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Hydrologic Monitoring Report Fall River Pass Well

This report summarizes the hydrologic monitoring at the Fall River Pass well and water system at the end of the 2012 summer season. The well continued to be a reliable source of water for facilities at the Alpine visitor center, even though it was a dry year and the amount of groundwater pumped was greater than in previous years.

Water Use

Annual water production records for the Fall River Pass water system were obtained from park staff at the water lab. Data include the period starting with the summer of 1990 and continuing through the end of the summer 2012 season (Figure 1).

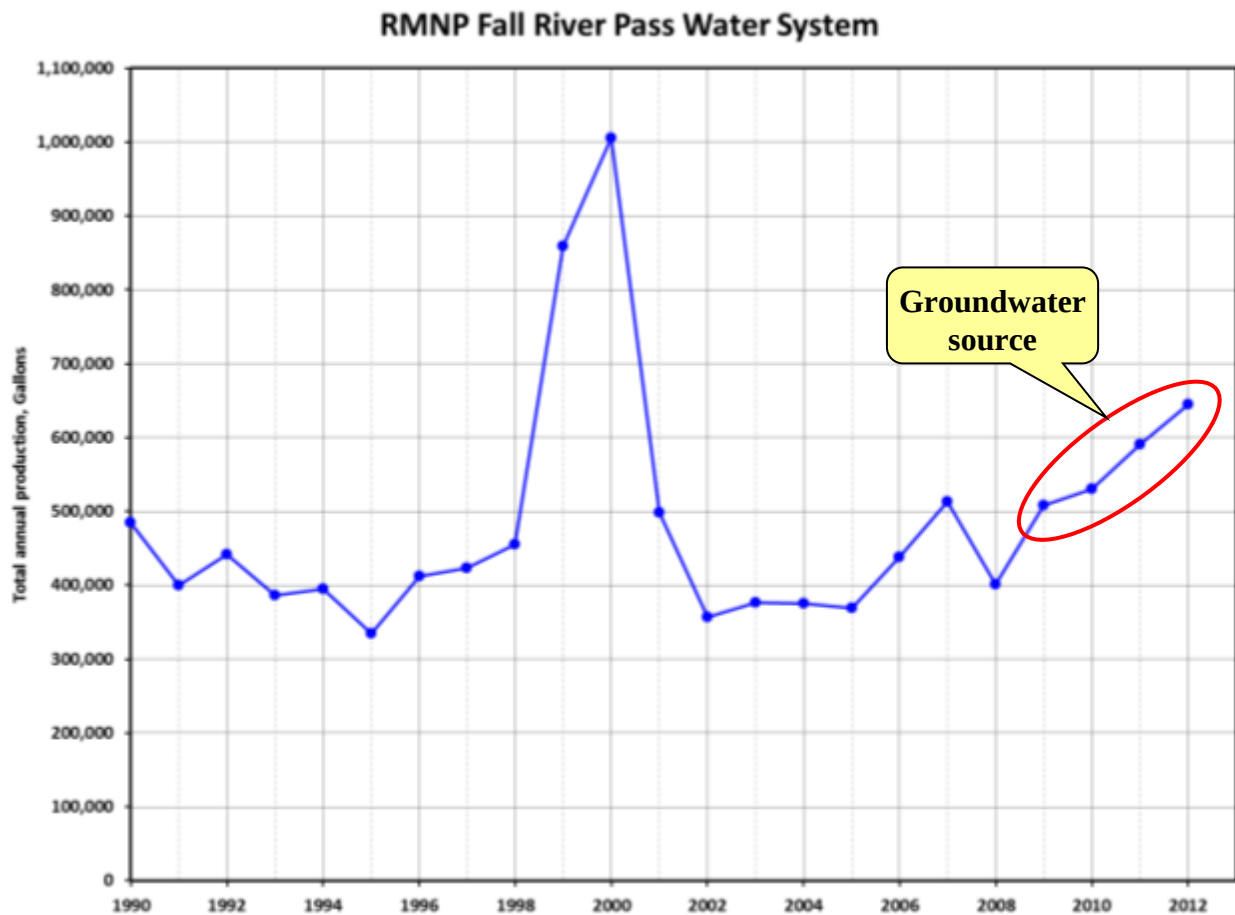


Figure 1. Annual water production for the Fall River Pass water system.

