

L54(479)
NABR/General

Memorandum

To: Regional Director, Rocky Mountain Region

From: Dan B. Kimball, Chief, Water Resources Division

Subject: Report for Travel by Larry Martin to Natural Bridges National Monument on August 29-31, 1994.

The attached trip report concerns travel by Larry Martin to Natural Bridges National Monument to provide technical assistance concerning well production capacities.

The monument is served by two water supply wells. Both wells have periodically experienced mechanical problems, probably due to the large depth to water. Better monitoring of well production may provide advanced warning of future well and pump problems before they result in pump failure. Yield from each of the wells is about 6 gallons per minute. This is a sufficient quantity to meet current needs and probably also anticipated future demand increases. Continued monitoring of well and aquifer performance should be conducted to verify these projections and identify potential problems before they become critical.

An study to identify and assess the water and water-related resources within the monument is recommended to provide information on these resources and possible threats to them. This study would include; surface water quality and quantity and potential impacts by upstream and within park activities and land use practices, inventory and assessment of springs, inventory and assessment of hanging gardens, and assessment of potential impacts of ground water withdrawals by the monument.

If you have any questions, please call Bill Jackson at (303) 225-3503 or Larry Martin at (303) 225-3515.

Attachment

cc: NABR - Supt.
RMR-RN - Wise
RMR-PM - Sacco
479 - Jackson, Kimball, Inglis, Flora
BLM - Paul Summers

September 13, 1994

L54(479)
NABR/General

Memorandum

To: Chief, Water Resources Division

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

From: Larry Martin, Hydrologist, Water Operations Branch

Subject: Trip Report for Travel to Natural Bridges National Monument on August 29-31, 1994.

PURPOSE: The purpose of this trip was to provide technical assistance concerning well production capacities and provide advice on whether the existing water supply wells will supply anticipated increased demand. We also discussed the type of studies that would be needed to determine potential impacts of ground water withdrawals on water and water-related resources in the monument.

ITINERARY: Departed Fort Collins on August 29 and spent the night in Blanding, Utah. Arrived at the monument on August 30. Departed on August 31 and returned to Fort Collins.

CONTACTS: Steve Chaney, Superintendent.
Dale Cannon, Chief of Maintenance
Stan White, Maintenance worker

BACKGROUND:

Several planning documents for the monument have mentioned that the production capacity of the two existing water supply wells could be a limiting factor in meeting demands of increased visitation and additional park-based housing. Most of these assertions seem to have been derived from anecdotal information or suppositions based on such information. The monument needs accurate technical data concerning well production capabilities to facilitate long-term planning. A joint planning process will be initiated with the Bureau of Land Management, and possibly the Forest Service, to look at such alternatives as providing interagency housing, and resultantly the number of residents living at the monument. Related to this issue is determining if, and to what extent, ground water withdrawals in the monument could be affecting water and water-related resources.

DISCUSSION:

The original water supply well (Well No. 1) at the monument was a converted oil and gas test well. That well went dry in 1975 and was abandoned. It is not known if the well was properly plugged. The location of the well is no longer known. It may have been covered by one of the newer buildings in the maintenance area, or it may have been capped below land surface and covered with soil. If it was not backfilled with clean soil and cement, it could remain as a potential pathway for

contaminants from the surface to enter the aquifer. Monument staff agreed to inquire of one of the retired maintenance workers about the location of the abandoned well. If it can be located, it will be reopened, filled with clean native soil to about 20 feet below land surface, and filled to the surface with cement.

The monument is currently served by two water supply wells. Information on well construction, depth to water, and yield for the two wells are given in the attached tables. The "Near" well (Well No. 2) is used as the primary well in the winter months because the pipeline from this well to the utility area is buried under ground for its' entire length. The "Far" well (Well No. 3) is the primary well for summer use. It is not used in the winter because sections of the pipeline run across the land surface where bedrock is exposed.

I was unable to conduct yield and drawdown tests at either well because the airlines were inoperable. I was unable to get the probe of the water level meter past an obstruction at 300 feet in Well No. 2. Cascading water from casing perforations in Well No. 3 prevented getting a good response with the meter. Eventually the probe became stuck in Well No. 3 and remains there.

Yield from Well No 3 has been reduced due to a problem with the pump, possibly a broken impeller(s). Yield from this well has been limited in recent months to 2-3 gpm. This well is normally the "summer" supply well for the monument. This year, however, it has been necessary to periodically use Well No. 2 to refill the storage tank during periods when Well No. 3 could not meet demand.

The pump in Well No. 3 needs to be removed and repaired/replaced. At the same time that this work is being done, the water level meter can be retrieved from the well. Also at that time, the airline should be replaced with an access tube to allow future measurements of water levels in the well. While the pump repair personnel and equipment are in the monument, this may be an opportune time to replace the airline in Well No. 2 with an access tube and check the condition of the pump and wiring.

