based upon federal law.” A.R.S. § 45–251(4). In a bifurcated legal system of  
14 water rights, the existence of a hydrological connection between surface water and groundwater  
15 expands the scope of a general adjudication to include a number of well owners. As a part of the  
16 adjudication process, water pumped from wells must be classified in whole or in part as  
17 appropriable under § 45–141 or excluded from the legal rules applying to prior appropriation.  
18 *Gila II*, 175 Ariz. at 386, 857 P.2d at 1240. The Court effectively directed ADWR to develop a  
19 test that will be used in that classification or, more specifically, in connection with an evidentiary  
20 presumption to determine whether water diverted by a well includes appropriable water.  
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23 This specific case was initiated to consider the tests developed by ADWR regarding well  
24 water and to resolve the objections made to those tests. It began in 2003 with a referral from the  
25 trial court to the special master to resolve objections to the Subflow Technical Report distributed  
26 by Arizona Department of Water Resources. Every Stipulating Party or its predecessor-in-  
27 interest, without exception, was a named party in 2003. *See Minute Entry at 2 (April 17, 2003)*.  
28

1 For almost two decades, all of the Stipulating Parties, along with the United States, have litigated  
2 the appropriate tests to determine the extent to which a well is pumping appropriable water. In its  
3 post-trial brief, the United States failed to demonstrate any fact or circumstance that would  
4 warrant a change to the *de facto* acceptance by the prior special master and courts over the  
5 preceding 18 years of the fact that the inclusion of the Stipulating Parties in this case furthers the  
6 goals of judicial economy and administration in the determination of tests necessary to classify the  
7 water pumped from wells.  
8

9 The United States questions whether the Stipulating Parties possess a legitimate interest in  
10 the outcome of the litigation by arguing that they “have not put at issue any claim tied to any well  
11 outside any subflow zone in Arizona.” U.S. Post-Trial Brief at 4 (June 30, 2021). This  
12 proceeding, like the earlier proceedings that culminated in the *Gila II* and *Gila IV* decisions, does  
13 not focus on a specific well. Cases involving claims for appropriable water from wells located  
14 outside the subflow zone will be tried in separate contested cases, many of which have yet to be  
15 initiated, e.g., *In re Forest Service – Coronado*, Contested Case No. W1-11-0539. Contested  
16 cases have been initiated where a well located outside the subflow zone provides a source of water  
17 and involves one or more Stipulating Parties. See, e.g., *In re Magma Copper – Mining*, Contested  
18 Case No. W1-11-2428; *In re Magma Copper – Irrigation*, Contested Case No. W1-11-2503; *In re*  
19 *Phelps Dodge Corporation I*, Contested Case No. W1-11-1207.  
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22 The United States also makes a broader argument that the Stipulating Parties have “not  
23 established – or even – alleged that DWR through its model or anyone else has harmed them”.  
24 U.S. Post-Trial Brief at 4. The *Gila II* Court explained the potential for harm from a defective test  
25 prepared by ADWR:  
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1 [U]se of a flawed test for identifying wells pumping subflow could cause  
2 significant injustice. Many surface owners unable to mount a challenge  
3 could effectively lose their right to pump percolating groundwater, simply  
4 because their wells were improperly presumed to be pumping  
5 appropriable subflow. Considering the time, expense, and importance of  
accurate hydrographic survey reports, and the complex lawsuits over their  
correctness, it would be a senseless waste to use a flawed presumption for  
identifying wells pumping subflow.

6 *Gila II*, 175 Ariz. at 388-389, 857 P.2d. at 1242-1243,  
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### 8 **B. Subflow Depletion Test**

9 The United States, Gila River Indian Community, and the San Carlos Apache Tribe  
10 contest the need for the development of the subflow depletion test. The United States argues that  
11 “well-based appropriation claims” should continue to be litigated based on pre-*Gila IV* case law  
12 without the use of any tests developed by ADWR. U.S. Post-Trial Brief at 10. This proceeding is  
13 limited to the single question identified in the Minute Entry and therefore, the issue raised by the  
14 United States will not be addressed here but will be addressed in a more appropriate forum.  
15