The system was supplied from a surface-water source through the 2008 season. In 2009, water production was shifted to pumping from a well near the top of Fall River Road.

Water production has increased since the source was changed to pumping groundwater. In 2012, the total amount of water pumped from the well was 644,000 gallons.

An analysis of the amount of water pumped from the well is possible by examination of the daily meter reading records. Water pumping records for the summer seasons of 2009 – 2012 show similar pumping patterns for all four years;

1. An initial period of heavy pumping in late-May and early June to fill the storage tanks.
2. Less pumping during the early-to-middle part of June.
3. High season pumping from mid-June until mid-August.
4. Tapering off during the last week of August.
5. Shut down the system in early September.

Pumping from the well is illustrated by plotting the cumulative volume pumped from the well. Figure 2 shows the cumulative pumping for the 2012 season. The data plot in a stepwise fashion because the meter is not read every day. Groundwater pumping from mid-June to mid-August 2012 averaged nearly 7,600 gallons per day.

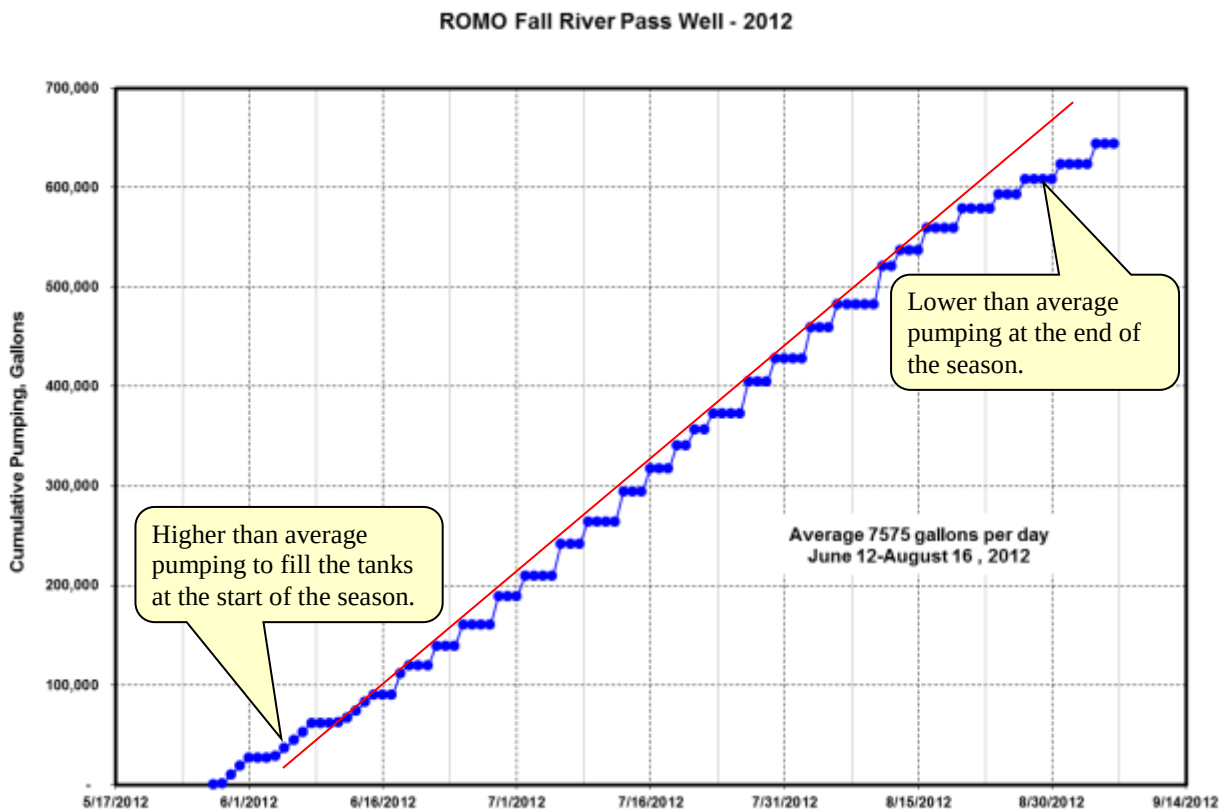


Figure 2. Cumulative pumping from the Fall River Pass Well, Summer 2012.
Red line shows average daily pumping for most of the summer.

