

The San Francisco Peaks

Snowmaking, Wastewater and Human Health

Wastewater Bulletin

July 2006

The San Francisco Peaks majestically rise out of the forested plateaus of Northern Arizona. These islands of ecological and cultural diversity are sacred to thirteen Native American Tribes, provide habitat for threatened plants and animals and inspire all with their beauty. Water, in the form of winter snows and summer rains, collects on the Peaks providing life-giving sustenance to both human and natural communities. The health of these communities is threatened by the proposed use of reclaimed wastewater to make artificial snow for use on the ski slopes of the Arizona Snowbowl.

The Role of Reclaimed Water in the Arid Southwest

Living in the middle of a forest, it is easy to forget that Flagstaff is located in a semi-arid region where much of the moisture from snow and rain is lost to evaporation. According to local experts, ground water recharge is greatest in the winter months when the ground is saturated with snow-melt and evapotranspiration occurs at lower rates. Even with this gain, a significant portion of our winter snowpack is lost naturally to sublimation—the process where snow “evaporates” before it can melt and become runoff. In the production of artificial snow, 41% to 96% of the water used is lost to evaporation and sublimation—significantly reducing any potential recharge to the aquifer. In fact, artificial snowmaking is a consumptive use, similar to irrigation.

Reclaimed wastewater is not “extra” water. Using reclaimed water instead of returning it to the aquifer for recharge and other down-stream uses has potentially significant impacts to our future water supplies. During the winter months, reclaimed wastewater from sewage treatment plants recharges the Coconino aquifer through discharge into the Rio de Flag drainage. Flow from this recharge can be intercepted by two wells in the Foxglen and Continental subdivisions. The Flagstaff City Council needs to study the ramifications of removing up to 1.5 million gallons of water a day from the aquifer for use in snowmaking during the important recharge months of November through February.

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Reclaimed Water... Is it Really Safe

Is Arizona's Wastewater Clean?

Current water quality standards in Arizona inadequately address the use of reclaimed water. Drinking water standards cover only a limited number of contaminants and were designed for evaluating supplies of fresh water, not for evaluating reclaimed water.

Under Arizona regulations, reclaimed wastewater is defined as A+ water, but does not meet the same standards as potable (drinkable) water. Class A+ water is acceptable if "there are no detectable fecal coliform organisms in four of the last seven daily reclaimed water samples taken...". Public drinking water is not allowed to have any positive repeat samples detecting fecal coliform.

According to the Forest Service analysis covering the use of reclaimed water on the Peaks, a wide variety of microbial pathogens may be found in wastewater. Although intestinal pathogens are generally removed by wastewater treatments, effluent still contains detectable levels of intestinal bacteria, viruses and protozoan parasites. Since water quality standards and current treatments do not ensure 100% protection, even waters that have met coliform standards can be responsible for outbreaks of waterborne disease. For example, a June 2002 outbreak of Norwalk virus in the Grand Canyon was the result of reclaimed water being deposited into the Colorado River from the sewage treatment plant inside Glen Canyon Dam.

Many people incorrectly assume that the pathogens in reclaimed water used for snowmaking are destroyed by the freezing, thawing and dilution that occurs as a part of the snowmaking process. In 2000, the U.S. Army Corp of Engineers published a study which showed that many species of bacteria survived multiple freeze-thaw cycles and reproduced in the resultant snowmelt, even though the same process destroyed over 99% of the total and fecal coliform bacteria. Given the fact that current

wastewater treatments are not perfect, it is essential for the City of Flagstaff to share with the public, specific pathogen concentrations in Flagstaff's wastewater, including a full discussion of potential consequences of ingesting snow while skiing or playing.

In addition to pathogens, reclaimed wastewater is allowed to contain higher levels of chemical contaminants than drinking water. For example, an antibacterial agent called Triclosan is found in Flagstaff's reclaimed water. Ultra Violet light can transform Triclosan into dioxin—known to cause cancer, birth defects, immune suppressions and fertility reductions. This is of special concern when discussing snowmaking because as snow, the wastewater would be on a large surface area for long periods of time at high elevations of the San Francisco Peaks where Ultra Violet light is very intense. In addition to natural exposure, the Rio de Flag water treatment plant uses Ultra Violet light to disinfect water.

Such potential contamination is of great concern, given the likelihood that children might eat snow made from this reclaimed wastewater. Arizona Department of Environmental Quality (ADEQ) regulations list snowmaking as an allowable use for reclaimed wastewater. However, these same regulations prohibit the use of reclaimed wastewater for human consumption or any activity with the potential for ingestion. While there will be signs posted at the Snowbowl informing visitors of the use of reclaimed water, the Forest Service simply assumed that because ADEQ approved the use of reclaimed water for making snow, the potential effects of contact through this method were fully considered.

Current drinking water standards are not reliable as the sole standard of safety. **Additional scientific research and new wastewater treatment standards are needed before reclaimed wastewater can be used in situations where it can be safely ingested.**



Scientific Research Shows Cause for Concern

The use of reclaimed wastewater is a fairly new practice. As a result, scientific research is just now revealing serious concerns about untreated substances remaining in reclaimed wastewater and their potential effects on human health, wildlife and aquatic systems.

