

# The Prehistoric Bajada “Hanging Canals” of the Safford Basin: Small Corporate Group Engineering in Southeastern Arizona

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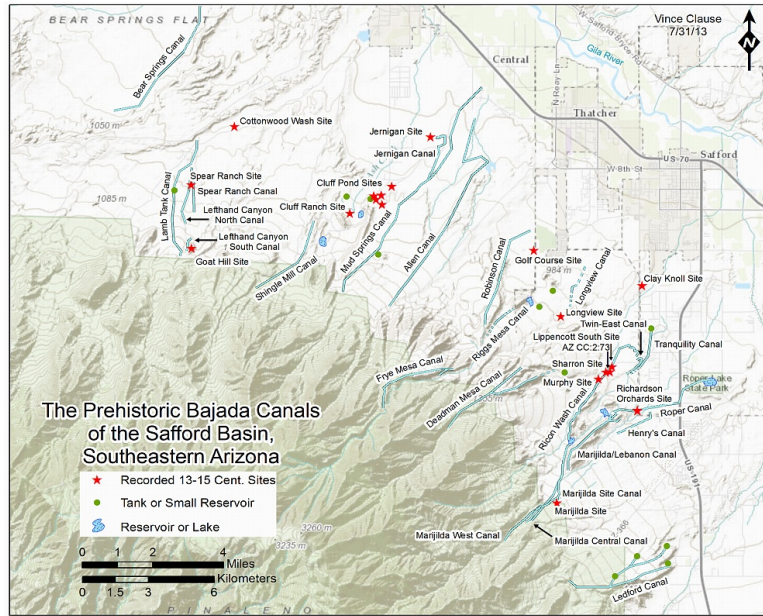
Ongoing archaeological survey in the arid **Safford Basin** of Arizona has disclosed a series of exceptional small **prehistoric** canals (Figure 1) that have expanded our knowledge of water management engineering and agricultural intensification in the American Southwest.

These unusual canals are found in an area where other contemporaneous and older water management schemes are also present. These include conventional lowland riverine canals (Neely and Murphy 2008), many extensive non-irrigated terraced and gridded fields (Doolittle and Neely 2004), numerous check-dams, and grouped arrays of agricultural mulch rings and rockpiles.

Twenty-nine **bajada** canal systems and fragments have been identified to date (Figure 1). The longest are about 9.5 kilometers. The total length of all systems exceeds 80 kilometers. These canals have been difficult to date since our study has been based solely on surface survey. We have depended on **stratigraphy**, surface artifact finds, and some associated prehistoric sites to provide temporal parameters. While a few canals may date as early as ca. A.D. 800, the majority appear to originate after ca. A.D. 1250 with some persisting until ca. A.D. 1450.

These canal systems differ from the prehistoric canal systems found in the vicinity of Phoenix and elsewhere in the Southwest in that they obtained their water from the **Pinaleno** Mountain bajada drainages fed by runoff, springs, and from **artesian** sources, rather than from rivers. They are also unusual in that they traverse the vertically undulating to severely erratic uplands of **basin and range** topography rather than being restricted to a nearly level riverine floodplain. Some carry their water load from over 1650 m down to just above the floodplain of the **Gila River** at about 900 m.

The difficulty in excavating these systems is further intensified by the very rocky nature of much of the terrain that they traverse.



**Figure 1 —Locations of the bajada sourced canals recorded to date.**

In more level terrain, the canals are of the traditional type - rather narrow, linear excavations into the ground surface that follow the contours of the landscape. In other locations within the same canal system, they can appear as "perched" or as "hanging" canals traversing the sheer sides of mesas - with some coursing up to 60 meters above the adjacent basin floor (Figure 2).