Water level in the well

The well at Fall River Pass is equipped with a pressure transducer and datalogger. Depth to water and water temperature are recorded every hour. The water level response in 2012 followed the same pattern as in previous years. The water level rise in the spring due to recharge from melting snow occurred a little earlier in 2012 due to the warm spring. The water level was drawn down lower during the peak summer pumping season due to drier than normal conditions and that significantly more water was pumped in 2012. The water level during pumping was about 130 feet above the level of the pump intake at the minimum water level in August.

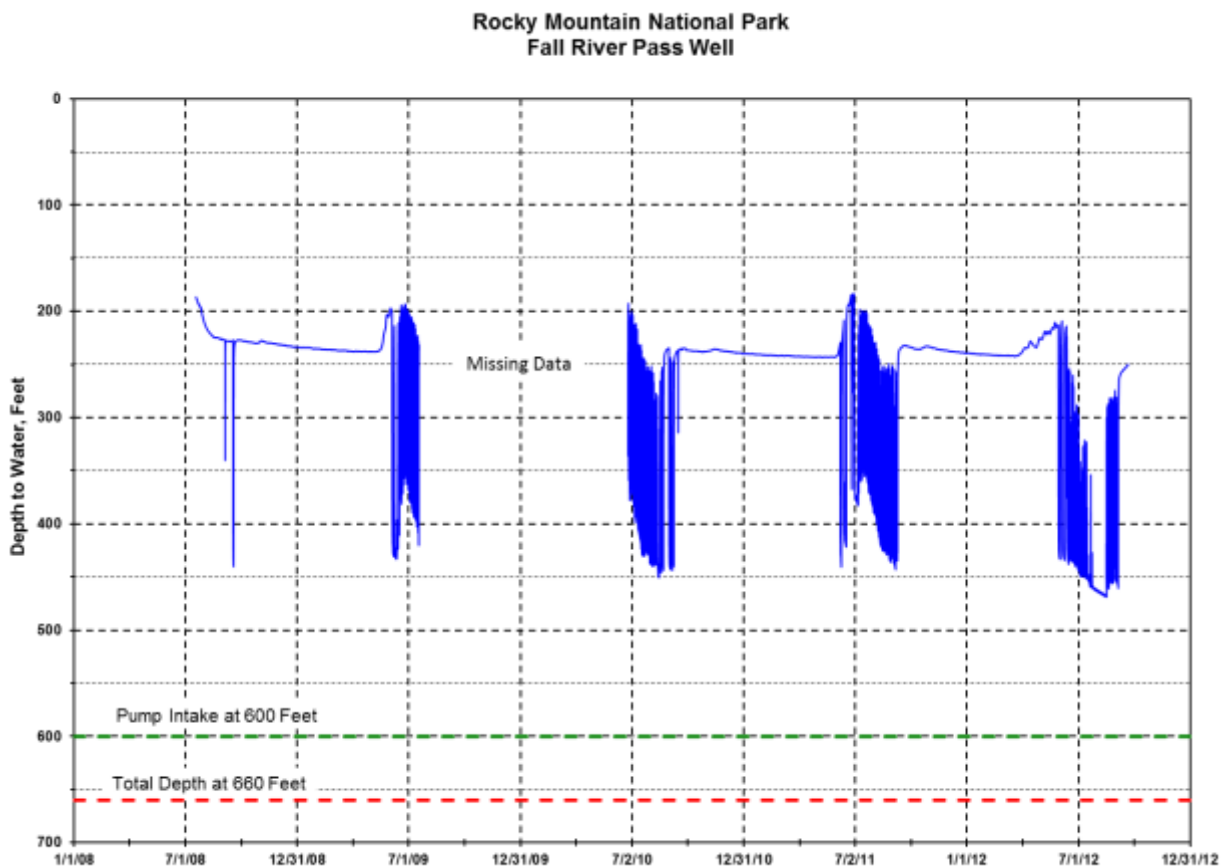


Figure 3. Water level response in the Fall River Pass Well, 2008-2012.

The data from January 1, 2012 to September 20, 2012 are shown in Figure 4. The data show a steady water level throughout the winter. The water level rise from infiltration of melting snow started about April 1st this year, 1-2 months earlier than has been observed in previous years. Water level declined during the heavy pumping periods of July and August and then recovered to normal levels when pumping stopped. There was a period of nearly continuous pumping from about mid-July to mid-August this year.

