DECLARATION OF RICH BURTELL ON THE NON-NAVIGABILITY OF THE UPPER SALT RIVER AT AND PRIOR TO STATEHOOD

In re Determination of Navigability of the Salt River
(Case Nos. 03-005-NAV and 04-008-NAV(Consolidated))

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

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

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I. INTRODUCTION AND SUMMARY OF OPINIONS

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, I worked at the Arizona Department of Water Resources (ADWR) for twelve years. At ADWR I was manager of the Adjudications Section and, as manager of that section, was frequently involved in evaluating the nature and occurrence of surface water in Arizona streams.

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

4. I have been asked by Freeport Minerals Corporation (Freeport) to evaluate the navigability of the Upper Salt River at and prior to statehood. This declaration provides supplemental evidence in a case currently before the Arizona Navigable Stream Adjudication Commission (ANSAC). On October 22, 2012, ANSAC voted to reopen the record for receiving evidence on six remanded cases. These cases address the navigability of the Gila River, San Pedro River, Santa Cruz River, Lower Salt River, Upper Salt River and the Verde River. In April 2015, ANSAC consolidated the Upper and Lower Salt River into a single case now known as the Salt River.

5. In evaluating the navigability of the Upper Salt River, I am mindful that ANSAC intends to receive, review, and consider evidence on two issues: (a) the navigability or non-navigability of the Salt River in its "ordinary and natural condition" prior to the State of Arizona's admission to the United States on February 14, 1912, consistent with the Arizona Court of Appeals decision in *State v. Arizona Navigable Stream Adjudication Comm'n*, 224 Ariz. 230, 229 P.3d 242 (App. 2010)[a]; and (b) segmentation of the Salt River consistent with the United States Supreme Court's decision in *PPL Montana, LLC v. Montana*, 556 U.S. ___, 132 S.Ct. 1215 (2012).

6. In preparing this declaration, I reviewed: (a) the evidence compiled from ANSAC's first Salt River hearing (Hearing No. 04-008-NAV); (b) ANSAC's December 13, 2007 document *Report, Findings and Determination Regarding the Navigability of the Upper Salt River from the Confluence of the White and Black Rivers to Granite Reef Dam*; (c) legal memoranda filed in 2012 by various parties regarding the Upper Salt River and posted on ANSAC's website (www.ansac.az.gov); (d) authorities cited in those legal memoranda; and, (e) evidence regarding the Upper Salt River submitted to ANSAC by the parties in 2014 and 2015. If additional information becomes available, I reserve the right to revise or supplement my opinions.

7. My declaration is organized into nine sections – Introduction and Summary of Opinions (Section I), River Segmentation (Section II), Boating (Section III), Historic Accounts and Early Government Assessments of Navigability (Section IV),

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[a] The Arizona Court of Appeals characterized ordinary flow conditions as "usual, absent major flooding or drought" and natural flow conditions as "without man-made dams, canals or other diversions."

Early Transportation Needs (Section V), Natural Impediments to Navigability (Section VI), Stream Discharge Reconstruction (Section VII), River Depth Reconstruction (Section VIII) and Conclusions (Section IX). References cited herein follow the last section. A map showing the Salt River watershed upstream of the Verde River confluence is presented in **Figure 1**.

8. After this introduction and summary of opinions, I discuss in Section II how the Arizona State Land Department (ASLD) proposed to divide the Upper Salt River into three segments for purposes of determining its navigability. Section III describes pre-historic, historic and recent attempts to boat these river segments. Despite a clear need to utilize the river for trade and travel, only a few historic accounts of floating down the stream were identified in addition to recent use by recreational boaters.

9. Section IV describes how the river appeared to early travelers. Prior to substantial development and under ordinary conditions, travelers along the river typically observed a shallow stream readily crossed except during spring snowmelt and following storm events. This section also describes early government assessments of navigability that support the conclusion that the Upper Salt River was not susceptible to navigation.

10. The transportation needs of the first Europeans in the region are discussed next in Section V, and it is found that the Upper Salt River was not utilized for trade or travel even though the need clearly existed by the military, miners, settlers, and later, the builders of Roosevelt Dam. In Section VI, I present three natural impediments to navigating the Upper Salt River which are consistent with this lack of use – rapids, braiding, and shallow water.

11. To further assess the river in its ordinary and natural condition, Sections VII and VIII reconstruct the flow and depth at points along the Upper Salt River. Flows are reconstructed using an accounting procedure that adjusts gaged records for upstream diversions. Stream depths are reconstructed using these adjusted flows and hydraulic rating curves based on field measurements. The results show that the stream was generally too shallow to support commercial navigation.

12. Based on my review of existing information and the supplemental evidence presented here, I conclude in Section IX that the Upper Salt River was neither actually navigable nor susceptible to navigation in its ordinary and natural condition at and prior to statehood. I also conclude that if Upper Salt River is divided into segments, none of the segments would have been navigable at that time.

II. RIVER SEGMENTATION

13. The Court in *PPL Montana* found that practical considerations support the segmentation of rivers when determining navigability:

> "Physical conditions that affect navigability often vary significantly over the length of a river. This is particularly true with longer rivers, which can transverse vastly different terrain and the flow of which can be affected by varying local climates…These shifts in physical conditions provide a means to determine appropriate start points and end points for the segment in question. Topographical and geographic indicators may assist." *PPL Montana v. Montana*, 132 S.Ct. 12 (2012)

14. In its June 2012 memorandum on the effects of *PPL Montana*, ASLD, an advocate for stream navigability, recommended that ANSAC consider several segmentation factors including (a) whether the river is located in a canyon or runs through flats or wide river valleys; (b) the river's flow rate; (c) the classification of rapids by degree of difficulty; (d) whether the river is a gaining or losing stream; and (d) the river's slope or steepness (p. 4).

15. Based on these factors, ASLD recommended in the memorandum that the Salt River be divided into three segments from its headwaters to Roosevelt Dam (p.5):

- Segment 1 (White/Black River Confluence to Apache Falls) – "*Narrow, deep bedrock canyon with remote access and located within the Fort Apache Indian Reservation. Modern boating is not permitted by the tribe upstream of Apache Falls, but would likely include numerous rapids. Significant tributaries include Carrizo Creek.*"

- Segment 2 (Apache Falls to Sleeper Rapid) – "*Segment includes one of the most frequently boated river segments in Arizona, and is home to several commercial boating operations. River is located in deep bedrock canyon and includes many named and unnamed rapids. Gleason is largest of 'flats' reaches with wide canyon, few rapids and easier access. Significant tributaries include Cibeque and Canyon Creek. Located within the Tonto National Forest, Salt River Canyon Wilderness, and the Fort Apache and San Carlos Indian Communities.*"

- Segment 3 (Sleeper Rapid to Roosevelt Dam) – "*River continues in deep bedrock canyon, but with fewer and smaller rapids. Located primarily within the Salt River Canyon Wilderness. Includes the large flats area now inundated by Roosevelt Lake. Significant tributaries include Pinal and Cherry Creeks.*"

16. I understand that at a recent scheduling conference, proponents of navigability indicated that they will not assert the navigability of Segment 1.

17. While my opinion is that no reach of the Upper Salt River was navigable or susceptible to navigation, I believe that it is useful to divide the river into segments for purposes of addressing stream characteristics and evaluating navigability. **Figure 2** shows the location of the first three Salt River segments that were agreed to. I evaluate each of these segments in this declaration. The length and slope of the segments are listed below[b]:

Segment	Length (miles)	Slope (feet/mile)
1	35	25
2	33	24
3	39	10

[b] I calculated segment lengths and slopes using historic and current USGS topographic maps.

III. BOATING

18. This section describes prehistoric, historic and recent efforts to boat the Upper Salt River. No evidence of prehistoric boating by Native Americans was found. Six historic accounts of boating the Upper Salt River were identified, including two trips to assess whether logs could be floated downstream to Phoenix, and a third trip that involved floating lumber to the site of Roosevelt Dam. The fourth account is likely related to one of the three prior trips, and the fifth and six accounts involve using a ferry to cross the river during high water. Regarding recent efforts to boat the Upper Salt River, ANSAC has received evidence on the recreational use of the river by kayakers, canoeists and rafters, primarily within Segments 2 and 3.

19. As indicated by the U.S. Supreme Court in *PPL Montana*, extensive and continued historical use of a river for commercial purposes is the most persuasive evidence of navigability. As to evidence of present-day boat use, the Court noted that it:

> "may be considered to the extent it informs the historical determination whether the river segment was susceptible of use for commercial navigation at the time of statehood. For the susceptibility analysis, it must be determined whether trade and travel could have been conducted 'in the customary modes of trade and travel on water' over the relevant river segment 'in [its] natural and ordinary condition'…At a minimum, therefore, the party seeking to use present-day evidence for title purposes must show…the watercraft are meaningfully similar to those in customary use for trade and travel at the time of statehood…If modern watercraft permit navigability where the historical watercraft would not…then the evidence of present-day use has little or no bearing on navigability at statehood…Modern recreational fishing boats, including inflatable rafts and lightweight canoes or kayaks may be able to navigate waters much more shallow or with rockier beds than the boats customarily used for trade and travel at statehood." *PPL Montana v. Montana*, 132 S.Ct. 1215, 1233-34 (2012)

20. The fact that the Upper Salt River was not used as a "highway for commerce" before substantial diversions occurred (see Section V) suggests that the few historic attempts to float down the river were unique and not a reflection of the practical utility of the river for trade and travel. Natural impediments to navigability (Section VI), coupled with the results from my undepleted flow analysis (Sections VII and VIII), further support the conclusion that the river in its ordinary and natural condition was not suitable as a highway for commerce. Recent and current use of Segments 2 and 3 of the Upper Salt River by recreational boaters does not, in my opinion, change this conclusion since the modern, low draft boats now in use are not "meaningfully similar to those in customary use for trade and travel at the time of statehood." (*PPL Montana*, 132 S. Ct. at 1233).

A. Prehistoric

21. According to Fuller (2003, p.2-22) "Archaeological research has not documented any use of the river for commercial trade and travel or for any regular flotation of logs."

22. ANSAC (2007, p.21) further concluded that "there is no evidence whatsoever of the use of the Upper Salt River by prehistoric cultures for boating or travel on the water. Nor is there any evidence of attempted floating of logs for use in construction of pueblos. In prehistoric times all travel was almost exclusively on foot."

B. Historic

23. **Table 1** summarizes six historic accounts of boating the Salt River above the current site of Roosevelt Dam. Included in this table is the month and year of the account, the type of boat used and its length, the boat's cargo and number of passengers, the purpose and direction of the trip, and associated ASLD river segment(s). The table also lists the source(s) of the account and my comments.

24. The earliest account that I found of boating the Upper Salt River comes from June 1873 and reportedly involved as many as six men in a dugout canoe attempting to drive logs downriver to Tempe. Newspaper accounts indicate that the group started some 200 miles upstream of Fort McDowell and "with much toil and difficulty, on account of rapids and boulders in the river, they descended a long way, when having lost their arms, ammunition and provisions, excepting flour, they arrived at a canon so narrow as not to admit of the passage of a log, and were compelled to abandon their boat and foot it."

25. The next two accounts, which date from 1883 and 1885, may actually have been the same trip. Both trips involved four men and began a few miles above the mouth of Tonto Creek. A Phoenix newspaper reported the 1883 trip some 26 years after it supposedly occurred and noted that Jim Meadows was one of the crew. Newspapers describing the 1885 trip indicated that boating party included John Meadows. Whether these men were the same person or what their relationship was, if any, is unknown. However, it is curious that both crews reported their boat became grounded on rocks during the trip requiring considerable effort to get back into the water. And while the purpose of the 1883 trip was never mentioned, a newspaper explained that the June 1885 trip was taken to ascertain "the feasibility of floating logs or lumber down from the Upper Salt River" to Phoenix. There is no evidence that timber drives to Phoenix ever occurred.

26. In January 1890, the Gila County Board of Supervisors requested bids for construction of a ferry at Robertson's Crossing near the Pinto Creek confluence. A local paper noted that a ferry at this point was "greatly needed as during stages of high water communication between this and the northern portion of the county is completely cut off." It is unknown whether the ferry was ever built.

27. In February 1905, a ferry was in fact "put in running order" at Griffin's Ford near the town of Livingstone to shuttle "feed and provisions" across the Salt River. This ferry was needed due to flooding, which had cut off supplies to a sawmill located north in the Sierra Ancha mountains.

28. Finally, during high flow in February 1908, three men attempted to use the Salt River to float lumber to the tunnel of Roosevelt Dam by means of a raft. The dam was under construction at the time and the lumber had been transported to the river via a road that ran just above the tunnel. The crew apparently lost control of their craft as it swung into the current and two jumped off and swam to safety. The third crewman drowned after the raft was carried over the dam.

29. Taken together, these six historic accounts do not demonstrate that the Salt River above Roosevelt Dam was reliably used, or susceptible to use, for trade or travel prior to statehood. There is simply no evidence of extensive or continued use of the river as a highway for commerce.

C. Modern

30. Regarding modern boating along the Upper Salt River, ANSAC (2007, pp.40-42) concluded:

> "Recreational rafting on the Upper Salt River above the Tonto Basin appears to have begun after World War II when rubber rafts became available to the public…Current floating of the Salt River is described in a number of guide books and may be undertaken by individuals…Testimony was heard regarding commercial rafting from the Salt River Canyon Bridge (where Highway 60 crosses the Salt River) down to Roosevelt Dam (where Highway 288 crosses the River. In the past few years, an industry has grown up whereby certain companies, for a fee, will transport, as a recreational experience, people down the reach one of the Upper Salt River…These rafting trips occur during the high water period in late winter and early spring. While testimony was given that the flow of the river for such rafting could be as low as 700 cubic feet per second, <u>preferred flow was between 800 to 4,000 cubic feet per second</u>. Most of the trips the witness had been on, the flow was between 1,500 and 3,000 cubic feet per second. It was noted that while there were kayaks and possibly rafts that could have made this trip in 1912, the technological advances in the type of material, such as the rubber or neoprene rafts and even stronger material for kayaks, which were not available in 1912, made these trips more possible and enjoyable from a recreational standpoint after the 1950s. Also, individuals who had the equipment could go do these flow trips individually without paying a guide and a company to transport them. These float trips are strictly for recreational purpose, to view the scenery and wildlife, for the excitement of running rapids and possibly some fishing, but not for commercial purposes, nor did the rafts carry any commercial goods for resale." [emphasis added]

31. Southwest Paddler (2010) indicates that rafts floating Segments 2 and 3 of the Salt River need a minimal flow of 1,200 cubic feet per second (cfs) with the optimal boating season "a short two or three months in March through May, though the season may be extended or reduced according to the depth of the snow pack and/or recent local rains. The river will run very low in dry winter years."

32. Recent use of the Upper Salt River by commercial outfitters has been limited due to low flow conditions. Over the 20-year period from 1995 through 2014, average monthly flows in the Salt River at the Highway 60 crossing have only exceeded 800 cfs during 15% of the time (USGS, 2014a). Last year, according to Marley Gabel, who works for Mild to Wild Rafting and Jeep Trail Tours, guided raft trips down the Upper Salt River were cancelled on account of low water and associated safety concerns.

IV. HISTORIC ACCOUNTS AND EARLY GOVERNMENT ASSESSMENTS OF NAVIGABILITY

33. In this section of my declaration, I describe streamflow conditions observed by early travelers along the Upper Salt River before significant settlement in the area and/or before substantial diversions began. Also described are early assessments by government officials that concluded that all or portions of the Upper Salt River were not navigable. Taken together, this information indicates that, prior to significant development, the Upper Salt River was typically a shallow stream readily crossed by horse or mule and characterized by rapids and pools. The river was at times deeper and more difficult to cross, but usually only following storm events and/or during spring snowmelt. These findings support the conclusion that the Upper Salt River was not navigable in its ordinary and natural condition prior to statehood.

34. As summarized in **Table 2**, above Roosevelt Dam, irrigation by European settlers along and near the Salt River increased to about 800 acres by 1890 and nearly 4,000 acres by 1900. Water to irrigate these lands was diverted directly from the Salt River and its tributaries, notably Tonto Creek. Based on data presented in Section VII, I estimate that these diversions initially depleted less than 10 cfs from the Salt River. By 1900, these depletions would have increased but still remained less than approximately 40 cfs. As described in Section VIII, it is unlikely that even this level of stream depletion would have substantially changed the depth of the Upper Salt River and impacted its susceptibility to navigation.

A. Accounts

35. In 1864, King S. Woolsey led a group of settlers on a campaign against Apache Indians living in central Arizona. Among the settlers who accompanied Woolsey was F.A. Cook, who kept a diary of their activities. Cook recorded crossing the Salt River twice in an area between the mouths of Pinto and Tonto creeks (Segment 3). On June 14, he described fishing in the Salt River at this point as "new to many of us but was verry [sic] fine sport for we had to go into the river and in some places it was up to our necks…" A few months later, during the afternoon of August 18th, Woolsey's party recrossed the river but Cook makes no mention of any difficulties in their crossing (Reeve, 1949, pp.94, 102 and 120).

36. About ten years after, in late February 1874, army surgeon Colonel W.H. Corbusier crossed the Salt River near Roosevelt (Segment 3) and observed that "the water was so high and turbulent that we could not cross, and it was some time before we found a fording place." (Corbusier, 1971, pp.18-25).

37. The next year, Indian Commissioner L.E. Dudley led a group of Indians from the Rio Verde Reservation to San Carlos. In his report, Dudley noted crossing the Salt River on March 3, presumably also near Roosevelt. He "found that the stream could be forded, but running as swiftly as it does in the month of March, it was a sad duty to compel men, women and children to wade through cold water, even though they were Indians. The water was about waist deep to a tall man…" (Corbusier, 1971, pp.258-262 and 278).

38. At "low water", Hodge (1877, p.38) described the Salt River as "a clear, beautiful stream having an average width of two hundred feet for a distance of one hundred miles above its junction with the Gila, and a depth of 2 feet or more."

39. Archeologist A.F Bandelier visited the Upper Salt River in 1883 and recorded in his journal on May 26 that the Salt River near the mouth of Pinto Creek "is very swift, and as broad as the Gila at San Carlos, but only 'belly deep.'" (Lange and Riley, 1970, pp.114-115). This reach of the Salt River is also in Segment 3.

40. Finally, on April 19 and 25, 1904, aquatic biologist F.M. Chamberlain examined the Salt River between the towns of Livingstone and Roosevelt, both in Segment 3. He found the river:

> "a shallow, rather broad stream, 10 to 50 ft. or more in width, and from a few inches to a foot or more in average depth. The bottom is sand or gravel with large boulders in places. The water is roily…Throughout this stretch are small pools of enough depth to protect fish…Just below Roosevelt the Salt River enters a canon and there forms good size pools. In this region, protected by its inaccessibility, it is said salmon of marketable size can still be taken. I did not investigate it. At the entrance to this box the Tonto is building a dam that is to convert this part of the valley into a reservoir." (Brown, 2009, p.120)

B. Government Assessments

41. In a December 1865 memorial, the legislature of the Arizona Territory asked Congress for an appropriation to improve the navigability of the Colorado River. As stated in their memorial:

> "…the Colorado River is the only navigable water in this Territory; that it is navigable, in high stages of water, five hundred miles; that by the expenditure of a small amount of money, it may be rendered navigable much higher up. That portion of the river between Fort Yuma and Fort Mohave has a changeable channel and is obstructed by boulders, snags, and sand bars rendering the navigation difficult and dangerous; that the removal of said obstructions would greatly facilitate the navigation of this part of the river…that if navigation of said river is improved it will accommodate the General Government and greatly increase and hasten the development of vast mineral and other resources of this Territory." (Territory of Arizona, 1866, p.77) [emphasis added]

Although written at a time of little irrigation (probably less than a few hundred acres) along the Upper Salt River, the memorial makes no mention of the Salt River.

42. In late April and early May of 1881, the General Land Office (GLO) completed four cadastral surveys along Segment 3 of the Salt River. The surveys included:

- Township 3 North, Range 14 East
- Township 4 North, Range 12 East
- Township 4 North, Range 13 East
- Township 4 North, Range 14 East.

Review of the survey plats and accompanying field notes shows that neither bank of the Salt River was meandered during any of these surveys. This is important since, as explained by Littlefield (2014, pp.17-19), surveyors at that time were instructed to meander both banks of rivers that they believed were navigable and meander one bank of rivers considered “well-defined natural arteries of internal communication.” At the time these surveys were conducted, probably less than 500 acres were being irrigated along the Upper Salt River with little impact on stream discharge (**Table 2**).

43. Further information regarding stream conditions during the GLO surveys was found in the field notes. At nine points where their section lines crossed the Salt River, the surveyors recorded either “water shallow”, “shallow water”, “shallow” or “river shallow” (**Table 3**). Note that these surveys were completed during the spring when snowmelt runoff is common.

44. None of the government assessments described above determined that the river was susceptible to navigation. These assessments provide further evidence that the Upper Salt River was not susceptible to navigation in its ordinary and natural condition prior to statehood.

V. EARLY TRANSPORTATION NEEDS

45. The first Europeans to occupy the Upper Salt River watershed were the military and miners. Settlers soon followed. Although all required a ready means of transporting people and goods through the area, none utilized the Salt River for that purpose, a further indication that the river was not navigable. This section of my declaration describes the early transporation needs of the region, and how trails and wagon roads were used to meet those needs, even prior to substantial irrigation.

46. By the mid to late 1870s, a military post (Fort Apache) was established near the headwaters of the Salt River, Globe City had formed to support local silver mines, and farmers were beginning to irrigate lands along the Salt River and Tonto and Pinal creeks. With this level of early development, it is difficult to believe that neither military personnel, miners nor farmers would utilize the Salt River as a highway for commerce if it had been susceptible to navigation.

A. Military

47. In 1870, a military post was established along the White River about 20 river miles above the headwaters of the Salt River. The post was originally named Camp Ord and later referred to as Camp Mogollon, Camp Thomas, and Camp Apache. It was finally renamed Fort Apache in 1879. According to Brandes (1960, pp.10-11), this post was “of singular importance to the Army” due to its location between the domains of the Apaches and Navajos.

48. From the start, supplying troops and goods to this post proved a challenge. In 1871, the War Department (1872, pp.78-79) reported that the nearest town was Tucson, located about 230 miles away by wagon road and trail. Supplies were at first shipped to the camp via Fort Whipple near Prescott, northeast to Show Low, and then south, a route covering some 268 miles (Bowman, 1978a, p.124 and Hinton, 1878, p.xxvi). By the mid to late 1870s, other military routes to Fort Apache had been established, including General Crook’s Road from Camp Verde which crossed southeast

over the Mogollon Rim for a distance of 113 miles (Bowman, 1978b, pp.10-30).[c,d] and a route from Maricopa Wells near Phoenix which totaled 316 miles (Hinton, 1878, p.xxii).

49. Lacking a cheaper and more efficient water route, it was both expensive and time-consuming to supply Fort Apache. In his analysis of supplying military posts in the southwest between 1861 and 1885, Miller (1989, pp.302 and 305) mentions the following regarding Fort Apache:

> "…freighters in Arizona charged their highest rates for transporting government supplies to Camp Apache…the road leading north from the Gila River was wretched. Colonel August Kautz observed after an inspection tour in 1875 that Apache was 'almost inaccessible from the West and South by wagon transportation.'…Consequently the army looked to the east for a safer and more economical supply route through New Mexico, a route made possible by the advance of the railroads…But transporting supplies to Apache from Las Vegas [New Mexico] was in [Captain Charles] Egan's eyes [chief commissary officer in Arizona] a complete failure...The commissary officer at Apache attributed the problem to bad roads, describing the 100-mile stretch approaching the post as little better than a well-defined mountain trail. He claimed the road was 'almost impassable for wheeled vehicles from about November 1st to March 1st.' During the spring one freighter had abandoned his cargo about 70 miles before reaching Apache."

50. **Figures 3a** and **3b** are maps showing the transportation routes that connected towns and military posts along and near the Salt River circa 1876 and 1885, respectively. If the Salt River had been a practical and reliable means of transportation at this time, the military would have utilized it to supply Fort Apache rather than having to rely on the alternatives described above.

B. Miners

51. Mining in the Globe District, located south of the Salt River, began in the early 1870s when silver deposits were discovered near the present town of Globe.[e] When these deposits played out about a decade later, copper deposits began to be developed and continue to be mined in the area today. As summarized by ADWR (1992, p.42):

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[c] Summerhayes (1908, pp.76-86), who accompanied the first wagons to travel Crook's Road in 1874, described it as "so difficult that our wagon-train could not move as fast as the light vehicles [ambulances] or the troops. Sometimes at a critical place in the road, where the ascent was not only dangerous, but doubtful, or there was, perhaps, a sharp turn, the ambulances waited to see the wagons safely over the pass…For miles and miles the so-called road was nothing but a clearing, and we were pitched and jerked from side to side of the ambulance, as we struck large rock or tree-stumps; in some steep places, logs were chained to the rear of the ambulance, to keep it from pitching forward onto the backs of the mules."

[d] As noted in his autobiography, Crook (1960), who ordered that the road be built, was familiar with the use of inland waterways for military purposes. He mentions trips he made up the Columbia, Klamath and Sacramento rivers by canoe and steamboat (p.13, 58 and 73), being ambushed by Native Americans who utilized canoes on the Wenatchee River (p.64), and receiving supplies on the Yellowstone River via steamboat (p.204).

[e] Globe City was founded in 1876 and by 1880 census-takers counted 704 individuals in the town plus "many miners and a few cattlemen in the surrounding area." The nearby mining town of McMillenville alone reached about 1,700 people at that time (Haak, 1991, pp.10 and 14).

> "The biggest hindrance to development of the mining industry was poor transportation, and not a lack of water as in many western mining regions. In the early day, supplies were hauled in 150 miles from Silver City, New Mexico…Starting in 1898, Globe experienced a financial boom occasioned by the completion of a rail link to the Southern Pacific Railroad near Bowie, and by the beginning of construction of Roosevelt Dam and the Apache Trail in 1905."

Figure 4 presents early photographs of wagons hauling goods to Globe.

