

December 7, 2000

L54(2380)  
CHIR/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 Chiricahua National Monument on  
November 27 through December 1, 2000.

PURPOSE: This trip was made to supervise construction and conduct drawdown and yield testing of a new water supply well at Chiricahua National Monument.

SUMMARY: A new water supply well was constructed in the campground at Chiricahua National Monument. Testing of the well indicates it will reliably produce 50 gallons per minute. Greater production may be possible, but additional testing with a larger pump would be needed to verify drawdown and yield characteristics at higher pumping rates. The well was constructed with 60 feet of surface casing cemented in place to form a surface seal. This seal should prevent surface water or shallow alluvial groundwater from entering and contaminating the well. The surface casing and cement seal extends through the unconsolidated alluvial deposits in the valley and approximately 15 feet into bedrock.

DISCUSSION: The old well at Chiricahua is located in the campground, immediately adjacent to Bonita Creek. The well was constructed in 1962. Well construction standards have changed considerably since then. The surface seal on the well extends only 10 feet below ground surface and does not provide an adequate seal to prevent surface or near-surface flow in Bonita Creek from entering the well. The well has perforated casing from 25-95 feet below ground surface. Unconsolidated alluvial deposits extend to about 40 feet below ground surface at this well. Water from this well would be classified as "groundwater under the influence of surface water". Continued use of water from this well for public water supplies would eventually require that it be treated as if it came from a surface water source, such as a lake or stream.

The new well was drilled near the middle of the campground, about 30 feet south of the amphitheater and 30 feet east of campsite #17. The location was picked to place the well beyond the projected 500-year floodplain. The location is within the previously disturbed area of the campground, but not infringing on any of the current developments or structures in the campground.

Drilling commenced on Tuesday, November 27. A 6-inch pilot hole was drilled to a depth of 70 feet by air rotary drilling methods. It was necessary to switch to mud rotary drilling to ream the hole to a larger diameter for setting and cementing the surface casing. Drilling resumed using mud rotary methods on Wednesday, November 28. The hole was reamed to 15-inch diameter to a depth of 60 feet. Steel casing (10-inch i.d.) was set in the hole from 2 feet above ground surface to 58 feet below ground surface. The steel casing was cemented in place by pumping cement slurry into the casing until cement was seen flowing from the annular space between the casing and the borehole. The bottom of the surface casing extended about 15-16 feet below the contact between the unconsolidated alluvial material and bedrock. The depth of this surface seal should prevent alluvial groundwater from entering the well.

Well drilling was completed on Thursday, November 30. A 10-inch bit was used to drill out the cement from inside the steel casing. Drilling continued to a total depth of 125 feet below ground surface. The geologic log for the well is provided in the following table.

Geologic Log of Chiricahua Campground Well constructed in Nov-Dec, 2000

| <u>Depth, feet</u> | <u>Description</u>                                                                               |
|--------------------|--------------------------------------------------------------------------------------------------|
| 0-42               | Unconsolidated alluvial material, sand, gravel, cobbles, boulders. Mostly rhyolitic tuff origin. |
| 42-77              | Grey and red rhyolite strongly welded tuff.                                                      |
| 77-87              | Welded rhyolite interbedded with grey volcanic ash.                                              |
| 87-102             | Grey volcanic ash. Composition similar to clay.                                                  |
| 102-124            | Dense, dark red, tightly welded rhyolite tuff.                                                   |
| 124-125            | Weakly welded rhyolitic ash-flow tuff. Highly fractured. Primary source of water for this well.  |

The well produced very little water until drilling penetrated the fractured rhyolitic tuff at a depth of 124 feet. The ash and tightly welded tuff from 87-124 feet act as a confining layer, trapping water in the underlying fractured tuff. After drilling penetrated the fractured tuff, the water level in the well rose to about 35-40 feet below ground surface. The well was developed by blowing water through the drilling string causing large volumes of water to be blown from the well. Estimated yield of the well during this process was more than 100 gallons per minute.

Well construction was completed by installing 6-inch pvc well screen and casing and gravel packing the well. The pvc screen and casing consisted of a 1-foot tailpiece at the bottom of the well, 60 feet of factory slotted pvc (0.015" slots), and 60 feet of plain pvc well casing. The top of the string of pvc screen and casing was about 3 feet below ground surface. Forty-four 50# sacks of Colorado Silica Sand (grain size 6-9) were poured into the well to act as a filter. The sand filled the well to 60 feet below ground surface, slightly higher than the slotted section of the well screen (63 feet below ground surface).

A test pump was installed in the well. Testing for drawdown and yield was conducted on Friday, December 1. Water was discharged from the well through a 2-inch hose to the ditch alongside the road through the campground. Water ran down the ditch, eventually entering Bonita Creek near the group campsite. The maximum production using the test pump was 35 gallons per minute. Pumping the well at 35 gpm for 6 hours resulted in 5 feet of drawdown. It appeared that the well could be pumped indefinitely at 35 gpm. Higher pumping rates could probably be sustained, but additional testing should be conducted if the park wanted to equip the well with a pump larger than about 50 gpm.

