Salt Lake City Watershed Management Programs: 1847-1997

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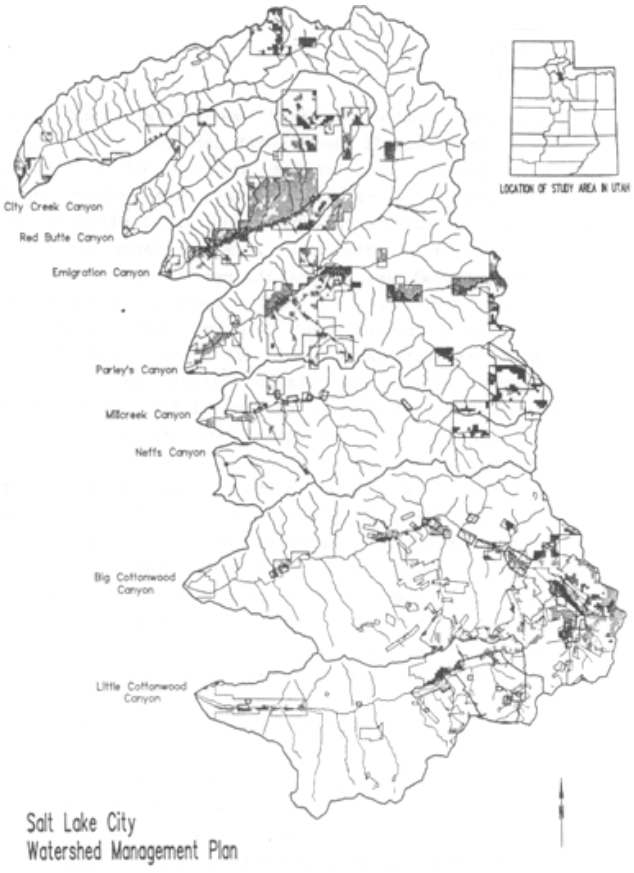
Introduction

Salt Lake City's watershed management practices date back to the early Mormon Pioneers. Water development and efforts to protect it from pollution can be traced back to the pioneer leaders who understood that water was key to the settlement's survival. This report describes the history of watershed management over the past 150 years. In the beginning, water dipped from open ditches was acceptable quality to the settlers; however, as the years have passed, higher standards have become required. Modern society now demands drinking water of the highest purity, requiring effective watershed management as part of a multiple-barrier treatment strategy to prevent pathogens (organisms that cause diseases) from reaching the consumer's tap.



The pioneers found the Wasatch Mountains untouched, yielding a supply of pure water devoid of human pollution. With the settlement of the Salt Lake valley, the pioneers mined minerals, cut timber, grazed livestock and recreated leaving man's scars on the once pristine Wasatch. Despite all the forces to destroy and pollute, there has been success in protecting the Wasatch Canyons from the effects of man's presence. The following describes the policies, legislation, ordinances and programs that protect 185 square miles of watershed located along

eastern Salt Lake County and the drinking water supply for 400,000 people.

Early Resource Protection

With the settlement of the Salt Lake valley by the Mormon Pioneers in 1847, prominent leaders were given the stewardship of the valley's natural resources. On January 5, 1850, the State of Deseret General Assembly granted William Crosby and three others the control of the canyons south of Big Cottonwood; Heber C. Kimball was granted the waters of North Mill Creek on January 8, 1851; George A. Smith on January 9, 1851 was granted exclusive control of the timber in the canyons on the east side of the range on the west side of the Jordan River; and on December 9, 1851 the General Assembly granted Ezrith Benson exclusive privilege of controlling the water in Tooele County. In order that the waters of City Creek would continue to run pure for the inhabitants of the Great Salt Lake City, on December 4, 1851 Brigham Young was granted exclusive control over the timber, rocks, minerals and water in City Creek Canyon.