Dashed lines have been added to Figure 4 to show the total depth of the well and the depth of the pump intake. The well is 660 feet deep and the pump intake is at 600 feet.

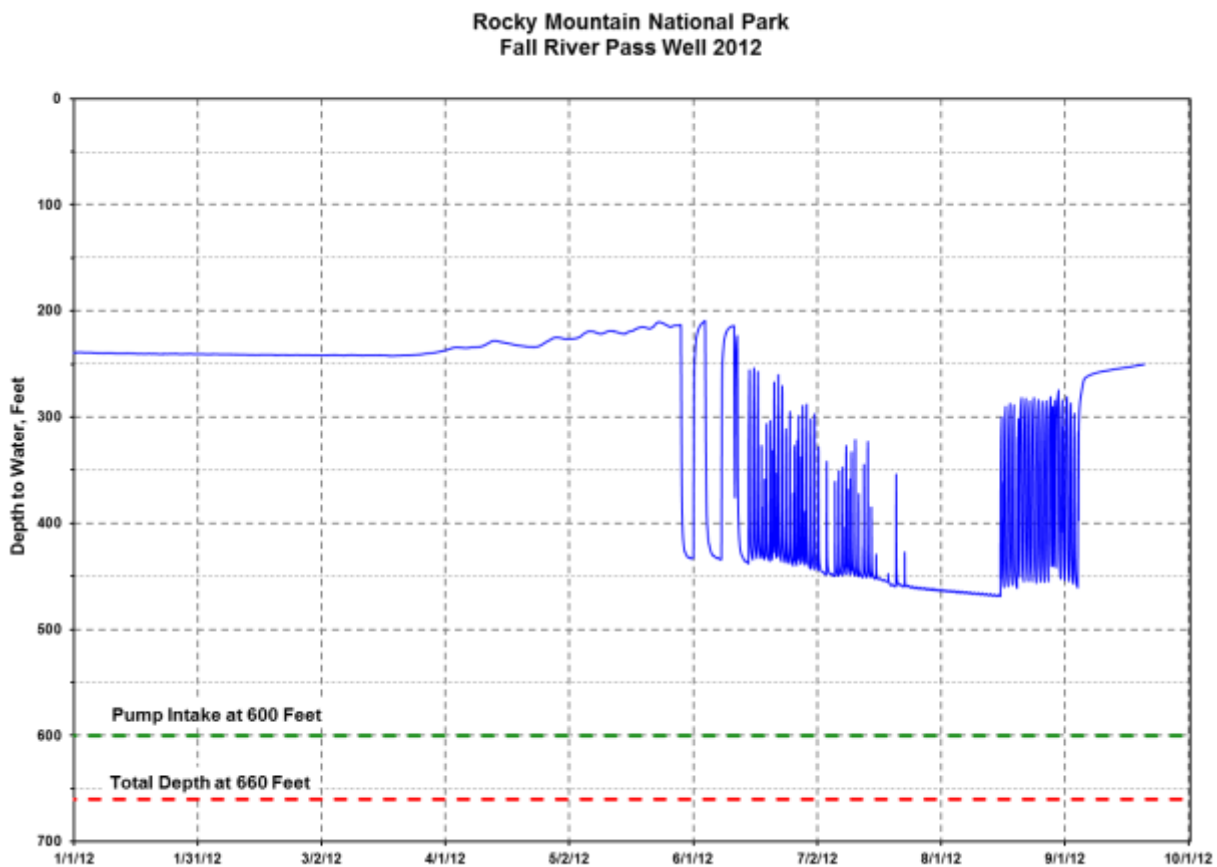


Figure 4. Hydrograph of water levels in the Fall River Pass Well, January – September, 2012.

A more detailed look at the water level response to pumping and recovery is provided in Figure 5; showing data from the summer pumping period from late-May to early-September 2012. The water level during extended pumping periods or toward the end of the summer season was about 470 feet below ground surface, leaving 130 feet of water in the well above the level of the pump intake. This is similar to patterns observed during the past three summers, as shown in Figure 3. The water level was about 10 feet lower in 2012, most likely due to drier conditions and pumping larger volumes of groundwater. It appears that the well will be a reliable source of water for facilities at Fall River Pass. However, there is not much additional capacity available to meet increased demand; should that become a need. The data suggest that it would be possible to pump the well continuously through the summer without causing excessive drawdown (see for example the graph from late-July to mid-August). At a pumping rate of 6gpm, the well could produce 8500 gallons per day.

