

November 4, 2008

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SEKI/General

Memorandum

To: Superintendent, Sequoia and Kings Canyon National Parks

Through: William L. Jackson, Chief, Water Resources Division (WRD)
Gary Rosenlieb, Chief, Water Operations Branch (WOB)

From: Larry Martin, Hydrogeologist, Water Operations Branch, WRD

Subject: Assessment of water use at Wolverton and Lodgepole and the need for monitoring programs, Sequoia National Park

Introduction

The General Management Plan for Sequoia and Kings Canyon National Parks commits the parks to, “*Conduct in-depth watershed studies...to develop a system to monitor and manage water availability, spring water recharge, and groundwater availability under differing precipitation regimes.*” The desire for monitoring programs is primarily aimed at the Lodgepole and Wolverton water systems in the Giant Forest area of the park. These are the largest water systems that provide potable water for visitors to Sequoia National Park. The water systems at Grant Grove are discussed in a separate trip report.

While this might initially seem like a necessary and noble endeavor, it’s impossible as a practical matter. The watersheds are too large and geologically complex to allow prediction of runoff, particularly the low-flow characteristics. Fractures in the granitic bedrock are recharged during the spring snowmelt season and then slowly release water by draining during the late-summer dry season. Whether these characteristics will change significantly under some future (changed) climate regime is unknown and unpredictable with any degree of confidence.

Park staff will learn how water availability is being affected by observing low-flow conditions during years of high and low winter precipitation. Low-flow streamflow characteristics may or may not change depending on the amount of snowpack, the onset of snowmelt in the spring, duration of the summer dry period, and other climate and hydrologic conditions.

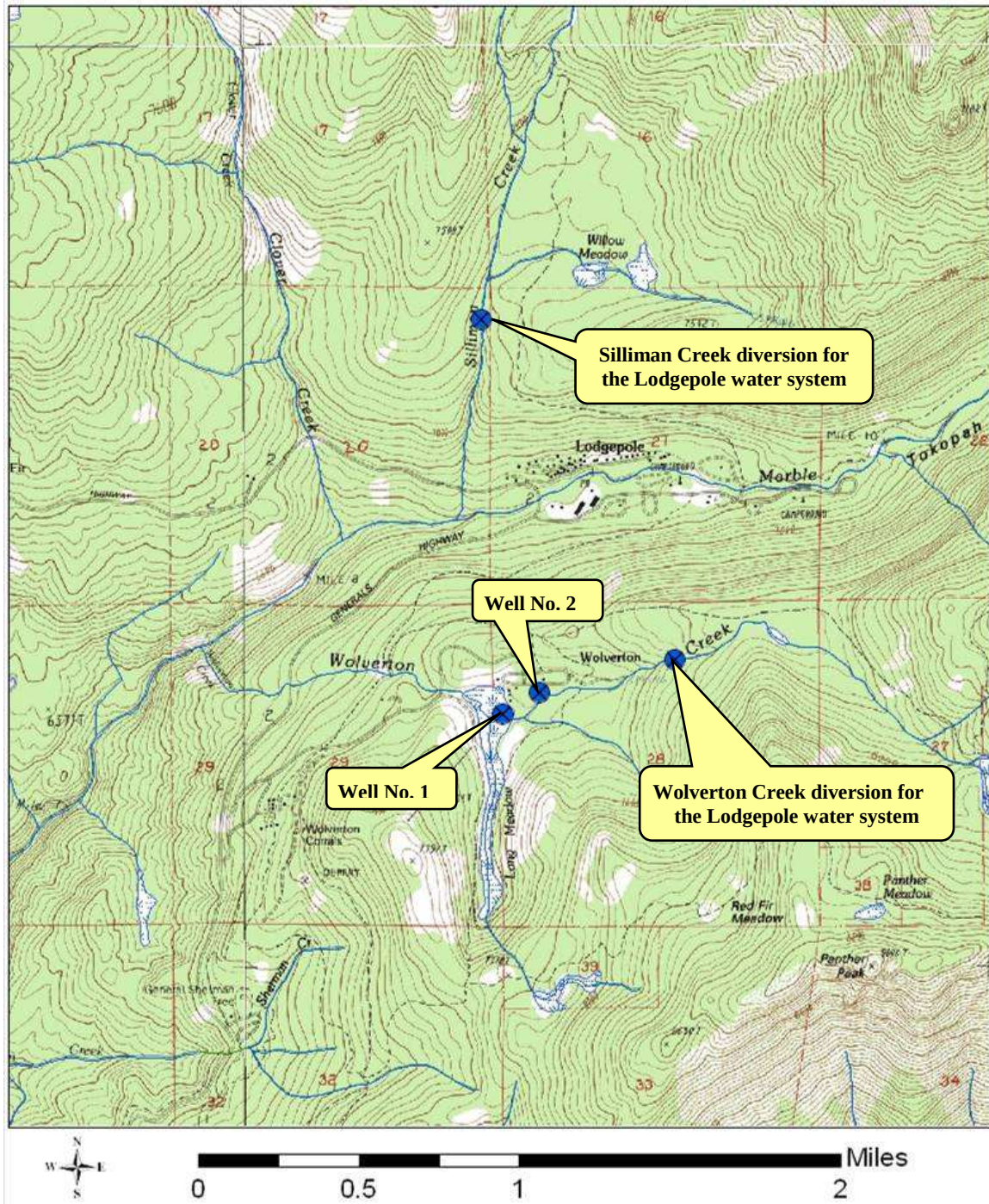


Figure 1. Surface water diversions and water-supply wells for the Lodgepole and Wolverton water systems