The U.S. Congress established the Territory of Utah on September 9, 1850. The early philosophy of the new territory legislature regarding public ownership of natural resources was reflected in legislation passed on February 4, 1852. Chapter 1, Section 38 provided that the County courts "... had jurisdiction and control over all timber, water privileges, or any water course or creek, and exercise such powers as in their judgment shall best preserve the timber and subserve the interest of the settlement in the distribution of water for irrigation or other purposes." However, grants of rights held under legislative authority were not to be interfered with. Under the law the court granted rights to the use of the streams of Salt Lake County, and appointed commissioners to grant petitions and enforce them. The court took testimony, visited the region in question and made a decision based on the facts.

On March 21, 1851, the first City Council passed ordinances for the prevention and removal of filth from water courses. "Be it ordained by the City Council of Great Salt Lake City

that no person or persons shall be allowed to build cow yards, privies, or deposit any filthy substance on the banks of the streams running through this City so as to affect the water thereof."

As the City grew in population there was greater demand for timber, mining and livestock grazing. In order to protect the watersheds from these activities, the City Council began purchasing watershed property in City Creek Canyon. Land purchases were made with individuals and the Union Pacific Railroad. By 1907, the City had acquired most of City Creek and substantial acreage in Emigration, Red Butte and Parleys Canyons. Over the years, the City has continued to acquire watershed property and today owns over 23,000 acres or 18 percent of the seven-canyon watershed area.

Extraterritorial Jurisdiction

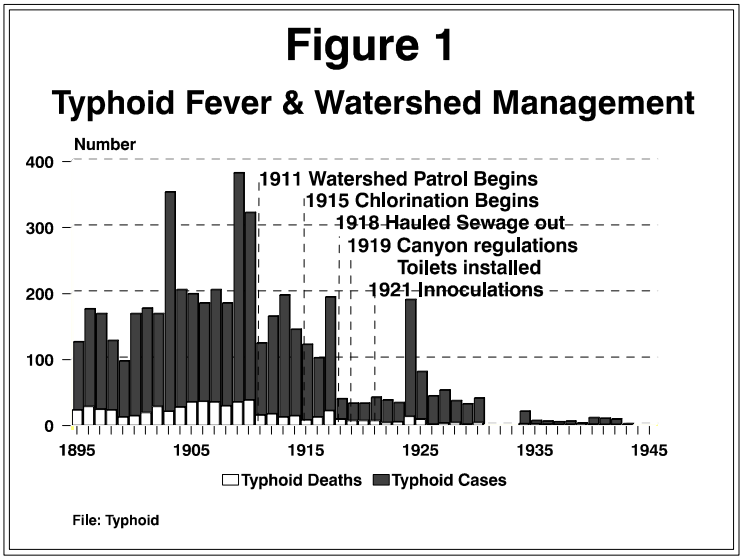
The State Constitution authorizes the State Legislature to grant Cities of the First Class (population of 100,000) Extraterritorial Jurisdiction to protect their watershed and drinking water supply. The Utah statutes give Salt Lake City broad and substantial discretion in the management of its watersheds to protect its drinking water sources from pollution. Salt Lake City is currently the only city in Utah having such powers. Based on this authorization, the City has passed ordinances for the protection the watersheds and to preserve water quality.

Early Watershed Management Programs

During the turn of the century, hundreds of the City's inhabitants were taken ill with Typhoid Fever, with many dying. The City took action (See Figure 1) to improve sanitation within the watersheds to stem the outbreak of water borne diseases. In 1911, the City began patrolling Parleys Canyon to eliminate potential pollution of the drinking water. In 1912 Dr. Samuel G. Paul, City Health Commissioner warned, "While there was no evidence that the typhoid epidemic last summer was water borne, and while the water sheds were better patrolled than ever

before, yet more precautions should be taken to protect the supply and the city should be given jurisdiction over the entire water shed. This should be taken up at the present session of the legislature."

In 1913 patrols began in Big Cottonwood Canyon; in 1915 and 1916 chlorination of the water was initiated in Parleys and Big Cottonwood; in 1917, removal of sewage from Parleys canyon was implemented; camp regulations and toilets were put into place in Big Cottonwood Canyon in 1919; and in 1920 City Creek was first chlorinated. By 1937 confirmed cases of Typhoid Fever traced to drinking water were reduced to nearly none, thanks in part to watershed management programs and chlorination of the drinking water.