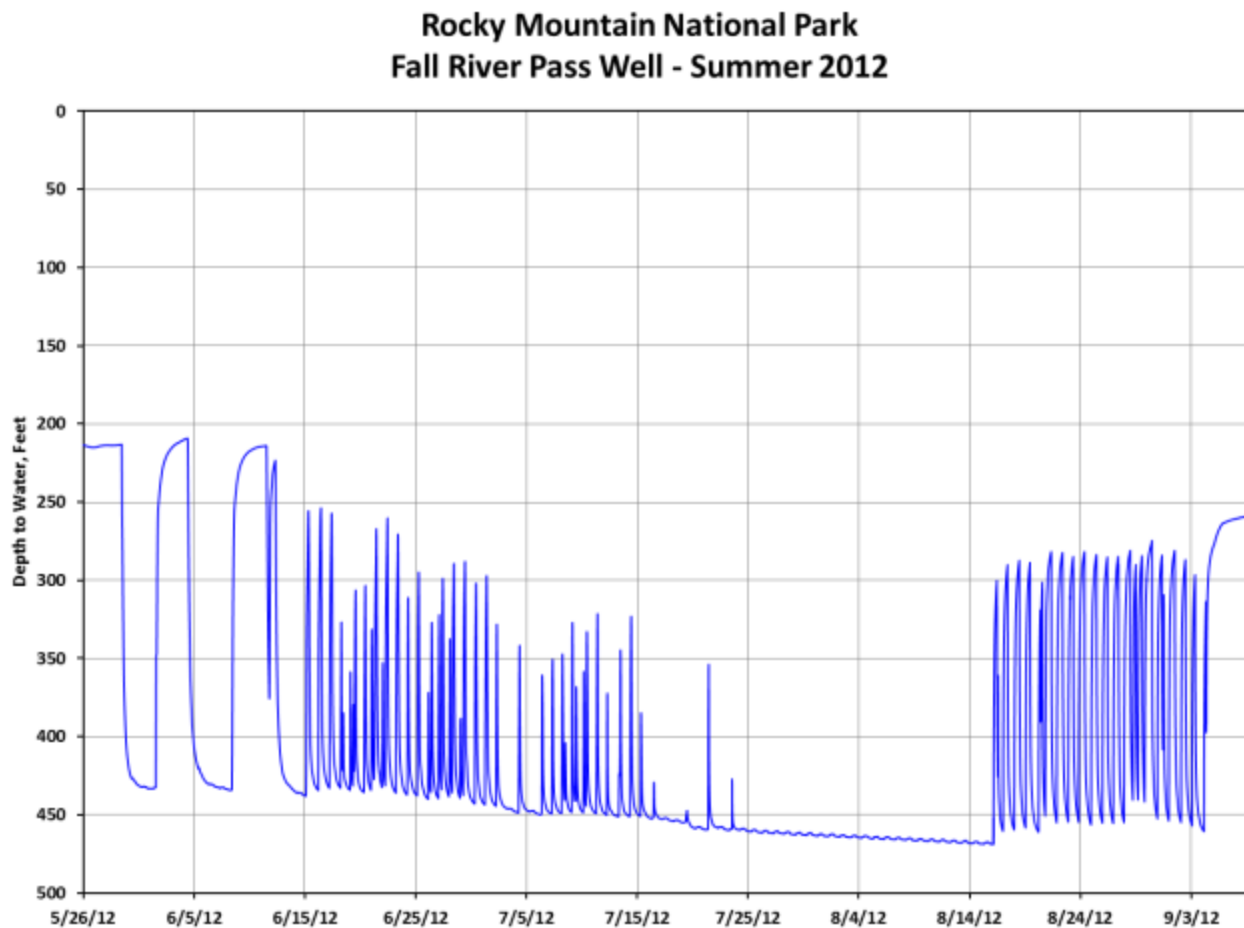


Figure 5. Water level response to pumping during the summer season, 2012.

The Fall River Pass Well was pumped continuously for several days to fill the water storage tanks at the beginning of the summer. Figure 6 shows the water level response during this period when the storage tanks were being filled. The following table showing the pumping schedule for the initial tank filling is derived from the water level records and the meter reading records.

The data show that the well can be pumped continuously for several days with no danger of dewatering the well or the aquifer.