16 The Gila River Indian Community argues that the Subflow Depletion Test need not be  
17 developed before the issuance of a final decree. It argues that the subflow depletion test is  
18 unnecessary except for purposes of enforcing any final decree entered. The San Carlos Apache  
19 Tribe also argues that the subflow depletion test has limited use. It states that the subflow  
20 depletion test “would only be useful as a defense by well owners, upon whom the burden would  
21 rest, to prove that the cone of depression test has inaccurately determined that the cones of  
22 depression of their specific wells intersect the subflow zone, and their wells are therefore subject  
23 to the jurisdiction of the adjudication.” San Carlos Apache Tribe’s Post-Trial Brief Re: Vertical  
24 Extent of the Subflow Zone at 3 (June 30, 2021). These two parties have asserted their opposition  
25 to the development of a Subflow Depletion Test in their objections to the Report of the Special  
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1 Master on Methodology for Determination of Cone of Depression (November 14, 2018) and are  
2 not addressed here.

3 Arizona Department of Water Resources is building a groundwater model using a  
4 computer software program known as MODFLOW. This program is considered the industry  
5 standard for modelling groundwater flow. [Hudson 022221:161]. Arizona Department of Water  
6 Resources will incorporate field data into that model to simulate the groundwater system and the  
7 changes to that system from influences such as a well. The United States makes two procedural  
8 arguments directed at the groundwater modelling undertaken by ADWR for the Subflow  
9 Depletion Test. It argues that any consideration of the initial model prepared by ADWR is moot  
10 because ADWR has revised that model. It further contends that the revised model is not ripe for  
11 review because ADWR has not completed the model. This proceeding neither evaluates the  
12 initial model nor examines the new model. It does not address the design of the MODFLOW  
13 groundwater model currently under development for use as a subflow depletion test except as it  
14 pertains to the issue at hand, i.e., the depth of the subflow zone. The need for accurate test results  
15 to provide clear and convincing evidence in the adjudication of legal water rights requires ADWR  
16 to build a groundwater model consistent with the parameters set by the Court. This proceeding  
17 focuses on a single parameter that must be incorporated into any version of the groundwater  
18 model that will perform the evidentiary function envisioned by the *Gila IV* Court.  
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### 22 23 **C. Vertical Boundary of the Subflow Zone**

24 The determination of the vertical boundary of the subflow zone affects the results of a  
25 subflow depletion test. [Inwood 022221:64; Hudson 022221:151-153, 162-164, 170-177; Mock  
26 022321:14-17; Ford 022321:31-32; Cross 022321:55]. In general, the greater the depth of the  
27 aquifer that the groundwater model treats as part of the subflow zone, the more water that will be  
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1 attributed to the pumping of the well and, thus, the greater the amount of the depletion. [Hudson  
2 022221:152, 164]. Consequently, if the vertical boundary of the subflow zone is placed too deep  
3 in an aquifer, the risk exists that the amount of depletion will be overstated. [Hudson 022321:177;  
4 Ford 022321: 29, 31; Cross 022321: 55, 178]. If the vertical boundary is not set deep enough  
5 within the aquifer, using the same reasoning, the subflow depletion created by a well will be  
6 understated.  
7