The water level response to pumping and recovery is shown in Figure 1, attached to this report.

Figure 2 shows the construction of the well.

The permanent pump setting in the well should be either above or deeper than the ash layer occurring at 87-102 feet below ground surface. The pump intake should not be set adjacent to the ash layer to reduce the potential for sucking the fine-grained ash into the well. A 40-50 gpm pump could be set at about 60 feet below ground surface (3 joints of 20-foot drop pipe) without fear of drawing the water level below the pump intake. Testing showed that sustained pumping at 35 gpm would lower the water level in the well to about 42 feet below ground surface.

CONCLUSIONS: A new well was constructed in the campground at Chiricahua National Monument. The well was constructed in a manner to prevent surface water and shallow alluvial groundwater from entering the well. Most of the water entering the well comes from a fractured bedrock aquifer encountered at 123-125 feet below ground surface. This aquifer is confined by overlying layers of bedrock and volcanic ash. Water in the aquifer is under artesian pressure, but the pressure is not sufficient to cause it to flow at the surface. The well should be capable of supplying the water needs of the entire park.

ACTION ITEMS:

1. No further action by WRD Staff.

cc: 479 - Kimball, Pettee, Flora  
CHIR - Jose Rameriz, Elvin Cluff, Dave Evans  
IMSF – Paul Robinson, Public Health Consultant  
DSC – Ken Franc, Bill Shelly

