

April 15, 1999

L54(2380)
FOBO/General

Memorandum

To: Superintendent, Fort Bowie National Historic Site

Through: William L. Jackson, Chief, Water Operations Branch

From: Larry Martin, Hydrologist, Water Operations Branch

Subject: Trip Report for Travel to Fort Bowie National Historic Site on March 23-24, 1999.

PURPOSE: This trip was made to assess potential alternative sites for construction of a new water supply well at the park.

SUMMARY: Potential well sites at the park are constrained by land use and land management restrictions, land ownership, and geologic conditions. The best available site at the park is in the boneyard, north of the maintenance shop. This site has the advantages of; favorable geologic conditions, existing road access, the site is already disturbed, and it is near the water treatment and distribution infrastructure. Estimated cost of a new well at this location is \$8-10,000. Park staff need to conduct regular monitoring of Apache Spring and Mine Tunnel Spring so we will have baseline data to determine if spring flow is affected by a new well.

CURRENT CONDITIONS: The park obtains its drinking water supply from a well in Siphon Canyon. Water is transported to the storage tank and distribution system via an above ground pipeline approximately $\frac{3}{4}$ mile long. The pipeline is in need of repair or rebuilding. Across most of the route of the pipeline (and alternative routes) bedrock is at or near the surface, so burial is not a viable option. Also, the pipeline runs through an archaeological site where disturbance should be avoided.

Water use at the park is about 30,000 gallons per month, with peak days of about 1500 gallons. Water is used to supply 1 permanent residence, 1 seasonal residence, the maintenance shop, and the visitor center. Water use at the visitor center is minimal as there are no public restrooms, only port-a-potties. Future plans call for construction of a restroom facility near the visitor center, which could nearly double the consumptive use and pose a serious threat to continued flow from the springs.

Visitation at the park is small, approximately 50 people per day. The park is several miles off the interstate highway, the last couple of miles being a gravel road. Visitors must hike $1\frac{1}{2}$ miles from the parking area to visit the ruins of the fort.

The well site in Siphon Canyon was selected, in part, because of its distance from natural springs at the park. Apache Springs and Mine Tunnel Springs were an important consideration in selecting the stage route through Apache Pass and location of the fort. It is very important that the park does nothing to impair the flow of water from the springs, as they are a part of the cultural interpretation of the park. Also, there are alien water rights for a portion of the flow from these springs.

SPRINGS: Apache Springs has been developed by construction of an infiltration gallery. Water is routed through a stone building, where flow is split by adjusting valves on the pipes. Some of the flow is returned to the streambed via a buried pipe which discharges at an artificial waterfall structure, creating a scenic setting for park visitors. The water infiltrates into the streambed within about 300-400 feet. The remainder of the flow is routed through buried plastic pipe to a stock tank approximately ¼ mile from the stream and out of sight of most visitors.

Water from Mine Tunnel Springs is collected in infiltration galleries and routed through black plastic tubing to splitting weirs. Half of the water is returned to the stream and half is transported via plastic tubing to stock tanks outside the park. There is a long history of water rights controversy related to these springs which is beyond the scope of this report. At the time of this visit, there was no flow from the Upper Mine Tunnel Spring. Flow from Lower Mine Tunnel Spring was measured (at the splitting weir) at 3 gallons per minute. The winter of 1998-99 has been very dry and discharge from the springs may be lower than normal at this time.

HYDROGEOLOGY: The park is in the Chiricahua Mountains, which are primarily composed of granitic rocks. Fort Bowie lies on a band of steeply dipping sedimentary rocks, primarily siltstone and limestone that have been sandwiched between the granitic blocks by thrust faulting. The granitic blocks are essentially impermeable. The sedimentary rocks contain significant quantities of water only where they have been broken and fractured by folding and faulting. The primary sources of groundwater in this area are alluvium in the streambeds and along fault zones in bedrock formations. The current well obtains water primarily from the alluvium in Siphon Canyon.