8 Other than the United States, which described the vertical boundary of the subflow zone as  
9 a “hypothetical feature,” (United States Post Trial Brief at 9) none of the remaining parties dispute  
10 that the subflow zone, for purposes of the subflow depletion test, extends vertically through the  
11 entire depth of the floodplain Holocene alluvium and any Pleistocene alluvium. Stipulation ¶13 at  
12 3 (January 19, 2021). No party objected to the Stipulation and the agreement that the subflow  
13 zone for the San Pedro River watershed should be modelled by ADWR without attempting to  
14 differentiate between floodplain Holocene alluvium and floodplain Pleistocene alluvium is  
15 accepted. The Stipulating Parties argue that the subflow zone does not include basin fill deposits  
16 and does not extend to bedrock. Stipulation ¶¶ 8, 13 at 2, 3. It is their position that the vertical  
17 boundary of the subflow zone is the plane between the floodplain alluvium and the basin fill. In  
18 contrast, the Gila River Indian Community and the San Carlos Apache Tribe argue that the  
19 subflow zone extends much deeper and the bedrock underlying the aquifer serves as the lower  
20 boundary of the subflow zone.  
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23 The proceedings to define the subflow zone began in 1987 when eleven cities, including  
24 three of the Stipulating Parties, brought a motion in front of Judge Goodfarb concerning the  
25 treatment of wells in the General Adjudication. *Gila II*, 175 Ariz. at 385, 857 P.2d at 1239. Judge  
26 Goodfarb fashioned a test to be applied to wells based on an examination of surface and  
27 groundwater interaction. The decision, rejected by the Court, defined subflow by substituting the  
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1 impact of pumping on streamflow for a determination of the whether the pumped water was part  
2 of the streamflow. See *Gila IV*, 198 Ariz. at 336, ¶ 10, 9 P.3d at 1075; *Gila II*, 175 Ariz. at 392,  
3 857 P.2d at 1246.

4  
5 In this case, the San Carlos Apache Tribe argues that as water from the basin fill layer  
6 flows vertically into floodplain alluvium and the diversion of that water will, in time, deplete the  
7 river flow, the appropriate measure of subflow depletion should include the water pumped from  
8 basin fill. Although the diversion of water may not affect the streamflow if there is sufficient  
9 recharge and sources of water from other parts of the aquifer, the expert witnesses' testimony  
10 generally supports the hydrological explanation provided by the San Carlos Apache Tribe. [Cross  
11 022321:9-10; Hudson 022221:181, 189-190]. The law as set forth in *Gila II* does not, however,  
12 support an expansive subflow zone. Subflow is a narrow concept and, therefore, the  
13 quantification of subflow depletion must be constrained to only the depletion of that water that is  
14 subflow at the time it is depleted. Subflow is water that is part of the stream. *Maricopa County*  
15 *Mun. Water Conserv. Dist. No. 1 v. Southwest Cotton Co.*, 39 Ariz. 65, 95, 4 P.2d 369, 380  
16 (1931). Subflow is not percolating water on its way to the stream. *Gila II*, 175 Ariz. at 392, 857  
17 P.2d at 1246. Subflow depletion does occur, and should be accounted for in the groundwater  
18 model, at the interface between the floodplain alluvium and the basin fill when subflow is drawn  
19 down into the basin fill due to pumping the basin fill. [Hudson 022321;165-166, 168, 182, 202].

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22 The apparent simplicity that the bifurcated system of law governing water rights may  
23 have offered more than a century ago has been increasingly replaced by complexity where  
24 technology has advanced and forced the recognition that water rights must be adjudicated from  
25 surface and groundwater sources that are hydrologically connected. See *Silver v. Pueblo del Sol*  
26 *Water Company*, 44 Ariz. 553, 423 P.3d 348 (2018). The *Gila II* Court was well aware of the  
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1 impact of its decision that retained the narrow definition of subflow on the respective rights of  
2 potentially competing water users:

3           Thus, we reaffirm *Southwest Cotton's* narrow concept of subflow. We  
4 realize this does not solve the problems of equitably apportioning all  
5 available water in the state between conflicting interests and claims of  
6 groundwater users and surface appropriators. We believe, however, that  
in this area of the law, as much or more than any other, any appropriate  
change in existing law must come from the legislature.

7 *Gila II*, 175 Ariz. at 393, 857 P.2d at 1247.

8           Following the remand of the case from the *Gila II* Court, Judge Goodfarb applied  
9 a different analytical approach focused on a stable geologic formation beneath and  
10 connected to the stream. He explained:

11           This Court believes the proper terminology for the geologic unit which defines  
12 "subflow" is the "saturated floodplain Holocene alluvium." That term is used  
13 deliberately. Both the Holocene or younger alluvium and the basin fill are  
14 descended from the same source, the rock of uplifting mountains. While the  
15 depositional processes were somewhat different, where these units meet it is  
16 sometimes difficult to discern the differences between one type of eroded,  
17 depositional debris from another, particularly when they may both be saturated  
18 and water bearing. Moreover, water, when it fills the porosity of a geologic unit,  
19 doesn't know the difference between what is "subflow," younger alluvium or  
basin fill. However, only the younger Holocene alluvium can pass the test of  
"subflow" as it is the only stable geologic unit which is beneath and adjacent to  
most rivers and streams, except those in the mountains where bedrock surrounds  
the flow.