Chiricahua National Monument  
New well in campground December 1, 2000

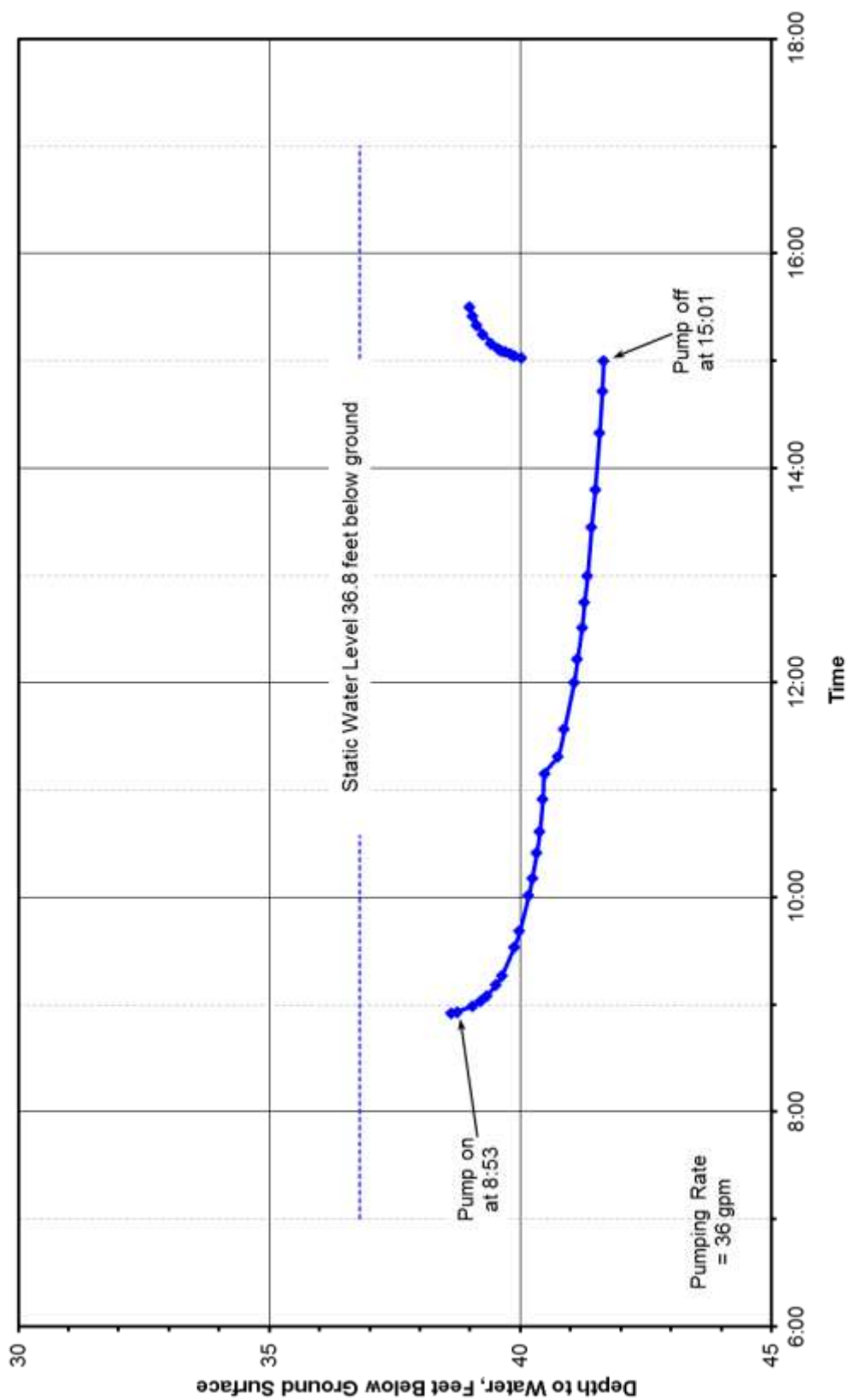


Figure 1. Water level during well testing

## Chiricahua National Monument

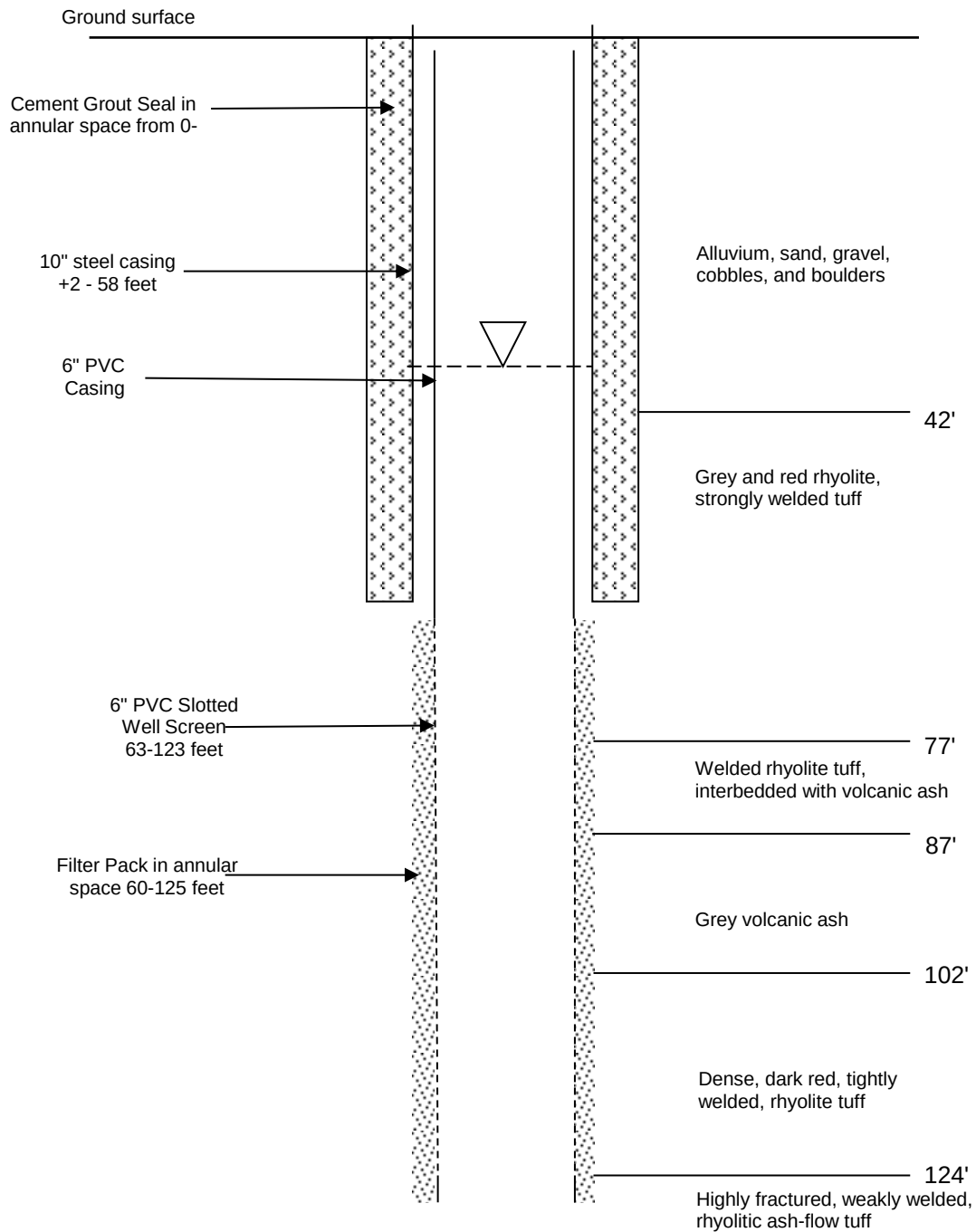


Figure 2. Sketch of well completion, not to scale