<u>Pump On</u>	<u>Pump Off</u>	<u>No. Hours</u>	<u>Approx. Volume</u>
May 29 11:50	June 1 11:50	72	26,000 gallons
June 4 10:50	June 8 9:50	95	34,000 gallons
June 11 13:50	June 11 19:50	6	2,000 gallons
June 12 8:50	June 15 2:50	66	24,000 gallons
TOTAL			86,000 gallons

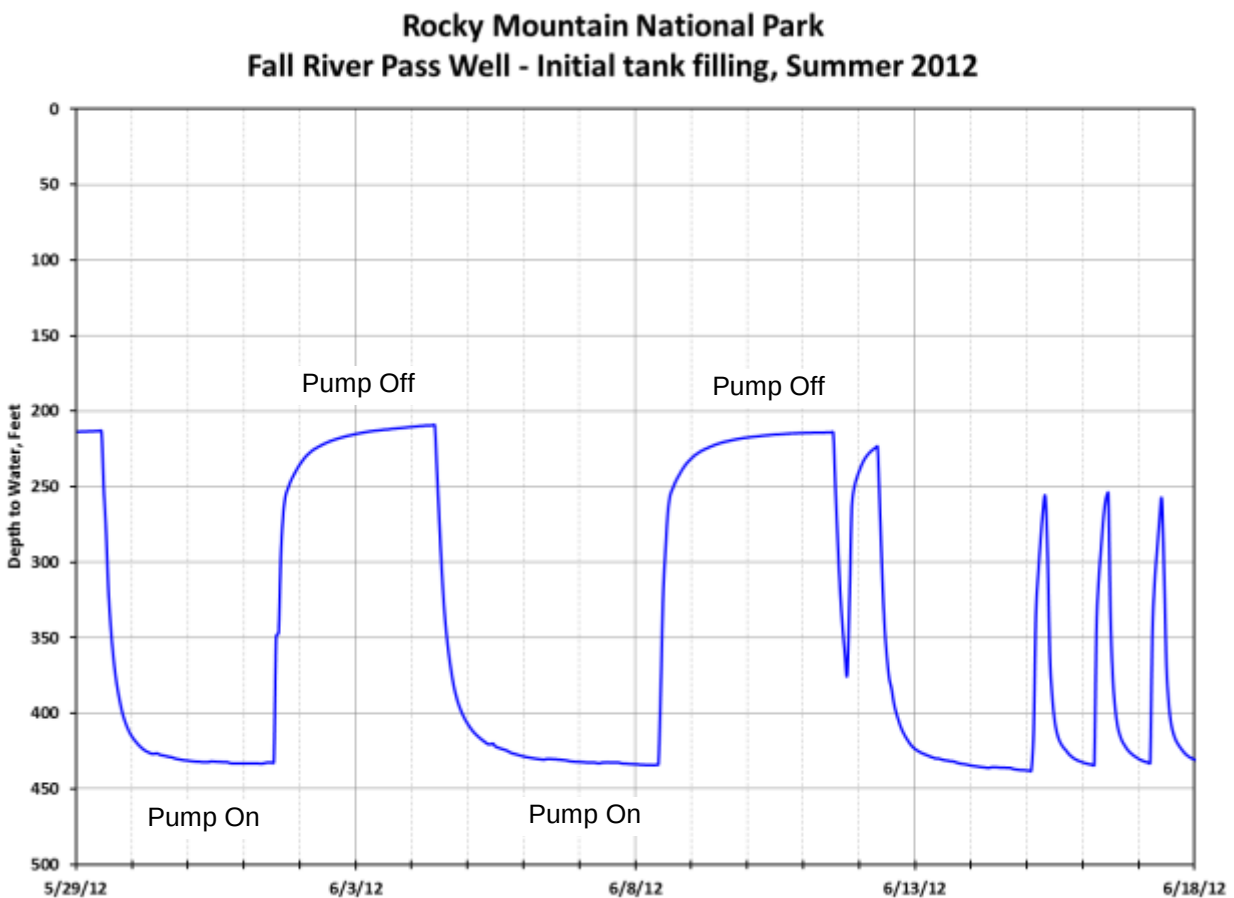


Figure 6. Hydrograph of water levels in the Fall River Pass Well during a period of extended pumping to fill the water storage tanks at the beginning of the summer season.