During the geologic reconnaissance of this investigation, it was noted that springs occur along the fault zones at the lowest topographic location along the faults. Generally, these locations are coincident with incision of stream channels crossing the fault zones.

POTENTIAL WELL SITES: Consideration of potential well sites was limited to the vicinity of the maintenance area. Other areas of the park were not considered because there are no roads to potential well sites, concerns about disturbance of historic areas by construction of another pipeline, and concerns about maintaining the flow of Apache Springs for cultural interpretation and water rights agreements.

The best potential well site (within these constraints) is for construction of a well into the alluvium where the access road forks to go to Bear Springs Ranch and the park maintenance/residential area. A well at this location would collect groundwater from the alluvium which is probably maintained by flow from Bear Springs to the south of the park and Mine Tunnel Springs. Collecting water at this location would not interfere with existing water rights and could not affect flow from either of the springs. However, this site is on private property outside the park.

The only other reasonable potential well site is to drill into the fault zone in the vicinity of the maintenance/residential area. After discussing this option with park staff, it was concluded that the best site would be in the boneyard north of the maintenance shop. This site has the advantages of being in an already disturbed area, easily accessible by a drilling rig, and adjacent to the existing water treatment facilities and distribution system. It is also several hundred feet from Mine Tunnel Springs, which might help to reduce the potential for impacting spring flow when the well is pumped. Anticipated depth of a well at this site is 100-250 feet, dependent on intercepting fractured rock along the fault zone. Cost estimates for a 250 foot well are \$8-10,000.

MONITORING: Park staff should begin regular monitoring of flow from the springs so that when a new well is constructed we will be able to determine whether pumping from the well affects the flow of the springs. Flow should be measured at least weekly, preferably at the same time and day of the week and by the same person so that a regular routine is established, making it less likely to be forgotten. Flow should be measured by measuring the amount of time required to fill a 5-gallon bucket. At Apache Spring, the valves should be adjusted to force all of the flow to emerge at the spring (close the valve on the pipeline to the stock tank). Allow the flow to stabilize (approximately 5 minutes) and then measure the time to fill the bucket. At Mine Tunnel Springs, flow can be measured by filling the 5-gallon bucket at each side of the splitting weir. If Upper Mine Tunnel Spring begins to flow again (at the splitting weir behind the pumphouse), flow should be measured at that location also.

Data should be recorded in a notebook or placed in a file for safe-keeping. If money is obtained for drilling a new well in FY-00, then we would have at least a year of data prior to construction of the well. We will be able to correlate spring flow data with precipitation to determine how much seasonal variation there is and how spring flow is related to local recharge from precipitation. Monitoring would need to continue for at least a year following construction of a new well to determine whether long-term pumping affects spring flow.

Frequent monitoring of spring flow during testing of the new well should allow us to determine if there are short-term impacts to spring flow from pumping of the well. It is a very real possibility that pumping the new well could cause immediate cessation of flow from the Mine Tunnel Springs, a situation which might require mitigation or remediation of impacts.

REFERENCES:

Click, D.E., 1966, Water-supply investigation of the Fort Bowie National Historic Site, Cochise County, Arizona. USGS Summary Report, 3 pp.

Davidson, E.S., 1965, Water-supply investigation of the Fort Bowie National Historic Site, Cochise County, Arizona. USGS Administrative Report, 10 pp.

Drewes, Harald, 1984, Geologic Map and Sections of the Bowie Mountain North Quadrangle, Cochise County, Arizona. USGS Map I-1492, 1:24,000

Sabins, F.F., Jr., 1957, Geology of the Cochise Head and western part of the Vanar quadrangles, Arizona, Geological Society of America Bulletin, v. 68, pp. 1315-41

ACTION ITEMS:

1. Provide further assistance to the park during drilling and testing of a new well. Responsible Party: L.Martin. To be completed by: As requested, dependent on funding.

cc: IMR - John Reber
SOAR - Kathy Davis
479 - Dan Kimball, Henrique Barreto
FOBO/CHIR - Larry Ludwig, Jose Rameriz