20           Order at 56 (June 30, 1994) ("Goodfarb Order").

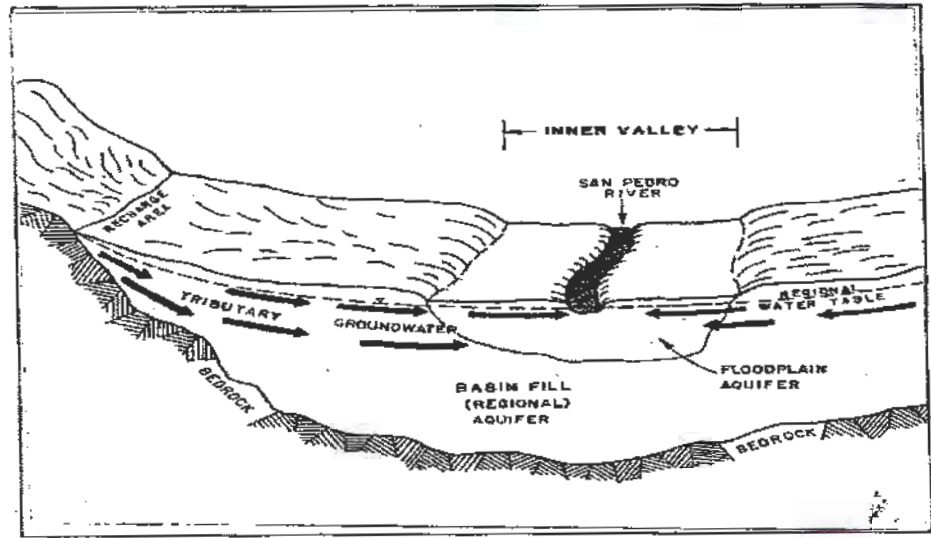
21           Judge Goodfarb found that the subflow zone consists of the floodplain alluvium that must  
22 be "differentiated from adjacent geologic units such as tributary aquifers and the basin-fill aquifer  
23 which discharge into it or receive discharge from it." Goodfarb Order at 34. He reinforced his  
24 decision that the subflow zone does not extend into the basin fill with the explicit language that  
25 "[e]ven though there may be a hydraulic connection between the stream and its floodplain  
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1 alluvium to an adjacent tributary aquifer or basin-fill aquifer, neither of the latter two or any part  
2 of them may be part of the 'subflow' zone." Goodfarb Order at 65.

3  
4 The *Gila IV* Court upheld that the definition of subflow crafted by Judge Goodfarb, "in all  
5 respects"<sup>1</sup>, because it was based on a "geological feature that is a distinct, mapable, geologic unit"  
6 that "exists adjacent to and beneath the stream" is "more closely associated with the river than  
7 with surrounding aquifers" and properly excludes "tributary aquifers" and saturated basin fill.  
8 *Gila IV*, 198 Ariz. at 339, n.5, ¶24, 9 P.3d at 1078. Neither Judge Goodfarb nor the *Gila IV* Court  
9 defined the subflow zone as two-dimensional, i.e., length and width. The subflow zone defined  
10 by the trial court and approved in *Gila IV* exists within the three-dimensional floodplain aquifer  
11 that has length, width, and depth, i.e., a vertical boundary. Judge Goodfarb described his  
12 methodology as a "building block method to find proper parameters of the subflow zone laterally  
13 and vertically". Goodfarb Order at 35. He found that the weight of the evidence points to the  
14 saturated floodplain Holocene alluvium as the most credible "subflow zone. Its lateral and  
15 vertical limits have

16 existed for some  
17 10,000 or more  
18 years." Goodfarb

19 Order at 58. The  
20 illustration, duplicated  
21 in *figure 1*, further  
22 reinforces the  
23 determination that the



24 subflow boundary exists  
25 between the floodplain

**Figure 1.** Illustration of floodplain aquifer as distinct from the underlying basin fill (regional) aquifer.  
**Source:** Goodfarb Order at 11.

