

August 16, 2000

L54(2380)
FOBO/General

Memorandum

To: Superintendent, Chiricahua National Monument

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 August 1-9, 2000.

PURPOSE: This trip was made to supervise construction and testing of a new water supply well at Fort Bowie National Historic Site.

SUMMARY: A new water supply well was constructed near the maintenance facilities at Ft. Bowie. Testing of the well indicates it should reliably produce 15-20 gallons per minute.

DISCUSSION: My previous trip report (March 1999) discusses the geology and hydrogeology at Ft. Bowie and the rationale behind picking the location of the new well described in this trip report. The park had a strong desire to have the water supply well closer to park facilities. If the new well proves to be a reliable supply, the pipeline from the well in Siphon Canyon can be removed. This would eliminate a very large maintenance and financial burden from the park, eliminate the visual intrusion of the above ground pipeline, and eliminate the potential conflicts associated with having a pipeline cross archaeological and historical sites.

The new well was constructed in the park's "boneyard", an area used for storage of construction material and remnants from construction projects. The well is about 50 feet west of the chlorinator building and about 200 feet north of the maintenance building.

Construction was started on August 1. The well was drilled using an air rotary drilling rig. A mixture of Baroid Quickfoam and water was added to the air stream to facilitate cooling of the drill bit and efficient removal of drill cuttings from the borehole. Water was encountered at a depth of about 115-120 feet. Drilling proceeded to a depth of 160 feet on August 1. There was no drilling on August 2 because we were waiting for the well casing to arrive. On August 3 drilling continued

to a total depth of 220 feet. Perforated casing was installed in the lower 110 feet of the well. Plain casing was installed in the upper 110 feet of the casing. Six-inch casing was used for the entire length of the well, with torch-cut perforations in the lower 110 feet.

Geologic Log of Ft. Bowie Well No. 2

<u>Depth, feet</u>	<u>Description</u>
0-20	Limestone with interbedded graphite layers
20-30	Limestone, reddish
30-110	Limestone, black. Interbedded with quartz and minor amounts of pyrite.
110-120	Black siltstone or gouge zone (rock ground by movement along a fault plane).
120-130	Limestone
130-160	Hard black siltstone, more quartz, more gouge material.
160-220	Hard black siltstone with quartz. Hard drilling, approximately 20 feet per hour.

It appeared that the main water-bearing zone in the well was the fault zone encountered between 110 and 160 feet deep. The well was constructed to 220 feet deep to investigate the possible presence of additional water-bearing zones at greater depths and to facilitate drawdown of water level in the well during pumping.

The static water level in the well is about 51-52 feet below ground surface.

A test pump was installed in the well on August 8 and the well was pumped at various rates on August 8 & 9 to determine the yield and recovery rate of the well. Results of the test pumping are shown on the attached graphs.

The well was initially pumped at the maximum rate of the pump, about 40 gallons per minute (gpm). This pumping rate exceeded the maximum yield of the well and the water level was drawn down to the level of the pump. The valve on the discharge line was partially closed to reduce the pumping rate to about 22 gpm, which resulted in the water level rising and stabilizing at about 130 feet below ground surface. The pump was shut off for ½ hour to monitor the rate of recovery. Water level in the well rose to about 70 feet below ground surface in ½ hour. The pump was restarted and pumped at about 20 gpm for 2 hours causing the water level to be drawn down to about 115 feet below ground surface. Water level recovery was then monitored for 2 hours during which time the water level rose to about 60 feet below ground surface.

Test pumping continued on August 9. The well was pumped at about 15 gpm for 3½ hours resulting in 43 feet of drawdown. The water level stabilized at about 95 feet below ground surface. The valve was then opened completely to facilitate collection of water chemistry samples. The pumping rate was about 40 gpm for 15 minutes and then 23 gpm for about an hour. The pump was shut off at about 13:00 and water level recovery was monitored until 16:30. Water level recovered from 142 to 57 feet below ground surface during the 4½ hours of monitoring recovery. The graph

of water level recovery shows that most of the recovery took place in the first 20-30 minutes following cessation of pumping. The water level at the end of 4½ hours of recovery was within about 5 feet of the static water level.

Discharge at Lower Mine Tunnel Spring was monitored during construction and testing of the well. Discharge ranged from 5 to 5¼ gpm. The higher flow rates were measured during construction of the well. It appears that the extensive test pumping resulted in a slight decrease of discharge at the spring of about ¼ gpm. Park staff were instructed to continue monitoring discharge from the spring to determine if there is any correlation between spring flow and normal operation of the new well. Normal demand for water at the site is about 1500-2000 gallons per day. Test pumping of the well greatly exceeded this amount, so it may be that normal operation of the well and long recovery periods between pumping will result in no discernable change in flow from the spring.