52. Bigando (1989, p.37-38) describes early efforts at copper mining and transportation in this area:

> "The single most serious factor affecting the cost of mining was transportation. The shipping problems associated with coke, an esential [sic] material for smelting copper ore, provide a typical example. High quality coke was shipped all the way from Cardiff, Wales, while a lower grade was brought in from the coal fields of southern Colorado. It came as far as Willcox by rail, and then had to be unloaded from the railroad cars, reloaded on wagons, and freighted across the San Carlos Reservation.[f]
>
> Supplies coming from the west came into Globe on the backs of mules, since no wagon roads existed.
>
> The problem of lack of wagon roads began to be resolved in 1882, when the Gila County Board of Supervisors started granting toll road franchises.
>
> Saxe's Toll Road was the first to be franchised, on January 7, 1882. Saxe's road began at Bloody Tanks, where it connected with the Silverking trail. Saxe ran a hotel at the Tanks where travelers rested after crossing the mountains by mule, before being transferred to a stagecoach for the remaining trip into Globe.
>
> On April 19, 1882, a franchise was granted for the Howard and Reduction Toll Road, running from Pioneer Pass to Riverside.
>
> Kellner's Toll Road, running up Ice House Canyon and Kellner Canyon to the head of Russell Gulch, and on to the Kellner Sawmill, was incorporated into the Pinal Summit Toll Road in June, 1883. When completed, this road connected the Howard and Reduction Toll Road and became the first wagon road connecting Globe and Florence…
>
> As important to the community [of Globe] as the construction work [of Roosevelt Dam that began in the early 1900s], however, was the road that had recently been completed between the dam site and Mesa. The Roosevelt-Mesa [Apache] road provided Globe with a much shorter

[f] The time associated with these shipments was not insignificant. Dunning (1966, p.110) indicated that in the early 1880s, teams of 10 to 12 mules took several weeks to make the 260-mile round trip to the rail station.

> wagon route to Phoenix then the existing road over the Pinal Mountains."

53. Sain (1989, pp.6-7, and 9) further describes early attempts to reach the mining camps of Globe:

> "The most serious drawback to copper mining was the difficulty of transportation and shipping bullion out. The nearest railroads were at Willcox and Casa Grande, both more than 100 miles away.
>
> To take care of the transportation needs, 200 pack animals served the community over the trail from the Silver King Mine [near present day Superior]. This trail was so precipitous and narrow that wagons could not travel on it. There were two daily pack trains, and each mule carried up to 200 pounds, the load diamond-hitched onto the large aparejo…
>
> Early in 1899, James A. Fleming of the Black Warrior Copper Company visited the Salt River valley to arouse interest in a road from Mesa to Globe. The Maricopa County people agreed to build the road as far as Pinto Creek, and Fleming agreed to build that part of the road in Gila County from Webster Gulch to Pinto Creek. The road was surveyed and toll arrangements planned, but the Miami-Superior Highway was not completed until 1922."

54. Finally, before the railroad arrived in Globe from Bowie, local merchant George W.P. Hunt remarked:

> "Gila County lies in east central Arizona, and is the most inaccessible portion of the Territory…[it] is the only portion of the Territory which has no railways crossing its boundaries…Where mining has built up a large place, railroads have been attracted to it; it is the inevitable history of the West and Southwest. The time must be near at hand when the freight wagons here will be only a memory of frontier days, and the railroad will come to take their place. Globe now enjoys a possibility of two railroads within the year…The sentiment here is almost universally in favor of the Phoenix [rail] road. Communication with the Salt River Valley is regarded as more desirable by the merchants. It will open a market for the produce of the Salt River Valley, which is now almost entirely excluded on account of the long distances it has to be freighted." (Governor of the Arizona Territory, 1897, pp. 100 and 102)[g]

55. As with the military, it is difficult to explain, based on the above discussion, how early miners in the Globe District and the merchants that supplied them, would have ignored the Salt River as transportation route if, indeed, it represented a highway for commerce.

[g] Hunt would go on to become the first governor of the State of Arizona and serve a total of seven terms.

C. Settlers

56. In addition to mining camps, farms and ranches sprang up in the area which helped to supply the mines. According to Granger (1960, pp.93-120), post offices were established at the following settlements located along or near the Salt River:

- Armer (1884)
- Catalpa (1885)
- Cline (1886)
- Ellison (1894)
- Livingstone (1896)
- Wheatfields (1880).

Maps showing the approximate location of these communities are provided in **Appendix B**.

57. Post offices are evidence of population centers that would have had their own transportation needs. People living near the settlements and larger mining towns would have utilized the Salt River for trade and travel if it had been practical to do so.

58. According to Haak (1991, p.60), "mail delivery was haphazard at best in those early days." In 1878, mail was transported to Globe over a trail from Silver King via mules and donkeys. Citizens of Globe reportedly complained that it arrived "broken and in pieces and wet when the weather was stormy." By 1881, mail was reaching the mining town via stage from Florence, by contactor from the train station at Willcox, and still by saddle train from Silver King

D. Construction of Roosevelt Dam

59. Roosevelt Dam, located at the downstream end of Segment 3, was constructed between 1903 and 1911 (USBR, 2009). Supplies were freighted to the dam site first from Globe and later Mesa. The Arizona Republican (1905a) provides an early history of how the dam site was supplied:

> "Before starting actual work on the construction of the dam, power plants, etc., the <u>government found it necessary to construct a great deal of wagon roads through a rough mountainous country</u>. The first road built was about three miles long from the clay hills to the cement mill. Another road was built from the river to the timber country in the Sierra Ancha Mountains, where a saw mill was put in operation. The capacity of the mill is about 7,000 feet per day and over 1,000,000 feet of lumber has been sawed since the mill started and as much more will be required before the dam is built. <u>A great many teams are kept busy hauling the lumber to the tunnels on the power canal line and also to Roosevelt where it is used in constructing bridges, houses and other structures.</u>

Up to January 1st, 1905, all the machinery, building material and supplies were hauled over a rough road from Globe 48 miles away and nearly 29 miles of road was built to connect it with the dam. This road is built above the high water mark of the reservoir and was completed in February 1904.

The government originally intended to construct a road down the Salt River canyon suitable only for the transport of material necessary for the construction of the transmission line. Work on this road began in November 1903 but was discontinued a short time afterwards.

As the people of the Salt River valley have obligated themselves for the return to the government of the reservoir constructing expenses, it was only natural that they wanted to derive the commercial benefit from its construction. A bill was introduced in congress and passed which enabled Phoenix, Mesa and Tempe to issue bonds to aid the government in the road from Mesa to the dam site. After the funds derived from the sale of the bonds became available the government resumed work on the road and it was completed in December 1904.

In the construction of this wagon road, which is sixty miles long, many engineering difficulties were encountered…

<u>The building of the Phoenix-Roosevelt road will not only facilitate that work of building the dam and lower the cost of freight shipped from outside points but will also open a country which heretofore has been almost inaccessible.</u>" [emphasis added]

60. It is noteworthy that during construction of Roosevelt Dam, the Salt River was not regularly utilized as a highway for commerce, either above or below the dam site. The need clearly existed. For instance, rather than floating it downstream, lumber from the saw mill in the Sierra Ancha Mountains was hauled across the river near Livingstone and then down to Roosevelt via a wagon road. As described in Section III, an attempt in February 1908 to use the river for transporting lumber the short distance from the road at Roosevelt to the nearby dam tunnel during high flow proved unsuccessful.[h]

61. Only one account was found of using the Salt River to transport materials *upstream* to the dam site. On April 24, 1905, the Arizonan Republican reported that, due to recent flooding, freight from Mesa was having to be hauled the last four miles to Roosevelt either via pack train over a trail or "hauled up the river in a boat, both modes of transportation of but little comfort to the traveler and expensive." Flows in the Salt River were unusually high that spring with the median daily discharge at Roosevelt greater than 8,900 cfs between February 3 and April 24, 1905 (USGS, 2014a).[i]

[h] Prior to dam construction, Arthur Davis, Chief Engineer of the Reclamation Service, reported that "saw mills will be established near the [power canal] line and logs floated down Salt River from the mountain valleys above. This native timber will also be used for false works and other temporary structures about the works." (Arizona Republican, 1902). As indicated above in paragraph 59, there is no evidence that the Salt River was actually ever used for this purpose once construction of the canal began.

[i] By comparison, in Section VIII I estimate that, prior to cultural diversions, the median daily discharge of the Salt River at Roosevelt did not exceed about 500 cfs.

VI. NATURAL IMPEDIMENTS TO NAVIGATION

62. In the prior three sections of this declaration, I (a) describe the lack of prehistoric and limited historic boating along the Upper Salt River (Section III); (b) provide historic accounts and early government assessments which indicate that, prior to significant development, the Upper Salt River was generally shallow with rapids and pools and not considered navigable (Section IV); and (c) demonstrate that the need for practical and reliable transportation existed in the area before substantial development of the river began (Section V). In this section, three natural impediments to navigation are discussed that explain why the Upper Salt River was neither actually used, nor susceptible to use, as a highway for commerce in its ordinary and natural condition. These impediments are rapids, braiding, and shallow water.

A. Rapids

63. At least 41 rapids have been mapped along the Salt River above Roosevelt Reservoir. **Table 4** lists the river mile, name and class of the rapids within Segments 2 and 3 and **Attachment C** presents recent (2010) aerial photographs of rapids within Segment 1.

64. From the confluence of the White and Black rivers to Apache Falls (Segment 1), over 13 rapids were identified that range from Class II to III and increase in difficulty to Class IV beginning about six miles above Apache Falls. Apache Falls is rated a Class V rapid. Twenty-four (24) named rapids, typically ranging from Class II to IV, are encountered between Apache Falls and Sleeper Rapid (Segment 2). Another four named rapids, typically Class II, occur below Sleeper Rapids to Roosevelt Reservoir (Segment 3).

65. The rapids along the Upper Salt River are characterized by swift and turbulent flow, varying degrees of drop, and, in some places, by boulder-choked channels. Such conditions are an impediment to navigation and the frequency of these rapids, particularly within Segments 1 and 2, would have been more than just an inconvenience to commercial boaters before statehood.

66. When compared to the findings of the Special Master in *United States v. Utah*, the class and frequency of rapids above Roosevelt Reservoir alone make it evident that this reach of the Salt River was not navigable in its ordinary and natural condition prior to statehood. *United States v. Utah*, 283 U.S. 64, 51 S.Ct. 438 (1931). In the *Utah* case, the Special Master determined that the San Juan River was not navigable, a finding that the U.S. Supreme Court later adopted. Among the factors that the Special Master cited in his report was the occurrence of rapids and the steep slope of the riverbed:

> "The number of difficult rapids, with steep and rapid drops, (whether that number be 37 as estimated by Miser or 30 as estimated by Allen, or 16 or 12 by Hoyt) make it impossible, in my opinion, for any boat to navigate safely unless conducted with great caution and by expert boatmen; and even then boats must ordinarily be 'lined' or portaged or their cargoes portaged at several places. These rapids occur at intervals throughout the entire stretch of the River. Moreover, the general gradient or slope of the River bed, viz. an average of 7 feet per mile, with long stretches of 8 feet per mile, is so steep as to make navigation difficult and impracticable. Out of the total of 133 miles, there is

practically no stretch of River of any considerable length where the gradient is less than 5 feet per mile…accompanying such gradients, there are naturally high velocities, far exceeding the velocities on the Green, Grande, or Colorado Rivers in the sections involved in this suit. Such velocities, combined with the narrowness of the River and with the fact that it flows in many portions through box canyons with no opportunity to spread out in case of sudden floods, unquestionably make navigation a matter of hazard to boats and cargoes, even if not to life and limb." (Warren, 1930, pp.180-181)

67. According to Southwest Paddler (2010), the rapids along the 26.5-mile reach of the San Juan River from Sand Island to Mexican Hat are "run-of-the-mill Class I to II boulder gardens" and the rapids along the 58-mile reach from Mexican Hat to Clay Hills Crossing are "mostly Class I and II, with a few class III's thrown in for good measure." The latter reach is considered "one of the nation's most popular river trips."

68. Like the San Juan River, the Upper Salt River is very popular among modern recreational boaters (see Section III). Its rapids are as large, if not larger, its slopes are steeper (see Section II), and, like the San Juan, it is characterized by narrow canyons. These factors as well as the other evidence demonstrate that Segments 1 and 2 of the Upper Salt River were non-navigable under *The Daniel Ball* standard.

B. Braiding

69. Braiding can also be an impediment to navigation and is characterized by unstable, multi-thread channels separated by bars and/or islands. These channel conditions, combined with relatively low streamflows, can render navigation of a river impractical. Historic and recent evidence demonstrates that braiding was common along the Upper Salt River prior to statehood, which provides further explanation for the lack of use of this stream as a highway for commerce.

70. **Figures 5a** and **5b** present early maps of the Upper Salt River prepared in 1881 and 1905-1907, respectively. The maps cover the lower half of Segment 3, which is now submerged beneath Roosevelt Reservoir, and reveal at least six locations where the Salt River was previously split into two channels. In addition, **Figure 5c** presents two ground-level photographs taken in 1906 near the current site of Roosevelt Dam. These photos clearly show that the Salt River was also braided at and above its confluence with Tonto Creek.

71. Multi-thread channels are still found along the Salt River *upstream* of Roosevelt Reservoir. Using recent aerial photographs, I identified 15 sites in Segments 1 and 2 and the upper half of Segment 3 with multi-thread channels. **Table 5** lists the location of each site, its river mile, number of stream channels and photo dates. USGS streamflow data collected at the time the photos were taken indicate that this braiding persisted at flow rates both above and below my median reconstructed values.

72. Based on the preceding evidence, I believe that portions of the Upper Salt River were braided in their ordinary and natural condition, which would have further limited its use as a highway for commerce.

C. Shallow Water

73. Prior to development, the Upper Salt River was a relatively shallow stream, readily crossed on foot and by horses and mules except during flood events and spring snowmelt. In the next section of my declaration, I reconstruct ordinary and natural flows at three sites along the river and then use these flows to reconstruct stream depth. I find that the depth of the Salt River typically remained at or less than approximately 2 feet during 50% of the year at numerous locations. Streams of this depth would not have been suitable for boats customarily in use for commerce prior to statehood.

74. By comparison, G.M. Wheeler's survey of the Colorado River measured an average stream depth of 5.85 feet at Fort Yuma in March 1876 and 4.1 feet at Camp Mohave in September 1875 (Mueller and Marsh, 2002, p.10). Neither measurement was made during the high flow season which typically ran from April through August (USGS, 2014a).[j]

VII. STREAM DISCHARGE RECONSTRUCTION

75. In this section of my declaration I describe how ordinary and natural streamflows were reconstructed at three USGS gaging stations along the Upper Salt River. The purpose of reconstructing these streamflows was to further assess how the river looked prior to the effects of man and determine whether it was susceptible to navigation in this undisturbed condition. Undepleted streamflows were estimated using an accounting procedure that adjusted (increased) gauged flows for upstream cultural depletions. In the paragraphs that follow, the period that stream flows were reconstructed is described first, followed by a discussion of the gages used and upstream diversions and depletions. Results from the analysis are presented next and then compared to an earlier undepleted flow estimate.

76. I conclude from this analysis that, during 75% of the time, undepleted streamflows along the Upper Salt River would have remained (a) less than 623 cfs within Segment 1 and the upper reach of Segment 2; (b) less than 918 cfs within the upper and middle reaches of Segment 3; and, (c) less than 977 cfs within the lower reach of Segment 3. Because the quantities diverted for irrigation upstream of the gages and added back to the river to reconstruct flows were not corrected for spills and return flows, these values are considered an *upper estimate*. Actual undepleted flows along the Upper Salt River would have been lower. These values are also considered high due to the assumed impacts from well pumpage. Results from this analysis are used in Section VIII to estimate the depth of the reconstructed flows and their suitability for navigation.

A. Analysis Period

77. Several factors were considered before selecting a period for streamflow reconstruction including:

[j] Even with these stream depths, navigation of the Colorado River could be challenging. As noted by the Arizona legislature in an 1865 memorial to Congress, the portion of the Colorado River between Fort Yuma and Fort Mohave "has a changeable channel and is obstructed by boulders, snags and sand bars rendering the navigation difficult and dangerous." (Territory of Arizona, 1866, p.77).

a) Availability of flow and diversion data;

b) Whether runoff was representative of long-term conditions;

c) Well pumpage; and

d) Changes in cultural depletions.

Each factor is discussed briefly below. Based on these factors, I reconstructed flows along the Upper Salt River from the late 1880s to 1940.

78. During this analysis period, at least 15 years of streamflow data were available from each gage and major diversions in the region were known.

79. It is important when reconstructing streamflows to consider whether runoff during the period was representative of long-term conditions. In other words, was the period wet, dry or about normal? A period of near normal flows is desirable when evaluating susceptibility to navigation. **Figure 6** shows annual streamflows in the Salt River at Roosevelt Dam reconstructed from 1820 to 1960 using tree rings. Also shown in the figure is the average annual streamflow at this point based on tree rings dating back to the year 1361. These data show that, during my analysis period, about an equal number of years had annual flows above and below the long-term average.[k]

80. Determining the effects of well pumpage on streamflows can be complex. Streamflow reconstruction is therefore simplified if well pumpage was not significant at the time. According to ADWR (1992, p.107), the majority of irrigation wells in the Upper Salt River watershed "appear to have been drilled within the last forty to fifty years." My analysis period ended in 1940 so potential stream depletion by irrigation wells was not considered a factor. However, since the late 1800s, wells have supplied water to the mines and towns of the region. Those wells were addressed in my analysis.

81. Early records of industrial and municipal well use in the area are unfortunately not readily available. By the early 1970s and early 1980s, ADWR (2009, p.149) does estimate that well pumpage in the Salt River Basin totaled approximately 20,000 acre-feet per year, or about 28 cfs. Since much of this pumpage was either directly or indirectly related to copper mining in the Miami-Globe area, I looked at past copper production rates as a proxy for early well pumpage. **Table 6** lists copper production in the mining district from 1905 to 1980. Production generally increased until the 1920s and from then did not substantially change. It is reasonable to conclude from this that early well pumpage in the region did not exceed the more recent pumpage estimate of 28 cfs. Considering the distance between most of these early wells and the Salt River, the direct impact from this well pumpage on streamflows was almost certainly much less.

[k] Meko and Hirschboek (2008) reconstructed these streamflows by first correlating recent tree ring widths to the quantity of flow measured at nearby USGS gaging stations. This correlation and older tree ring data were then used to estimate flow conditions before data were available from the gages. They did not adjust the recent streamflow data for upstream cultural depletions. As such, the flow data they reconstruct using tree rings is useful as a relative rather than absolute measure of past flows along the Upper Salt River.

82. The last factor I considered in selecting a period for streamflow reconstruction was changes in cultural depletions. Periods of record are rarely the same for all gages and diversion points, so it helps when reconstructing flows to select a time when diversions are relatively stable. Fortunately, the acreage of irrigated lands in the Upper Salt River watershed did not change substantially between the late 1800s and 1940 as reflected by the data summarized in **Table 2**. Also, as described above, copper production in the region increased during the early 1900s until the 1920s but then generally remained at those higher levels through the 1970s. Finally, the export of surface water from the watershed and later water imports did not begin until after my period of flow reconstruction had ended (ADWR, 2005, Tables 8 and 14).

83. Regarding the effect of Roosevelt Reservoir on my streamflow reconstruction, water began to store behind the dam in late 1908 (USGS, 1910, p.186-188). Two of the stream gages I analyzed were located above the reservoir and their flow data unaffected. The third gage was located just below the dam site so only the flow data collected from there before November 1908 were analyzed.

B. Gages

84. Streamflows were reconstructed at three USGS gages along the Upper Salt River:

- near Chrysotile (09497500);
- near Roosevelt (09498500); and
- at Roosevelt (09500500).

Figure 2 shows the location of these gages relative to ASLD's stream segments. The gages near Chrysotile and at Roosevelt are located at the upstream and downstream ends of Segments 2 and 3, respectively. The gage near Roosevelt is located roughly in the middle of Segment 3. Photographs of the gage sites are provided in **Figures 7a** through **9a**.

85. **Table 7** summarizes the streamflow data collected at these gages during my analysis period. Flow duration rates are provided for each gage based on measured daily or monthly mean flows.[1] The 25% flow rates indicate that flows measured at the gages equaled or exceeded the specified values 25% of the time. In other words, streamflows remained less than these rates during 75% of the time. Similarly, the 50% flow rates indicate the measured flow that was equaled or exceeded at the gage during 50% of the time. The latter is equivalent to the median flow over the period of record. I consider these percentiles to be characteristic of ordinary streamflows and use them for flow reconstruction rather than average values. Average flows are skewed by large runoff events and therefore are less representative of typical flow conditions.

C. Diversions and Return Flows

86. To reconstruct ordinary and natural streamflow conditions along the Upper Salt River, stream depletions resulting from cultural diversions upstream of the gages were added to the gaged flows described above. Irrigation diversions and

[1] For the gage at Roosevelt, daily mean flow data were unavailable for the entire period of record so monthly mean flow data were used instead.

industrial and municipal well pumpage were the largest cultural water uses identified in the region at this time and are discussed further below.

87. **Table 8** lists the irrigation and other cultural depletions upstream of each gage. During the analysis period, the acreage irrigated along the Upper Salt River and its tributaries was relatively stable, and totaled between about 3,000 to 4,000 acres. As explained by Stewart and Bicknell (1896), a large portion of the water historically diverted from the Upper Salt River to irrigate these lands returned to the stream:

> "The farmers here use all the water they want, generally they take out much more than they need. As there is an abundance of water in the river and the land lies very low any one can take out a ditch for himself. As none of the land irrigated is over one mile from the river, and the land is very porous, it is probable that a large portion of the water taken out finds its way back again. They build no dams, but take out water by natural sloughs or by slight wings of boulders and brush."

Stewart and Bicknell (1896) also noted that "we do not think that the appropriation of water on [Wild Rye] creek, nor on Tonto creek has any material effect on the flow of lower Salt River."

88. To estimate stream depletions from this irrigation, I used a depletion rate of 1 cfs per 100 irrigated acres. This rate is based on historic irrigation diversion data collected by the USGS along the Upper Gila River and does <u>not</u> account for spills and return flows. However, as noted by Plateau (2014, pp.14-15 and Tables 11 through 13), available information indicates that an appreciable amount of these historic Upper Gila irrigation diversions did, in fact, return to the river. Actual depletions of Upper Salt River flows from irrigation are, therefore, believed to have been less than estimated here.

89. **Table 8** lists the estimates of streamflow depletions along the Upper Salt River associated with irrigation. The latter were added to the gauged flows in **Table 7** to calculate undepleted flows. Estimates of early well pumpage are also listed in **Table 8** and these were considered an additional depletion although, as explained in paragraph 81, the direct affect of this pumpage on Salt River flows is difficult to quantify due to the distance between the wells and the stream.

D. Results and Qualifications

90. Undepleted flows at the three USGS gaging stations are summarized in **Table 7**. My analysis shows that, absent cultural depletions, flows in the Upper Salt River remained less than 977 cfs along all three stream segments during 75% of the year and less than 456 cfs along these segments during 50% of the year.

91. Note when reviewing these results that corrections were not made for gains in streamflow from infiltration of irrigation water or natural losses in flow from evapotranspiration (ET). It was assumed in the analysis that none of the water diverted upstream of a gage site for irrigation or other purposes returned to the river via baseflow and was measured by the gages. It is further assumed that all of the depleted water added back to the river reached the downstream gage (i.e. none was naturally lost along the channel from ET). Both assumptions are unlikely and, as a result, my reconstructed flows are conservative and should be considered upper estimates. Actual

Upper Salt River streamflows would have been lower in their natural and ordinary condition.

E. Comparison to Prior Estimate

92. I identified one earlier study that reconstructed streamflows along the Upper Salt River. In 1952, the Bureau of Reclamation (BOR) published a report on the water supply of the Lower Colorado River Basin. In that report, undepleted streamflows were calculated at numerous gaging stations within the basin for the period 1914 through 1945. Flow records were adjusted for depletions upstream of the gages, including consumptive uses, channel losses, and ET.

93. At the USGS gaging station near Roosevelt, BOR (1952, p.152) calculated that the *average* or *mean annual* undepleted flow of the Salt River was approximately 710 cfs. By comparison, I reconstructed a median daily flow at this gage of 443 cfs and a 25% flow duration rate of 918 cfs. As expected and explained above in paragraph 85, my median daily flow reconstruction was lower than BOR's average annual undepleted flow estimate since the latter is skewed by large flow events. In any case, these estimates of undepleted flow in the Upper Salt River are relatively small and, when evaluated in the next section in terms of their associated depths, would have been unsuitable for commercial navigation.

VIII. STREAM DEPTH RECONSTRUCTION

94. The reconstructed streamflows from Section VII are used in this section to reconstruct the depth of the Upper Salt River. River depths prior to depletion were estimated using hydraulic rating curves developed from field data collected at two of the three USGS gages – near Chrysotile and at Roosevelt. I did not develop a rating curve for the gage near Roosevelt due to potential backwater effects from a diversion structure located about one mile downstream of the gage that was utilized for power production during construction of Roosevelt Dam.

A. Rating Curves

95. The rating curve for the gage near Chrysotile relates stream discharge to mean stream depth and is based on hundreds of recent (1985-2014) field measurements by the USGS.[m] I consider these recent measurements to be representative of channel conditions during the period of flow reconstruction. As noted by Fuller (2003, p.4-15):

> "Review of the geology of the Upper Salt River indicates that the channel geomorphology is substantially unchanged from its condition at or before statehood, except where the river has been inundated by reservoir impoundments."

96. The recent USGS field measurements and associated rating curve for the gage near Chrysotile are plotted in **Figure 7B**. Note that field measurements made at the gage site by wading are differentiated in the figure from those made via cable car. Photographs of the gage in **Figure 7A** show that the cable car is aligned over a pool and results in measurements of mean stream depth that are substantially greater for a

[m] Also referred to as hydraulic depth, mean depth is equivalent to the average depth of the stream across the channel cross-section.

given discharge. Measurements made by wading, on the other hand, typically occur near the edge of pools where the stream is often shallower and less subject to scour and fill. It is at these locations where the rating curve was developed.

97. Hydraulic rating curves for the gage at Roosevelt are based on historic stage measurements rather than mean stream depths since the latter were unavailable. Stage is a measure of stream depth and is recorded where the channel cross section is relatively deep to avoid the gage missing readings at low flow. As such, stage is more representative of the maximum stream depth at the gage site for a given discharge than its mean depth.

98. **Figure 9B** shows two rating curves that I developed for the Roosevelt gage using stage-discharge measurements taken in 1902 and 1904. The gage height at zero flow was estimated for both ratings based on available field measurements.[n] The difference between stage at zero flow and stage at a given discharge is approximately the maximum stream depth at the gage for that discharge.

B. Results

99. To reconstruct the depth of undepleted streamflows in the Upper Salt River, the 25% and 50% flow duration rates reconstructed in Section VII were compared to the hydraulic rating curves described above. The results are included in **Table 7**. By combining my reconstructed streamflows with these ratings, I found that undepleted flows in the Upper Salt River typically had a mean depth equal to or less than approximately 2 feet during 50% of the year. These reconstructed stream depths are consistent with the historic accounts presented in Section IV. However, they would not have supported commercial boat travel in light of prior court decisions (e.g. *United States v. Utah,* discussed in paragraphs 105 and 106) and certain navigability guidelines (see paragraph 107).