Figure 7 shows the drawdown and recovery of water levels during a typical pumping regime from mid-July, prior to fixing a leak at the 20,000-gallon tank. The period from July 10-14 is typical of normal operations from mid-June to mid-July, 2012. The pump was operated about 23 hours per day, with a recovery period of 1 hour or less. The pump operated nearly continuously from July 15 to August 15 (see Figure 5). An average of 7,575 gal/day was pumped during this period.

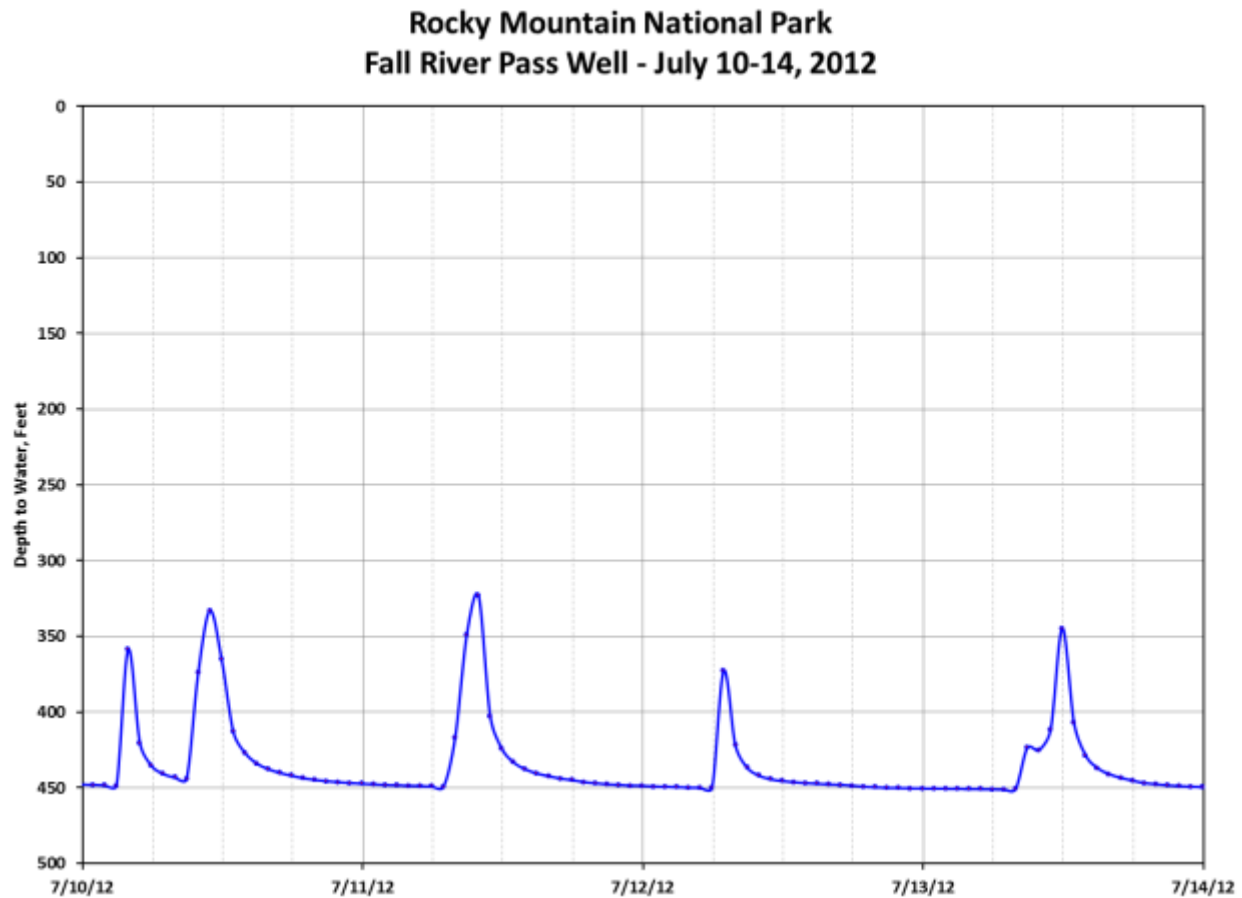


Figure 7. Hydrograph of water levels in the Fall River Pass Well during typical pumping operations, July 10-14, 2012.