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27 <sup>1</sup> *Gila IV*, 198 Ariz. at 344, ¶ 48, 9 P.3d at 1083.  
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1 aquifer and basin fill. *Gila IV* affirmed the Goodfarb Order and held that the floodplain Holocene  
2 alluvium defines and limits the depth as well as the breadth of the subflow zone. Thus, the  
3 vertical boundary of the subflow zone for purposes of building a groundwater model to calculate  
4 subflow depletion for wells located outside the lateral boundaries of the subflow zone in the San  
5 Pedro River watershed is the boundary between the floodplain alluvium and the basin fill.

6 The Arizona Department of Water Resources called two witnesses to testify about the  
7 development of the groundwater model. Mr. Inwood testified that Layer 1 of the ADWR model  
8 currently includes Holocene and Pleistocene alluvium and, in some locations, upper basin fill.  
9 [Inwood 022221:26]. He did confirm that an additional layer that only includes the floodplain  
10 alluvium could be added to the model. [Inwood 022221:62]. As Mr. Inwood testified, ADWR  
11 can distinguish between the geological material in some areas but other areas may be difficult.  
12 [Inwood 022221:30-31]. The relevant inquiry becomes the amount of data necessary to achieve  
13 the level of certainty and accuracy necessary to properly model those difficult areas.  
14

15 Alluvium and basin fill materials will intermingle at the boundary between the geological  
16 layers precluding the delineation of an exact border. Accordingly, absolute certainty is not  
17 possible. The necessary accuracy of the designated boundary should consider the sensitivity of  
18 the calculated depletion to the depth of the layers identified as within the subflow zone. If the  
19 calculated depletion changed dramatically when the depth of the subflow zone changed  
20 minimally, then calculated depletion would be considered very sensitive to changes in depth. In  
21 that case more certainty, and thus more data, would be required, to establish the depth of the  
22 subflow zone. If, on the other hand, the calculated depletion changed minimally when the depth  
23 of the subflow zone changed substantially, then the calculated depletion would not be considered  
24 particularly sensitive to the change in depth and less certainty as to the precise depth of the  
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1 floodplain alluvium, and less data about the depth of the floodplain alluvium, would be required  
2 to support the depth of the subflow zone.

3 Dr. Amy Hudson, who holds a Master of Science in environmental science and  
4 engineering and a Ph.D. in geoscience with a specialty in hydrogeology, effectively constructed a  
5 sensitivity test of the calculated depletion amount to the depth of the subflow zone. She prepared  
6 a synthetic or theoretical MODFLOW model, which was a simplified representation of a system  
7 with a river and an aquifer reliant on mountain front recharge with an alluvial unit and underlying  
8 basin fill. [Hudson 022221:169, 197]. The model consisted of six layers, with the top four layers  
9 having a uniform thickness of 30 feet, a fifth layer of 80 feet and sixth layer of 200 feet. [Hudson  
10 022221:173, 182]. The model results, as corrected, are consistent with the consensus of the  
11 experts, as discussed above, that as the depth of the aquifer increased so did the amount of  
12 calculated depletion. The model shows a substantial difference after one year of pumping  
13 between depletion calculated at a depth of thirty feet and depletion calculated at a depth of 200  
14 feet, 688 cubic feet per day and 1,030 cubic feet per day, respectively. [SRP Exh. 2 at 9].<sup>2</sup>

17 The model also tested the sensitivity of the depletion calculation to smaller changes in the  
18 thickness of the aquifer located at the level of the floodplain alluvium thickness. The model  
19 demonstrated that the amount of depletion changed minimally as the depth of the layers moved  
20 from 30 to 120 feet in the early years although the differences increased over time as shown in  
21 Table 1 below. For example, the amount of depletion at the end of the first year at a depth of 30