The amount of water withdrawn from streams to meet the peak demand of the public-water systems at Lodgepole and Wolverton is very small, probably less than 0.1 cfs. Assessments of ecological and biological conditions in the vicinity of diversion dams should readily reveal whether these diversions have a significant impact on the flora and fauna associated with the streams.

Water-supply wells at Wolverton

There are at least two water-supply wells at Wolverton (Figure 1). Several other wells have been drilled, mostly to explore the water-producing potential of the sediments in Long Meadow. Most (or all) of those wells were plugged and abandoned because they did not produce enough water. The two wells that were developed as water-supply wells each produce 50 gpm or more. The wells are primarily used as backup wells; the primary source of water is the diversion of surface water from Wolverton Creek. Extensive pumping of water from the wells would lower the water table in the meadow and cause adverse impacts to the natural hydroperiod and consequently, the flora and fauna of the meadow.

Wolverton Water System

Water is diverted from Wolverton Creek upstream of Long Meadow (Figure 1). The Wolverton water system provides water for visitor facilities at Giant Forest, Wolverton, Wuksachi, and the Red Fir maintenance area.

Several large leaks in the Wolverton water system were repaired in the last year. The resultant decrease in water usage can be seen by comparing water usage in 2008 with previous years (Figure 2). It appears that the leakage must have been about one million gallons per month (about 25 gpm). Water usage in 2008 was greatly reduced through a combination of water conservation, leak detection and repair, and more efficient operation. Current water usage is about 500,000 gallons per month in the off-season and about 900,000 gallons per month in the peak visitor season. Peak demand (900,000 gallons per month) is equivalent to about 21 gpm or 0.05 cfs.

Lodgepole Water System

Water for the Lodgepole water system is diverted from Silliman Creek about a half mile northwest of Lodgepole (Figure 1). The Lodgepole water system provides water for visitor facilities in the Lodgepole valley, including a visitor center, store, restaurant, campgrounds, and showers and laundry.

Water use ranges from about 100,000 gallons per month in the off-season to about 1.1 million gallons per month (about 25 gpm or 0.05 cfs) in July and August (Figure 3).

Need for a Monitoring Program

Streamflow is generally measured and reported in cubic feet per second (cfs). One cfs is equivalent to 450 gpm. Low-flow streamflow data are not available for the streams where water diversion is occurring. Maintenance personnel report that there has never been a shortage of water at the diversion dams.

Wolverton Water System

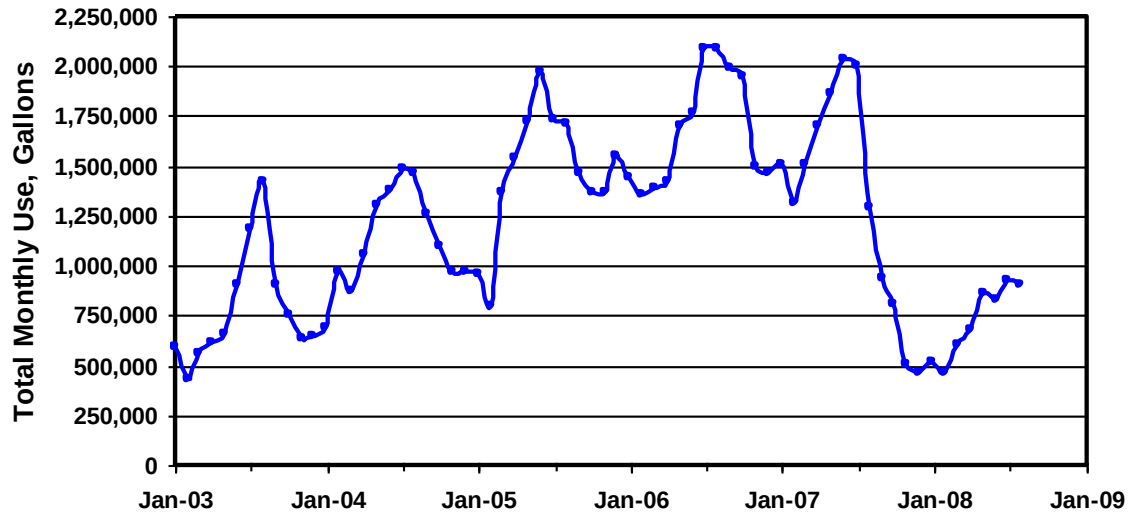


Figure 2. Monthly water use for the Wolverton water system.