Federal Legislation

In 1906, the President of the United States through proclamation created the "Salt Lake Forest Reserve, "which covered all the canyons except Little Cottonwood Canyon to manage the federal lands. It was suggested "…that the City withdraw its supervision over the watersheds and rely on the Forestry Service, which it was believed to be better equipped and more capable than the City could afford to prevent stream pollution, fires, and trespass on both the City and federal watershed lands." Notwithstanding the temptation by an unknown City official to have the Forestry Service take over all of the watershed management duties, Salt Lake City did continued to manage the watersheds as a partner with the federal government agency.

The Salt Lake City - Federal Government partnership was strengthened October 7, 1912 when the City Commission and the Secretary of Agriculture signed an agreement. The agreement bound the City from selling or disposing of any of its land or the timber thereon within the forest. In turn the Forest Service agreed to not allow livestock grazing or cattle driving through forest lands to the extent that ordinances of Salt Lake City, state of Utah and Federal laws or regulations permitted. The City further agreed to pay the salaries of two Forest officers, not to exceed $100 per annum for each officer and pay one-half the labor and supplies incurred by the Forest Service in fighting fires. The Forest Service agreed to employ three officers for patrol and protective work. Both agreed to protect the land from trespasses and each to prosecute the offenders under applicable state and federal laws. The Forest Service planted trees and the City paid the cost on City lands.

Two years later Congress passed PL. 199 withdrawing federal lands from mineral location and removing federal lands from surface disposal for City Creek, Red Butte, Emigration and Parleys Canyons. The legislation directed the Agriculture to administer the lands in cooperation with Salt Lake City "for the purpose of storing, conserving, and protecting from pollution the said water supply… and to prescribe and enforce regulations to carry out the protection of the water supply for Salt Lake City."

In 1934 additional legislation, PL. 259 was passed to protect Salt Lake City's water supply by reserving the surface estate to the United States in any mineral patents in the canyons of Mill Creek, Big Cottonwood and Little Cottonwood Canyons for the protection of Salt Lake City's water supply. The U.S. Wasatch-Cache National Forest Service has entered into interlocal agreements with Salt Lake City to manage forest lands in such a manner as to protect the City's water supply.

The Forest Service is the largest watershed property owner with 62 percent of the 185

square mile watershed, primarily in Mill Creek and Big and Little Cottonwood Canyons. Four ski resorts are situated within the forest that operate under forest permits.

Public - Private Partnerships

There have been a number of successful public- private partnerships in the watersheds. In 1912, a group called the special committee of the Commercial Club made a sanitary survey of the canyon watersheds. Their report was considered thorough and comprehensive in assessing the conditions, causes and difficulties met in trying to protect the City's watersheds and water supply. The report noted that the greatest menace was Brighton, and that companies were trying to subdivide land for selling for summer towns, creating sanitation problems similar to those experienced in Brighton. As Brighton was beyond the 10-mile distance from Salt Lake City, the City was not able to enforce its ordinances. The sanitation problems of these potential canyon towns were considered threat to the drinking water supply. The report also recommended hiring more patrol officers, constructing toilet facilities and establishing stream set-back requirements.

In 1921, the Salt Lake Rotary Club established Rotary Park in City Creek Canyon, a popular gathering place for picnicking and enjoying this beautiful canyon. When the canyon was closed in 1953 the Park was closed to the public and fell into disrepair, but in the 1990's the Club invested greatly in restoring the Park.

In 1982, in an effort to acquire 485 acres of private land in the lower portion of Little Cottonwood Canyon, a partnership was formed with Salt Lake City, the Forest Service and the Trust For Public Lands (TPL). The water utility fund bonded for $3,436,000 in water and sewer revenue bonds to pay the owner. TPL as a broker found forest lands to sell to individuals with the revenues repaying the bond debt and interest payments. The Forest Service gave up lands in less critical areas, and in turn gained ownership of the 485 acres in Little Cottonwood Canyon. At the conclusion of the transaction, the TPL retired the debt.