The canals often create the illusion of water flowing uphill in that their mesa top slope is usually somewhat steeper than the rate of fall of the canal itself. In these latter cases, **the perched or hanging segments are designed to follow the most direct route and are essentially independent of their surrounding terrain.** This reduces the energy input needed to excavate additional canal length or depth to follow the irregularities of the topography. Such construction would also reduce water loss through seepage and evapotranspiration.

After reaching its mesa top through a long, a gentle, and an evidently carefully calculated optimal grade, and then continuing as far as possible along the usually flat but gently sloping ground surface, the canals will typically "fall off" the far end of the mesa in steep but apparently highly controlled, nondestructive cascades descending in nearly vertical constructions similar to French Drains.

Canal cross-sections (Figure 3) at the ground surface vary from 0.30 m to one meter (with atypical examples up to two meters in width) and 20 to 40 centimeters in depth (with atypical examples up to one and a half meters in depth).



**Figure 2. Hanging canal (middleground) flowing from right to left along the west side of the long narrow mesa landform near the mouth of Marijilda Canyon. At this point, the canal is about 50 meters above the basin floor. The canal coursing upslope illusion is discernible.**

As with many of the Gila River bottomland canals of the area, historic inhabitants of the greater Safford area refurbished some of these prehistoric canals. Several reaches of the canals still flow to this day. However, most retain enough integrity to be recognized as having a prehistoric origin.

Portions of most of the systems remain almost pristine, and are currently filled with fine-grained sediments. These systems are located mostly on Arizona State and Coronado National Forest lands that remain largely undeveloped. While often of difficult access, as there are few roads and fewer mesa top trails, major canal portions are usually easily traced on foot and by satellite imagery. Unfortunately, both historic and modern constructions and land modifications have negatively affected these systems.

A number of unusual constructions were incorporated into some of these canal systems; two examples are: first, an **aqueduct**, about one and a half meters in height and 100 meters long, was created to bridge a "saddle" in the topography associated with prehistoric segment of the Lebanon Canal. The second example is at a point where the primary Frye Mesa Canal is situated near the top edge of the mesa, a branching "counterflow" canal was excavated down the mesa slope at an acute angle apparently to irrigate fields lying below and behind the point of branching.



**Figure 3. Looking down canal at the narrow, nearly completely filled Robinson Canal as it routes along the steep mesa side on its way to fields on Robinson Flat. Note the canal coursing upslope illusion.**

Several canal systems illustrate elaborate methods of purposeful switching of the water routes from canals to natural drainages, and then back to canals. In sum, these systems appear to represent a major understanding and a rather careful exploitation of the topography, hydraulic fundamentals, as well as both extreme energy and use efficiency.

The discovery of these canals and our continuing survey in the Safford Basin suggests that the basin was a prehistoric population center and a major supplier of cultivated crops. Their use seems to be primarily long distance water delivery to fields, but the canals also apparently supplied water to small habitation sites.

Survey in Lefthand Canyon (near the west boundary of our current survey - Neely 2005) and Marijilda Canyon (near the east boundary of our survey - Neely In Preparation) has recorded a rather heavy population scattered along the canals, but the sites are nearly all small. To date, survey along most of the other canals has recorded only a few small sites.

These findings provide evidence in the form of agricultural intensification and settlement that points to a sociopolitical organization based on the collaboration and collective action of small corporate groups rather than a more complex social stratification and socio-political structure. These finding parallel a study by Hunt et al. (2005) focusing on the nearby [Hohokam](#) area.



Ceramics and house remains from contemporary habitation sites indicate both trading activity as well as actual residence by several of the prehistoric cultural groups of the Southwest including the master canal builders of the Phoenix area, the Hohokam (Purcell and Clark 2008). While it is likely that the canals were engineered and constructed by the local inhabitants of the Safford Basin, the Hohokam presence brings us to tentatively speculate that Hohokam migrants may have at least in part assisted in engineering the later more sophisticated canal constructions.

The engineering involved in the planning and construction of these canals seems phenomenal considering the lack of leveling instruments and metal tools. It would appear possible that pilot extensions of the canals themselves could have served as **water levels**.