100. The reconstructed stream depths listed in **Table 7** are based on estimates of undepleted flow that I believe are higher than the actual flows would have been. As a result, the reconstructed stream depths are also believed to be high. Moreover, these depths represent conditions at discrete points along the river where the USGS found the channel generally unaffected by rapids and therefore suitable for discharge and stage measurements. However, as discussed in Section VI of this declaration, rapids were common along the Upper Salt River prior to development and at these points flow depths would generally have been *lower*.

101. To demonstrate the effect of rapids on stream depth, I measured depths recently at two riffles along the Upper Salt River. Riffles are small rapids of relatively little fall that occur more frequently along the river than the larger rapids listed in **Table 4**. One riffle was located in Segment 2 and the other in Segment 3. I visited both riffles on April 7, 2015.

102. **Figure 10a** illustrates the channel cross section I measured at the Segment 2 riffle. This riffle occurs about 5 miles below the USGS gage near Chrysotile. During my visit, the gage recorded a flow of approximately 296 cfs, which nearly matches my reconstructed median flow of <298 cfs (**Table 7**). The cross section shows how shallow stream depths can be in the Salt River at riffles, even at a flow rate

[n] I utilized an Excel spreadsheet model developed by T.L. Ingersoll of the USGS that employs a rating curve plotting methodology described in Rantz (1982, p.289).

equivalent to my reconstructed median value. The average stream depth at this Segment 2 riffle was 1.1 feet with a maximum depth of 2.2 feet.

103. I observed similar channel conditions at the Segment 3 riffle. This riffle occurs about 13 miles above the USGS gage near Roosevelt. During my visit, that gage recorded a flow of approximately 362 cfs, which is about 18% below my reconstructed median flow of <443 cfs. The average stream depth at the Segment 3 riffle was 0.9 feet with a maximum depth of 1.8 feet (**Figure 10b**).

104. Maps presented by WEI (1990, pp. 63-72) show the location of approximately 97 riffles within Segment 2 and approximately 60 riffles within Segment 3 <u>in addition to</u> the rapids listed in **Table 4**. Such frequent occurrence of shallow stream depths would have posed an ongoing impediment to commercial boat travel prior to statehood.

C. Comparison to Other Navigability Criteria

105. When compared to the findings of the Special Master in *United States v. Utah*, the average stream depths I reconstructed for the Upper Salt River and measured at riffles indicate that the Upper Salt river would not be found navigable in its ordinary and natural condition prior to statehood. *United States v. Utah*, 283 U.S. 64, 51 S.Ct. 438 (1931). In the *Utah* case, the Special Master determined that the San Juan River was not navigable, a finding that the U.S. Supreme Court later adopted. Among the factors that the Special Master cited in his report was the relatively shallow depth of the river which he found had a mean depth of less than 2 feet during 167 days or 46% of the year (Warren, 1930, pp.154-181). By comparison, along the Upper Salt River, reconstructed stream depths were typically less than approximately 2 feet during 50% of the year at two gaging stations. This comparison weighs even more for the non-navigability of the Upper Salt River considering the conservative nature of my streamflow reconstructions (see Section VII).

106. Also cited in the Special Master's report were results from a "low water" survey of the Green and Grand Rivers. The survey had been conducted by the War Department in November 1908 to determine the navigability of the two Utah rivers and whether their improvement by the Federal Government was advisable. The survey found that:

> "There are many 'cross-overs' in both rivers which have a depth of between 2½ and 3 feet during the low-water stage. This depth is sufficient for light draft boats suitable to these rivers, and 3 feet is, therefore taken as the governing low-water depth to be considered in improvement. The maintenance of a greater depth is not warranted by the probable commerce." (Warren, 1930, pp.101-102)

The War Department determined that both rivers were navigable, a conclusion that the Special Master indicated, while not binding on the United States:

> "has a certain amount of relevancy. I find that (the) conclusions as to depths, velocities, etc. are amply confirmed by the evidence in this suit as to actual boat trips on these Rivers made by witnesses." (Warren, 1930, p.130)

The Special Master, who ultimately also found both rivers to be navigable, determined that the mean depths of the Green and Grand Rivers only fell below 3 feet during 53 days and 16 days of the year, respectively. These flows were considerably deeper than those of the Upper Salt River in its ordinary and natural condition.

107. It is also helpful when reviewing the reconstructed stream depths of the Upper Salt River to consider thresholds established by the State of Washington for assessing the navigability potential of rivers. According to Magirl and Olsen (2009, p.2), Washington considers streams with a mean depth of less than 2 feet "probably not" navigable while streams with mean depths between 2 and 3.5 feet "may be (navigable) depending on (the) balance of factors." Streams with mean depths greater than 3.5 feet are considered "probably" navigable. In light of the relatively shallow stream depths I reconstructed and measured and other impediments to navigation (rapids and braiding), the Washington criteria support my conclusion that the Upper Salt River was not navigable in its ordinary and natural condition.

108. Shallow stream depths, rapids and braiding were all characteristic of the Upper Salt River prior to its development. I believe these natural impediments to navigation explain why the river was neither used nor susceptible to use as a highway for commerce at and prior to statehood.

IX. CONCLUSIONS

109. It is my opinion that, in its ordinary and natural condition, the Upper Salt River was neither navigable nor susceptible to navigation at and prior to statehood.

110. It is also my opinion that if the Upper Salt River is divided into three segments, as proposed by ASLD, none of these segments would have been navigable in their ordinary and natural condition.

111. I base these opinions on my review of existing and supplemental evidence presented in this declaration including, but not limited to: (a) past and recent efforts at boating; (b) observed predevelopment streamflow conditions and early government assessments of navigability; (c) early transportation needs in the area; (d) natural impediments to navigability; and (e) reconstruction of the ordinary flow and depth of the river prior to development.

I declare under penalty of perjury that, to the best of my knowledge, the foregoing is true and correct.

Executed on this 31st day of July, 2015.

RICHARD T. BURTEL

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TABLES

TABLE 1. HISTORIC ACCOUNTS OF BOATING THE SALT RIVER ABOVE ROOSEVELT DAM[a]

<table>
<tr><th rowspan="2">YEAR</th><th rowspan="2">MONTH</th><th colspan="2">BOAT</th><th rowspan="2">NUMBER OF PASSENGERS AND CREW</th><th rowspan="2">CARGO</th><th rowspan="2">PURPOSE</th><th rowspan="2">DIRECTION</th><th rowspan="2">ASLD RIVER SEGMENT</th><th rowspan="2">SOURCE</th><th rowspan="2">PLATEAU COMMENTS</th></tr>
<tr><th>Type</th><th>Length</th></tr>
<tr><td>1873</td><td>June</td><td>dugout canoe</td><td>unknown</td><td>as many as 6</td><td>supplies</td><td colspan="2">drive logs down river to Tempe</td><td>possibly 1 through 3</td><td>Weekly Arizona Miner (1873a,b)</td><td>Reportedly travelled 200 miles upstream of Fort McDowell; "with much toil and difficulty, on account of rapids and boulders in the river, they descended a long way, when having lost their arms, ammunition and provisions, excepting flour, they arrived at a canon so narrow as not to admit of the passage of a log, and were compelled to abandon their boat and foot it."</td></tr>
<tr><td>1883</td><td colspan="3">unknown</td><td rowspan="2">4</td><td rowspan="2">supplies</td><td>unknown</td><td>from Livingstone (about 10 miles above the Tonto Creek confluence) to Tempe</td><td rowspan="2">3</td><td>Arizona Republican (1909)</td><td>First reported in newspaper 26 years after the event supposedly occurred with a crew that included Jim Meadows; possibly the same event reported in 1885 (see below).</td></tr>
<tr><td>1885</td><td>June</td><td>unknown</td><td>18' x 5'</td><td>"ascertaining the feasibility of floating logs or lumber down from the Upper Salt River" to Phoenix</td><td>from Eddy's ranch (4 miles above the Tonto Creek confluence) to Tempe</td><td>Arizona Gazette (1885) and Daily Phoenix Herald (1885)</td><td>This boating party included John Meadows; whether he was the same person or what his relationship was to Jim Meadows from above is unknown. Crew from the 1883 and 1885 trips both reported getting their boat hung up on rocks and the considerable effort required to get it back in the water.</td></tr>
<tr><td colspan="2">circa 1890</td><td>ferry</td><td colspan="3">unknown</td><td colspan="2">"a ferry at [Robertson's crossing] is greatly needed as during stages of high water communication between this and the northern portion of [Gila] county is completely cut off."</td><td>3</td><td>Arizona Silver Belt (1890)</td><td>The Gila County Board of Supervisors requested bids for construction of a ferry at this point, but it is unknown whether the ferry was ever built.</td></tr>
<tr><td>1905</td><td>February</td><td>ferry</td><td colspan="2">unknown</td><td>"feed and provisions"</td><td colspan="2">ferry supplies across the river</td><td>3</td><td>Arizona Republican (1905c)</td><td>River was in flood, cutting off the supply route to a sawmill in the Sierra Ancha mountains.</td></tr>
<tr><td>1908</td><td>February</td><td>raft of lumber</td><td>unknown</td><td>3</td><td>lumber</td><td colspan="2">carry timber "from the road that runs to the river just above the [Roosevelt Dam] tunnel to the tunnel's mouth by means of a raft"</td><td>3</td><td>Arizona Republican (1908a,b)</td><td>Flood season; near the half-finished dam, two of the crew jumped off the raft and swam to safety while the other drowned when he was carried over the dam.</td></tr>
</table>

Notes:

[a] Does not include various boat traffic cited by Fuller (2003, pp.3-38 and 3-39) on the lake that formed above Roosevelt Dam during its construction.

TABLE 2. HISTORIC TO RECENT IRRIGATION ALONG THE SALT RIVER AND ITS TRIBUTARIES ABOVE ROOSEVELT DAM

YEAR	LOCATION	IRRIGATED AREA	NOTES	DATA SOURCE
circa 1850	watershed above dam site	not specified	Western Apache farms were concentrated along the Salt River below the Pinal Creek confluence, the East Fork of the White River, and Carrrizo, Cibeque, Pinal, and Tonto creeks.	Welch and Ciolek-Torrello (1994, p.63)
1864	along Pinal and Sycamore creeks		King S. Woolsey encountered Indian corn and wheat fields along both creeks.	Arizona Miner (1864)
1870	along the Salt River		European settlers took over lands previously irrigated by the Apaches just below Pinal Creek.	Welch and Ciolek-Torrello (1994, p.61)
mid to late 1870s	Tonto Creek		European settlers begin to develop farms in the watershed.	Peace (1981, p.p.9-10)
1880	Wheatfields		Post office established for community of ranches established along Pinal Creek.	Granger (1983, p.665)
circa 1881	within Gila County		*"Very little farming is done in this county. With the exception of a few gardens along Pinal creek, and a narrow strip on Salt river…"*	Hamilton (1881, pp.86-87)
1883	Globe District (see Figure 3)	up to 300 acres	*"There is no agriculture in the whole district worth speaking of. Garden patches in the valleys, and on Salt River, farms not exceeding 300 acres."*	Lange and Riley (1970, pp.105-106)
circa 1887	along Tonto Creek	between 45 and 225 acres	Lands in the Gisela area.	Peace (1981, p.21)
1890	within Gila County	815 acres	*"The tilled land is principally along the Salt river, between Pinal and Tonto creeks, or in their vicinity. Among the headwaters of Tonto creek and in the Tonto basin, at an elevation of from 6,000 to 7,000 feet, corn and potatoes are raised without irrigation if the land is carefully tilled. Other crops require the artificial application of water."*	Newell (1894, pp.24-25)
1896	along Tonto Creek	205 acres	Lands in the Gisela area were irrigated from Felton and Curry ditches; the former ditch was started in 1879 and completed in 1881; the latter ditch was dug between 1883-1884.	Peace (1981, p.21)
		70 acres	Lands irrigated by Packard Ditch.	Stewart and Bicknell (1896)
	along the Salt River	1,670 acres		
1899	within Gila County	3,924 acres	Does not include Indian reservations but does include portions of the East Verde River.	Turney (1901, p.15)
	near and below the mouth of Pinal Creek	2,518 acres		Stroud and Prothero (1899, pp.8-11)
1901	beneath future site of Roosevelt Reservoir	740 acres		Davis (1903, p.51)
1904		800 acres		Arizona Republican (1904)
1909	within Gila County	2,778 acres	Does not include Indian reservations but does include portions of the East Verde River.	Bureau of the Census (1913, p.85)
circa 1916	lower Tonto Basin	923 acres		Forbes (1916) as cited in Welch and Ciolek-Torrello (1994, p.67)
1924 to 1938	above USGS gage on the Salt River near Chrysotile	about 3,000 acres		USGS (1947, p.388)
1944	above USGS gage on the Salt River near Roosevelt	about 4,000 acres		USGS (1947, p.392)
early 1970s	along Tonto Creek	350 acres		Welch and Ciolek-Torrello (1994, p.66)
circa 1979	Fort Apache Indian Reservation	1,070 acres	Within the Upper Salt River Watershed	ADWR (1992, pp.159 and E-21)
	San Carlos Apache Reservation	20 acres		
circa 1990	non-Indian lands	1,255 acres	Actively irrigated lands mapped by ADWR within the Upper Salt River Watershed	ADWR (1992, pp.127)

TABLE 3. GENERAL LAND OFFICE SURVEY NOTES ON SALT RIVER STREAM CONDITIONS IN SEGMENT 3

SURVEY DATES	LOCATION	DIRECTION	DESCRIPTION	REFERENCE
Township 3 North, Range 14 East (Book AZR0010)				
April 22-23, 1881	Between Sections 4 and 5	North	"water shallow"	Page 4
	Between Sections 6 and 7	West	"shallow water"	Page 11
	Between Sections 5 and 6	North	"shallow water"	Page 13
Township 4 North, Range 12 East (Book AZR0019)				
May 3-6, 1881	Between Sections 22 and 23	North	"shallow"	Page 29
	Between Sections 21 and 22	North	"water shallow"	Page 39
	Between Sections 15 and 22	East	"water shallow"	Pages 40 and 41
Township 4 North, Range 13 East (Book AZR0020)				
April 25-May 2, 1881	Between Sections 35 and 36	North	"river shallow"	Page 21
	Between Sections 28 and 29	North	"water shallow"	Page 40
Between Townships 4 North, Range 12 and 13 East (Book AZR1255)				
April 18-26, 1881	Between Sections 19 and 24	North	"water shallow"	Page 84

TABLE 4. SALT RIVER RAPIDS MAPPED ABOVE ROOSEVELT RESERVOIR

RIVER MILE[a]	NAME	CLASS	RIVER MILE[a]	NAME	CLASS	RIVER MILE[a]	NAME	CLASS
ASLD SEGMENT 1 (Confluence of White and Black Rivers to Apache Falls)[b]								
60.3	Apache Falls[c]	V	See **Attachment C** for the location of at least 13 other rapids within this segment.					
ASLD SEGMENT 2 (Apache Falls to Sleeper Rapids)[d]								
59.9	Baptism	II to III	52.2	3-Way	II to II^{+}	38.2	Eye of the Needle	III^{+} to IV
59.5	Island	III to IV	50.8	Salt River Draw	III^{+} to IV	37.6	Black Rock	III^{+} to IV
58.4	Bump and Grind	II to III	49.4	Salt Banks	II to II^{+}	32.7	Upper Corral	II to III
58.2	Maytag Chute	III to III^{+}	48.9	Ledges	II to III	30.9	Lower Corral	II to III
57.6	Reforma	III^{+} to IV	48.3	Little Boat Eater	III to III^{+}	30.2	The Maze	III to III^{+}
57.5	Mother Rock	II to III	46.0	The Rat Trap	III^{+} to IV	28.3	Quartzite	III^{+} to IV
57.2	Overboard	III to IV	45.8	White Rock	II to III	28.2	Corkscrew	III to III^{+}
53.9	Exhibition	II to III	43.4	Granite	III to IV	28.0	The Sleeper	II^{+} to III^{+}
ASLD SEGMENT 3 (Sleeper Rapids to Roosevelt Dam)[d]								
25.7	Cliff Hanger	I to III	17.8	Five-Way[e]	II			
23.7	Wake Up	II to II^{+}	Not specified	Ten-Way[e]	II			

Notes:

[a] River miles start at Apache Falls (60.3) and decrease downstream toward Roosevelt Reservoir.

[b] According to Anderson and Hopkinson (1987, p.121), Segment 1 contains Class II to III rapids which increase in difficulty to Class IV beginning about 6 miles above Apache Falls; no rapids were specifically named by those authors. **Attachment C** provides aerial photographs and topographic maps from SEI (2015) that show the location of some significant rapids within this segment.

[c] River mile, name and class from American Whitewater (2014).

[d] USFS (1995, pp.9-22) provided the river mile and name of rapids within Segments 2 and 3, and Southwest Paddler (2007) provided their class.

[e] River mile, name and class from Southwest Paddler (2007).

TABLE 5. RECENT SITES OF MULTI-THREAD CHANNELS ALONG THE UPPER SALT RIVER

ASLD STREAM SEGMENT	LOCATION			NUMBER OF CHANNELS[b]		
	River Mile[a]	Coordinates				
		Latitude	Longitude	on 6/4/2010[c]	on 2/26/13[d]	on 1/7/2014[e]
1	82.2	33^0 47' 9.7"	110^0 19' 45.7"	2	2	Image not available
	80.2	33^0 47' 49.8"	110^0 20' 54.4"	3	3	
2	58.2[f]	33^0 47' 35.7"	110^0 31' 0.3"	2	2	
	52.1[g]	33^0 49' 43.1"	110^0 33' 49.3"	2	2	
	44.3	33^0 48' 46.2"	110^0 38' 56.4"	2	2	
	41.2	33^0 46' 55.4"	110^0 40' 25.0"	2	2	
	39.7	33^0 46' 1.9"	110^0 41' 23.5"	3	3	
	38.7	33^0 45' 14.3"	110^0 41' 32.1"	2	2	
3	35.4	33^0 43' 40.4"	110^0 43' 24.4"	2	Image not available	2
	31.2	33^0 41' 47.2"	110^0 44' 31.1"	3		3
	24.1	33^0 40' 19.3"	110^0 48' 2.7"	3		4
	18.6	33^0 38' 48.0"	110^0 49' 20.6"	2		3
	18.0	33^0 38' 49.4"	110^0 49' 49.7"	2		2
	15.3	33^0 39' 29.8"	110^0 50' 32.6"	3		3
	13.6	33^0 38' 25.5"	110^0 51' 32.6"	2		2

Notes:

[a] For comparison to **Table 4**, Apache Falls are located at river mile 60.3; river miles decrease downstream toward Roosevelt Reservoir.

[b] Based on aerial photography from Google (2015).

[c] On June 4, 2010, the mean daily flow measured in the Salt River at the USGS gages at Chrysotile and near Roosevelt was 527 and 590 cubic feet per second (cfs), respectively (USGS, 2014a).

[d] On February 26, 2013, the mean daily flow measured in the Salt River at the USGS gages at Chrysotile and near Roosevelt was 220 and 293 cfs, respectively (USGS, 2014a).

[e] On January 7, 2014, the mean daily flow measured in the Salt River at the USGS gages at Chrysotile and near Roosevelt was 152 and 212 cfs, respectively (USGS, 2014a).

[f] Location of Maytag Chute Rapid (see **Table 4**).

[g] Location of 3-Way Rapid (see **Table 4**).

TABLE 6. HISTORIC COPPER PRODUCTION FROM THE GLOBE-MIAMI MINING DISTRICT

YEAR	COPPER PRODUCTION (short tons)	REFERENCE
1905	11,900	USGS (1906, p.353)
1910	11,400	USGS (1911, p.188)
1915	40,500	USGS (1917, p.677)
1920	72,500	USGS (1922, p.466)
1930	79,060	USBM (1933, p.33)
1940	57,900	USBM (1941, p.200)
1950	84,700	USBM (1953, p.472)
1960	72,400	USBM (1961, p.101)
1970	77,400	USBM (1972, p.93)
1980	82,700	USBM (1981, p.56)

TABLE 7. RECONSTRUCTED UNDEPLETED UPPER SALT RIVER DISCHARGES AND DEPTHS

USGS GAGE	ASLD STREAM SEGMENT	DRAINAGE AREA (square miles)[a]	ANALYSIS PERIOD	DURATION OF DAILY MEAN DISCHARGE (cfs)[b, c]				RECONSTRUCTED DEPTH (feet)[f]	
				Measured[d]		Reconstructed[e]			
				25%	50%	25%	50%	25%	50%
near Chrysotile	2	2,850	September 1924 through December 1939	592	267	<623	<298	<2.2 (average)	<1.7 (average)
near Roosevelt	3	4,310	October 1913 through December 1939	850	375	<918	<443	Not reconstructed due to potential backwater effects from the power canal diversion dam.	
at Roosevelt[g]	3	5,830	January 1889 through October 1908	909	388	<977	<456	<2.4 to <2.7 (maximum)	<1.6 to <2.3 (maximum)

Notes:

[a] From USGS (1954, pp.672-679).

[b] cfs = cubic feet per second.

[c] 25% indicates that, over the analysis period, daily mean discharges at the gage equaled or exceeded the specified value during 25% of the time. Similarly, 50% indicates that the specified discharge was equaled or exceeded 50% of the time. The latter is equivalent to the median daily discharge over the period.

[d] Daily mean discharge data from USGS (2014a).

[e] Calculated by adding the cultural stream depletions from **Table 8** to the measured discharges listed here. Less than (<) values indicate that Plateau considers actual reconstructed discharges to be less since depletion estimates are believed to be high.

[f] Based on the reconstructed discharges listed here and the rating curves presented in **Figures 7b** and **9b**. Values for the gage near Chrysotile are average depths whereas values for the gage at Roosevelt are maximum depths based on stage measurements. Less than (<) values indicate that Plateau considers actual depths to be less because reconstructed discharges are conservative and believed to be high.

[g] Daily mean discharge data were unavailable for this gauge so monthly mean discharge data were used instead. From 1889 through 1900, data were collected downstream near Fort McDowell.

TABLE 8. ESTIMATED HISTORIC CULTURAL DEPLETIONS ABOVE USGS GAGING STATIONS ALONG THE UPPER SALT RIVER

USGS GAGE	ANALYSIS PERIOD	ESTIMATED UPSTREAM IRRIGATION DEPLETIONS		OTHER ESTIMATED UPSTREAM DEPLETIONS (cfs)[d]	TOTAL ESTIMATED DEPLETIONS ABOVE GAGE (cfs)[d,g]
		Irrigated Acres[a]	Irrigation Depletion (cfs)[b,c,d]		
near Chrysotile	1924-1939	3,000	<30	<1[e]	<31
near Roosevelt	1913-1939	4,000	<40	<28[f]	<68
at Roosevelt	1889-1908	4,000	<40	<28[f]	<68

Notes:

[a] See **Table 2** for data sources.

[b] cfs = cubic feet per second.

[c] Calculated by using a stream depletion rate of 1 cfs per 100 irrigated acres. This rate is based on historic irrigation diversion data collected by the USGS along the Upper Gila River and does not account for spills and return flows. As noted by Plateau (2014, pp.14-15 and Tables 11 through 13), available information indicates that an appreciable amount of these historic Upper Gila diversions returned to the river. Actual depletions of Upper Salt River flows from irrigation are, therefore, believed to have been less.

[d] Less than (<) values indicate that Plateau considers actual depletions to be less than listed here.

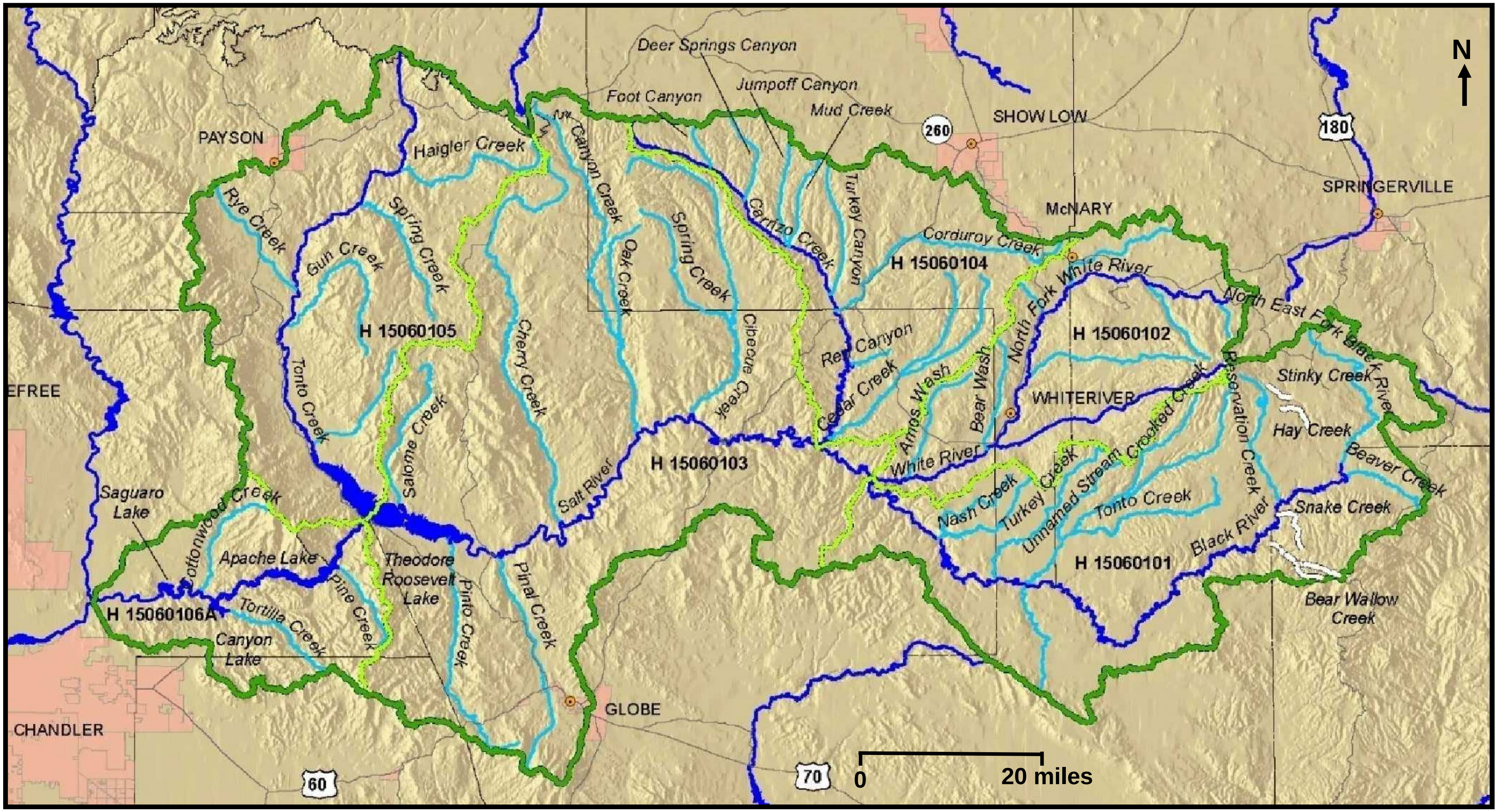
[e] The domestic water use by 6,500 people would total about 1 cfs if demand averaged 100 gallons per person per day. I found no evidence during my analysis period that this many people were living upstream of the Chrysotile gage or using water at this rate.