Modern Watershed Management Programs

In 1949, the Metropolitan Water District of Salt Lake City (formed by Salt Lake City in 1934) hired a Board of Engineers to prepare a "Report on Investigation of Water Supplies." The firm of Black & Veatch was the consulting engineer, directed by the Board of Engineers consisting of J.A. Carollo, J.M. Montgomery and N.T. Veatch. They conducted a sanitary survey of the City's Wasatch Canyon watersheds and the Provo River Project's diversions and Deer Creek Reservoir. The report quantified coliform bacteria contamination levels in these sources of supply and recommended watershed programs to counter increasing public use and pollution levels. The report further recommended that a water treatment plant be constructed to treat City Creek in order to meet U.S. Public Health Drinking Water Standards (promulgated February 5, 1946) and further set in motion a plan for treating all of the City's surface water supplies.

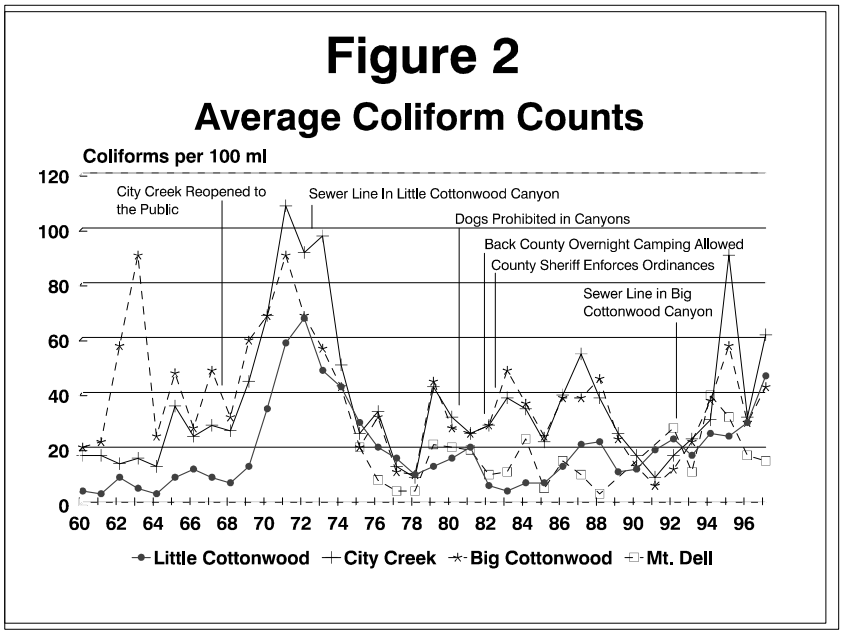
The Report initiated modern-day watershed management programs, using coliform bacteria (a group of bacteria predominantly found inhabiting the intestines of humans and animals) as the pollution indicator. Sanitation measures and watershed ordinances are the backbone of the program. Eliminating grazing and trailing of livestock, along with exclusion of domestic animals, have improved water quality over the years, despite growing use of the canyon watersheds for recreation.

Pollution Indicator

Coliform bacteria counts have been used since the 1950s as an indicator to measure the levels of pollution in the canyon streams, and have been the primary tool in determining the effectiveness of watershed management programs. For example, elevated City Creek coliform counts in 1949-50 caused the City to take measures to protect the canyon and treat the water. City Creek Canyon was closed to the public and a water treatment plant constructed in 1953. The

canyon remained closed until the coliform counts were reduced to acceptable levels in 1967.

Coliform levels (See Figure 2) peaked between 1970 and 1975 in Little Cottonwood, Big Cottonwood and City Creek. City Creek reached the highest value in 1971 with an annual average of 105 colonies per 100 ml, followed by Big Cottonwood at 90 colonies per 100 ml the same year. Little Cottonwood peaked in 1972 with 67. The canyon coliform count levels were on a general decline during the 70s to their collective low level in 1978. Coliform counts remained relatively low during the 1980s, however there has been a marked increase beginning in 1994. There was a slight coliform increase in the Parleys drainage during the 80s, much of which is attributed to the construction of the Little Dell Project and golf course expansion. Since1994 coliform counts appear to be increasing in all four canyon streams. Only Mt. Dell, buffered by the larger Little Dell Reservoir, decreased during this period. In 1996, the City and its partners, the Forest Service, City County Health Department and County Sheriff began reviewing canyon management programs to determine if additional measures are needed to reduce the increasing level of pollution.