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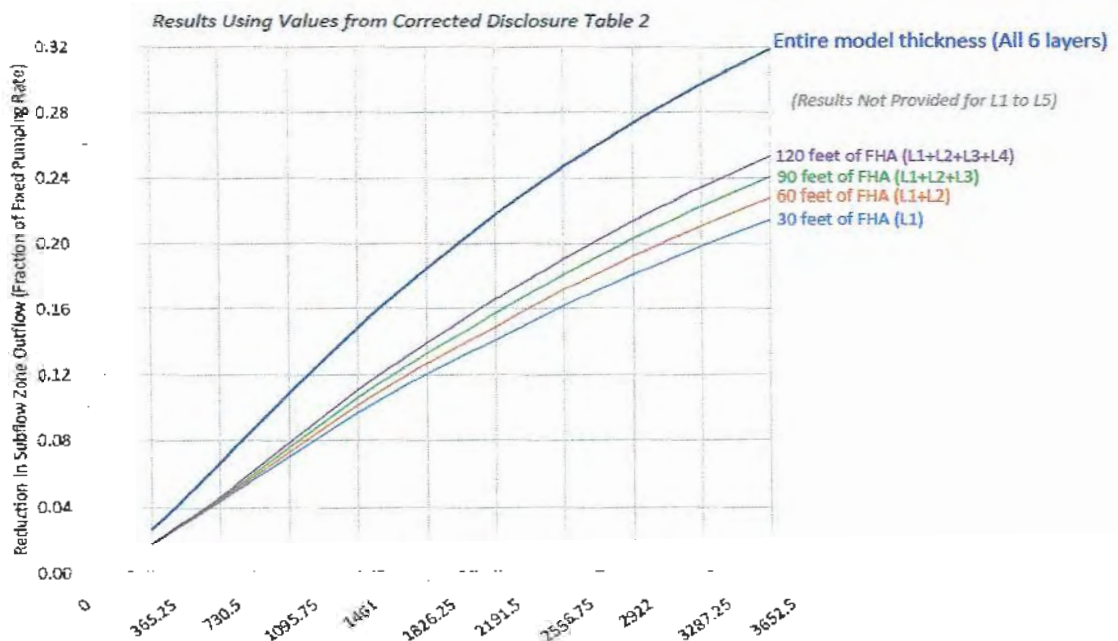
25 <sup>2</sup> Dr. Mock opined that the initial years of pumping primarily cause a loss of water from  
26 storage and not a loss of flow meaning that over time pumping will increasing impact the amount  
27 of flow, thereby demonstrating the importance of time in the calculations. [GRIC Exh. 001 at  
28 6].

1 feet was 688 cubic feet per day but when the depth increases by fourfold to 120 feet, the amount  
 2 of depletion changed by 1.5 percent to 698 cubic feet per day.

Depth of Model Layer	Time (days)									
	365.25	730.5	1095.75	1461	1826.25	2191.5	2556.75	2922	3287.25	3652.5
30 ft	688	1713	2702	3730	4631	5440	6241	6985	7656	8264
60 ft	675	1730	2809	3907	4877	5747	6624	7414	8130	8780
90 ft	686	1749	2915	4080	5116	6060	6990	7825	8581	9268
120 ft	698	1795	3027	4261	5361	6391	7359	8235	9028	9751
All layers	1030	2569	4174	5727	7125	8387	9511	10519	11430	12254

10 **Table 1.** The amount of depletion, in cubic feet per day, is shown for each model layer over a ten-year period.  
 11 Source: Rebutal Expert Report of Mock, GRIC Exh. 001 at 9.

12 Dr. Mock, who holds a doctoral degree in hydrology and a minor in applied mathematics,  
 13 graphed the corrected results of the model, shown in *figure 2*, that illustrate the reduction of  
 14 outflow from the subflow zone (on the y-axis) for each model layer thickness over time in days  
 15 (on the x-axis). As shown by the tight band of the results for various layers of thickness of the  
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 28 **Figure 2.** The amount of subflow depletion increases because of the depth of the subflow zone, but changes in the  
 model depth of the top layers depicting floodplain alluvium do not translate into significant changes in depletion.  
 Source: GRIC Exh. 001, figure 1.