After the wells have been repaired, I can return to the monument and conduct yield and drawdown test for each of the wells. Information obtained from these tests will provide an indication of the maximum yield of the wells, the length of time a well can be continuously pumped, and the recovery period following pumping. This information will be necessary to determine if yield can be increased from either of the existing wells and to verify projections made later in this report.

Available maintenance records for both wells indicate that generally the yield is 6-7 gpm. Well No. 3 is currently producing much less than that, but that is due to a mechanical problem with the pump. Well No. 3 was originally test pumped at a rate of 10 gpm. Yield is less than that now, probably due to limitations of the pump. A larger pump might increase yield, but increased drawdown might limit the length of time the well could be pumped resulting in no net increase of water from the well.

Monument maintenance staff indicated that they prefer using only one well at a time, effectively limiting production to about 6 gpm. If both wells were used at the same time, yield could be increased to 12 gpm but it would be necessary to recalibrate the chlorinator to match the increased flow rate. Using both wells simultaneously remains an option to accommodate future demand if a

single well can't keep up.

Static water level measurements in the wells have been sporadic due to the great depth to water, difficulties getting a probe into the well, and broken airlines. Also, for many of the measurements that have been made, we have no way of knowing the length of time the well was allowed to recover prior to the measurement. We have no way of knowing whether the reported measurements are a true indication of static water levels. Available measurements do not indicate that water level declines have been a problem.

Water usage at the monument reportedly has increased 25% in the last 4 years. Currently, peak demand is about 150,000 gallons per month (see attached table). A well pumping at 6 gpm needs to operate 25,000 minutes or 17 days (58% of the time) to meet that demand. In the winter, demand drops to 20-30,000 gallons per month. A well needs to operate only about 10% of the time to meet the winter demand. The monument has a 50,000 gallon storage tank.

Future increased needs can be divided into 3 categories; campground use, visitor center, and additional housing. The campground is filled on most nights during the summer. There are no plans for expanding the campground, and thus no projected increase demand for that area. For planning purposes, we can project average residential use at 250 gallons per day. Projected housing increases at the monument call for an additional 3-5 units in the next 10 years. Increased water demand to supply these units could amount to about 37,000 gallons per month. Visitor center use is more difficult to estimate. We could project an average use of 5 gallons per visitor, but it is impossible to predict how much more visitation might increase. Visitation in 1993 totaled about 150,000 persons. If we project a 25% increase (37,500 persons) and assume that 30% of the increase (11,000) occurs in a single month during the peak demand season, then the increased water demand at the visitor center would be 55,000 gallons per month. Thus, the total increased demand would be 90,000 gallons. I believe these projected increases are on the high side, but also are legitimate figures for planning purposes.

Peak water demand for the monument 10 years from now could reach 240,000 gallons per month. The operating time of a single well would need to increase to 93% of the time to meet this demand. That is probably the practical limit for water supply in the monument if only one well is operated at a time. Meeting this demand would probably require alternating pumping from the 2 wells on a daily basis to allow some time for recovery of the aquifer in the vicinity of the wells. It should be noted that the wells currently are sometimes operated continuously for several days to a week with no adverse effects. Additional yield could be obtained by operating both wells simultaneously.

Both of the existing wells have had mechanical breakdowns of the pumps periodically. More frequent maintenance may be required on these wells because of the large depth to water which adds stress to the mechanical parts of the system. The water is not corrosive, nor does it contain excessive minerals that could cause undue wear to the pumps. The storage tank was reportedly clean of sediment at the last regular maintenance, indicating that the wells are not producing sand or sediment which could cause excessive wear.

As demand on the system increases, it becomes increasingly important that we monitor pump performance and aquifer response. Monitoring well yield should continue, and perhaps be more

rigorous, to provide an early warning of reduced well yield, an indication that the pump may have mechanical problems. Static water level monitoring in the wells will provide an early warning if the aquifer is being overstressed. As soon as the pumps are repaired, a regular monitoring program should be initiated to provide the monument (and WRD) with information needed to assess the impact and limitations of ground water withdrawals.

The impacts of ground water withdrawals on water and water-related resources in the monument have not been previously addressed. The small quantity of water being used (average 5000 gallons per day during peak season) and distance to possible discharge areas in the canyons makes it unlikely that significant impacts could occur or be identified. However, an assessment and identification of water and water-related resources within the monument should be conducted to provide the monument with information on those resources and possible threats. The following paragraphs summarize the items that should be included in the scope of work for such an investigation.

Surface water quantity and quality concerns include land use practices on upstream areas of drainage basins flowing into the monument. Grazing on BLM and Forest Service land may affect quality of water flowing into the monument. Past uranium exploration on BLM land has resulted in numerous small mines and tailings piles which may contribute to water quality degradation within the monument (and downstream park units).