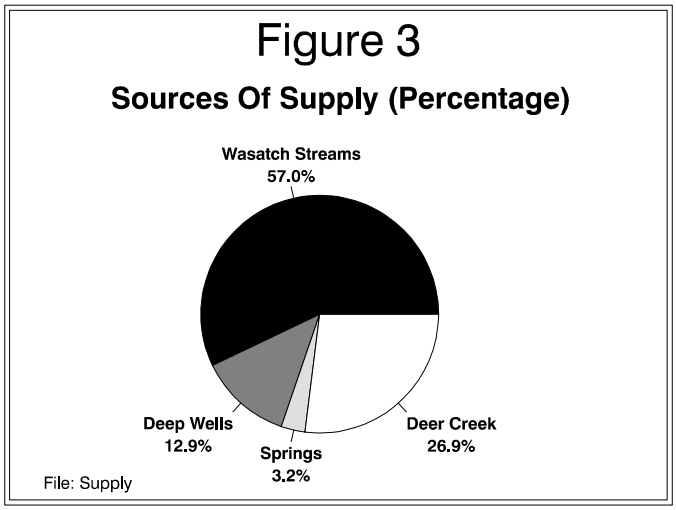
Wasatch-Uinta/Cache National Forest Use

According to the US Forest Service, the number of visitors to the WasatchUinta/CacheNational Forest District is increasing at a rapid rate. In 1969 there were 1.5

million visitors. This increased to 10.518 million in 1995, or an increase of 600 percent in 26 years (an annual increase of 23 percent). The Wasatch-Cache/Uinta National Forest is the highest used forest in the nation. The numbers of visits or entries are over 32 million persons. This is an extraordinary growth rate. If continued, this will become a serious concern. The Wasatch Canyon may be headed for the same fate as other national parks and forest areas, which are experiencing overuse, resulting in regulations to limit traffic and numbers of people in an effort to stem the environmental degradation of these national treasures. Some cities completely prohibit public access to drinking water watersheds in an effort to protect drinking water supplies. Wasatch-Cache Forest usage, due to its proximity to the rapidly growing Wasatch Front, could be reaching its sustainable recreation limits within the foreseeable future.

Water Supply

The importance of the Wasatch Canyon Watersheds cannot be overstated. (See Figure 3) The 7 canyon streams produce an average annual 150,000 acre-feet of water, of which 40 percent is diverted for drinking water supply. The remainder of the water is used to meet downstream exchange agreements with farmers and or is high spring run-off running to the Jordan River and Great Salt Lake .



During the summer months all the water flows in City Creek, Parleys, Big Cottonwood and Little Cottonwood streams are fully diverted for drinking water and exchange obligations. The waters of Emigration, Red Butte and Mill Creek are used to meet a combination of water rights and exchange agreements. The drinking water diversions provide municipal water for 400,000 people in Salt Lake City's service area. has grown to over 750,000 people and the

population is expected to increase to nearly 1.4 million by 2025, according to the results of the Wasatch Front Demand/Supply Model Report published jointly by the Utah Division of Water Resources and Bureau of Reclamation in 1993. The Report projects that current water demand will nearly double by 2025, requiring an additional 196,307 acre-feet of water supply. The Central Utah Project will only deliver a portion of this water. Therefore, much of this new water will have to come from reuse of low quality water from irrigation and treated sewage effluent combined with conservation. The Wasatch Canyon supplies will be the most desirable source compared to the alternatives.

New and More Stringent Drinking Water Standards

The 1986 amendments to the Safe Drinking Water Act require more stringent drinking water standards. The Surface Water, Coliform and Disinfection By-products Rules have now, and will in the future, make treatment of the canyon streams (classified as surface supplies) more difficult. In the past the inactivation of coliform bacteria was the measurement of safe drinking water. Now under the new Surface Water Treatment Rule (SWTR), *Giardia* and viruses are the target organisms for treatment effectiveness. SWTR requires systems to remove or inactivate at least 99.9 percent (3 logs) of *Giardia* cysts and at least 99.99 percent (4 logs) of viruses.