There was no flow from Upper Mine Tunnel Spring during this site visit. The spring was not flowing during my previous visit in March 1999. It appears that there has been no flow from this spring for several years.

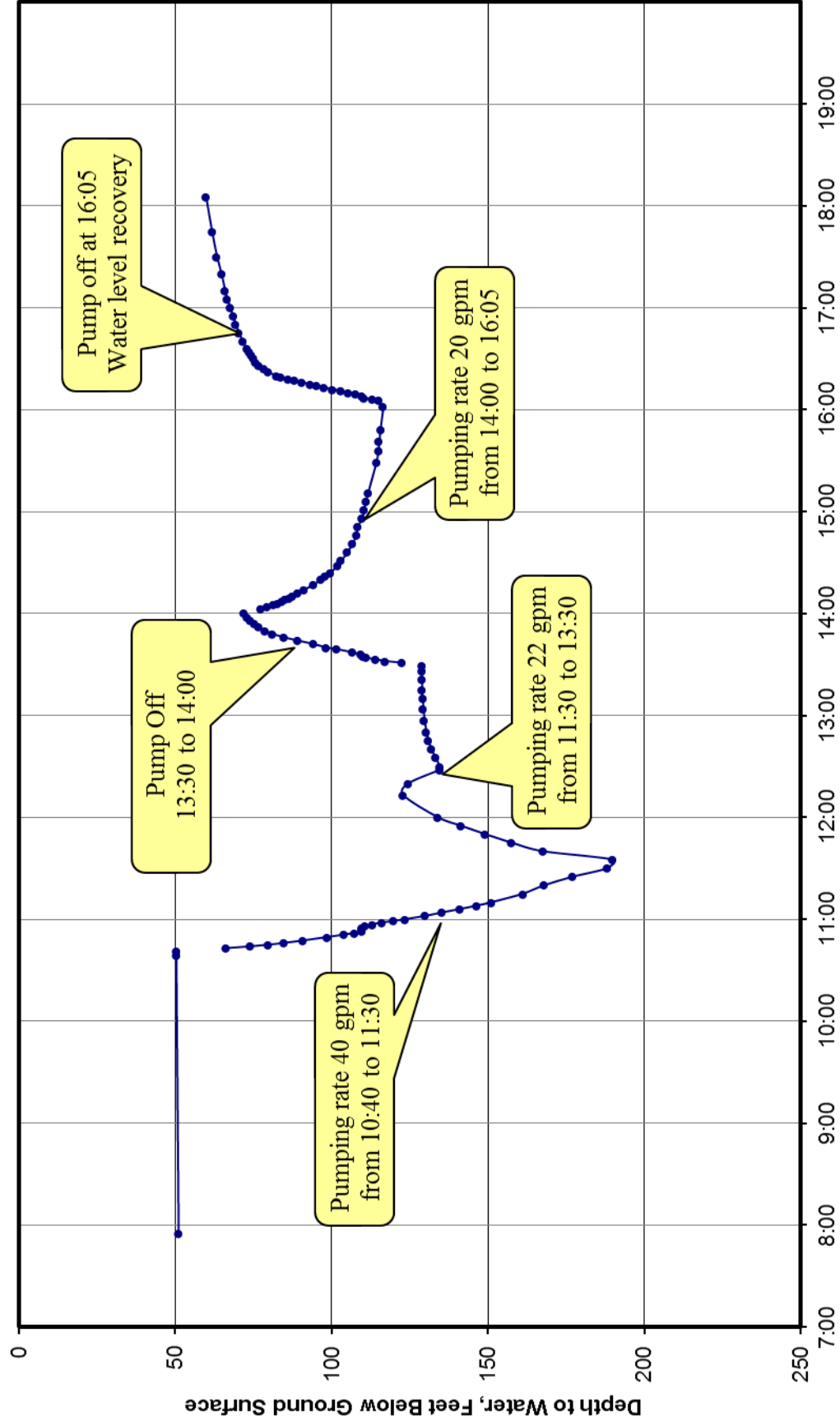
CONCLUSIONS: The new well should be equipped with a pump capable of delivering 15 gpm to the storage tank. The water level in the well will be drawn down to about 95 feet below ground surface at this pumping rate.

ACTION ITEMS:

1. Park staff will continue to monitor flow from Apache Spring and Mine Tunnel Spring to determine if there is any noticeable effect on spring flow from pumping of the new well.

cc: 479 - Dan Kimball, Henrique Barreto
FOBO - Larry Ludwig
CHIR - Jose Rameriz
SOAR – Phil Clark

Ft. Bowie Well No. 2
August 8, 2000



Ft. Bowie Well No. 2
August 9, 2000