Several perennial and seasonal springs occur within the monument. These features should be inventoried and an initial assessment made regarding their importance as habitat and water sources for wildlife. Identification of the hydrogeologic sources will provide a means of assessing their susceptibility to impacts from ground water withdrawals at the wells.

Hanging gardens occur within some of the canyons. Low permeability silty sand layers occurring within the Cedar Mesa Sandstone act as aquicludes, producing perched aquifers. Where the canyons have downcut through these aquicludes, seeps can support hanging gardens. The areal extent of the aquicludes and perched aquifers above the aquicludes is unknown. It is possible they may be continuous with perched aquifers encountered in the wells. The location and stratigraphic occurrence of hanging gardens should be mapped so that an assessment of possible relationships to ground water withdrawals can be made.

ACTION ITEMS:

1. Locate abandoned Well No. 1 if possible and properly plug the well to prevent contamination of the aquifer. Responsible Party: Monument maintenance staff.
2. Conduct yield and drawdown test on existing wells. Responsible Party: Martin. To Be Completed By: Spring 1995.
3. Develop a well monitoring program for monument maintenance staff to provide early warning of pump or aquifer problems. Responsible Party: Martin. To Be Completed By: Spring 1995.
4. Assist monument staff in developing a scope of work or study plan to investigate potential impacts of ground water withdrawals on water and water-related resources of the Monument.

Responsible Party: Martin. To Be Completed By: To be determined (dependent on obtaining funding).

Attachments

Natural Bridges National Monument Well No. 2, or "Near" Well							
Date	Oct. 1964	June 1979	June 1980	Jan. 1985	Nov. 1985	Feb. 1991	Aug. 1994
Depth to water, ft	554' 9"		533' 2"	564'	562'	558' 6"	
Yield, gpm	7.9	10			6	7	6-8
Total Depth	700			700		700	
Pump Setting	678' 8"			652		648	

October, 1964 --Well construction completed. Casing 6-5/8" ID from +2' to 700'. Perforated between 270-280' and 539-689'.

June, 1979 --Note on chemical analysis report states that the well was pumped at 10 gpm for 22 hours prior to sampling.

January, 1985 --Replaced pump, motor, and electrical cable

February, 1991--Pump pulled and found to be worn to the extent that it would only pump 1.5 gpm. Replaced pump and yield was restored to 7 gpm.

August, 1994 --Unable to measure water level due to obstruction in the well. Air line inoperable. Discharge was checked at flow meter in the water treatment building. Flowing at 8 gpm, but maintenance personnel stated that it usually produces only 6 gpm.

Well No. 2 was completed and tested for yield and drawdown in October, 1964. A step drawdown test was conducted at rates of 4 gpm for 6 hours, 5 gpm for 6 hours, 6 gpm for 11 hours, and 7.9 gpm for 6.5 hours. Total drawdown at the end of the test was 88'-8". Recovery occurred to within 2 feet of the static level in 10 hours and total recovery occurred within 24 hours. A second test was conducted at a pumping rate of 7.9 gpm for 6 hours. Total drawdown during the second test was 85'-3". Recovery occurred to within 8 feet of static level within 2 hours, to within 3 feet in 4 hours, and to within 6 inches after 10 hours of recovery.

Natural Bridges National Monument Well No. 3, or "Far" Well				
Date	May 1979	June, 1980	Feb. 1991	Aug. 1994
Depth to water, ft	520	588	535	
Yield, gpm	10	10	7	2-1/4
Total Depth	750		750	
Pump Setting			701	

May, 1979 --Well construction completed. Casing 8" ID, 20 perforations from 250-540 feet and 400 perforations from 540-750 feet. Tested at 10 gpm for 24 hours, no information on drawdown, but recovered to 534 ft in 2-1/2 hours.

June, 1980 --Static water level taken after pump had been off only 1-1/4 hours. Pumped at 10 gpm for 50 minutes before water level was drawn down to pump intake (654'). Cut flow rate to 6.2 gpm and continued for 2 hours with water level at 652'. Water level recovered to 588' after 55 minutes of recovery.

February, 1991--Replaced pump and restored yield to 7 gpm.

August, 1994 --Unable to measure water level in well due to cascading water interfering with operation of water level indicator. Air line inoperable. Discharge was checked at flow meter in the water treatment building, 2-1/4 gpm.

Water usage (gallons) at Natural Bridges National Monument, as determined from the flow meter reading in the wellhouse.

Month	1992	1993	1994
January	86,510	21,030	27,730
February	61,860	17,390	26,170
March	34,400	31,200	47,460
April	65,510	99,140	56,640
May	95,550	92,450	86,110
June	129,430	139,100	145,550
July	123,500	149,080	135,750
August	115,730	111,230	132,350
September	101,380	93,100	
October	79,170	59,460	
November	23,810	38,090	
December	27,140	22,500	