1 floodplain Holocene alluvium, depletion results are not particularly sensitive to changes in the  
2 depth of the floodplain alluvium. [Cross 022321:59]. Due to the level of sensitivity of the  
3 calculation to depth, less rather than more data is required to achieve the certainty needed in the  
4 model. The need for extensive data collection within the aquifer is further reduced because, as  
5 Mark Cross, a hydrogeologist with a Master of Science in hydrology, testified, the thickness of the  
6 subflow zone varies within relatively small limits within the upper 100 feet of the subsurface. [*Id.*  
7 at 60].

9 As pointed out by Salt River Project, the only substantive factual dispute at trial involved  
10 the potential costs to collect the data necessary to build the groundwater model and, more  
11 specifically, the costs to drill any new boreholes if additional boreholes were necessary to  
12 differentiate between the floodplain alluvium and the basin fill in certain areas of the San Pedro  
13 River watershed. At this point, ADWR has not “made an effort in this proceeding to delineate  
14 contact between the upper basin fill and younger alluvium...” [Inwood 022221:90]. Given that  
15 this proceeding focused on the appropriate lower boundary of the subflow zone and ADWR has  
16 not undertaken the analysis of the data available to it to create the required model layer, it would  
17 be premature to make a determination on the specific data required to support a model that is  
18 intended to provide clear and convincing evidence about subflow depletion caused by a well  
19 located outside the lateral boundaries of the subflow zone.

22 Arizona Department of Water Resources currently has data available to it that it may use  
23 to delineate the vertical extent of the subflow zone such as well logs, geotechnical logs, and  
24 geophysical logs. [Inwood 022221:31; APS BHP Exh. 001] Jon Ford, a groundwater hydrologist  
25 and geologist with decades of experience, testified that he was able to examine the totality of  
26 available data, such as drillers’ logs and pumping rates for existing wells, for an area within the  
27 San Pedro River Watershed to interpret the thickness of the floodplain alluvium, without drilling  
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1 any boreholes. [Ford 022321 34-36]. Mr. Cross also stressed the importance of reviewing  
2 multiple drillers' logs and other data and analyzing the data in a holistic manner. [Cross  
3 022321:62,69]. Mr. Cross also testified that ADWR can use its analysis of that data along with its  
4 knowledge of the wells located outside the lateral boundaries of the subflow zone to identify any  
5 important data gaps that require new information and to identify the types, locations, and amounts  
6 of additional data needed. [Cross 022321:58]. He recommended that ADWR's data collection  
7 efforts focus on those locations where having additional information would have a large impact on  
8 reducing uncertainty. [Cross 022221:59-61]. For example, if there are many supply wells  
9 outside the subflow zone in a particular region, it could be more important to reduce the level of  
10 uncertainty in that area. [*Id.* at 60]. He concluded that it would be acceptable to approximate the  
11 location of the bottom of the subflow zone if "the approximation is consistent with existing data,  
12 including drillers' logs." [Cross 022321:84-85].

15 Arizona Department of Water Resources should analyze the data readily available to it and  
16 exercise its professional judgment to assess the amount of new data necessary to develop the  
17 groundwater model that will serve as test of whether a particular well located outside the subflow  
18 zone is depleting the subflow zone. Once the model is completed, the parties will have an  
19 opportunity to file comments and objections, and to the extent any party believes that the model  
20 results suffer from insufficient data, the objection can be resolved in a proceeding with specific  
21 facts.  
22

23  
24 **IT IS ORDERED** that for purposes of developing a test to calculate the amount of  
25 subflow depletion from wells located outside the lateral boundaries of the subflow zone in the San  
26 Pedro River Watershed, the vertical boundary of the subflow zone shall be modelled as the  
27  
28



1 geologic contact between the floodplain alluvium and the basin fill (the plane where the  
2 floodplain alluvium meets the basin fill).

3  
4   
5 Susan Ward Harris  
6 Special Master

7 The original of the foregoing was delivered to the Clerk  
8 of the Maricopa County Superior Court on August 30,  
9 2021, for filing and distributing a copy to all persons  
10 listed on the Court approved mailing list for this  
11 Contested Case.