[f] Includes well pumpage for industrial and municipal use based on recent data from ADWR (2009, p.149) and historic copper production rates listed in **Table 6**. The direct effect of this pumpage on Salt River flows is uncertain due to the distance between the wells and stream. The listed values are, therefore, believed to overestimate actual well depletions.

[g] Calculated by summing the estimated irrigation and other upstream depletions.

FIGURES

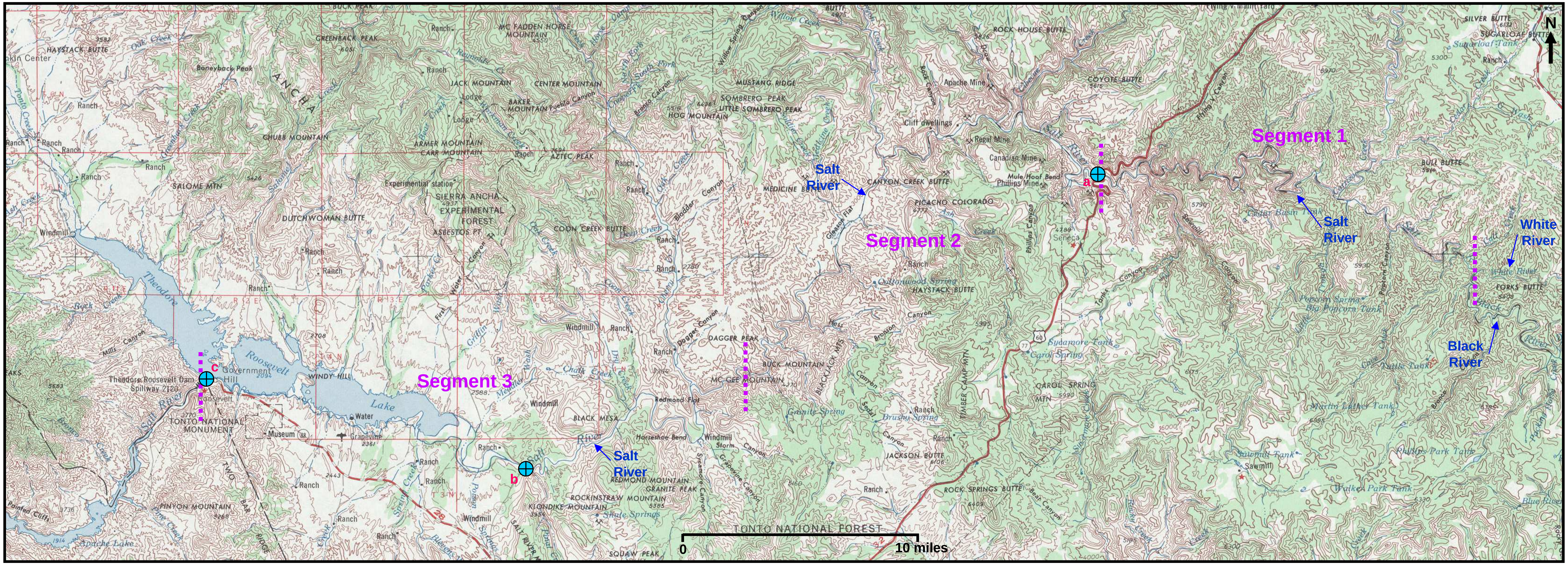
FIGURE 1. MAP OF THE SALT RIVER WATERSHED ABOVE THE VERDE RIVER CONFLUENCE



	Watershed Boundary		Major Stream
	Subwatershed Boundary		Major Tributary

Source: Uhlman and others (2008, p.33).

FIGURE 2. SALT RIVER STREAM SEGMENTS AND USGS GAGING STATIONS ABOVE ROOSEVELT DAM



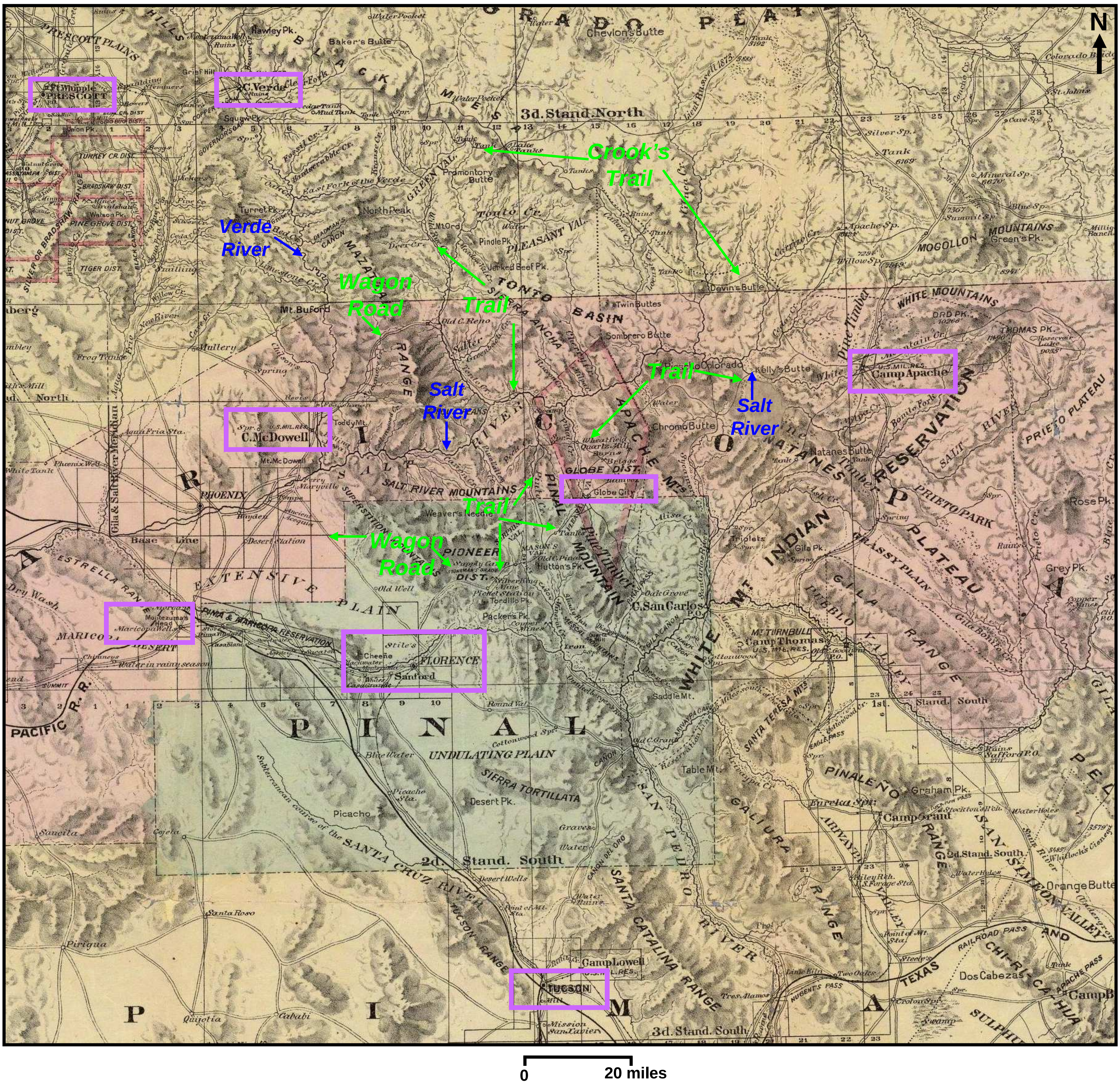
Boundary of ASLD Stream Segments

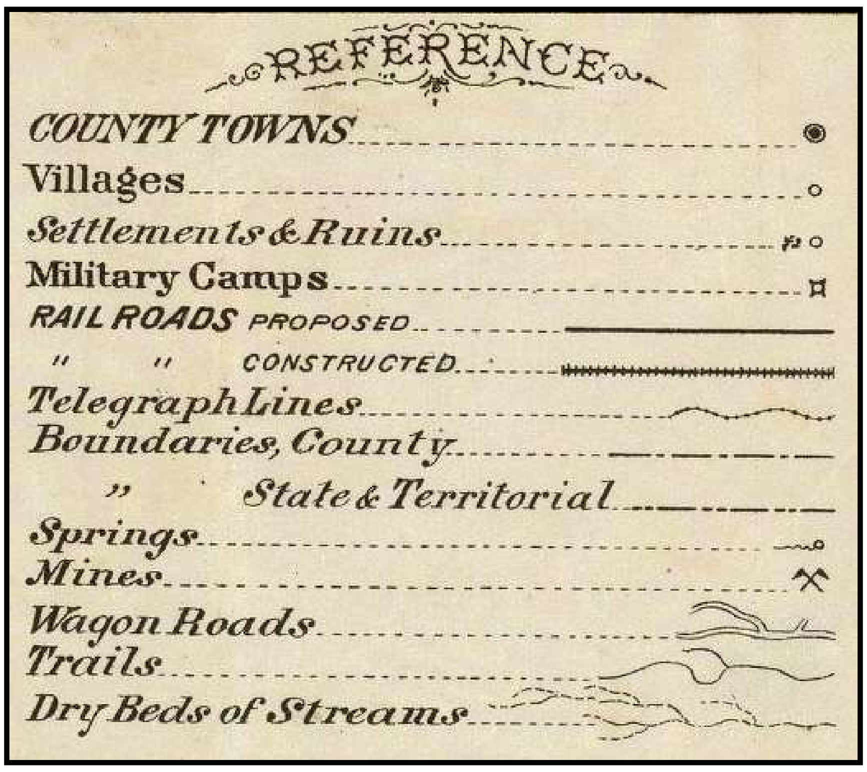
Base map: U.S. Army Corps of Engineers (1969).

<u>USGS Gaging Stations on the Upper Salt River</u>

a near Chrysotile
b near Roosevelt
c at Roosevelt

FIGURE 3A. TRANSPORTATION ROUTES CONNECTING TOWNS AND MILITARY POSTS ALONG AND NEAR THE SALT RIVER CIRCA 1876





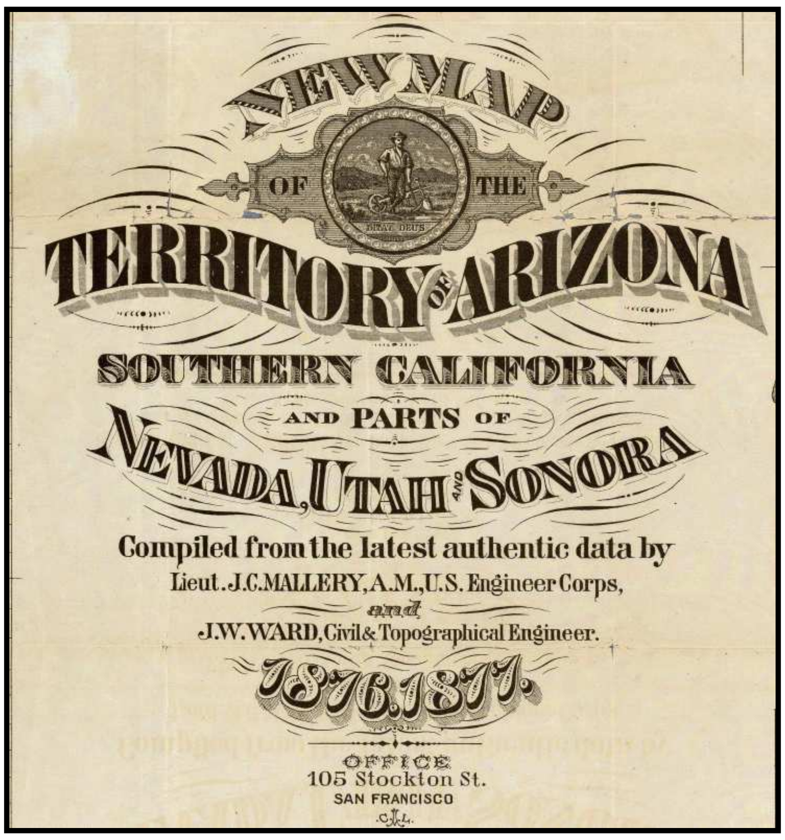
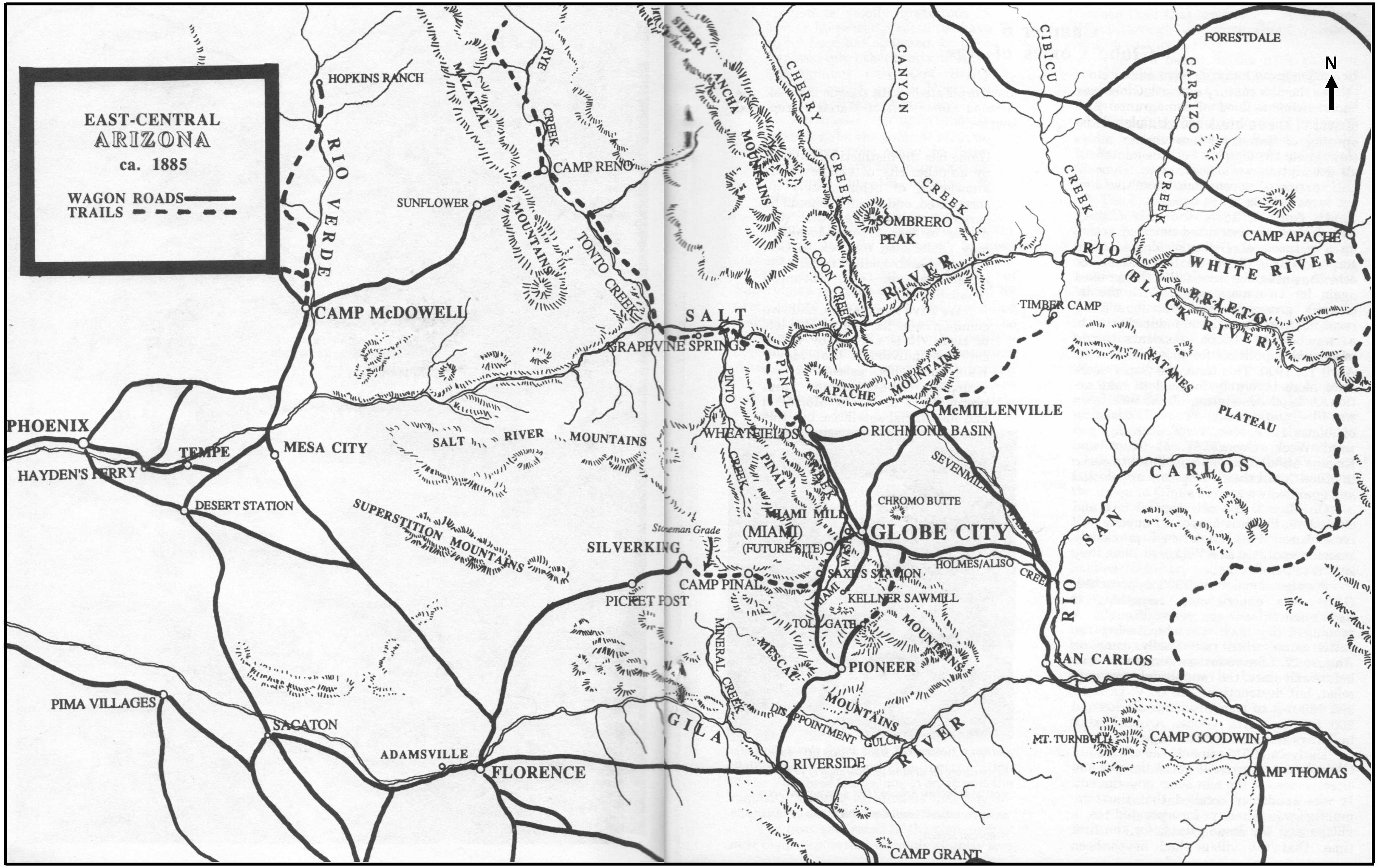


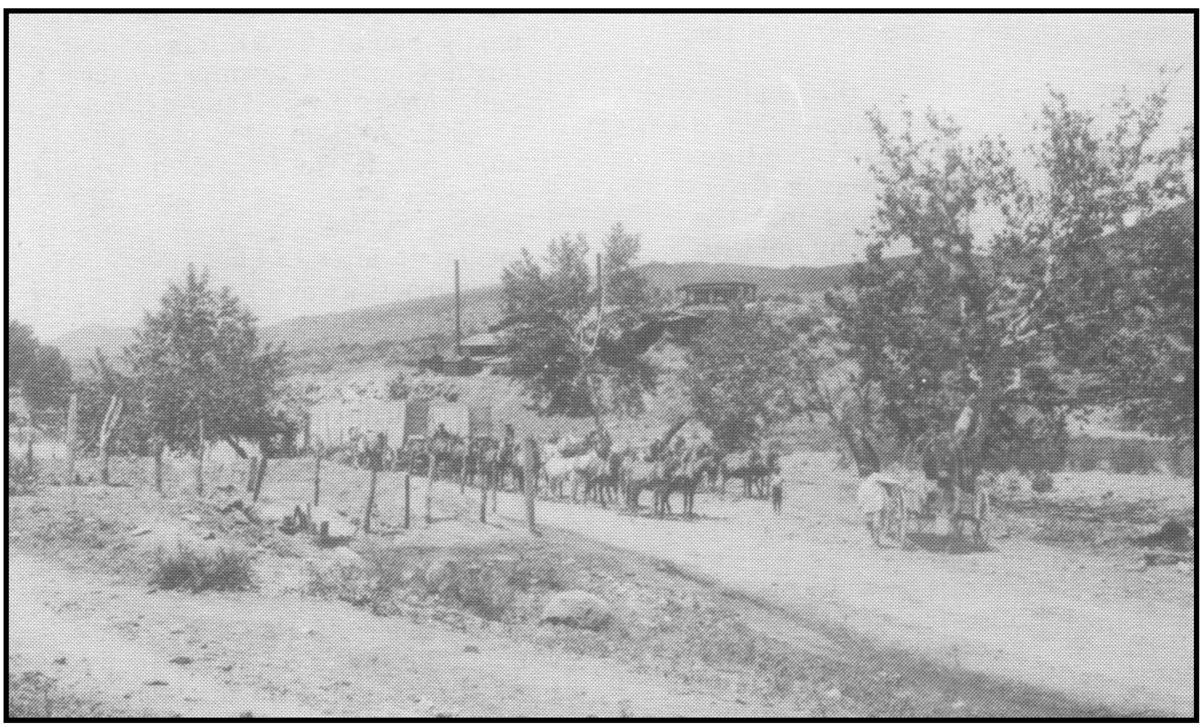
FIGURE 3B. TRANSPORTATION ROUTES CONNECTING TOWNS AND MILITARY POSTS ALONG AND NEAR THE SALT RIVER CIRCA 1885



Source: Bigando (1989, p.65a).

FIGURE 4. EARLY PHOTOGRAPHS SHOWING GOODS BEING HAULED TO GLOBE

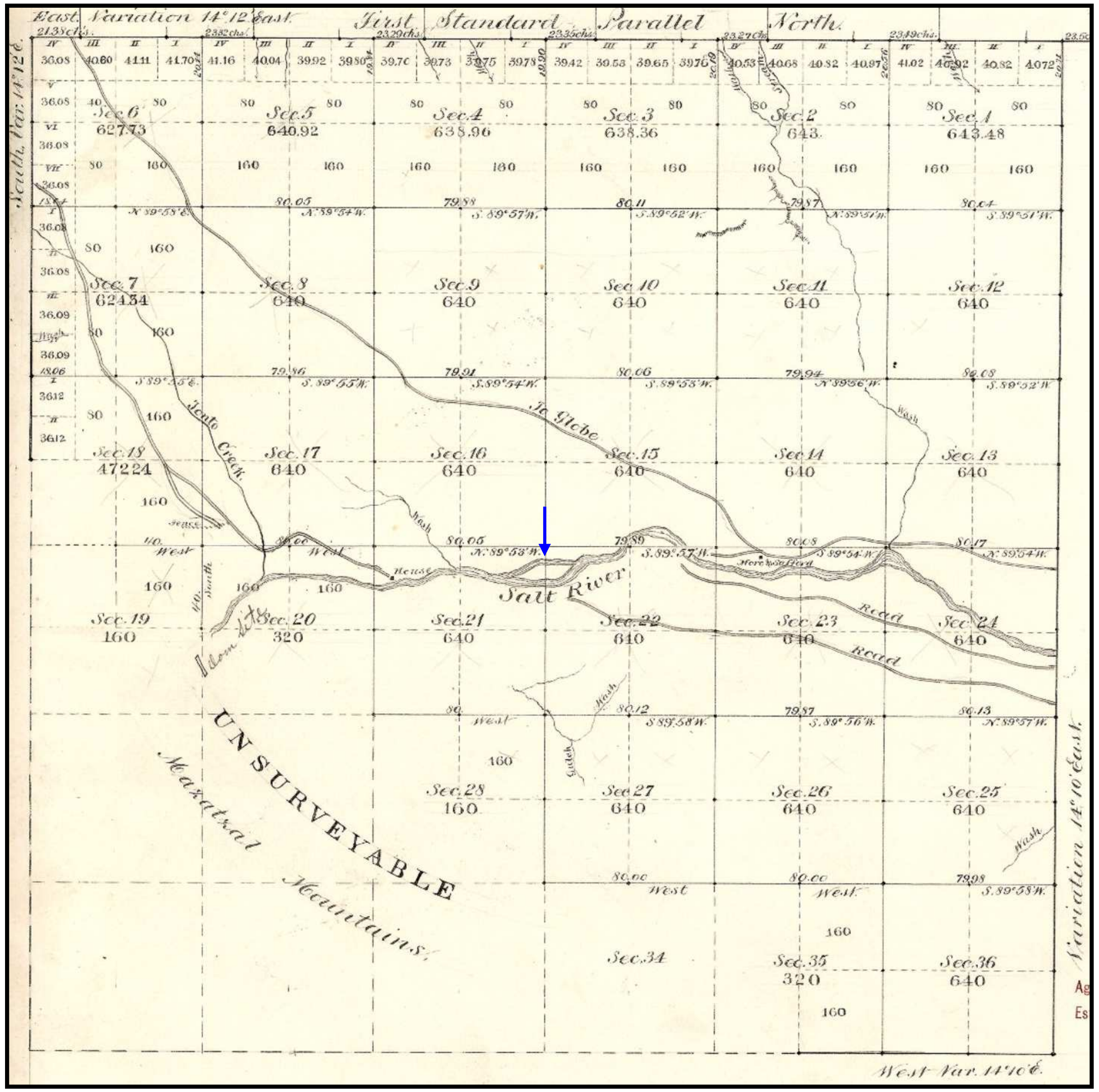
"Ox teams bring freight to Globe from Silver City, New Mexico, ca. 1877."



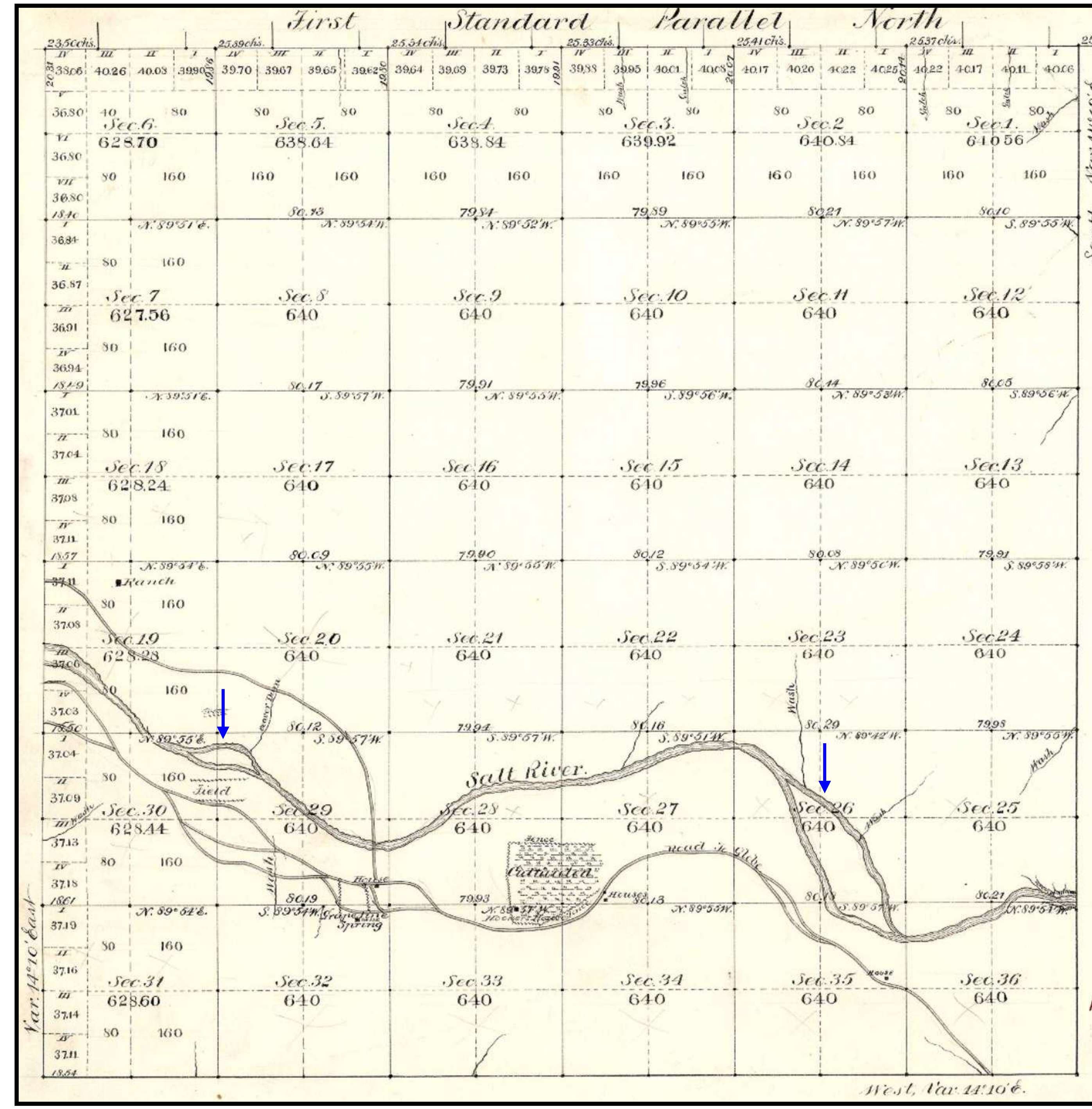
"Prior to the coming of the railroad, high sided wagons transported coke to the smelters of Globe and carried ore, bullion and concentrate on the return trip to the shipping point at Willcox."