When measurement techniques are perfected, a zero MCLG *Cryptosporidium oocyst* will be established for drinking water. At this time there are still unanswered questions about this organism; but there is growing concern as more waterborne disease outbreaks are reported in the United States and Canada. Niether *Giardia lamblia cysts* or *Crytosporidium parvum oocysts* when ingested by humans are fatal, however if the individual has a weakened immune system, the resulting disease can be fatal. This immune deficient segment of the population is growing and these organisms are now driving drinking water regulations. *Cryptosporidium* is widespread in the environment, and has been found in cattle, sheep, swine, goats, dogs and cats, as well as wildlife; such as deer, beaver, muskrats and squirrels. In the future with more stringent drinking water

standards, current watershed management programs and water treatment may be inadequate.

In 1996, Congress reauthorized the Safe Drinking Water Act. Some of the requirements under the 1986 amendments were modified. Methods for standard setting were changed to address sound science and cost benefits. Watershed protection was written into the legislation as the most critical element in preserving finished water quality.

Salt Lake City-County Health Department

The Salt Lake City-County Health Department plays an important role in watershed management of the Wasatch Canyon Watersheds. The department was created in state statue to serve as a regional agency. This agency prescribes its own regulations for the watersheds. Salt Lake City and the Salt Lake City-County Health Department work conjunctively to protect the watersheds and water quality.

Canyon Master Plans

In 1987, faced with the prospect of a winter Olympic bid and ski resort expansions in Big Cottonwood Canyon, Salt Lake City conducted an extensive master planning effort. The "Salt Lake City Watershed Management Plan," was adopted by the City Council on April 5, 1988. Key elements of the plan included the implementation on July 1, 1988 of a "Watershed Protection Fund," to raise the revenues to acquire critical watershed property and water rights; and on April 9, 1991, the City Council passed the "Canyon Water Surplus Water Sales Ordinance," that governs the sale of water by the City within the Wasatch Canyon watersheds. The comprehensive plan provides Salt Lake City guidance in the management of the canyon watersheds and protection of its drinking water supply.

On September 27, 1989 the Salt Lake County Commission approved the "Wasatch Canyon

Master Plan," which focused on land-use issues, complimenting the City's watershed master plan. In 1992, water quality planning responsibility was transferred from the City-County Health Department to the County Commission.

Grandiose Schemes

During the decade of the 80s, a number of large-scale development proposals surfaced that would have forever altered the Wasatch Canyon watersheds. These high impact ventures were successfully discouraged.

Wasatch Super Tunnel

This 1987 scheme contemplated the construction of a 20-mile tunnel to be driven from the City of Draper, about one mile underground to Snowbird Ski Resort and Alta in Little Cottonwood Canyon and Brighton in Big Cottonwood Canyon at a minimum cost of $400 million. The City strongly opposed the project based on the fact that the tunnel would intercept water owned by Salt Lake City and the impact on the canyon watersheds.

Utah Summit Ski Resort

Again in 1987, a large-scale ski resort project was proposed for Parleys Canyon south of I-80 and east of Lambs Canyon. A world-class designation ski resort was proposed that included a main lodge, ski lifts, restaurants, condominiums, convenience stores and a medical center. The development would have covered 1,790 acres, and would have been the largest recreation area in the intermountain region. The City opposed the project, vowing to fight the project based on watershed protection issues. Further, City land was required, and the City refused to sell or lease any watershed property.

Ski Interconnect

In 1989, The Mountain Association of Governments sponsored an inter-resort transportation study connecting Park City to the Wasatch Canyon resorts. The study considered a cable-tram network and 30-foot diameter tunnels connecting the Wasatch Front with Snowbird, Solitude and Park City. Another tunnel would connect Brighton to Heber. The City opposed the concept of the study, relying on the City's "Watershed Master Plan" and the County's "Wasatch Canyon Master Plan," as a basis for non-support. The planning effort failed.