**Engineering can be defined as a sense of the fitness of things.** Aptly meeting this criterion, the Safford Basin bajada canal systems are a highly sophisticated innovation that is superbly energy optimal and a brilliant engineering solution for reliable water transport and delivery over the basin and range topography of the area. They are a phenomenal prehistoric adaptation to an arid environment to irrigate agricultural fields distant from once apparently abundant water sources.

## References Cited

- Doolittle, William E. and James A. Neely (editors).  
2004 **The Safford Valley Grids: Prehistoric Cultivation in the Southern Arizona Desert.** **Anthropological Papers of the University of Arizona 70.** University of Arizona Press. Tucson.
- Hunt, Robert C., David Guillet, David R. Abbott, James Bayman, Paul Fish, Suzanne Fish, Keith Kintigh, James A. Neely  
2005 **Plausible Ethnographic Analogies for the Social Organization of Hohokam Canal Irrigation.** **American Antiquity** 70(3): 433-456.
- Neely, James A.  
2005 **Prehistoric Agricultural and Settlement Systems in Lefthand Canyon, Safford Valley, Southeastern Arizona.** In "Inscriptions: Papers in Honor of Richard and Nathalie Woodbury", edited by R. N. Wiseman, T. O Laughlin, and C. T. Snow, pp. 145-169. **Papers of the Archaeological Society of New Mexico 31.** Albuquerque.
- Neely, James A.  
In Preparation. **Prehistoric Settlement and Agricultural Systems in the Maricopa, Rincon, and Graveyard Wash Areas, Safford Basin, Southeastern Arizona.** To be submitted to the **Journal for Field Archaeology.** Boston.

Neely, James A. and Everett J. Murphy  
2008 **Prehistoric Gila River Canals of the Safford Basin, Southeastern Arizona: An Initial Consideration**. In "Crossroads of the Southwest: Culture, Identity, and Migration in Arizona's Safford Basin" (**Proceedings of the AAC Fall 2005 Meeting**), edited by David E. Purcell, pp. 61-101. Cambridge Scholars Publishing. Newcastle, UK.

Purcell, David E. and Jeffery J. Clark  
2008 **Multi-Cultural Communities in the Safford Basin**. In "Crossroads of the Southwest: Culture, Identity, and Migration in Arizona's Safford Basin" (**Proceedings of the AAC Fall 2005 Meeting**), edited by David E. Purcell, pp. 39-59. Cambridge Scholars Publishing. Newcastle, UK.

### Further reading

Allhands, Joanna, **Hanging canals' lesson: We haven't changed much**, **AZCentral.com** Feb 27, 2013.

Lancaster, Don. **Prehistoric Hanging Canals of the Safford Basin** 2013.

Neely, James A. and Don Lancaster, **A Prehistoric Hanging Canal Lecture** 2013.

Neely, James A. and Don Lancaster, **A Tour of Some Prehistoric Hanging Canal Images** 2014.

Neely, James A. and Don Lancaster, **The Bajada Canals of the Safford Basin: Small Small Corporate Group Collaboration in Southeastern Arizona**, **Glyphs** Volume 64, Numbers 3 & 4, 2013. Combined paper also [here](#).

Wagner, Dennis, **Arizona hanging canals whet appetite for ancient history**, **USA Today**, February 24, 2013

Wagner, Dennis, **Mysterious Canals Believed to Come from Ancient Civilization**, The Arizona Republic, Feb 24, 2013

### Ongoing Studies

A collection of related hanging canal papers: [www.tinaja.com/tinsamp1](http://www.tinaja.com/tinsamp1)

The latest hanging canal developments: [www.tinaja.com/whtnu14.shtml](http://www.tinaja.com/whtnu14.shtml)

Tours and personal research opportunities: [don@tinaja.com](mailto:don@tinaja.com)