Source: Bigando (1989, pp. 26 and 51).

FIGURE 5A. MULTI-THREAD CHANNELS MAPPED WITHIN SEGMENT 3 OF THE SALT RIVER DURING 1881



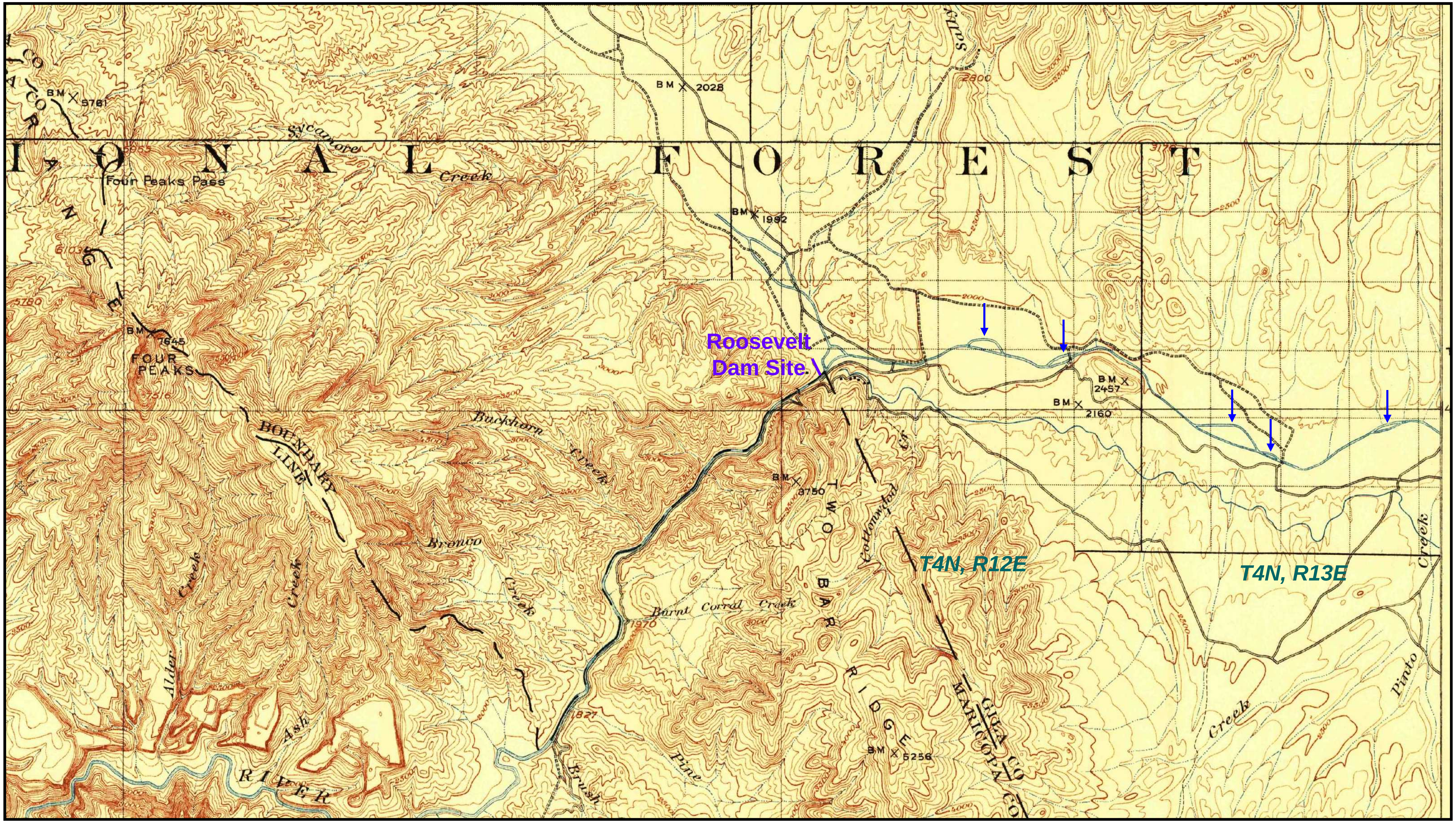
Township 4 North, Range 12 East



Township 4 North, Range 13 East

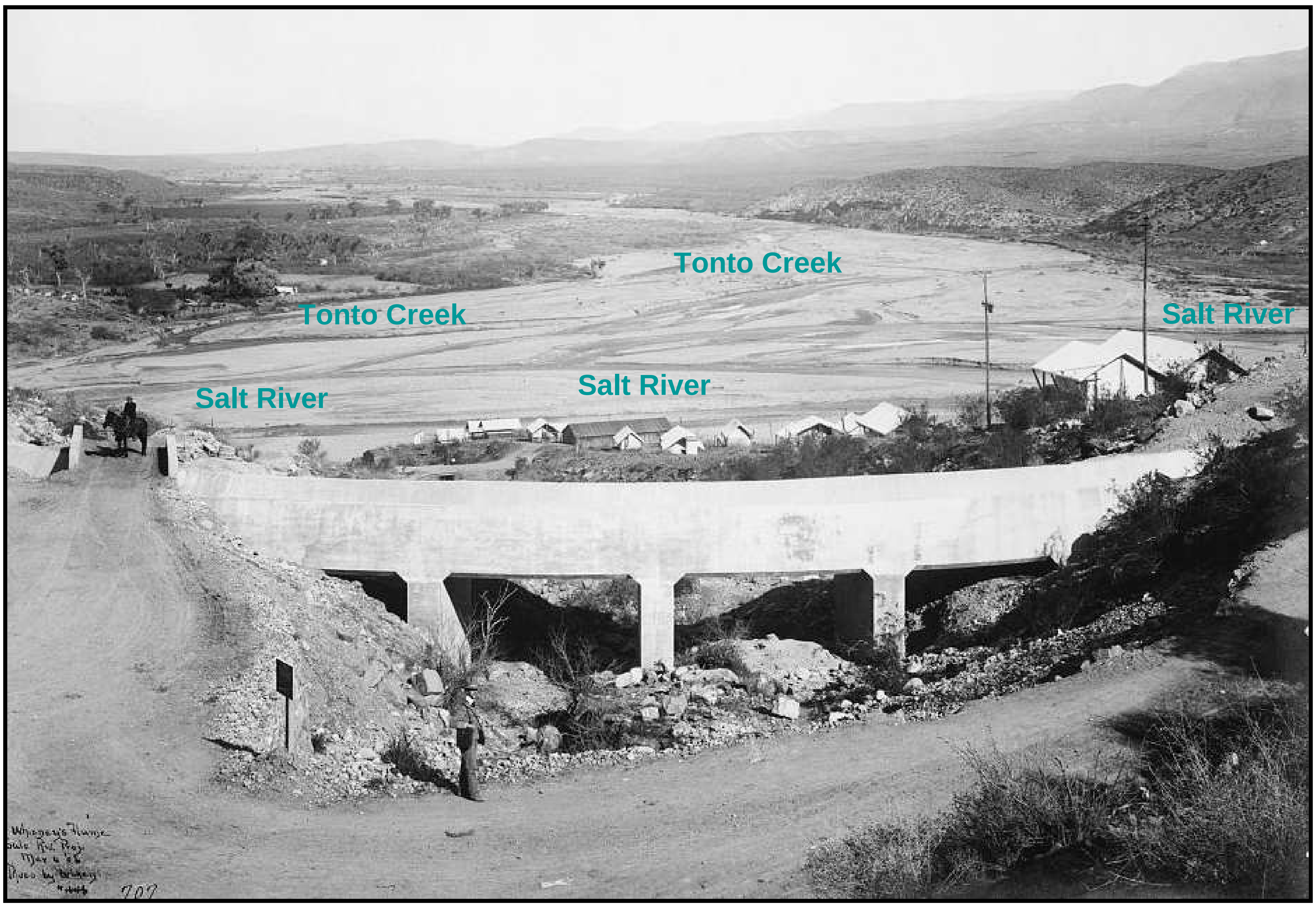
Source: GLO (1882a,b).

FIGURE 5B. MULTI-THREAD CHANNELS MAPPED WITHIN SEGMENT 3 OF THE SALT RIVER CIRCA 1905-1907

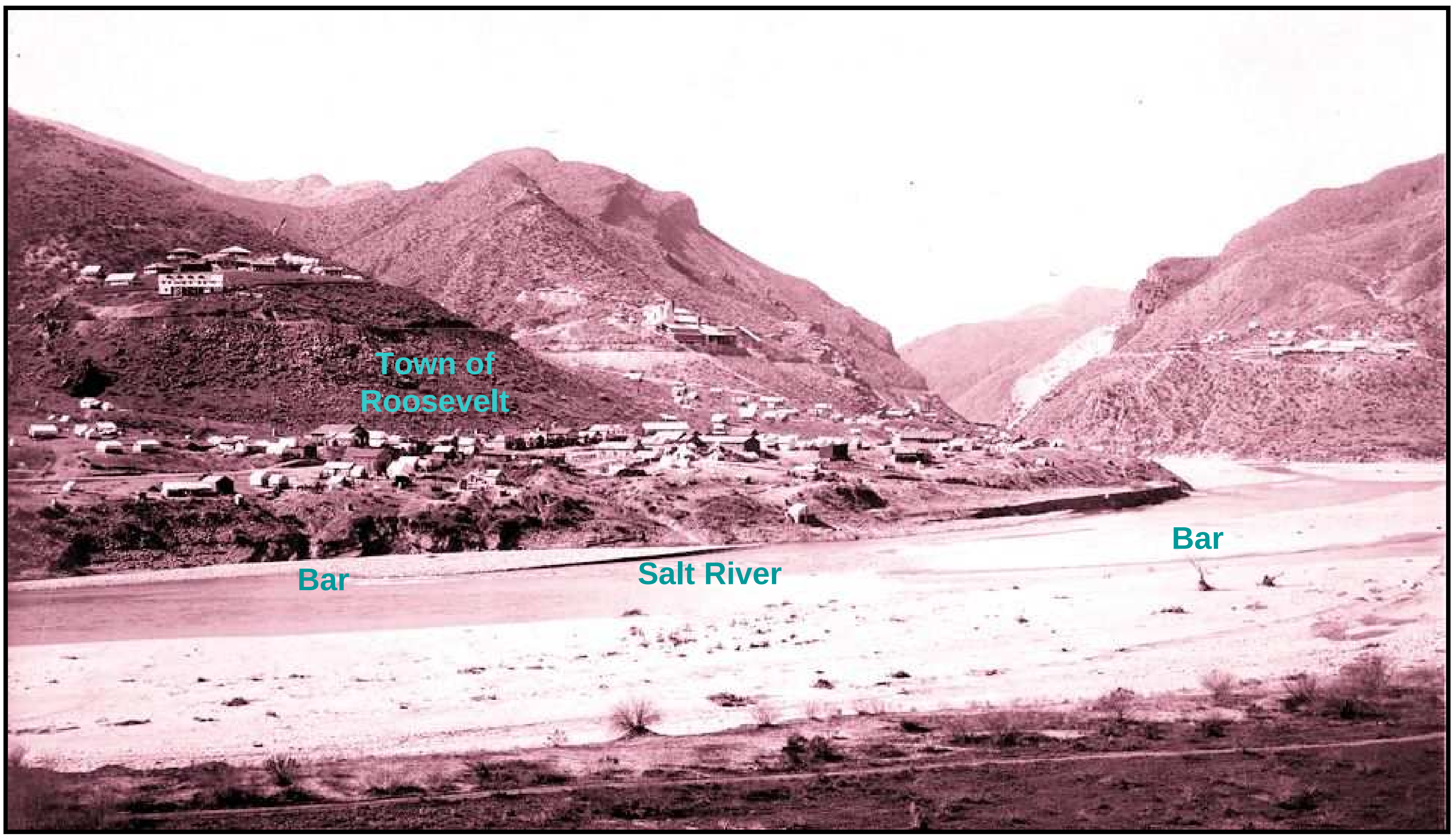


Source: USGS (1909).

FIGURE 5C. 1906 GROUND-LEVEL PHOTOGRAPHS OF BRAIDING ALONG THE SALT RIVER AT AND ABOVE THE TONTO CREEK CONFLUENCE



Northwest view of the confluence of Tonto Creek with the Salt River on March 3,1906 (mean daily flow of 1,730 cubic feet per second at USGS gage at Roosevelt)



Southwest view of the town of Roosevelt on March 6,1906 (mean daily flow of 1,570 cubic feet per second at USGS gage at Roosevelt)

Sources: Library of Congress (2014), USGS (2014a) and Zarbin (1984, p.127).

FIGURE 6. ANNUAL SALT RIVER DISCHARGE AT ROOSEVELT DAM RECONSTRUCTED FROM 1820 THROUGH 1960 USING TREE RINGS

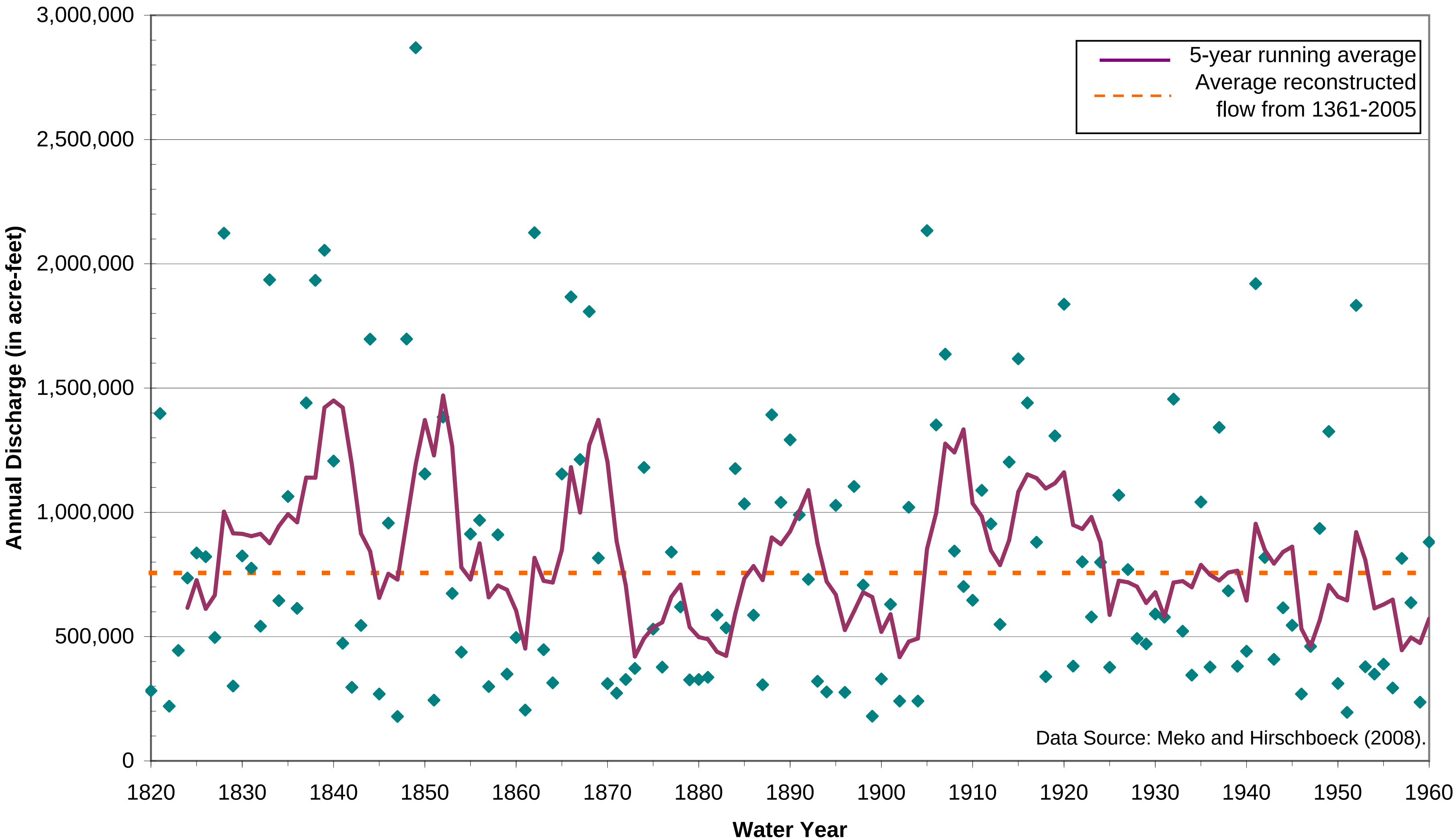
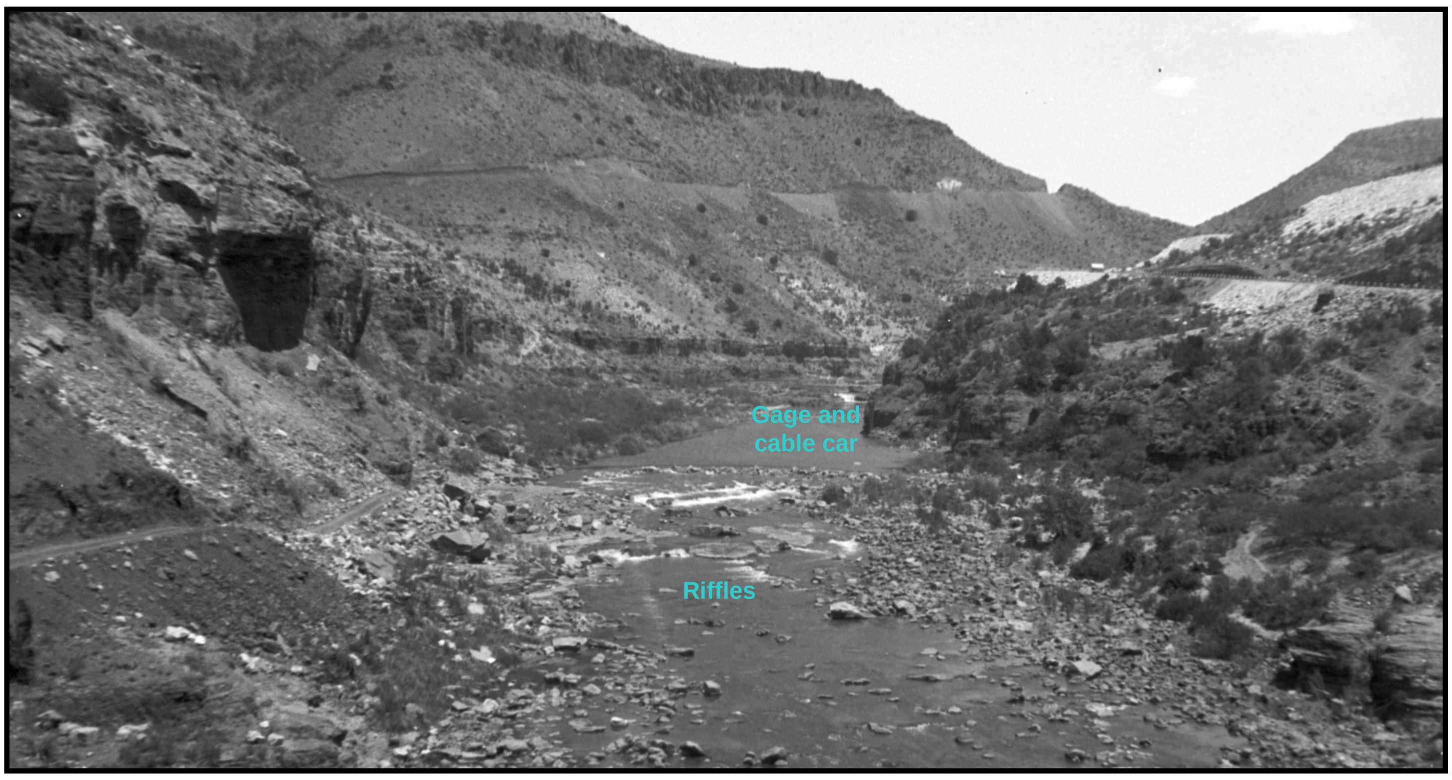
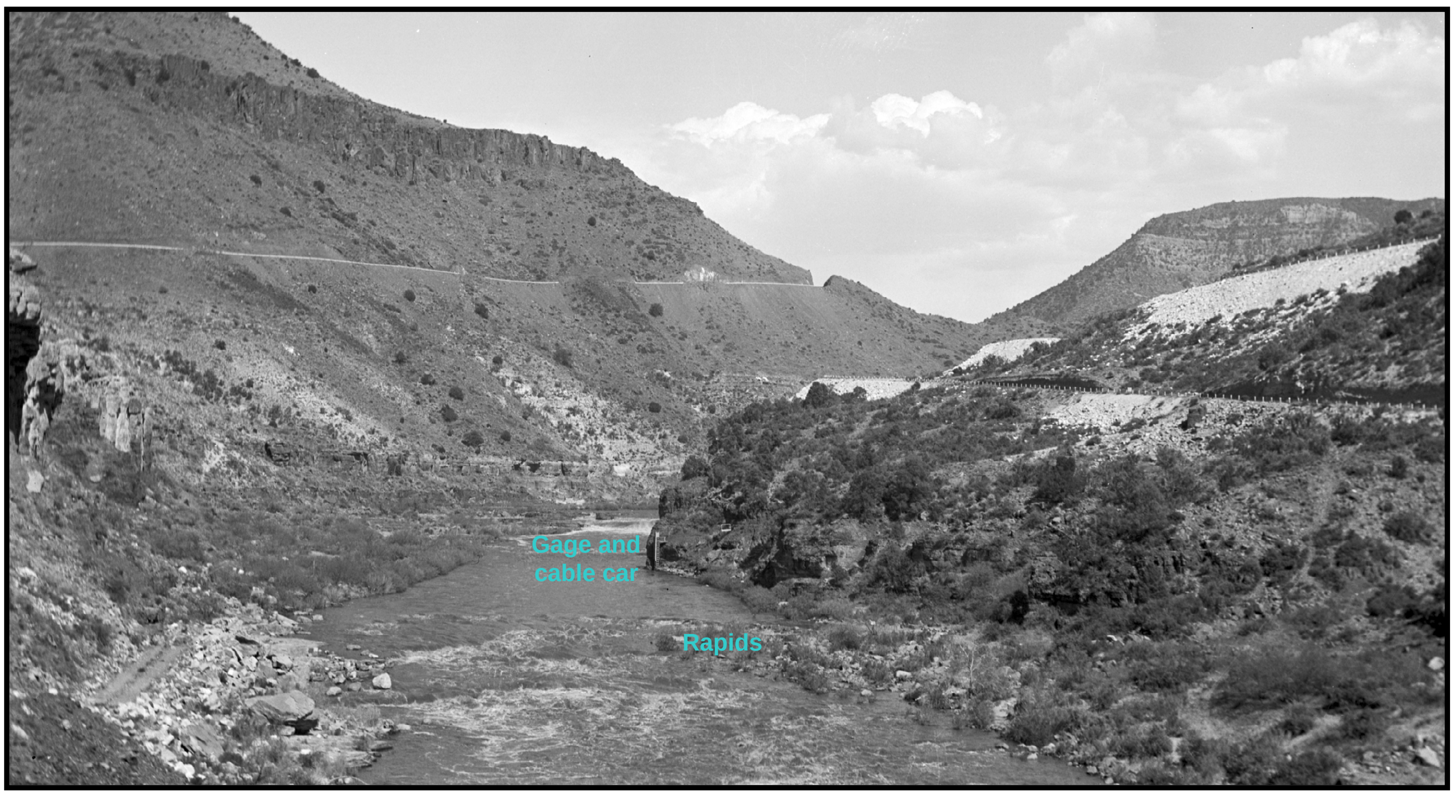


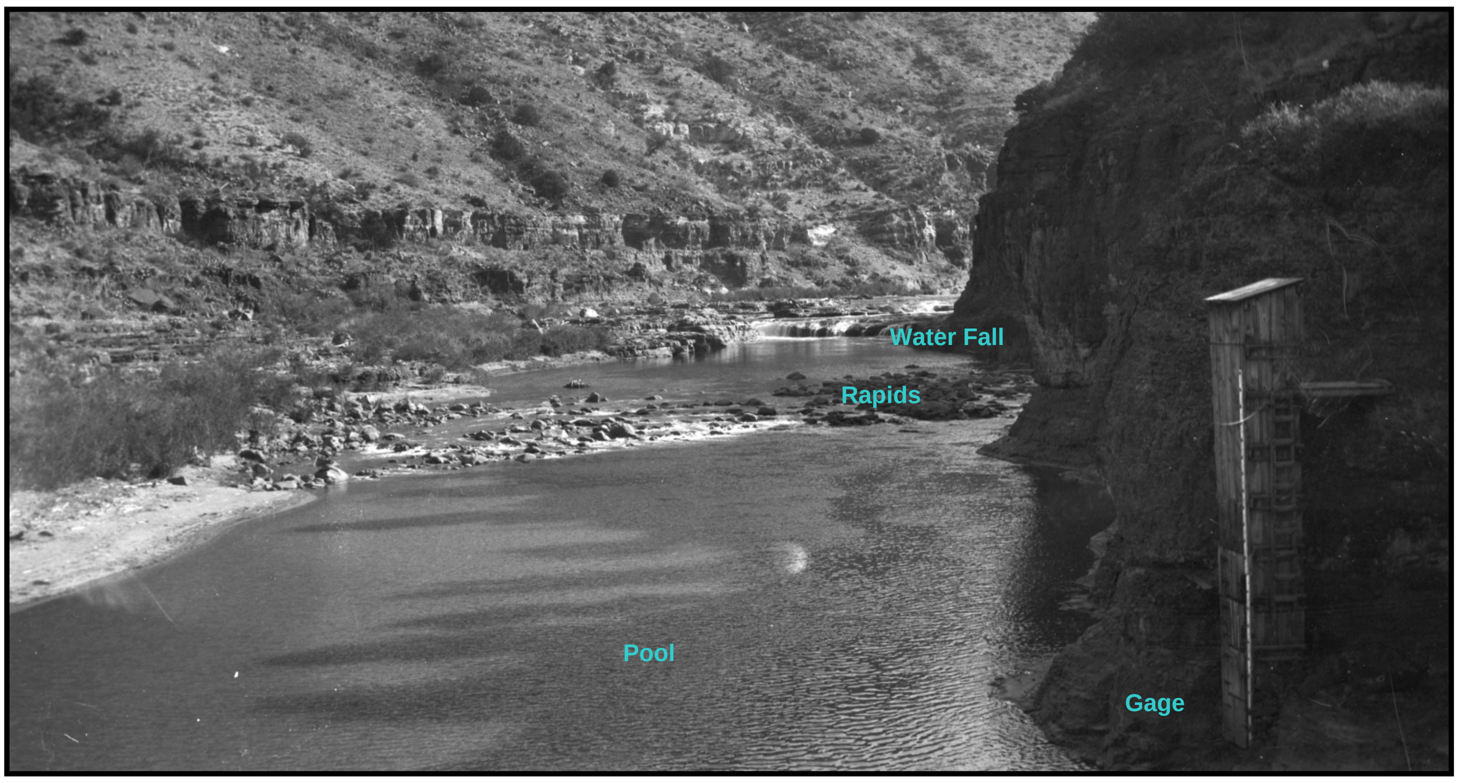
FIGURE 7A. PHOTOGRAPHS OF USGS SALT RIVER GAGE NEAR CHRYSOTILE



Upstream view on May 23, 1934 (mean daily flow of 153 cubic feet per second).