Lodgepole Water System

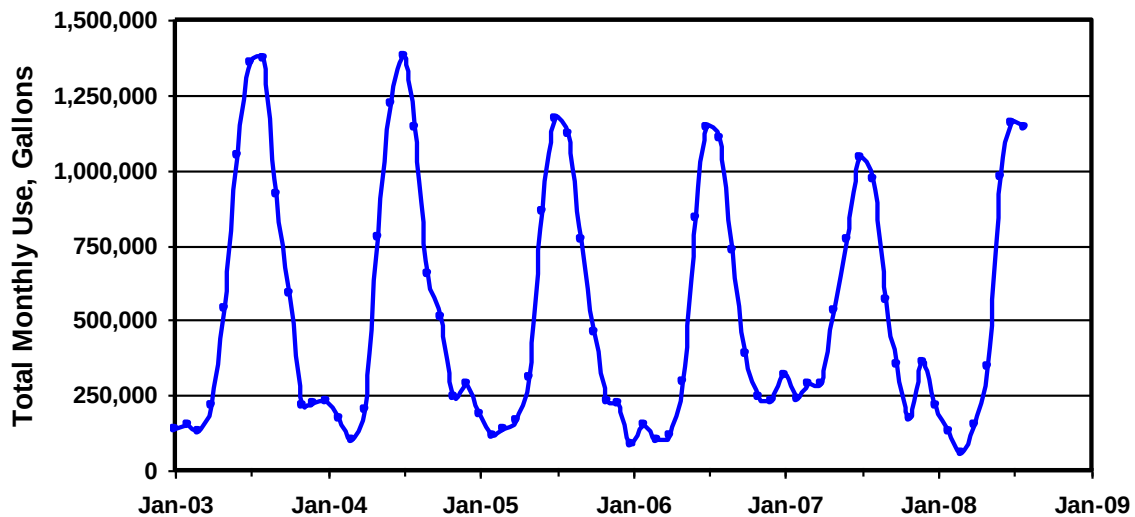


Figure 3. Monthly water use for the Lodgepole water system.

The actual rate of diversion is not known for either of the water systems. The diversion rate is greater than the average use (25 gpm) of treated water for each of the systems because some water is used for backflushing or returned to the stream below the treatment plant. If the diversion rate is double the rate of water use, that would be about 0.1 cfs (50 gpm). The diversion rates are very small compared to natural streamflows.

A monitoring program could be initiated to better document the rate of diversion from each creek and the percentage of streamflow being diverted. The easiest and most accurate method of measuring the total diversion from each creek would be to install a water meter on the raw water line that brings water into the treatment plant. Streamflow in the creek could be measured either upstream or downstream of the diversion dam, wherever the flow could best be captured or channelized to facilitate measurement. Measuring streamflow would be difficult and likely subject to a high degree of uncertainty due to the difficulty of capturing a small amount of flow in a large stream channel. Much of the flow might occur as underflow through the sand, gravel, and boulders in the bed of the stream channel.

Because of the difficulty and probable uncertainty of streamflow measurements, it might be just as beneficial to make qualitative assessments of the amount of flow upstream and downstream of the diversion dams. For example, streamflow could be observed at 3-4 locations in a reach extending 100-200 meters upstream of a diversion dam and another 3-4 observations in a reach extending 100-200 meters downstream, and then a qualitative judgment could be made about whether there was a noticeable change in the amount of water flowing in the creek. It's unlikely that diversion of 0.1 cfs would result in a noticeable change.

Measuring the amount of water diverted from a creek could be easily accomplished by installing a meter on the raw water line at the entrance to the water treatment plant. Measuring streamflow in the creek would be difficult and probably could not be accomplished with any reasonable accuracy.

Impacts of water withdrawals

Apparently there have been no investigations to determine whether the existing water diversions have affected the water-dependent natural resources in the creeks. Whether impacts have occurred is a question that should be addressed by ecologists and biologists. Since the diversions have been in place for several tens of years, there's been plenty of time for establishment of ecological differences upstream and downstream of the diversion dams. The ecologists and biologists would need to be consulted to design a monitoring program to provide a quantitative assessment of ecological or biological differences upstream and downstream of diversion dams.

It's highly unlikely that the small rates of diversion would cause any noticeable ecological changes in these highly variable streams. The seasonal variation and the variation between wet and dry years likely overwhelm any effect due to diversion of 0.1 cfs or less.

Summary and Recommendations

1. Conduct leak detection and repairs on all parts of the water systems to minimize the amount of water needed for the water-supply and distribution system.
2. Conduct a review of all phases of the water treatment and distribution system to identify opportunities for improved efficiency.

3. Divert only the minimum amount of water necessary to meet the demand for potable water.
4. Conduct ecological and biological assessments of the streams in the vicinity of the diversion dams to determine whether water diversion has caused measurable impacts to the flora and fauna associated with the streams.

If there are any questions regarding this trip report, please call me at (970)-225-3515.

cc:

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