Winter Olympics Bid

During the 80s organizers planned for a winter Olympics bid. Early in the planning effort consideration was given to holding events in the Wasatch Canyons, however, there were serious environmental concerns raised. In 1991, it was decided to exclude venues in Big and Little Cottonwood Canyons as part of the City's Olympic bid. But the Cross Country and Biathlon venues were designated to be held at the Mt. Dell Golf Course.

After Salt Lake City was awarded the 2002 Olympic games the Salt Lake Olympic Committee (SLOC) wanted to move the Cross County and Biathlon venues from the Mt. Dell Golf Course up-canyon to above Little Dell Reservoir because of better snow conditions. Salt Lake City and the environmental community questioned the use of the new site. Having to require reopen the Little Dell EIS which ultimately discouraged SLOC from pursuing the site.

Challenges

If history is used as a window to view the future, then as more and more people seek out the canyon watershed areas for recreational use, present watershed management programs will be overwhelmed. The City's experience in City Creek during the early 50s demonstrates how easy it

is to severely impact the fragile canyon environment and pollute the water. Even today restrictions are used to control this small canyon. Red Butte, the smallest canyon, is restricted as a Research Natural Area.

In 1990, a joint effort by the U.S. Forest Service and Salt Lake County, placed restrictions on Mill Creek Canyon by establishing a control gate and fee system. Revenues collected at the gate are used to improve the quality of the canyon. While the canyon itself has greatly benefited, water pollution is still a problem. This source is not presently used as a water supply, and therefore the City does not exercise its watershed ordinances on the canyon. Mill Creek is a small canyon, as the larger canyons reach the same proportionate level of use as the smaller ones, possible watershed degradation will occur, followed by the degradation of water quality. It is inevitable, that in the future, some use restrictions will have to be implemented in Parleys, Big and Little Cottonwood Canyons. In 1997, there was some discussion about having a control gate at the mouth of Big Cottonwood Canyon, but it did not gain over-whelming support.

With promotion by the ski resorts for all-season use and the projected population growth along the Wasatch Front, invariably Wasatch Canyon watershed public usage will continue to increase, similar to that of the past two decades. Concurrent with increased watershed use and resulting potential degradation, drinking water standards are becoming more stringent -- these two forces are on a collision course.

Currently, the technology and standards used to predict watershed degradation are not keeping pace with drinking water technology and standards. Drinking water standards and water treatment processes are being set by new technology while watershed indicators(coliform organisms) have not substantially changed. We are now only beginning to test for *Giardia, Cryptosporidium* and viruses in the raw water coming from the watersheds. The effort to find a more suitable indicator for bacteriological contamination will have to increase if watershed management programs are to match the more stringent drinking water standards. Research will

have to increase to improve watershed pollution indicators and measurements.

Public Health - Watershed and Treatment Barriers to Prevent Pathogens from Reaching the Finished Drinking Water

Modern water treatment of surface waters relies on a multiple barrier approach to ensure the removal of harmful bacteria. Watershed protection is the first barrier and the treatment process is the second. The effective watershed barrier eliminates pollution before it gets to the water treatment plant. Optimized treatment can be more effective when the pollution level is minimized. With the threat of *Cryptosporidium* in surface water supplies, the water industry has taken extra precautions in the treatment and filtration of drinking water. Since traditional disinfection with chlorine does not effectively destroy the *Crytoporidium* organism, filtration to prevent the parasite from reaching the distribution system has taken on significant importance to the water and health communities. Therefore, water treatment plants are operating at standards much more stringent than federal standards in order to reduce this health risk. As a precautionary measure, the American Water Works Association in 1994 recommended that water suppliers adopt a maximum finished filtered turbidity standard of 0.1 NTUs, well below the EPA standard of 0.5 NTUs. It has been found that treatment plants operated at this standard are more effective in consistently removing the parasite, through the filter media.

There is a marked difference in water quality between controlled and non-controlled watersheds. In 1970 the controlled watersheds showed a marked decrease in total

coliform counts using "Most Probable Numbers." The counts were 32 times greater in the non-controlled watersheds of Mill Creek and Emigration Canyons, where Salt Lake City does not enforce watershed ordinances. Emigration Canyon is developed without a sewer system, while Mill Creek is a highly used recreation area. This data strongly supports controlled watershed management programs in reducing pollution levels.