Upstream view on November 26, 1935 (mean daily flow of 277 cubic feet per second).



Upstream view circa 1930s.

Sources: USGS (2014a,b) and
Webb and others (2007, p.320).

FIGURE 7B. SALT RIVER DEPTH VS. DISCHARGE AT USGS GAGING STATION NEAR CHRYSOTILE (1985-2014)

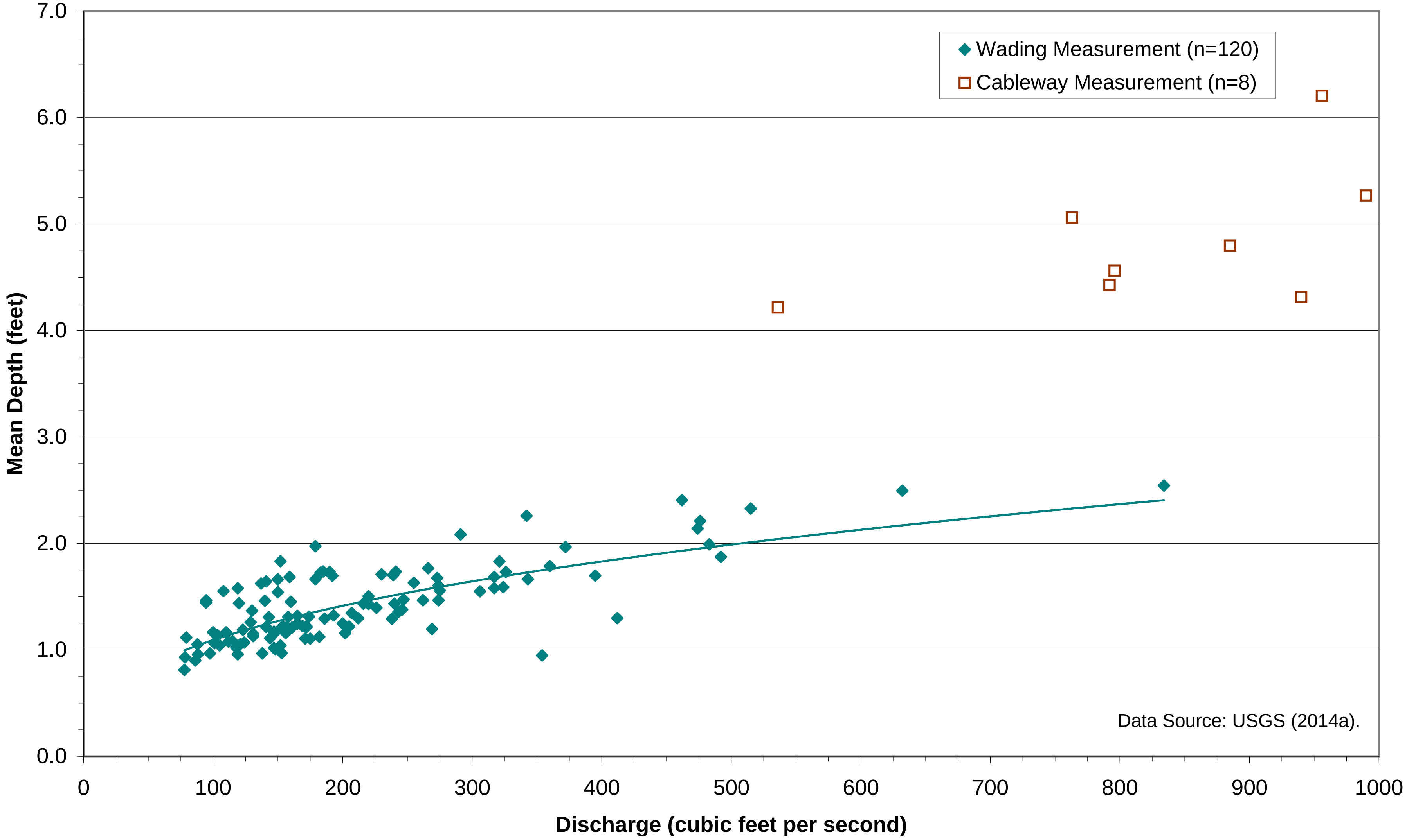
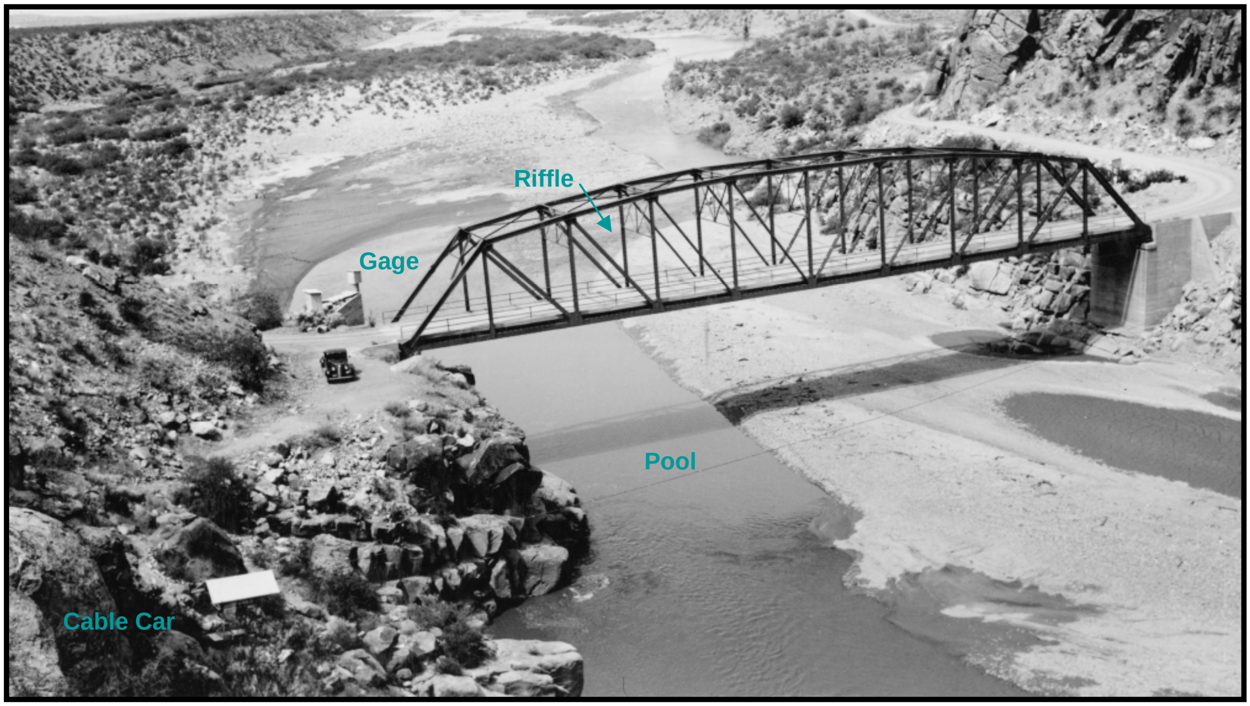
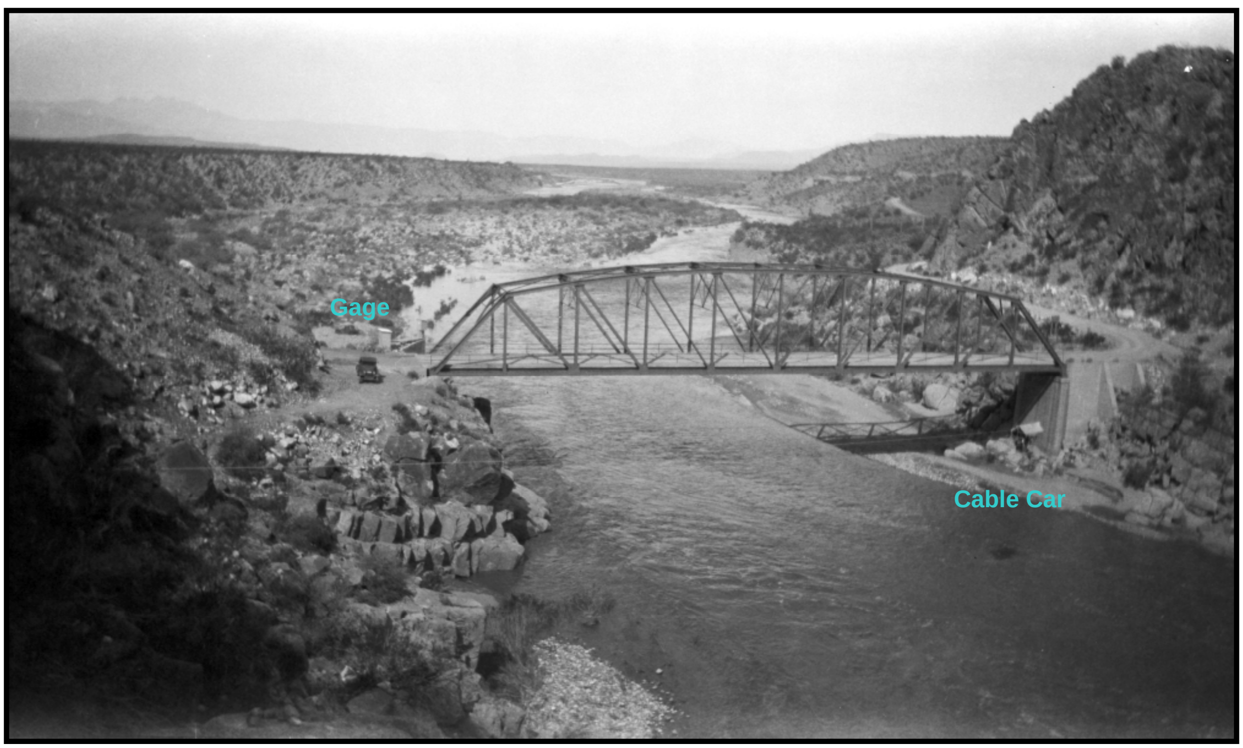


FIGURE 8. PHOTOGRAPHS OF USGS SALT RIVER GAGE NEAR ROOSEVELT



Downstream view on September 15, 1938 (mean daily flow at 308 cubic feet per second).



Downstream view circa 1930s.

Sources: USGS (2014a,b).

FIGURE 9A. 1898 GROUND-LEVEL PHOTOGRAPH SHOWING THE FUTURE LOCATION OF USGS SALT RIVER GAGE AT ROOSEVELT AND LATER ROOSEVELT DAM

Note: Gage located on left bank about 2,000 feet downstream from Tonto Creek confluence and operated from February 1901 to December 1907.

Sources: BOR (2009) and USGS (1947, p.400).

FIGURE 9B. SALT RIVER STAGE VS. DISCHARGE AT USGS GAGE AT ROOSEVELT (1902 and 1904)

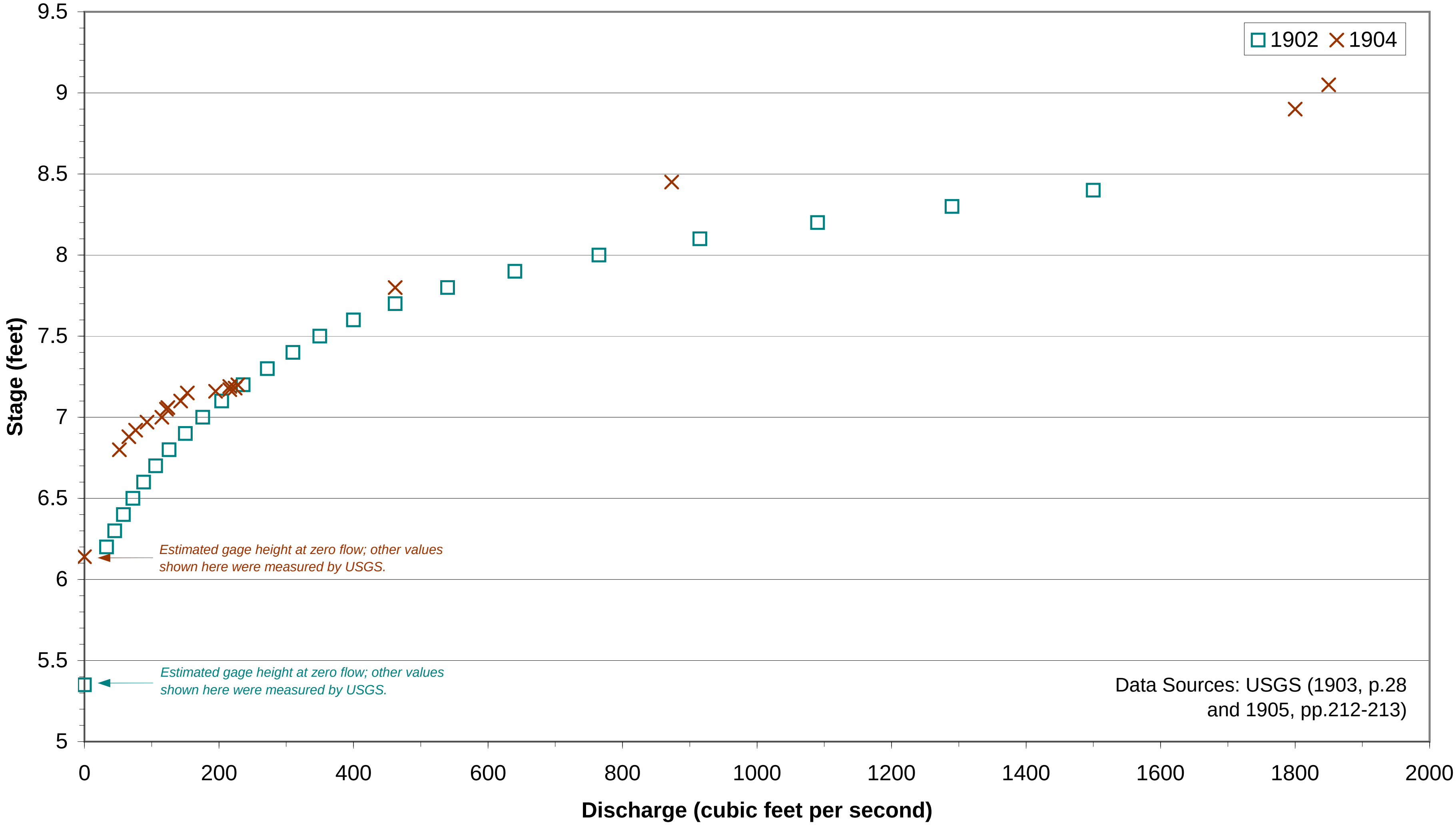


FIGURE 10A. CROSS-SECTION AT A SEGMENT 2 SALT RIVER RIFFLE MEASURED BY PLATEAU ON APRIL 7, 2015

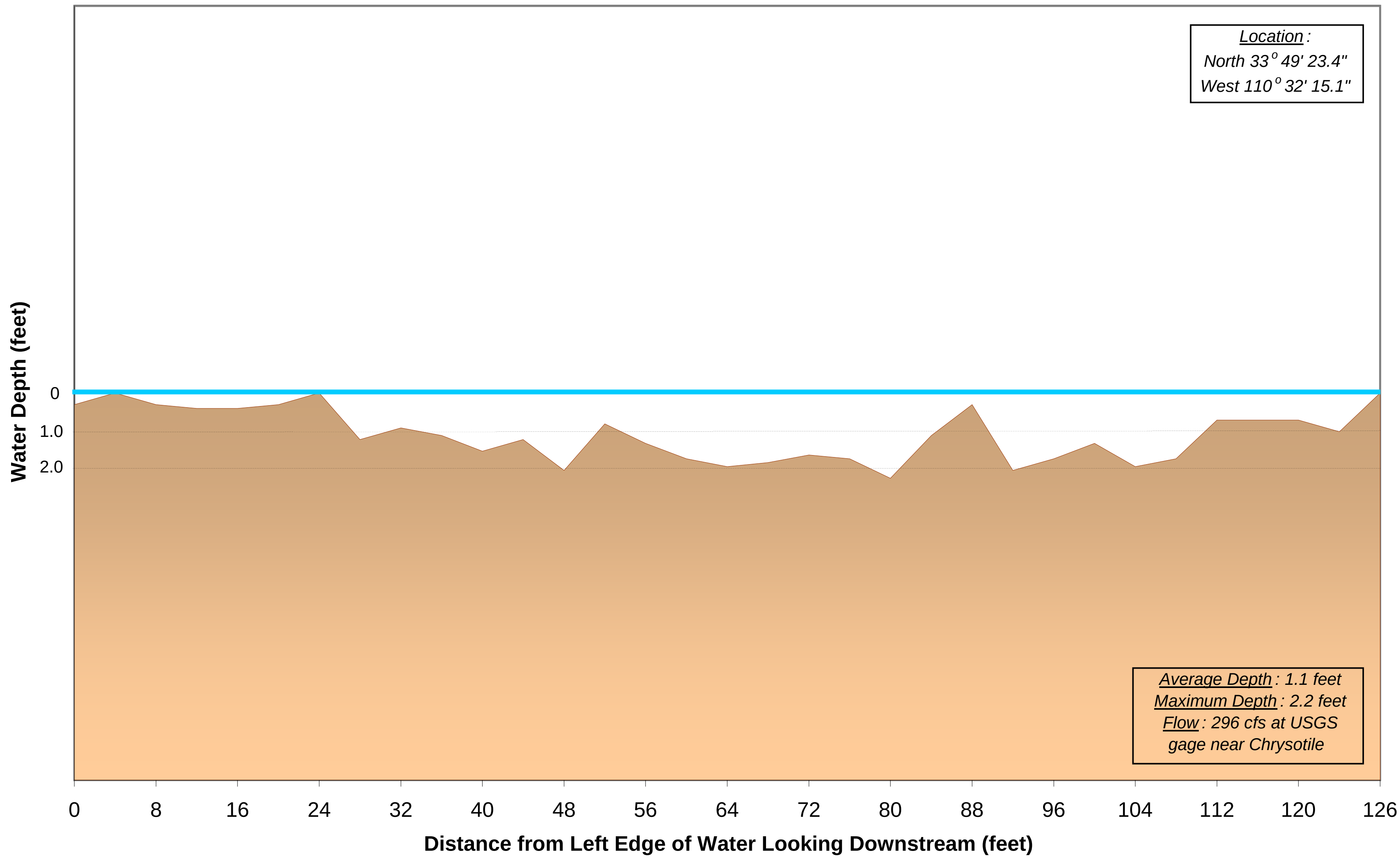
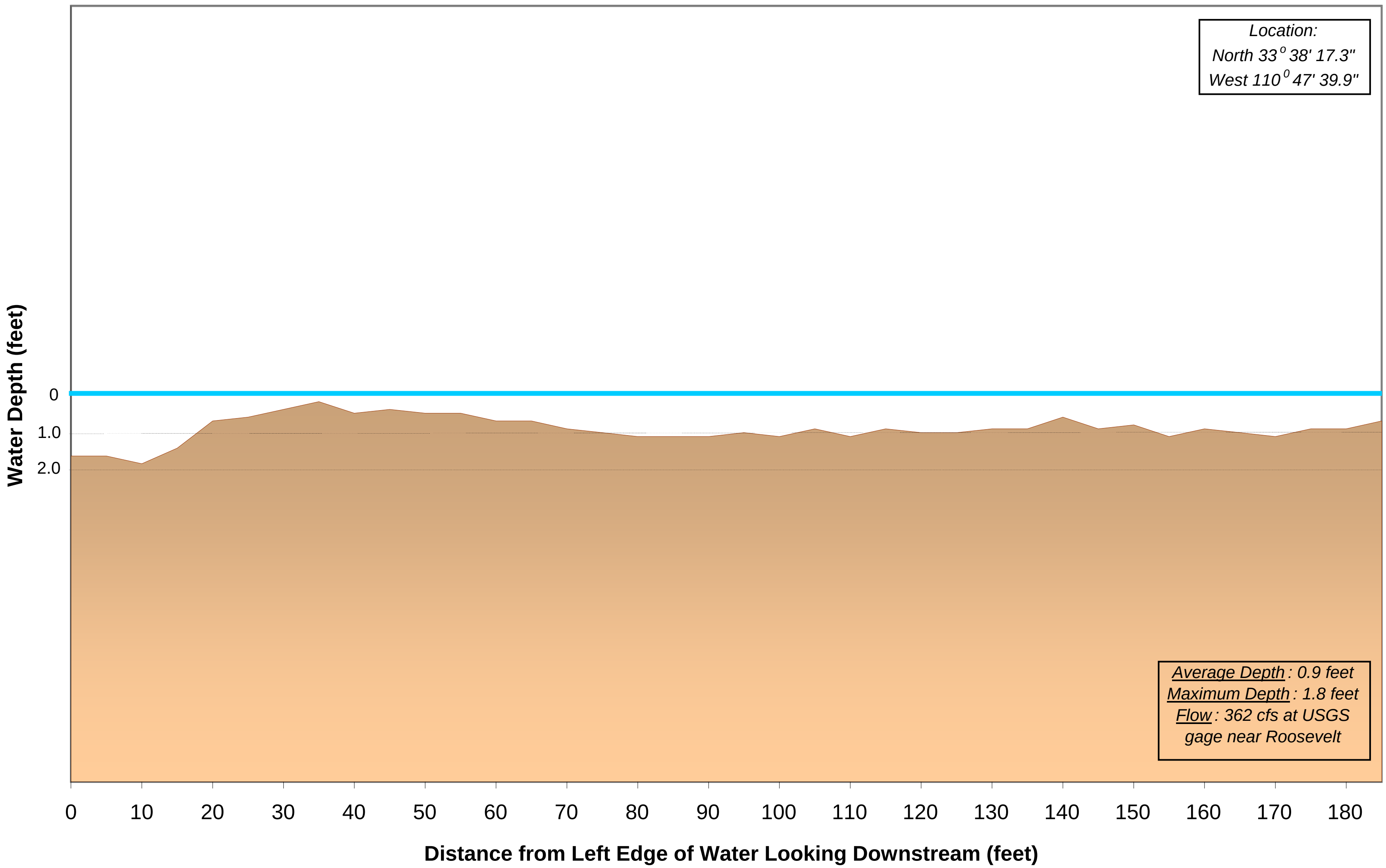


FIGURE 10B. CROSS-SECTION AT A SEGMENT 3 SALT RIVER RIFFLE MEASURED BY PLATEAU ON APRIL 7, 2015



ATTACHMENTS

ATTACHMENT A

Curriculum Vitae 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 / RECENT TRAINING

- Registered Geologist, Arizona (No. 33746)
- Water Well and Pump Performance (American Ground Water Trust, 2013)
- Mine Geochemistry , Hydrology and Water Treatment Workshops (EPA, 2013)
- Section 404 Permitting and Groundwater Plume Analysis Workshops (AHS, 2012)
- Stream Restoration Course (WMG, 2011)

SUMMARY

Mr. Burtell is an environmental scientist with 25 years of project and management experience. Areas of expertise include water rights and demand analyses; evaluation of ground and surface water resources; remote sensing; land ownership assessments; environmental compliance; investigation of mine, fuel and waste storage facilities; contaminant hydrology; and, collection and analysis of environmental data. 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)

July 2015

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

- 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
- SME (Maricopa Section)

RECENT PUBLICATIONS/REPORTS

- *Water Demand and Conservation Assessment for the Town of Camp Verde* (2014)
- *Unmetered Residential and Non-residential Well Use in the Sierra Vista Subwatershed* (2013)
- *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)
- *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)
- Exploration permit for the Idaho placer claim near Prescott Valley, AZ (various investors)
- Geochemical characterization of impacted waters and stormwater, and 404 permitting for the Zonia copper mine near Prescott, AZ (Redstone Resources Corporation)
- Ground-water resource evaluation for a proposed industrial minerals mine near Kirkland, AZ (confidential client)
- Hydrogeologic and well permitting support for reclamation of the St. Anthony uranium mine, NM (Pueblo of Laguna)
- Litigation of Bonita Creek water rights issues near Payson, AZ (various plaintiffs)
- Navigability assessment of major intrastate streams, AZ (Freeport Minerals Corporation)
- Review of federal reserved right claims for Aravaipa Canyon Wilderness Area, AZ (Freeport Minerals Corporation)
- 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

- Water rights analyses, AZ (confidential client)
- Water rights analysis for a proposed placer mine along the Agua Fria River, 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 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)
- Well use evaluation for communities in the Verde Valley, AZ (Western Resource Advocates)

ATTACHMENT B

Early Post Offices Located along or near the Upper Salt River

WILL C. BARNES'

ARIZONA PLACE NAMES

Revised and enlarged by

BYRD H. GRANGER

Illustrated by

ANNE MERRIMAN PECK

To Bee Kalish with affection and best wishes
Anne Merriman Peck

THE UNIVERSITY OF ARIZONA PRESS

TUCSON

1960

ALISO CREEK

El.: c. 2500′ Loc.: Gila 2, CA-8.2
Pro.: /alíyso/ Spanish: "alder tree"

Descriptive. This name was in use at least as early as 1864. On the San Carlos Indian Reservation map Aliso Creek shows as a small tributary to Gilson Creek, but on the Gila County map and one forest map (B-7) it shows as a larger creek but not labelled. The name Gilson appears only on one map.