Reclaimed water from wastewater treatment plants is screened for certain chemicals, but many chemicals of concern do not yet fall under screening protocols. The Forest Service acknowledges that recent research shows pharmaceutical substances and remnants of personal care products are indeed being discharged from municipal wastewater treatment plants and dispersed into the environment.

Scientific literature on the subject of reclaimed wastewater indicates that researchers are concerned that the residues from a variety of substances ranging from caffeine, nicotine, aspirin and fragrance to antibiotics, hormones, anti-cancer drugs and hospital waste can cause adverse health effects by weakening and interfering with immune and hormone systems when ingested. A 1999 paper, printed in the December issue of *Environmental Health Perspectives*, noted that studies had found more than 60 of these agents in water sources. According to a 2003 study by McGovern and McDonald, "between 50 and 90 percent of a typical drug dosage can be excreted and introduced unchanged into the environment."

A 2004 study, conducted by the Water Resources Division of the United States Geological Survey and Dr. Catherine Propper, with the Department of Biological Sciences at Northern Arizona University, found that City of Flagstaff treated wastewater is screened at several levels for contamination, but it is not screened for many chemicals known to influence

vertebrate physiological function. Some of these chemicals can interrupt the normal function of the vertebrate endocrine system by binding to hormone receptors and preventing many critical growth and physiological functions.

The Environmental Protection Agency and the Federal Drug Administration are just beginning to look at the environmental and public health issues involved with the vast array of personal care products and pharmaceuticals contained in wastewater. More research is needed to assess the long term consequences of humans ingesting sub therapeutic doses of numerous drugs. In the meantime we should not experiment with the health of our children, wildlife and ecosystems.

Arizona State Law and Federal Clean Water Act

The Federal Clean Water Act requires that the City of Flagstaff's wastewater treatment plants have a permit to discharge treated effluent into the Rio de Flag watershed. Moving the point of discharge to Forest Service land does not remove the City of Flagstaff's obligation to protect public health.

The Arizona Department of Environmental Quality (ADEQ) has approved the use of reclaimed water for snowmaking. However it also requires that reclaimed water be "contained" within the area of application. This means that ALL reclaimed water used for making snow at the Arizona Snowbowl must, as a requirement of its use, remain within the special use permit area. This hardly seems possible, given the steep slopes, accumulation of snowpack, and the eventual Spring run-off. In addition, the heavy rains of the Summer monsoon season also cause large amounts of runoff to flow into adjacent areas.

More People... Less Water

It is especially important during a drought cycle for the City of Flagstaff to determine the long term effects of diverting reclaimed water to the Snowbowl. According to the Arizona Department of Water Resources, the number of people in north central Arizona is expected to double in the next fifty years. Flagstaff's population is expected to increase by thirty-five percent from 2000 to 2020. If current water use trends continue, Flagstaff will need an additional 910 million gallons of water per year to meet the increase in demand. Most of the water used to feed this growth will come from already shrinking ground water supplies. Conservation could reduce demand in the short term, but will not solve the long-term problem of limited water supplies.

According to a 2002 City of Flagstaff report to the Water Commission, Flagstaff has become more dependent on groundwater from the regional Coconino aquifer, with groundwater use exceeding surface water use from Lake Mary. Over the last decade, sixty-four percent of the City's water supply came from the Coconino aquifer. Any transfer of treated effluent to make snow on the San Francisco Peaks, will reduce recharge to City groundwater supplies.

Flagstaff's portion of the capital costs of a proposed pipeline (by the North Central Arizona Water Supply Project) designed to replace the Lake Mary water supply is approximately \$40,700,000. A hefty price tag for a city the size of Flagstaff! The City has identified 30 to 40 sites for further groundwater explorations in the regional aquifer. However, the depth to groundwater will mean high drilling costs.



Giving Away Our Water?

The City of Flagstaff made a commitment to provide reclaimed water for making snow at the Arizona Snowbowl based on a flawed assumption that the Forest Service would adequately address issues relating to public health, safety and impacts to future water supply in the Environmental Impact Statement covering upgrades to the Arizona Snowbowl. However, the Forest Service considered the supply of reclaimed water to be a "water resource management decision by the City of Flagstaff" and outside of the scope of the planning process, including impacts to City wells in East Flagstaff. The City of Flagstaff has a responsibility to taxpayers to reveal all of the costs associated with supporting the project including what the Snowbowl will pay for the water, the cost of reclaimed waterlines to neighborhoods for personal use and how much consumers could save using gray water versus potable water.

The contract between the City of Flagstaff and the Arizona Snowbowl is up for renewal in March of 2007. As a part of the contract renewal process the City of Flagstaff should assess the impacts to taxpayers, including the loss of future opportunities relating to municipal and industrial needs. This study should be completed before continuing to allocate reclaimed wastewater supplies for snowmaking.

Long term climate studies have shown that drought cycles, like the one we currently experience, can last from 30 to 50 years! We have no cheap alternative to replace the loss of groundwater in Northern Arizona. Allocating wastewater for the purpose of skiing is gambling with Flagstaff's future.

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