Figure 8 shows the drawdown and recovery of water levels during a typical pumping regime from the latter part of the summer, after the leak at the 20,000-gallon tank was fixed and the demand was lower as visitation declined. The period from August 22-26 is typical of normal operations from mid-August to early-September. The pump was operated for 12-14 hours per day, with a recovery period of 10-12 hours. An average of 4,444 gal/day was pumped during this period.

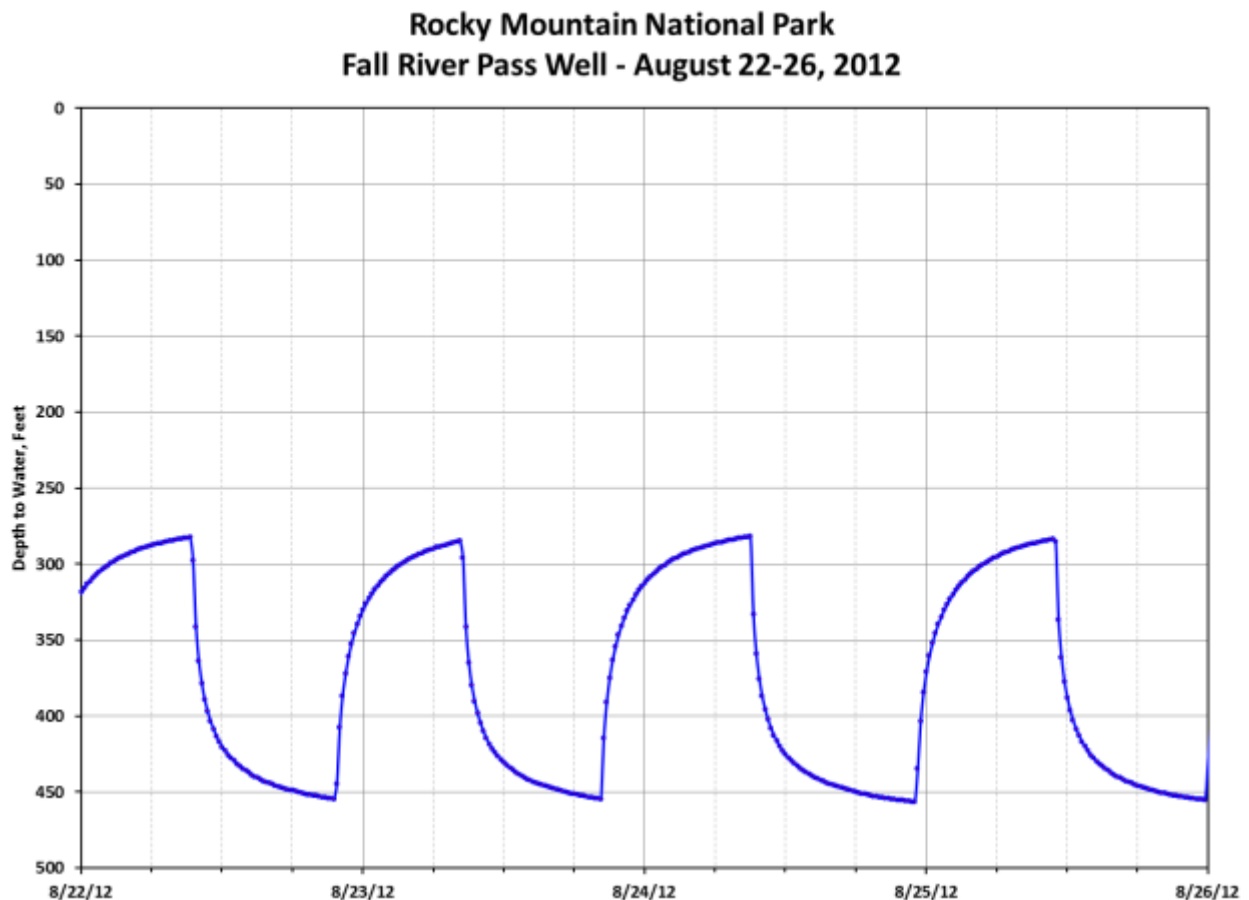


Figure 8. Hydrograph of water levels in the Fall River Pass Well during typical pumping operations, August 22-26, 2012.

Future Monitoring

Data was downloaded on September 20, 2012. The datalogger is programmed to continue recording hourly water levels through the winter and next summer. I plan to download data again in September 2013 and conduct analyses similar to that provided in this report.

If there are any questions or comments, please contact me.

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