Ref.: *Arizona Miner,* May 11, 1864, 3:3. Maps: C-12; C-14; B-7; E-18; C-4.

AMSTER Loc.: Northeast of Globe a short distance.

N. L. Amster was president of the Shannon Copper Company.

Ref.: 102, p. 10. Map: None.

ANCHA, SIERRA

El.: c. 5000′ Loc.: Gila 1, CH-4-8
Pro.: /siyérənčə/ Spanish: "broad mountain"

The name of these mountains is derived from the fact that their base is not cut by canyons. This gives the range a broad quality before it separates into peaks which include McFadden, Baker, Aztec, Center, and McFadden Horse Mountain. The Mohaves called the mountains *Ewee-Tha-Quaw-Ai,* meaning "Wide Ranges of Rocks." These mountains concealed camps for many bands of Apaches. The fact that the mountains harbored many Indians is reflected in the great number of skirmishes recorded in official army records, the first occurring in 1864 and the last in 1875.

Ref.: 85, p. 692; Woody; 52, III, 304; 85, pp. 441, 447; *Weekly Arizona Miner,* August 13, 1864 (State Library Files). Maps: GD-2; GD-9; GD-17; C-2; E-20.

a.n. **Sierra Ancha Experimental Forest**
Maps: GD-6, GD-14 Gila

Sierra Ancha Forest Reserve Maps: GD-6, GD-14 Gila
In 1900 it was recommended that this reserve be established.

Ref.: 55, p. 729.

Sierra Ancha Mines Map: B-7 Gila
The white spots visible on the sides of the Sierra Ancha are not snow but evidences of the asbestos mine located in the mountains. The gradual accumulation of dust on the ore dump is slowly changing color so that it no longer looks as white as snow.

Ref.: 4, p. 365; Woody.

ANGORA

El.: c. 6000′ Loc.: Gila 1, C-1

John F. Holder, first and only postmaster at this place, had angora goats.

P.O. est. June 25, 1900. John F. Holder, p.m. Discont. February 5, 1908.

Ref.: Barnes. Map: C-10.

APACHE PEAKS

El.: c. 4500′ Loc.: Gila 1, H-9
Pro.: /əpǽči/

At one time Apaches roamed through what were known as the Apache Mountains, where at least two skirmishes with troops occurred in 1870 and 1871. The name no longer applies to the mountains, but only to the four peaks which are grouped closely together.

Ref.: 85, pp. 435, 436; Barnes. Maps: C-12; B-7.

a.n.
Many place names use the word "Apache." A few are given below.

Apache Canyon	Map: GB-23	Graham
Apache Spring	Map: GB-23	Graham
Apache Peak	Map: GK-30	Pinal

APACHE TRAIL

El. c. 4000′ Loc.: Gila 1, EH-8.5-12
Pro. /əpǽči/ Maricopa 2, EI-5-6

The Apache Trail was late-born. When the trail finally developed, it followed Tonto Trail, referred to at times as the Yavapai Trail because members of the latter tribe lived along the north Tonto Creek which the trail followed.

The first part of the later automobile highway was built in connection with the construction of Roosevelt Dam in 1905, when the Reclamation Service cleared a road from Mesa to connect with the settlement of Roosevelt at the dam. The road was carved along the sides of mountains, through canyons, and over plateaus by Apaches under the direction of Louis C. Hill, supervising engineer. The Apache Trail Stage Company was incorporated on October 8, 1914. It was this stage line which hauled passengers who disembarked at Globe from the railroad, to Phoenix where they again boarded the train. The company did its best to make the trip as entertaining as possible. In many instances this included putting up numerous road signs bearing place names with fabulously interesting and entirely inaccurate stories. Stage passengers were enthralled by the tall tales of the Wild West, told by the drivers. The charter for the stage company expired on October 8, 1939.

The Apache Trail is one of the most beautiful in Arizona.

Ref.: Woody; 112, p. 218; State Library Archives. Map: A-13.

ARMER

El.: c. 4000′ Loc.: Gila 1, F-8

Pioneer cattlemen, the Armer family conducted the post office at Armer.

P.O. est. March 12, 1884. Lucinda Armer, p.m. Discont. May 13, 1895.

Ref.: Barnes; P.O. Records. Map: C-6.

a.n. **Armer Gulch**	Map: B-7	Gila
Armer Mountain	Map: B-7	Gila
Armer Wash	Loc.: Same as Armer Gulch	Gila
Armer and Tanner Winter Camp	Map: B-7	Gila

ARRASTRA GULCH

El.: c. 4000′ Loc.: Gila 1, C-2
Pro.: /arǽstrə/ or /ərǽstrə/ Spanish: "drag-stone mill"

Early miners in Arizona ground their ores by means of what was known as an *arrastra.* An *arrastra* was constructed by making a circular pit into which the ore was dumped. It was then ground by means of a large rock, usually fairly flat, to which was attached a stout limb from a mesquite or

CAPITAN, EL

El.: c. 4000′ Loc.: Gila 1, G-13.9

Pro.: /el kæpitæn/ Spanish: "the captain"

El Capitan was a mine which had a post office. The mine may have been named for the commanding peak known as El Capitan Mountain.

P.O. est. December 5, 1919. Frankie Wood, p.m. Discont. September 15, 1924.

Ref.: Barnes; P.O. Records. Maps: A-7; GD-13.

a.n. **Capitan Canyon, El** Map: GD-13 Gila

Capitan Mountain, El El.: 6564′. Map: GD-13 Gila

v.n. **Capitan Peak** Map: C-11

a.n. **Capitano Creek** Map: C-7 Gila

Capitan Pass Loc.: Just off Highway 77 at peak Gila

Capitan Pass Spring Map: GD-10 Gila

CARR PEAK

El.: 7604′ Loc.: Gila 1, G-7

Carr Peak took its name from the Carr Ranch.

Ref.: Woody. Maps: GD-6; A-7.

a.n. **Carr Mountain** El.: 7619′. Map: GD-6 Gila

Carr Mountain is west of Carr Peak and is also on the old Carr Ranch.

CASSADORE MESA

El.: c. 4000′ Loc.: Gila 2, A-7.5

Pro.: /kæsədor/

Cassadore was a sub-chieftain of the San Carlos Apaches. He lived in this area during the height of the Apache troubles in 1873. Troops were sent to capture Cassadore with orders to "take no prisoners." Cassadore and his band fled, only to be overtaken in the hills by the troops. The Indians of their own free will came to the army camp and surrendered with the explanation that white people had been killed, not by Cassadore's band, but by some "bad Indians." When the Indians told Capt. J. M. Hamilton that their food was gone, their moccasins so worn out that their feet were leaving blood on the rocks, and that they preferred to die by bullets rather than by hunger, the army man fed them and sent word to headquarters of their plight. The order to kill them was rescinded and the surrender of Cassadore's band was accepted on February 18, 1874. The Indians were taken back to their homes by the troops and left there.

The use of the name "Cazadero" does not seem warranted, inasmuch as there are today among the Apaches descendants bearing the Cassadore family name.

Ref.: Jennings; Woody; 4, pp. 446-447; Barnes. Map: B-7.

a.n. **Cassadore Creek** Loc.: Twelve miles n. San Carlos Gila

Cassadore Springs Loc.: Same as Creek Gila

Cassadore Mountain Loc.: T. 19 E., R. 2 N Gila

Cazador Map: GB-17 Cochise

A siding on the railroad.

CATALPA

El.: c. 2500′ Loc.: Gila 1, G-8.8

A man named Peter Robertson in 1877 brought the first sheep into the Little Salt River Valley (now under Roosevelt Lake). His location shows on the Smith Map of 1879 as "The Grove of Robinson." The name "Catalpa" was given to the post office because of the many catalpa trees in the Little Salt River Valley.

P.O. est. December 4, 1885. Peter C. Robertson, p.m. Discont. October 17, 1888.

Ref.: Woody; Barnes. Maps: B-7; C-6; E-20 (Grove of Robinson).

CATHOLIC PEAK

El.: c. 6000′ Loc.: Gila 1, A-4

The resemblance of this peak to a huge cross led to the application of the name.

Ref.: Barnes. Maps: B-7; C-12.

CENTER MOUNTAIN

El.: 6789′ Loc.: Gila 1, G-6.4

The position of this mountain in the Sierra Ancha midway between McFadden Horse Mountain and Baker Mountain led to naming it Center Mountain.

Ref.: Barnes. Maps: B-7; GD-6.

CHERRY CREEK

El.: c. 4000′ Loc.: Gila 1, GH-9.4

Wild cherry trees account for the name of this creek. The canyon through which the creek runs boxes for about ten miles above its confluence with the Salt River and in this stretch there are extensive cliff ruins.

Ref.: Barnes; Woody. Maps: C-4; E-18; E-20; GD-6; GD-11; GD-14.

a.n. **Cherry Flat Recreational Area** Map: GD-10 Gila

This recreational area in the Pinal Mountains was opened for citizens of Miami.

Cherry Springs Maps: GD-5; GD-2 Gila

CHILITO

El.: 4000′ Loc.: Gila 1, H-15.5

Pro.: /čiylíyto/ Spanish: "little pepper"

The London-Arizona Mining Company had its headquarters at this place. According to one source, the Mexicans called the first postmaster "Chilito" because of his fiery temper, and from this came the name of the post office.

P.O. est. June 11, 1913. George B. Chittenden, p.m. Discont. July 15, 1918.

Ref.: George Ketenbach (Patterson Notes). Map: C-12.

CHIRICAHUA BUTTES

El.: c. 7000′ Loc.: Gila 2, EF-5.9

Pro.: /čiyriykáwə/ Apache: *tsil*, "mountain"; *kawa*, "great"

Apaches of the Chiricahua band are said to have lived in this area.

Ref.: Barnes. Map: D-9.

CHRISTMAS

El.: 2990′ Loc.: Gila 2, A-11.6

The rich copper mines at this location were first discovered in the early 1880's by three prospectors, one of whom was Dr. James Douglas. However, the original locators were unable to maintain their claim because the land lay within the San Carlos Indian Reservation.

Several years later, George B. Chittenden (See Chilito) became interested in the property. He succeeded in having Congress pass a bill which changed the lines of the reservation, thus opening the property to re-location. Chittenden arranged that he would receive news of the passage of the bill via telegraph to Casa Grande and then by messengers riding on horseback in relay. The news came to his hands on Christmas Day, 1902, his birthday. Wasting no time, he rode immediately to locate the property, naming it Christmas.

For several years the mine was inactive, but by 1956 it had re-opened and developmental work was in progress.

P.O. est. June 17, 1905. William W. Swingle, p.m. Discont. March 30, 1935.

Ref.: Woody; Barnes; State Library Files, Unidentified clipping; 4, p. 346. Maps: A-7; C-10; GK-6.

CHRISTOPHER CREEK

El.: c. 6000′ Loc.: Gila 1, F-1.3

Isadore Christopher located his CI ranch on the creek which bears his name.

In July 1882, Christopher killed a bear, skinned it, and hung the skin in one of his cabins. The next day, while Christopher was away, the Apaches came along and burned his two log houses. The next visitors were troops which arrived while the cabins were still burning. The story spread that the soldiers solemnly buried the remains of the bear, thinking the Apaches had skinned "poor old Christopher."

Ref.: Barnes; Woody; Croxen. Maps: B-7; C-13; GD-12.

a.n. Christopher Mountain Map: GD-12 Gila

CHROMO BUTTE

El.: c. 4000′ Loc.: Gila 2, A-7

The use of the word *chromo* is descriptive.

Ref.: Woody. Maps: B-7; C-12.

CHRYSOTILE

El.: 4600′ Loc.: Gila 2, B-4

Pro.: /krisotayl/

Chrysotile, or asbestos as it is more commonly called, is mined at this location, hence the name. Chrysotile is unique in that it is the only asbestos in the United States which is white, a fact attributed to its being iron-free.

The asbestos mines at Chrysotile were found by Tom West in October 1911. They were finally sold to the Johns-Manville Company, which at first refused to purchase the property because the company's customers were used to the brown asbestos from Canadian mines and would not buy white asbestos.

Some confusion has arisen concerning the spelling of the name Chrysotile, which is occasionally misspelled "Chrysolite." Chrysolite, however, is a magnesium iron silicate, not an asbestos. One variety of chrysolite is an olive green stone used as a semi-precious gem called peridot. Peridot stones are found near Peridot (*q.v.*).

P.O. est. June 27, 1916. Nels A. Nelson, p.m. Discont. July 15, 1933.

Ref.: Woody; P.O. Records. Maps: A-7; C-12.

CITY CREEK

El.: c. 4000′ Loc.: Gila 1, C-2

In the late 1870's, Mormons had a colony called Mazatzal City on the Verde River at its juncture with this creek. When the Mormons moved to Pine (*q.v.*) c. 1882, the creek retained the name City Creek.

Ref.: Croxen; Barnes. Maps: B-7; GD-9.

CLAYPOOL

El.: c. 4000′ Loc.: Gila 1, H-11.5

The settlement at Claypool was developed by Senator W. D. Claypool (d. 1956) and his brother-in-law, George Wilson.

P.O. est. July 21, 1917. Frank E. Hall, p.m.

Ref.: Barnes. Maps: A-7; C-12.

CLINE

El.: 2192′ Loc.: Gila 1, D-7

Christian Cline settled here c. 1876 and ran cattle. The name Cline is a common one in the area today; his sons, grandsons, and great grandsons have populated the area, but the original settlement has disappeared.

P.O. est. January 11, 1886. Thomas J. Cline, p.m. Discont. August 15, 1912.

Ref.: Woody. Maps: C-8; GD-15.

a.n. Cline Creek Map: GD-15 Gila

Cline Mesa Map: GD-2 Gila

COLCORD MOUNTAIN

El.: 7690′ Loc.: Gila 1, H-2

Pro.: /kálkerd/

William C. Colcord with his brother Harvey and their mother arrived in 1886 and established a ranch under the Mogollon Rim (*q.v.* Coconino). Later they moved to Colcord Canyon. The name was applied to the mountain by the Forestry Service.

Ref.: Mrs. William C. Colcord. Map: B-7.

CONLEY POINTS

El.: c. 4000′ Loc.: Gila 1, C-1.2

In the early 1880's, the Conley family settled near these small peaks. An Indian woman once filed a homestead claim on the same flat, which led to the name "Indian Delia's Place," long since changed to Conley Points.

Ref.: Barnes. Map: B-7.

COOLIDGE DAM

El.: c. 2500′ Loc.: Gila 2, B-10.5

One of several important and interesting dams in Arizona, Coolidge is unique in that it was the first and largest egg-shaped, multiple-dome dam ever built. The top of the dam lies 259 feet above bedrock.

One of the delays encountered in constructing the dam was opposition by Apache Indians, who objected strenuously to the disinterment of bodies lying in the Apache graveyard

EAST VERDE RIVER

El.: c. 4000′ Loc.: Gila 1, AC-3-1
Pro.: /vérdiyˆ/ Spanish: "green"
On August 28, 1864, King S. Woolsey reported to the Governor of Arizona on Woolsey's third exploratory trip. He stated that his party had named a stream the "East Fork of the Verde."

In the late 1870's, Mormons settled about ten miles west of the present Payson, calling their location the East Verde Settlement. They abandoned it c. 1882, moving to Pine *(q.v.)*. The original settlement now belongs to the Doll Baby and N. B. ranches. (Sec. 17, T. 10 N., R. 9 E.)

Ref.: Croxen; Woody. Maps: GD-9; GD-11; GM-19; C-1; E-20.

EDWARDS PEAK

El.: 5770′ Loc.: Gila 1, C-7
Charles Edwards settled on a ranch near what was in the early days called Reno Mountain (cf. Camp Reno). Edwards was fatally shot near Cline's Ranch, but the murderer was never found.

Ref.: Barnes. Maps: C-13; GD-15.

a.n. Edwards Park Loc.: T. 6 N., R. 9 E. Gila
This park covers about four hundred acres of fairly open ground in the Mazatzals, one of the roughest ranges in Arizona.
Ref.: Barnes.
Edwards Spring Map: B-7 Gila

ELLISON

El.: c. 4000′ Loc.: Gila 1, H-7.9
Jesse W. Ellison (b. Texas, September 22, 1841) came to Arizona in 1885. He arrived at Bowie Station *(q.v.* Cochise) by rail with his eighteen hundred cattle. There he found so little water that his cattle stampeded. Many went pell mell into arroyos and were killed. Others were rounded up by people in the area, and with the remnants of his herd Ellison headed toward Gila County, going first to Big Green Valley. He registered his brand as a Q.

In 1885 bad luck hounded him. His house burned, and he left the ranch to start another in Star Valley. Ellison started the Q Ranch on what had been the Newton Ranch, the new name coming from Ellison's brand. Here he lived with his family until 1915 when he sold to Pecos McFadden. As his children grew up and went into the cattle business, their brands were their initials plus a smaller Q. Ellison died January 21, 1934.

P.O. est. July 27, 1894. Jesse H. Ellison, pm. Discont. March 16, 1907.

v.n. Q Ranch (B-7)
Ref.: McKinney; Woody; 112, III. Maps: B-7; C-9; GD-6.
a.n. Ellison Creek Maps: GD-11; GD-12 Gila

FIVE POINT MOUNTAIN

El.: c. 4000′ Loc.: Gila 1, F-13
Descriptive.

Ref.: Woody; Barnes. Map: B-7.

FLAT TOP MOUNTAIN

El.: c. 5000′ Loc.: Gila 2, G-11
Descriptive.

Ref.: Barnes. Map: GD-5.

FOSSIL CREEK

El.: c. 4000′ Loc.: Gila 1, A-1
The second King S. Woolsey expedition in March and April 1864 followed this stream. The name is descriptive of fossil remains found in the creek bed. Lummis reports that Fossil Creek is so heavily charged with minerals that objects which drop into it – such as twigs – are rapidly coated with layers of travertine and that it was this which led to the naming of the stream.

Ref.: Woody; Barnes; 107, p. 143. Maps: A-7; C-1; E-17 (Fossill).
a.n. Fossil Springs Map: GM-19 Gila

GERALD WASH

El.: c. 3500′ Loc.: Gila 1, G-10.8
James F. Gerald (b. Massachusetts, 1837) came to Arizona in 1877 from western Canada, where he had been a miner. For a while he was a hotel man in Globe, but purchased land and established a cattle ranch, working it until his retirement in 1911. The wash runs across the old Gerald ranch.

Ref.: Woody; 112, III. Map: GD-5.
a.n. Gerald Hills Map: GD-5 Gila

GIBSON PEAK

El.: c. 5000′ Loc.: Gila 1, D-2.3
Three Gibson brothers – Arthur, Wash and Joe – had a ranch in the area. The brothers were Mormons.

Ref.: Barnes; Pieper. Map: GD-9.
a.n. Gibson Creek Map: GD-9 Gila
Gibson Wash Maps: CD-13; GK-6 Gila

GILA PUEBLO

El.: c. 4000′ Loc.: Gila 1, H-12.1
Pro.: /híylə pwéblo/
The first name for this location was Healy Terrace because Charles Healy explored here for Indian ruins. The Gila Pueblo is the site of a big prehistoric Indian village which was sold to the Medallion Society c. 1930. The Society developed headquarters here for the study of Indian ruins in the region. In 1956, the former Healy Terrace was the headquarters for the Southwestern Monuments Park Service.

Ref.: Woody; 4, p. 39. Maps: B-7; C-13.

GILA RIVER

Loc.: The Gila traverses the southern third of Arizona.
Pro.: /híylə/
The most important tributary to the Colorado River at one time was the Gila River; it rises in New Mexico and forms part of the boundary of Gila County, to which it gave its name. The Gila River was never dry, and is now so in its lower stretches largely because of dams along its principal

Kinishba stands on flat ground at the edge of a deep wash. The buildings are two and three stories high with open courts and passage ways. The structures were probably built between 1232 A.D. and 1328 A.D. and have been occupied by at least three main cultural groups.

Ref.: 4, p. 444. Map: None.

KIRBY

El.: c. 2500′ Loc.: Gila 1, F-9.1

The Kirby family arrived with Mormon settlers who came into this valley between 1878 and 1884. At a later date Mrs. Kirby served as postmistress.

P.O. est. September 21, 1914. Amelia Kerby *(sic)* p.m.

Ref.: Woody. Map: C-12.

KOHL'S RANCH

El.: c. 6000′ Loc.: Gila 1, F-1.1

The post office at this location took its name from the owners of the ranch.

P.O. est. April 28, 1939. Mrs. Laura B. Kohl, p.m.

Ref.: P.O. Records. Maps: F-7; GD-12.

LAUFFER MOUNTAIN

El.: c. 5000′ Loc.: Gila 1, F-5.9

Jake Lauffer was a cattleman and prospector who ran a ranch in this vicinity in the 1880's. He was wounded by outlaws at this mountain on August 3, 1888.

Ref.: Barnes. Maps: C-10; GD-15.

LEWIS, CAMP

El.: c. 4000′ Loc.: Gila 1, BC-2

This camp was probably named for Col. Charles W. Lewis (b. Virginia, 1825; d. San Diego, California, 1871). Lewis was in command of troops at Calabasas (*q.v.* Santa Cruz) in 1865. In the same year he was appointed colonel in the 7th Regiment of California Volunteers. Lewis, who had lived in San Diego since 1846, returned there probably in March 1869.

Ref.: 27, p. 157; Charles W. Lewis File, APHS. Map: C-1.

LITTLE GIANT

El.: c. 3500′ Loc.: Gila 2, A-11

George H. Stevens was nicknamed "the Little Giant." He was an active politician in the 1880's. Stevens had an Indian wife. Their several sons and their descendants are today highly respected leaders among the San Carlos Indians (cf. Stevens Ranch, Greenlee).

P.O. est. April 1, 1879. Samuel A. Lowe, p.m. Discont. April 28, 1882.

Ref.: Barnes; Woody. Map: C-4.

LITTLE GREEN VALLEY

El.: c. 5000′ Loc.: Gila 1, F-2

There are two valleys north of Payson, both of them being noted in the early days for their luxuriant meadows surrounded by timbered hills. The larger was called Big Green Valley and the smaller naturally followed with its current name. The first settlers were William Burch and John Hood in 1876.

Ref.: Barnes. Maps: E-20; GD-12.

LITTLE TROUGH CREEK

El.: c. 4000′ Loc.: Gila 2, CD-4.5-3

The name derives from the Indian service having placed a watering trough in the canyon through which this creek runs.

Ref.: Barnes. Maps: C-13; D-3.

LIVEOAK

El.: c. 4000′ Loc.: Gila 1, G-11

Descriptive. It is possible that this post office was established in connection with the mining operations in the vicinity.

P.O. est. November 3, 1905. Rey A. Hascal, p.m. Rescinded February 10, 1906.

Ref.: P.O. Records; Barnes. Map: A-14.

a.n. **Liveoak Shaft**	Map: GD-5	Gila
Liveoak Gulch	Maps: GD-4; GD-5	Gila

LIVINGSTON

El.: c. 4000′ Loc.: Gila 1, G-9

Charles Livingston arrived in Arizona in the late 1870's. He ran the Flying V Ranch at the community which later bore his name. When Gila County annexed its upper portion from Yavapai County, a conflict arose with the Flying V brand of that county, owned by Jerry Vosburg. Livingston relinquished his use of the brand.

Later in 1888, Livingston homesteaded at the mouth of Pinto Creek. A small community soon sprang up. When it became necessary to have a post office, the name Curnutt was considered along with the name Livingston, since Curnutt was also an early settler in the region.

The community of Livingston was noted for the many and exciting horse races which occurred there. When Roosevelt Dam was completed and waters began to collect in the lake, Livingston was abandoned. It is now completely covered by a dense growth of willow and mesquite trees.

P.O. est. as Livingstone September 19, 1896. James H. Curnutt, p.m. Discont. June 20, 1907.

Ref.: Cooper; Barnes; Woody. Map: C-9.

LOUSY GULCH

El.: c. 5000′ Loc.: Gila 1, C-2.6

Ben Cole with his sons Emer and Link worked a mine at this location one winter in the 1880's. All became lousy, hence the name.

Ref.: Barnes. Maps: GD-9; GD-16.

MARSH CREEK

El.: c. 5000′ Loc.: Gila 1, EF-3

This creek was dammed by beaver and every flat along it became a marsh until the beavers were destroyed.

Ref.: McKinney. Map: GD-2.

deep by eighty-five long. The ruin was occupied by the Salado people c. 1200 A.D. These people apparently arrived in the Roosevelt and Tonto Basins a hundred years or so earlier, then living in small pueblos near the river.

Ref.: Peavy, *Arizona's National Monuments*, pp. 3, 4, 5, 6.

Tonto Natural Bridge El.: 4660′ Gila
The span at Natural Bridge (*q.v.*) is known by this name.

Tonto Spring Map: GD-12 Gila

Packard's El.: 2300′. Map: F-7 (Tonto Basin) Gila
A small settlement at Tonto Basin is sometimes referred to as Packard's, after an early rancher, Amanda Packard, who settled at Packard Spring and who later had a store on Tonto Creek where he advertised he had "grub-hay-grain" for sale. It is also referred to as Pumpkin Center and Punkin Center.

P.O. est. as Tontobasin, and Punkin Center May 8, 1929. Lillian L. Colcord, p.m. Name changed to Tonto Basin, May 2, 1930.

a.n. **Packard Wash** Map: B-7 Gila

Ref.: Woody; APHS Names File; 4, p. 454.

TORNADO PEAK

El.: 4483′ Loc.: Gila 1, HG-15.7

The peak takes its name from the Tornado Mining Company, which made a gold strike nearby in March 1927. The company apparently got its name because in its early existence a tornado swept through the area.

Ref.: Barnes. Map: GD-13.

TRIPLETS

El.: 5376′ Loc.: Gila 2, D-8.5

Descriptive.

v.n. **Three Peaks** (Map: C-2)
Triplets Peaks (Map: C-12)
Mount Triplet (Maps: C-13; C-14)

Ref.: Uplegger. Maps: C-1; E-20.

WEBBER CREEK

El.: c. 5000′ Loc.: Gila 1, CD-1-1.6

A man named Webber was the chief packer for an army outfit which mapped the Tonto Basin in 1879.

Ref.: Barnes. Maps: GD-11; E-20.

WEBSTER MOUNTAIN

El.: 5776′ Loc.: Gila 1, G-11

John R. Webster (b. Wisconsin, 1842) was listed in the Gila County Great Register of 1886 as living in Globe. The mountain is probably named for him.

Maps: GD-4; GD-5

a.n. **Webster Gulch** Maps: GD-4; GD-5; GD-7 Gila
Webster Spring Map: GD-5 Gila

WET-BOTTOM CREEK

El.: c. 4000′ Loc.: Gila 1, A-2.5-3

The bottom of this creek is now only occasionally moist.

Ref.: Gillette. Maps: B-7; GM-21.

a.n. **Wet-Bottom Mesa** Map: GM-19 Gila

WHEATFIELDS

El.: c. 6000′ Loc.: Gila 1, G-10

In August 1864, the King S. Woolsey expedition found an extensive Indian wheat field ready for harvesting. Woolsey reported that his men gathered as much wheat as they wished, threshing it and making it into piñole, thereafter letting their horses eat what was left. The Woolsey party named the place Wheat Field.

Hinton noted that there was much agricultural activity in this region, where irrigation was used. He also noted the presence of malaria, common in early Arizona. The various farms were later bought up by the Inspiration Consolidated Copper Company both for the water rights and for the protection of the company in case its tailings dams should ever break.

P.O. est. October 20, 1880. E. F. Kellner, p.m. Discont. March 17, 1881.

Ref.: Woody; 105, p. 141; 87, p. 264.

Maps: E-20; A-15; C-1 (Wheat Camp).

WHITE RIVER

El.: c. 4000′ Loc.: Gila 2, GE-3.
Navajo 3, IG-8-11.

The name probably originated from the fact that the stream came from the White Mountains.

v.n. **White Mountain Creek**
White Mountain River

Ref.: Barnes. Maps: C-2; E-18; E-20.

WILLIAMS CAMP

Loc.: Not known.

The origin of this name has not yet been ascertained.

P.O. est. September 20, 1927. Mrs. Alice Mistler, p.m. Discont. June 1, 1928.

Ref.: P.O. Records. Map: None.

WINDY HILL

El.: 2457′ Loc.: Gila 1, F-8.5

This is a descriptive name. The winds are usually blowing around this high point which projects into Roosevelt Lake.

Ref.: Cooper; Woody. Map: GD-15.

WINDSOR SPRING

El.: 6500′ Loc.: Gila 1, B-4.1

Walter Windsor (d. March 14, 1947) arrived in this area in the late 1880's and established a ranch and mining claim.

Ref.: Goode. Maps: B-7; GD-9.

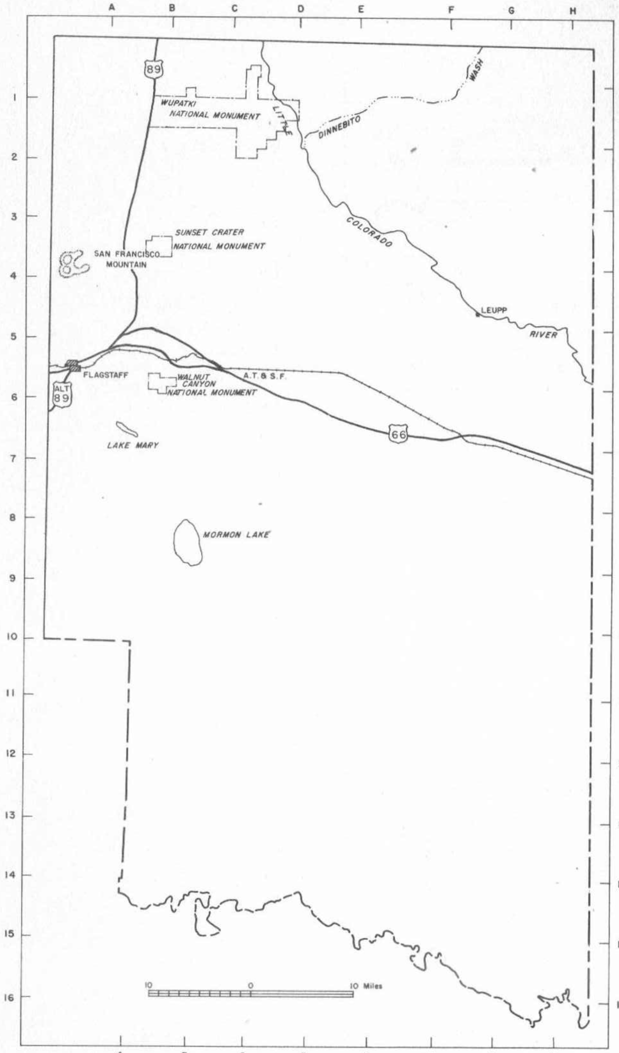
a.n. **Windsor Camp** Map: GD-9 Gila

WINKELMAN

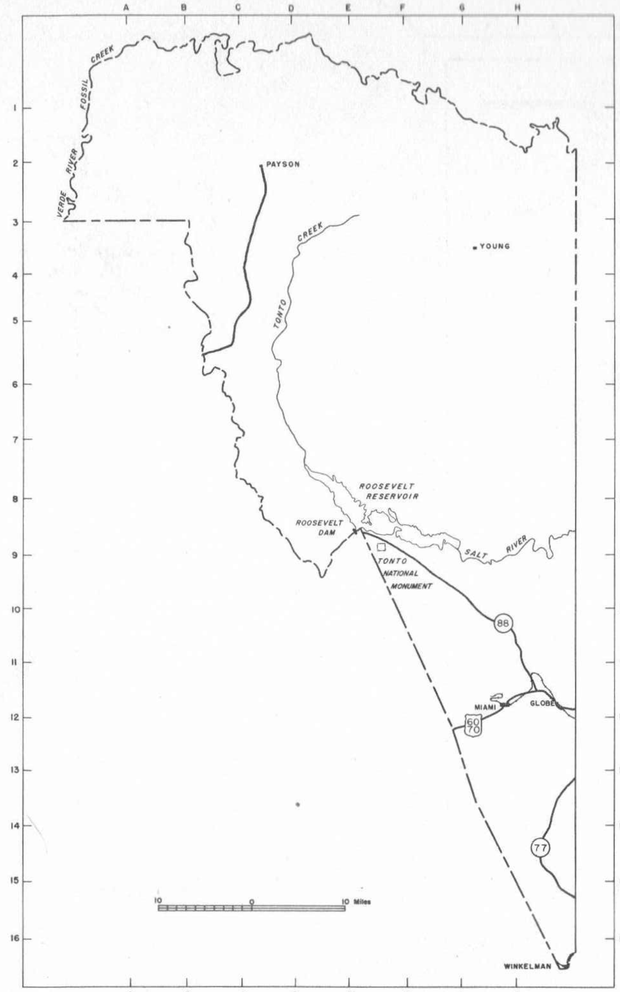
El.: 1947′ Loc.: Gila 2, A-12

The history of Winkelman has to be traced back through that of two other small communities which formerly existed in its vicinity.

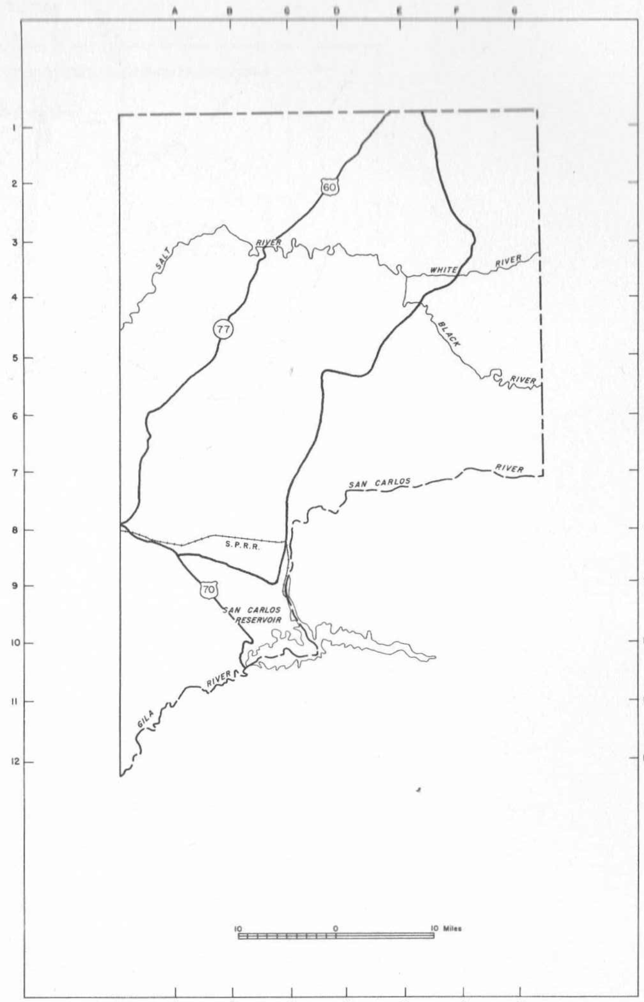
The first of these was Dudleyville, near the mouth of the San Pedro River. It was in this region that a large number of farmers settled following the survey of 1877 and 1878. Among these people was Dudley Harrington, who established his ranch in 1879. The trip to Florence for supplies



Coconino – 5



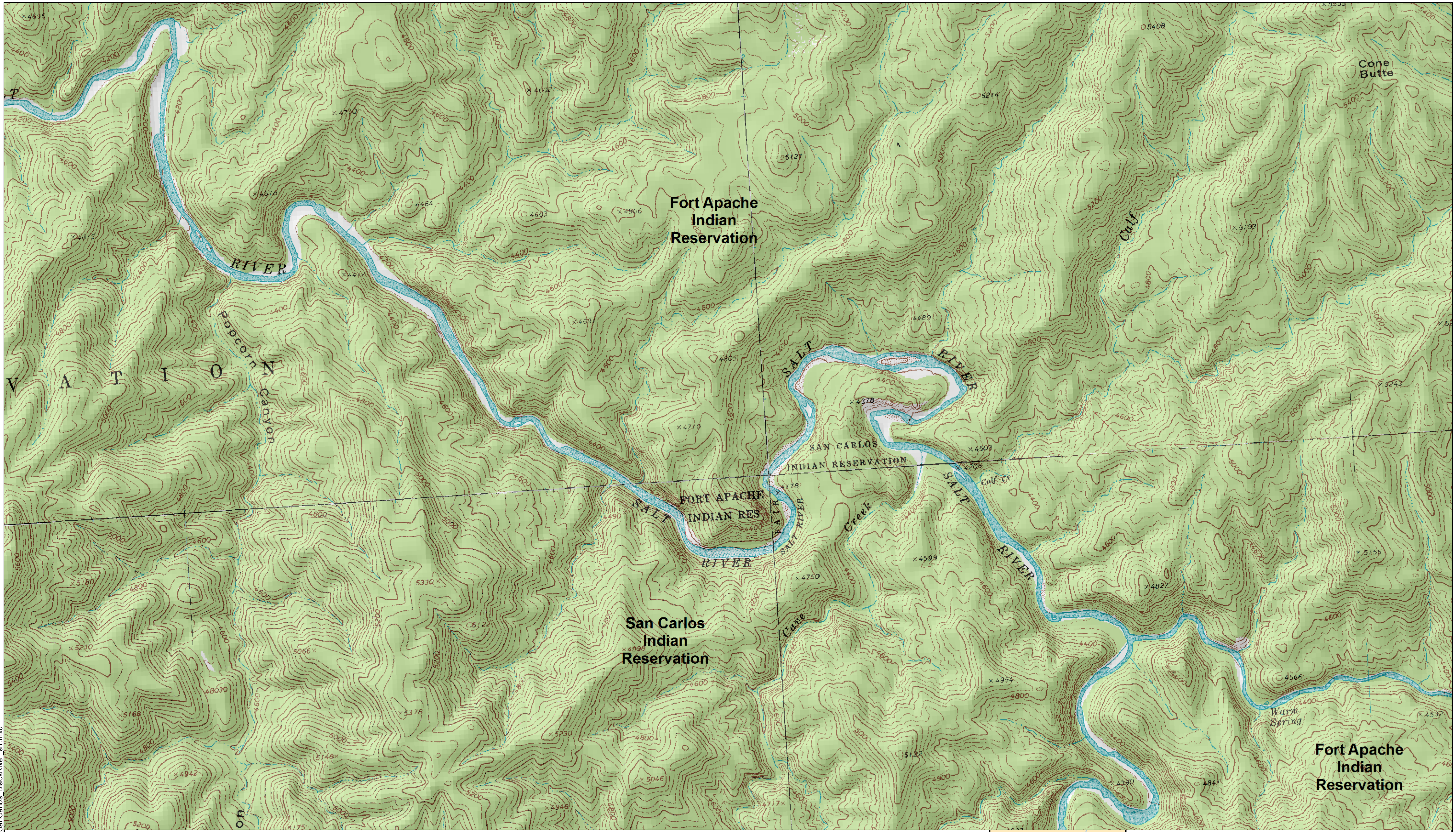
Gila – 1



Gila – 2

ATTACHMENT C

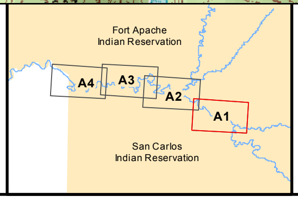
Rapids Identified Using 2010 Aerial Photographs along Segment 1 of the Salt River



Road/Jeep access

Rapid

SAN CARLOS INDIAN RESERVATION
ALONG THE SALT RIVER
MAP A1



0 1,000 2,000 Feet

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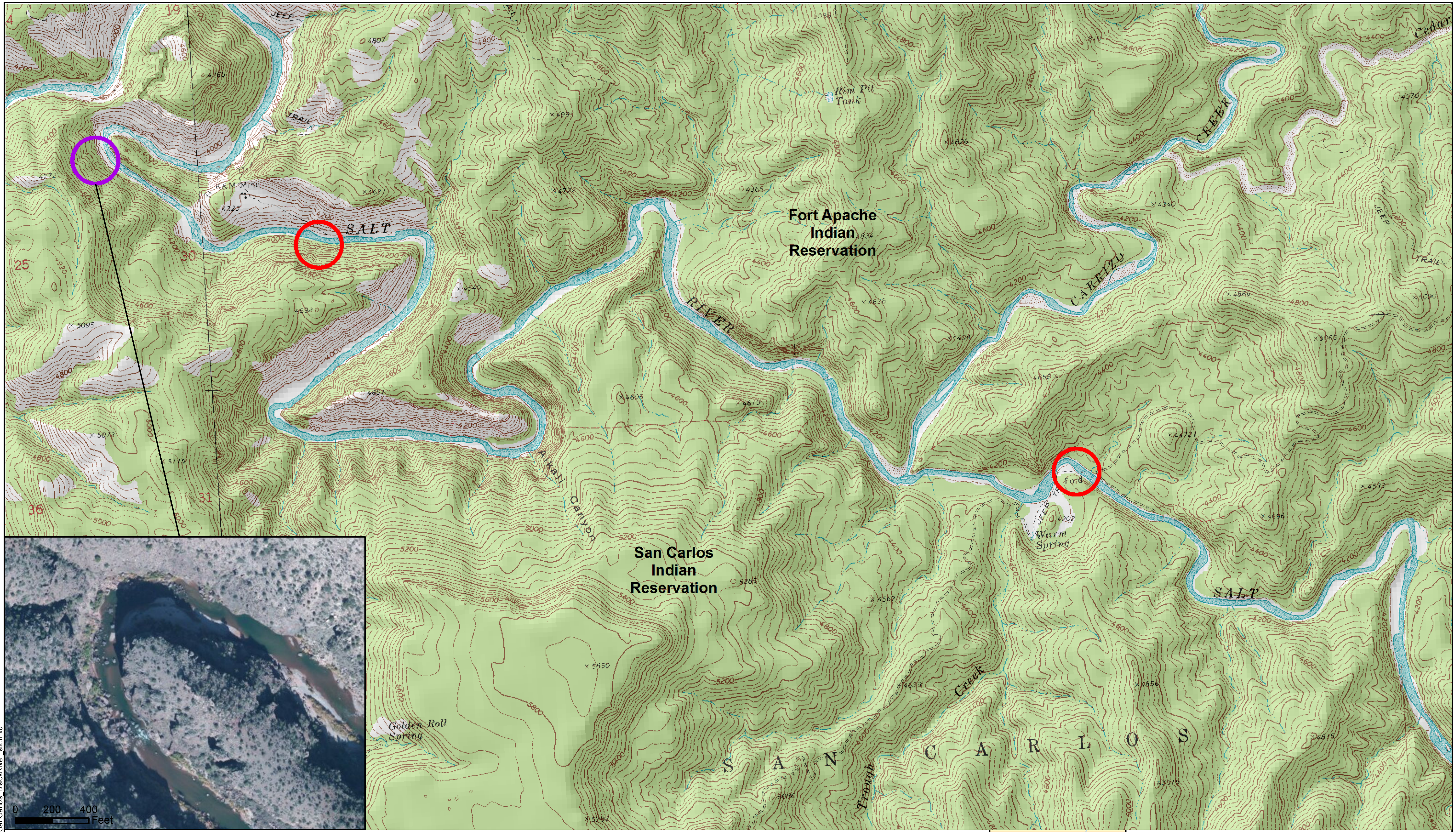
Basemap: USGS, 24k topo series, 2006.
Quads: Carrizo SE, Cone Butte, Popcorn Canyon, Forks Butte.

STETSON ENGINEERS INC.

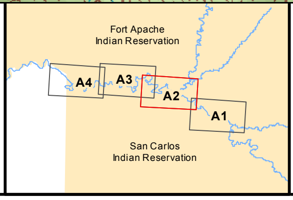
Document Path: J:\jn2536\SanCarlos_BlackRiver_a1.mxd



Road/Jeep access

Rapid

SAN CARLOS INDIAN RESERVATION
ALONG THE SALT RIVER
MAP A2



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Basemap:
Topo - USGS, 24k topo series, 2006.
Quads - Beckers Butte, Carrizo SE.
Image - ESRI, 2010.

STETSON ENGINEERS INC.

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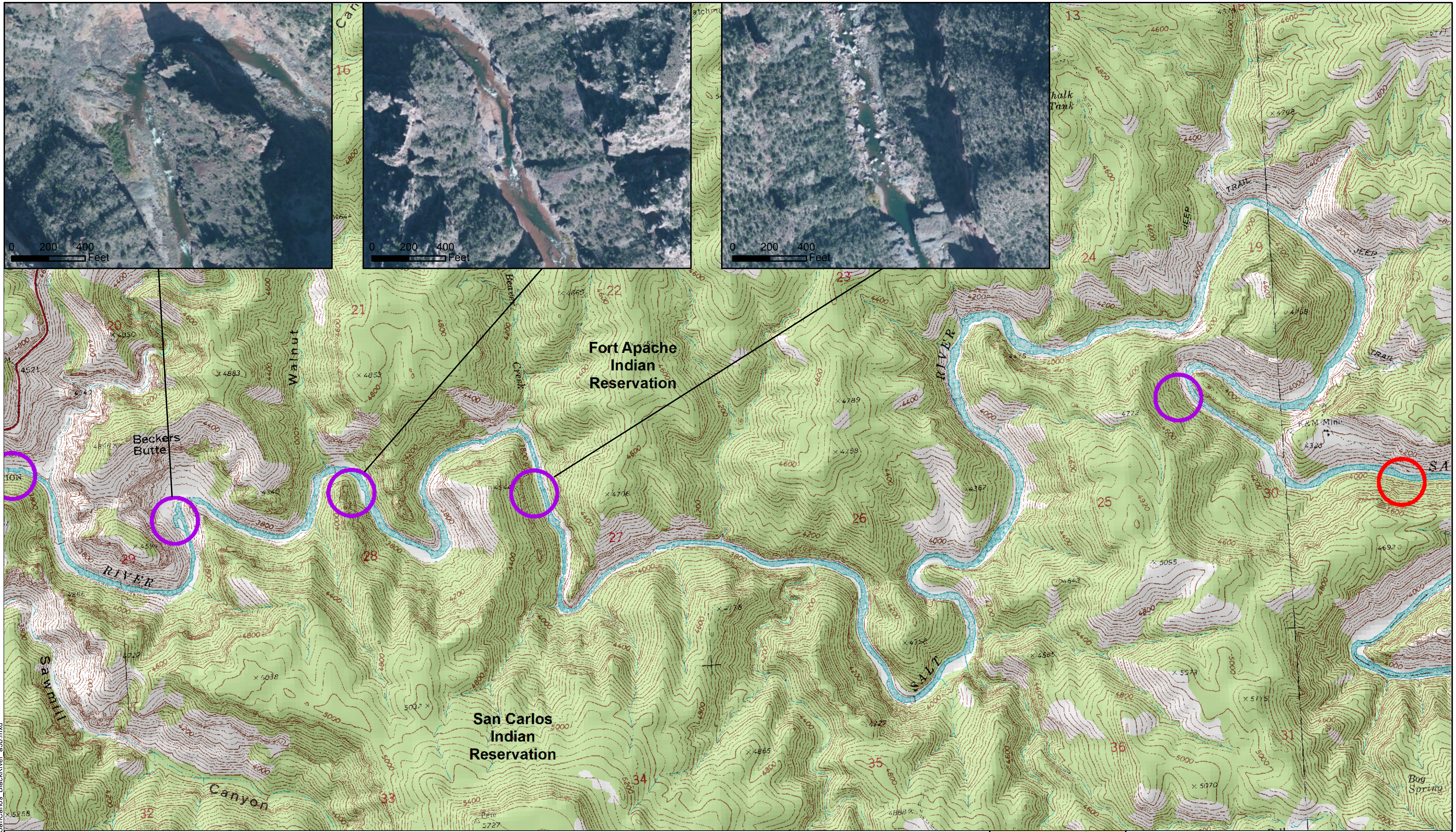
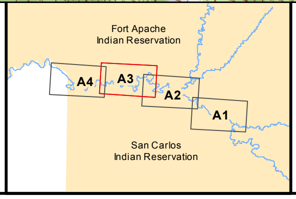


Road/Jeep access

Rapid

SAN CARLOS INDIAN RESERVATION
ALONG THE SALT RIVER
MAP A3



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Basemap:
Topo - USGS, 24k topo series, 2006.
Quads - Beckers Butte, Carrizo SE.
Image - ESRI, 2010.

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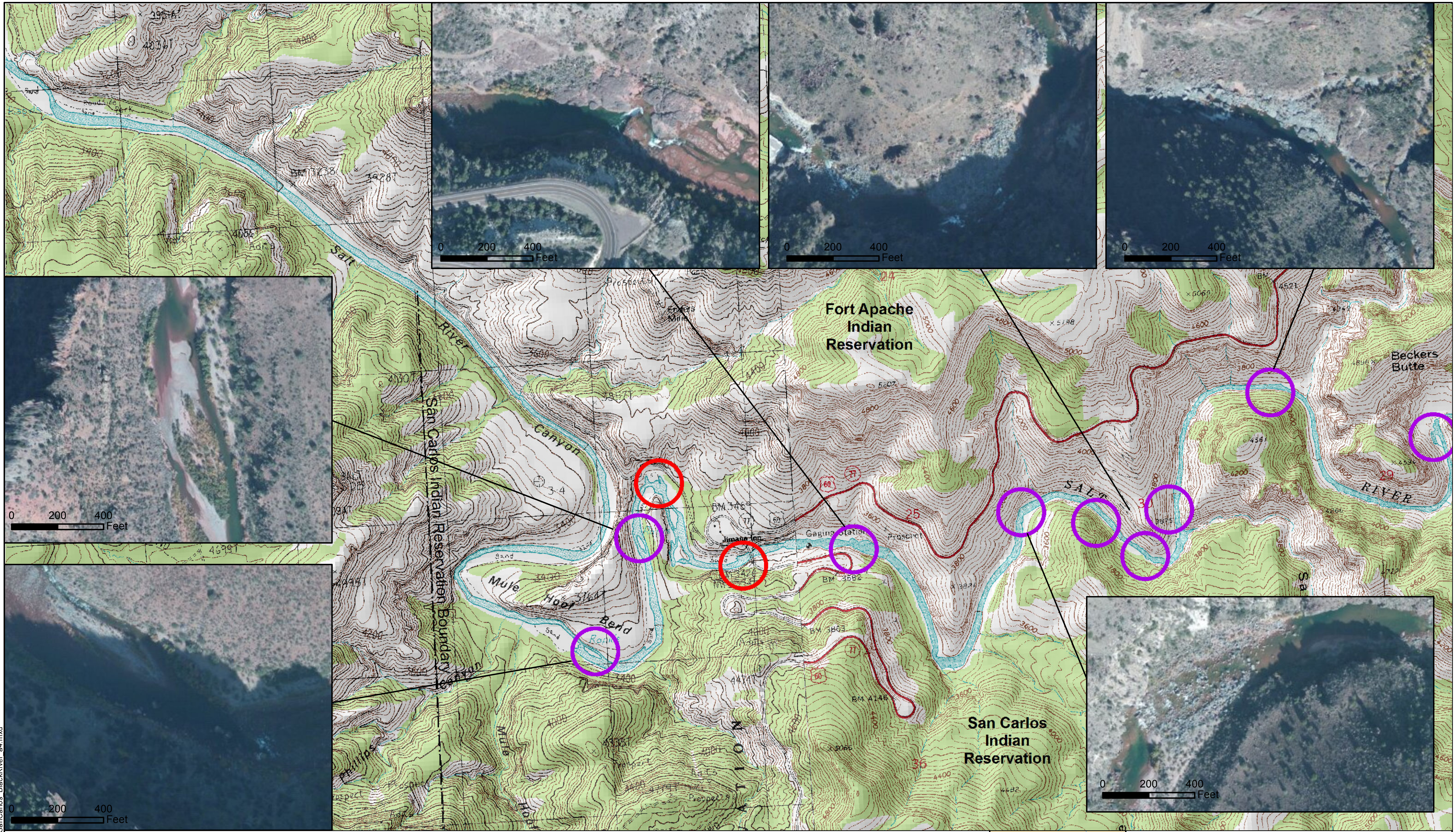
Document Path: J:\jn2536\SanCarlos_BlackRiver_a3b.mxd

A4



Document Path: J:\jn2536\SanCarlos_BlackRiver_a4.mxd

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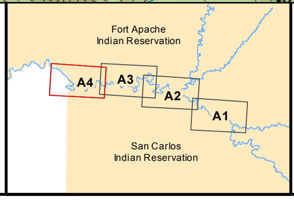
○ Road/Jeep access

○ Rapid

SAN CARLOS INDIAN RESERVATION
ALONG THE SALT RIVER
MAP A4



0 1,000 2,000
Feet

N

Basemap:
Topo - USGS, 24k topo series, 2006.
Quads - Mule Hoof Bend, Beckers Butte.
Image - ESRI, 2010.